

Department of Highways Ontario

Copy for the information of

A. G. Sternac
Mr. J.D. Harris
Senior Bridge Hydrology Engineer
Bridge Office, Downsview

A.P. Watt

August 9, 1968

W.P. 102-65, Bridge Site 20-157
Big Otter Creek Bridge
0.5 Miles West of Highway 10
Highway #3, (Tillsenburgh Diversion)
District #2, London
B.W. 1516

Attached please find two copies of the site plan S-4823-1, unnumbered plan and unnumbered profile along with one copy of the field notes showing a difference between the chainage which was used for the foundation report B.A. 2443 and the final alignment chainage for the above structure. The final plan and profile will be available by approximately September 11, 1968 and a copy supplied to you.

You will note on the site plan S-4823-1 that Engineering Surveys, South Western Region ran a stream diversion of the Big Otter Creek that crosses new Highway 3 at Sta. 102+27.39 Line "B". The location of this diversion is also shown on the unnumbered B plan and the ground profile along the diversion is shown on the unnumbered C plan.

From the field notes supplied you will note that the bore holes located in the foundation report B.A. 2443 have changed by exactly 81 feet because Engineering Surveys has now run the chainage along the whole job where previously only the river crossing was run. I will be contacting the foundation section about this change so that they may correct their report.

Would you kindly let me know as soon as possible whether you are in agreement with the stream diversion that Engineering Surveys has run. Would you also arrange for the final hydrology report to be written and completed by October 9, 1968.

A.P. Watt

A.P. Watt
REGIONAL BRIDGE LOCATION ENGINEER

APW/gi
att.

c.c. S. McCombie
A.G. Sternac ✓
R. Fitzgibbon

MEMORANDUM

To: Mr. A.G. Stermac
Principal Foundation Engineer
Lab. Building, Downsview

FROM: A.P. Watt

DATE: August 12, 1968

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 302-65, Bridge Site 20-157
Big Otter Creek Bridge
0.5 Miles West of Hwy. 19
Highway #3, (Tillsonburg Diversion)
District #2, London

66-F-67

Attached please find one copy of the bridge site plan E-4823-1, the unnumbered plan and the unnumbered profile along with a copy of the field notes showing a difference between the chainage which was used in the preparation of the foundation report W.J. 66-F-67 (Bridge Office number B.A. 2443) and the final chainage run for the whole Tillsonburg Diversion. The difference in chainage resulted because Engineering Surveys only ran the line in the area of the Otter Creek in 1966. In 1968, Engineering Surveys ran the whole alignment for the Tillsonburg Diversion Line G'

Please arrange to have the Materials and Testing drawing numbers 66-F-67A & B and all reference to chainage changed to agree with the latest 1968 survey.



A.P. Watt
REGIONAL BRIDGE LOCATION ENGINEER

APW/gi
att.

c.c. S. McCombie
J.D. Harris
F.E. Loscombe

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Mr. A.F. Watt,
Reg. Bridge Location Engineer,
London Regional Office,
London, Ontario

Bridge Office,
Downsview, Ontario

December 10, 1968

Big Otter Creek Bridge
(Westbound Lane)
0.5 Miles West of Hwy. 19
W.P. 302-65-00, Site 20-157
Highway 3, District No. 2

66-F-67

Attached herewith are prints of the Preliminary Bridge
Plan Drawing D-6038-71 for the above-mentioned structure.

The estimated cost of the proposed structure is \$190,000.
This cost includes tender, materials, engineering and sundry
construction.

Any comments or revisions you may have should be submitted
within three weeks.

CSG:rd

C.B. Grebaki,
Bridge Design Engineer

Attach.

c.c. E. McCombie
A. Stermac (2)
J. Anderson

No comment.

PP.
Dec. 17/68.

MEMORANDUM

To: Mr. J.L. Keen
Regional Bridge Project Engr.
Bridge Office, Downsview

FROM: A.P. Watt

ATTENTION:

DATE: December 20, 1968

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 302-65-00, Bridge Site 20-157
Big Otter Creek Bridge (Westbound Lane)
0.5 miles west of Highway 19
Highway #3, Tillsonburg By-Pass
District #2, London

D.H.O.
TORONTO
RECEIVED
DEC 23 1968
BRIDGE
OFFICE

As the above structure is now under design in the Bridge Office, I am forwarding Mr. A. McConnell's request for additional information to you as discussed on the telephone Dec. 20/68.

Mr. J. Roy, Regional Materials Engineer has informed us that the previous cut proposed on the west approach to the gorge is now 100% unusable material rather than the previous indication that 25% was usable material. Therefore, a borrow situation has arisen and a scheme to span the gorge from bank to bank has become a possible solution if economics are favourable.

Would you kindly submit a cost estimate for a structure spanning the gorge from bank to bank and include any additional information you feel will be of help in arriving at a solution. A reply would be appreciated by January 3, 1969.

The following information may be of assistance to you in your study:

- cost of fill material - 0.60¢ per cu. yd.
- compaction - 0.12¢ per cu. yd.
- stripping - \$1.00 per cu. yd.
- sodding - nil.
- curb and gutter - one side - \$3.00 per lin. ft.
- flex beam - one side - \$7.50 per lin. ft.
- pavement -
- EAST SIDE - 4½" H.M.)
- 6" granular A)
- 12" sand cushion) cost \$14.50 per lin. ft.
- shoulder material)
- WEST SIDE - 4½" H.M.)
- 6" granular A)
- 18" sand cushion) cost \$16.80 per lin. ft.
- shoulder material)

A.P. Watt

A.P. Watt
REGIONAL BRIDGE LOCATION ENGINEER

APW/gi

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Building

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: April 30, 1969

OUR FILE REF.

IN REPLY TO

SUBJECT: Big Otter Creek Bridge (W.B. Lane)
W.P. 302-65-00, Site 20-157
Highway 3 (Tillsonburg By-Pass)
District No. 2

66-15-67


Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG:rd

Attach.

c.c. Foundation Section


C.S. Grebski,
Bridge Design Engineer

*no comments
may 15-69
K.G.S.*

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

**Mr. A.P. Watt,
Reg. Bridge Planning Engineer,
London Regional Office,
London, Ontario**

**C.S. Grebaki,
Bridge Office**

March 16, 1970

**Big Otter Creek Bridge
Westbound Lane
0.5 Miles West of Hwy. 19
W.P. 302-65-00, Site 20-157
Highway 3, District No. 2**

66-F-67

Attached herewith are prints of the Preliminary Bridge Plan Drawing B-6797-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$780,000. This cost includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted within three weeks.

CSG:rd

**C.S. Grebaki,
Bridge Design Engineer**

Attach.

c.c. S. McCombie
A. Stermac (2)
J. Anderson

West abutment piles should reach
desired design capacity at el. 665 ±
Otherwise no comments

W. L. Gully
March 25th 1970

MEMORANDUM

To: Mr. K. Selby,
Supervising Foundation Engineer,
Foundation Office,
Lab. Building

From: J.L. Keen,
Bridge Office

Attention:

Date: May 26, 1970

Our File Ref.

In Reply To

Subject: Big Otter Creek Bridge - W.B.L.
0.5 Miles West of Hwy. 19
W.P. 302-65-00, Site 20-157
Hwy. 3 (Tillsonburg By-Pass, Dist. 2)

We have received your approval for the Preliminary Plan, Drawing D6797-P1 (March '70) for the above bridge. As we did not receive any comment from you concerning the stability of the embankment slopes we assume that our proposed arrangement is satisfactory.

However, in case it was not apparent to you when you reviewed our drawing, I wish to draw your attention to the west abutment embankment where fill will be placed on the west embankment slope to form a finished surface having a slope of 2:1. Presumably the entire slope will be seeded or sodded so that in time the surface will be protected by vegetation.

If you consider any further measures necessary to ensure slope stability we would appreciate hearing from you.

Enclosed is a copy of the Preliminary Plan for your convenience.



J.L. Keen,
Regional Bridge Design Engineer

JLK:rd

Encl.

c.c. S. Kryzevicius

SUMMARY OF PHONE CALL K. SELBY - J. KEEN MAY 27, 1970

- (1) No problems of slope stability provided granular fill is added according to appropriate standards (i.e. benching)
- (2) Problems of erosion due to surface water should be solved by construction of ditches etc.

K. L. Selby

MEMORANDUM

123 P-302-65
R. F. B. D. D. D.
Big Otter Creek Bldg

TO: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: June 25, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: Big Otter Creek Bridge
North Structure - Westbound Lane
W.P. 302-65-00, Site 20-157
Highway 3, District No. 2

66-F-67


Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

CSG:rd

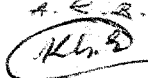
Attach.

c.c. Foundation Office


C.S. Grebski,
Bridge Design Engineer

29 JUNE 970

NO COMMENTS

A. K. B.




MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division,
Admin. Bldg.

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

Attention: Mr. S. McCombie

DATE: August 16, 1968

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Tillsonburg By-Pass at
Otter Creek Crossing, Hwy. #3
Twp. of Middleton, Co. of Norfolk
District No. 2 (London)
W.J. 66-F-67 -- W.P. 299-65

(Revised Edition)

The above report was distributed on November 10, 1966. Recently, we found it necessary to revise the Borelog sheets and Drawing 66-F-67A. For this reason, it was decided to reissue the entire report.

In accordance, therefore, would you kindly destroy the original copy(s) of this report, replacing same with the revised edition, attached hereto.

Thank you.

AGS/MdeF
Attach.

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
W. Zonnenberg
H. C. Dernier
A. P. Watt
J. Roy
B. A. Singh
Foundations Files
Gen. Files

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division.
Attention: Mr. S. McCombie

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

DATE: November 10, 1966

OUR FILE REF.

IN REPLY TO:

SUBJECT:


FOUNDATION INVESTIGATION REPORT
For
Proposed Tillsonburg By-Pass at
Otter Creek Crossing, Hwy. #3,
Twp. of Middleton, Co. of Norfolk,
District No. 2 (London)
W.J. 66-P-67 -- W.P. 299-65

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure site.

We believe that the factual data and recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please do not hesitate to call on our Office.

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
A. Gater
H. C. Dernier
A. P. Watt
J. Roy
A. Watt


A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER

Foundations Office
Gen. Files

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF THE SITE.
 3. FIELD INVESTIGATION PROCEDURE.
 4. LABORATORY TESTS.
 5. SUBSOIL CONDITIONS:
 - 5.1) Proposed Embankment Location.
 - 5.2) Proposed Cut Location.
 6. GROUNDWATER CONDITIONS.
 7. DISCUSSION AND RECOMMENDATIONS.
 8. SUMMARY.
 9. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
Proposed Tillsonburg By-Pass at
Otter Creek Crossing, Hwy. #3,
Twp. of Middleton, Co. of Norfolk,
District No. 2 (London)
W.J. 66-F-67 -- W.P. 299-65

1. INTRODUCTION:

A request for a soil investigation at the site of the proposed Tillsonburg By-pass in the vicinity of Otter Creek, was received from Mr. J. R. Roy, London Regional Materials Engineer, in a memo dated June 9, 1966.

A field investigation was subsequently carried out by this Section to determine:

- 1) the stability of the proposed 50-ft. embankment;
- 2) the stability of side slopes in the cut section, and also the suitability of the cut material for embankment fill; and
- 3) the type of bridge foundation for the proposed creek crossing.

Presented in this report are the results of this investigation, together with our design recommendations.

2. DESCRIPTION OF THE SITE:

Physiographically, the site is located in the region referred to as The Norfolk Sand Plain. The sands and silts of this region were deposited as a delta by the great discharge of meltwater from the Grand River area. The sand beds are some 75 ft. thick, but usually silt or clay strata or beds of boulder clay occur within 30 feet of the surface. Small rivers flowing directly to Lake Erie have cut deep valleys across the sand plain.

The Otter Creek is one of these small rivers which eroded the sand plain, cutting a 700-ft. wide and 100-ft. deep valley.

2. DESCRIPTION OF THE SITE: (cont'd.) ...

There is evidence that Otter Creek has changed its course from time to time, cutting new channels and depositing predominantly coarse-grained material.

The valley floor is relatively flat, and the steep valley walls are wood-covered.

The existing 'sand plain' is cultivated farmland.

3. FIELD INVESTIGATION PROCEDURE:

A total of twenty-four boreholes and eighteen dynamic cone penetration tests was carried out during the course of the field work.

Boring was achieved by means of conventional diamond drilling equipment adapted for soil sampling purposes. During the field work, disturbed samples were obtained by means of a standard split-spoon sampler. The energy used in driving the latter, conformed to the requirements of the Standard Penetration Test. Dynamic cone penetration tests were carried out adjacent to seventeen boreholes, and at one other location. Driving energy to advance the cone was 350 ft.-lbs. per blow. Other samples were obtained by means of 2-inch I.D. Shelby tubes which were pushed into the soil by hand, or occasionally driven into the soil with a 140-lb. hammer delivering 350 ft.-lbs. per blow. In-situ vane tests were carried out wherever possible, at elevations 12 inches below the various sample depths.

At some borehole locations, rock core samples were contained by standard diamond drilling equipment.

The locations and elevations of all boreholes are shown on Drawing No. 66-F-67A, which accompanies this report.

The locations and elevations of all boreholes were surveyed in the field by D.H.O. personnel from the Engineering Surveys Section.

4. LABORATORY TESTS:

Samples were visually examined and classified at the site as well as in the laboratory. Certain tests were carried out in the laboratory for classification, shear strength determination and settlement analysis purposes. These tests consisted of Atterberg limits, moisture content, grain-size distribution, organic content, unconfined and triaxial shear strength tests and consolidation tests. The test results are shown on the Borehole Record sheets which form part of this report.

5.1) SUBSOIL CONDITIONS AT THE PROPOSED EMBANKMENT LOCATION:

From ground level downward, the following soil types were observed:

5.1A) Alluvium:

This deposit was found to extend from the original ground level in all boreholes, with the exception of B.H. #2, to depths ranging from 6 ft. to 20 ft. The material consists of a heterogeneous mixture of gravel, sand and silt, with some clay, and also some decayed and undecayed organic substances. The 'N' values obtained from Standard Penetration tests ranged from 1 to 95 blows per foot. The relative density is estimated to range from very loose to very dense.

The natural moisture content was found to vary from 6% to 37%.

Results of mechanical analyses are summarized in the accompanying borelog sheets.

5.1B) Silty Clay to Clayey Silt:

This deposit underlies the alluvium and was observed in boreholes No. 1 to 17, 19, and 24. The upper boundary was found to be between El. 653 and El. 640, and the lower boundary between El. 623 and El. 618.

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

5.1B) Silty Clay to Clayey Silt: (cont'd.) ...

The chief constituents are clay and silt with traces of sand and gravel. Shelby tube samples obtained in this zone showed that the material is layered or interbedded silty clay, clay and clayey silt, with great variations in the thickness of the layers. The material also contains numerous tiny seams or pockets of silt. The occurrence of the silt is very irregular.

A plot of Plasticity Index versus Liquid Limit of the deposit shows a wide spread of the points along the 'A' line. This plot is shown on Fig. 4 of the Appendix.

Unconfined and triaxial compression tests carried out on 'undisturbed' samples, gave shear strength values, in general, ranging from 1,000 to 3,350 p.s.f. The shear strength increases with depth. Table I shows the average shear strength for each borehole, together with the minimum values. Physical properties of the material in the deposit as determined from field and laboratory tests, are summarized as follows:

Bulk Density	:	115 to 132 p.c.f.
Natural Moisture Content	:	11 to 35%
Liquid Limit	:	21 to 55%
Plastic Limit	:	16 to 28%
'N' Values	:	7 to 46 blows/foot

Typical grain-size distribution curves are shown in the Appendix (Fig. 5).

cont'd. /5 ...

B.H. No.	Unconfined		Triaxial		B.H. No.	Unconfined		Triaxial	
	Minimum	Average	Minimum	Average		Minimum	Average	Minimum	Average
1	-	-	900	1880	11	750	1410	1300	1380
2	-	-	1900	2400	12	1200	1800	1450	2040
3	-	-	1050	1400	13	-	-	-	-
4	-	-	-	-	14	1200	2170	1550	2000
5	-	-	1500	1650	15	1150	1620	1700	2230
6	-	-	1400	1900	16	850	1650	750	1640
7	-	-	-	-	17	-	-	-	-
8	550	1530	550	1630	19	2050	2660	1100	2030
9	-	-	-	-	24	-	-	-	-
10	1350	2100	1350	2040					

TABLE I

Summary of Undrained Shear Strength Tests (P.S.F.)

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

5.1C) Sandy Silt:

In B.H. #2, which is located on the existing natural slope, a sandy silt with traces of gravel and clay material was encountered between ground level and El. 647. The average moisture content is 20%. The 'N' values ranged from 5 to over 100 blows per foot, which indicates a loose to very dense relative density.

5.1D) Bedrock - Limestone:

Bedrock was observed at Elev. 622, 620, 622, 623, 618, 621, and 619 in B.H.'s #1, #2, #3, #7, #8, #14, and #19, respectively.

The bedrock consists of light to medium grey, mottled limestone with thin bands (2 - 3 mm) of shale.

During drilling operations, natural gas was observed in the boreholes as soon as the upper surface of the bedrock was intersected.

5.2) SOIL CONDITIONS AT THE PROPOSED CUT LOCATION:

The following soil types were encountered during the course of the field investigation:

5.2A) Clayey Silt to Silty Clay:

This deposit was observed in Boreholes #23, #25, and #20, immediately below the ground surface to depths of 41', 6', and 20', respectively, in B.H. #18 between El. 758.5 to El. 729.5, and in B.H. #21 at El. 694 to the full depth of exploration.

The material consists of clay and silt with some sand and traces of gravel. Occasionally sandy silt layers with high moisture contents were discovered within the cohesive material. The moisture content was found to vary from 12% to 23%, liquid and

cont'd. /7 ...

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

5.2A) Clayey Silt to Silty Clay: (cont'd.) ...

plastic limits ranged from 24% to 36%, and from 8% to 17%, respectively. The 'N' values ranged from 14 to over 100 blows per foot, which indicates a stiff to hard consistency.

