

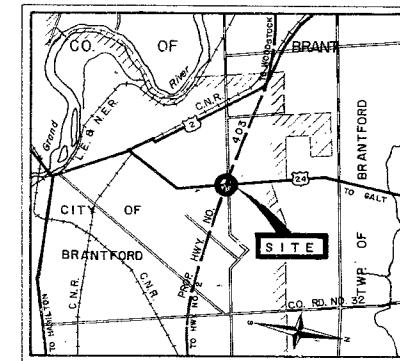
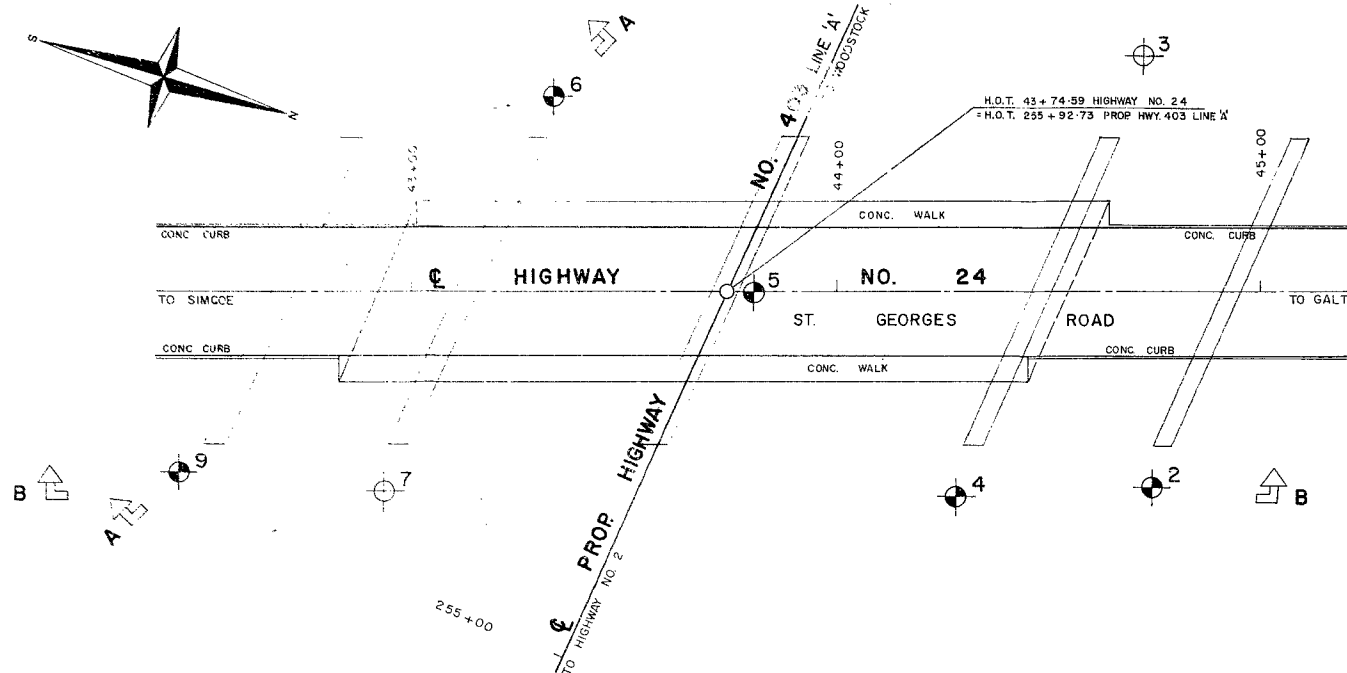
61-F-73

W.P. 151-60

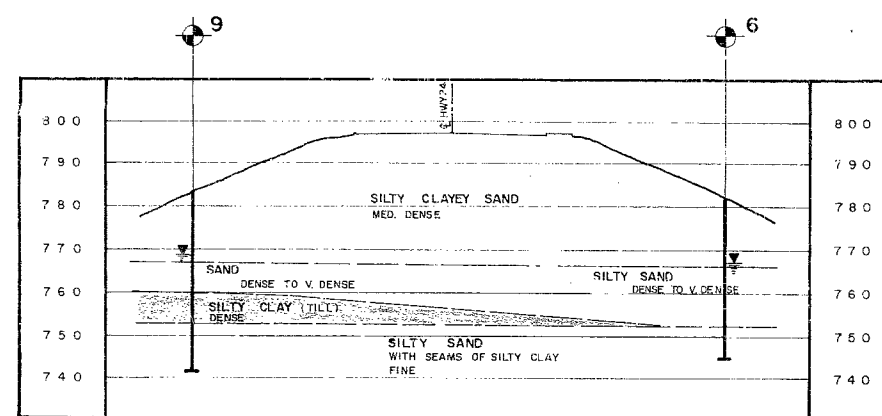
HWY #24

& #
HWY 403

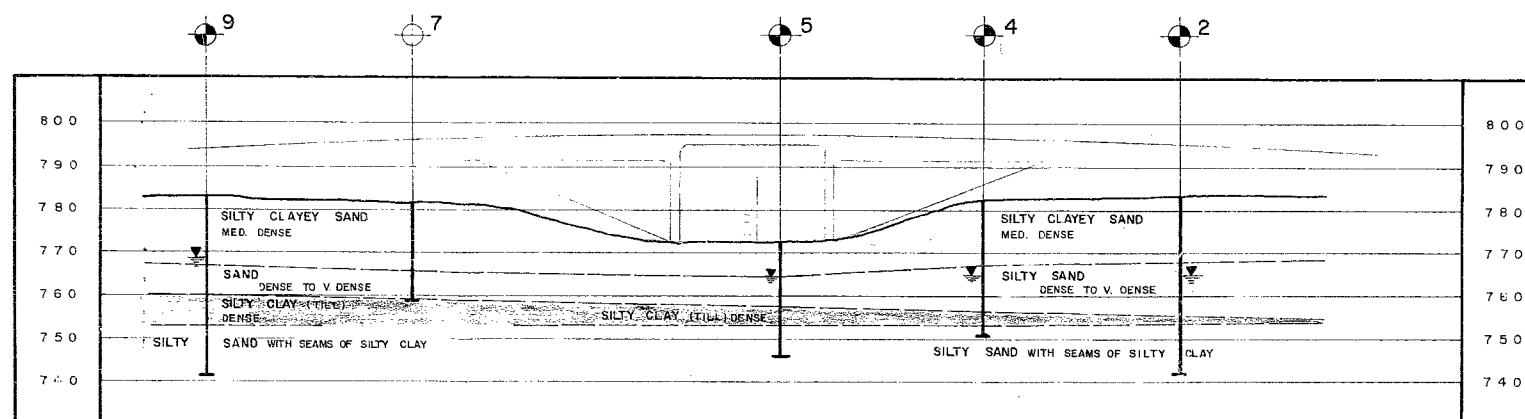
INTERCHANGE



KEY PLAN
SCALE: 1 in = 1 mi.



