

#

59-F-61

W.P. <sup>#</sup> 12-59

Hwy <sup>#</sup> 401

GRAVEL RD.

JEANNETTE CREEK

OVER

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. C. S. Grebski,  
Bridge Design Engineer,  
Bridge Division.  
Attention: Mr. K. G. Bassi

FROM: Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

DATE: September 7, 1966

OUR FILE REF.

IN REPLY TO

SUBJECT:

Hwy. 401 & Dillon Side Road  
District No. 1 (Chatham) -  
W.P. 12-59 - W.J. 59-F-61

As requested by you, we have reviewed the subsoil conditions and submit the following comments pertaining to the abutment foundations:

The proposed abutments can be supported on end-bearing piles driven to bedrock. Allowable loads will depend upon the section chosen (e.g., 12 BP 74 steel H-piles may be designed for 90 tons per pile). As an alternative, the abutments can be supported on 45-ft. long friction piles. In such a case, a safe load of 15 tons/pile may be used for #14 timber piles.

*Based on 2' with original ground.*

MD/MdeF

cc: Foundations Office  
Gen. Files

*M. Devata*

M. Devata,  
SUPERVISING FOUNDATION ENGR.  
For:  
A. G. Stermac,  
PRINCIPAL FOUNDATION ENGR.

*Look at El. 510.00 ± (definitely)*

*Differential Settlement with Abt. on H Piles & pier on spread footings  
between End pier & Abt (1 1/2')*

*between End pier & Centre pier 1 ±*

D.H.O. TORONTO RECEIVED SEP 8 1966 BRIDGE OFFICE
---

check Cost

Steel H Piles

14 Treated lumber

DEPARTMENT OF HIGHWAYS

MEMORANDUM

Cost	Supply	5.55	(150/1000)	2.00
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From: Mr. C. S. Grebner,  
 District Engineer,  
 Bridge Division,  
 Department of Highways,  
 Room 102, 2500 13th St., N.W.,  
 Washington, D.C.

To: Mr. C. S. Grebner,  
 District Engineer,  
 Bridge Division,  
 Department of Highways,  
 Room 102, 2500 13th St., N.W.,  
 Washington, D.C.

Date: 8/11/44

2500 13th St.

0.26 10 0.22

Our File Ref

8.11/44 3.29/44  
 Mr. C. S. Grebner,  
 District Engineer,  
 Bridge Division,  
 Department of Highways,  
 Room 102, 2500 13th St., N.W.,  
 Washington, D.C.

Cost/Pile	95 x 11	770.00	45 x 3.29	1485.75
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" / 1000 Capacity	\$ 8.56	\$ 9.86
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300 Ton. As shown by 240000, 1001, 296000. The following comments are made regarding the foundation:

Piers The proposed abutments can be supported on end-bearing piles driven to bedrock. Allowable loads will depend upon the section chosen (e.g., 12 SP 14 steel H-piles may be designed for 90 tons per pile). As an alternative, the foundation may be designed as a long friction pile. In such case, a pile load of 15 tons per pile may be used for the timber piles.

Line less of Girders 87.00  
 15 x 197 = 2960  
 5748

Increase in cost of all fittings are found on piles: Structure fully semi-continuous

5748  
 - 720  
 \$ 5028

Use Timber piles at Abts & Spread fittings at Piers

BA940  
RALEIGH Twp. #9



ONTARIO  
DEPARTMENT OF HIGHWAYS

emo to Mr. A. M. Toye, Date September 10, 1959.  
Bridge Engineer. Subject \_\_\_\_\_  
rom Materials & Research Section. \_\_\_\_\_

Attention: Mr. S. McCombie.

Re: Foundation Report - W.J. F 59-61 : W.P. 12-59,  
Hwy. 401, Line 'C' and Jeannette Creek &  
Gravel Road Proposed Crossing, Lots 12 & 13,  
Con. VII, Twp. of Raleigh, Approx, 8 Miles  
South of Chatham.

Please find enclosed, additional log sheets for  
boreholes 7, 8 & 9, to be inserted under Appendix I  
of the above report which was mailed to you recently.

Due to the fact that these sheets were submitted  
to the blueprinters at a later date than the others,  
their return to our office was consequently delayed.

We hope this hold-up has not caused you too much  
inconvenience.

/MdeF  
Encls.

cc: Messrs. A. M. Toye  
H. A. Tregaskes  
D. G. Ramsay  
A. Gater  
G. U. Howell  
J. Roy  
A. Watt

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

per:

*John A. Soderman*  
Secretary

# SUMMARY OF FIELD & LABORATORY TESTS

JOB F 59-61

W.P. 12-59

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
7	T 1	5'-6.5'	Stiff brown silty clay.	P	25.4	22.0	28.2	2030	121.4	Approx. 6% fine to medium gravel.
	T 2	10'-11.5'	Stiff grey silty clay.	P	30.0	20.7	38.0	-	108.2	
	T 3	15'-16.5'	" " " "	P	19.0	18.3	30.0	2060	130.5	
	T 4	20'-21.5'	" " " "	P	19.0	16.5	27.0	1430	130.4	
	T 5	25'-26.5'	" " " "	P	19.0	17.4	27.9	1210	131.5	
	T 6	30'-31.5'	" " " "	P	18.4	17.1	21.3	1395	132.0	
	T 7	36'-37.5'	" " " "	P	18.7	17.6	27.0	2060	130.8	
	T 8	45'-46.5'	" " " "	P	21.4	17.2	26.2	-	126.7	
	T 9	55'-56.5'	" " " "	P	18.9	15.3	23.5	1410	130.0	
8	T 1	5'-6.5'	Stiff brown silty clay.	11	28.8	-	-	6300	127.0	Approx. 6% fine to medium gravel.
	T 2	10'-11.5'	Stiff grey silty clay.	P	17.6	-	-	1700	136.4	
	T 3	15'-16.5'	" " " "	P	19.8	-	-	1205	132.1	
	T 4	20'-21.5'	" " " "	P	20.1	-	-	1128	131.6	
	T 5	25'-26.5'	" " " "	P	19.3	-	-	1410	130.8	
	T 6	30'-31.5'	" " " "	P	19.4	-	-	1280	129.9	
	T 7	35'-36.5'	" " " "	P - 6" 46 for 12"	18.0	-	-	1655	133.0	
	T 8	40'-41.5'	" " " "	P	18.5	-	-	1832	129.9	
9	T 1	5'-6.5'	Stiff brown silty clay.	P	25.6	-	-	1740	122.2	Sens: 1.0 cont'd. ....
	T 2	10'-11.5'	Stiff grey silty clay.	P	27.3	-	-	1685	122.0	
	T 3	15'-16.5'	Med. grey silty clay.	P	29.2	-	-	940	119.2	
	Vane	18'	" " " "	-	-	-	-	960	-	

TABLE NO. 1 - (cont'd.) ...

