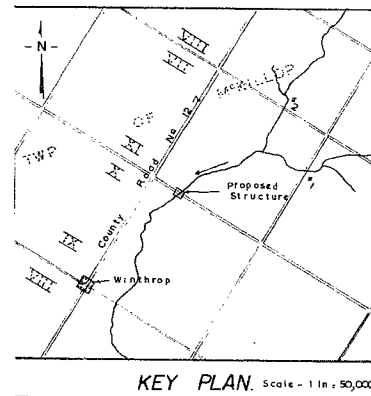
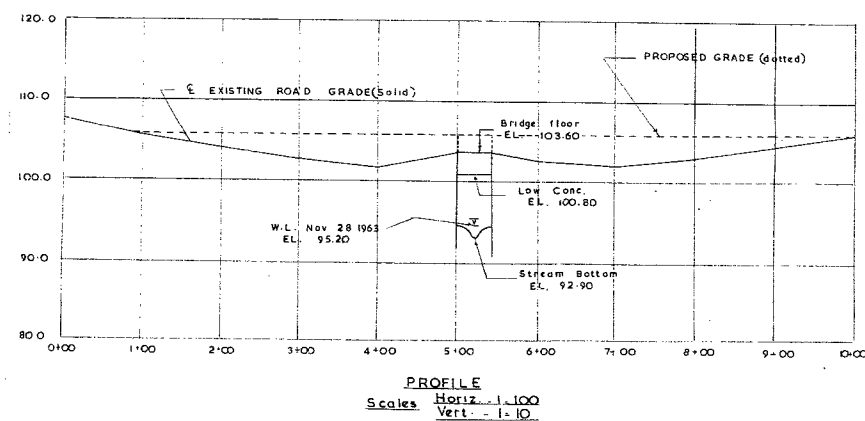
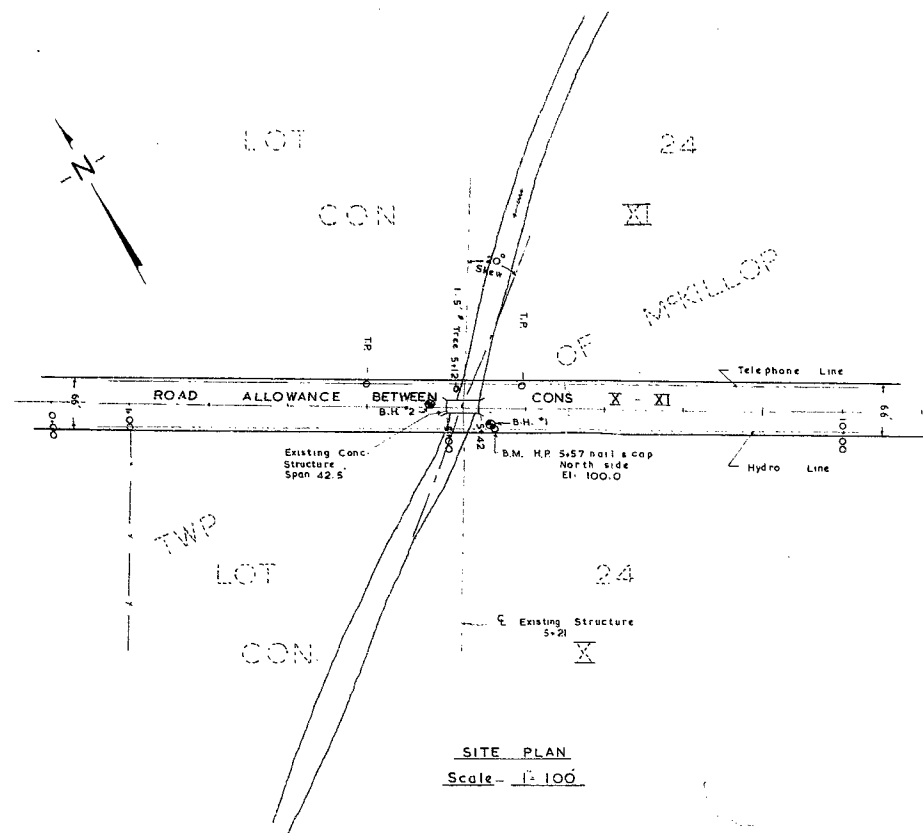