A - A



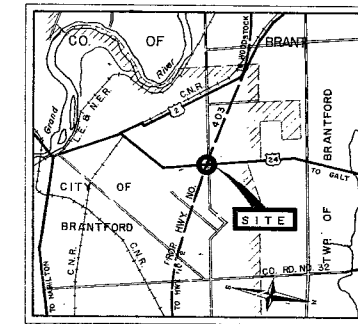
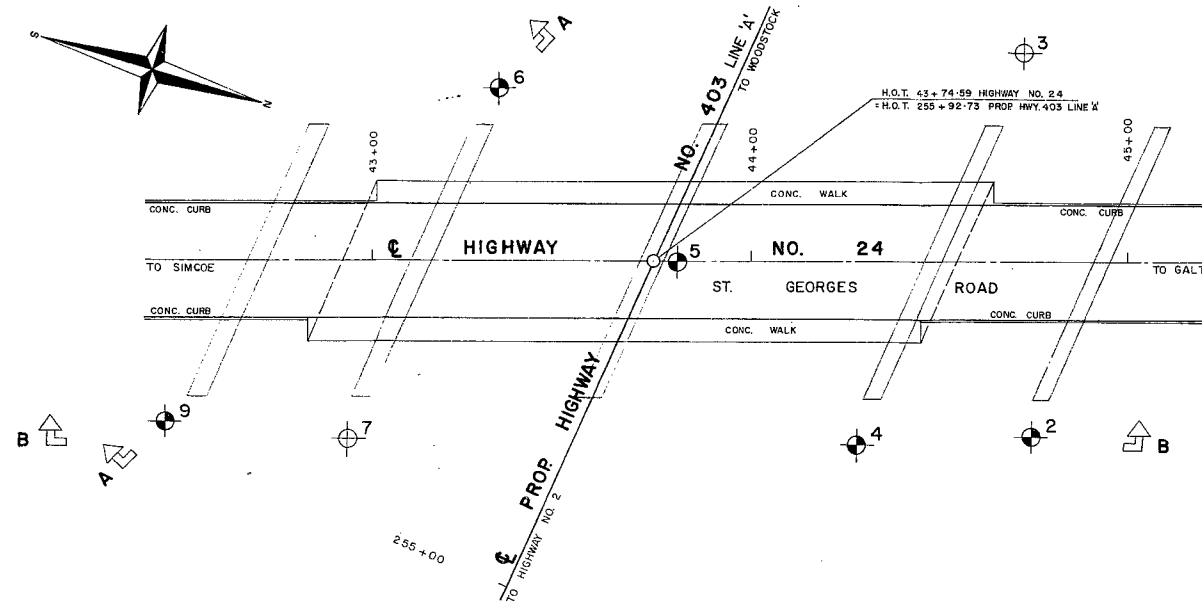
B - B

LEGEND			
	BORE & PENETRATION HOLE		
	PENETRATION HOLE		
	WATER LEVELS - Established at the Time of Field Investigation AUG. 1961.		
HOLE	ELEVATION	STATION	OFFSET
2	783.5	44+74	46' RT.
3	783.0	44+72	55' LT.
4	782.5	44+28	48' RT.
5	772.8	43+80	C
6	781.5	43+33	46' LT.
7	781.5	42+94	47' RT.
9	783.0	42+52	42' RT.

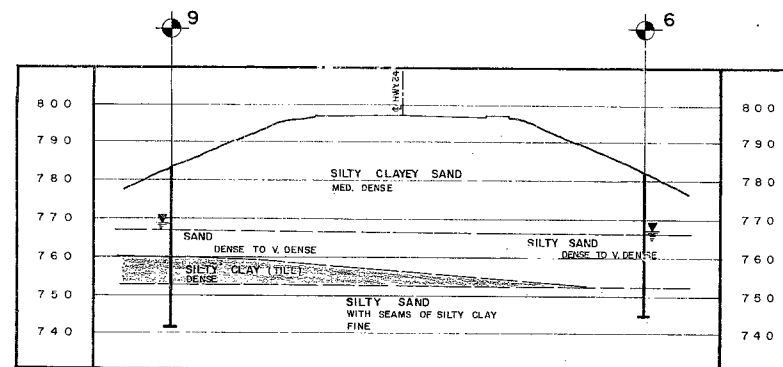
NOTE
THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO		
MATERIALS & RESEARCH SECTION		
HIGHWAY NO. 24		
AND		
PROPOSED HIGHWAY NO. 403		
LINE 'A'		
ORIGINATED V. KORLI	DISTRICT NO. 4	DATE 29 AUGUST 1961
DRAWN D. MUMFORD	W.P. NO. 151-60	JOB NO. 61-F-73
CHECKED	SCALE	DRAWING NO.
APPROVED	1 inch = 20 feet	61-F-73 A

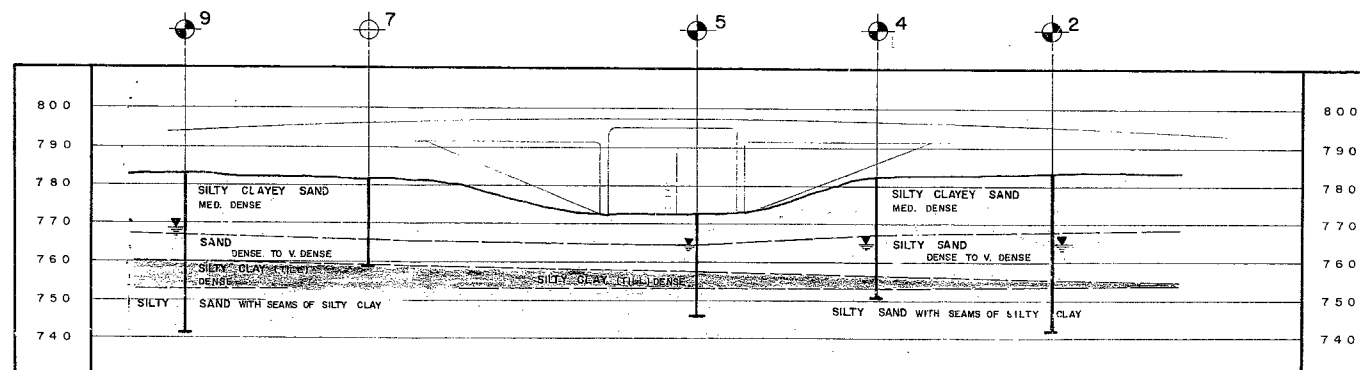
REF. NO. E-3976-1



KEY PLAN
SCALE: 1 in = 1 mi.



A - A



B - B

LEGEND			
	BORE & PENETRATION HOLE		
	PENETRATION HOLE		
	WATER LEVELS - Established at the Time of Field Investigation AUG. 1961.		
HOLE	ELEVATION	STATION	OFFSET
2	783.5	44+74	46' RT.
3	783.0	44+72	55' LT.
4	782.5	44+28	48' RT.
5	772.8	43+80	CL
6	761.5	43+33	46' LT.
7	761.5	42+94	47' RT.
9	783.0	42+52	42' RT.

NOTE
THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS - ONTARIO		
MATERIALS & RESEARCH SECTION		
HIGHWAY NO. 24 AND PROPOSED HIGHWAY NO. 403		
ORIGINATED V. KORLI	DISTRICT NO. 4	DATE: 29 AUGUST 1961
DRAWN D. MUMFORD	W.P. NO. 151-60	JOB NO. 61-F-73
CHECKED	SCALE	DRAWING NO.
APPROVED	1 inch = 20 feet	61-F-73 A

REF. NO. E-3976-1

23-64-464

Mr. A. H. Toye,
Bridge Engineer.
Materials & Research Section,
(Foundations Office).
Attention: Mr. S. McCosbie.

August 18, 1961.

D.R.O. FOUNDATION INVESTIGATION
REPORT.
W.J. 61-F-73 -- W.P. 151-60.

Re: Hwy. 24 Interchange and Proposed Hwy. 403, Line 'A',
Brantford City, County of Brant, Ont., District #4.

Accompanying this memo, is our detailed foundation
investigation report on the subsail conditions existing at
the above site.

We believe you will find the conclusions and recom-
mendations summarized in the report, adequate for your future
design work. However, should there be any queries in connection
with this project, please do not hesitate to call on our Office.