SUMMARY OF FIELD & LABORATORY TESTS

JOB F 59-61

W.P. 12-59.

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
9	T 4	23'-24.5'	Med. grey silty clay.	P	19.5	17.2	24.6	1055	131.0	Sens: 1.0
	Vane	26'	" " " "	-	-	-	-	960	-	
	T 5	30'-31.5'	Med. to stiff grey silty clay.	P	19.7	-	-	1355	130.9	
	T 6	35'-36.5'	" " " " " "	P	19.7	16.5	26.5	1150	129.0	
	T 7	45'-46.5'	Stiff grey silty clay.	P	18.6	15.9	25.2	1780	131.8	
			T Denotes thin-walled Shelby Tube							

# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION










W.P. 12-59 BORE HOLE NO. 7  
 JOB F 59-61 STATION 257+84 (58' Rt.)  
 DATUM Elev. 586' COMPILED BY B.K.  
 BORING DATE July 22/59 CHECKED BY A.L.

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			
				500	1000	1500	2000
	↓ Ground Level	586.0	0				
	Stiff brown silty clay.	579.0	10				
	Stiff grey silty clay - Approx. 6% fine to medium gravel.		20				
			30				
			40				
			50				
			60				
			70				
	Probably bedrock. End of hole.	508.0	80				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT- % DRY WT.				
10	20	30		
			T1	121.4
			T2	108.2
			T3	130.5
			T4	130.4
			T5	131.5
			T6	132.0
			T7	130.8
			T8	126.7
			T9	130.0

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 12-59

BORE/HOLE NO. 8.

JOB F 59-61

STATION 257+62 (58' Lt.)

DATUM Elev. 586'

COMPILED BY B.K.

BORING DATE July 23/59

CHECKED BY A.L.

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			
				500	1000	1500	2000
	↓ Ground Level						
	Topsoil	586.0	0				
	Stiff brown silty clay.	577.0	10				6300
	Stiff grey silty clay.		20				
			30				
		545.0	40				
	End of Borehole.		50				
			60				
			70				
			80				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
		x	T 1	127.0
	x		T2	136.4
	x		T3	132.1
	x		T4	131.6
	x		T5	130.8
	x		T6	129.9
	x		T7	133.0
	x		T8	129.9

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

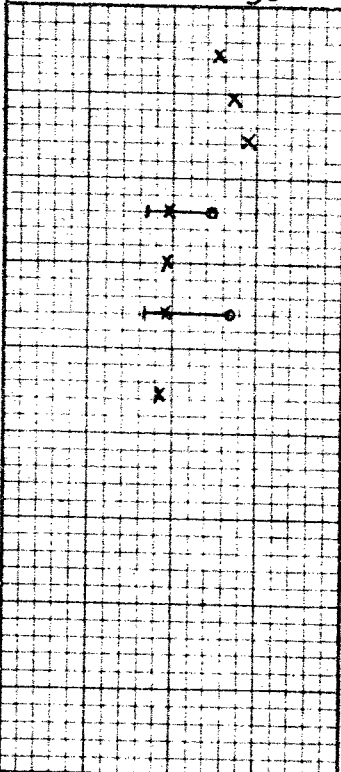
W.P. 12-59 BORE HOLE NO. 9.  
JOB F 59-61 STATION 256+70 (Q)  
DATUM Elev. 587' COMPILED BY B.K.  
BORING DATE July 23/59 CHECKED BY A.L.

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			
				500	1000	1500	2000
	↓ Ground Level	587.0	0	BLOWS/FT.			
	Stiff brown silty clay.	576.0	10				
	Stiff grey silty clay.		20				
			30				
			40				
	End of Borehole.	540.0	50				
			60				
			70				
			80				

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			T 1	
			T 2	
			T 3	
			T 4	
			T 5	
			T 6	
			T 7	



Memo to Mr. A. M. Teye, Date September 4, 1959.  
Bridge Engineer. Subject Re: Foundation Report -  
From Materials & Research Section. W.P. 12-59 - W.J. F-59-61

Attention: Mr. S. McCombie.

Hwy. 401, Line 'C' and Jeannette Creek  
& Gravel Road Proposed Crossing,  
Lots 12 & 13, Con. VII, Twp. of Raleigh,  
Approximately 8 Miles South of Chatham.

This memo accompanies our detailed foundation report at the above site. For your convenience, the results are summarized as follows:-

- (1) In general, the site is underlain by a medium stiff silty clay, followed by a limestone or shale bedrock.
- (2) An allowable bearing pressure of 2 1/4 tons/sq. ft. may be used for the foundations of the bridge structure, or the proposed underpass, provided that these foundations are founded at elevation:-
  - (a) 566' (or lower) for the bridge crossing at Jeannette creek; 582.50
  - (b) 579' (or lower) for the proposed revised gravel road location; *Based on G.L. 586 (original)*
  - (c) 566' (or lower) for the gravel road crossing at the present location.

The elevation of 566' for the Jeannette Creek Bridge is believed to provide adequate protection from scour and erosion, and also takes into consideration possible dredging of the channel.

- (3) If excavations for footings are to be left open for any period of time, a thin layer of weak concrete should be placed to prevent softening of the silty clay.

Talked to M. Devata on phone Oct 6/66. Above footing cont'd. /2 ...  
elevation (El. 579.00) is based on frost cover from original  
Ground Level of 585'. According to M. Devata, since the  
present G.L. is approx. 590', the footing elevations can be  
raised to El. 582.50 with the bearing pressure of 2 1/4 Tons/sq. ft.  
still being applicable.

*R. Sassi*

How much?

- (4) Settlements associated with the allowable bearing pressure of 2 1/4 tons/sq. ft. will be within tolerable limits for the type of structure proposed.
- (5) The impermeable nature of the subsoil should enable excavations to be made without serious inflow of water. An exception to this may be in the vicinity of the Jeannette Creek where thin sand seams may allow considerable water to enter the excavations. A minimum of 17 ft. as indicated in the report, should be provided from the toe of the embankment to the top edge of the creek bank.
- (6) Steel 'H' piles are not recommended at this site since refusal depth cannot be accurately predicted. If steel 'H' piles are required, pile load tests will be required to determine the pile length.

If any further information is required with respect to this project, please contact our office.

L. G. Soderman,  
PRINCIPAL SOILS & FOUNDATIONS ENGR.  
per:

*K. Peaker*

(K. Peaker,  
FOUNDATION FIELD SUPERVISING ENGR.)

KP/MdeF  
Encl.

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

# FOUNDATION REPORT

on

Hwy. 401, Line 'C' and Jeannette Creek  
& Gravel Road Proposed Crossing,  
Lots 12 & 13, Con. VII, Twp. of Raleigh,  
Approximately 8 Miles South of Chatham.