5.2B) Sandy Silt to Silty Sand:

This stratum was encountered in every borehole at various depths. The elevation of the lower boundary was not determined, since the borings were terminated in this deposit.

In the upper portion, down to approx. El. 725, the material is predominantly sandy silt with layers or pockets of clay and silty clay and traces of gravel.

Below approx. El. 725, the deposit is basically silty sand with some clay.

The relative density of the overall stratum may be described as compact to very dense, the 'N' values being in the order of 10 to over 100 blows per foot. The moisture content was found to vary from 14% to 24%.

Typical grain-size distribution curves are shown on Fig. 1, Fig. 2, and Fig. 3 of the Appendix.

cont'd. /8 ...

6. GROUNDWATER CONDITIONS:

The following groundwater levels were observed in the various boreholes:

<u>B.H. No.</u>	<u>Elev. (ft.)</u>	<u>Remarks:</u>
1	-	-
2	670.8	26 days after drilling
3	-	-
4	-	-
5	656.0	22 days after drilling
6	653.3	22 " " "
7	-	-
8	-	-
9	654.1	20 days after drilling
10	654.4	20 " " "
11	653.7	17 " " "
12	654.3	17 " " "
13	653.0	16 " " "
14	660.0	15 " " "
15	655.6	14 " " "
16	-	-
17	657.1	14 days after drilling
18	-	-
20	Caved in at 38' below ground level (dry)	
21	" " " 5'	" " " (dry)
22	" " " 13.8'	" " " (water)
23	" " " 23'	" " " (water)
25	-	-

7. DISCUSSION AND RECOMMENDATIONS:

Otter Creek is located at the east edge of a 700-ft. wide valley with steep slopes some 100 ft. high. It is proposed to cross this valley and creek by means of an embankment overland, and a 300-ft. long bridge over the creek, or by means of a long

cont'd. /9 ...

7. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

bridge spanning the entire valley. In the first case, a scheme has been proposed which would necessitate approach embankments in the order of 50 ft. some 400 ft. long, together with a cut section of maximum depth about 40 ft., and total length about 2000 ft.

In the second case, a scheme has been suggested by the Regional Soils Section, which would require a long bridge some 100 ft. high, no approach embankments, and shallow cut sections only. The choice of scheme will be dependent upon economical factors, and both schemes are discussed below.

SCHEME #1 and SCHEME #2 -

Structure:

The proposed structure should be supported by means of piled foundations. For this purposes, steel H-piles driven to bedrock are deemed to be the most practical. The maximum allowable loads for the particular pile section adopted should be assumed for design purposes.

SCHEME #1 -

Approach Embankments:

It is understood that the creek will be diverted some 100 ft. west of its present position. In this event, the maximum height of the approach embankment will be in the order of 52 ft. No stability problems are anticipated for fills of this height, provided that 2:1 slopes are constructed. All surface organic deposits within the limits of the proposed embankments should be removed prior to placing fill material.

Approach Cuts:

No stability problems are anticipated with regard to the proposed 40-ft. deep cuts, provided proper side slope drainage is effected. In connection with the latter, it should be noted that the subsoil consists of layered deposits, pervious and

cont'd. /10 ...

7. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

SCHEME #1 - (cont'd.) ...

Approach Cuts: (cont'd.) ...

impervious and, therefore, some perched water may be encountered. Water must be prevented from seeping through the sides of the slopes by the provision of drains and/or by means of a suitable sand filter about 2 feet in thickness. With regard to the suitability of the material from the cuts for fill, the Regional Soils Section have concluded that only about 25% could be used for embankment construction.

8. SUMMARY:

A foundation investigation for the proposed Tillsonburg By-pass is reported.

The following soil types were encountered over the embankment area: an alluvium deposit is followed by silty clay to clayey silt, followed by limestone bedrock.

The proposed structure should be founded on steel H-piles driven to the bedrock.

No stability problems are anticipated for the proposed 52-ft. high embankment, provided standard 2:1 slopes are constructed. All surface organic deposits should be removed within the limits of the embankments.

No stability problems are anticipated for the proposed 40-ft. deep approach cuts. Approximately 75% of the material from the cuts is not suitable for embankment fill.

Details are given in the foregoing section: "Discussion and Recommendations."

cont'd. /11 ...

9. MISCELLANEOUS:

The field work was carried out during the period July 12, 1966 to August 11, 1966. Equipment used was owned and operated by Johnston Drilling Co. Ltd. The supervision of the field work, together with the preparation of this report, was carried out by Mr. P. Payer, Project Foundation Engineer, under the general supervision of Mr. K. G. Selby, Supervising Foundation Engineer.

November 1966

APPENDIX I

CHECKED BY AK

[illegible]

FOUNDATION SECTION

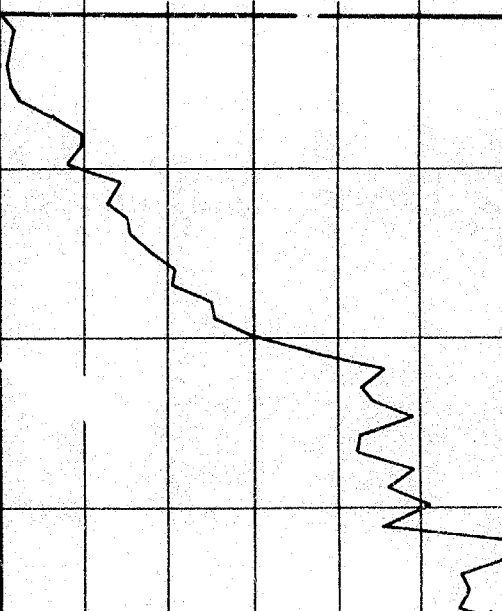
ORIGINATED BY P.P.

COMPILED BY A.M.S.

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING DIVISION		<h2 style="margin: 0;">RECORD OF BOREHOLE NO. 4</h2>	FOUNDATION SECTION
JOB <u>66-F-67</u>	LOCATION <u>Sta. 124+60 122' Rt.</u>	ORIGINATED BY <u>P.P.</u>	
W.P. <u>299-65</u>	BORING DATE <u>July 19, 1966.</u>	COMPILED BY <u>P.P.</u>	
DATUM <u>Geodetic</u>	BOREHOLE TYPE <u>Cone Test Only.</u>	CHECKED BY <u>[Signature]</u>	

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		25 50 75 100 125	PLASTIC LIMIT ——— WP		
							SHEAR STRENGTH P.S.F.	WP ——— W ——— WL		
								WATER CONTENT %	P.C.F.	
659.0	Groundlevel									
	Probably alluvium and clayey silt to silty clay.					650				
623.0						640				
						630				
36.0	End of borehole.						End of Cone Test			

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 66-F-67 LOCATION Sta. 124+56 5' Rt. ORIGINATED BY P.P.
W.P. 299-65 BORING DATE July 19 & 20, 1966. COMPILED BY P.P.
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing. CHECKED BY LL

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		25	50	75	100	125	WP	W	WL		
661.4	Groundlevel														
0.0	Sandy silt with some clay and gravel, - traces of organic material. Brown to grey V. loose to v. dense (Alluvium)		1	SS	10										
			2	SS	3										
			3	SS	5										
			4	TW	PM										
			5	SS	28										
			6	SS	55										
			7	SS	24										
			8	SS	69										
			9	SS	75										
640.9			10	SS	97										
20.5	Silty clay to clayey silt with traces of sand - Irregular seams or pockets of silt. Firm to stiff Brown to grey.		11	SS	27										
			12	TW	PM										
			13	TW	PM										
			14	SS	40										
			15	TW	PM										
618.1			17	SS	60										
43.3	(Probable Bedrock) End of borehole.														

End of Cone Test

W.L. ∇ 656.0'
Sa 25%
Si 63%
Cl 12%

Sa 4%
Si 96%
Cl 0%

Sa 2%
Si 88%
Cl 10%

Sa 2%
Si 40%
Cl 58%

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-67

LOCATION Sta. 122+55 5' Lt.

ORIGINATED BY P.P.

W. F. 299-65

BORING DATE July 18 & 19, 1966.

COMPILED BY P.P.

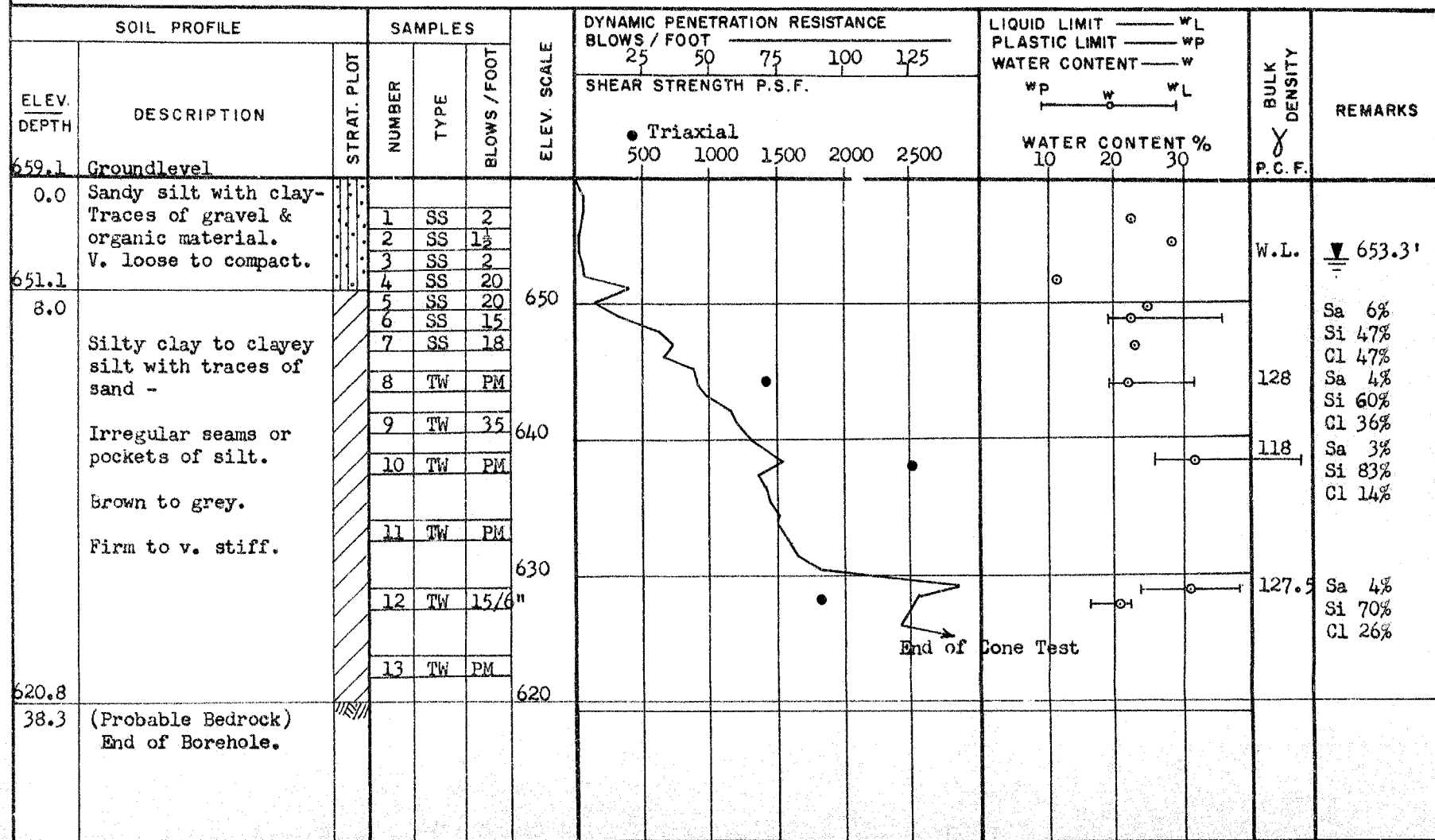
DATUM Geodetic

BOREHOLE TYPE Washbore - NX Casing.

CHECKED BY

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION



DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO. 7		FOUNDATION SECTION	
MATERIALS & TESTING DIVISION					
JOB <u>66-F-67</u>	LOCATION <u>Sta. 123+76 237' Rt.</u>	ORIGINATED BY <u>P.P.</u>			
W.P. <u>299-65</u>	BORING DATE <u>July 21 & 22, 1966</u>	COMPILED BY <u>P.P.</u>			
DATUM <u>Geodetic</u>	BOREHOLE TYPE <u>Washbore - BX & NX Casing.</u>	CHECKED BY <u>HR</u>			

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
							○ Unconfined ● Triaxial					WP	W	WL		
						25	50	75	100	125						
						500	1000	1500	2000	2500						
659.9	Groundlevel															
0.0	Sandy silt with traces of gravel, clay and organic material.		1	SS	1 1/2	650										Gr. 1% Sa. 4% Si. 87% Cl. 8%
	Brown to grey.		2	SS	1											
	V. loose to v. dense.		3	SS	2											
			4	SS	42											
			5	SS	85											
			6	SS	63											
			7	SS	50											
644.9	(Alluvium)		8	SS	34											
15.0	Silty clay to clayey silt with traces of sand and gravel -		9	SS	25	640										sa. 1% Si. 34% Cl. 65%
	Irregular seams or pockets of silt.		10	SS	20											
	Brown to grey.		11	SS	25											
	Firm to v. stiff.		12	SS	25											
			12A	TW	PM	630										126 119
			13	TW	PM											
622.7						620										Gr. 2% Sa. 10% Si. 50% Cl. 38%
37.2	Mottled limestone with thin shale layers.		14	RC	100%											
	Grey.		15	RC	100%											
612.6	Bedrock															
47.3	End of borehole.															

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-E-67

LOCATION Sta: 121+38 71' Lt.

ORIGINATED BY P.P.

W.P. 299-65

BORING DATE July 20, 21, 1966

COMPILED BY _____ P.P.

DATUM Geodetic

BOREHOLE TYPE Washbore - Bx & Nx Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit ——— WL	Plastic Limit ——— WP	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		25 50 75 100 125				
							SHEAR STRENGTH P.S.F.	WATER CONTENT % WP W WL			
						○ Unconfined + Field Vane ● Triaxial	500 1000 1500 2000 2500				
659.9	Groundlevel										
0.0	Sand with gravel traces of silt & clay and org.material. V. Loose Brown to Grey		1	SS	3	650				115	Gr.23% Sa.71% Si. 6% Cl. 6%
648.9	(Alluvium)		2	SS	3						
			3	SS	4						
			4	SS	1 1/2						
			5	SS	4						
11.0	Silty clay to clayey silt with traces of sand & gravel- Irregular seams or pockets of silt. Brown to Grey. Firm to V. stiff.		6	SS	4	640				120	Sa. 1% Si.28% Cl.71%
			7	TW	PM						
			8	TW	PM						
			9	TW	PM						
			10	TW	pM						
			11	TW	PM						
			12	TW	PM						
			13	TW	11/6"						
			14	SS	14						
			15	TW	12/6"						
618.4			16	TW	PM	620				121	
41.5	Limestone - grey Bedrock.		17	Rc.	100%	Refusal				131	
613.4										127	
46.5	End of borehole.					610					

FOUNDATION SECTION

JOB 66-F-67 LOCATION Sta. 123+20 231' Rt ORIGINATED BY PP
W.P. 299-65 BORING DATE July 21 & 22, 1966 COMPILED BY PP
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					WATER CONTENT %				
							25	50	75	100	125	500	1000	1500		
							SHEAR STRENGTH P.S.F.									
							○ Unconfined ● Triaxial									
662.6	Groudlevel															
650.1 12.5	Gravel, sand and silt with traces of clay & org.material. (Alluvium) Loose to dense Brown to Grey.		1	SS	5	660										Sa. 63% Si. 33% Cl. 4% Gr. 46% W.L. Sa. 47% Si. 7% Cl. 654.1
			2	SS	9											
			3	SS	6											
			4	SS	2											
			5	SS	11											
			6	SS	36											
	Clayey silt to silty clay with traces of sand and gravel, irregular seams or pockets of silt. Brown to Grey Stiff to v.stiff		7	SS	46	650										
			8	SS	38											
			9	SS	18			640								
			10	TW	PM											
			11	TW	PM				630							
			12	TW	24/6"											
			13	TW	21/6"											
623.1															126 123	
39.5	End of borehole.					620										130 130

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

JOB 66-F-67

LOCATION Sta. 120+67 22' Rt.

ORIGINATED BY PP

W.P. 299-65

BORING DATE July 21 & 22, 1966

COMPILED BY P.P

DATUM Geodetic

BOREHOLE TYPE Washbore - NX Casing

CHECKED BY *HL*

SOIL PROFILE

SAMPLES

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT

25 50 75 100 125

SHEAR STRENGTH P.S.F.

○ Unconfined

● Triaxial

500 1000 1500 2000 2500

LIQUID LIMIT — WL
PLASTIC LIMIT — WP
WATER CONTENT — W

WP — W — WL

WATER CONTENT %

10 20 30

BULK
DENSITY

P.C.F.

REMARKS

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W	WATER CONTENT %	BULK DENSITY	REMARKS
661.9	Groundlevel											
0.0	Sand with traces of silt, clay and org. material.		1	SS	3	660						
			2	SS	4							
			3	SS	3							
			4	SS	1 1/4							
	V. loose to compact		5	SS	1 1/4							
			6	SS	1 1/4							
649.1	(Alluvium)		7	SS	13	650						
12.5	Silty clay to clayey silt with traces of sand and gravel. Irregular seams or pockets of silt.		8	SS	7							
			9	SS	7							
	Brown to Grey		10	TW	PM							
	Firm to v. stiff.		11	TW	PM	640						
			12	TW	PM							
			13	TW	PM							
			14	TW	10/6"	630						
			15	TW	PM							
620.8												
41.1	End of borehole (Probable Bedrock)					620		Refusal				

Sa. 86%
Si. 14% 654.
Cl.