A. G. Sternad

A. G. Sternad,
PRINCIPAL FOUNDATION ENGINEER

AGS/MLM
attach.

cc: Messrs. A. H. Toye (2)
H. A. Froeseke
H. D. MacMillan
I. C. Campbell
J. C. Thatcher
T. J. Revich
J. Roy
J. E. Grusnier
E. R. Saint
F. Horman
A. Watt
Foundations Office
Gen. Files ✓

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 2. DESCRIPTION OF SITE AND GEOLOGY.
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 - 4.2) Brown, Fine to Coarse Sand.
 - 4.3) Brown, Medium to Fine Silty Sand.
 - 4.4) Grey, Silty Clay.
 5. GROUND WATER
 6. FOUNDATION CONSIDERATIONS & RECOMMENDATIONS.
 7. SUMMARY.
 8. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION

For

Hwy. 24 Interchange and Proposed Hwy. 403, Line 'A',
Brantford City, County of Brant, Ont., District #4.
W.J. 61-F-73 -- W.P. 151-60

1. INTRODUCTION:

Presented in this report are the results of a field soil investigation and laboratory tests, together with recommendations for the foundations for the proposed new bridge at the intersection of Hwy. #24 and Proposed Hwy. #403, Line 'A'.

The site is located in Brantford City, County of Brant, Ontario.

2. DESCRIPTION OF SITE AND GEOLOGY:

The topography of the area is flat to undulating. The site is in the physiographic region referred to as the Norfolk Sand Plain. The sands and silts of this region were deposited as a delta in Glacial Lakes Whittlesey and Warren. This deposition took place during the withdrawal of the Erie ice lobe.

3. FIELD AND LABORATORY WORK:

The soil investigation was carried out by means of a core drill machine adapted for soil sampling. During the investigation, 5 boreholes and two dynamic cone penetrations were made.

The boreholes were advanced by conventional wash-boring methods. Samples were taken at regular 5-ft. intervals. In granular soils the samples were taken by a 2" O.D. split-barrelled spoon sampler and the energy used in driving it, conforms to the requirements of the Standard Penetration Test.

cont'd. /2 ...

3. FIELD AND LABORATORY WORK:- (cont'd.) ...

The split spoon samples were visually examined in the field and representative samples were brought to the laboratory for further testing, for classification purposes, only. Results of these are given in Appendix I of this report.

The logs of the boreholes and their location are shown on Drawing #61-F-73A attached under Appendix I.

4. SOIL TYPES ENCOUNTERED:

4.1) General:

The investigation at the site revealed the following subsoil conditions:-

The upper layer is brown coloured silty, clayey, fine to coarse sand. It is underlain by a deposit of brown coloured silty fine sand. Interbedded in this deposit is a layer of grey silty clay.

4.2) Brown, Fine to Coarse Sand:

This material extends down to elevation 767 ft. It is well graded, the grain size varying from coarse to fine. At the top, it is silty and clayey and with depth becomes gravelly. The Standard Penetration Test results indicate that the layer is densely compacted ($N = 30$). The material in this layer is dry to moist.

4.3) Brown, Medium to Fine Silty Sand:

Underlying the top material is a layer of brown coloured silty fine sand. This layer was explored to a depth of 26 ft. - (elevation 742'). The material consists of medium to fine sand with some silt and some gravel of max. size 1" (boreholes 4 & 5). The material is very densely compacted ($N = 70$).

cont'd. /3 ...

4. SOIL TYPES ENCOUNTERED: (cont'd.) ...

4.4) Gray Silty Clay:

Interbedded in the above layer is a deposit of gray silty clay. The thickness of this layer varied from 1 ft. (B.H. 2) to 7 ft. (B.H. 9). This layer was not encountered in B.H. 6 which is on the West side of the existing bridge. The material is of very low compressibility and its consistency may be classified as hard - (N = 38 - 57).

5. GROUND WATER:

The ground water as measured in the boreholes, was located at elevations corresponding to the top boundary of the brown, fine silty sand layer (i.e., varying from elev. 768.5 to 764.5).

The subsoil below this depth should be considered as submerged.

6. FOUNDATION CONSIDERATIONS & RECOMMENDATIONS:

The subsoil at the site consists of a granular deposit interbedded with a very hard silty clay layer about 1 to 7 ft. thick. These conditions are favourable for the support of spread footing type foundations.

Abutments: (B.H.'s. 2 & 9)

It is recommended to place the abutments at about elevation 775 ft. and use a safe bearing pressure of 3 T.S.F.

Piers: (B.H.'s. 4, 5 & 6)

It is recommended to place these footings at about 5 ft. below the new Hwy. 403 grade line (i.e., elev. 768'). A safe bearing pressure of 3 T.S.F. is recommended.

7. SUMMARY:

1. The subsoil at this site consists mainly of a granular deposit. A layer of very hard silty clay, varying in thickness from 1 ft. to 7 ft., is interbedded in this granular deposit at 20' - 26' below the existing ground level.

The material in the subsoil is in a dense to very dense state of compaction and therefore favourable for the support of spread footings.

2. It is recommended to place the footings at the following elevations and use a safe bearing pressure of 3 T.S.F.

Abutments: (B.H.'s. 2 & 9) at about elevation 775 ft.

Piers: (B.H.'s. 4, 5 & 6) at about elevation 768 ft. This elevation is assumed to be about 5 ft. below the new Hwy. 403 grade line.

3. The approach fills on both sides do not present any stability problems.

8. MISCELLANEOUS:

The field work was carried out during July 31 to Aug. 11, 1961, under the supervision of Project Foundation Engineer, V. Korlu. All laboratory testing was done by the Materials and Research Section.

REPORT PREPARED BY: *P. S. Chatterjee*
for V. Korlu,
PROJECT FOUNDATION ENGINEER.

August 1961.

REPORT APPROVED BY: *Altermann*
A. G. Starnac,
PRINCIPAL FOUNDATION ENGINEER.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-73

W.P. 151-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETN RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	Omitted.									
2	S1	5'-6.5'	Coarse to fine sand with gravel.	21	-	-	-	-	-	
	S2	10'-11.5'	" " " "	27	11.3	-	-	-	-	
	S3	15'-16.5'	Brown fine sand(silty and clayey).	49	-	-	-	-	-	
	S4	20'-21.5'	" " " "	88	-	-	-	-	-	
	S5	25'-26.5'	" " " "	96	19.4	-	-	-	-	
	S6A	30'-31'	Grey silty clay, clayey silt (till).	119	12.6	-	-	-	-	
	S6B	31'-32.5'	Brown fine silty sand (with silty clay varving).		-	-	-	-	-	
	S7	35'-36.5'	" " " "	57	-	-	-	-	-	
	S8	40'-41.5'	" " " "	54	35.2	-	-	-	-	
3	cone penetration only.									
4	S1	5'-6.5'	Coarse to fine sand.	13	-	-	-	-	-	
	S2	10'-11.5'	" " " "	29	17.5	-	-	-	-	
	S3	15'-16.5'	Fine silty sand with gravel.	42	-	-	-	-	-	
	S4	20'-21.5'	" " " "	34	-	-	-	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-73

W.P. 151-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
4	S5	25'-26.0' 26'-26.5'	Fine silty sand with gravel. Grey silty clay (till).	76	13.2	13.7	18.2	-	-	
	S6	30'-31.5'	Fine silty sand.	163	18.0	-	-	-	-	
5	S1	5'-6.5'	Coarse to fine sand.	29	16.5	-	-	-	-	
	S2	10'-11.5'	Fine silty sand.	49	21.8	-	-	-	-	
	S3	15'-16.5'	Grey silty clay } (Till) clayey silt)	57	10.4	12.4	19.3	-	-	
	S4	20'-21.5'	Fine silty sand.	67	-	-	-	-	-	
	S5	25'-26.5'	" " "	59	21.2	-	-	-	-	
6	S1	5'-6.5'	Coarse to fine sand with gravel.	10	4.6	-	-	-	-	
	S2	10'-11.5'	Brown medium silty sand.	29	-	-	-	-	-	
	S3	15'-16.5'	Fine silty sand.	50	-	-	-	-	-	
	S4	20'-21.5'	" " "	97	22.5	-	-	-	-	
	S5	25'-26.2'	" " "	221-9"	-	-	-	-	-	
	S6	30'-31.5'	Medium to fine sand with silty clay varving of 1/4".	67	-	-	-	-	-	
	S7	35'-36.5'	" " " " "	53	-	-	-	-	-	
7			cone penetration only.							

