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68-F-91

#

W.P. 37-66

#

Hwy. 417 (LINE'D)

#

Hwy. 17 QUEBEC

BORDER

WESTERLY

MEMORANDUM

To: J. L. Forster,
Functional Planning Engr.,
Eastern Region,
KINGSTON, Ontario.

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

ATTENTION:

DATE: February 26, 1969

OUR FILE REF:

IN REPLY TO

FEB 27 1969

SUBJECT:

PRELIMINARY FOUNDATION REPORT

For

Proposed Hwy. 417 - (Line 'D')
Hwy. 17 (Quebec Border Westerly -
Sta. 204+00 to 497+00) - Structure
Sites No. 29, 30, 31 and 88
E. Hawkesbury Twp. - Prescott Co.
District No. 9 (Ottawa)
W.J. 68-F-91 -- W.P. 37-66

Attached, we are forwarding to you, our Preliminary Foundation Investigation Report pertaining to the above sites. Presented in this report are the results of the investigation, together with our general comments pertaining to the stability of the approaches and recommendations regarding structure foundations at various crossings.

We believe that the information contained therein will prove adequate for your immediate use. Should you require further data, or clarification of the report, please feel free to contact this Office.

AGS/EdaF

Attach.

cc: Messrs. J. L. Forster (2)
B. R. Davis (2)
H. A. Tregaskes
D. W. Parren
S. J. Markiewicz
C. R. Robertson
I. C. Campbell
G. Scott
J. E. Gruspier
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Foundations Files
Gen. Files

A. G. Stermac
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PRINCIPAL FOUNDATION ENGINEER

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PRELIMINARY FOUNDATION REPORT
For

Proposed Hwy. 417 - (Line 'D')
Hwy. 17 (Quebec Border Westerly -
Sta. 204+00 to 497+00) - Structure
Sites No. 29, 30, 31 and 88
E. Hawkesbury Twp. - Prescott Co.
District No. 9 (Ottawa)
W.J. 68-F-91 -- W.P. 37-66

1. INTRODUCTION:

The Foundation Section was requested to provide preliminary subsoil information at the proposed structure and creek crossings along Hwy. 417 (Line 'D'), namely, between Vars and the Quebec border. This portion of the proposed highway is approximately 52 miles in length. The request was contained in a memo from the Eastern Region Functional Planning Section (Mr. J. L. Forster, Regional Functional Planning Engineer), dated December 10, 1968. An investigation was subsequently carried out by this Section to determine the subsoil conditions at the crossings.

The portion of Hwy. 417, which will traverse along the alignment of existing Hwy. 17 (from the Quebec border, westerly - Sta. 204+00 to 497+00), will be one of the first sections constructed. This portion encompasses Structure Sites 29, 30, 31 and 88. This report presents preliminary information on the subsoil and groundwater conditions encountered at the above crossings, together with recommendations pertaining to foundation design and stability and settlement of approach embankments. Detailed bore-log sheets, together with the results of the laboratory testing carried out, will be submitted following completion.

Foundation Reports will also be submitted, in due course, on other sections of the alignment, namely, between Vars and Hwy. 17.

2. DESCRIPTION OF THE SITES AND GEOLOGY:

The portion of proposed Hwy. 417, following the existing alignment of Hwy. 17, is located in the Twp. of E. Hawkesbury,

2. DESCRIPTION OF THE SITES AND GEOLOGY: (cont'd.) ...

County of Prescott. The terrain is gently undulating in relief, between about elevation 140 and 225. The land is basically being utilized for farming purposes; there are, however, localized timbered areas, particularly north of Hwy. 17. The major drainage in the area is provided by the Ottawa River, which is located immediately north of Hwy. 17.

Geographically the alignment, in this section, is situated in two physiographic regions. The majority of the eastern portion (to the Quebec border) is situated in the "Russell and Prescott Sand Plains", an area in which a mantle or cap of sand overlies a sensitive deposit of marine clay. The thickness of the granular soils generally varies from 10 to 20 feet, while the clay deposit, in this area, is of the order of 15 to 25 feet.

The western section is, however, primarily located in the "Glengarry Till Plains" section. This area is characterized by drumlinized ridges with the intervening flats floored with clay, and in some cases, swamp deposits. The glacial till is stoney in texture and generally less than 25 feet in thickness.

The overburden is underlain by limestone and shale bedrock of the Chazy Group, Ordovician Period.

3. SUBSOIL CONDITIONS:

A detailed sampled borehole was put down at Structure Sites No. 29, 31 and 88, while two were put down at Site No. 30, during the course of the investigation.

The locations of the Structure Sites and borings are shown on Drawing No. 68-P-91A, located in the Appendix of this report. The elevations given in the report were estimated from the profile (un-numbered), provided by the Functional Planning Section. These elevations are referenced to a geodetic datum.

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

A brief resumé of the subsoil conditions encountered at each site is presented below:

SITE #29 (Approx. Station 183+00)

	Ground Elev.	- 224 ±
	Groundwater Elev.	- 214 (approx.)
<u>Depth</u>		
0' - 19.5'	Hard or very dense <u>Glacial Till</u> (Heterogeneous mixture of Clayey <u>Silt</u> with <u>Sand</u> & <u>Gravel</u> or <u>Sandy Silt</u> with <u>Gravel</u>) - boulders up to 8" in size throughout.	
19.5' - 23.5'	Fractured to sound (at 22') Grey <u>Limestone</u> Bedrock.	

SITE #30 (Approx. Station 329+00)

B.H. #1 (At Intersection)

	Ground Elev.	- 167 ±
	Groundwater Elev.	- 160 (approx.)
0' - 4'	Dense <u>Sand</u> & <u>Gravel</u> (<u>Roadway Fill</u>)	
4' - 5.5'	Loose <u>Sandy Silt</u> (<u>Topsoil</u>)	
5.5' - 8.0'	Compact Grey <u>Silty Sand</u>	
8.0' - 24.0'	Firm to Stiff <u>Clay</u>	
24.0' - 46.7'	Very stiff to hard <u>Clayey Silt</u> to <u>Silt</u> with <u>Sand</u> & <u>Gravel</u> (<u>Glacial Till</u>) - very bouldery below a depth of 40'	
46.7' - 55.5'	Fractured to sound <u>Limestone Bedrock</u>	

B.H. #2 (600' North of Intersection)

	Ground Elev.	- 155 ±
	Groundwater Elev.	- 151 (approx.)
0' - 4'	Dense <u>Sand</u> & <u>Gravel</u> (<u>Roadway Fill</u>)	
4' - 13.5'	Firm to <u>Stiff Clay</u> to <u>Silty Clay</u>	
13.5' - 16.0'	Very Stiff to hard <u>Clayey Silt</u> with <u>Sand</u> & <u>Gravel</u> (<u>Glacial Till</u>)	

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

SITE #31 (Approx. Station 336+00)

Ground Elev. - 151 ±
Groundwater Elev. - 144 (approx.)