120

118

120

124

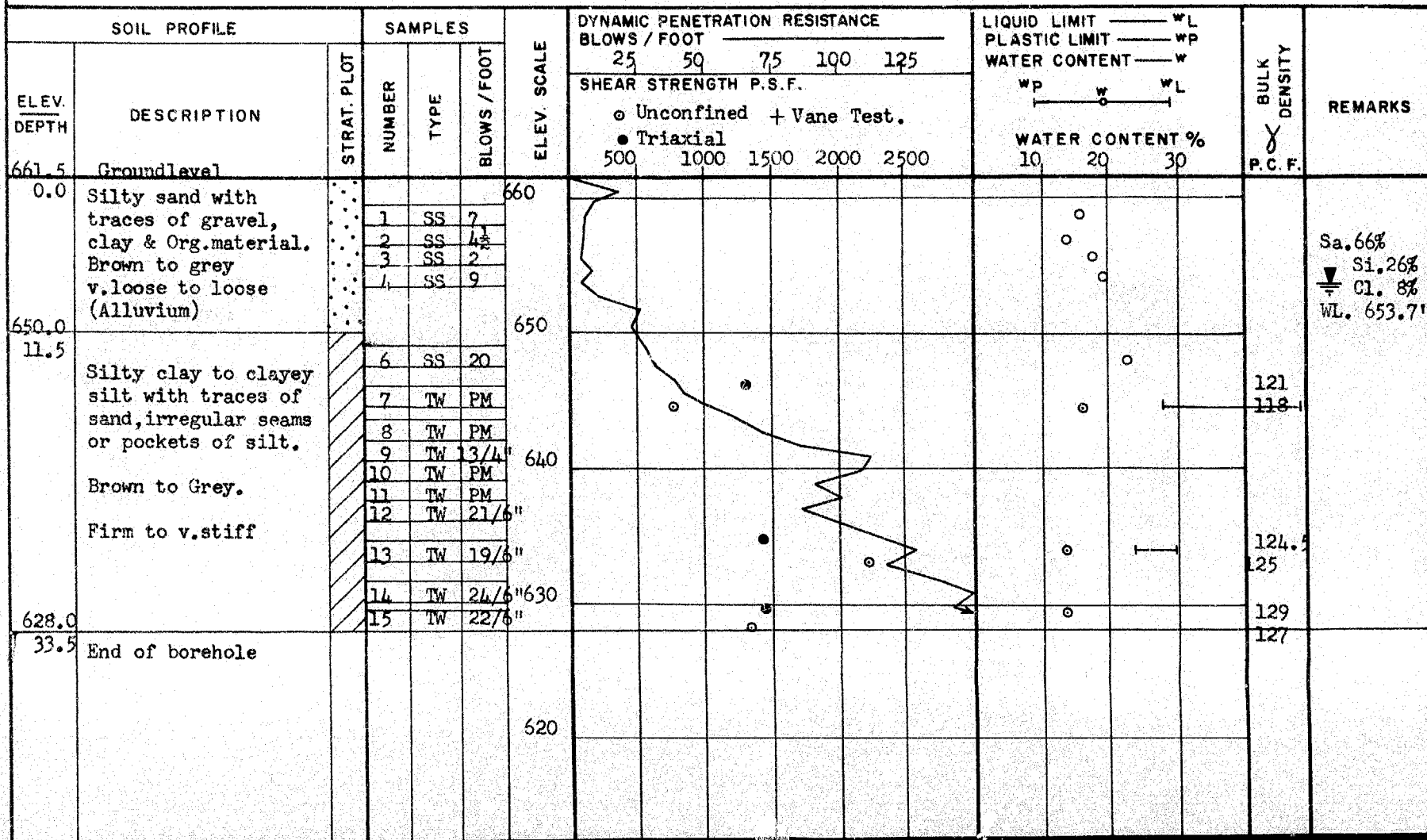
DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-67 LOCATION Sta. 122+25 233' Rt. ORIGINATED BY P.P
W.P. 299-65 BORING DATE July. 25, 1966 COMPILED BY P.P
DATUM Geodetic BOREHOLE TYPE Washbore - NX Casing CHECKED BY HR

RECORD OF BOREHOLE NO. 11.

FOUNDATION SECTION



FOUNDATION SECTION

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit — WL	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP		
							25 50 75 100 125 Unconfined Triaxial	WATER CONTENT % WP — W — WL		
658.9	Groundlevel									
0.0	Sandy silt to silty sand with traces of gravel, clay and org. material. Brown to grey v.loose to compact (Alluvium)	[Pattern]	1	SS	1					WL. 6543
			2	SS	4					
			3	SS	1					
			4	SS	14					
			5	SS	22					
646.9			6	SS	29					
			7	ss	19					
12.0	Silty clay to clayey silt with traces of gravel and sand. Irregular seams or pockets of silt. Brown to grey Stiff to v.stiff	[Pattern]	8	SS	18					
			9	TW	PM					123
			10	TW	PM					121.5
			11	TW	PM					125
			12	TW	PM					124
			13	TW	14/6"					130
			14	TW	10/6"					131
623.0										
35.9	End of borehole.						Refusal			

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66- F - 67

LOCATION Sta. 120+57 & 124' Lt. of E

ORIGINATED BY P.P

W. P. 299- 65

BORING DATE July 26.

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE Washbore & NX casing.

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 14

FOUNDATION SECTION

JOB 66 - F - 57 LOCATION Sta. 120+28 & 59' Rt. of E ORIGINATED BY P.P.
W.P. 299-65 BORING DATE Aug. 26 & 27 COMPILED BY A.M.S.
DATUM Geodetic BOREHOLE TYPE Washbore, NX casing & AXT R.C. CHECKED BY SL

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY Y P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %					
							○ Unconfined ● Triaxial					WP — W — WL					
							25	50	75	100	125	500	1000	1500			2000
661.6	Groundlevel																
0	Sand with traces of silt, clay & Org. material. v.loose. (Alluvium)		1	SS	4	660											WL-560.0
652.7			2	SS	4 1/2												
8.9	Silty clay to clayey silt with traces of sand. Irregular seams or pockets of silt Brown to Grey Stiff to v.stiff.		3	SS	2 1/2												
			4	SS	1 1/2	650											
			5	TW	PM											120	
			6	TW	PM											120	
			7	TW	PM	640										124	
			8	tW	PM											124	Sa. 1% Si. 3% Cl. 6%
			9	TW	PM	630											
			10	TW	PM												
621.4			11	ss	20/2"	620											
40.2	Bedrock		12	RC	100%												
	Limestone																
611.4	Grey		13	RC	100%												
50.2	End of borehole.					610											

(Bounces)

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-67

LOCATION Sta. 122+59 & 157 LT. of G

ORIGINATED BY P.P

W. P. 299-65

BORING DATE July 27 & 28

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE Washbore & NX casing.

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	Liquid Limit — WL Plastic Limit — WP Water Content — W	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			
							○ Unconfined ● Triaxial	wp w wl 10 20 30 WATER CONTENT %		
661.6	Groundlevel.									
0	Gravel, sand & silt with traces of clay and org. material. Brown to Grey. V.loose to compact (Alluvium)		1	SS	8	660				
			2	SS	10					
			3	SS	3 $\frac{1}{2}$					
			4	SS	4					
			5	SS	2 $\frac{1}{2}$					
			6	SS	10	650				
			7	SS	11					
647.8			8	SS	14					
13.8			9	TW	32					
	Silty clay to clayey silt with traces of sand. Irregular seams or pockets of silt.		10	TW	35	640				
	Stiff to v.stiff		11	TW	PM12"					
	Brown to grey.		12	TW	32	630				
			13	TW	28					
619.1			14	TW	42	620				
42.5	End of borehole. (Probable Bedrock)						(Bounces)			

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 66-F-67

LOCATION Sta. 120+20 & 6' Lt of E

ORIGINATED BY P.P

W. P. 299-65

BORING DATE July 28 & 29

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE Washbore & NX casing.

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-67

LOCATION Sta. 124+60 & 146' Lt. of E

ORIGINATED BY P.P

W. P. 299-65

BORING DATE July 28 & 29

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE Washbore & NX casing.

CHECKED BY XKZ

RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE	Liquid Limit ——— WL Plastic Limit ——— WP	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	WATER CONTENT ——— W		
							25 50 75 100 125			
							SHEAR STRENGTH P.S.F.			
							○ Unconfined ● Triaxial	WATER CONTENT % 10 20 30		
664.3	Groundlevel.						500 1000 1500 2000 2500			
0	Sandy silt with traces of clay and org. material. Brown to Grey		1	SS	15	660				Sa:25% Si:64% Cl:11%
			2	SS	15					
			3	SS	7					
			4	SS	39					
			5	SS	46					
			6	SS	43					
651.3	Loose to dense (Alluvium)					650				
13.0	Silty clay to clayey silt with traces of sand.		7	SS	24	640				Sa:1%.WL65% Si:87% Cl:12%
			8	TW	26					
			9	TW	30					
			10	SS	20					
			11	SS	26					
	Irregular seams or pockets of silt.					630				
	Brown to grey									
	Stiff to v.stiff.									
627.8										
36.5	End of borehole.					620				

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 18

FOUNDATION SECTION

JOB 66-F-67 LOCATION Sta. 128+80 & 65' Rt. of CL ORIGINATED BY P.B.
 W. P. 299-65 BORING DATE August 4 & 5 COMPILED BY A.M.S.
 DATUM Geodetic BOREHOLE TYPE Washbore, NX & BX Casing CHECKED BY K.G.S.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

66-F-67

LOCATION Sta. 120+32 & 55' Lt of E

ORIGINATED BY _____ P.P.

JOB _____
299-65

BORING DATE Aug. 2 & 3. 1966

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE Washbore & NX Casing.

CHECKED BY *[Signature]*

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-67

LOCATION Sta. 127+10 & 8' Lt. of CL

ORIGINATED BY P.P.

W.P. 299-65

BORING DATE August 2 & 3

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE Washbore & BX Casing

CHECKED BY K.G.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.		WATER CONTENT % 10 20 30			
744.2	Ground Level										
0	Clayey Silt With Traces Of Sand Brown		1	SS	27	740					Sa.6 Si.76Cl.18
			2	SS	18						
734.6	Compact		3	SS	61						
9.6	Silty Sand		4	SS	99	730					
	With Traces Of		5	SS	63						
	Gravel & Clay		6	SS	113	10"					Sa.76 Si.Cl.24
	Brown		7	SS	51						
	Very Dense		8	SS	59	720					
			9	SS	98						
			10	SS	87						Gr.2Sa.79 Si.Cl.19
			11	SS	102	11"					
			12	SS	120						Sa. 81 Si. Cl. 19
693.6			13	SS	63						W.L.
41.0	Sandy Silt		14	SS	75	700					Sa.26 Si.67Cl.7
	With Traces of		15	SS	87						
	Clay and layers		16	SS	55						
	Of Clayey Silt		17	SS	116	10"					
	Brown To Grey										
	Very Dense										
679.2						680					
65.0	End Of Borehole					670					

FOUNDATION SECTION

ORIGINATED BY P.P.

COMPILED BY P.P.

CHECKED BY K.G.S.

FOUNDATION SECTION

ORIGINATED BY D.P.

COMPILED BY A.M.S.

CHECKED BY AK

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w			BULK DENSITY P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.			WATER CONTENT %				
							w _p	w	w _L	w _p	w			w _L
763.2	Ground Level													
0	Sand					760								
758.2	Brown Loose		1	SS	6									
5.0	Sandy Silt		2	SS	58								Gr. 1Sa.8	
	With Layers		3	SS	52								Si. 61Cl.30	
	& Pockets Of		4	SS	25	750							W.L.	
	Clay & Silty Clay		5	SS	35								Sa. 46	
	Brown & Gray		6	SS	39								Si. 59Cl.4	
	Compact To V. Dense		7	SS	21	740							Sa. 2	
			8	SS	13								Si. 88Cl.10	
			9	SS	15								Sa. 3	
			10	SS	10	730							Si. 78Cl.19	
			11	SS	12									
			12	SS	18									
722.2			13	SS	19								Sa. 6	
41.0	Silty Sand		14	SS	57	720							Si. 75Cl.19	
	Brown		15	SS	90									
	Very Dense		16	SS	103									
			17	SS	82	710								
			18	SS	84	700								
696.7			19	SS	24									
66.5	End Of Borehole					690								

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 24

FOUNDATION SECTION

JOB 66 - F - 67

LOCATION Sta. 123+82 & 80' Lt. of E

ORIGINATED BY P.P

W.P. 299 -65

BORING DATE Aug. 10

COMPILED BY A.M.S.

DATUM Geodetic

BOREHOLE TYPE Washbore & BX Casing.

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	25	50	75	100	125	WP	W		
662.0	Groundlevel															
0	Gravel, sand and silt with traces of clay and org. material. Brown to grey (Alluvium)		1	SS	3	660										
652.0			2	SS	2											
10.0			3	SS	32											
			4	SS	17	650										
			5	SS	13											
			6	SS	13											
	Clayey silt to Silty clay					640										
	Firm to stiff					630										
622.0																
40.0	End of borehole.					620										

WATER CONTENT %
10 20 30

Sa: 1%
Si: 43%
Cl: 56%

WL-655.6'

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 66-F-67

LOCATION Sta. 114 + 85 on Ø

ORIGINATED BY P.P.

W.P. 299-65

BORING DATE August 10

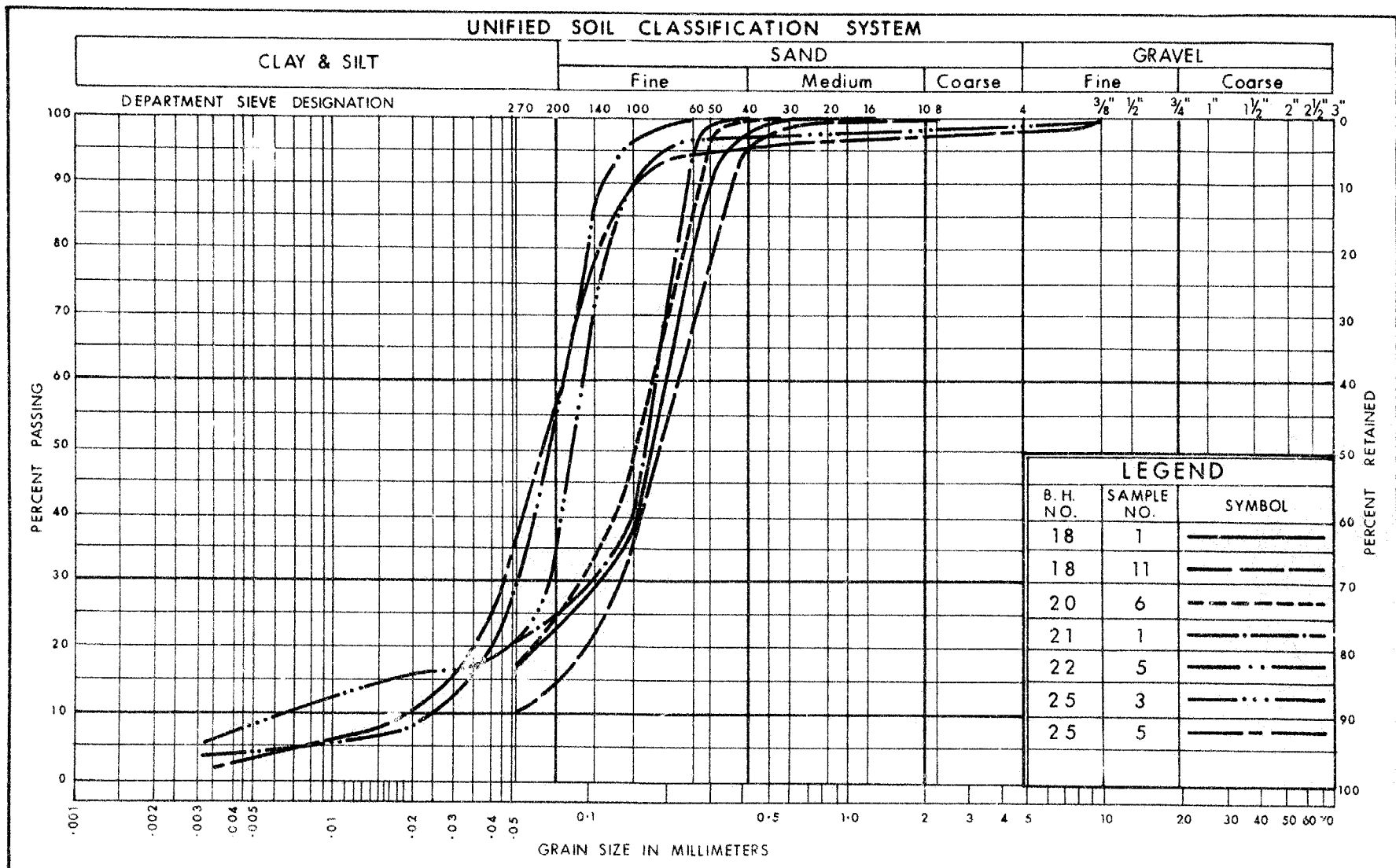
COMPILED BY A.M.S.