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-73

W.P. 151-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
8	Omitted.									
9	S1	5'-6.5'	Brown clayey sand.	4	6.8	-	-	-	-	
	S2	10'-11.5'	Medium sand with gravel.	24	-	-	-	-	-	
	S3	15'-16.5'	Fine silty sand.	63	-	-	-	-	-	
	S4	20'-21.5'	Fine silty sand.	62	22.8	-	-	-	-	
	S5	25'-26.5'	Grey silty clay (till).	38	15.8	15.1	23.8	-	-	
	S6	30'-31.5'	Medium to fine silty sand.	71	-	-	-	-	-	
	S7	35'-36.5'	Medium to fine sand with seams of silty clay 2".	55	-	-	-	-	-	
	S8	40'-41.5'	Fine silty sand.	80	16.8	-	-	-	-	
			S denotes split spoon sample.							

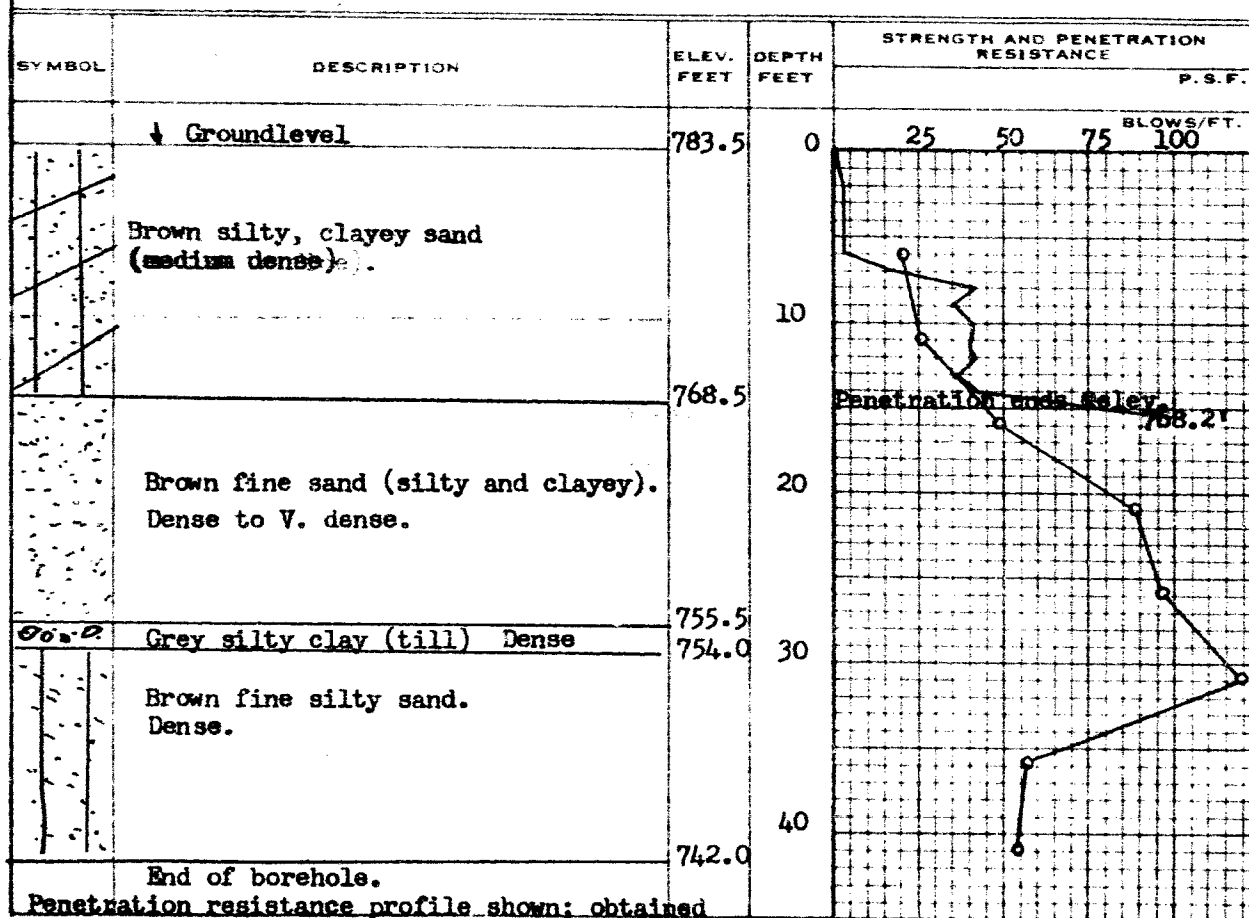
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 151-60 BORE HOLE NO. 2
 JOB 61-F-73 STATION 44+74 (46' Rt.)
 DATUM 783.5' COMPILED BY B.K.
 BORING DATE Aug. 1/61. CHECKED BY V.K.

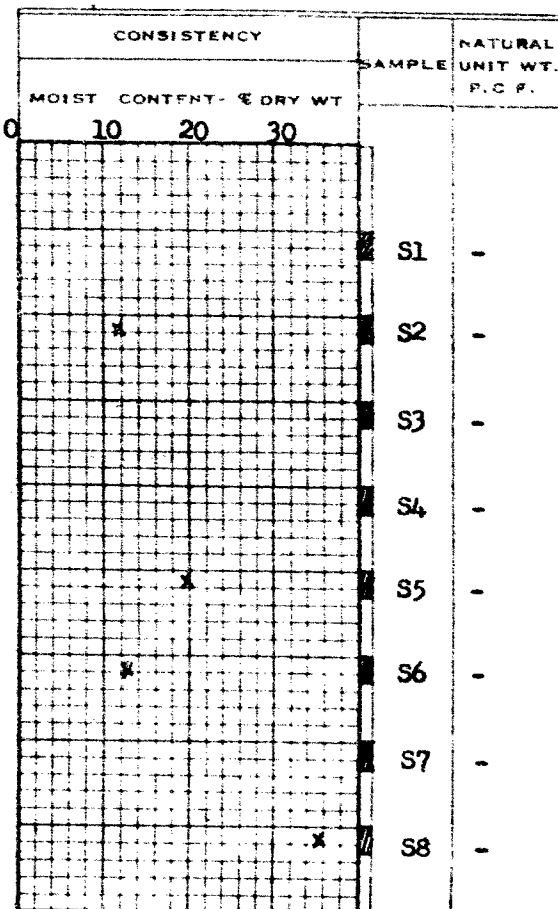
2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

