

59-F-34

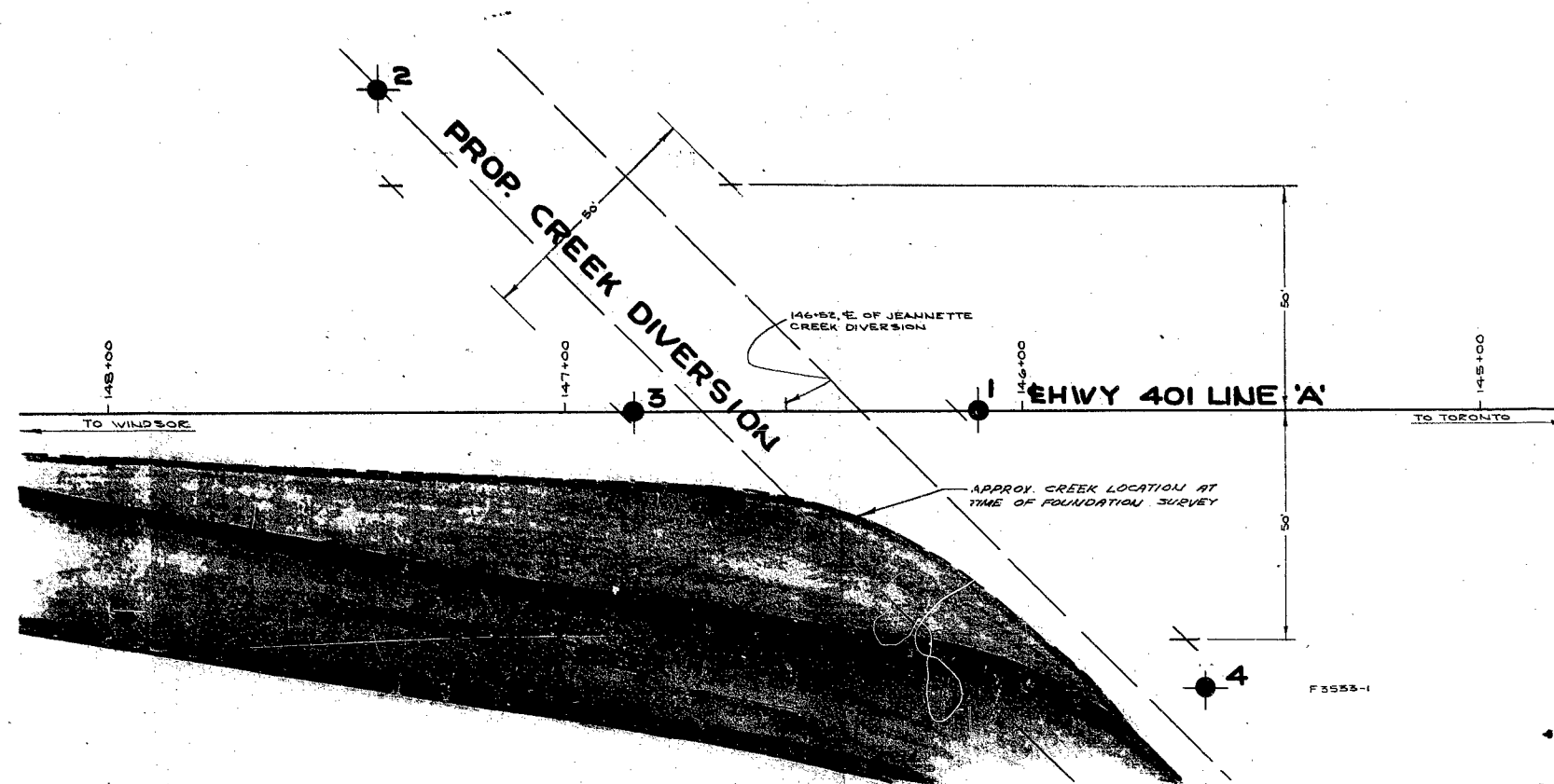
W.P. # 14-59

Hwy. # 401

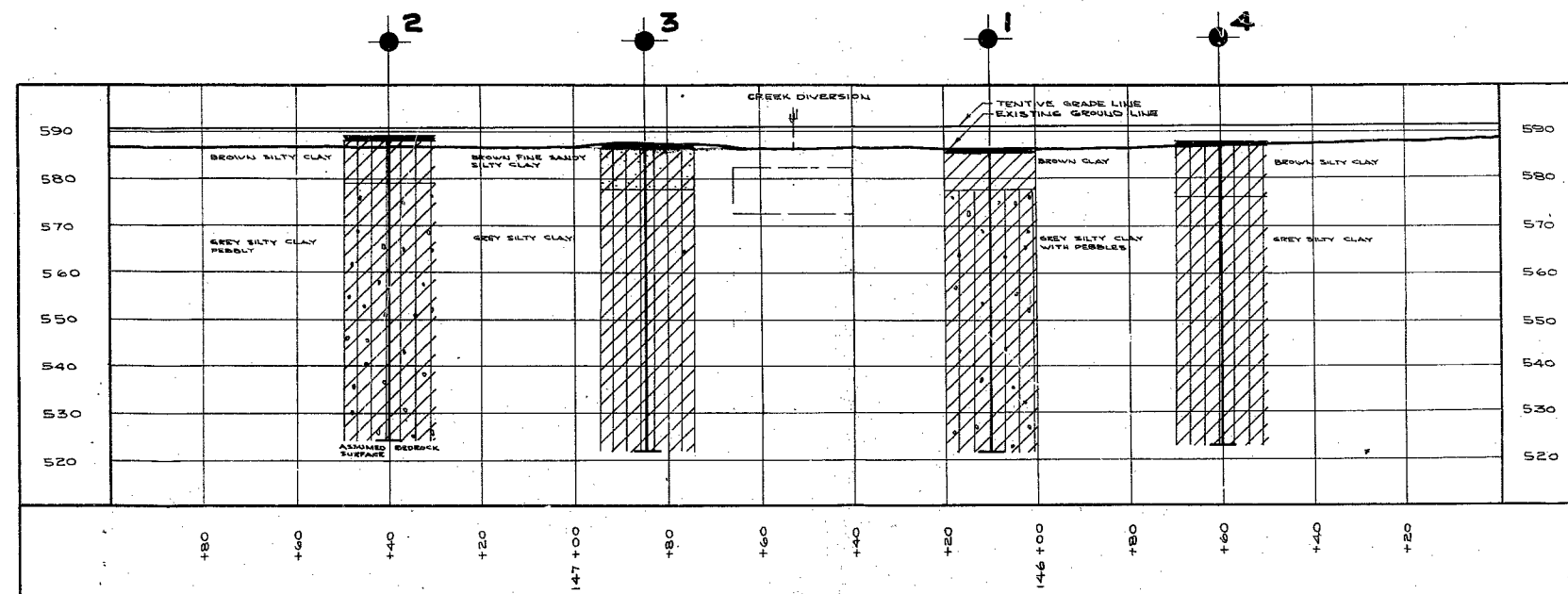
CROSSING

JEANNETTE

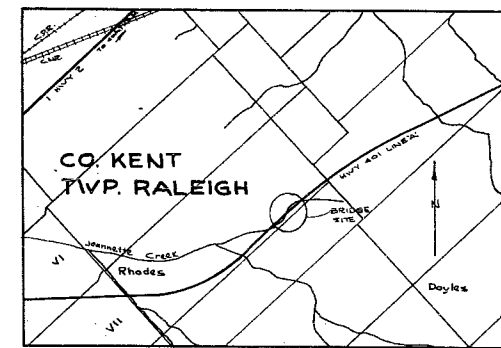
CREEK



PLAN



PROFILE



KEY PLAN
SCALE 1/4" = 1 MI.

LEGEND

- BORE HOLE
- PENETRATION HOLE
- BORE & PENETRATION HOLE

HOLE NO.	ELEVATION	STATION	DISTANCE FROM E
1	587.0'	146+10	E
2	589.5'	147+40	70' RT.
3	588.0'	146+85	E
4	588.0'	145+60	60' LT.

- 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

JEANNETTE CREEK DIVERSION
PROPOSED CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 401 DISTRICT 1 COUNTY KENT
TOWNSHIP RALEIGH LOT 15 CON. VII
LOCATION APP. 8 MI. S OF CHATHAM
DRAWN BY: T. MELLORS CHECKED BY: W.P. 14-59
DATE 29 MAY 59 APPROVED BY: DRAWING NO.
SCALE 1/4" = 1 MI. F-59-34A

Mr. A. M. Teye,

July 2, 1959.

