

#64-F-285M

MUNROE BRIDGE

LOT #21, CON #3 & #4

WESTMINSTER

TWP.

B.A. 1889

DOMINION SOIL INVESTIGATION LIMITED

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BRANCH
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FOUNDATION ENGINEERS

P.O. BOX 933
SAULT STE. MARIE
ONTARIO
TELEPHONE AL. 4-2615

London, June 29th, 1964

4-6-12,
Report.

Fred A. Bell & Associates,
Consulting Engineers,
17 Hincks Street,
ST. THOMAS, Ontario.

64 - E - 285 M

Attention: Mr. R. Lemon

Gentlemen:

Soil Investigation for Munroe Bridge, Lot 21,
Concessions 3 and 4, Township of Westminster

We have completed this project in accordance with your verbal order of June 5th, 1964. This report is a record of our findings and recommendations.

It is understood that the existing 48 feet span structure which carries a concession road over the Dingman Creek will be replaced by a new bridge with a span of approximately 60 feet. The centre of the new structure will be 10 feet to the south and 5 feet to the west of the existing one. The approximate locations of the boreholes were determined during a visit to the site by Mr. R. Lemon and the writer on the 5th of June, 1964.

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

SUMMARY

The strata consist of 3 to 4 feet of clayey, sandy silt below which is a very stiff to hard clay till. At a depth of approximately 20 feet, the till is underlain by a very stiff layer of fat clay. It is recommended that the structure should be supported on spread footings bearing in the till layer at 41.822.5. The net soil pressure should not exceed 5000 pounds per square foot and it is estimated that the settlement due to consolidation will be 1 to 1.5 inches. Differential settlement will be small.

No unusual construction problems are anticipated.

Fred A. Bell & Associates,
June 29th, 1964

FIELD WORK

Field work was carried out on the 11th and 12th of June, 1964 and consisted of 2 boreholes at the locations shown on Figure 2. The holes were advanced by washboring and lined with 8x casing for part of their depth.

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. One standard penetration test was performed adjacent to borehole 1.

Results of the field tests are recorded on geotechnical sheets comprising enclosures 3 and 4.

SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown on the data sheets and a general picture of the subsurface conditions is given by the profile on enclosure 2. The principle strata are as follows:

- (a) Under a 6 inch layer of topsoil a brown damp clayey sandy silt extends to a depth of 3 to 4 feet. The site is located in a spillway valley and this material is probably an alluvial sediment.
- (b) A glacial till deposit extends to an average elevation of 812 feet. This consists of a silty clay with 2 or 3% of fine granular particles embedded in its matrix. The consistency of the material varies from *very stiff* to *hard* as demonstrated by N-values ranging from 25 to 58. Its moisture content is a little above the plastic limit.
- (c) The boreholes were terminated in a deposit of very stiff clay of high plasticity. It has the appearance of a lake deposit and contains thin horizontal seams of sandy silt.

At the time of the investigation the level of water in the creek was El. 828.4. The level of water in the boreholes remained from 4 to 8 feet below this level after the drilling had been completed.

FOUNDATIONS

The level of the bed of the creek at midstream is about El. 827.8 and the soil deposit below this level is stiff and cohesive.

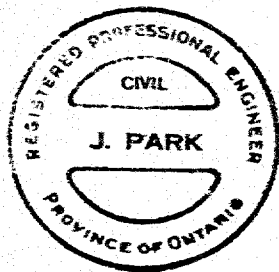
Fred A. Bell & Associates,
June 29th, 1964

The conditions are thus suitable for the use of spread footing foundations. It is recommended that the footings should bear at El. 822.5, allowing approximately 5 feet for scour protection. The standard penetration tests within the till layer below this level gave N-values ranging from 25 to 36. On this basis a net soil pressure of 5000 pounds per square foot is recommended for the design of the footings.

It is estimated that settlement due to consolidation of the soil after the structure has been completed will lie in the range 1 to 1.5 inches. Because of the similarity in the soil conditions at the 2 boreholes, differential settlement will probably be very small.

CONSTRUCTION

The stiff cohesive soil will present no unusual construction problems. It may be necessary to brace or slope the upper sandy silt layer but the sides of temporary excavations into the till stratum will stand vertically without support. The volume of seepage into the excavation will probably be very small. Seepage water should be collected in sumps dug below the footing level and removed by pumping. It is suggested that a thin blanket of lean concrete should be spread over the footing grade as soon as it has been exposed and approved. This will provide a clean working surface and will prevent disturbance by construction personnel or equipment.