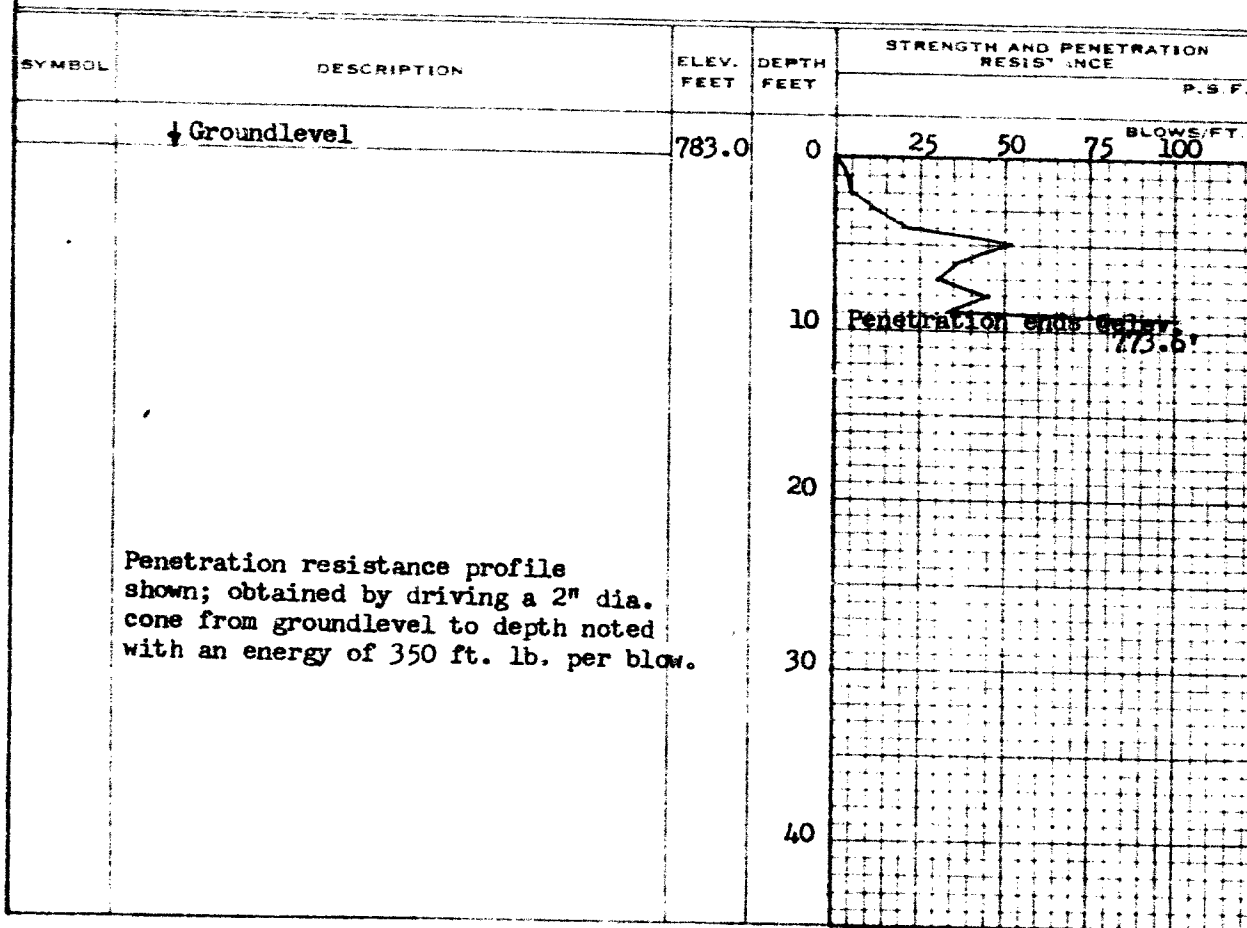
W.P. 151-60
JOB 61-F-73
DATUM 783.0'
BORING DATE Aug. 11/61.

BORE HOLE NO. 3
STATION 44+72 (55' Lt.)
COMPILED BY B.K.
CHECKED BY V.K.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	---	0
VANE TEST (C) AND SENSITIVITY (S)	---	+
NATURAL MOISTURE AND		
LIQUIDITY INDEX	---	X
LIQUID LIMIT	---	
PLASTIC LIMIT	---	

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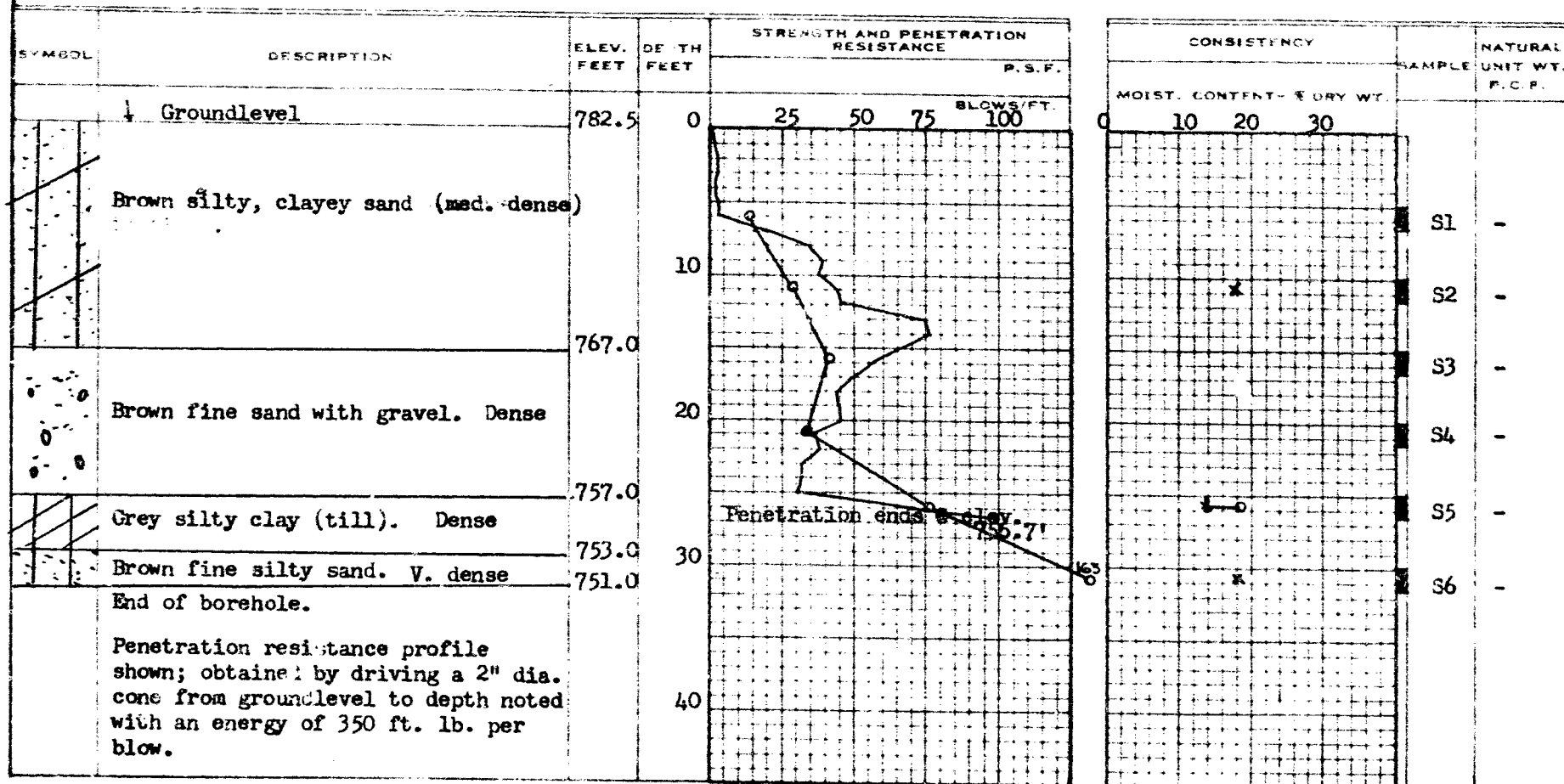
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 151-60 BORE HOLE NO. 4
 JOB 61-P-73 STATION 44+28 (48' Rt.)
 DATUM 782.5' COMPILED BY B.K.
 BORING DATE Aug. 3/61. CHECKED BY V.K.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) \bigcirc
 VANE TEST (C) AND SENSITIVITY (S) $+$
 NATURAL MOISTURE AND LIQUIDITY INDEX \times
 LIQUID LIMIT \bigcirc
 PLASTIC LIMIT $-$