DATUM Geodetic

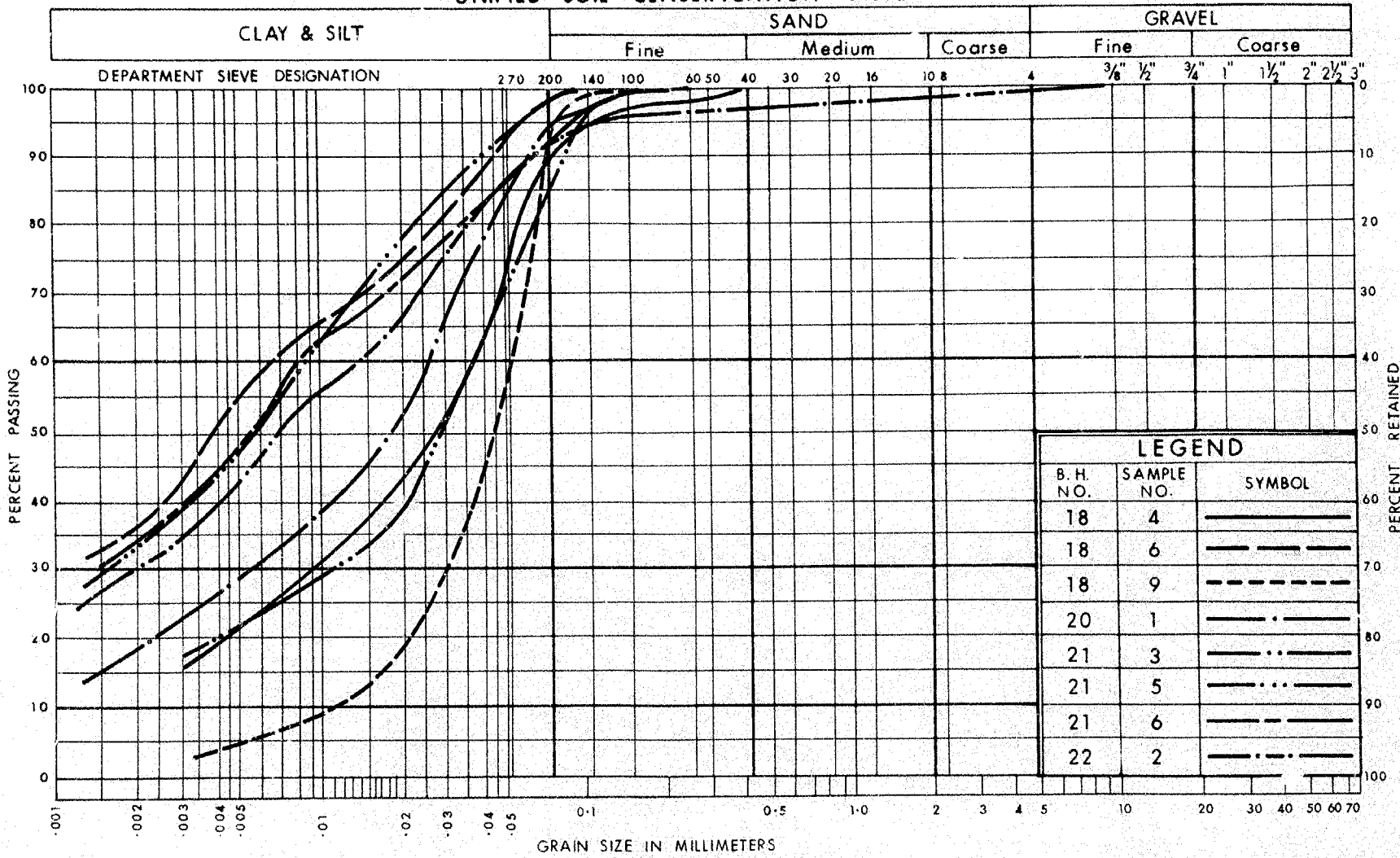
BOREHOLE TYPE Washbore & NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT % WP W WL			
784.4	Ground Level											
0	Clayey Silt											
779.5	With Some Sand		1	SS	14	780						
	Firm											
4.9	Silty Sand		2	SS	6							
	To Sandy Silt		3	SS	36	770						
	With Traces Of		4	SS	86							
	Gravel & Clay		5	SS	84/9"							
	Loose To Very Dense		6	SS	80/8"	760						
	Brown		7	SS	99/9"							
747.9			8	SS	91/8 1/2"	750						
36.5	End Of Borehole					740						



UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FIG. 2



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

W.P. No. 299 - 65
JOB No. 66 - F - 67
OTTER CREEK

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

Fine

Medium

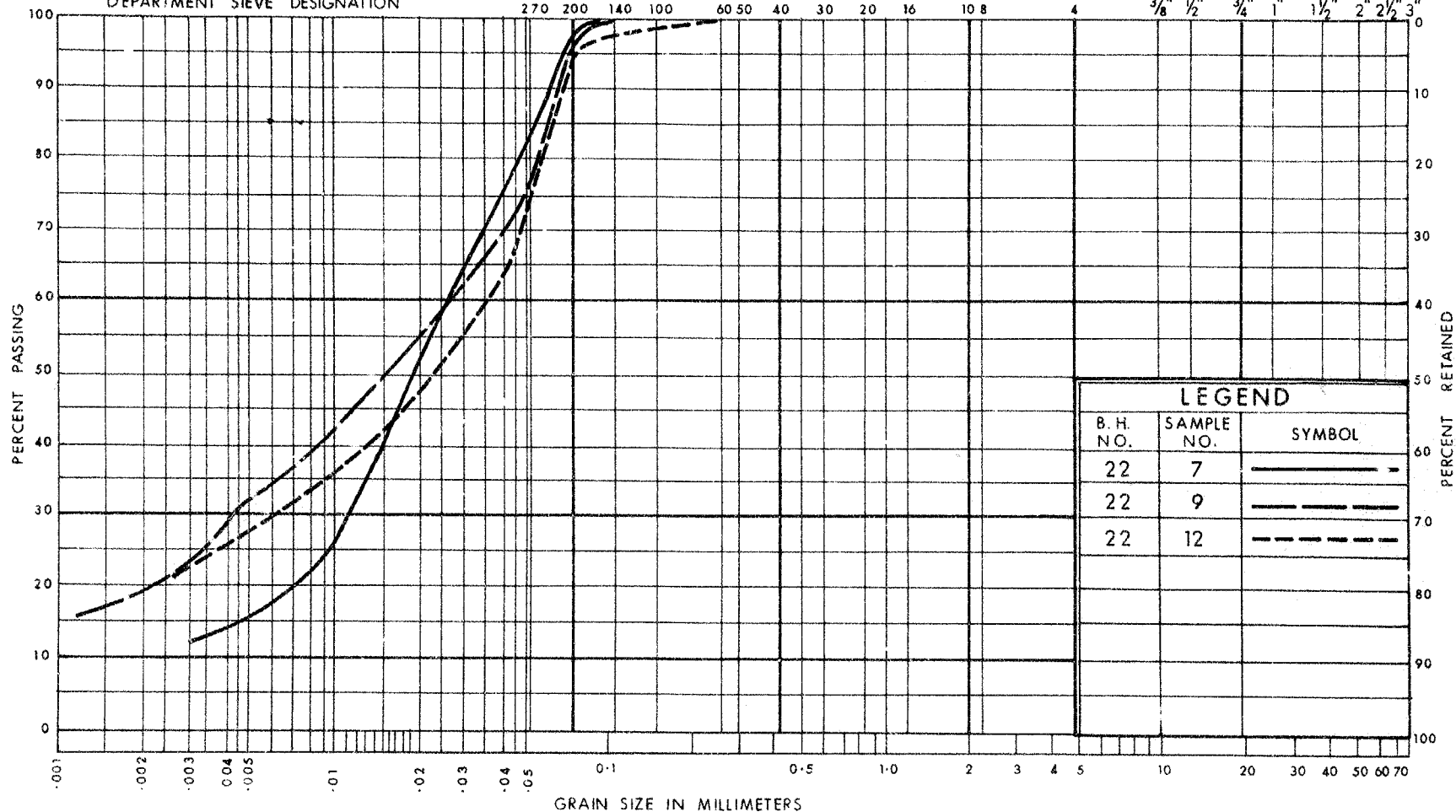
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270 200 140 100 60 50 40 30 20 16 10 8 4 3/8 1/2 3/4 1 1 1/2 2 2 1/2 3"



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MATERIALS and
TESTING
DIVISION

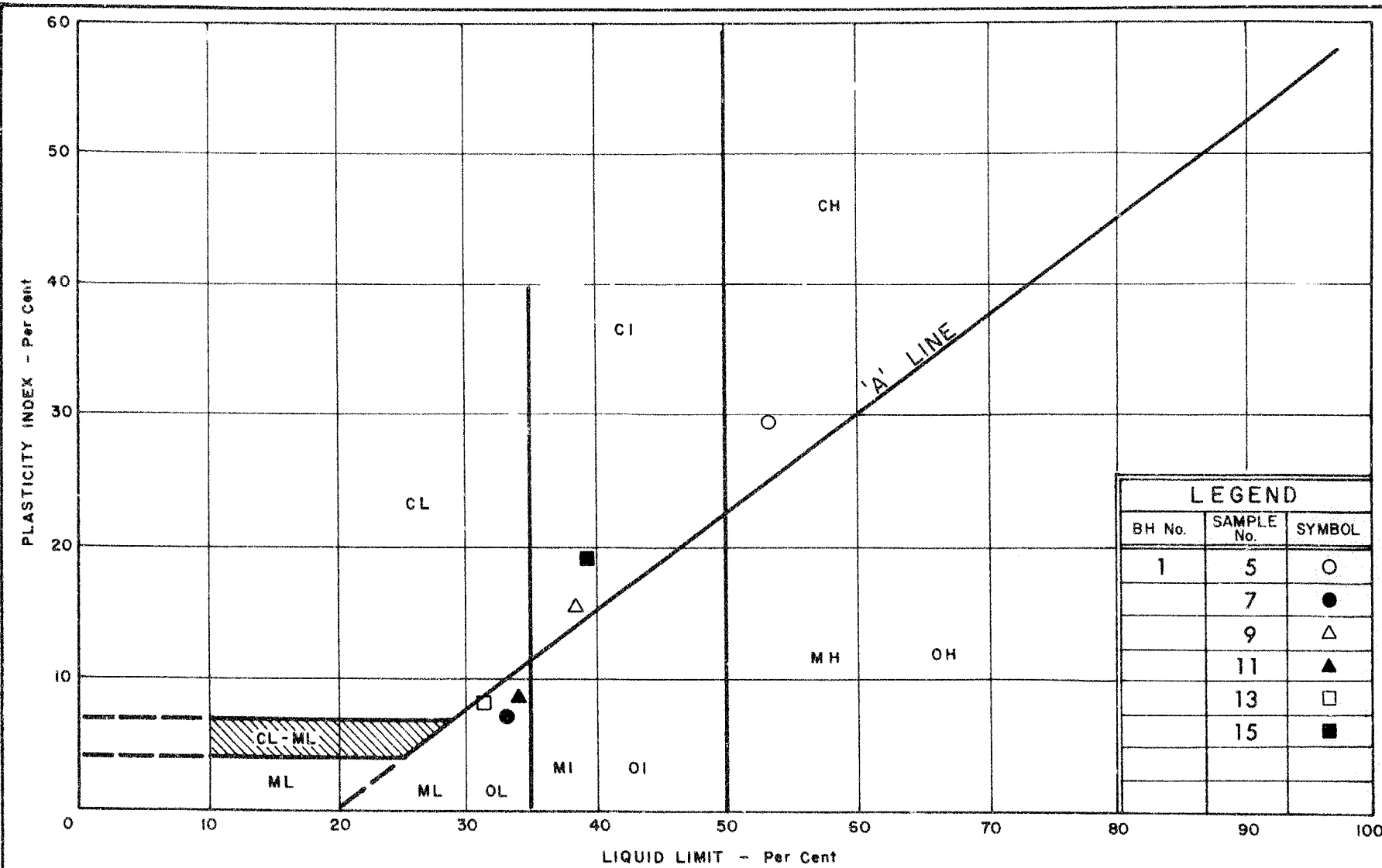
GRAIN SIZE DISTRIBUTION

FIG. 3

W.P. No. 299 - 65

JOB No. 66 - F - 67

OTTER CREEK



LEGEND		
BH No.	SAMPLE No.	SYMBOL
1	5	○
	7	●
	9	△
	11	▲
	13	□
	15	■

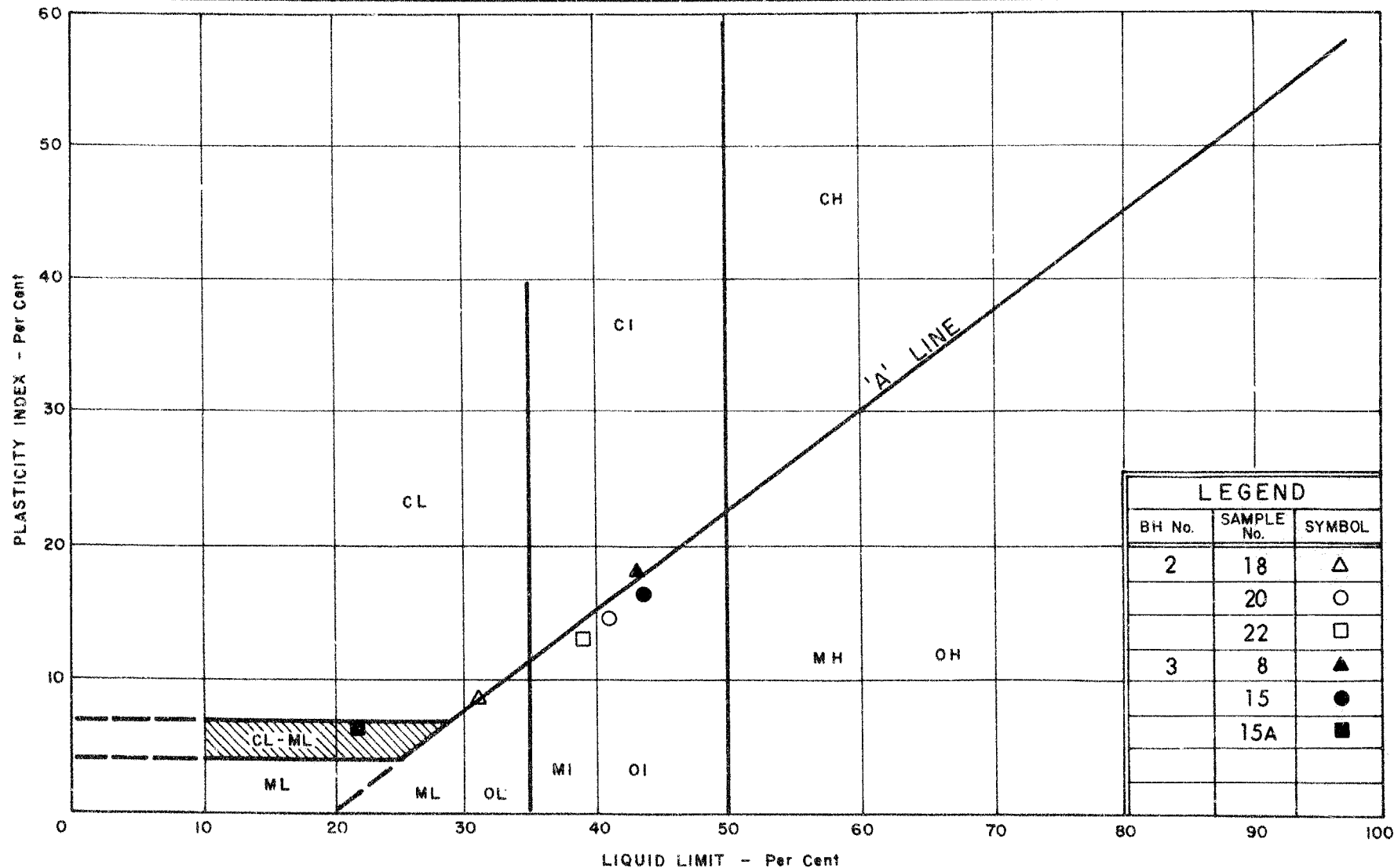


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PLASTICITY CHART

FIG. 4a

WP. No. 299 - 65
JOB No. 66 - F - 67
OTTER CREEK



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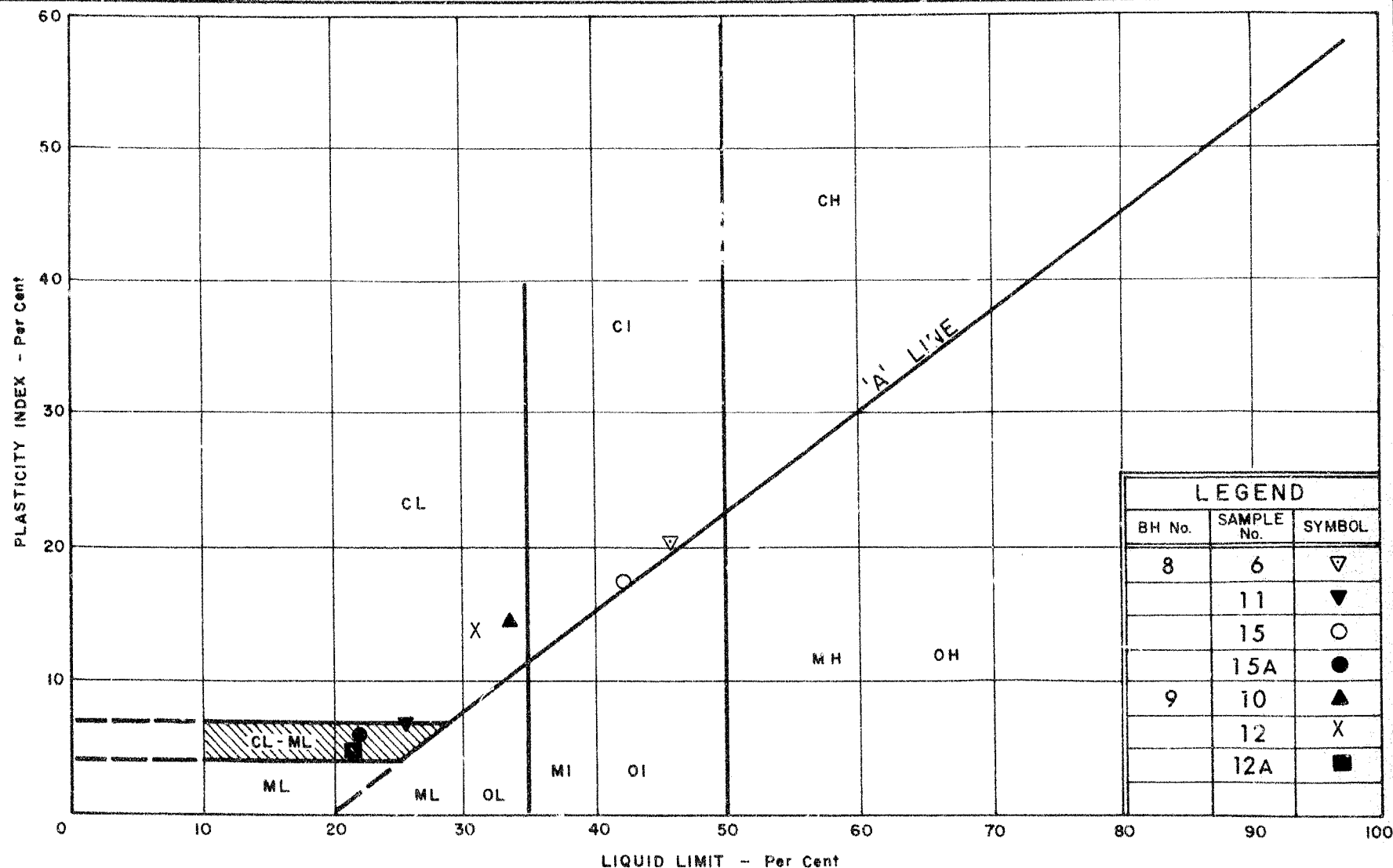
PLASTICITY CHART