<u>Depth</u>	
0' - 4'	Dense Sand & Gravel (<u>Roadway Fill</u>)
4' - 29.5'	Stiff to hard Clayey Silt with Sand & Gravel (<u>Glacial Till</u>)
29.5' - 39.8'	Fractured to sound (at 34') <u>Limestone Bedrock</u>

SITE #88 (Approx. Station 496+75)

Ground Elev. - 143 ±
Groundwater Elev. - 131 (approx.)

0' - 4.0'	Very dense Sand & Gravel (<u>Roadway Fill</u>)
4.0' - 11.0'	Compact Sandy Silt to Silty Sand with some Clay & Gravel, trace of Organic Matter (<u>Creek Bed Deposit</u>)
11.0' - 19.0'	Hard Grey Clayey Silt to Silt with Sand & Gravel (<u>Glacial Fill</u>)
19.0' - 34.0'	Very Dense <u>Sand & Gravel</u> , trace of silt
34.0' - 51.0'	Hard Grey <u>Silty Clay</u> , trace of Sand & Gravel
51.0' - 59.0'	Very Dense <u>Sand & Gravel</u> , Boulders up to 6" in size

4. DISCUSSION - PROPOSED STRUCTURE CROSSINGS:

Proposed Hwy. 417 (Line 'D') will join with existing Hwy. 17 at approximately Station 204+00 (West of Chute à Blondeau), from here it will travel along the existing alignment to the Quebec border (Station 497+00). The existing two-lane highway will form the Eastbound lane (E.B.L.) of Hwy. 417; only slight modification will be made in the present alignment and profile grade. The W.B.L., however, will be located to the north of Hwy. 17; the median between the two lanes will vary between 130 and 300 feet.

4. DISCUSSION - PROPOSED STRUCTURE CROSSINGS: (cont'd.) ...

The proposed profile grade of the W.B.L. will be reasonably close to the existing ground surface, with only a few notable exceptions, where cuts and fills of considerable extent will be required. Such areas will be discussed in detail in Section 5.

It is understood that underpass structures will be constructed at the major crossings (Sites 29, 30 and 83). To aid in the functional planning study presently being carried out, preliminary recommendations have been made on the type of foundations acceptable as well as the stability and settlement of approach fills. These recommendations are summarized in tabular form as follows:

FOUNDATION RECOMMENDATIONS

Site No.	Approx. Exist. Ground Elev. (Profile Grade Hwy. 417)	Max. Height of Approach Fill (Approximate) (ft.)	R E C O M M E N D A T I O N S		Remarks
			Structures	Embankments	
29 (Sta. 183+00)	224 (228.5)	22' to 24'	<u>Piers</u> Spread Footings at or below elev. 220., allowable bearing pressure up to 5 tsf. <u>Abutments</u> End-bearing piles driven to practical refusal within glacial till - estimated tip elev. 210. - designed for full capacity of pile.	No stability problems for standard 2:1 slopes.	-
30 (Sta. 329+00)	167 (166 to 168)	24'	<u>Piers & Abutments</u> End-bearing piles driven to bedrock - approx. tip elev. 120. - designed for full capacity of pile.	No stability problems for standard 2:1 slopes. Probable consolidation settlement: 12" in 1 year 18" in 3 years - (Max.)	Give consideration to constructing embankments prior to structure. (Stage construction)

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

Site No.	Approx. Exist. Ground Elev. (Profile Grade Hwy. 417)	Max. Height of Approach Fill (Approximate) (ft.)	R E C O M M E N D A T I O N S		Remarks
			Structures	Embankments	
31 (Sta. 336+00) (Creek Crossing)	149 - W.B.L. 143 - E.B.L. (W.B.L. - 160) (E.B.L. - 153)	11'	<u>Rigid Frame (Open Type) Box Culvert</u> - Founded on shallow foundations at or below elev. 147 - (W.B.L.), allowable bearing pressure up to 3 tsf.	No stability pro- blems contemplated, provided surficial organic matter removed.	Excavate up to 2' of surficial organic matter
88 (Sta. 493+00)	148 - W.B.L. 154 - E.B.L. (151 - W.B.L.) (154 - E.B.L.)	26' (North Approach)	<u>Piers</u> Spread Footings within glacial till with at least 5' of earth cover, allow- able bearing pressure up to 4 tsf. <u>Abutments</u> End-bearing piles driven to practical refusal within glacial till - estimated tip elev. 115. - designed for full capacity of pile.	No stability pro- blems for standard 2:1 slope, provided surficial organic matter removed.	possibly require ex- cavation of up to 4' of surficial organic matter

5. CUT AND FILL SECTIONS - W.B.L., HWY. 417:

The proposed profile grade for the W.B.L. is such that there will be sections where either cuts or fills of considerable extent (greater than 10 feet) will be required. The major ones are listed below.

	<u>Approx. Limits</u>	<u>Max. Cut or Fill</u>
Cut	Sta. 471+00 to 480+00	21'
Fill	Sta. 463+00 to 471+00	34'
Fill	Sta. 412+00 to 420+00	14'

Visual observations indicate that existing Hwy. 417, within the above limits, is performing satisfactorily - i.e., no signs of instability. Furthermore, the cuts and fills in the respective areas are of the same order of magnitude as those listed above. This would seem to indicate that no serious stability problems should be encountered during the construction of the W.B.L. of Hwy. 417.

6. SUMMARY:

The results of a preliminary foundation investigation for the structure and creek crossings, for that portion of proposed Hwy. 417 which follows the existing alignment of Hwy. 17 (Quebec border westerly), are presented in this report. The sites are Nos. 29, 30, 31 and 88.

The subsoil at the sites, with the exception of Site No. 30, generally is composed of competent glacial till or granular deposits directly overlying limestone bedrock; the surface elevation of the bedrock is quite variable. At Site No. 30 a stratum of firm clay, approximately 16 feet in thickness, overlies the glacial till.

6. SUMMARY: (cont'd.) ...

Preliminary comments regarding

- i) the type of foundation acceptable,
- ii) stability and settlement of approach embankments, and
- iii) additional recommendations, such as sub-excavation of surficial organic material,

are presented in tabular form in this report.

It should be stressed that this report is of a preliminary nature and is intended for functional planning purposes only. A complete foundation investigation will be necessary at all the structure sites, when design details become available.