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Plan No: F-3533-4

Profile No: F-3533-5

## Distribution:

Mr. A. M. Teye,  
Bridge Engineer. (2)

Mr. H. A. Tregaskes,  
Construction Engineer. (1)

Mr. D. G. Ramsay,  
Road Design Engineer. (1)

Mr. A. Gater,  
Sr. Project Design Engr. (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.J. F-59-61

W.P. 12-59

## INTRODUCTION:

Presented in this report are the results of a subsoil investigation carried out at a site approximately 8 miles south of Chatham where proposed Hwy. 401, Line 'C' crosses the existing Jeannette Creek and underpasses the contemplated gravel road revision in Lots 12 & 13, Con. VII, Twp. of Raleigh (Sta. 256+40), at existing creek crossing & Sta. 257+71 at gravel road-revision crossing, Profile No. F-3533-5). This report contains the detailed results of field and laboratory findings and recommendations for the foundation of the structures.

The field investigation was carried out on three separate occasions due to changes in the location of the structures. Initially, a closing of the existing gravel road was proposed with a crossing at approx. Sta. 256+40 at the existing Jeannette Creek. This initial investigation, consisting of 4 sampled boreholes, Borings 1, 2, 3 & 4) was carried out between Feb. 2nd and Feb. 13th, 1959. After the completion of this investigation, a diversion of the creek was proposed at approx. Sta. 255+83. As a result of this proposed creek diversion, a second investigation, consisting of 2 sampled boreholes (Borings 5 & 6) was carried out on June 16th, 1959, to confirm similar subsoil conditions. Immediately after the second investigation, an underpass structure was suggested at the contemplated gravel road revision. In view of the fact that the contemplated gravel road revision is located at a distance of over 100 feet from our previous borings, a third investigation, consisting of 3 sampled boreholes (Borings 7, 8 & 9) was carried out between July 22nd & July 23rd, 1959. Subsoil conditions at the site, as revealed by the three investigations, are relatively uniform.

INTRODUCTION: (cont'd.) ...

For structures located between approximately Sta. 255+00 and Sta. 258+00, either at the gravel road revision and existing creek, or the existing gravel road and creek diversion crossings, recommendations contained in this report can be followed.

DESCRIPTION OF THE SITE & GEOLOGY:

The site and its surrounding areas are generally flat farmland presently under cultivation. Jeannette Creek has been dredged and widened to the existing drainage channel. The normal water level of the creek is at an elevation of approximately 2 or 3 feet above its stream-bed. During spring run-off, it has been reported that the high water level reached the top of the creek banks. Erosion due to scour, is evidenced along the banks of the creek.

The site under consideration, is located on a clay plain. According to available geological information, the area is covered by deep deposits of clay overlying limestone bedrock. At this site the clay exists in a medium to stiff condition to a depth of approximately 72 ft. where probably bedrock commences.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 9 sampled boreholes carried out on three separate occasions. An initial boring programme consisting of Borings 1, 2, 3 & 4, was carried out by a standard diamond drill adapted for soil sampling, between Feb. 2nd & Feb. 13, 1959. A second boring programme consisting of Borings 5 & 6 and a third

cont'd. /3 ...

DESCRIPTION OF FIELD & LABORATORY WORK: (cont'd.) ...

consisting of Borings 7, 8 & 9, was carried out by a continuous flight auger on June 16th, 1959 and July 22nd to July 23rd, 1959, respectively.

Samples were recovered at the depth required by means of 2" I.D. thin-walled Shelby samplers, or a 2" O.D. split barrelled spoon sampler. The dimension of this spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Upon recovery, samples were examined, identified and wax-sealed or placed in moisture proof containers for transport to our laboratory. In addition to the sampled boreholes, a dynamic cone penetration profile was obtained adjacent to Borings 1 & 2 and in-situ vane shear tests were carried out in Borings 5, 6 & 9.

Upon receipt in the laboratory, samples were visually examined and identified. Triaxial shear and consolidation tests in addition to routine index tests, were carried out on selected representative samples. Laboratory test results have been presented in the borehole logs and are detailed in Table No. 1 under Appendix I.

SUBSOIL CONDITIONS:

In general, the site is composed of a medium to stiff silty clay stratum overlying probably bedrock.

In each of the sampled boreholes, the topsoil was found to be underlain by the medium to stiff silty clay stratum. The upper 7' to 10' of the clay stratum has been oxidized to its present brownish colour. Below the oxidized zone, the colour is

cont'd. 4/ ...

SUBSOIL CONDITIONS: (cont'd.) ...

predominantly grey. This stratum of medium to stiff silty clay was explored to a depth of 78 ft. (i.e. Elev. 508') in Boring 7, and 72 ft. (i.e. Elev. 512') in Borings 5 & 6, where probably bedrock was encountered. Bedrock has not been proven by core-drilling since the auger was not equipped to take rock core samples. According to local residents in the immediate vicinity of the site, limestone bedrock was encountered at approximately Elev. 512' to 508'.

The medium to stiff silty clay contains approx. 27% silt, 18% sand and 6% fine to medium gravel throughout. The average unit weight and moisture content were found to be 130 p.c.f. and 19%, respectively. Liquid and plastic limits averaged 27% and 17%. Field and laboratory tests show a minimum shear strength of 1000 p.s.f. A plot of shear strength vs. depth, has been presented and is included in this report under Appendix I.

Field and laboratory test results have been summarized in Table No. 1 and are included in this report under Appendix I.

WATER CONDITIONS:

Due to the low permeability of the clayey subsoil, it was not feasible to accurately establish the ground water table at the site during the boring programmes. Samples obtained below the creek water level were saturated and the ground water table at the site has been assumed to be at the seasonal water level of Jeannette Creek, approximately Elev. 576' to 583'. Artesian water conditions were noted when bedrock was encountered during the boring operations. The excess hydrostatic head reached Elev. 544'.

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

The critical elevation below which "piping" occurs during dewatering or footing excavations, has been estimated to be at approx. Elev. 525'. Sand seams were encountered in the upper 20 ft. of the subsoil in Borings 3, 4 & 9 that were located close to the bank of the creek. If high water table conditions were present during construction, pumping operations might be necessary during footing excavations in the immediate vicinity of the banks of the creek.

FOUNDATION CONSIDERATIONS:

1. Bridge at Jeannette Creek:

Subsoil conditions are such that spread footing support can be obtained at Elev. 566' or below. At this elevation or below, for footings 7' to 10' wide, an allowable bearing pressure of 2 1/4 tons/sq. ft. can be used in spread footing design. For a single-span structure, total and differential settlements, consequent upon application of this bearing pressure, are considered tolerable. Footings founded at Elev. 566' or below, are believed to have adequate protection from stream erosion and scour and allowances for future deepening of the creek channel.