Bridge Engineer.

Re: FOUNDATION REPORT -

Materials & Research Section.

W.P. 14-59 - W.J. F 59-34

Attention: Mr. S. McCombie.

Jeannette Creek & Hwy. 401 Line 'A' -
Crossing, Raleigh Twp., Lot 18, Con.17.

This memorandum accompanies our report on the subsoil conditions existing at the above described Jeannette Creek Crossing.

For your convenience, the principal recommendations arising out of this investigation, are repeated as follows:-

- (1) The subsoil at the site consists of a deep deposit of lacustrine silty clay overlying a dense deposit of sand and gravel. The upper 10 to 12 feet of the clay deposit has been subjected to oxidation and exists in a medium stiff state. The non-oxidized stratum of silty clay underlying the upper oxidized zone, exists in a stiff state and shows evidence of slight preconsolidation.
- (2) It is recommended that the structure be supported on spread footings founded in the stratum of stiff grey silty clay. A safe permissible bearing pressure of 2 1/2 Tons/sq.ft. can be used for footings founded in this layer. Total settlement under each abutment will be of the order of 2 inches and will take place over a period of not less than 25 years.
- (3) The stiff silty clay layer is not considered highly susceptible to scour or erosion. A minimum footing depth below final stream bed elevation of five feet, is considered adequate scour protection.
- (4) Due to the highly impermeable nature of the clayey subsoil and the absence of water-bearing sand seams in this stratum, footing excavations should be sensibly dry.

cont'd. /2 ...

Recommendations - (cont'd.) ...

- (5) The subsoil at this site has sufficient strength to safely support the approach embankments. Standard 2:1 slopes are satisfactory.

If there are any queries in connection with the above report, please contact our office.

L. G. Soderman

LGS/MdeF
Encl.

L. G. Soderman,
PRINCIPAL SOILS & FOUNDATIONS ENGINEER.

cc: Messrs. A. M. Teye ✓
H. A. Tregaskes
D. G. Ramsay
H. Orlando
G. U. Howell
J. Roy
A. Watt
Foundation Section.
Gen. Files.

FOUNDATION REPORT

on

Jeannette Creek & Hwy. 401 Line 'A' -
Crossing, Raleigh Twp., Lot 18, Con.17.

Plan No: F 3533-1

Profile No: F 3533-3

Distribution:

Mr. A. M. Tye, Bridge Engineer.	(2)
Mr. H. A. Tregaskes, Construction Engineer.	(1)
Mr. D. G. Ramsay, Design Engineer.	(1)
Mr. H. Orlando, Project Design Engr., London.	(1)
Mr. G. U. Howell, District Engr., Chatham.	(1)
Mr. J. Roy, Regional Soils Engr., London.	(1)
Mr. A. Watt, Ontario Water Resources Commission.	(1)
Foundation Section.	(1)
Gen. Files.	(1)

W.P. 14-59

W.J. F 59-34

INTRODUCTION:

A subsoil investigation has been recently carried out at the above mentioned site. This report contains the detailed results of field and laboratory findings and recommendations for the foundations of the proposed bridge.

The location of the site is at the crossing of the new Hwy. 401 proposed Line 'A' and the Jeanette Creek diversion, southwest of Chatham, in Lot 18 (Con.17), Twp. of Raleigh - (Station 146+52, Profile No. F-3533-3).

The field work started on April 27, 1959 and was completed on April 30, 1959.

DESCRIPTION OF SITE AND GEOLOGY:

The site under consideration is located within the physiographic region referred to as the St. Clair Clay Plain. The glacial lakes, Whittlesey and Warren which covered this area, helped to level the basic clay till by covering its undulating surface with lacustrine deposits. Later, this area was submerged again by Lake St. Clair which deposited additional clay and silt material.