7. MISCELLANEOUS:

The field work for this project was carried out during the period of January 17 and 29, 1969, under the supervision of Mr. B. T. Darch, Senior Foundation Engineer.

The equipment used was owned and operated by F. E. Johnston Drilling Co. Ltd.

This report was written by Mr. Darch, and was reviewed by Mr. M. Devata, Supervising Foundation Engineer.

February 1969

APPENDIX 1

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE FOR SITE 29

FOUNDATION SECTION

JOB 68-F-91 LOCATION Hwy. 417 (Line D) Approx. Sta. 183+00
 W.P. 37-66-05 BORING DATE Jan. 24, 28, 29 & 30, 1969
 DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing - BXL Rock Core

ORIGINATED BY BTB
 COMPILED BY VK
 CHECKED BY

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — % PLASTIC LIMIT — % WATER CONTENT — %		BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH P.S.F.		WATER CONTENT %			
224.5	Ground Level					○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB. VANE		20 40 60	PC.F	GR.SA.SI.CL
0.0	Silty sand & gravel (Glacial Till) (occasional layers of hard clayey silt with sand & gravel up to 4" thick throughout - boulders up to 8" in size throughout) (Brown)	0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 180.0 190.0 200.0 210.0 220.0 230.0 240.0 250.0 260.0 270.0 280.0 290.0 300.0	1	SS	121/9"						
			2	SS	132						
			3	SS	100/3"						
			4	SS	104						
204.5	Very dense										
19.5	Dolomite Bedrock with		5	BXL	100%						
200.7	shaly dolomite interbeds fractured to sound at elev. 202		6	BXL	98%						
23.3	End of Borehole										

214.
 WL in open
 BH

JOB 68-F-91 LOCATION Hwy. 417 (Line D) Approx. Sta. 329+00 ORIGINATED BY LTD
W.P. 37-66-05 BORING DATE Jan. 17, 20 & 21, 1969 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Washboring - BX, BX & AX Casing - AXT Rock Core CHECKED BY

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. UNIT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BL/FT	PLASTIC LIMIT		
167.0	Ground Level									
163.0	Silty sand & Gravel (Roadway Fill) (Brown) Compact									
162.0	Sandy silt topsoil									
159.0	Silty sand with trace of clay. (grey) Loose		1	SS	8	160				2 72 21 5 160.
158.0	Clay to silty clay, trace of sand (occasional seams of silt up to 1/2" thick randomly throughout)		2	SS	4					WL in open BH
153.0	(Grey)		3	TW	PM	150				
143.0	Firm to stiff		4	TW	PM					
24.0	Reworked zone		5	SS	8	140				
	Clayey silt with sand & gravel (Glacial Till)		6	SS	28					21 34 37 8
	(occasional silty layers up to 4" thick throughout) (boulders 6" in size below elev. 127)		7	SS	20	130				21 33 34 12
	(Grey)		8	SS	52					
120.5	Very stiff to hard		9	SS	62	120				
116.5	Sandy dolomite to shaly dolomite Bedrock		10	BXL	90% Rec					
111.5	(Grey) Fractured to south at elev. 118		11	BXL	90% Rec					
55.5	End of Borehole					110				

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2 SITE 30 FOUNDATION SECTION

JOB 68-F-91 LOCATION Hwy. h17(Line D) 600' North of BH #1 ORIGINATED BY VK

W.P. 3-7-66-05 BORING DATE Feb. 14 & 15, 1969 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Washboring - BX Casing CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w		BULK DENSITY γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PROT.	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT %			
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					
155.1	Ground Level											P.C. 3 GR. SA. SI. CL.
0.0	Silty sand & Gravel											
151.0	(Roadway Fill) Compact											
4.0	Desiccated Crust		1	SS	11	150						
	Stiff											
	Clay to silty clay, trace of sand. (Grey)		2	SS	3							
141.5	Firm											
13.5	Clayey silt with sand & gr. (Glac. Till) v. stiff		3	SS	11	140						
139.0	to hard											
16.0	End of Borehole											

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE FOR SITE 31

FOUNDATION SECTION

JOB 68-F-91 LOCATION Hwy. 417 (Line D) Approx. Sta. 336+00 ORIGINATED BY BTD
 W.P. 37-66-05 BORING DATE Jan. 22 & 23, 1969 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Washboring - NX, BX, AX Casing - AXT Rock Core CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE		WATER CONTENT % 20 40 60			
151.1	Ground Level											
0.0	Silty sand & gravel (Roadway fill) (Brown)	X	1	SS	83	150						WL in open BH
147.0	Very dense											146.0
4.0	Reworked zone stiff	T	2	SS	10				0.4			11 47 33 12
	Clayey silt with sand & gravel (Glacial Till)	T	3	SS	39	140						
	(occasional seams of silt & sand up to 4" thick throughout)	T	4	SS	16				0.1			21 37 34 8
	(Grey-brown to grey)	T	5	SS	29	130						
		T	6	SS	26				0.1			18 33 40 9
121.5	Very stiff to hard.	T										
29.5	Shaly dolomite bed- rock, with interbeds of shale up to 18" thick (Grey)	X	7	AXT	85% Rec	120						
	Fractured to sound at elev. 117		8	AXT	95% Rec							
111.2												
39.8	End of Borehole					110						