JP/mkf

Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED

A handwritten signature in cursive script that reads "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	0.075	0.002	>	NO SIZE LIMIT		
U.S. Standard Sieve Size:		No. 4		No. 10	No. 40	No. 200						

SAMPLE TYPES.

AS Auger sample
CS Sample from casing
ChS Chunk sample

RC Rock core
% Recovery
SS Split spoon sample

TP Piston, thin walled tube sample
TW Open, thin walled tube 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.

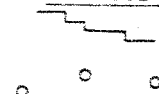
DYNAMIC PENETRATION RESISTANCE : to drive a 2" dia., 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

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
LL % Liquid limit
PL % Plastic limit
PI % Plasticity index
LI Liquidity index

γ Natural bulk density (unit weight)
e Void ratio
RD Relative density
Cv Coeff. of consolidation
mv Coeff. of volume compressibility

k Coeff. of permeability
C Shear strength in terms of total stress
 ϕ Angle of int. friction
C' Cohesion in terms of effective stress
 ϕ' Angle of int. friction

UNDRAINED SHEAR STRENGTH.

- DERIVED FROM -

TRIAXIAL COMPRESSION TEST

UNCONFINED TEST

LABORATORY

FIELD

VANE TEST

POCKET PENETROMETER TEST

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 :

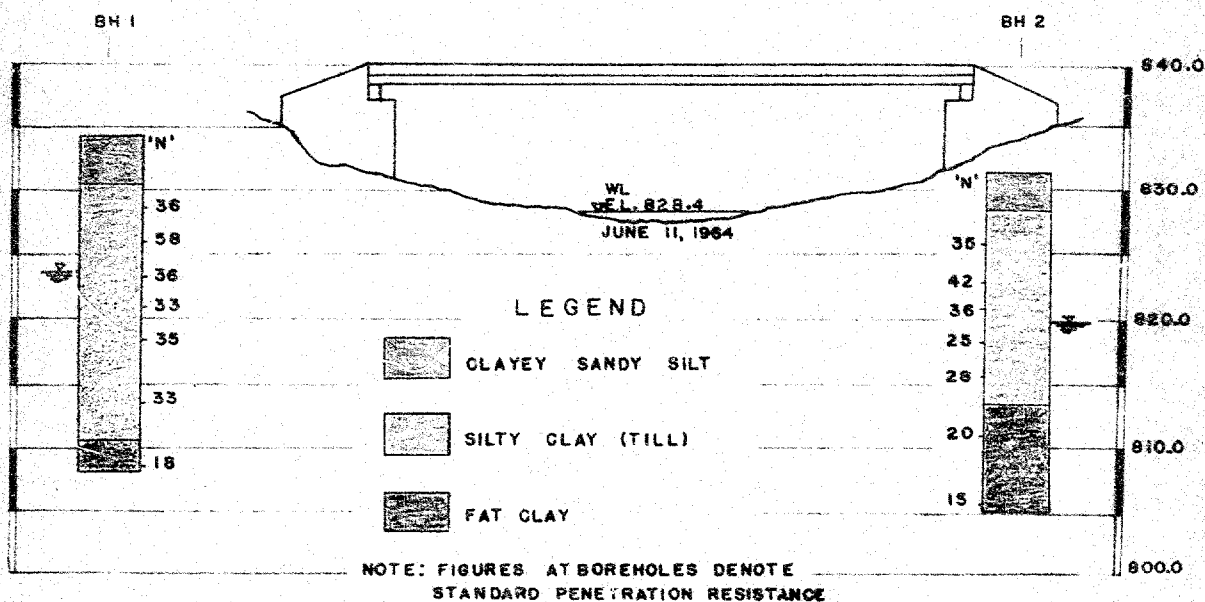
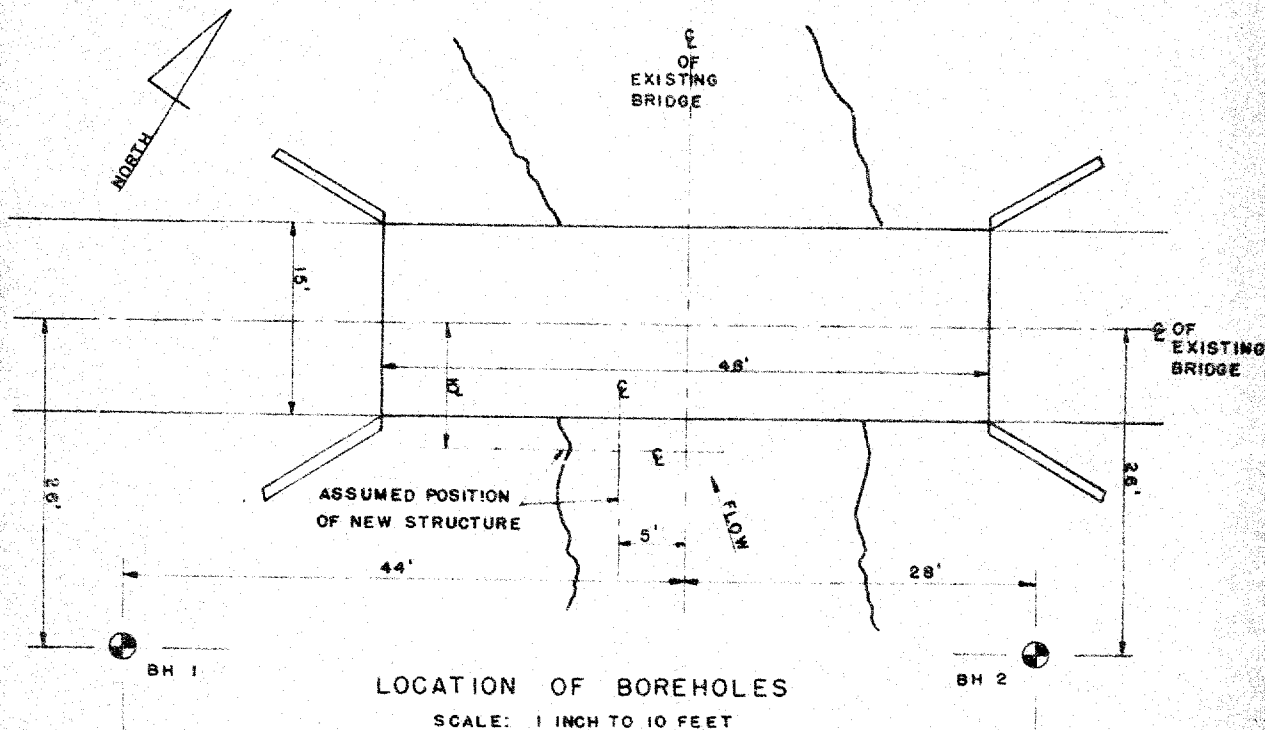
RD :