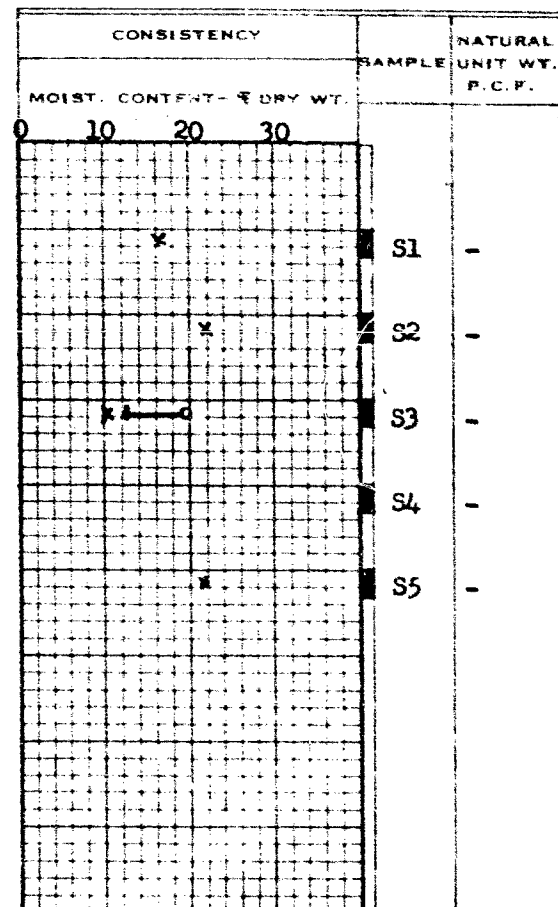
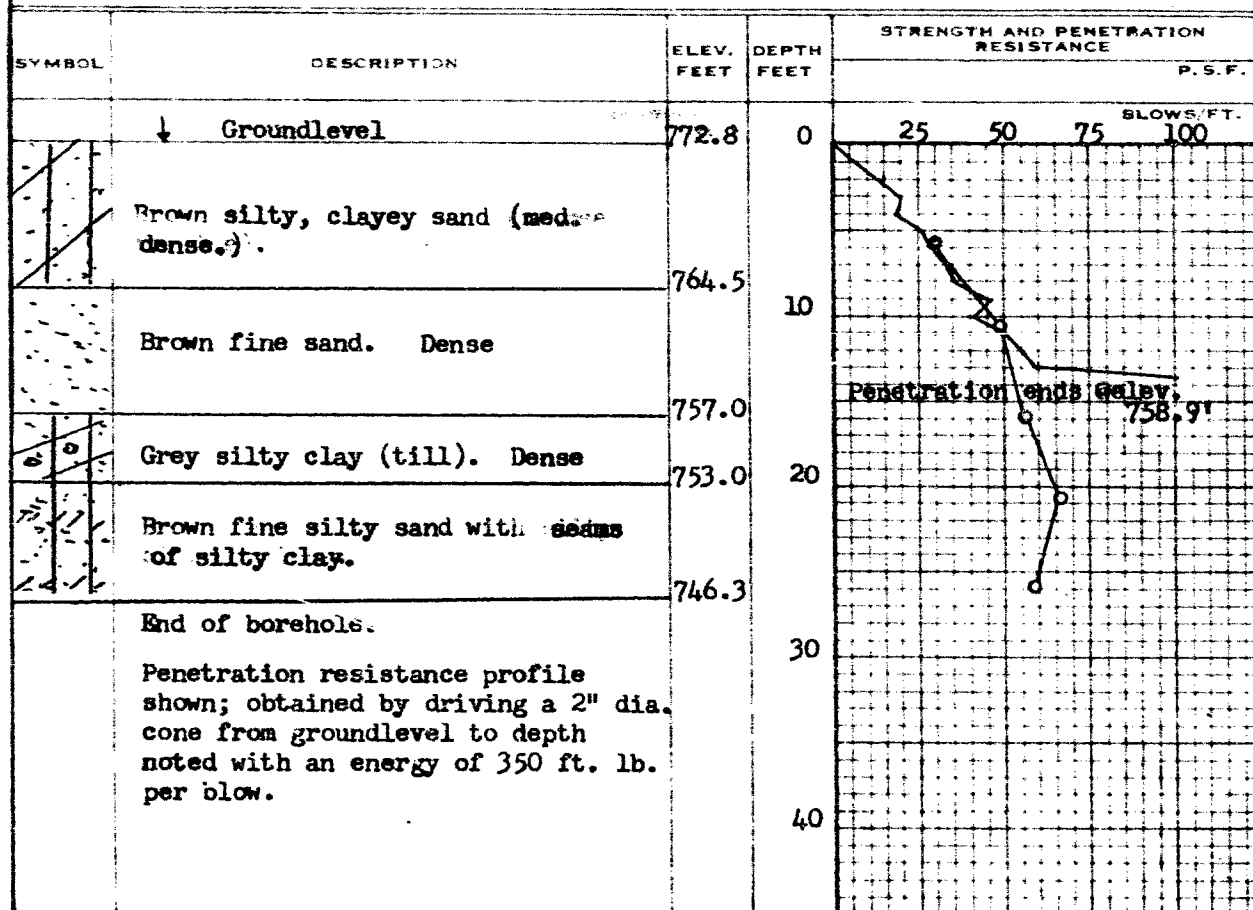
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 151-60 BORE HOLE NO. 5
JOB 61-F-73 STATION 43+80 (E)
DATUM 772.8' COMPILED BY B.K.
BORING DATE Aug. 4/61. CHECKED BY V.K.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 151-61 BORE HOLE NO. 6

JOB 61-F-73 STATION 43+33 (46' It.)