In view of the presence of sand seams in the upper 20 ft. of the subsoil that were encountered in Borings 3, 4 & 9, (all located close to the creek bank) if high water table conditions are present during footing excavations, pumping operations might be necessary. If footing excavations are carried out during the

cont'd. /6 ...

FOUNDATION CONSIDERATIONS: (cont'd.) ...

1. Bridge at Jeannette Creek: (cont'd.) ...

normal creek water level period, the impermeable nature of the clayey subsoil will allow excavations below the stream-bed of the creek to be carried out in the dry.

Under the proposed grade line, the maximum height of fill is approximately 9 ft. The subsoil can safely support this embankment loading. In order to avoid endangering of the stability of the canal of the creek (existing or diversion), the toe of the embankment slope at the gravel road crossing (existing or revision), should be maintained at a minimum clearance distance of 17 ft. from the top of the canal bank. This distance is exceeded in Drawing - No. F 59-61A which shows the proposed gravel road revision and existing Jeannette Creek as well as the existing gravel road and Jeannette Creek diversion.

2. Underpass Structure at Gravel Rd. Revision:

Adequate foundation support for this underpass structure can be obtained in the medium to stiff clay stratum. At elevation 579' or below, subsoil conditions are such that for footings of 7' to 10' in width, an allowable bearing pressure of 2 1/4 t.s.f. can be used in spread footing design. For a single-span structure, total and differential settlements are considered tolerable. Footings founded at Elev. 579' or below are believed to have adequate protection from frost action.

cont'd. /7 ...

FOUNDATION CONSIDERATIONS: (cont'd.) ...

2. Underpass Structure at Gravel Rd. Revision: (cont'd.) ...

No serious ground water problems during construction, are anticipated. Due to the impermeable nature of the clayey subsoil, if seepage does occur during footing excavations, seepage inflow will be local and of minor quantities, only.

Under the proposed grade line of the gravel road revision, the maximum height of fill is approximately 28 ft. The subsoil can safely support this embankment loading.

If an underpass structure is to be constructed at the existing gravel road crossing, footings shall be founded at elevation 566' or lower. This elevation is recommended because of the softening action of the creek on the upper 10 to 15 feet of silty clay. At this elevation or below, an allowable bearing pressure of 2 1/4 t.s.f. can be used in spread footing design.

CONCLUSIONS AND RECOMMENDATIONS:

1. The site is underlain by a medium to stiff silty clay stratum overlying limestone bedrock.

2. Bridge at Jeannette Creek:

(A) Subsoil conditions are such that at Elev. 566' or below, for footings of 7' to 10' in width, an allowable bearing pressure of 2 1/4 t.s.f. can be used in spread footing design. Footings founded at this elevation or below, are believed to have adequate protection from stream erosion and scour and allowances for future deepening of the creek channel. For a single-span structure, total and differential settlements are considered tolerable.

cont'd. /8 ...

CONCLUSIONS AND RECOMMENDATIONS: (cont'd.) ...

2. Bridge at Jeannette Creek: (cont'd.) ...

- (B) If high water table conditions are present during footing excavations, pumping operations may be necessary. If footing excavations are carried out during the normal creek water period, excavations below the stream-bed of the creek can be carried out in the dry with only minor water removal problems.
- (C) No approach fill stability problems are anticipated.

3. Underpass Structure at Gravel Rd. Revision:

- (A) Spread footings at Elev. 579' or below are recommended. For footings of 7' to 10' in width, an allowable bearing pressure of 2 1/4 t.s.f. can be used.
- (B) No excess seepage problems with respect to footing excavations are anticipated.
- (C) No approach fill stability problems are anticipated.
- (D) For a single-span structure settlements resulting from application of 2 1/4 t.s.f. bearing pressure and the embankment load are considered tolerable.

4. Existing Gravel Road:

If an underpass structure is to be constructed at the existing gravel road crossing, it is recommended that footings be founded at Elev. 566' or below.

*Dr. de Lant*  
for A. K. Loh,  
Project Foundation Engr.

APPENDIX I.

## SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-61

W.P. 12-59

[illegible]



# SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-61  
W.P. 12-59

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
6	T8	50'-52'	Stiff grey silty clay with approximately 6% fine to medium gravel.	38	16.6	16.7	24.1	2700	131.1	
			S. Denotes Split Spoon Sample T. " Thin Walled Shelby Tube							

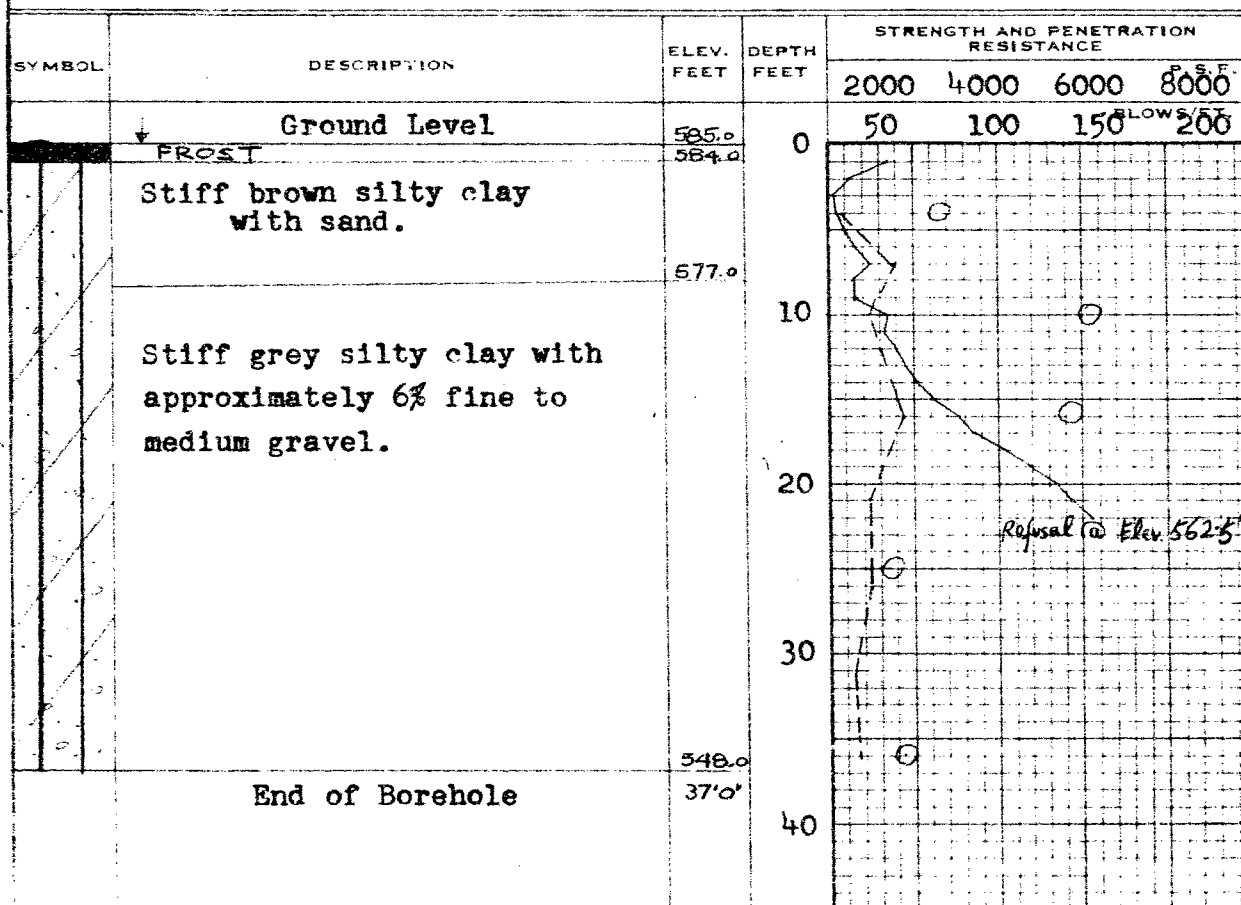
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 1  
JOB F-59-61 STATION 256+08 (37' Rt.)  
DATUM Geodetic COMPILED BY B.K.  
BORING DATE Feb. 14/59 CHECKED BY A.L.