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE FOR SITE 88

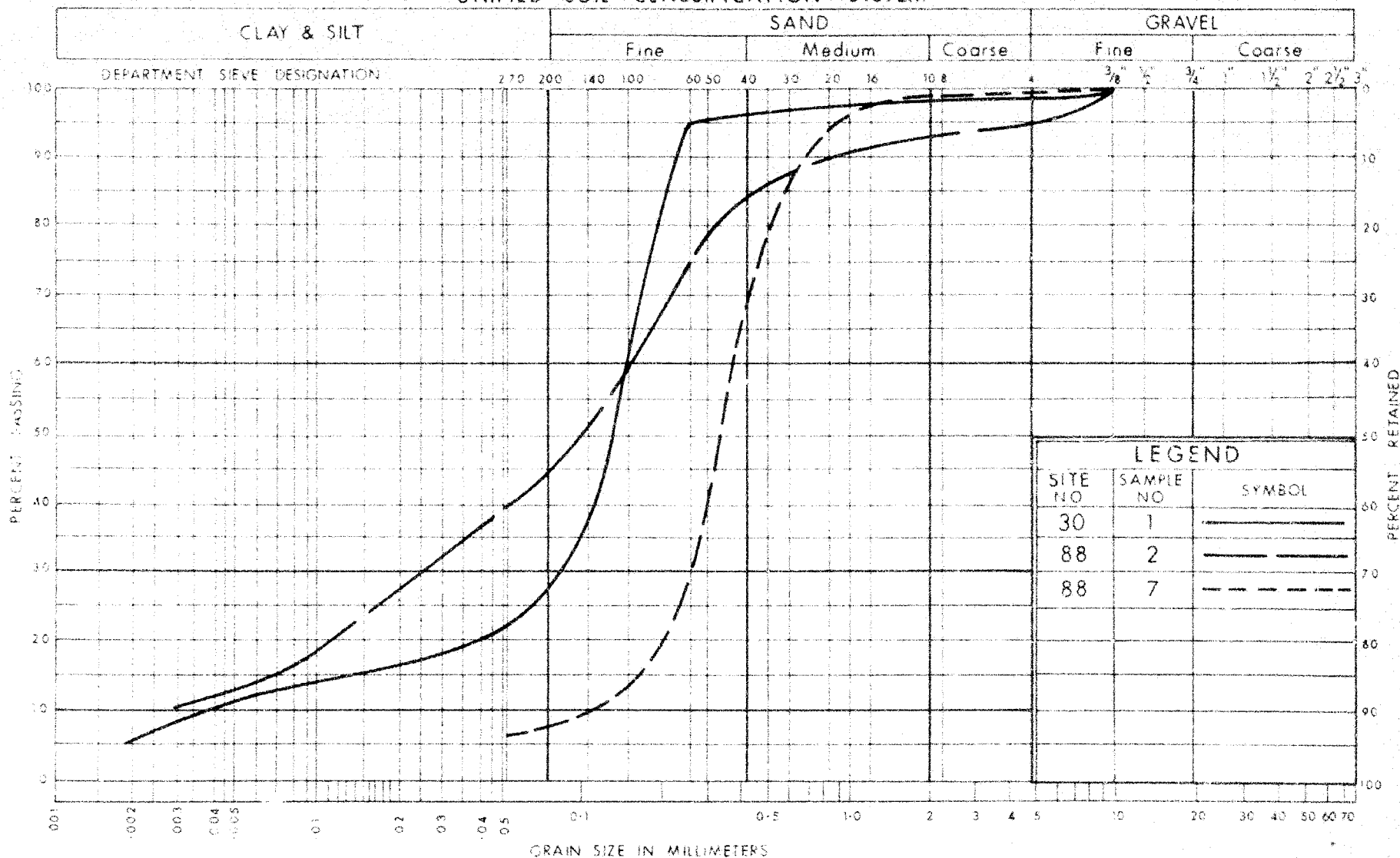
FOUNDATION SECTION

JOB 68-F-91 LOCATION Hwy. 417 (Line D) Approx. sta. 496 + 75
W.P. 36-66 BORING DATE Jan. 20, 21 & 22, 1969
DATUM Geodetic BOREHOLE TYPE Washboring - BX, A7 Casing

ORIGINATED BY BTD
COMPILED BY VK
CHECKED BY

SOIL PROFILE			SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT — * PLASTIC LIMIT — * WATER CONTENT — %		BULK DENSITY PCF	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH P.S.F.		WATER CONTENT %			
143.0	Ground Level					<input type="radio"/> UNCONFINED + FIELD VANE <input checked="" type="radio"/> QUICK TRIAXIAL x LAB. VANE		20 40 60			
0.0	Silty sand & gravel (Roadway Fill) (Brown)	X	1	SS	51						
139.0	Very dense.										
4.0	Silty sand to sandy silt with a trace of clay & organic matter (creek bed deposit)		2	SS	21					org. 1.5%	0 51 36 7
132.0	(Grey) Compact		3	SS	8					org. 0.3%	3 38 47 12
11.0	Clayey silt with sand & gravel (Glacial Till)		4	BLX	75						WL in open BH
124.0	(Boulders up to 5" in size throughout) (Grey)			5	SS	100					5 49 36 10
124.0	Hard										
19.0	Sand & gravel with a trace of silt (occasional partings of clay, up to 1/4" thick throughout)		6	SS	54						
	(Grey & brown)			7	SS	130					1 92 (7)
				8	SS	112					
109.0	Very dense										
34.0	Silty clay with a trace of sand & gravel		9	SS	57						0 2 65 33
	(grey)			10	SS	51					0 1 59 40
	Hard										
92.0											
51.0	Sand & gravel with a trace of silt (boulders up to 6" in size throughout)										
84.0	Very dense. (Brown)										
59.0	End of Borehole										