Very loose 0 - 15 %
Loose 15 - 35 %
Compact 35 - 65 %
Dense 65 - 85 %
Very dense 85 - 100 %

COHESIVE SOILS :

c lbs/sqft

Very soft less than 250
Soft 250 - 500
Firm 500 - 1000
Stiff 1000 - 2000
Very stiff 2000 - 4000
Hard over 4000



SUBSURFACE PROFILE

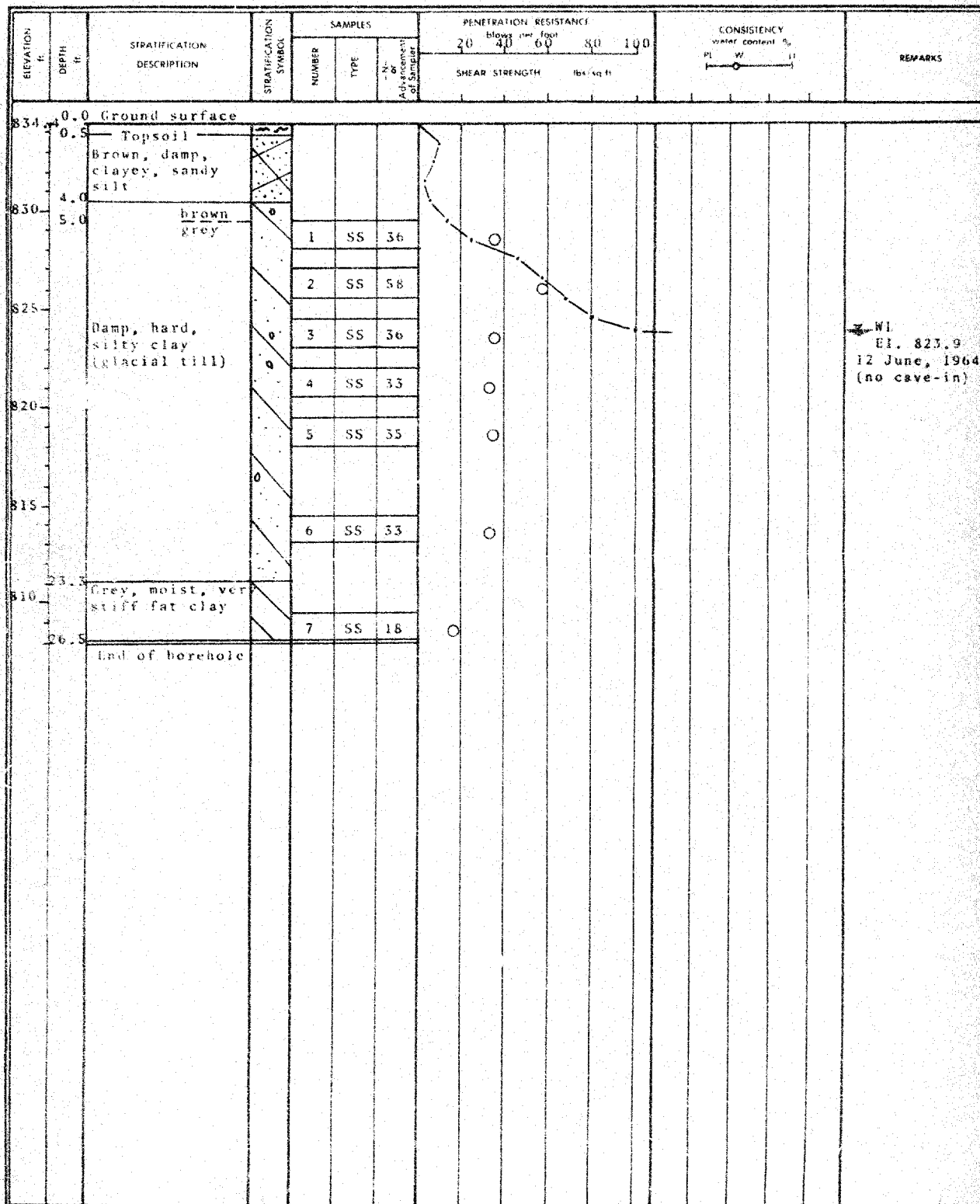
SCALE: 1 INCH TO 10 FEET

OUR REFERENCE NO 4-6-12

GEOTECHNICAL DATA SHEET FOR BOREHOLE 1

CLIENT: Messrs. Fred A. Bell & Associates Ltd. METHOD OF BORING: Wash boring
 PROJECT: Munroe Bridge DIAMETER OF BOREHOLE: 8x (3 inch)
 LOCATION: Westminster Township DATE: June 11th, 1964
 DATUM ELEVATION: Geodetic

ENCLOSURE NO 3



OUR REFERENCE NO. 4-6-12

GEOTECHNICAL DATA SHEET FOR BOREHOLE 2.....

CLIENT: Messrs. Fred A. Bell & Associates Ltd.
 PROJECT: Munroe Bridge,
 LOCATION: Westminster Township
 DATUM ELEVATION: Geodetic

METHOD OF BORING: Wash Boring
 DIAMETER OF BOREHOLE: 3 x 1.5 inch
 DATE: June 12th, 1964

ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE				CONSISTENCY		REMARKS		
				NUMBER	TYPE	Advance- ment of Sampler	blows per foot				water content %				
							20	40	60	80	100	PL	W	LL	
							SHEAR STRENGTH				lb/sq ft				
831.60.0		Ground surface													
830.0	0.5	Topsoil													
	3.0	Brown, damp, clayey sandy silt													
825		Grey silty clay (glacial till) hard, damp to moist moist very stiff		1	SS	35									
				2	SS	42									
				3	SS	36									
820	12.0			4	SS	25									
				5	SS	28									
815	18.5	Grey, moist, ver stiff, fat clay (fine sandy silt layers)		6	SS	20									
810															
				7	SS	15									
805	26.5	End of borehole													

7 WL
El. 819.9
12 June, 1964
(no cave-in)

WL
 El. 819.9
 12 June, 1964
 (no cave-in)