FIG. 4b

W.P. No. 299 - 65

JOB No. 66 - F - 67

OTTER CREEK



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DIVISION

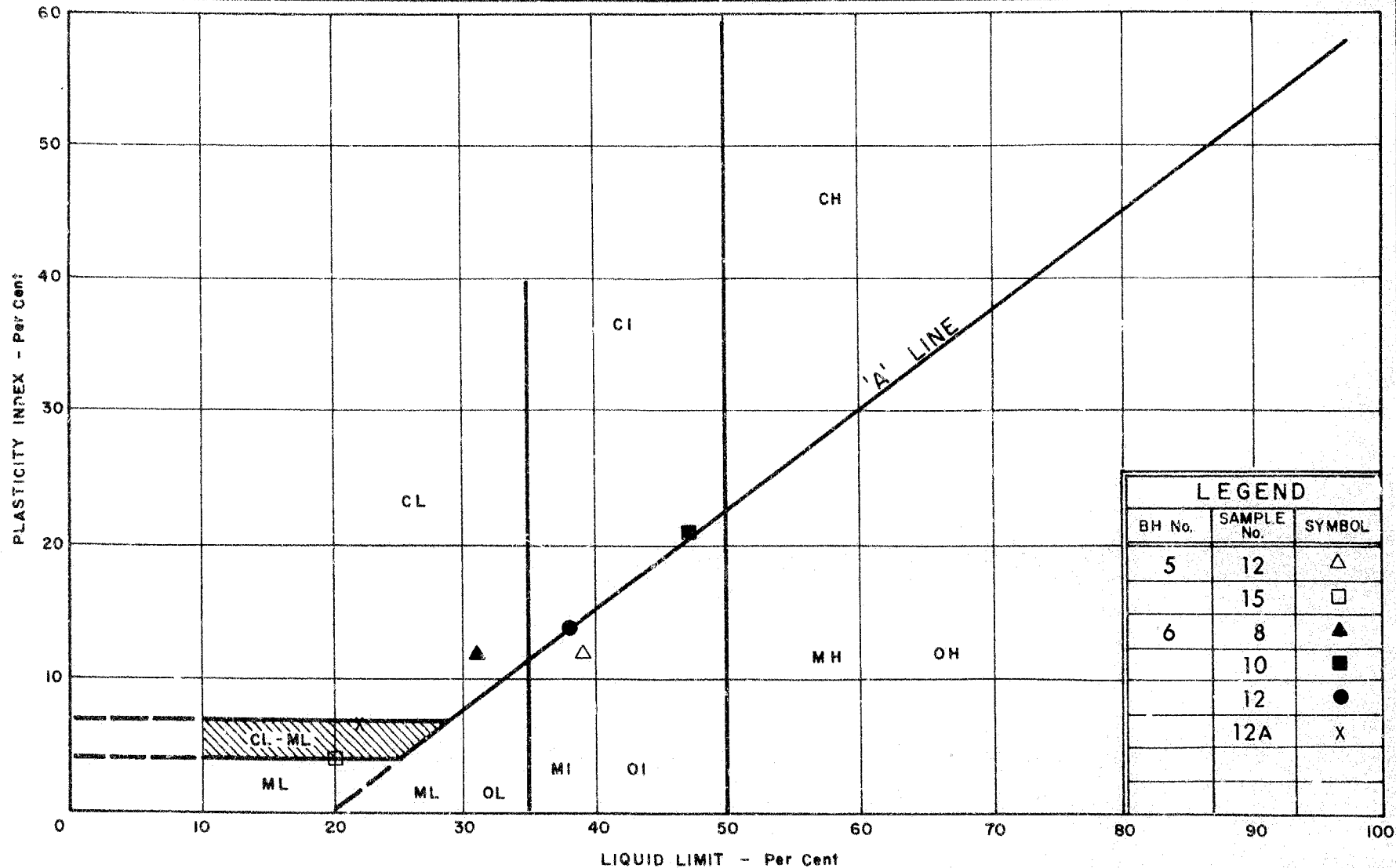
PLASTICITY CHART

FIG. 4d

W.P. No. 299 - 65

JOB No. 66 - F - 67

OTTER CREEK



DEPARTMENT OF HIGHWAYS
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TESTING
DIVISION

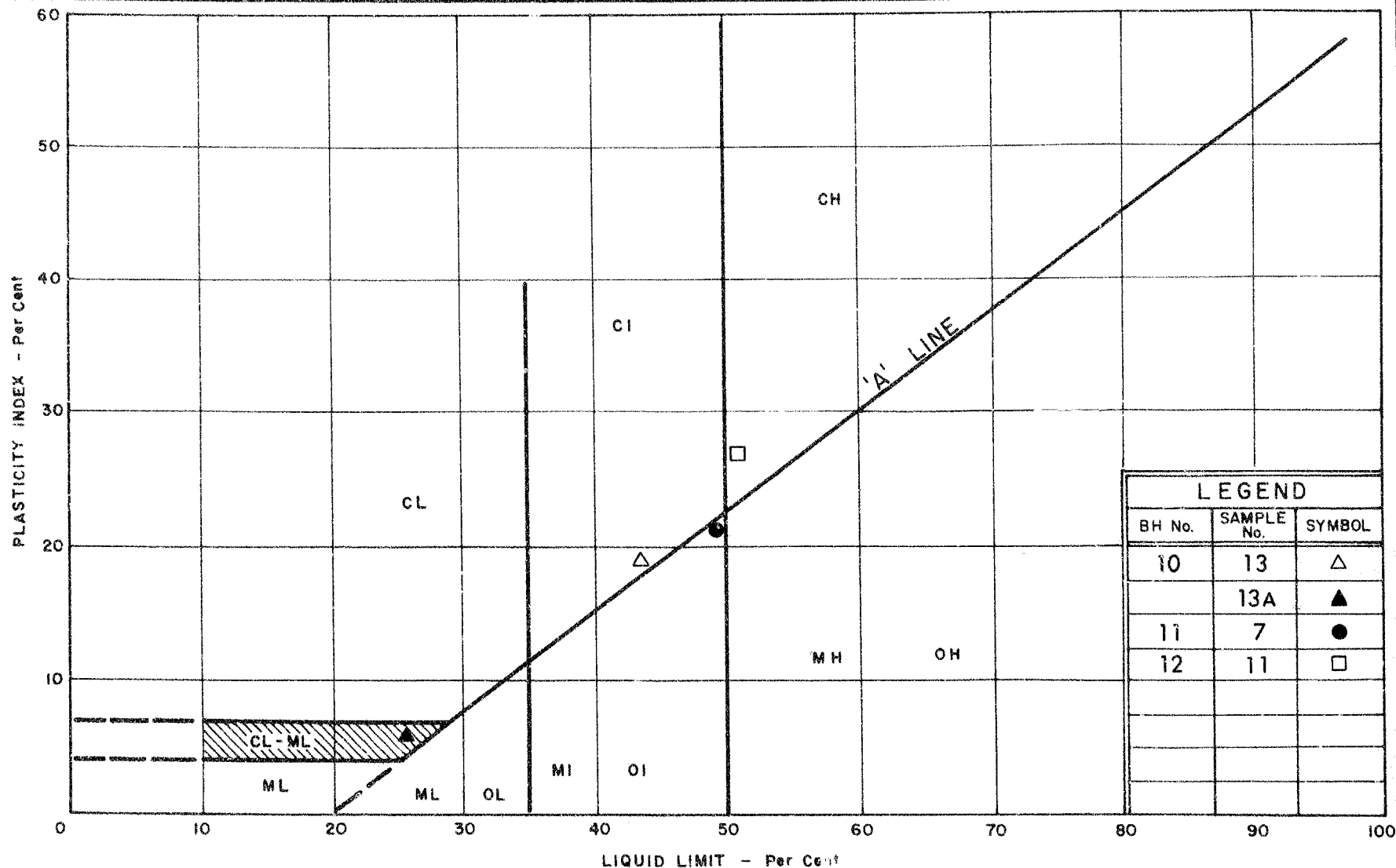
PLASTICITY CHART

FIG. 4c

W.P. No. 299 - 65

JOB No. 66 - F - 67

OTTER CREEK



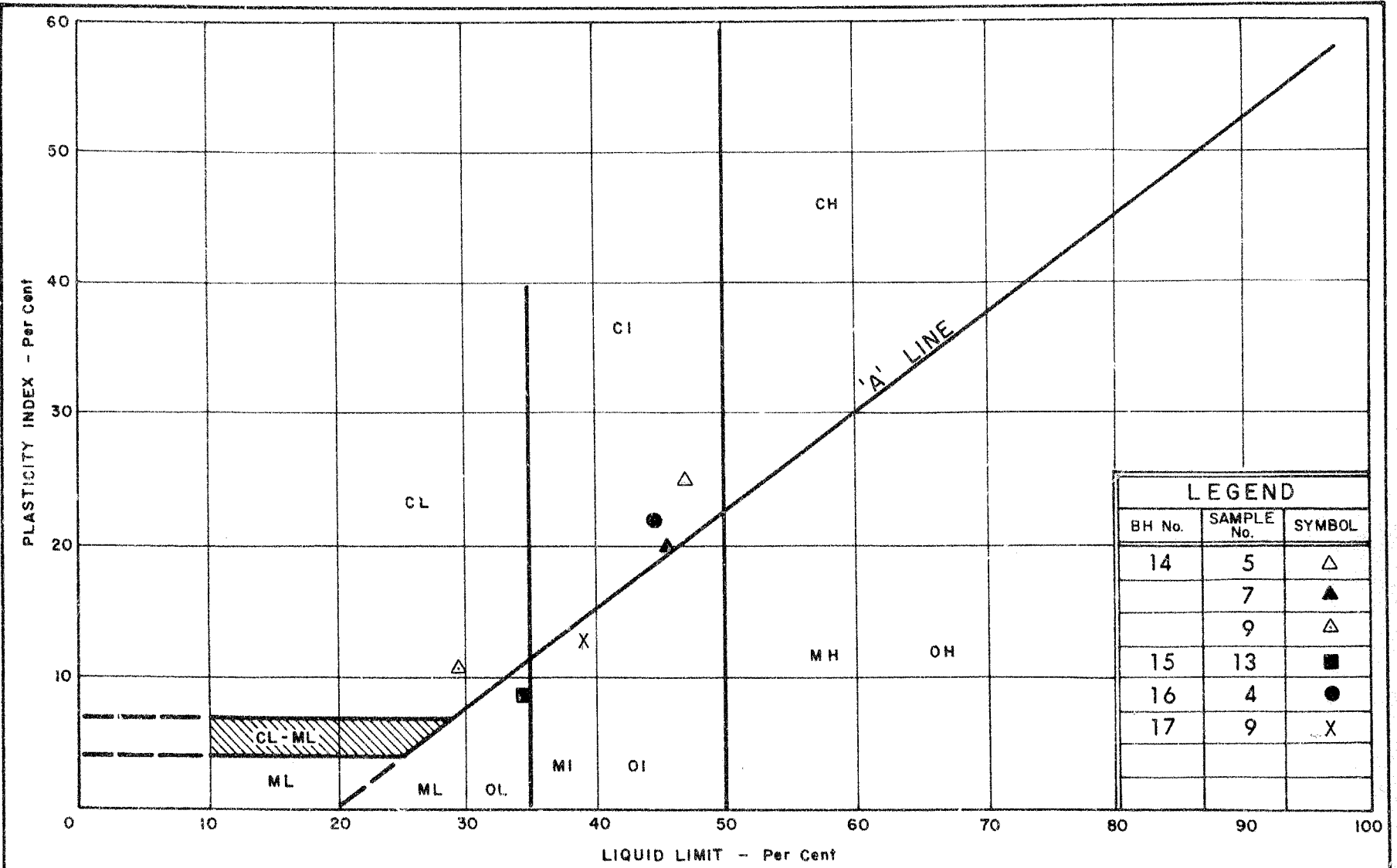
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

FIG. 4e

W.P. No. 299 - 65

JOB No. 66 - F - 67



LEGEND		
BH No.	SAMPLE No.	SYMBOL
14	5	△
	7	▲
	9	△
15	13	■
16	4	●
17	9	X

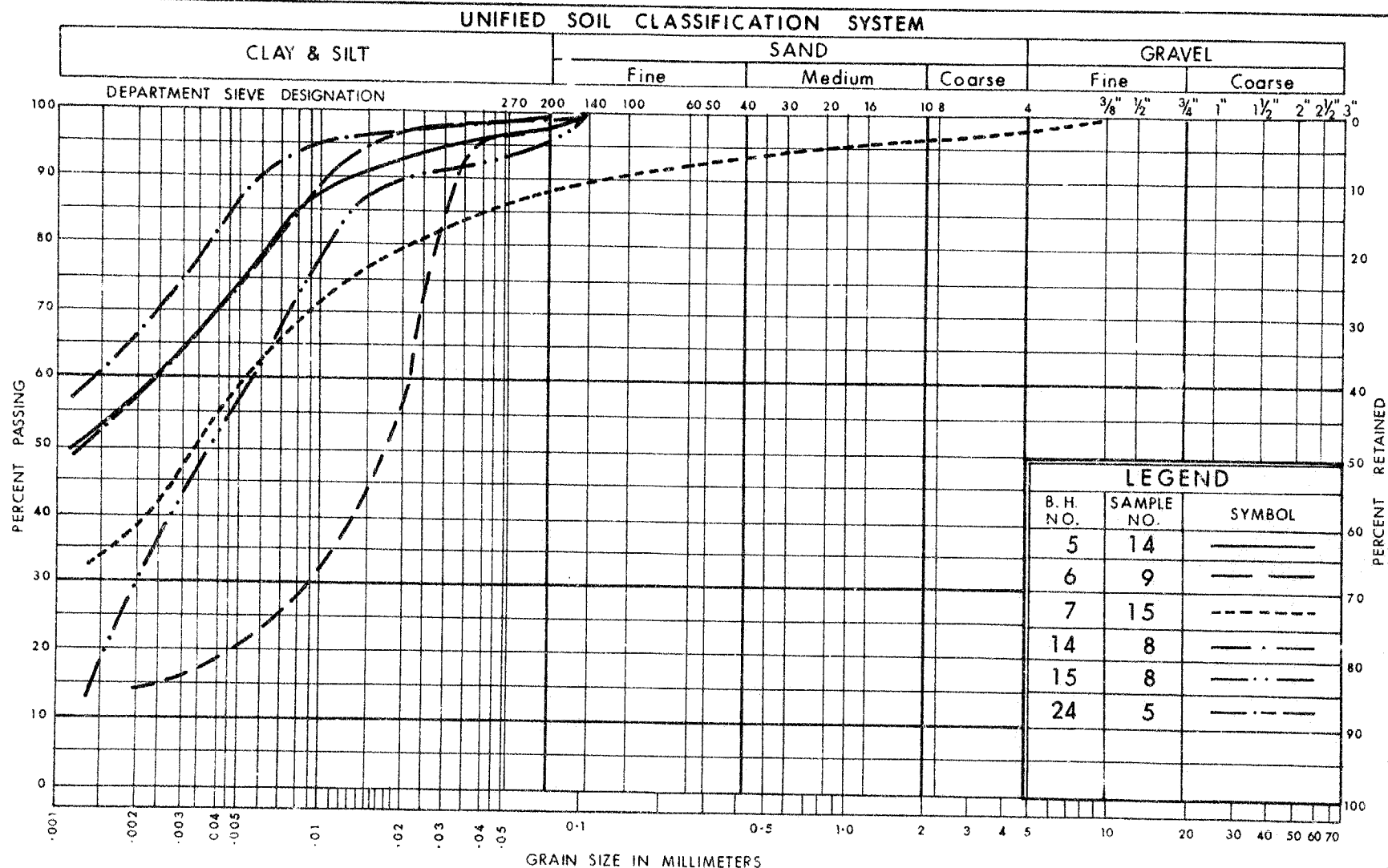


DEPARTMENT OF HIGHWAYS
MATERIALS and
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DIVISION

PLASTICITY CHART

FIG.4 f

W.P. No.	299 - 65
JOB No.	66 - F - 67



ONTARIO

DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

**GRAIN SIZE DISTRIBUTION
CLAYEY SILT TO SILTY CLAY**

FIG. 5

W.P. No. 299-65

JOB No. 66-F-67

OTTER CREEK

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPE

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division,
Admin. Bldg.

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

Attention: Mr. S. McCombie

DATE: August 16, 1968

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Tillsonburg By-Pass at
Otter Creek Crossing, Hwy. #3
Twp. of Middleton, Co. of Norfolk
District No. 2 (London)
W.J. 66-F-67 -- W.P. 299-65

(Revised Edition)

The above report was distributed on November 10, 1966. Recently, we found it necessary to revise the Borelog sheets and Drawing 66-F-67A. For this reason, it was decided to reissue the entire report.

In accordance, therefore, would you kindly destroy the original copy(s) of this report, replacing same with the revised edition, attached hereto.

Thank you.

AGS/MdeF
Attach.

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
W. Zonnenberg
H. C. Dernier
A. P. Watt
J. Roy
B. A. Singh
Foundations Files
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

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

Attn: Mr. J. Keen,
Regional Bridge Project
Engr.