63-F-235M

LOT 24, CON. 10+11

MORRISON BRIDGE

No. 110



FOLLOW SEPARATE INSTRUCTIONS FOR PREPARATION OF BRIDGE SITE PLAN WHEN MAKING BRIDGE SURVEY.

DATA

- SPECIAL FEATURES: WATERFALLS, DAMS, EXCEPTIONAL FLOODS, ICE, DRIFTWOOD, SLIDING BANKS, ETC. None Usual Amount of Ice
- (A) UPSTREAM & DOWNSTREAM BRIDGES (GIVE LOCATION, LENGTH, HEIGHT ABOVE N.H.W.L., NET CROSS-SECTIONAL AREA AT HIGH WATER & ESTIMATED AGE) 1 1/2 Mi. Upstream 41' Span (100' Skew) H.L. Above N.H.W.L. - 0.1' Area @ H.W.L. 210' Age 12 Yrs. 1/2 Mi. Upstream 20' H.L. Above N.H.W.L. - 1' Area @ H.W.L. 100' Age 12 Yrs. Downstream 1/2 Mi. Span 70' H.L. Above N.H.W.L. - 0.1' Area @ H.W.L. 570' Age 10 Yrs. (B) REASONS WHY THESE BRIDGES ARE, OR ARE NOT, FAIR INDICATIONS OF SIZE OF PROPOSED BRIDGE: Flooded Road @ "I" Structure and a Stream (Additional) (3.8 Sq. Miles of Water) Enter Downstream
- REASONS FOR CHANGES IN HEIGHT OR LENGTH FROM THAT OF OLD BRIDGE: Height increased To Clear N.W.L. Span increased Slightly To Accommodate 20' Skew

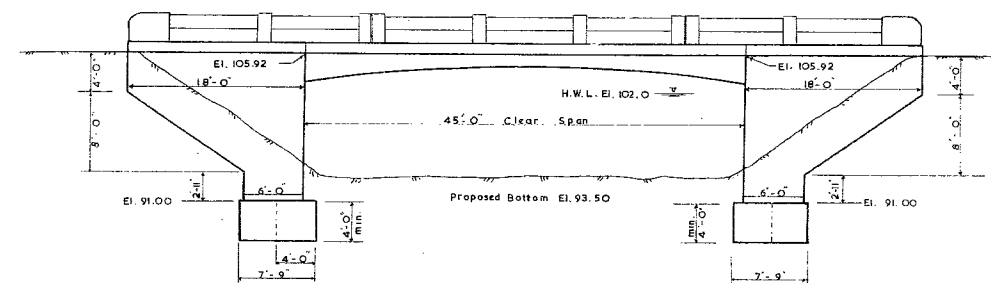
DATA (contd.)

- IS DITCH, STREAM, OR RIVER GRADIENT LIABLE TO BE LOWERED? Possibility That Stream May Be Cleared Out And Lowered Slightly
- NAVIGATION CLEARANCES REQUIRED, IF ANY: None
- RAILWAY CLEARANCE REQUIRED, IF ANY: None
- IF STRUCTURE IS OVER OR UNDER A RAILWAY HAS APPROVAL BEEN OBTAINED? (A) FROM RAILWAY CO. N/A (B) FROM BOARD OF TRANSPORT COMMISSIONERS: N/A
- HAS APPROVAL BEEN OBTAINED UNDER NAVIGABLE WATERS PROTECTION ACT? N/A
- IS A TEMPORARY DETOUR REQUIRED? Yes
- WHO WILL BUILD IT? Contractor
- WHO WILL MAINTAIN IT? Contractor
- INFORMATION AND EVIDENCE OF EXTREME FLOODING WAS OBTAINED FROM Road Subdivision and REFLECTS HIGHEST WATER ELEVATION IN THE AREA OF THIS CONSTRUCTION TO BE EL. 102.0' AND THE LOWEST WATER ELEVATION TO BE EL. 93.5'
- ROAD DESIGN INFORMATION:
ESTIMATED A.D.T. 100
DESIGN SPEED: 40
STOPPING SIGHT DISTANCE: 275