FIELD AND LABORATORY WORK:

The field investigations at this site were carried out by means of a continuous flight auger machine. Four detailed sampled borings were made and both undisturbed, thin-walled Shelby tube, and disturbed, split spoon samples were recovered. A minimum sampling interval of 3 feet was used. Where it was necessary to dynamically drive samplers, an energy equivalent to that specified for the Standard Penetration Test was used. 'N' values, giving

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

blows/ft. of sample penetration, have been noted in the borehole profiles appended. Borings were carried down to a maximum depth of 65 feet below existing ground surface. At this depth, a very hard layer was encountered in all of the holes.

All samples were visually examined in the field and forwarded to the Soils Laboratory, where they were tested for their textural structure, and index properties. On selected samples, triaxial shear and consolidation tests were also performed. A summary of the laboratory and field test results is presented in graphical form on the borehole profiles and in tabular form at the end of this report.

DESCRIPTION OF SOIL TYPES:

Based upon the field and laboratory work carried out, the following subsoil stratigraphy has been determined:-

1. Brown Medium Stiff Silty Clay:

The shallow veneer of organic topsoil evidenced at this site is underlain by a stratum of brown silty clay varying from 10 to 12 feet in thickness. This cohesive deposit contains a minor percentage of sand and fine gravel sizes (< 25%) and exists in a medium stiff state. Average values of unit weight, Atterberg Limits and undrained shear strength, have been determined as follows:-

Unit Weight in-situ 122 p.c.f.

Natural Moisture Content..... 26%

Liquid Limit 42%

Plastic Limit..... 17%

Apparent cohesion in terms of total stresses - $C = 1140$ p.s.f.

cont'd. /3 ...

DESCRIPTION OF SOIL TYPES: (cont'd.) ...

2. Grey Stiff Silty Clay:

Immediately underlying the above described oxidized stratum of silty clay, a stiff layer of grey silty clay was intersected in each borehole. The texture of this grey cohesive layer is virtually identical to the overlying brown oxidized stratum. The obvious differences in moisture content, unit weight, and shear strength, however, suggest that these strata are of different geological origin.

Average strength, moisture content, unit weight and Atterberg Limit values have been determined as follows:-

Unit Weight in-situ 132 p.c.f.

Natural Moisture Content 18%

Liquid Limit 26%

Plastic Limit 16%

Apparent cohesion in terms of total stresses - $C = 2500$ p.s.f.

In-situ rotating vane test values of $C > 2000$ p.s.f.

Coefficient of compressibility $M_v = 0.0105$ sq.ft./ton

Compression Index $C_c = 0.116$

Coefficient of Consolidation $C_v = 0.093$ sq.ft./day.

The virtual extent of this stiff, cohesive stratum was not proven below elevation 424.5 ft. - i.e. (\approx 65 feet below existing ground surface.

GROUND WATER CONDITIONS:

Due to the impermeable nature of the cohesive soil type occurring at this site, it was not possible to positively establish

cont'd. /4 ...

GROUND WATER CONDITIONS: (cont'd.) ...

the water table elevation during the period of the boring program. Observations made during the field work, supplemented by the degree of saturation of all samples recovered, indicates that the water table is at or very near existing ground surface. The assumption of a water table coincident with existing ground surface, has been made in the settlement calculations carried out, and bearing capacity evaluation. No water-bearing sand seams or artesian conditions were encountered in the borings put down at this site.

BEARING CAPACITY EVALUATION:

(a) Spread Footings:

Simple spread footings can be designed to support the structure proposed for this site provided that the underside of footing elevation is at or below 575.0 ft. Footings placed at or below this elevation, will be founded within the stiff grey silty clay layer.

The safe allowable bearing capacity for footings, typically 7 feet in width, founded at or below Elev. 575.0 ft., has been determined as 2 1/2 Tons/sq.ft. (using a safety factor = 3). The estimated total settlement consequent upon the application of a nett footing pressure of 2 1/2 Tons/sq.ft. is 2 1/2 inches. For a single-span structure, the differential settlement between abutments should not exceed an estimated value of 1 inch.

To provide protection against scouring or undermining of the footings, a minimum footing depth of 5 feet below the bottom of the diverted creek is recommended.

cont'd. /5 ...

BEARING CAPACITY EVALUATION: (cont'd.) ...

(b) Pile-Supported Footings:

If it is economical to design pile-supported footings for the proposed structure, steel 'H' piles should be used. Practical refusal for driven 'H' pile sections will be at or slightly below Elev. 523.0 ft. At this elevation a dense granular stratum was intersected in Borehole No. 2.