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

## LEGEND

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



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
		X	TW 1	126.0
	*		TW 2	127.2
X	1	1	TW 3	128.8
	X		TW 4	133.0
	1X	0	TW 5	129.0
	X		TW 6	131.8
	1X	0	TW 7	120.3
	1 X	0	TW 8	130.2

Borehole No. 1.

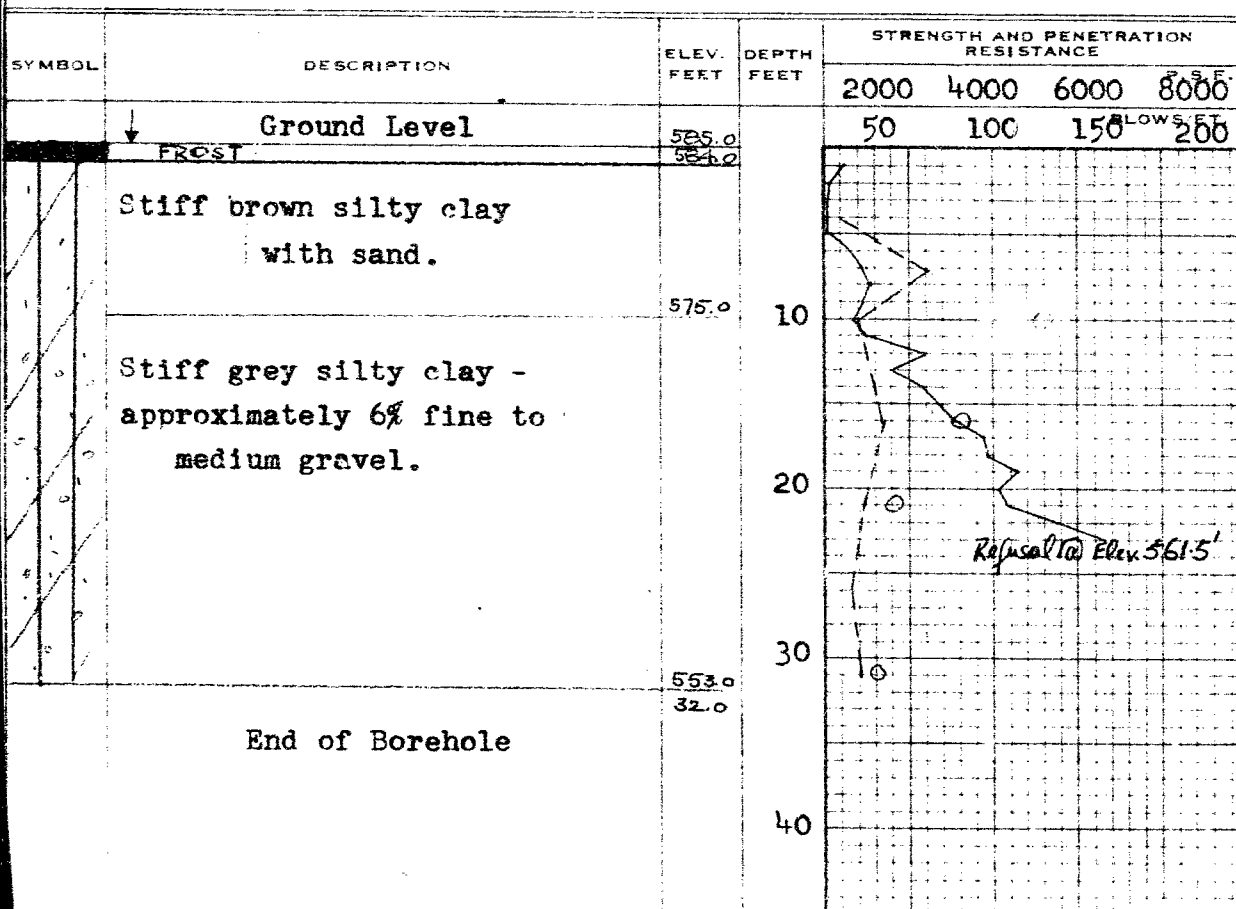
## OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 2  
 JOB F-59-61 STATION 255+82 (37' Lt.)  
 DATUM Geodetic COMPILED BY B.K.  
 BORING DATE Feb. 14/59 CHECKED BY A.L.

## LEGEND

2" DIA. SPLIT TUBE --- SS 1/2 UNCONFINED COMPRESSION ( $Q_u$ ) --- O  
 2" SHELBY TUBE --- TW VANE TEST (C) AND SENSITIVITY (S) --- +  
 2" SPLIT TUBE --- LI  
 2" DIA. CONE --- LI  
 2" SHELBY --- LI  
 CASING --- X  
 LIQUIDITY INDEX --- X  
 LIQUID LIMIT --- O  
 PLASTIC LIMIT --- I



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
		X	TW 1	126.0
	X		TW 2	129.4
	X		TW 3	122.8
	X		TW 4	136.0
	X		TW 5	132.0
	X		TW 6	127.8
	X		TW 7	128.0

Borehole No. 2

# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 3  
 JOB F-59-61 STATIC 256+83 (37'Rt.)  
 DATUM Geodetic COMPILED BY B.K.  
 BORING DATE Feb. CHECKED BY A.L.