ELEV.	DESCRIPTION	BLOWS PER FOOT	ELEV.	DESCRIPTION	BLOWS PER FOOT
97.2	Ground Surface		102.8	Ground Surface	
96.2	Organic Topsoil			Gravel Road Bed	
	Sandy Silt Fill			Dark Brown Silt Fill, Mixed With Organics, Compact Damp	
94.2	Sand And Gravel (Fill)		95.80		12
92.2		43			6
		30			20
		32		Slight Cohesion, Compact	
	Grey Sandy Silt Till, Dense Slight Cohesion	31			45
		50		Grey Sand Silt Till	
		78	87.80	Dense, Clay	
	Many Seams Of Gravel And Sand		85.30	Seam Of Gravel And Sand	45
85.70	End Of Borehole	38		Very Dense	101
			78.30	End Of Borehole	75

BOREHOLE No. 1

BOREHOLE No. 2



NOTE

Over El. 100.0' - Geologic El. of 106.60'

STRUCTURE DATA

- NET SPAN LENGTH AND TYPE OF BRIDGE: 45' Span Rigid Frame Reinforced Concrete
- ROADWAY WIDTH ON BRIDGE: 26'
- NUMBER & WIDTH OF SIDEWALKS: None
- SKREW ANGLE: 20°
- TOTAL LENGTH & TYPE OF PILING: None
- APPROX. VOLUME OF CONCRETE: 280 CU YDS
- APPROX. WEIGHT OF STR. STEEL: None TONS
- APPROX. WEIGHT OF REINFORCEMENT: 17 TONS
- APPROX. VOLUME OF APPROACH FILL: 1500 CU YDS
- DRAINAGE AREA: 13.5 SQ. MI.

FIELD INVESTIGATION MADE: Nov. 28, 1963

BY: K. G. DUNN
SURVEY ENGINEER

B. M. ROSS
Consulting Engineer

OWNER: TWP. OF MCKILLOP
Co. HURON

MUNICIPAL DIST. No. ROAD No. CON. X. XI

SITE PLAN

Feb. 3, 1964
DATE

BRIDGE NAME: MORRISON BRIDGE

LOADING: H20S16

BRIDGE No. BR-110

DWG. No. BR-110-1

BA. 1764

MR. B. M. ROSS
CONSULTING ENGINEER
GODERICH ONTARIO

Report on
SOIL INVESTIGATION
for
ROAD BRIDGE
LOT 24, CONCESSIONS ^I~~V~~ & ^{II}~~VI~~
TOWNSHIP OF McKILLOP

63-F 235M

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO
Reference No. 3-12-L4
December 1963

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SUMMARY

The strata consist of 5 to 7 feet of mostly granular fill, underlain by a natural glacial till deposit consisting mainly of sandy silt.

It is recommended that the structure should be supported on strip footings at El. 88.0 feet using a gross soil pressure not exceeding 6000 p.s.f. The anticipated settlements are sufficiently small to permit a rigid-frame design.

No unusual construction problems are anticipated.

I INTRODUCTION

In accordance with a letter of authorization from Mr. B. M. Ross dated 6th of December 1963, a soil investigation has been carried out at a site in the Township of McKillop where it is proposed to replace an existing road bridge with a new structure.