SUMMARY & RECOMMENDATIONS:

- (1) The subsoil at the site consists of a deep deposit of lacustrine silty clay overlying a dense deposit of sand and gravel. The upper 10 to 12 feet of the clay deposit has been subjected to oxidation and exists in a medium stiff state. The non-oxidized stratum of silty clay underlying the upper oxidized zone, exists in a stiff state and shows evidence of slight preconsolidation.
- (2) It is recommended that the structure be supported on spread footings founded in the stratum of stiff grey silty clay. A safe permissible bearing pressure of 2 1/2 Tons/sq.ft. can be used for footings founded in this layer. Total settlement under each abutment will be of the order of 2 inches and will take place over a period of not less than 25 years.
- (3) The stiff silty clay layer is not considered highly susceptible to scour or erosion. A minimum footing depth below final stream bed elevation of five feet, is considered adequate scour protection.

cont'd. /6 ...

SUMMARY & RECOMMENDATIONS: (cont'd.) ...

- (4) Due to the highly impermeable nature of the clayey subsoil and the absence of water-bearing sand seams in this stratum, footing excavations should be sensibly dry.
- (5) The subsoil at this site has sufficient strength to safely support the approach embankments. Standard 2:1 slopes are satisfactory.

V. Korlu,
FOUNDATION PROJECT ENGR.

APPENDIX I.

TABLE NO. I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-34

W.P. 14-59.

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
1	T1	5'-7'	Brown silty clay.	13	27.2	17.5	46.5	835	122.8	
	T2	9'-11'	Grey silty cl. with some sand & pebbles.	15	18.2	16.5	27.6	-	-	
	T3	14'-16'	" " " " " "	26	20.0	19.4	29.9	1770	131.2	
	T4	19'-21'	" " " " " "	62	17.5	16.1	24.9	2130	133.8	
	T5	24'-26'	" " " " " "	44	17.7	-	-	2090	132.4	
	T6	34'-36'	" " " " " "	58	18.0	15.9	27.5	2180	133.6	
	S7	39'-41'	" " " " " "	40	16.3	-	-	-	-	
	T8	44'-46'	" " " " " "	32	-	-	-	-	-	Lost.
	S9	54'-56'	" " " " " "	22	-	-	-	-	-	"
	Vane	57.5'								57.5' Vane (1600 Sens. -
	S10	64'-65.5'	" " " " " "	-	-	-	-	-	-	" (900 1.54
2	T1	4'-6'	Brown silty clay.	6	26.7	17.5	42.7	763	117.8	
	T2	9'-11'	Grey & brown silty clay.	9	27.2	16.7	30.8	974	124.8	
	T3	14'-16'	Grey silty clay with sand & pebbles.	17	22.9	16.2	28.1	735	121.6	
	T4	19'-21'	" " " " " "	43	18.8	13.1	26.1	1610	132.7	
	T5	29'-31'	" " " " " "	58	17.9	16.0	27.4	1885	126.3	
	T6	39'-41'	" " " " " "	26	19.8	15.8	26.2	1065	129.3	
	S7	49'-50.5'	" " " " " "	13	20.2	-	-	-	-	
	S8	59'-60.5'	" " " " " "	22	-	-	-	-	-	
2	Vane	7.5'		-	-	-	-	1840	-	Sens: 3.84
		12.5'		-	-	-	-	1920	-	2.67

cont'd. /2 ...

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-34

W.P. 14-59.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION






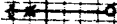

W.P. 14-59 BORE HOLE NO. 01
 JOB F 59-34 STATION 146/10 C.L.
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Apr. 27/59 CHECKED BY V.K.

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

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000	4000	6000	8000
	↓ Ground Level	587.0	0	50	100	150	200
	TOP SOIL Brown clay	586.8					
	Grey silty clay with pebbles	586.0	10				
	W.L. ∇	583.0	20				
		581.5	65.5				
	End of borehold (assumed bed-rock)	581.5	65.5				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			TW1	122.8
			TW2	-
			TW3	131.2
			TW4	133.8
			TW5	132.4
			TW6	133.6
			SS7	-
			TW8	-
			SS9	-
			SS10	-

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 14-59 BORE HOLE NO. 2

JOB F 59-34 STATION 147+40 (70ft. R.L.)