DATE: November 18, 1968

OUR FILE REF.

IN REPLY TO

SUBJECT:

Otter Creek Crossing - Hwy. #3
Twp. of Middleton, Co. of Norfolk
District No. 2 (London)
W.J. 66-F-67 -- W.P. 299-645

Following your recent queries as to the feasibility of constructing 1-3/4:1 forward slopes and the advantage of constructing an embankment several years in advance of its actual requirement, we have reviewed our Foundation Report W.J. 66-F-67.

With regard to the 1-3/4:1 forward slopes, we find that the maximum height of fill is 62 ft. measured from the bed of the river to profile grade. Our report states that fill heights up to 52 feet may be constructed with 2:1 slopes in which case no stability problems should occur. In the case of the 62-ft. high fill, we find that the shear strength properties of the fill material affect the stability to a very great extent, and we must therefore make certain stipulations regarding these in order to ensure a stable section. These are:

(1) For a minimum length of 150 ft. on each side of the bridge, the embankment must be constructed of a granular type material compacted sufficiently well to achieve an angle of internal friction of 35°. Construction, according to existing D.H.O. Standards, would be satisfactory, but emphasis should be placed on supervision of the contractor's operations.

(2) Sufficient slope protection and internal drainage must be provided to ensure that no buildup of water pressure occurs within the embankment.

(3) Rip-rap up to H.W.L. must be provided to protect the embankment against erosion by scour. Since the stability of the embankment is greatly dependent on the conditions prevailing at the toes and in the river bed, we further recommend that the entire river bed under the structure be rip-rapped to prevent any possible deepening by scour.

cont'd. /2 ...

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Attn: Mr. J. Keen,
Regional Bridge Proj. Engr.

2.
November 18, 1968

If all of the foregoing recommendations are followed, we recommend that 1-3/4:1 forward slopes be constructed.

With regard to your query whether the approaches for the additional 2 lanes, which will not be required for some years hence, should be built now, we believe that no particular advantage will be gained by this. There should be little or no effect on the structure or on the pavement in the future when the embankment is widened and, unless there are other advantages to be gained (not connected with foundations), we would recommend that the 2-lane embankment only, be built at the present time.

K. G. Selby

KGS/MdsF

K. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
W. Zonnenberg
H. C. Dernier
A. P. Watt
J. Roy
B. A. Singh

Foundations Files ✓
Gen. Files

NOTE:

OCT. 20th 1965

W.P. 299-65; HWY #3 TILLSONBURG BY-PASS

DISCUSSED PROBLEM WITH MURRAY BATTON AND ARRIVED AT FOLLOWING CONCLUSIONS:

(1) THE PRESENTLY PROPOSED CUT & FILL SCHEME HAS TWO MAJOR PROBLEMS:

(a) THE CUT IS IN A MATERIAL THAT IS IN PLACES VERY WET & WILL THEREFORE PRESENT SERIOUS CONSTRUCTION PROBLEMS.

(b) THERE IS ABOUT 425,000 CU.YDS OF WASTE MATERIAL AND NO ADEQUATE DISPOSAL AREA.

(2) PROBLEM(S) UNDER 1(a) CAN SOMEHOW BE OVERCOME ALTHOUGH IT IS FELT THAT D.H.D COULD RUN INTO HIGH EXPENDITURE.

(3) TO RESOLVE PROBLEM UNDER 1(b) A SUITABLE DISPOSAL AREA HAS TO BE FOUND.

ON THE LAND WEST OF OTTER CR. & DOWNSTREAM OF CROSSING, A POSSIBLE 60,000 CU.YDS CAN BE PLACED

IF (a) THE FILL IS 10 FT HIGH, AND

(b) SLOPES AT CREEK ARE 2:1

WHETHER

(4) IT IS QUESTIONABLE IF FILL AS DESCRIBED UNDER 3(a) & (b) CAN BE BUILT.

(5) IN VIEW OF ABOVE SAID EVERY EFFORT SHOULD BE MADE TO CHANGE THE DESIGN. THE NEW

DESIGN SHOULD CALL FOR NO CUTS AND
CROSSING OF THE ENTIRE VALLEY WITH
A TREESTLE-TYPE STRUCTURE.

afternoon

DEPARTMENT OF HIGHWAYS, ONTARIO
MEMORANDUM

To: Mr. J. Roy,
Reg. Materials & Testing Eng.
LONDON REGION.

From: Mr. H. R. McIntyre,
Sr. Project Design Eng.
LONDON REGION.

ATTENTION:

DATE: October 20th, 1969.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Re: W.P. 299-65 Hwy. #3 Tillsonburg
Bypass

This project has 425,000 cu.yds. of material which is unacceptable for earth fill. The material is located in the cut sections west of Big Otter Creek.

A meeting was held with the Conservation Authorities to determine whether there was any location to place the material in the area where a benefit could be gained by the Authority. No indication was given for a suitable location. It was also pointed out that the Conservation Authority has no control over the basin.

The Department is proposing to purchase all the lands owned by L.W. Sanders which is west of the Big Otter Creek including the land required for stream diversion.

The Conservation Authorities indicated that material may be placed downstream of the structure. Also, if stream diversion were included for the land in the river north of the structure, earth fill could be placed upstream and west of the stream diversion.

The two main cases for concern when considering placing fill in this basin are:

- (1) possible slippage adjacent to the Otter Creek because of the fill.
- (2) affect on storage area at flood times in the Big Otter Creek basin.

The cost to the Department to haul this material from the site probably by truck against scraper operation could amount to \$100,000. In discussions with the District and Construction Engineer, London, it was agreed that the first step to determine whether material should be placed in this area and also the quantity which could be used, would be to have a Soils Investigation. This report should allow Road Design to detail the limits of fill and then be able to submit to the Conservation Authority a plan so they can report as to whether there will be a serious effect on flooding in the area.

Cont.....2

I would like to discuss the possibility of having a Soils Investigation carried out for this project.



H.R.B. McIntyre,
Sr. Project Design Engineer,

HRBM/sl.

c.c. L.E. Walker - Dist. Eng. London.

280

Mr. W. Zonnenberg,
Regional Design Engineer,
London.

Materials and Testing,
London.

Mr. H. R. B. McIntyre.

October 21, 1969.

- W.P. 299-65, Highway #3,
Tillsonburg By-Pass,
Disposal of Waste Material,
London District.

66-F-67

We have considered the matter of placing waste material from the large cut at the west approach to the Big Otter Creek in the flood plain, south of the proposed by-pass and west of the Creek diversion. Murray Batten has also discussed the matter with the Principal Foundation Engineer.

We believe that it would be undesirable to place more than 10 feet of material in the disposal area indicated. It would also be advisable to keep the fill back from the creek bank, say 25 feet, and to estimate a 4 to 1 slope. There could still be, even under these conditions, a good possibility of sloughing failures of this material in the direction of the creek.

May I redirect your attention to our memo to R. G. Gascoyne, October 12, 1966, page 3 and to the Soils Design Report, pages 8 and 9, where the expected difficulties in the cut construction are discussed. Note that on page 9, a method of partially predraining the material is mentioned which "would probably" dry the materials to allow handling. That should probably be "may" dry the materials enough for handling.

If you have seen a piece of equipment bogged down in wet silty materials, or a cut flowing in as fast as it is excavated; this is the type of problem we would face here. On many occasions we leave subdrainage and slope treatment in cuts out of design and recommend treatment during construction when the cut is excavated. In this case we have given the cut the full treatment and still expect modifications and additions during construction.

12.

From the investigation carried out in this proposed cut and our combined experiences in cuts in similar materials and under similar moisture conditions - we expect this one to be a tough one.



J. R. ROY,
REGIONAL MATERIALS ENGINEER.

JRR:hp.

C.C. - L. E. Walker,
C. A. Wrong,
A. G. Stermac, ✓
A. M. Hatten,
File.

*File
WSP*

Mr. W. Sonnenberg,
Regional Design Engineer,
London.

Materials and Testing,
London.

October 31, 1969.

- W.P. 299-65, Highway #3,
Tillsonburg By-pass, Cut
Construction, Station 129 to
Station 139, District #2.

66F67

In view of construction difficulties encountered with wet cut materials of a similar nature to that encountered with the section between Station 127 and Station 139, during the past couple of years, it is recommended that an addition construction contingency be estimated for this proposed cut construction.

While there should be no stability problems with 2:1 slopes after the cut excavation drains the subsoils in this cut, considerable sloughing may be expected during the excavation. For this reason, cut slopes should be estimated at 3:1 in this cut. The final cut slopes may be slightly flatter or steeper than 3:1 depending on conditions that develop after the excavation is completed and after the cut slopes have dried sufficient to allow grading and slope protection treatment.

In addition, it may be expected that there will be serious construction delays with excavation of this cut, and that there will probably be considerable maintenance problems associated with the cut slopes for sometime after construction is completed.

A. M. Batten
A. M. BATTEN,

AMB:hp.

FOR:

J. R. ROY,
REGIONAL MATERIALS ENGINEER.

C.C. - A. Sternac,
G. A. Wrong,
L. E. Walker,
A. M. Batten,
File.

Mr. A. Stermac

66-5-67 ✓
66-5-14
66-5-97

Materials and Testing Division,
Downsview, Ontario,
January 5, 1967.

Mr. R. Beards,
c/o Room 669,
601 Booth Street,
Ottawa 4, Ontario.

Dear Ron:

Further to our telephone conversation of December 28, 1966, I am pleased to send you a few examples of our foundation reports.

You indicated you would look at these reports and determine the information that you must have from them, along with the rock cores. You will note that each report has an attachment containing a key plan of the area, and also a detailed plan showing the location of the bore holes along with the stratigraphy. The log of the bore holes is contained in the report.

As these reports are from my permanent file, I would ask that they be returned to me with your comments as to what information you would like to have with the cores.

Yours sincerely,

AR

A. Rutka,
Materials & Testing Engineer.

AR:pa
Encls.
c.c. A. Stermac.

Mr. A. Stermac

Mr. J. Roy,
Regional Materials Engineer,
London Region.

Mr. A. Rutka,

November 23, 1966.

Hwy. 3. W.P. 299-65, Tillsonburg Bypass

66F-67

You have a copy of Tony's foundation report for the structure over the Otter Creek Crossing. Before a decision is made regarding the length of the span, and particularly as to whether it should cross the whole valley, I presume you will have a meeting with the Bridge Location Engineer and the Road Design office, to determine the most desirable design, particularly from the economical point of view.

I think that I would favour spanning most of the valley, in view of the very wet cut material, although the foundation report indicates that the slope stability of the cut would be satisfactory. There are many major problems that could arise with the use and disposal of wet materials, and I am sure these will be discussed at the regional level.

AR

A. Rutka,
Materials & Testing Engineer.

AR:pa
c.c. A. Stermac,
G. Wrong.

Mr. R. G. Gascoyne,
Regional Functional Planning
Engineer,
London.

Materials and Testing,
London.

October 12, 1966.

- W. P. 299-65, Highway #3,
Tillsonburg By-Pass.

A preliminary investigation has now been completed on the proposed alignment for the above mentioned project.

The project is located in the physiographic area known as the Norfolk Sand Plain which consists of large deltaic deposits in glacial lakes Whittlesey and Warren. A great discharge of melt water from the Grand River area entered the lakes between the ice front and the moraines to the north-west, building the delta from west to east as the glacier withdrew. The alluvial deposits from this discharge are known to be as deep as 90 feet at some locations in this formation and the preliminary borings revealed them to be quite deep in the area of the project. Also the borings revealed that these deposits vary from acceptable fine sands to frost susceptible silt loam and silty clay loam, the latter materials being predominant in the area where heavy grading is proposed. In the locations where the frost susceptible soils were encountered, high moisture conditions were prevalent and these factors will involve considerable

grading problems with the proposed alignment. It should be noted, however, that investigation carried out on both the south and north sides of the proposed alignment revealed similar conditions to those along centre line for distances of 900 feet on either side of the proposed alignment on the Otter Creek Valley crossing.

From Station 0 to Station 90 the soil types are mapped as Plainfield Sand and Fox Sandy Loam and mainly consist of acceptable fine sands and fine sandy loams. No outstanding difficulties are foreseen with grading in this area and it is likely that 18" granular (6" G. S. C. Class "A" and 12" sand cushion) will provide a suitable pavement base over the local materials.

From Station 90 to Station 185 the soil types are mapped as Fox Sandy Loam and Miami Clay Loam, the predominant type being Miami Clay Loam which is located from Station 110 to Station 185. Several deep borings placed in the 15' to 20' cut from Station 95 to Station 100 and in the 20' to 35' cut sections from Station 126 to 145 revealed that the aforementioned frost susceptible silty loam and silty clay loam materials are predominant in these cut sections and that moisture conditions are very high in almost all of the proposed cut materials. For the most part the silty clay loam materials were near or above their liquid limit and the silt loams and very fine sandy silts were in a saturated condition well above the estimated optimum moisture contents. For these reasons it is felt that it will be impossible to use a large portion of the proposed cuts for fill purposes in the large fill

between Station 120 and Station 125. It is therefore recommended that an estimated 75% of these cut materials be considered as unsuitable for fill construction purposes. In addition the unit price for excavating these cuts should be estimated at 40% above normal prices in view of the extensive difficulties foreseen with carrying out the excavations. Stage construction and trenching methods will likely have to be employed and excavation to proposed slopes will likely be impossible during the initial excavation operation such that extensive handling will be required during the slope trimming operations. A 16" bore hole placed at Station 162 indicates that similar cut conditions would be encountered if the grade line is lowered to the west for a subway at the C. M. R. crossing.

Borrow material will be very difficult to obtain in the immediate project area due to the presence of unacceptable material surrounding the west half of the project and high land values on the east half. Acceptable fine sand borrow can likely be obtained in the area 1 to 2 miles south of the project but prices may be higher than normal due to high land values and to the fact that excavations will likely be limited in depth by the water table.

The foundation material from Station 118 to Station 125 consists of an approximate 40' depth of clay till material over bedrock at approximately elevation 620. The clay till material is such that no major stability problems are expected with the proposed alignment provided that some local organic

deposits are removed prior to placing the fill material.

It is understood that this section of Highway #3 is expected to be four laned in 10 to 20 years. In view of probable damages to an Otter Creek Structure that would be caused by differential settlement if fill widening was placed at a later date, it is recommended that the full width of the four lane fill be placed with the initial construction on this section.

In view of the above difficulties it is recommended that consideration be given to crossing the Otter Creek ravine at a much higher level with a trestle type structure crossing such that no cut or a shallow cut will be involved from Station 126 to Station 146. Based on preliminary information from the foundation investigation a structure of this type would likely be founded on bearing piles driven to bedrock.

The closest granular deposits suitable for G. B. C. Class "A" production are located 4 to 5 miles south-west of Mount Elgin where several fine spillway deposits are situated in the vicinity of Reynold's Creek. Some sand scalping may be required to produce the required gradation from this area. Alternative to this area the closest material suitable for G. B. C. Class "A" production is situated 4 to 5 miles north of Delhi. Scalping is usually required in this area for G. B. C. Class "A" production.

The closest known source of sub-base material is

situated 2 to 3 miles south of the project where some of the pits along the Otter Creek contain fine granular which is suitable for use as sand cushion.

A. M. Batten
A. M. BATTEN,

MEM:mp.

FOR: J. A. ROY,
REGIONAL MATERIALS ENGINEER.

C.C. - A. Watt,
A. Cater,
C. A. Wong,
✓ A. G. Sternac,
A. M. Batten,
File.

Regional Materials Engr.,
Materials & Testing Div.,
Regional Office, London.

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

September 26, 1966

W.P. 299-65 - Highway #3,
Tillsonburg By-Pass

66-4-67

Attached, please find the borelogs and grain-size distribution curves of typical materials in the proposed cut section of the above mentioned By-Pass.

You will appreciate that we were unable to carry out any Proctor tests, since the samples were retrieved from split-spoon samplers.

In many cases the water content is at or below the plastic limit, and it would therefore appear that the material could just have the desired moisture content. In cases where the natural moisture is closer to the liquid limit, the material is rather silty, and we would believe that it would drain and dry out quite readily. However, we shall leave it to you to use these results to your best advantage.

Should you have any additional queries regarding the attached, please feel free to contact this Office.

AGS/MdeF
Attach.

cc: Mr. G. A. Wrong

Foundations Office ✓
Gen. Files

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

MEMORANDUM

Mr. A. G. Stermac,
Principal Foundations Engineer,
Materials and Testing Division,
DOWNSVIEW.

FROM: Materials and Testing,
London.

DATE: June 9, 1966.

FILE REF.

IN REPLY TO

SUBJECT: W. P. 299-65, Highway #3,
Tillsonburg By-Pass.

In connection with the Functional Planning Report, due July 6th, 1966, a date Planning will be unable to meet, this office made some preliminary borings with a truck mounted power auger in the vicinity of Otter Creek.

A boring at Station 123 + 00, fifteen feet deep, showed a brown varved clay below 8 feet. At this location a 50 ft. fill is contemplated. Further to the west, where a 35 ft. cut is contemplated, a boring at Station 127 + 50 indicated a saturated very fine sand and silt from a depth of 9 feet to 25 feet.

We would appreciate it if you could check out the foundation of this proposed embankment and also the cut with respect to the cut backslopes. We anticipate that much of the material in this large cut will not be suitable for embankment fill due to its texture and high moisture content.

Both areas are readily accessible and the centreline will be staked June 13th. The stakes are unlikely to be disturbed before you can investigate this site.

When you are in a position to do this work, we would like to have someone from this office at the site to meet your field crew.

/2.

We have sent a plan and profile under separate cover.
The attached district map shows the location we are interested
in.



J. R. ROY,
REGIONAL MATERIALS ENGINEER.

JRR:hp.
ATT'D.

C.C. - A. M. Batten,
File.

Mr. I. C. Campbell,
Functional Planning Engineer,
Functional Planning Section,
DORCHESTER, Ontario.

Mr. R. G. Gascoyne,
Regional Functional
Planning Engineer,
S. W. REGION, LONDON.

