

#

62-F-288 m

BAIN BRIDGE

NO. 2. LOT 10, CON 485

DOWNIE

Twp

## MEMORANDUM

TO: A. Stermac  
Principal Foundation Eng.  
Materials & Research Section  
Lab. Bldg.

FROM: G.C.E. Burkhardt

DATE: February 18, 1963.

OUR FILE REF. BA 1590

IN REPLY TO

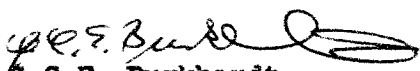
SUBJECT: Downship of Downie  
Bain Bridge No. 2  
Lot 10, Con. IV/V  
County of Perth  
Structure Site No. 26-204

Attached please find one copy of the Foundation Report, by Dominion Soil Investigation Limited, and one copy of the Preliminary Plans for your comments.

We intend to approve the plans as soon as possible. Therefore we would appreciate it very much, if we could have your comments at your earliest convenience.

Since we have not enough copies of the plans we would like to have the copy back which we are sending to you today.

GCEB/m

  
G.C.E. Burkhardt,  
for K.L. Kleinsteinber,  
Municipal Bridge Liaison Engineer

*Report basically O.K. Bridge designer however,  
does not show recommended sheet pile  
length of sheet piles should not be more than  
below footing bottom*

*height of water above this level unless greater  
depth is required because of hydrologic reasons.*

*Feb. 20, 1963.*

*Altman*

*Copy phone*

MR. R.M. DAWSON  
CONSULTING ENGINEER  
258 William Street  
STRATFORD ONTARIO

Report on  
SOIL INVESTIGATION  
for  
BAIN BRIDGE NO. 2  
LOT 10, CONCESSIONS 4 and 5  
TOWNSHIP OF DOWNIE, COUNTY OF PERTH

*62-12-L8*

by  
DOMINION SOIL INVESTIGATION LIMITED  
363 Queens Avenue  
LONDON ONTARIO

Reference No. 2-12-L8  
December  
1962

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### INTRODUCTION

In accordance with a letter of authorization dated the 12th of December 1962 from Mr. R.M. Dawson, a soil investigation has been carried out at a site in the Township of Downie where it is proposed to replace an existing township road bridge with a new structure. The bridge carries a gravel road across the River Avon.

It is understood that the new bridge will be of approximately the same span and in the same position as the existing one, and that it is intended to support the structure on spread footings at geodetic El. 1105 feet.

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 PHYSIOGRAPHY

The site lies 3 to 4 miles east of the City of Stratford in a spillway valley formed during the recession of the Wisconsin glacier and now occupied by the River Avon. This river is one of the main drainage channels in the surrounding Stratford Till Plain and flows southwards to join the Thames. The soils in the region are typically comprised of dense stoney ground moraine.

## II FIELD WORK

Field work was carried out during the period 26th to 28th December 1962 and consisted of 2 boreholes at the locations shown on enclosure 2. The holes were washbored and lined with Bx (3-inch) casing.

Standard Penetration tests were performed at frequent intervals of depth, and dynamic cone penetration tests were made adjacent to each borehole. The former test gave a measure of the relative density or consistency of the soil and provided disturbed samples, while the latter test gave a continuous record of soil density.

The results of the field tests are recorded on enclosure 3. Elevations have been referred to the level of the deck of the existing bridge which is taken as El. 1123.2 feet.

## III SUBSURFACE CONDITIONS

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

The stratification at the two boreholes differs in several respects. The upper gravel and sand deposit at borehole 1 is predominantly granular and cohesionless. Particles are angular and sub-angular and the particle size is generally less than 1-1/2 inches. The underlying till contains 80 to 90% of silt with only small proportions of clay and gravel.

At borehole 2, the upper 10 feet of sand and silt contains numerous clay seams, and only traces of gravel are present. The dense grey silt layer is very slightly cohesive. The underlying till contains more clay than at borehole 1 (about 10%) and the gravel content is as high as 30%.

#### IV FOUNDATIONS

It is intended to locate the under side of footings at El. 1105 feet which, at borehole 1, is in the dense gravel and sand layer, and at borehole 2 is in the dense grey silt. The respective N-values of the two materials at this level are 20 and 42. On the basis of these results it is recommended that the footings should be designed for a gross soil pressure (including the weight of overburden) not exceeding 3 t.s.f. Provided that the footings are poured on a firm undisturbed grade, the total settlement associated with the recommended soil pressures is not expected to exceed one inch.

#### V CONSTRUCTION

The permeability of the soil above the footing level is high especially at borehole 1. The main construction problem will therefore be to secure a dry excavation and to prevent the floor of the excavation from loosening or heaving under hydrostatic head. This can best be done by surrounding the excavation with steel sheet piles driven into the till to make a water seal. The sheet piling will also act as bracing and, if required, as permanent protection against scour.

The footing grade should be carefully examined for local weaknesses and any faulty material should be removed. In the gravel and sand layer the soil can be recompacted, but in the silt layer it should be replaced with lean concrete.