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

## LEGEND

SS 1/2 UNCONFINED COMPRESSION (Qu) O  
 TW VANE TEST (G) AND SENSITIVITY (S) +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	587.6		50	100	150	200
	Stiff brown silty clay with sand. W.L. $\nabla$ 582.6						
		578.0	10				
	Stiff grey silty clay - approx. 6% fine to medium gravel interbedded with 1" sand seams between Elev. 582 & 580.		20				
			30				
			40				
	End of Borehole	545.6					

CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			TW 1	124.0
			TW 2	118.0
			TW 3	129.0
			TW 4	132.0
			TW 5	128.0
			TW 6	129.9
			TW 7	-Lost

## OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 12-59

BORE HOLE NO. 4

JOB F-59-61

STATION 256+57 (37' Lt.)

DATUM Geodetic

COMPILED BY B.K.

BORING DATE Feb. 13/59

CHECKED BY A.L.

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2" SPL.

2" DIA. CONE

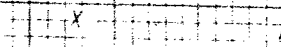
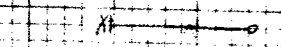
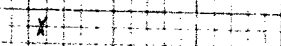
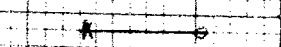

2" SHELBY

CASING

## LEGEND

SS 1/2 UNCONFINED COMPRESSION ( $Q_u$ ) — ○  
 TW VANE TEST (C) AND SENSITIVITY (S) — +  
 NATURAL MOISTURE AND LIQUIDITY INDEX — X  
 LIQUID LIMIT — —  
 PLASTIC LIMIT — —

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				2000	4000	6000	8000
	Ground Level	587.6		50	100	150	200
	Stiff brown silty clay with sand. W.L. ▽	583.6					
		577.0	10				
	Stiff grey silty clay - approximately 6% fine to med. gravel interbedded with 1" sand seams between Elevations 582 & 580.		20				
		561.0	30				
	End of Borehole	27.0	40				

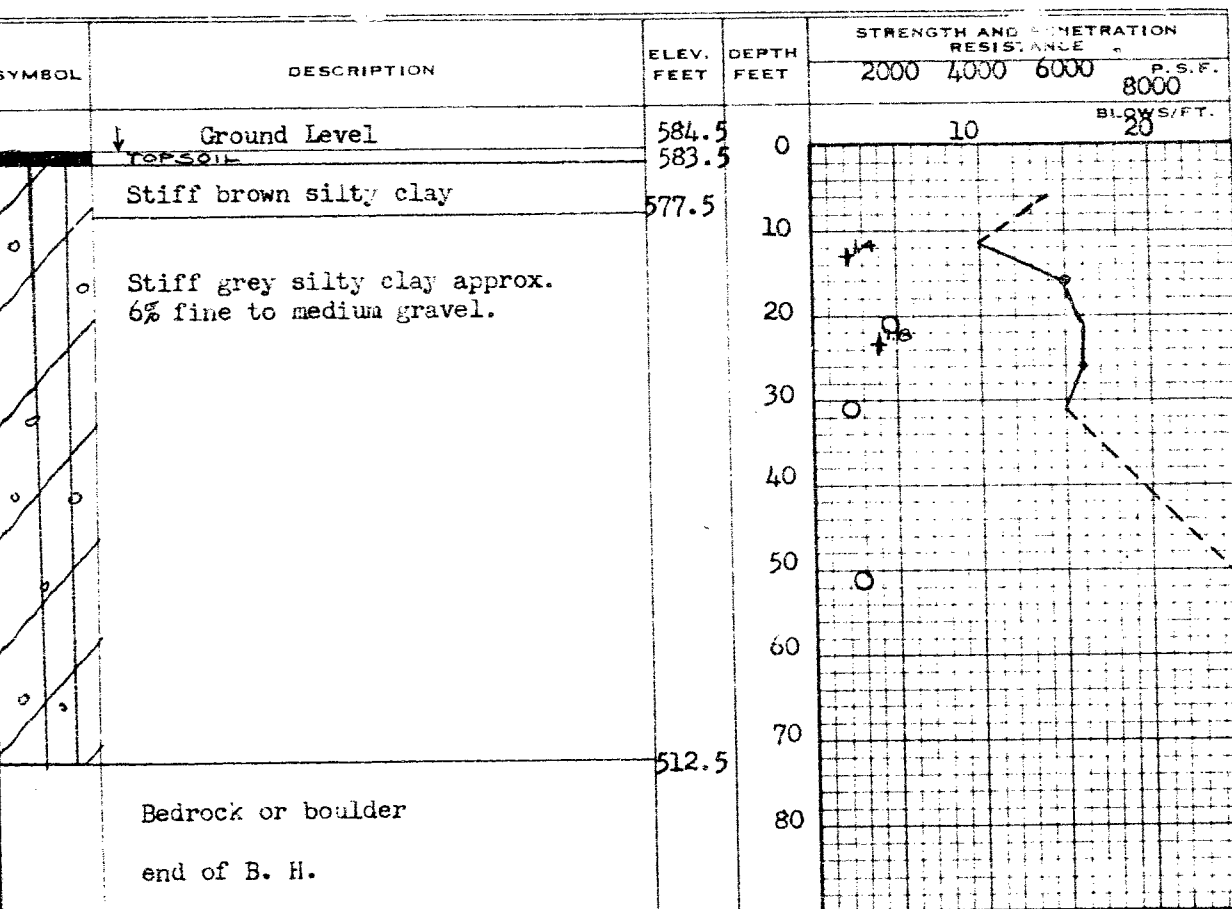
CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT. 10      20      30				
			TW 1	118.0
			TW 2	123.4
			TW 3	137.5
			TW 4	131.5
			TW 5	127.5

# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

N.P. 12-59 BORE HOLE NO. 5  
 JOB R-59-61 STATION 254 + 84 (45' RT)  
 DATUM Elev. 584.5' COMPILED BY B. K.  
 BORING DATE June 15/59 CHECKED BY A. L.

## 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 —



CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.				
10	20	30		
			T1	-
			T2	130.1
			S3	-
			T4	130.8
			S5	-
			T6	128.4
			T7	125.3