A plan of the site was supplied by Mr. Ross's office, showing the outline and profile of the existing bridge. It is understood that the new structure will be in the same position, and will have a span of 45 feet.

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

II PHYSIOGRAPHY

The site is located within the system of "Horseshoe Moraines" which are a series of parallel ridges rising, in this area, above the Stratford Till Plain. The low ground between the ridges is relatively flat and is generally comprised of dense ground moraine. The present site lies within one of these flatter areas, on a tributary of the Maitland River.

III FIELD WORK

Field work was carried out during the period 9th to 11th of December 1963, and consisted of 2 boreholes at the locations shown on enclosure 2. Dynamic cone penetration tests were performed adjacent to each borehole. The holes were advanced by wash boring and lined with Bx (3-inch) casing.

Standard Penetration tests were performed at frequent intervals of depth to determine the relative density or consistency of the soil, and to recover disturbed samples. The dynamic cone penetration tests provide a continuous record of penetration resistance and reveal abrupt changes in stratification.

The results of the field tests are recorded on geotechnical data sheets comprising enclosures 3 and 4. Elevations have been referred to the client's local bench mark (nail on hydro-pole at Sta. 5+57, El.100.0 feet).

IV SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown in the data sheets and a general picture of the subsurface conditions is given by the profile on enclosure 2.

At both boreholes the surface layers consist of miscellaneous fill materials, associated with the construction of or comprising the road embankment. These extend to depths of 5 to 7 feet.

The underlying natural soil deposit is a glacial till which is mainly a sandy silt. Below El.90 feet it is in a dense to very dense condition. At borehole 1, and to a depth of 13 feet in borehole 2, the till has only a slight cohesion arising from a small clay content and a slight degree of cementation. Below 13 feet in borehole 2 the clay content is noticeably higher and the material is quite cohesive.

Many seams of gravel and sand were encountered within the till stratum at both boreholes, as noted on the data sheets. In several places seams of completely granular pervious material were found, and artesian conditions were noted within these layers at borehole 1. Apart from the granular layers, the gravel content in the till varies from about 5% to 15%. The particles are generally subangular in shape and less than one inch in diameter.

V FOUNDATIONS

The strata offer adequate bearing capacity to support the structure on strip footings. The elevation of the bed of the creek is 92.9 feet so that a footing elevation of 88.0 feet is proposed to allow for scour. This level lies within the till stratum at both boreholes. The consistency or relative density of the soil is indicated by an 'N'-value of 30 (\pm) at borehole 1 and 45 decreasing to 28 at borehole 2. At borehole 1 the soil within the zone of influence of pressure from the footing is mainly granular and slightly cemented, whereas at borehole 2 it has both granular and cohesive properties. Further variations in consistency within the area of the footings should be anticipated.

On the basis of the field test results a gross soil pressure of 8000 p.s.f. would be safe at the proposed footing elevation. However, in view of the observed irregularities in the strata it is recommended that the maximum gross soil pressure should not exceed 6000 p.s.f. Provided that the footings are poured on a clean undisturbed grade, the total settlement associated with this figure is unlikely to exceed one inch, and differential settlement between the abutments is not expected to exceed 3/4 inch. Conditions are therefore suitable for a rigid-frame design.

Most of the settlement will occur immediately as the loads are applied. In considering the resistance of the footing to horizontal sliding, it may be assumed that the coefficient of friction between the soil and the concrete is equal to 0.35. If this does not provide sufficient resistance against sliding, the footings could be lowered and the passive earth

resistance of the till below the level of maximum scour could also be considered. The following design values are recommended for this case:

Unit weight of the
undisturbed till $\gamma = 140 \text{ p.c.f.}$

Coefficient of passive
earth pressure $K_p = 3.0$

VI CONSTRUCTION

No unusual construction problems are anticipated. The soil is sufficiently dense and impervious that effective dewatering should be possible by pumping from sumps dug below the footing grade. Where the clay content in the till is very low, it may be rather sensitive to disturbance, and for this reason the footings should be poured with a minimum of delay after the grade has been exposed and approved. Any disturbed soil at the grade level should be cut out and replaced with lean concrete. It should not for any reason be re-compacted.