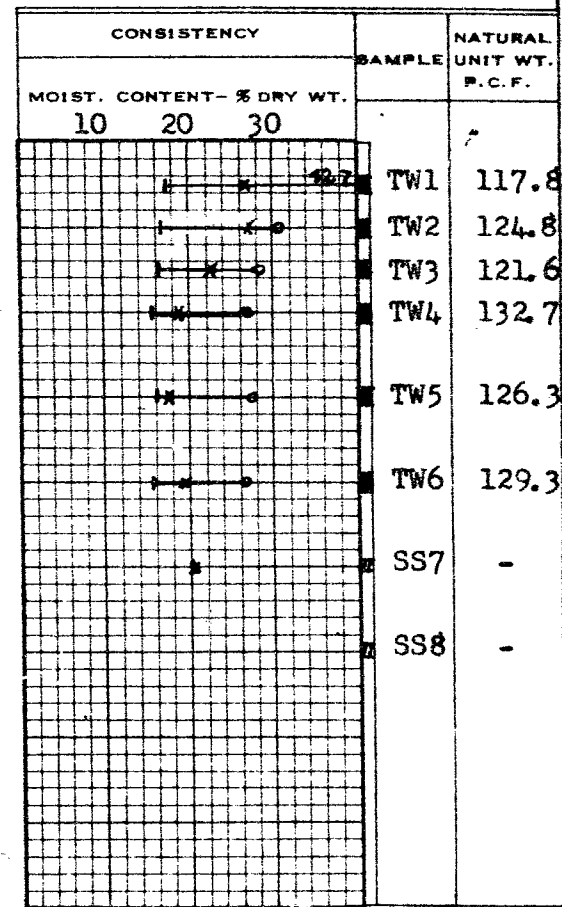
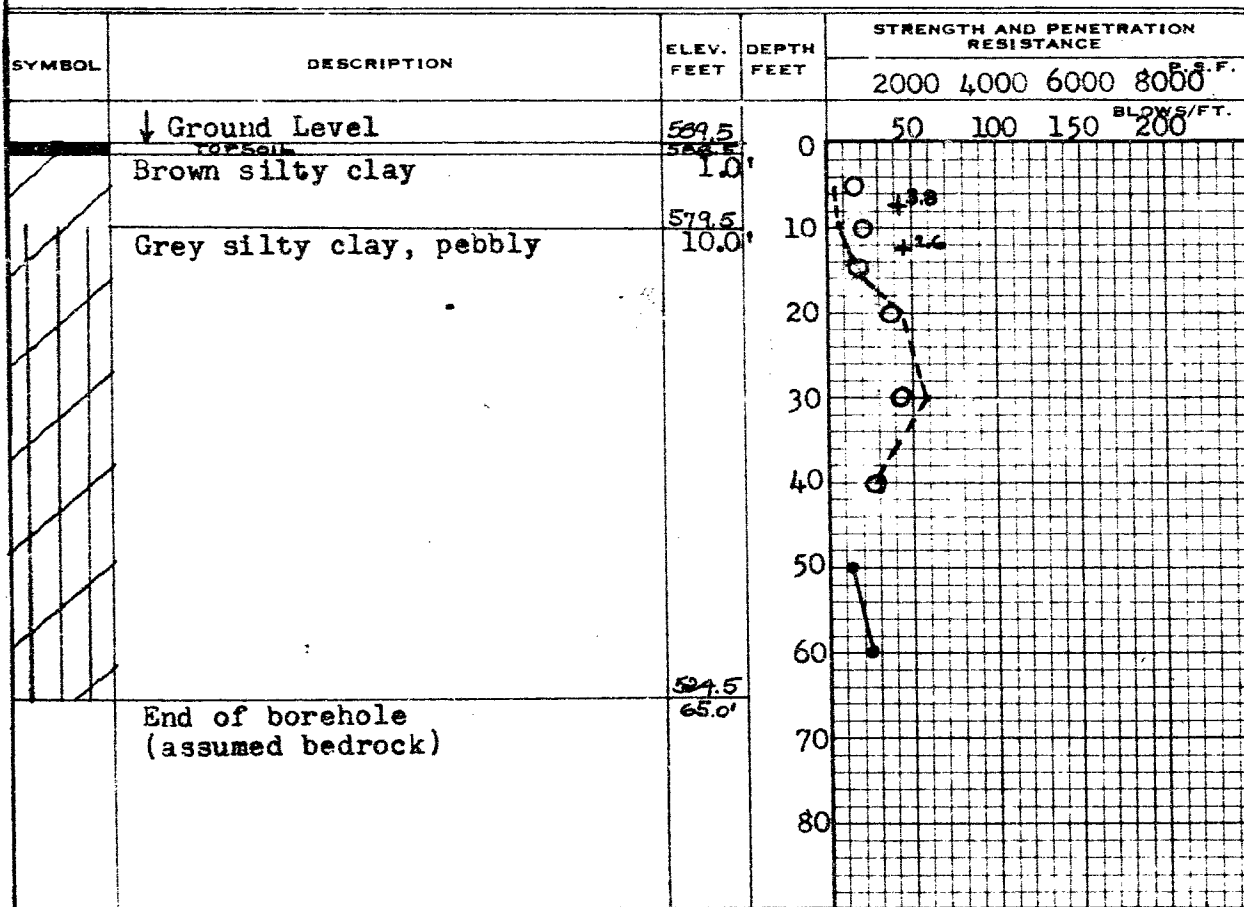
DATUM Geodetic COMPILED BY B.K.