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

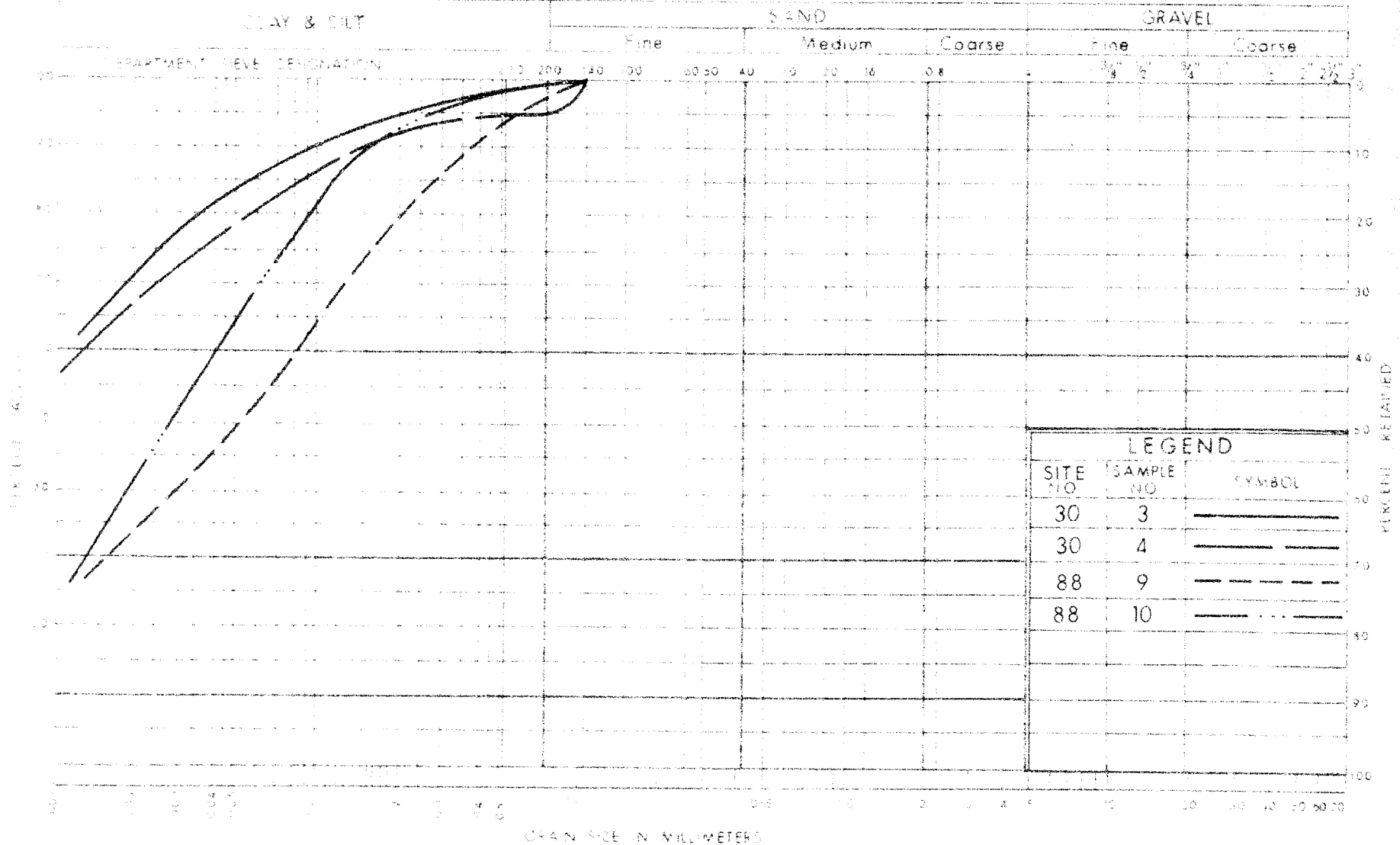
GRAIN SIZE DISTRIBUTION SILTY SAND

WP No. 37-66-05

JOB No. 68-F-91

FIG NO 1

UNIFIED SOIL CLASSIFICATION SYSTEM



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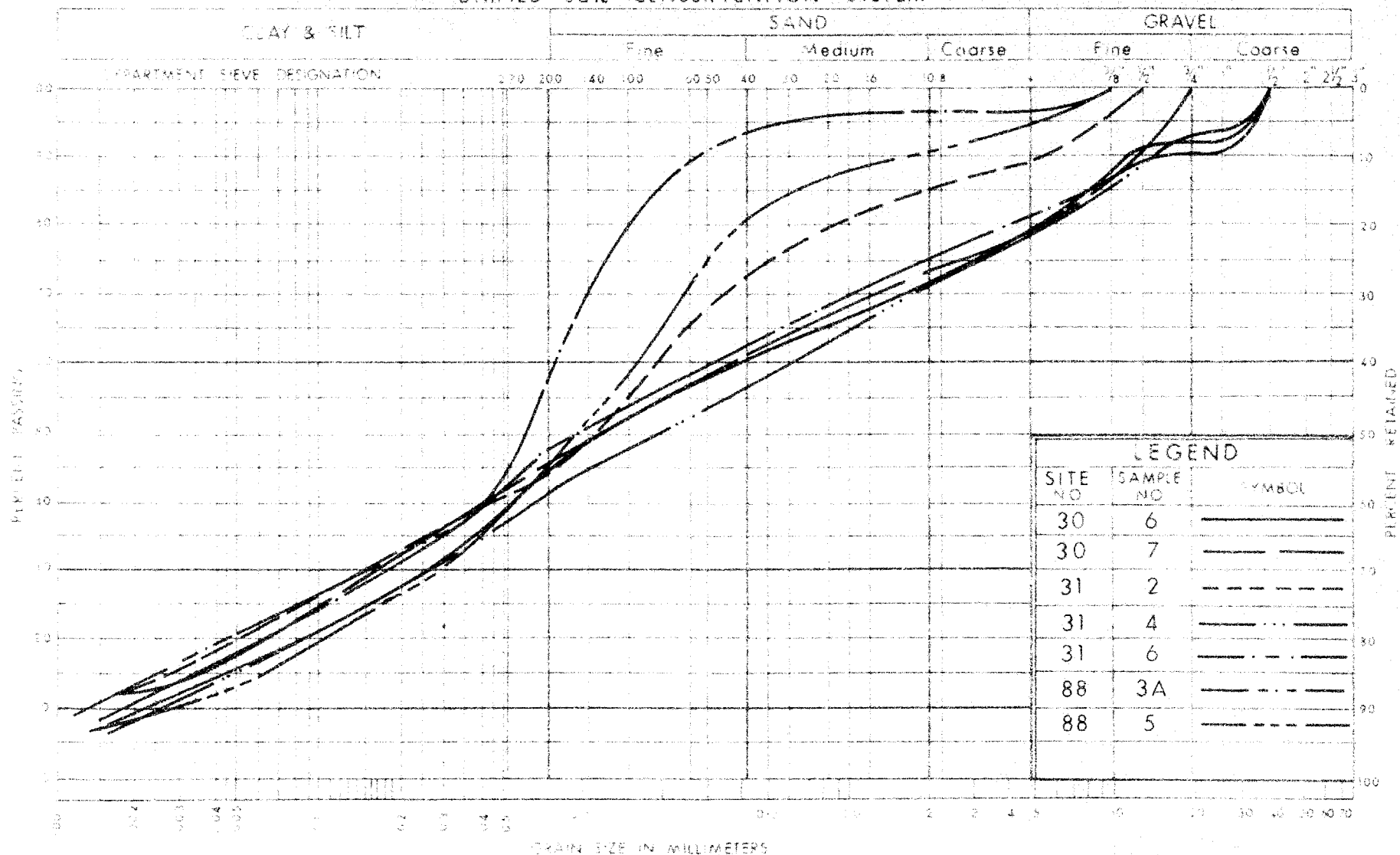
GRAIN SIZE DISTRIBUTION CLAY & SILTY CLAY