Borehole No. 5

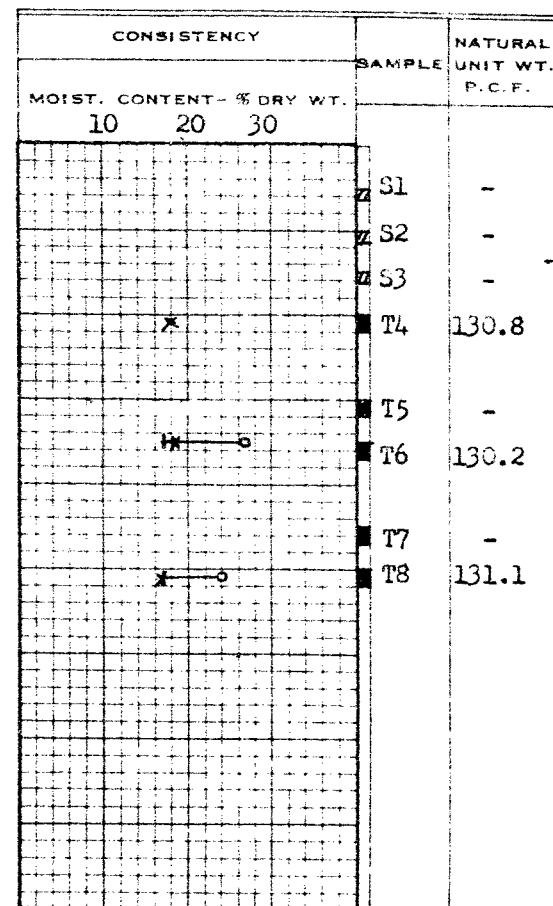
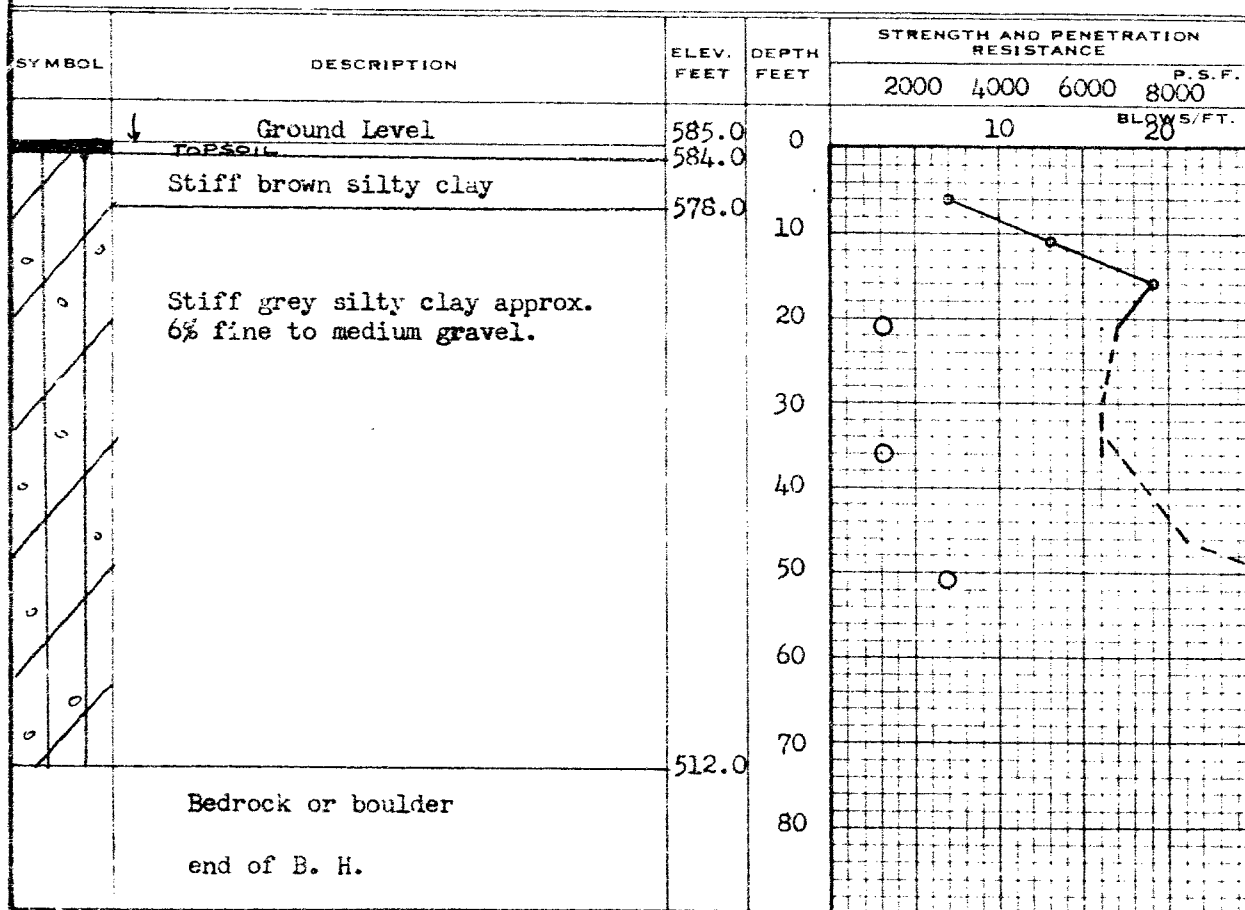
# DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 12-59 BORE HOLE NO. 6  
JOB E-59-61 STATION 255 + 26 (45' LT.)  
DATUM Elev. 584.5' COMPILED BY B. K.  
BORING DATE June 16/59 CHECKED BY A. L.