It is suggested that a thin layer of lean concrete should be spread on the floor of the excavation as soon as it has been exposed and inspected. This will prevent disturbance by construction personnel or equipment, or by water seepage.

#### VI SUMMARY

1. The strata are predominantly granular and pervious to a level below that proposed for the footings. A hard, slightly cohesive till was encountered at lower elevations.
2. Footings located at El. 1105 feet should be designed for a gross soil pressure not exceeding 3 t.s.f.
3. To secure a dry, stable excavation, sheet piles should be driven into the till to make a water seal.

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. Proceedings of the 4th International Conference on Soil Mechanics and Foundation Engineering (Research on Determining the Density of Sands by Spoon Penetration Testing, by H.J. Gibbs and W.G. Holtz of the United States Bureau of Reclamation).
4. Terzaghi and Peck: Soil Mechanics in Engineering Practice, John Wiley and Sons, New York, 1948.



Encl.  
JP/mc

DOMINION SOIL INVESTIGATION LIMITED

A handwritten signature in cursive script, appearing to read "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
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	OBSERVATIONS	
"	"	pressure	p	MADE WHILE	
"	"	tapping	t	CORING	
					Steady pressure
					No pressure
					Intermittent pressure
					Washwater returns
					Washwater lost

## PENETRATION RESISTANCES

**DYNAMIC PENETRATION RESISTANCE** : to drive a 2", 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 :



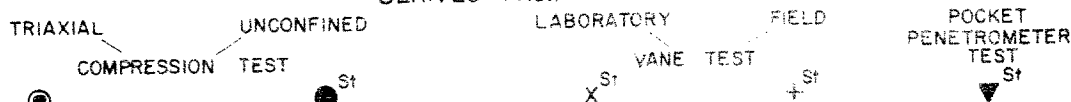
322

## SOIL PROPERTIES.

W %	Water content	$\delta^*$	Natural bulk density (unit weight)	k	Coeff. of permeability
LL %	Liquid limit	e	Void ratio	C	Shear strength — in terms of
PL %	Plastic limit	RD	Relative density	$\phi$	Angle of int. friction — total stress
PI %	Plasticity index	Cv	Coeff. of consolidation	C'	Cohesion — in terms of
LI	Liquidity index	m <sub>v</sub>	Coeff. of volume compressibility	$\phi'$	Angle of int. friction — effective stress

## UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —



Strain at failure is represented by direction of stem

20%  
15% — 5%  
10%

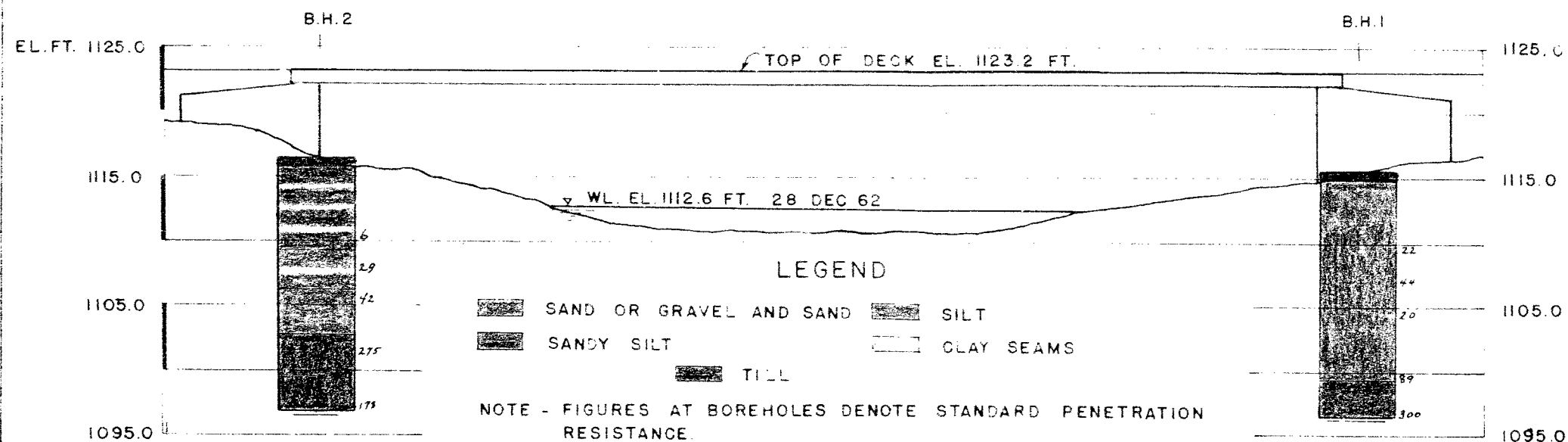
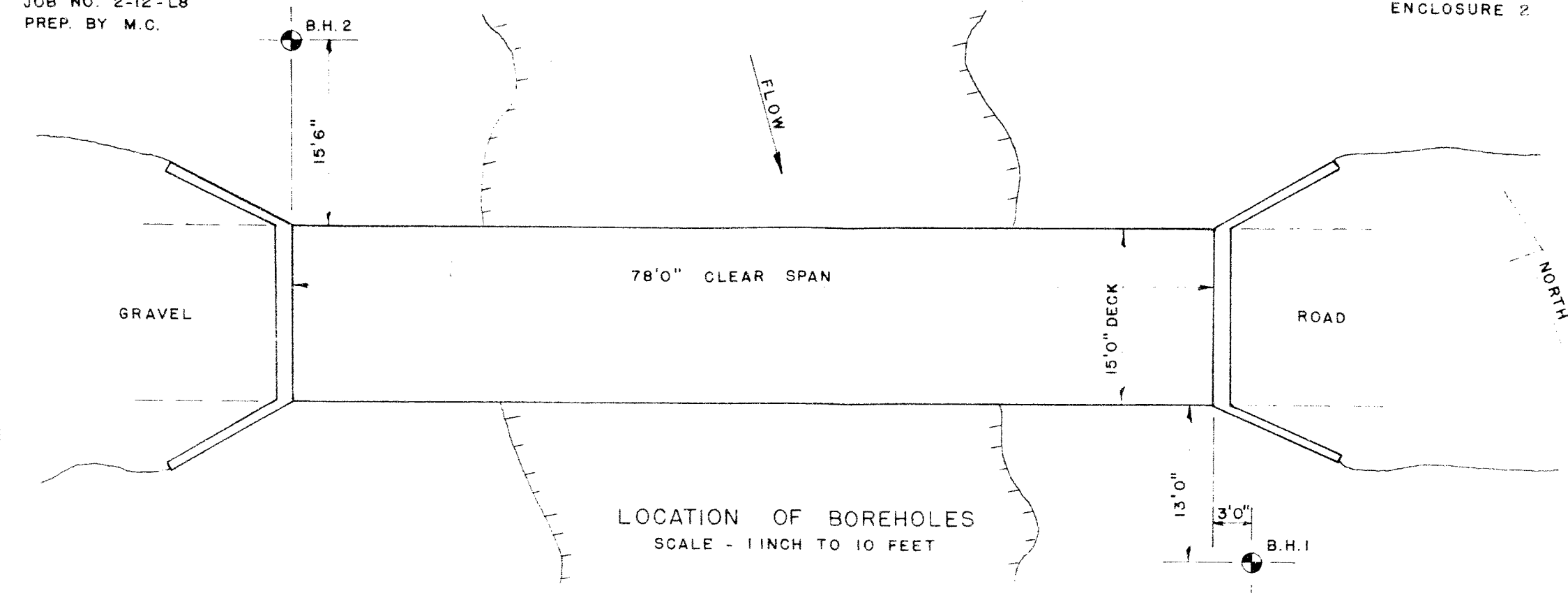
St : sensitivity =  $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

## 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

JOB NO. 2-12-L8  
PREP. BY M.C.

ENCLOSURE 2



SUBSURFACE PROFILE  
SCALE - 1 INCH TO 10 FEET

DOMINION SOIL INVESTIGATION LIMITED

# GEOTECHNICAL DATA SHEET FOR BOREHOLE 1. and 2

OUR REFERENCE NO. 2-12-L8

CLIENT: Mr. R.M. Dawson  
PROJECT: Bain Bridge No. 2

METHOD OF BORING: Washboring  
DIAMETER OF BOREHOLE: 3-inch

ENCLOSURE NO 3

Borehole LOCATION: See enclosure 2

DATE: Borehole 1 - 26/27 Dec 62

DATUM ELEVATION: Existing bridge deck 1123.2 feet

Borehole 2 - 27/28 Dec 62

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLE			PENETROMETER RESISTANCE blows per foot					CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	TEST NO.	20	40	60	80	100	PL	WL	LL	
1115.4	0	Ground surface													Borehole 1
		Topsoil													
10.0	5	Well graded silty sand and gravel mixtures (dense to very dense)		1	SS	22									
				2	SS	44									
05.0	10			3	SS	20									
															Details of Extrapolated N-values Sa.#5 100/4"
99.4	15	Hard grey sandy silt till (very slightly cohesive)		4	SS	89									
				5	SS	300									
96.6	20	End of borehole													
1116.4	0	Ground surface													Borehole 2
		Topsoil													
	5	Brown sandy silt with seams of clay and traces of gravel		1	SS	6									
09.4				2	SS	29									
06.4	10			3	SS	42									
															Details of Extrapolated N-values Sa.#4 65/6", 35/1" Sa.#5 32/0", 46/6", 22/1"
02.9	15	Dense grey silt (slight cohesion)		4	SS	275									
		Hard grey gravelly clayey sandy silt till													
96.8	20			5	SS	178									
		End of borehole													

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: MC CHD: JP