WP No 37-66-05

JOB No 68-F-91

FIG NO 2

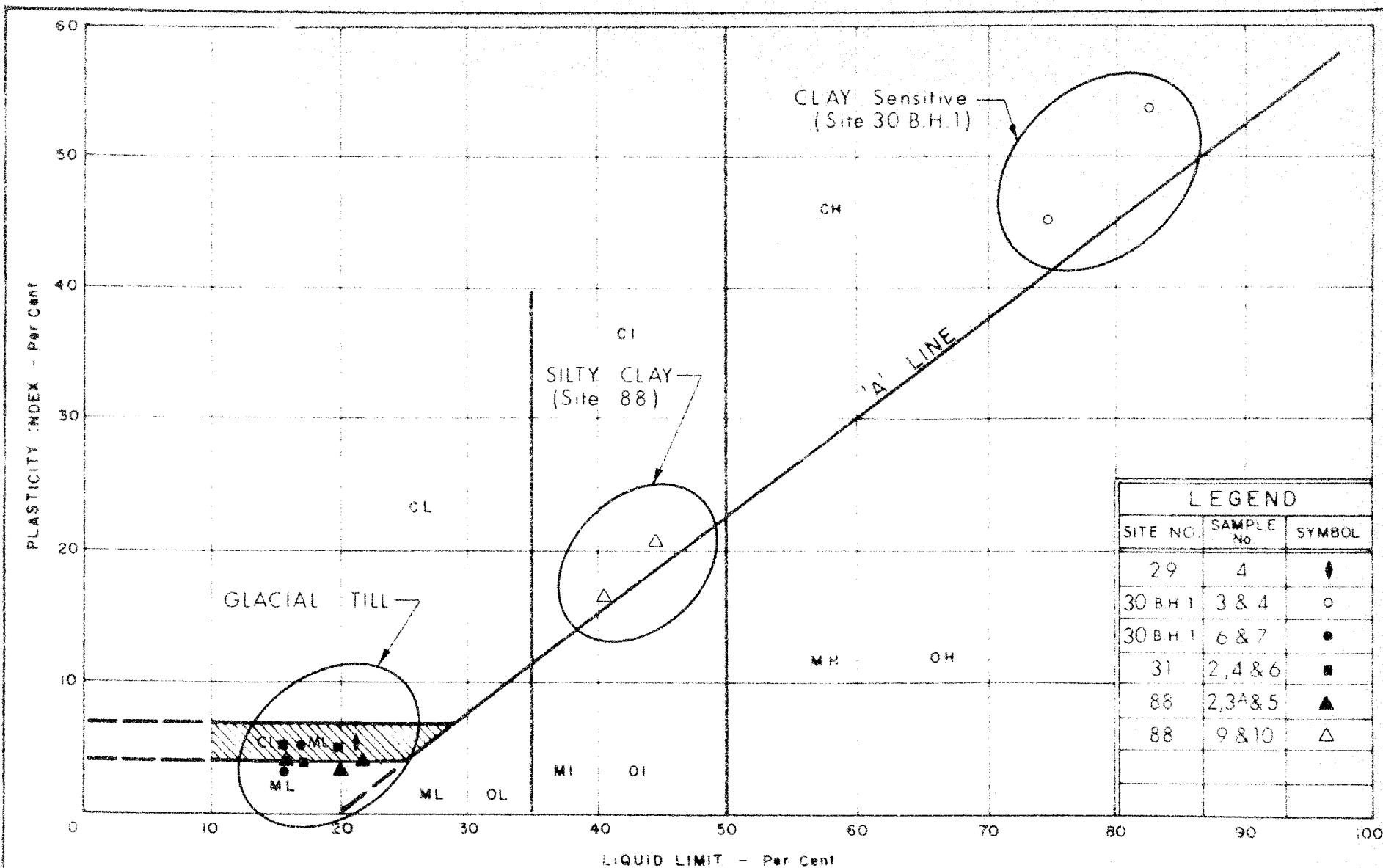
UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
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DIVISION

GRAIN SIZE DISTRIBUTION
CLAYEY SILT WITH SAND & GRAVEL
(Glacial Till)

WP No. 37-66-05
JOB No. 68-F-91
FIG NO 3



DEPARTMENT OF HIGHWAYS
 MATERIALS and
 TESTING
 DIVISION

PLASTICITY CHART

WP No 37-66-05

JOB No. 68-F-91

FIG NO. 4

VOID RATIO vs PRESSURE

$W_L = 74.5$
 $W_p = 29.6$
 $W = 53.0 \%$

SITE 30-B.H. 1
 SAMPLE 4
 DEPTH 20'-22'
 ELEV. 147'-145'