June 27, 1966.

W. P. 299-65 - Highway No. 3
Tillsonburg Bypass
-- District No. 2 - London --

Functional Planning was scheduled to have completed this and other associated projects by July 13, 1966 for a construction program. As a result of the Field Meeting on June 19, 1966, the existence of a Soils problem in the vicinity of the Otter Creek and approaches became known. The situation, after Soils had investigated the area to the fullest of their ability, was that a full Foundation investigation must be done before Soils can approve of the centerline and grade.

As of today, it will take up to two weeks to get Foundations on the site and 6 to 8 weeks to have results such that a recommendation can be made. The above times are on the premise that Planning will not cause the existing Foundations schedule to be completely upset.

Therefore, Regional Planning date cannot be set. It is recommended that we await the results of Foundations and the recommendation of Soils before we suggest a revised completion date. In the meantime, all Planning work must be held up. A survey request cannot be issued by July 1, 1966 to Engineering Surveys as previously agreed upon.

I trust the above proposal and course of action on these projects is satisfactory.

A. McConnell
A. McConnell,
for: R. G. Gascoyne,
Regional Functional Planning Engineer.

ROC:GARA

c.c. - W. Wigle

J. Ray

A. Sternac

A. Gater

F. E. Lacombe

File - W. P. 299-65

MEMORANDUM

Mr. A. G. Stermac,
Principal Foundation Engineer,
Materials and Testing Division,
DOWNSVIEW.

FROM: Materials and Testing,
London.

DATE: August 26, 1966.

FILE REF.

IN REPLY TO

SUBJECT: - W.P. 299-65, Highway #3,
Tillsonburg By-Pass.

We are concerned that the material in the large cut at the west end of the By-Pass might not be suitable for constructing the adjacent fill and the near by railway overhead approach embankments because of its natural moisture content.

It would be appreciated if, when the samples of this cut material are run, you could advise us of the results with any comments you might care to make.



J. R. ROY,
REGIONAL MATERIALS ENGINEER.

JRR:hp.

C.C. - File.

66-F-67

Mr. J. Roy,
Regional Materials Engineer,
London Regional Office.

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

August 16, 1966

W.P. 299-65 -- Highway No. 3
Tillsonburg By-pass

With reference to your memo of June 9, 1966, regarding the stability of the proposed embankment and cut at the above mentioned site, we wish to inform you of the following:

A relatively extensive field investigation was just completed by this Section. Due to the large number of samples, it will be some time before the final report can be submitted. It should be also mentioned that while at the site, we had also carried out the necessary investigation for the river crossing.

It is our opinion that the subsoil conditions are such that no major stability problems should be anticipated along the investigated portion of the proposed alignment. Due to the relatively high embankment and deep cut, certain minor design allowances may prove to be necessary. However, we feel that, in general, this proposed alignment can be accepted and considered as having no problems from the foundation and slope stability point of view.

In our final report we will comment on the suitability of cut materials for embankment construction.

We believe that at the present and for functional planning purposes, this information should be adequate. Should you have some additional queries, please feel free to contact this Office.

AGS/MdeP

A. G. Sternac
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER

cc: Mr. A. Crowley

Foundations Office
Gen. Files

MEMORANDUM

TO: Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

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

ATTN: Mr. J. Keen,
Regional Bridge Project
Engr.

DATE: November 18, 1968

UR FILE REF.

IN REPLY TO

SUBJECT:

Otter Creek Crossing - Hwy. #3
Twp. of Middleton, Co. of Norfolk
District No. 2 (London)
W.J. 66-F-67 -- W.P. 299-65

Following your recent queries as to the feasibility of constructing 1-3/4:1 forward slopes and the advantage of constructing an embankment several years in advance of its actual requirement, we have reviewed our Foundation Report W.J. 66-F-67.

With regard to the 1-3/4:1 forward slopes, we find that the maximum height of fill is 62 ft. measured from the bed of the river to profile grade. Our report states that fill heights up to 52 feet may be constructed with 2:1 slopes in which case no stability problems should occur. In the case of the 62-ft. high fill, we find that the shear strength properties of the fill material affect the stability to a very great extent, and we must therefore make certain stipulations regarding these in order to ensure a stable section. These are:

(1) For a minimum length of 150 ft. on each side of the bridge, the embankment must be constructed of a granular type material compacted sufficiently well to achieve an angle of internal friction of 35°. Construction, according to existing D.H.O. Standards, would be satisfactory, but emphasis should be placed on supervision of the contractor's operations.

(2) Sufficient slope protection and internal drainage must be provided to ensure that no buildup of water pressure occurs within the embankment.

(3) Rip-rap up to H.W.L. must be provided to protect the embankment against erosion by scour. Since the stability of the embankment is greatly dependent on the conditions prevailing at the toes and in the river bed, we further recommend that the entire river bed under the structure be rip-rapped to prevent any possible deepening by scour.

cont'd. /2 ...

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Attn: Mr. J. Keen,
Regional Bridge Proj. Engr.

November 18, 1968

If all of the foregoing recommendations are followed, we recommend that 1-3/4:1 forward slopes be constructed.

With regard to your query whether the approaches for the additional 2 lanes, which will not be required for some years hence, should be built now, we believe that no particular advantage will be gained by this. There should be little or no effect on the structure or on the pavement in the future when the embankment is widened and, unless there are other advantages to be gained (not connected with foundations), we would recommend that the 2-lane embankment only, be built at the present time.

K. G. Selby

KGS/MdeF

K. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. B. R. Davis
H. A. Tregaskes
D. W. Farren
W. Zonnenberg
H. C. Dernier
A. P. Watt
J. Roy
B. A. Singh
Foundations Files
Gen. Files ✓

#66-F-67

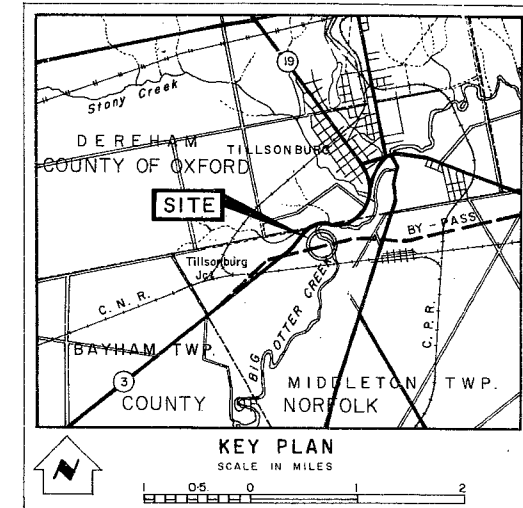
W.P. # 299-65





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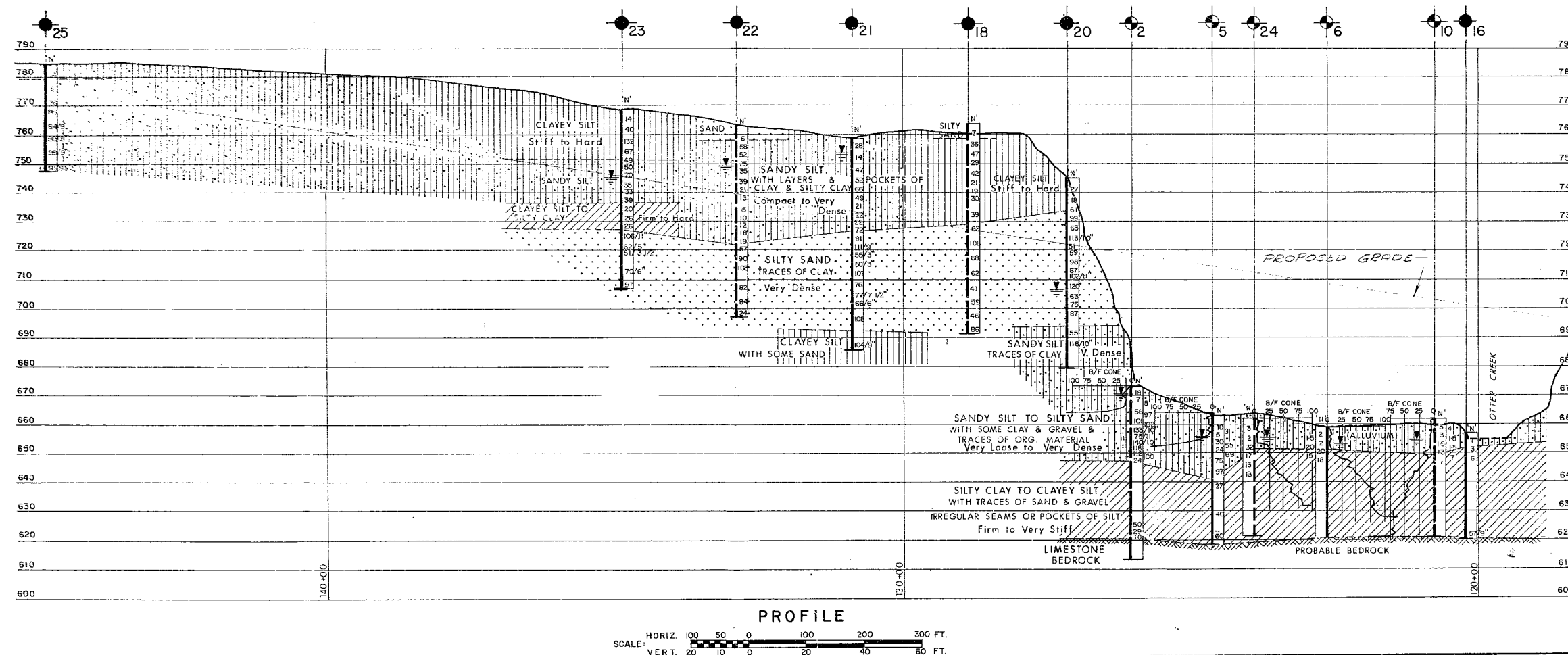
HWY # 3

BIG OTTER

CREEK BRIDGE

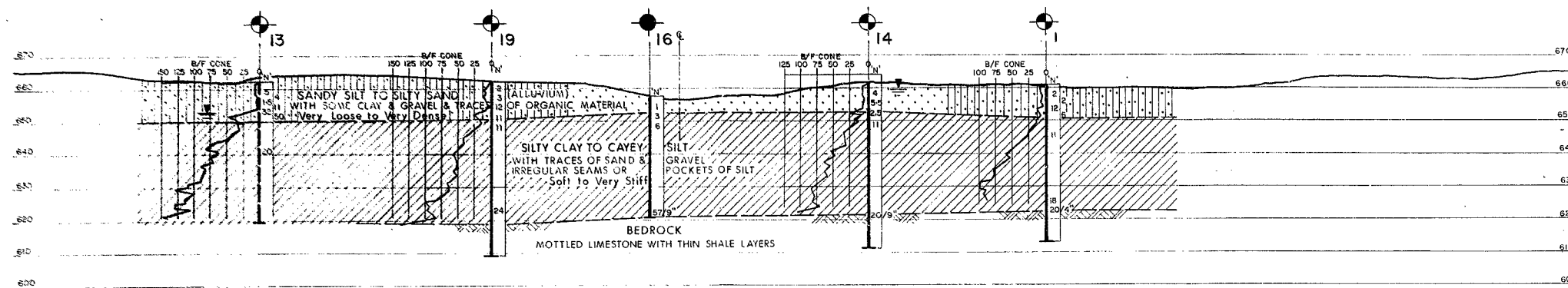


LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation. JULY, AUG. 1960		
NO.	ELEVATION	STATION	OFFSET
1	659.7	120+30	115' RT.
2	672.8	125+97	116' RT.
3	662.0	123+24	111' RT.
4	659.0	124+60	122' RT.
5	661.4	124+56	5' RT.
6	659.1	122+55	5' LT.
7	659.9	123+76	237' RT.
8	659.9	121+38	71' LT.
9	662.6	123+20	231' RT.
10	661.9	120+67	22' RT.
11	661.5	122+25	235' RT.
12	658.9	121+54	114' RT.
13	661.0	120+57	124' LT.
14	661.6	120+28	59' RT.
15	661.6	122+59	157' LT.
16	657.0	120+20	6' LT.
17	664.3	124+60	146' LT.
18	765.3	128+80	65' RT.
19	662.4	120+32	55' LT.
20	744.2	127+10	8' LT.
21	757.7	130+85	Q. ?
22	763.2	132+90	65' LT.
23	768.2	134+85	Q. ?
24	662.0	123+82	80' LT.
25	784.4	144+85	¢

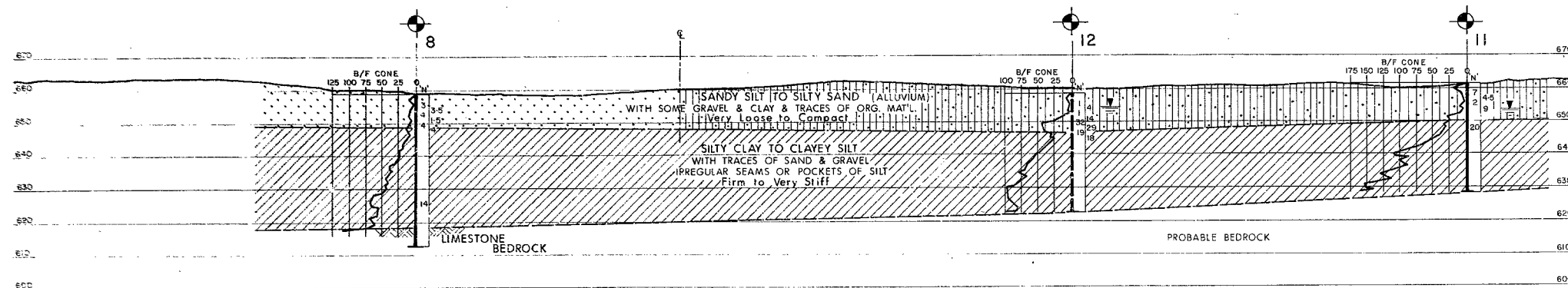


REVISIONS			
	DATE	BY	DESCRIPTION

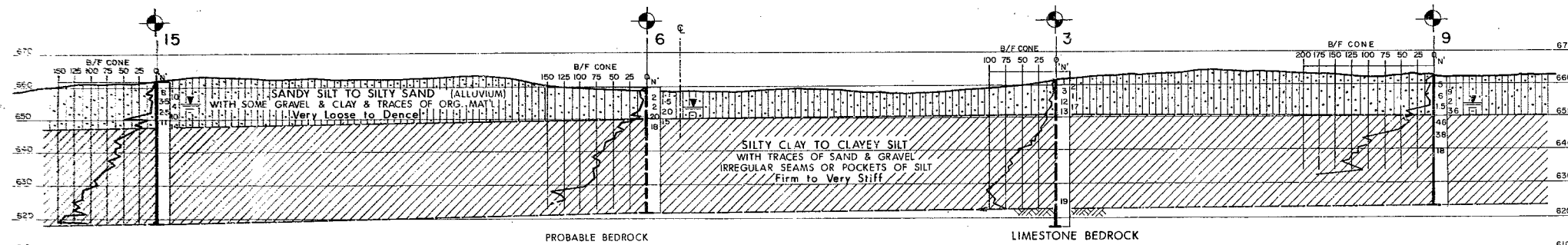
DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING DIVISION - FOUNDATION SECTION			
OTTER CREEK			
KING'S HIGHWAY NO. 3 - PROPOSED DIVERSION		DIST. NO. 2	
CO. NORFOLK		(TILLSONBURG BY - PASS)	
TWP. MIDDLETON		LOT 4, 5 & 6 CON. V	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBM'D	P.P.	CHECKED <input checked="" type="checkbox"/>	W.P. NO. 299-65
M.T. DRAWING NO.		66-F-67	
DRAWN	P.G.O.	CHECKED <input checked="" type="checkbox"/>	JOB NO. 66-F-67
DATE 30 SEPT., 1966.		SITE NO.	
APPROVED <i>A. J. [Signature]</i>		CONT. NO.	
		BRIDGE DRAWING NO.	



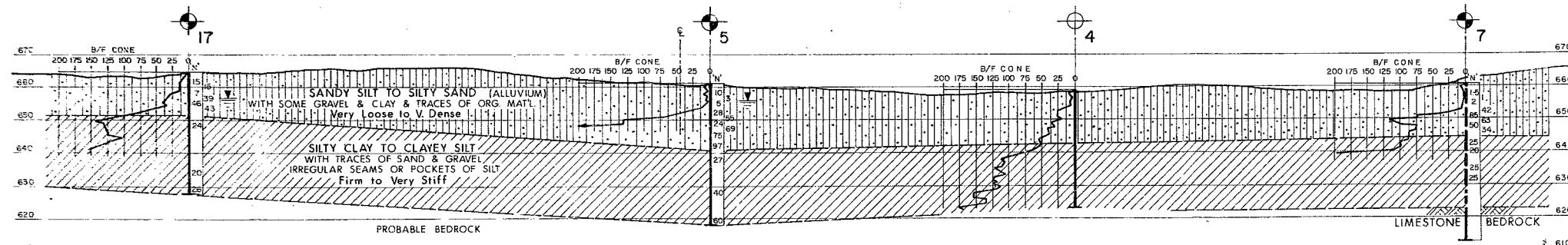
A - A



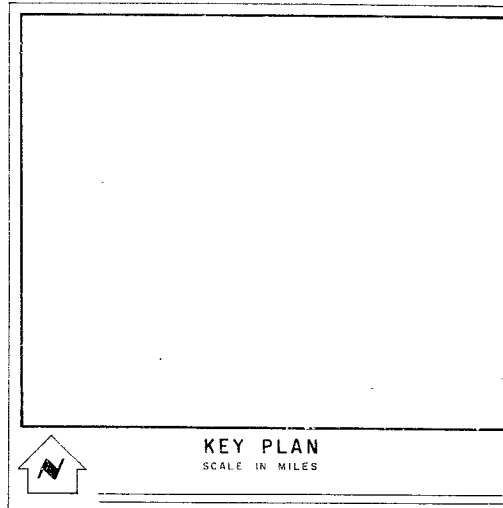
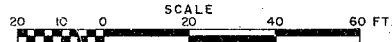
B - B



C - C



D - D
SECTIONS



LEGEND

- Bore Hole
- ⊕ Cone Penetration Hole
- ⊕ Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.