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



Borehole No. 6

## SHEAR STRENGTH IN P.S.F.

1000 2000 3000 4000 5000 6000

ELEVATION IN FEET

585

575

565

555

545

535

525

515

10

20

30

40

50

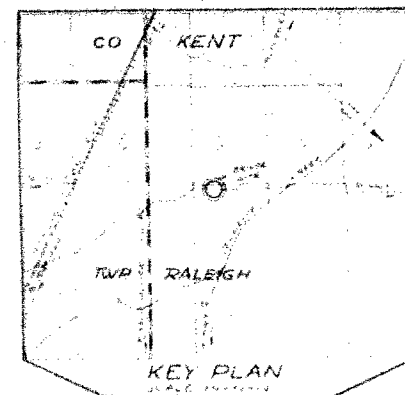
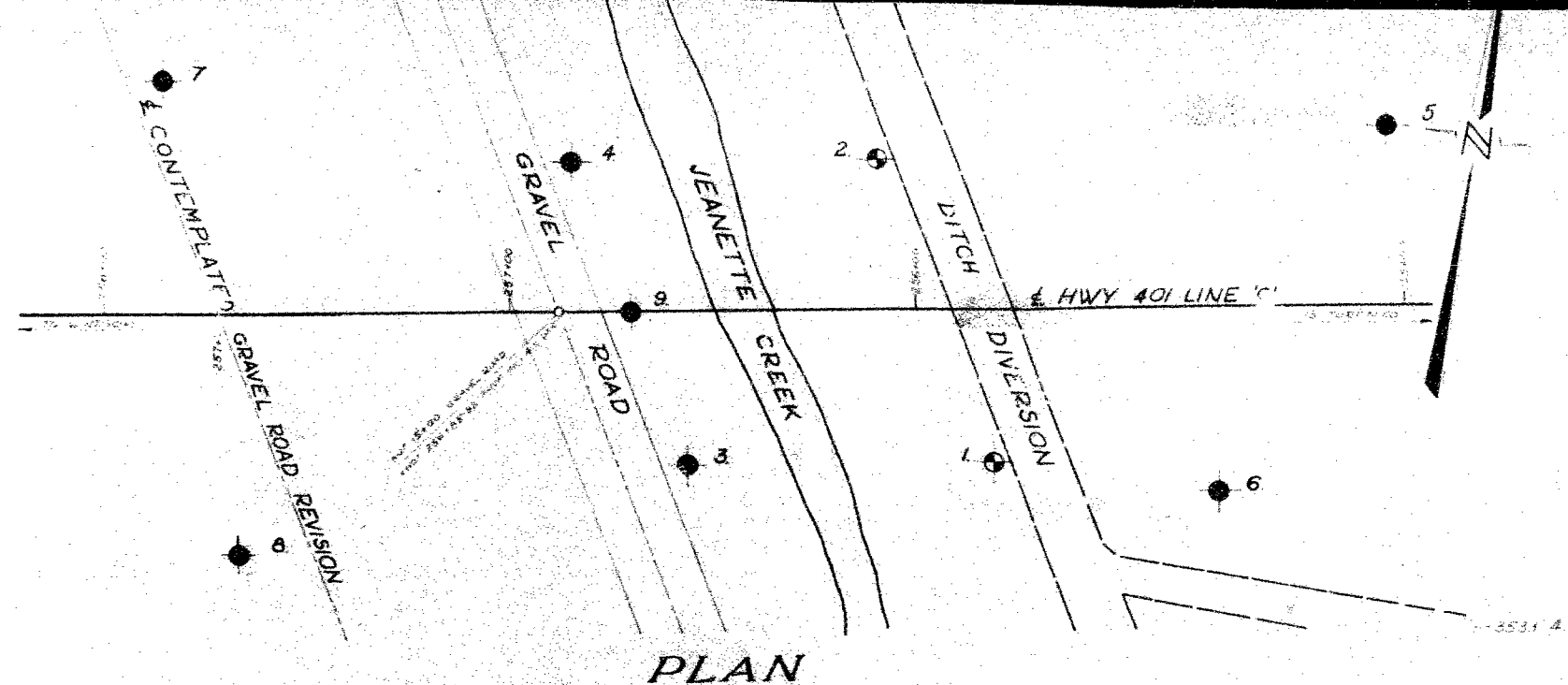
60

70

DEPTH IN FEET

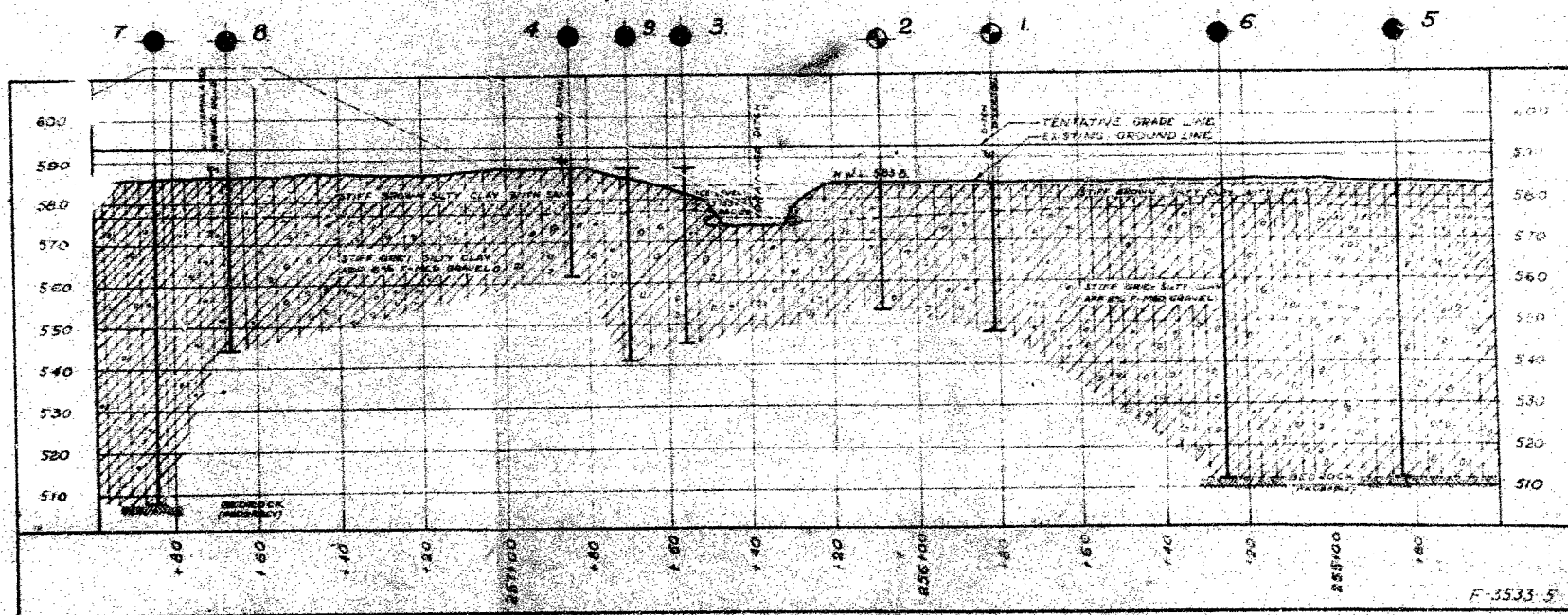
⊕ B.H. NOS 1 & 2  
 ⊙ B.H. NOS 5 & 6  
 + B.H. NOS 3, 4 & 9  
 • B.H. NOS 7 & 8

WATER CONTENT % X NAT. → ATTERBERG LIMITS



LEGEND			
Bore Hole			●
Penetration Hole			○
Bore & Penetration Hole			⊙
HOLE NO.	ELEVATION	STATION	DISTANCE FROM HOLE
1	5850	25614	1.0
2	5871	25615	1.0
3	5876	25615	1.0
4	5876	25615	1.0
5	5871	25615	1.0
6	5850	25615	1.0
7	5860	25614	1.0
8	5850	25615	1.0
9	5876	25615	1.0

NOTE:  
The elevations between the bore holes are shown as a guide only. The elevations between the bore holes are not necessarily accurate and should not be used for any other purpose.



DEPARTMENT OF HIGHWAYS - ONTARIO			
MAINTAINED & RECONSTRUCTED			
DITCH & GRAVEL ROAD PROPOSED CROSSING			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY. 401	DISTRICT 1	COUNTY KENT	
LOCATION RALEIGH	CON. 12-13	CON. 11	
LOCATION R.R. 6 N.E. OF CHATHAM			
DESIGNED BY: B. J. J. J.	CHECKED BY: J. J. J.	DATE: JULY 30, 1969	APPROVED BY: J. J. J.
DRAWN BY: J. J. J.			SCALE: 1" = 100'
			F-59-61A