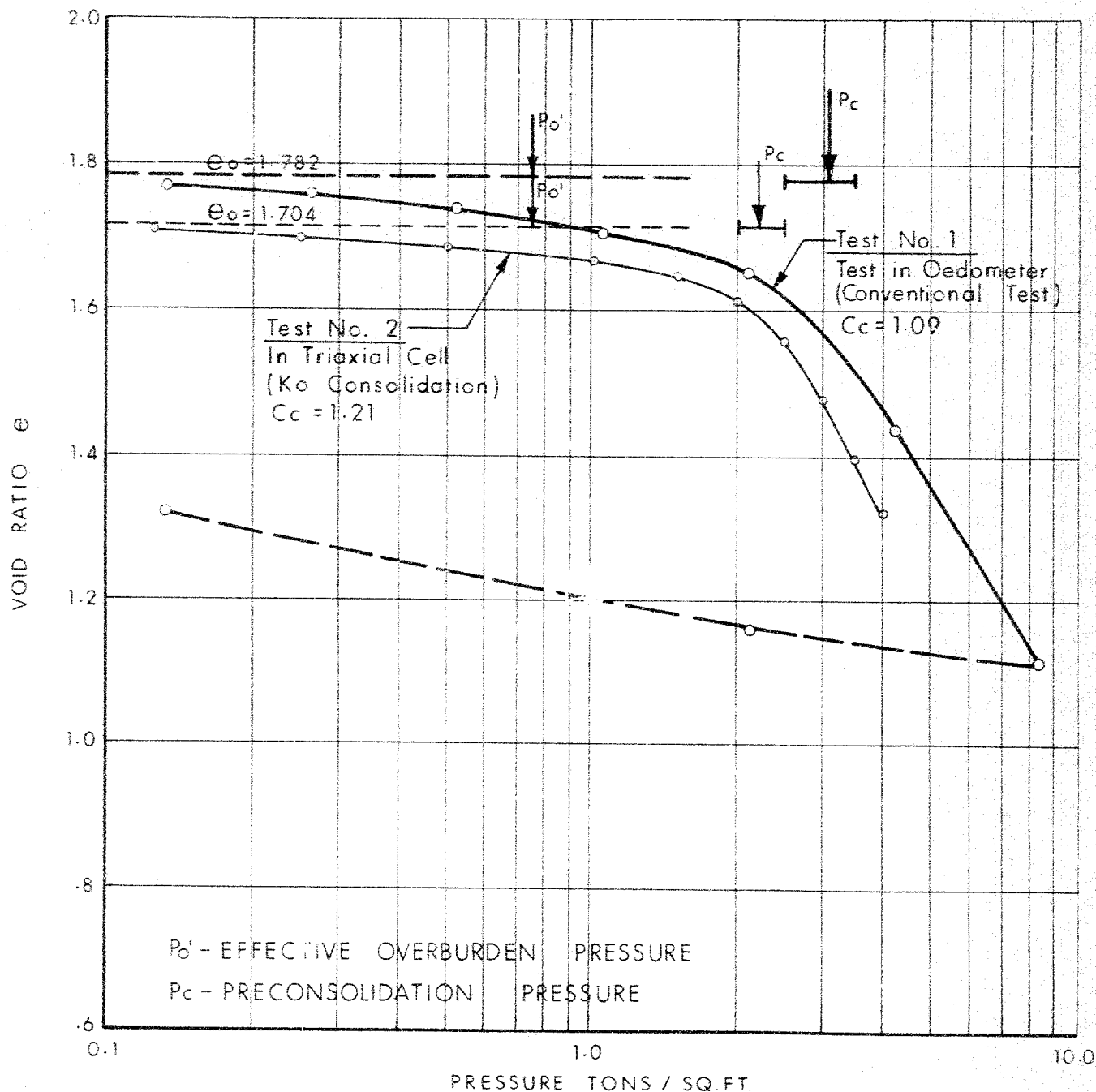


FIG. 5

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

Q _u	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	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
T_f	SHEAR STRENGTH
c	EFFECTIVE COHESION INTERCEPT
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_i	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

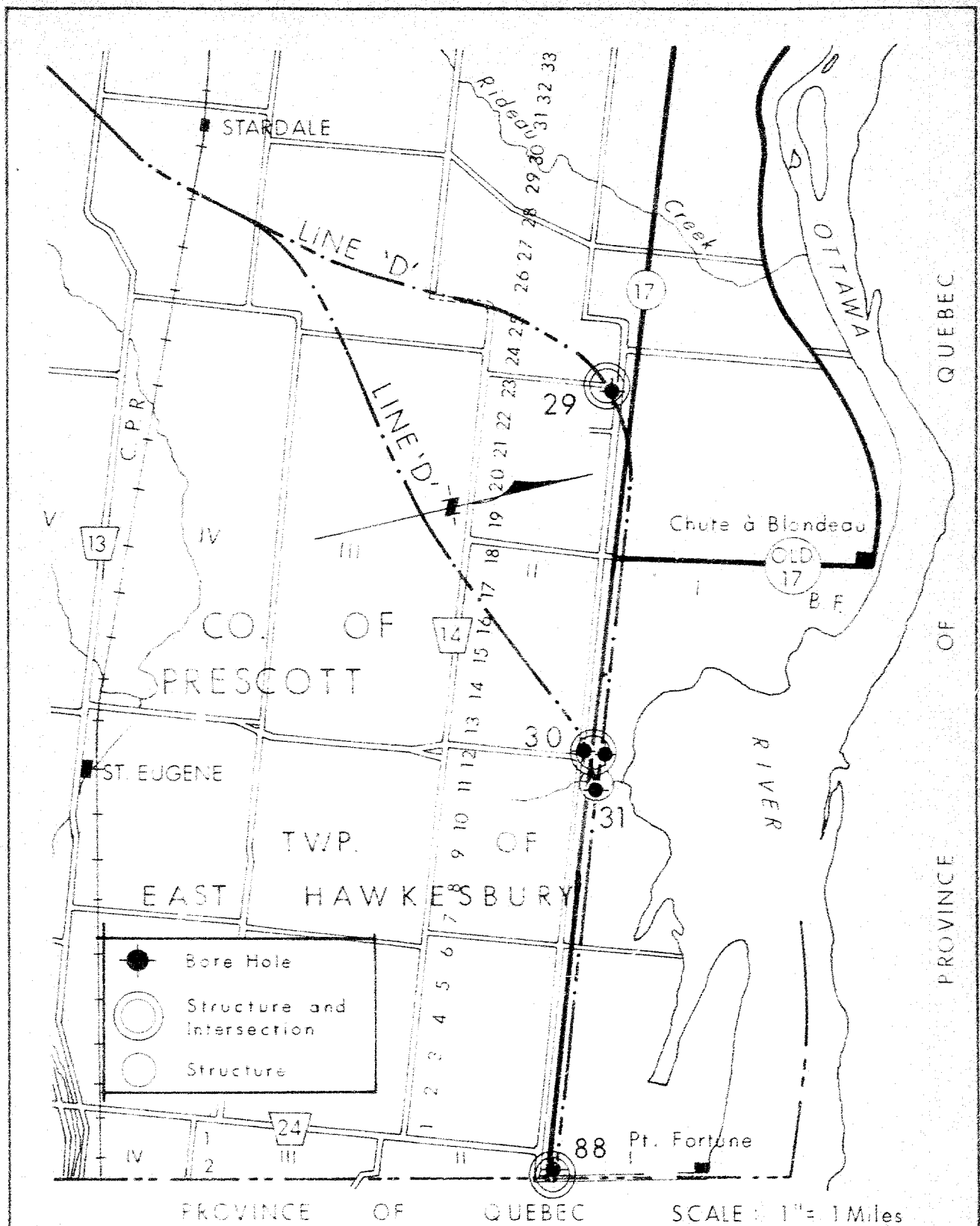
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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

SLOPES

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



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

ONTARIO

PRELIMINARY INVESTIGATION HWY. 417 LINE 'D'
SITES 29, 30, 31 & 88

(QUEBEC BOUNDARY WESTERLY)

HWY. 417

DIST. NO. 9

JOB. 68-F-91

DATE Feb. 17 1969

APPROVED

DRAWING NO. 68-F-91A

MEMORANDUM

TO: Mr. A. J. Percy,
Regional Manager of Systems Design,
KINGSTON, Ontario.

FROM: Materials and Testing Office,
KINGSTON, Ontario.

ATTENTION: Mr. H.R.B. McIntyre

DATE: March 12th, 1973

OUR FILE REF.

IN REPLY TO

68-F-91

SUBJECT: W.P. 37-66-04, Hwy. 417, B.C.P., from E. of Glasgow County Road 24
Easterly to Hwy. # 17, District # 9, Ottawa

In accordance with the discussions at the pre-contract review meeting on February 13th, 1973, the deep strength asphalt design applied to County Road # 13 has been reviewed over the south approach fills where considerable subsoil consolidation is anticipated after the fill loads are applied.

In view of the anticipated settlement between the structure and station 106±, it is recommended that the pavement design (7" asphalt over 9" granular 'A') be altered to 3" asphalt over 13" granular 'A'. This change will not affect the subgrade elevations. As the anticipated settlements and distortions are restored with asphalt, the required pavement design will be obtained.