All of the water-bearing granular seams found in the till are 5 or more feet below the proposed level of excavation, so that no difficulty is anticipated from this source.

The faces of temporary excavations into the till may be expected to stand vertically without support. The upper fill material should be braced or sloped at 2 (horizontal) to 1 (vertical).

VII REFERENCES

1. The Physiography of Southern Ontario by L. J. Chapman and D. F. Putnam 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).
3. Terzaghi and Peck: Soil Mechanics in Engineering Practice. John Wiley and Sons, New York 1948.



DOMINION SOIL INVESTIGATION LIMITED

James Park
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 :



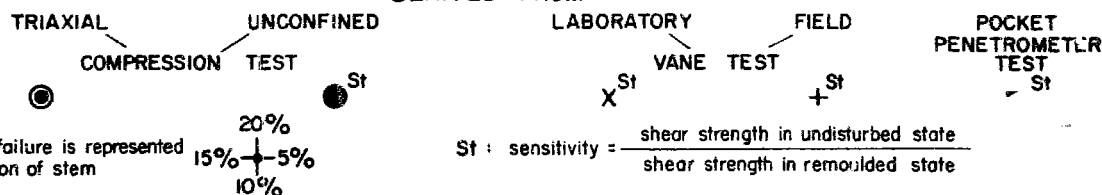
322

SOIL PROPERTIES.

W % Water content	γ_s Natural bulk density (unit weight)	k Coeff. of permeability
LL % Liquid limit	e Void ratio	C Shear strength
PL % Plastic limit	RD Relative density	ϕ Angle of int. friction
PI % Plasticity index	Cv Coeff. of consolidation	C' Cohesion
LI Liquidity index	m _v Coeff. of volume compressibility	ϕ' Angle of int. friction

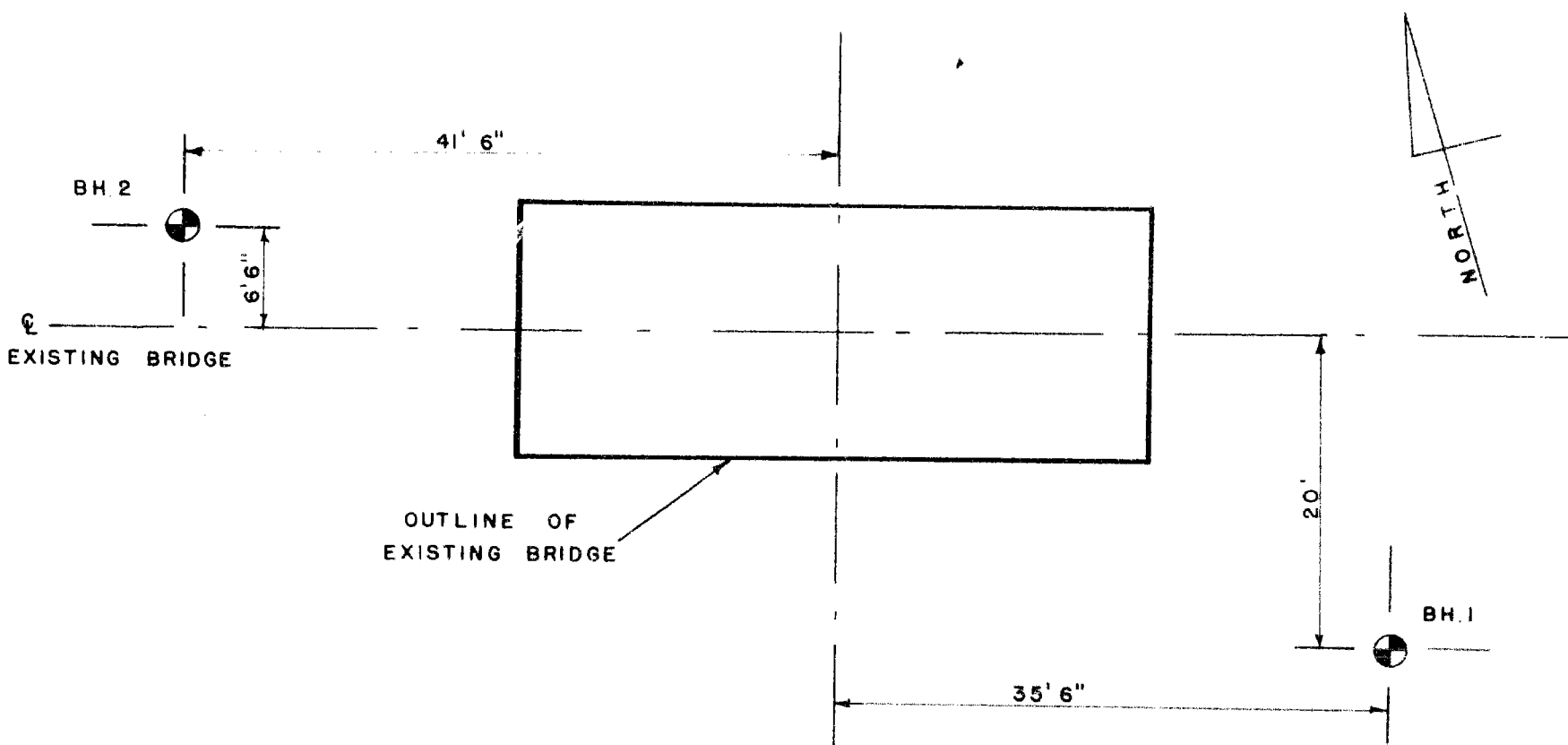
UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —