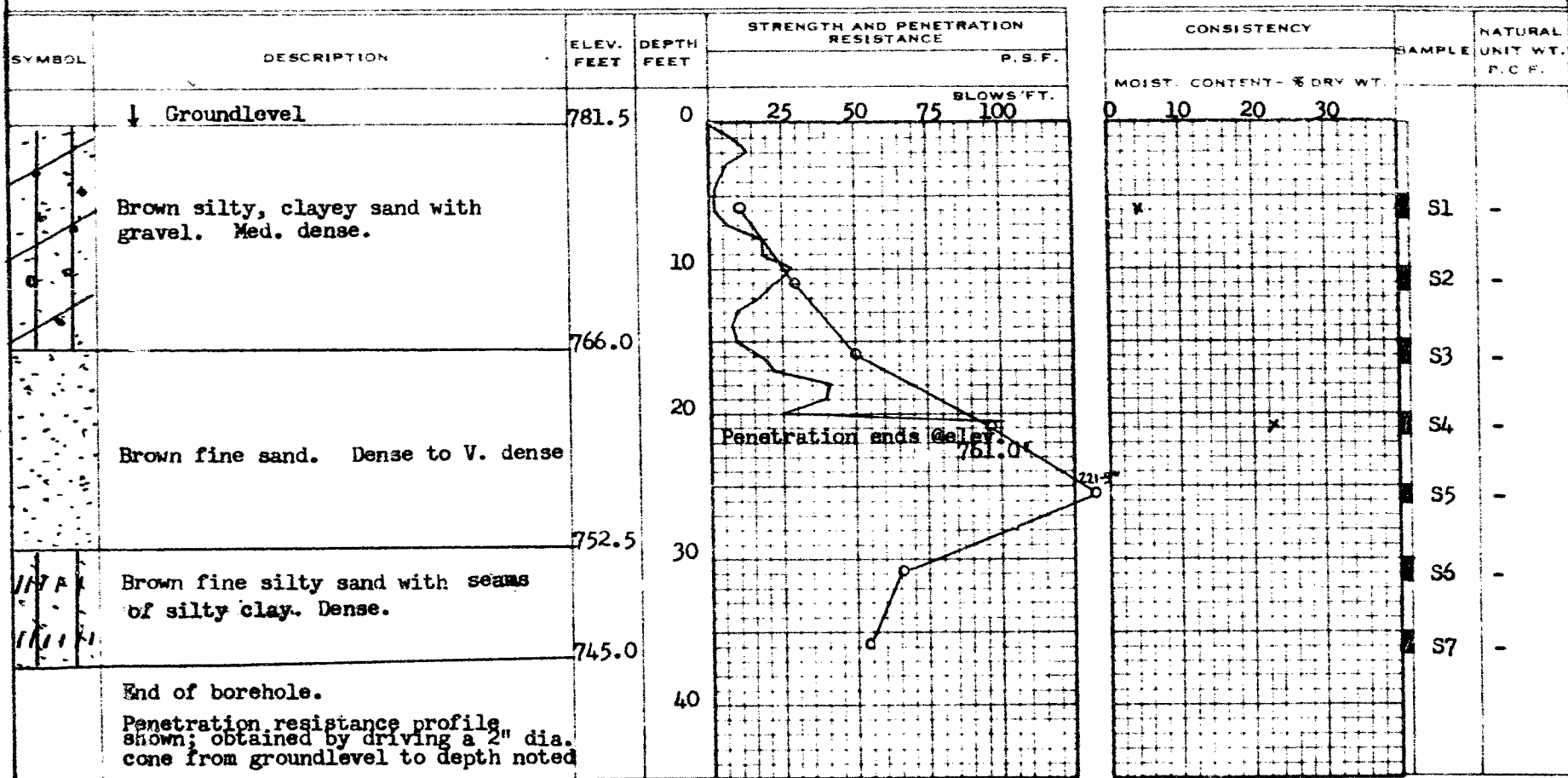
DATUM 781.5' COMPILED BY B.K.

BORING DATE Aug. 10/61. CHECKED BY V.K.

2" DIA. SPLIT TUBE ————
 2" SHELBY TUBE ————
 2" SPLIT TUBE ————
 2" DIA. CONE ————
 2" SHELBY ————
 CASING ————

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u) ————
 VANE TEST (C) AND SENSITIVITY (S) ————
 NATURAL MOISTURE AND LIQUIDITY INDEX ————
 LIQUID LIMIT ————
 PLASTIC LIMIT ————



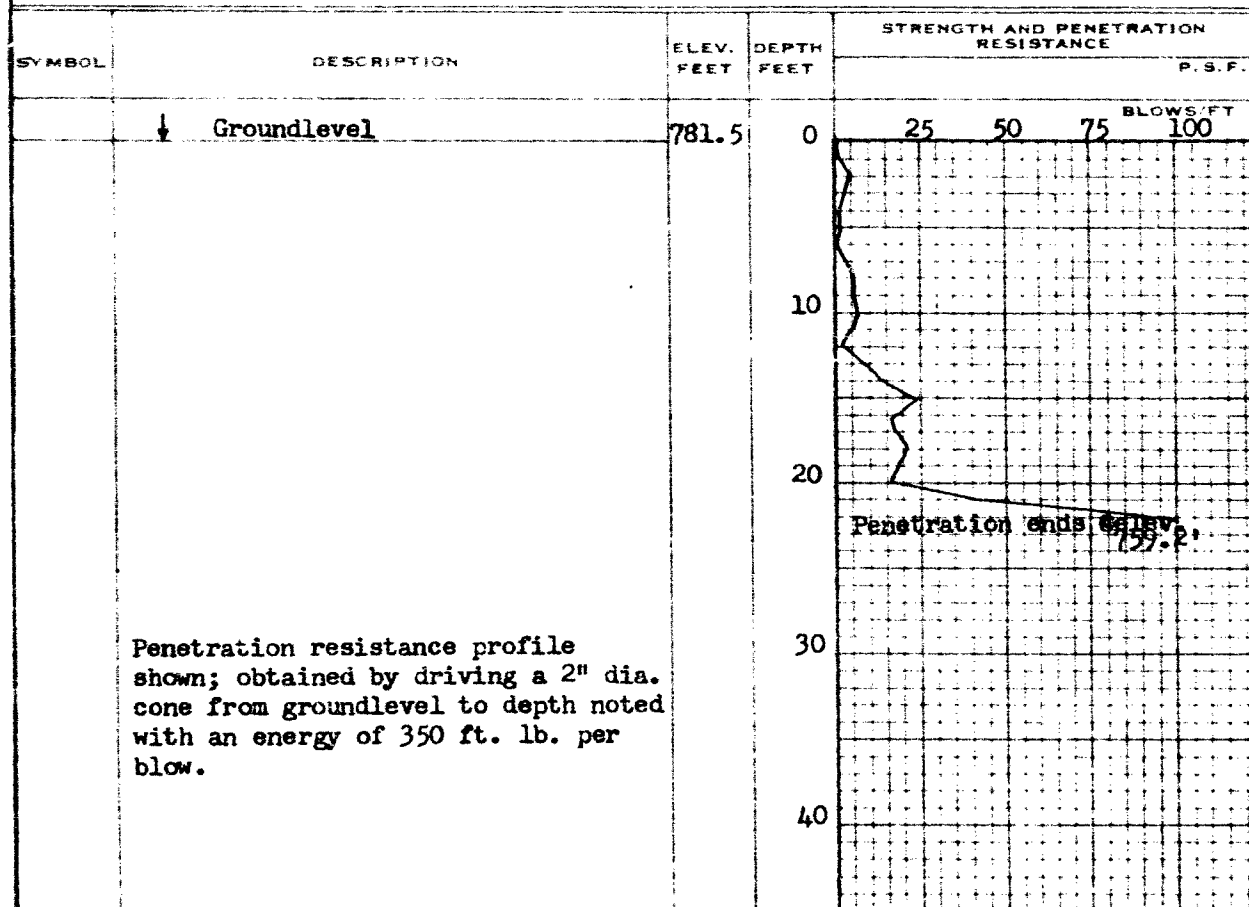
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 151-60 BORE HOLE NO. 7
JOB 61-F-73 STATION 42+94 (47' Rt.)
DATUM 781.5' COMPILED BY B.K.
BORING DATE Aug. 8/61. CHECKED BY V.K.