BORING DATE Apr. 29/59 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) — O
VANE TEST (C) AND SENSITIVITY (S) — +
NATURAL MOISTURE AND LIQUIDITY INDEX — X
LIQUID LIMIT — —
PLASTIC LIMIT — —



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 14-59 BORE HOLE NO. 3
 JOB F-59-34 STATION 146/85 C.
 DATUM Geodetic COMPILED BY B.K.
 BORING DATE Apr. 29/59 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) _____ O
 VANE TEST (C) AND SENSITIVITY (S) _____ +
 NATURAL MOISTURE AND LIQUIDITY INDEX _____ LI
 LIQUID LIMIT _____ X
 PLASTIC LIMIT _____

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000	4000	6000	8000
	↓ Ground Level	588.0	0	50	100	150	200
	Brown, fine, sandy & silty clay	587.0	1.0'				
	Grey silty clay	579.0	10.0'				
		521.5	70				
	End of borehole (assumed bed-rock)	66.5	80				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.	10	20		
			TW1	133.7
			TW2	130.8
			TW3	131.3
			TW4	128.4
			TW5	132.5
			TW6	131.5

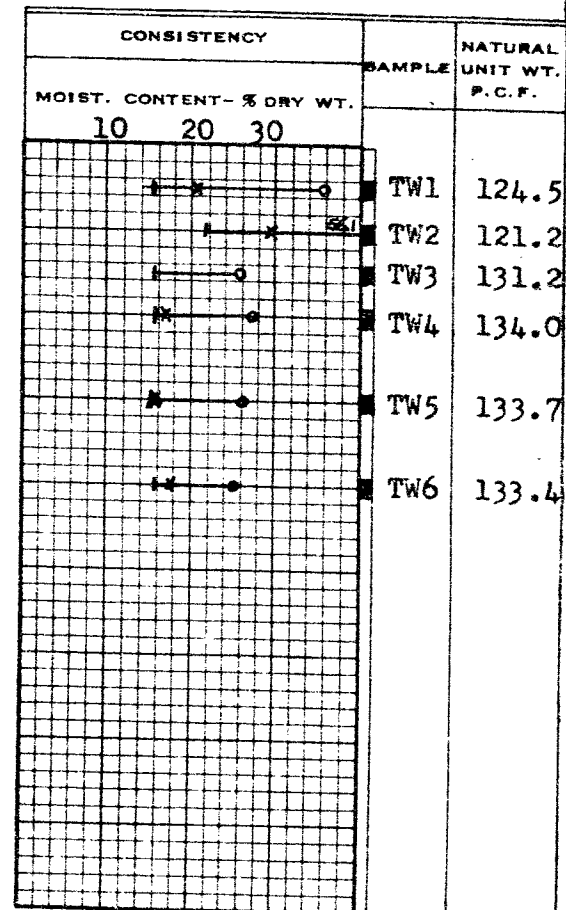
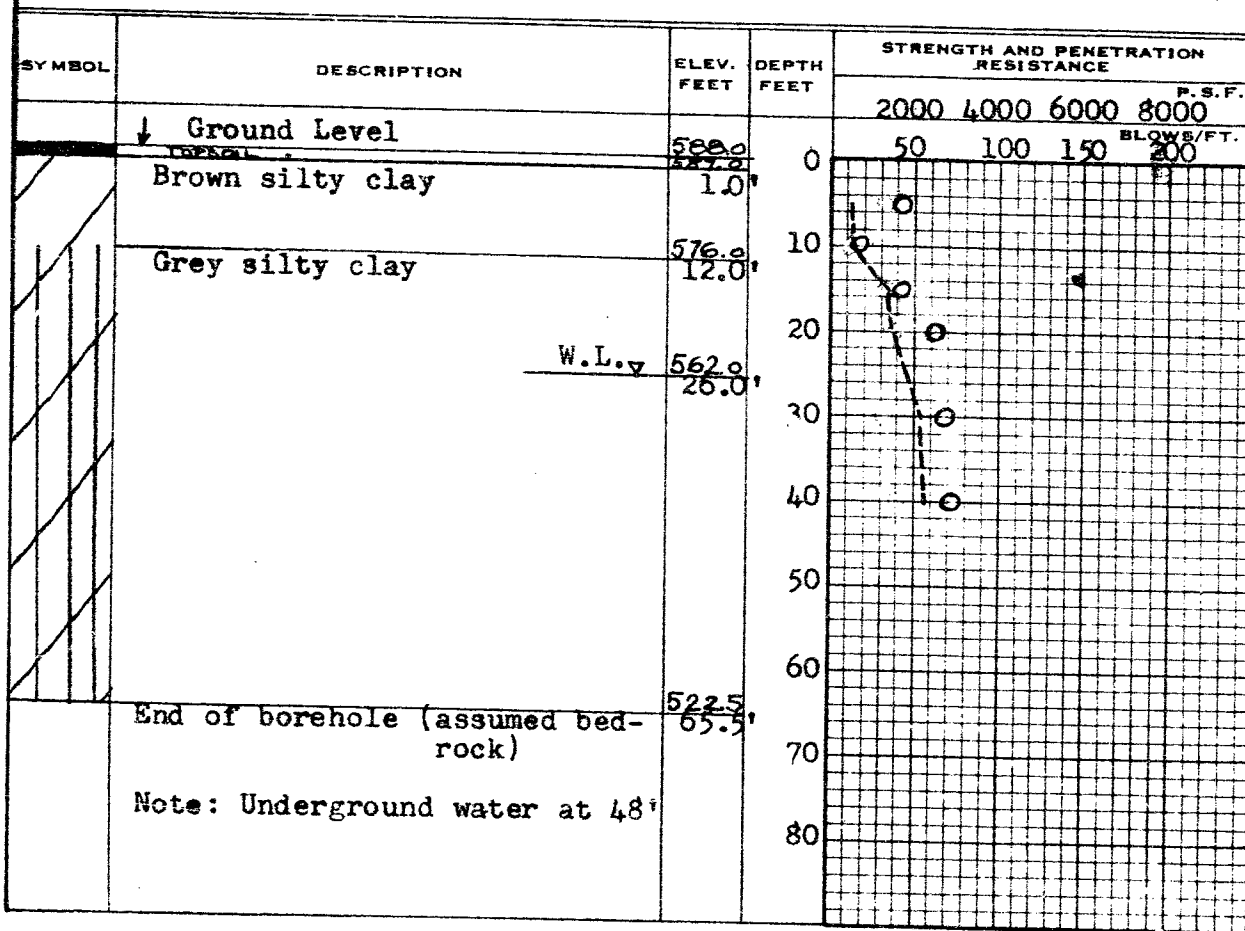
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 14-59 BORE HOLE NO. 4
JOB F-59-34 STATION 145/60 (60ft.L.)
DATUM Geodetic COMPILED BY B.K.
BORING DATE Apr. 30/59. 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) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX LI
LIQUID LIMIT X
PLASTIC LIMIT



Note: Underground water at 48'