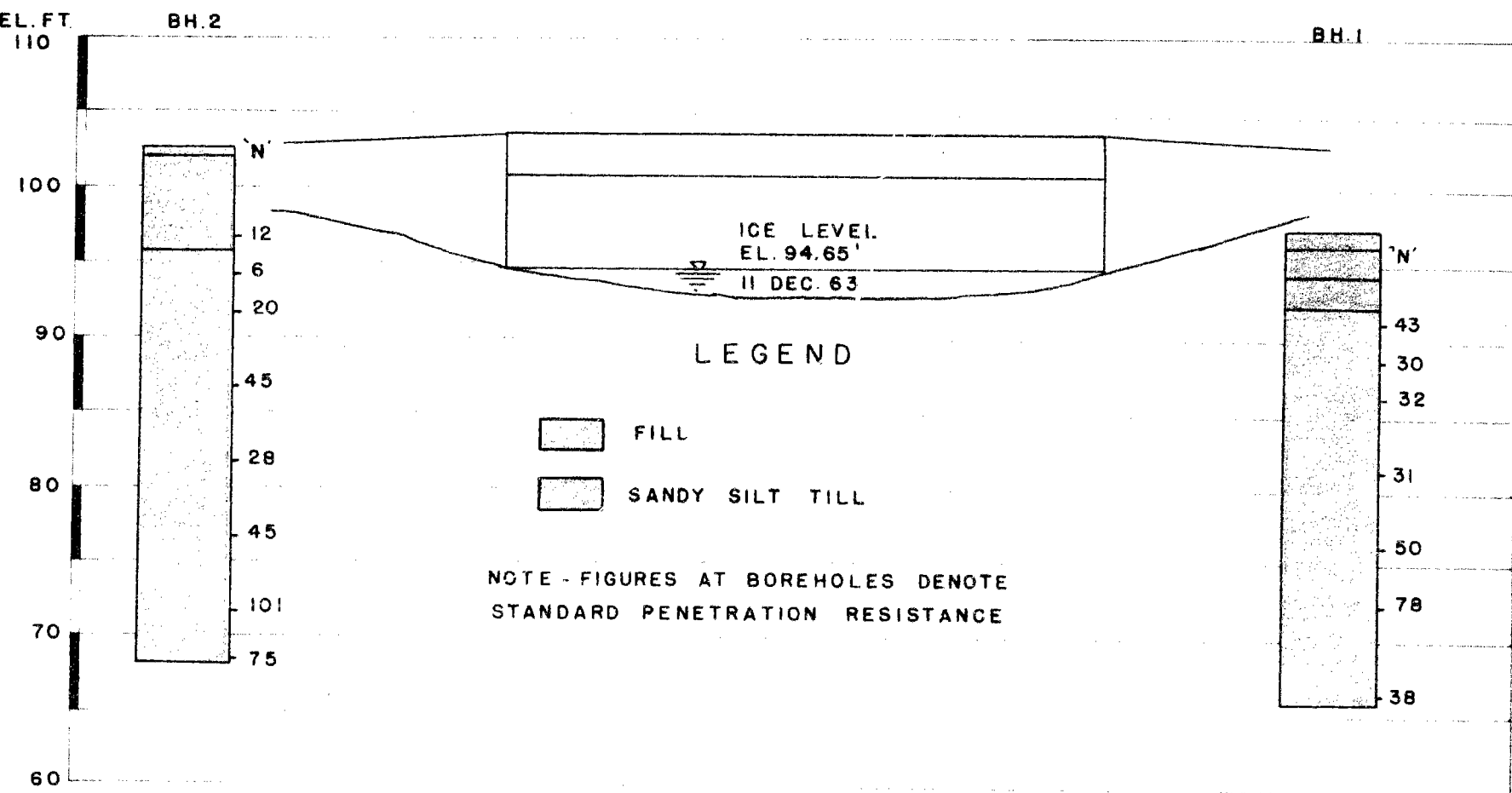
SOIL DESCRIPTION.