2" DIA. SPLIT TUBE _____
2" SHELBY TUBE _____
2" SPLIT TUBE _____
2" DIA. CONE _____
2" SHELBY _____
CASING _____

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)	0
VANE TEST (C) AND SENSITIVITY (S)	+
NATURAL MOISTURE AND	LI
LIQUIDITY INDEX	X
LIQUID LIMIT	0
PLASTIC LIMIT	

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

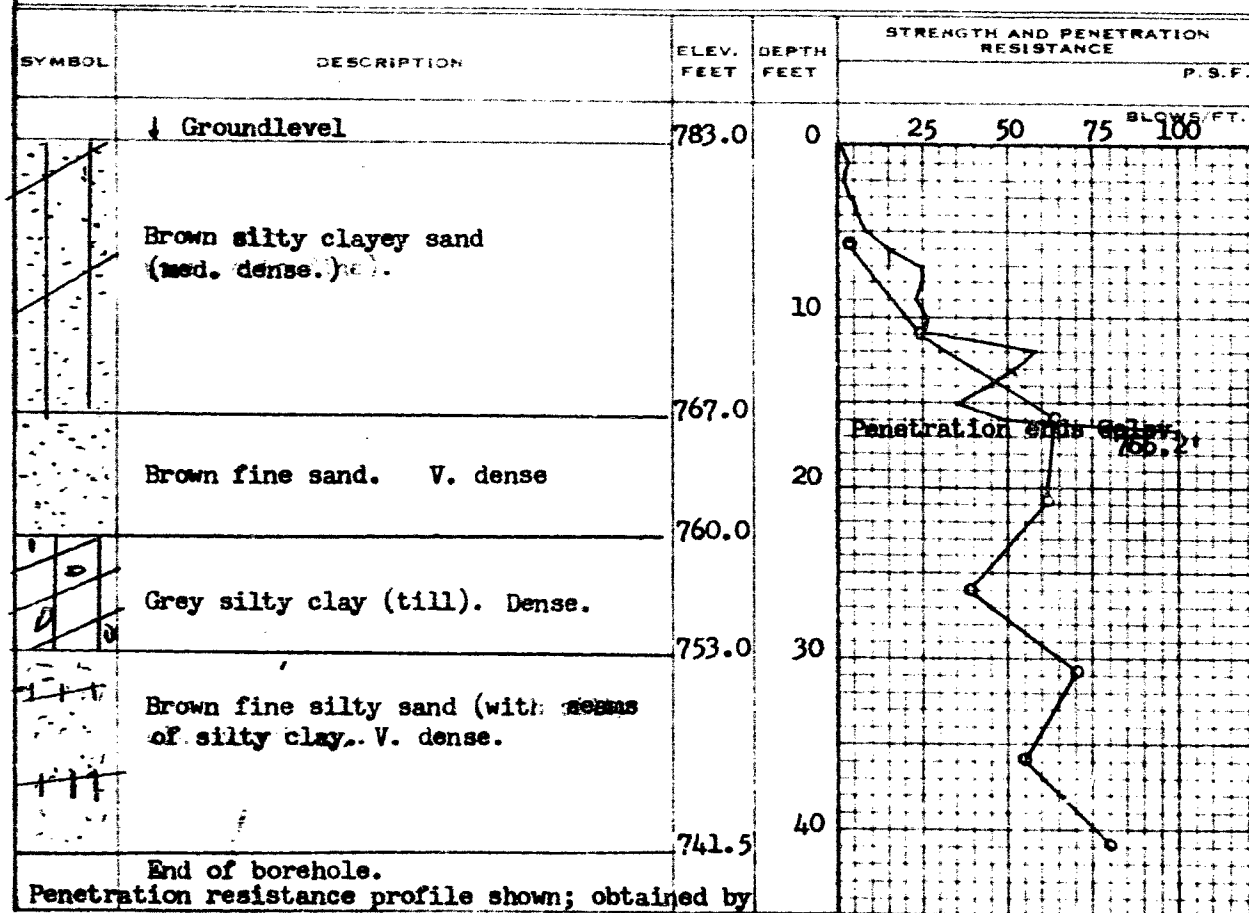
MATERIALS AND RESEARCH SECTION

W.P. 151-60 BORE HOLE NO. 9
 JOB 61-F-73 STATION 42+52 (42' Rt.)
 DATUM 783.0' COMPILED BY B.K.
 BORING DATE Aug. 3/61. CHECKED BY V.K.

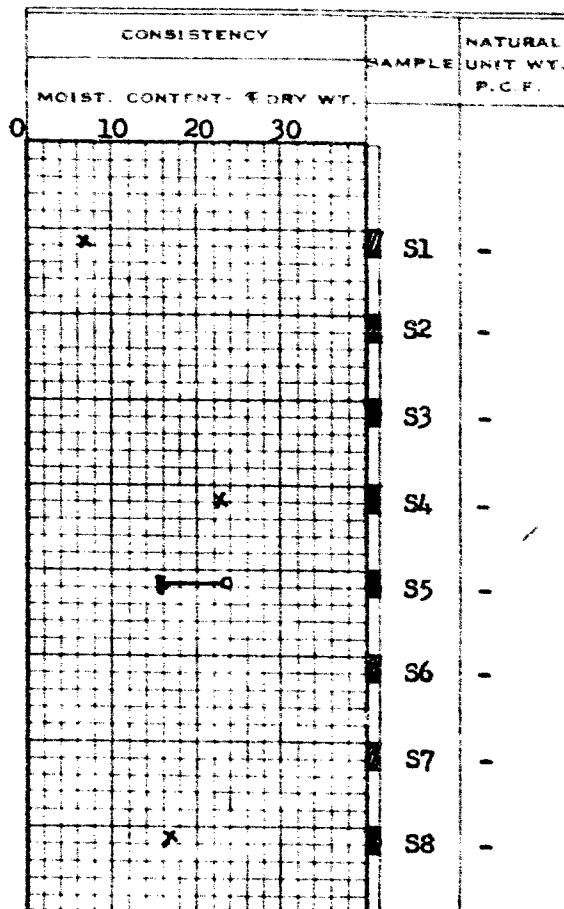
2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Q_u)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.



Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Division,
(Foundation Section)

November 10, 1961.

PROPOSALS FOR FOUNDATION FOR
CENTRE PIER -

Attention: Mr. C. Bassi

Re: Hwy. #24 & Proposed Hwy. #403,
Line 'A', Brantford, Dist. #4,
W.J. 61-F-73 -- (W.P. 151-60.)

In reply to your recent inquiry regarding the foundation for the centre pier of the above structure, the following proposals are submitted:-

Piled foundations should be provided for this pier which will be located directly above an existing 5' Ø sewer. 12½" O.D. tube piles with a 0.25" wall thickness are recommended. For a design load of 50 tons per pile, it is estimated that they should be driven to approximately elev. 748.0'.

In order to minimize the effects of ground heave on the existing sewer, the piles should be driven open and by means of a churn drill working inside the pipe drilling ahead of it. The piles should be advanced in this manner to elev. 758.0'. They should then be bailed out and a concrete plug formed in the bottom. They may then be driven to practical refusal. It should be possible to locate these piles within two feet of the existing sewer.

We have obtained an estimate of the cost of carrying out this work from Franki of Canada, Ltd., which is as follows:-

- (1) Install and remove equipment \$2,000.00
(2) Supply and drive piles (as described) ... \$ 11.00/ft.

cont'd. /2 ...

It is possible that this procedure will be carried out at two other proposed structures on the Brantford By-pass. Item (1) is the total cost for installing and removing equipment at the three locations if the work is carried out at one time. If the three jobs are done at different times, the estimate for this item is \$1,500.00 per structure.

A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

Per:

K. G. Selby

(K. G. Selby,
SR. PROJECT FOUNDATION ENGR.)

KGS/MieF

cc: Mr. B. Davis
Foundations Office
Gen. Files. ✓