NO.	ELEVATION	STATION	OFFSET

- 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.

REVISION RECORD	
NO.	DATE

REVISIONS			
	DATE	BY	DESCRIPTION

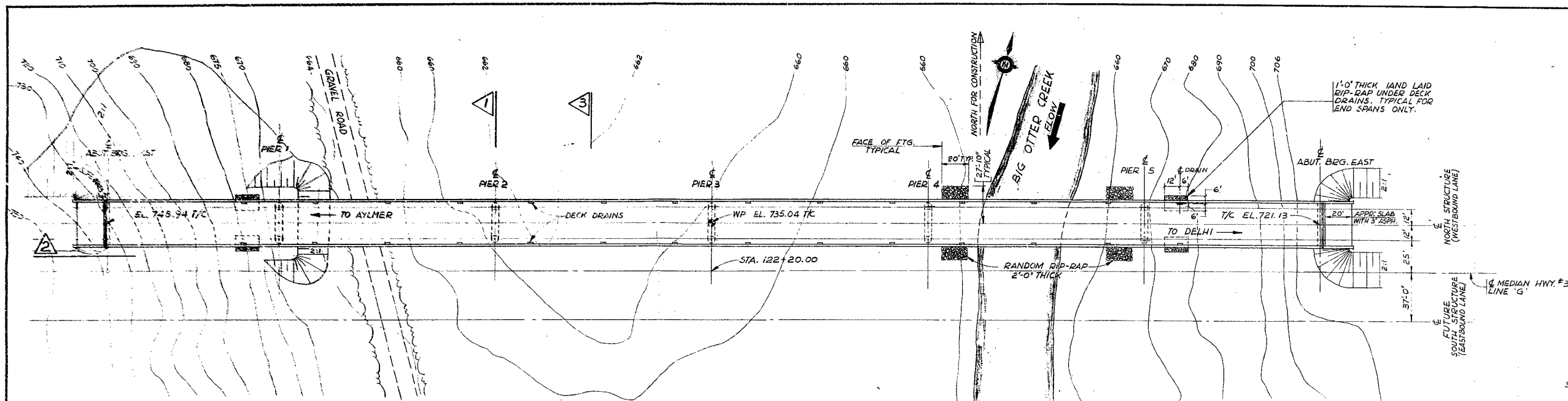
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MATERIALS & TESTING DIVISION - FOUNDATION SECTION

OTTER CREEK

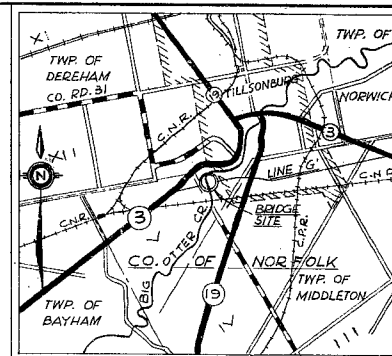
KING'S HIGHWAY NO. 3 - PROPOSED DIVERSION DIST. NO. 2
CO. NORFOLK [THILSONBURG BY-PASS]
TWP. MIDDLETON LOT 4, 5 & 6 CON. V

SECTIONS & SOIL STRATA

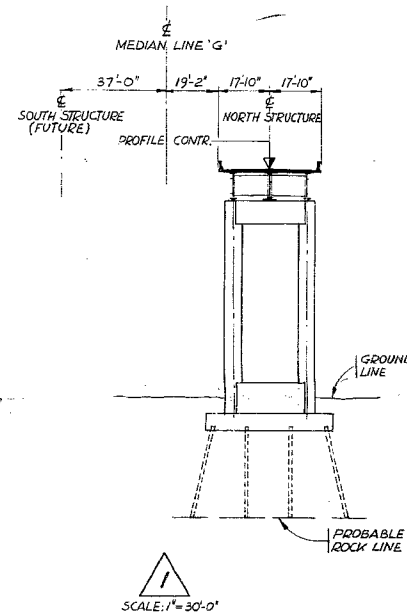
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DRAWN P.G.O.	CHECKED	JOB NO. 66-F-67	66-F-67B
DATE SEPT 5, 1966	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONT. NO.		



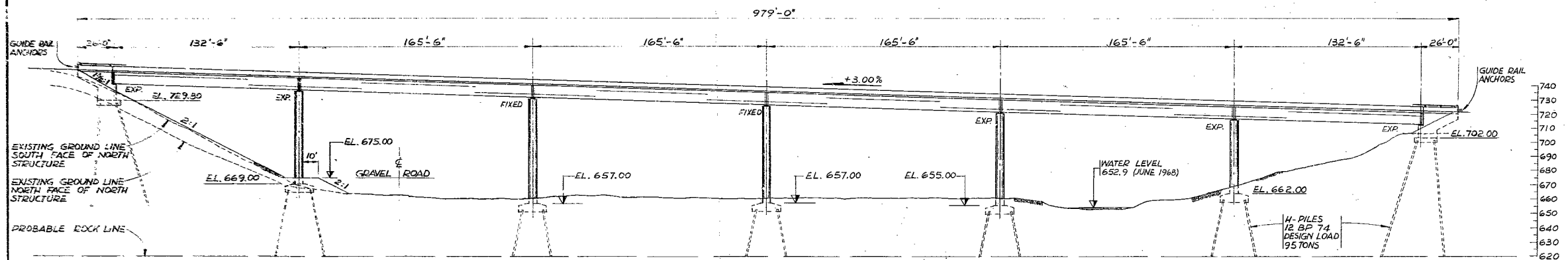
PLAN
SCALE: 1" = 40'-0"



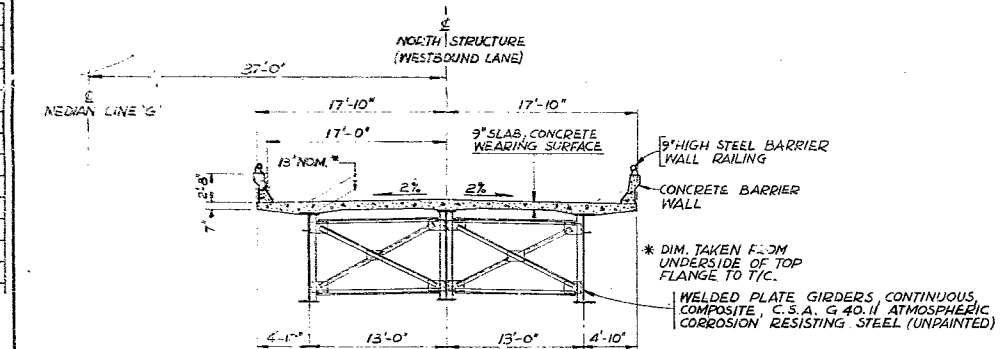
KEY PLAN
1" = 1 MILE



B.M. ELEV. 658.53 GEODETIC DATUM
N. & W. IN N. 200' O.T. MAPLE 345.0 LT. 119+76 LINE 'G'



2
SCALE: 1" = 40'-0"



3
SCALE: 1/8" = 1'-0"

NOTES
CLASS OF CONCRETE
PIERS (EXCEPT FOOTINGS) 5000 PSI
DECK & BARRIER WALL 4000 PSI
REMAINDER 3000 PSI
CLEAR COVER TO REINFORCING STEEL
FOOTINGS & ABUTMENTS - 3"
PIERS - AS NOTED ON DWGS. D-6797-7 & -8
DECK - 1" BOTTOM - 1 1/2" TOP
CURBS & APPROACH SLABS - 2"
CONCRETE BARRIER WALL 1 1/2"
CONSTRUCTION NOTES
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF 3/16".
NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

- LIST OF DRAWINGS**
D-6797-1 GENERAL LAYOUT
2 ABUTMENT LOCATIONS & SOIL STRATA
3 FOOTING LAYOUT
4 FOOTING REINFORCING
5 ABUTMENT DETAILS
6 ABUTMENT REINFORCING
7 PIER DETAILS & COLUMN REINFORCING
8 PIER CAP & PLINTH REINFORCING
9 BEARINGS
10 STRUCTURAL STEEL I
11
12
13 DECK DETAILS
14 DECK REINFORCING
15 E. JOINT JOINTS
16 APPROACH SLABS
17 STANDARD DETAILS
18 CONCRETE BARRIER WALL
19 STEEL BARRIER WALL RAILING

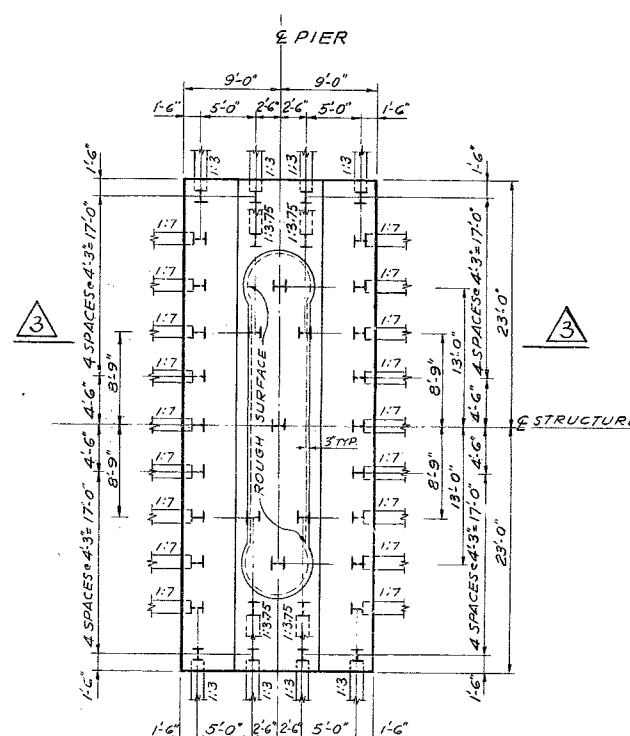
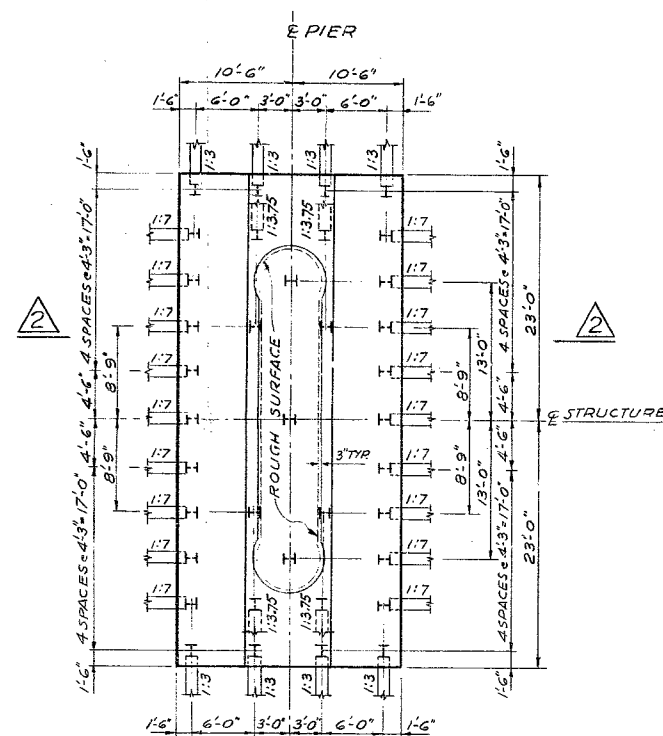
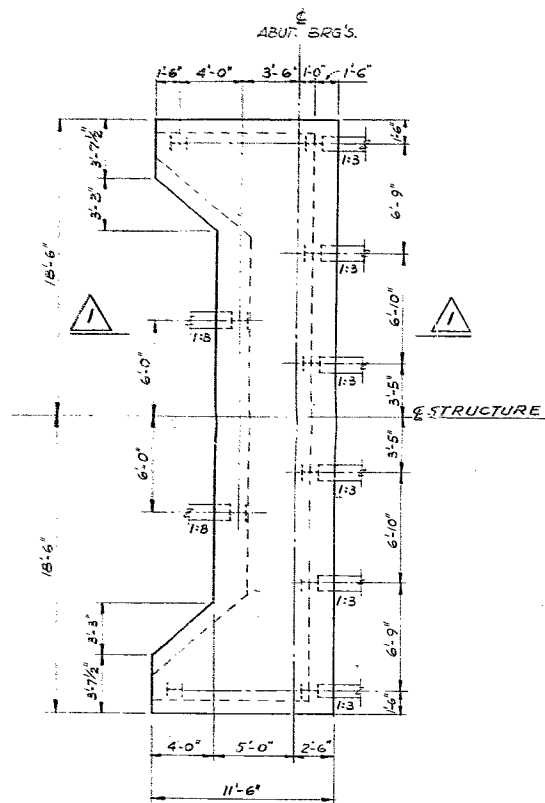
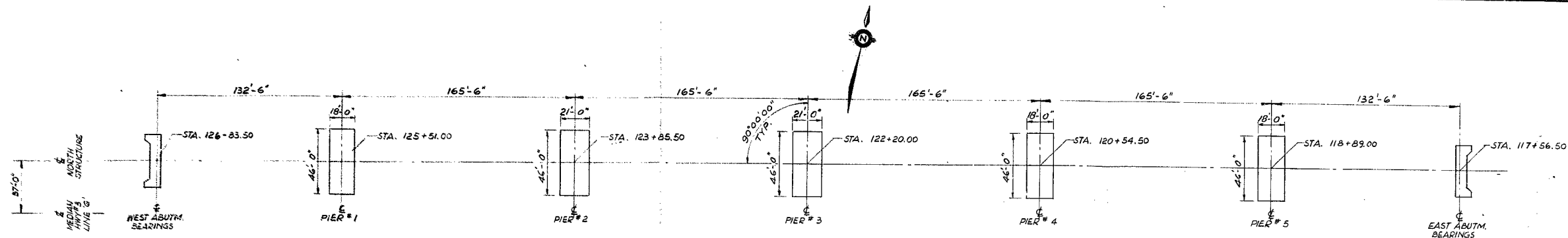


FOR REDUCED PLAN



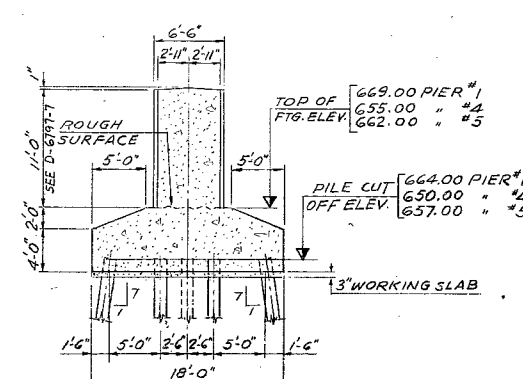
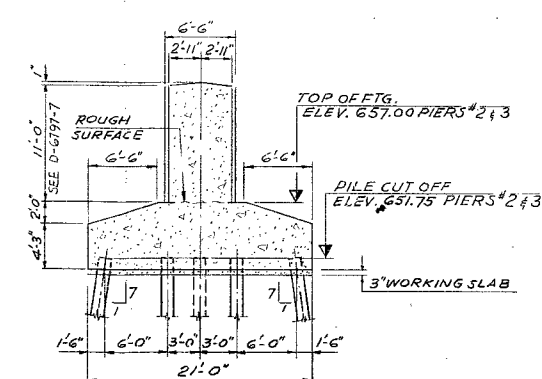
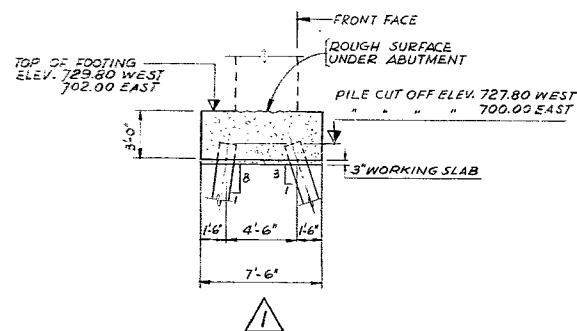
REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
664-67			
BIG OTTER CREEK BRIDGE NORTH STRUCTURE - WESTBOUND LANE 0.5 MILES WEST OF HWY. 19			
KING'S HIGHWAY No. 3 (TILLSONBURG BY-PASS)		DIST. No. 2	
CO. NORFOLK		CON. 5	
TWP. MIDDLETON		LOT 6	
GENERAL LAYOUT			
APPROVED	BRIDGE ENGINEER	SITE No. 20-157	W.P. No. 302-65-00
DESIGN	CHECK	CONTRACT No.	
DRAWING	CHECK	DRAWING No.	D-6797-1
DATE	JUNE -1970	LOADING	HS-20-44



12 BP 74 STEEL H-PILES DESIGN LOAD - 95 TONS		
LOCATION	NO. OF PILES	PILE LENGTH
WEST ABUT.	10	72'-0"
PIER #1	37	52'-0"
PIER #2	37	39'-0"
PIER #3	37	39'-0"
PIER #4	37	37'-0"
PIER #5	37	43'-0"
EAST ABUT.	10	90'-0"

- PILES FOR WEST ABUTMENT TO BE DRIVEN IN ACCORDANCE WITH BD 82-7 ON D-6797-17
- ALL OTHER PILES TO BE DRIVEN TO REFUSAL AT SOUND BEDROCK.
- PILE SPICING DETAILS AS PER BD 82-1 ON D-6797-17



REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

BIG OTTER CREEK BRIDGE

KING'S HIGHWAY No. 3 (TILLSONBURG BY-PASS) DIST. No. 2
CO. NORFOLK
TWP. MIDDLETON LOT 6 CON. 5

FOOTING LAYOUT

APPROVED	BRIDGE ENGINEER	SITE No. 20-157	W.P. No. 302-65-00
DESIGN	CHECK	CONTRACT No.	
DRAWING	CHECK	D.C.	
DATE	LOADING	DRAWING No.	D-6797-3

FOR REDUCED PLAN