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



LOCATION OF BOREHOLES

SCALE: 1 INCH TO 10 FEET



SUBSURFACE PROFILE

SCALE: 1 INCH TO 10 FEET

GEOTECHNICAL DATA SHEET FOR BOREHOLE 1.....

OUR REFERENCE NO. 3-12-1.4

CLIENT: Mr. B. M. Ross

PROJECT: Road Bridge

LOCATION: Township of McKillop

DATUM ELEVATION: 100.0 (nail on hydro pole at Sta. 5+57)

METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: 5x (5-inch)

DATE: December, 1965.

ENCLOSURE NO.

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	N- or Advance- ment of Sampler	20	40	60	80	100	PL	W	LI	
97.2	0	Ground Surface													
		Organic topsoil													
95		Sandy silt fill													
		Sand and gravel (fill?)													
	5			1	SS	43									
90				2	SS	50									
	10			3	SS	32									
85		Grey sandy silt till, very dense, sandy slight cohesion.		4	SS	31									
	15			5	SS	50									
80				6	SS										
	20			7	SS	78									
75		many seams of gravel and sand		8	SS										
	25			9	SS	38									
70															
65		End of borehole													

WL in creek
El. 94.7'
11 Dec. 65.

Artesian condi-
tions were
noted in seams
of gravel and
sand at 23 to
24 feet and near
29 feet. An
estimated flow
of 1 to 2
gallons per
minute was noted.

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: SB

CH'D: JP

OUR REFERENCE NO. 5-12-L4

GEOTECHNICAL DATA SHEET FOR BOREHOLE 2.....