It should be noted that some borrow fill may be required to restore the subgrade before the Granular 'A' is placed on this section. In this connection, the District may be able to advise on the allowance that should be made for restoration.

It is anticipated that the District will require the grading contractor to restore the subgrade over this area just prior to the acceptance of contract # 72-24.

A. M. Batten
A. M. Batten,
Senior Soils Supervisor

AMB/sgp

c. c. - J. E. Callaghan Att: J. Cruickshank
G. A. Wrong
A. G. Stermac ✓

MEMORANDUM

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

From: Functional Planning Office,
Kingston, Ontario.

ATTENTION:

DATE: December 10, 1968.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 35-66 to 37-66, Hwy. 417, Vars to Quebec Border,
District 9 - Ottawa

At a meeting on December 3rd, 1968, at this office with Mr. M. Devata and the Regional staff concerning the above projects, it was agreed that preliminary foundation information is required for the structure sites on the recommended corridor. This will assist this section in establishing the final alignment in detail.

Please accept this memo as our request to have the preliminary investigations carried out.

Mr. Devata advised that he would prefer to start the investigation at Vars immediately and proceed eastward to Casselman to complete as much as possible prior to the New Year. We are in agreement with this procedure and would suggest a schedule as follows, which is based on the present construction program.

- 1st Priority - Structure Sites 1 to 3 inclusive - 3 SITES
Structure Sites 79, 80 and 81 - 3
- 2nd Priority - Structure Sites 29, 30, 31 & 88 - 4
- 3rd Priority - Structure Sites 82 to 83 inclusive - 2
85 to 87 inclusive - 3
22 to 28 inclusive - 7

The site numbers referred to are shown on the mosaic which was forwarded to you on November 14th, 1968 with the exception of Site #88 which is at the intersection of Highway 17 and the County Road at the Quebec Border.

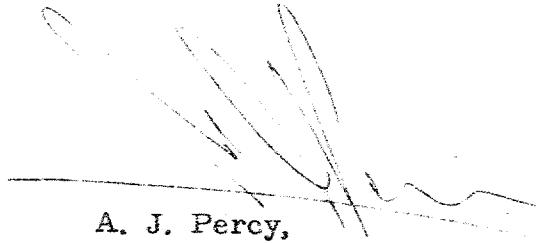
We have arranged to have Engineering Surveys stake out and tie in the structure sites with existing landmarks and establish assumed bench mark elevations for future reference.

W.J. 68-F-88
68-F-89
68-F-~~88~~90
68-F-~~88~~91

...../2

Mr. W. Hutton of your office was in this office on December 9th, 1968, at which time he was given a mosaic for his reference and introduced to Engineering Surveys staff working on the project.

We trust the above meets with your approval.

A handwritten signature in dark ink, appearing to read 'A. J. Percy', is written over a horizontal line.

A. J. Percy,
For: J. L. Forster,
Regional Functional Planning Engineer.

AJP/mjh
c. c.
S. J. Markiewicz
G. Scott
J. E. Gruspier
A. G. Boucher
L. Timson
H. A. Aron
K. M. Williams

DEPARTMENT OF HIGHWAYS ONTARIO
DESIGN BRANCH - ENGINEERING SURVEYS DIVISION
SURVEY REQUEST

Job Name VARS T. CASSELMAN COUNTY CAMBRIDGE

Hwy. No. 417 District #2 - OTTAWA Region KINGSTON

W.P. No. 32-66-01003 Work Schedule _____ Priority (If Not a W.P.) _____

Date DEC 9/68 Date of Previous Request (If Any) _____

Req'd. By [Signature] Title PLANNING Section ENV. FUNCTIONAL PLANNING

Future Design Standards

Hwy. Class No. _____ Design Speed _____ Median Width _____ R/W Width _____

Survey Information

Limits of Survey VICINITY VARS & CASSELMAN

Bridge Site Plans Req'd. At _____

Railway Crossing Plans Req'd. At _____

Pipe Line Crossing Plans Req'd. At _____

Instructions (Note Any Special Requirements or Drafting Instructions)

- ① STAKE OUT FUTURE STRUCTURE SITES #1, 2, 3, 4, 5, 6, 7, 8, 10 & 80 FOR PRELIMINARY FOUNDATION INVESTIGATION IN CO-OPERATION WITH FOUNDATION SECTION.
- ② TIE IN STRUCTURE SITES TO EXISTING LANDMARKS
- ③ SET UP ASSUMED BENCHMARKS TO TIE IN SITE ELEVATIONS FOR FUTURE CORRELATION WHEN GEODESIC B.M.'S ESTABLISHED.
- ④ ESTABLISH FOLLOWING INFORMATION FOR BRIDGE OFFICE:
 - (a) ROUGH PROFILE REPRESENTATIVE OF RIVER CHANNELS AT SITES #5, 7, 8 & 80
 - (b) REFERENCE B.M. ASSUMED AT SITE #4 WITH SITE #5
 - (c) A.M. AT SITE #6 WITH SITE #7 & 8
- ⑤ SITES SHOWN ON ACCOMPANYING AERIAL PHOTOS & MOSAIC
PLEASE RETURN AERIAL PHOTOS AS SOON AS POSSIBLE

December 12/68.

MEMO: TO FILES 68-F-~~86~~ 88
68-F-~~87~~ 89
68-F-~~88~~ 90
68-F-~~89~~ 91

RE PRELIMINARY FOUNDATION INVESTIGATIONS.
HWY. # 417 - 28 STRUCTURE SITES.

BECAUSE OF PHYSIOGRAPHIC AND GEOLOGIC
SIMILARITIES IT IS RECOMMENDED THAT THE
SITES BE SUB-DIVIDED INTO THE FOLLOWING
WORK PROJECT NOS.

- 1/ W.I. 68-F-~~86~~ 88 W.P. 35-66 SITES 1 to 8, inclusive
(VARS TO SOUTH NATION RIVER) 79 and 80
- 2/ W.I. 68-F-~~87~~ 89 W.P. 35-66 SITE 81
W.P. 37-66 SITES 82, 83, 84, 85, 86, 87
(SOUTH NATION RIVER EAST TO MC CRIMMON)
- 3/ W.I. 68-F-~~88~~ 90 W.P. 37-66 SITES 22 to 28, inclusive.
(MC CRIMMON EAST TO NEW HWY #17.)
- 4/ W.I. 68-F-~~89~~ 91 W.P. 36-66 SITES 29, 30, 31 and 88.
(ALONG NEW HWY #17 to QUEBEC BORDER)

B.T.D.