CLIENT: Mr. R. M. Ross

PROJECT: Road Bridge

LOCATION: Township of McKillop

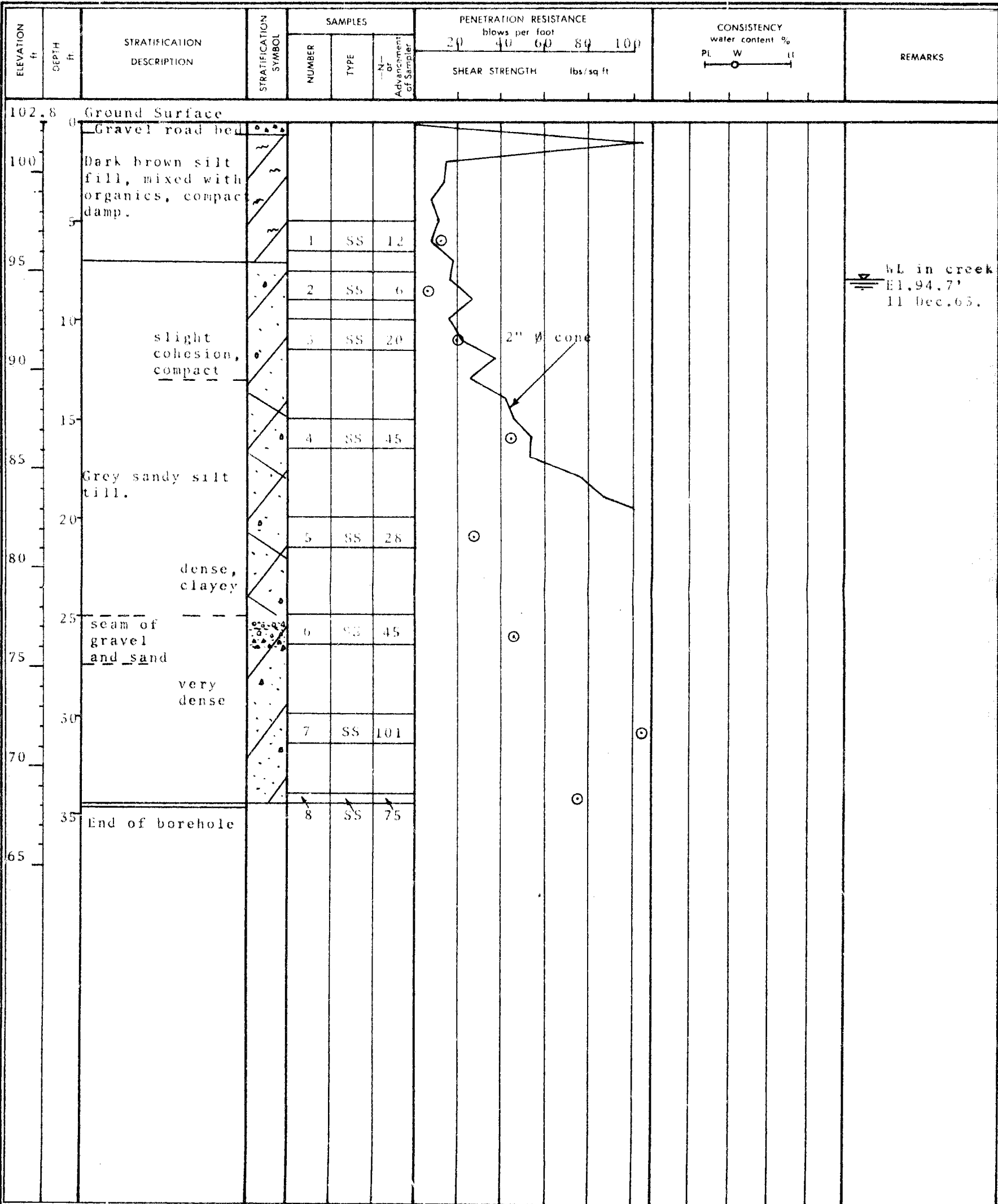
DATUM ELEVATION: 100.0' (nail on hydro pole at Sta. 5+57)

METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: 8x (3-inch)

DATE: December, 1963.

ENCLOSURE NO. 4



VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: SB

CHD: JP