#68-F-65

W.P. 6-66

HWY. # 416

CROSSING C.P.R.

SOUTH GOWER TWP.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

Attn: Mr. S. McCombie

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

Date: Oct. 31, 1968

Our File Ref.

In reply to

NOV - 7 1968

Subject:

PRELIMINARY FOUNDATION INVESTIGATION
For The
Southbound and Northbound Lane
Overhead Structures at the Crossing
of Proposed Hwy.#416 (Alternate Align-
ments Line 'B' and 'C')and the C.P.R.
Township of South Gower, County Grenville
District No. 9 (Ottawa)

W.J. 68-F-65 --- W.P. 6-66

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 requitements. Should additional information be required, please do not hesitate to contact our office.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS:mt
Attach.

cc: Messrs. B.R.Davis (2)
H. A. Tregaskes
D. W. Farren
S. J. Markiewicz
C. R. Robertson
G. Scott
J. E. Gruspier
J. L. Forster
B. A. Singh

Foundation Files
General Files

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Overhead Structures At The Crossing
Of Proposed Hwy. #416 (Alternate Alignments
Line 'B' And 'C') And The C.P.R.

Township of South Gower, County of Grenville
District No. 9 (Ottawa)
J.J. 68-F-65 --- J.P. 6-66

1. INTRODUCTION:

The Foundation Section was requested to carry out a preliminary subsurface investigation at the above crossing, located some 5 miles north of the Town of Kemptville in the Township of South Gower. The request was contained in a memo from the Bridge Division (Mr. G. Scott, Regional Bridge Location Engineer, Eastern Region), dated July 23, 1968. An investigation was subsequently carried out by this Section to determine the subsoil conditions at two alternate alignments for Hwy. #416, designated Line 'B' and 'C'.

This report contains the results of the preliminary investigation, carried out at the two possible re-alignments together with recommendations pertaining to the foundations of the proposed structures and the stability of the approach embankments at each site. In addition recommendations are made with regard to which of the two alternatives would be the most suitable as far as foundation considerations are concerned.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The proposed alternate crossings, located adjacent to the Ottawa-Kemptville C.P.R. right-of-way, are about ¾ of a mile

cont'd. /2 ...

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

apart. The Rideau River is located about 1 mile to the west. Both sites, which are generally flat lying in relief, are remote from any county roads. In the vicinity of Hwy. #416, Line 'B', the terrain is heavily wooded; the surface drainage is poor and thus numerous wet and swampy areas are prevelent. The immediate area surrounding line 'C' of Hwy. #416 has been cleared, there is however an extensive swamp located on either side of the existing railway embankment.

The C.P.R. track is raised about 3 to 4 feet above the surrounding ground level. Shallow ditches run along both sides of the embankment so formed.

Physiographically the site is situated in the "Edwardsburg Sand Plain" region. In this region a surficial mantle of sand, up to 5 feet in thickness, generally overlies a significant depth of glacially deposited cohesive till. Occasionally silts and clays, deposited by the Champlain Sea during the post-glacial period following the Wisconsin Glacial Age, are sandwiched between the surficial sand and basal glacial till.

3. FIELD AND LABORATORY WORK:

Four cased boreholes (two on each of Lines 'B' and 'C'), each with an accompanying dynamic cone penetration test, were carried out during the course of the field investigation. The borings were advanced by diamond drill rigs adopted for

cont'd. /3 ...

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

soil sampling purposes. This information was supplemented by putting down 6 shallow sampled hand probe holes (4 on Line 'B' and 2 on Line 'C'); the main purpose of the hand probings was to define the lateral and vertical extent of the surficial organic layers present. The detailed borings, put down along Line 'B', are both located on the west side of the existing railway embankment. The east side is heavily wooded which would make access difficult. For this reason it was not deemed economically feasible to put down detailing borings on this side during this preliminary investigation; hand probings were put down in this area, however.

Samples of the cohesive strata, were obtained at required depths, in 2" I.D. shelby tubes, which were manually pushed into the soil. In an effort to reduce the degree of disturbance, some Shelby tubes were advanced using a piston technique. In addition, samples of the glacial till as well as occasional samples of the cohesive overburden were obtained using a 2" O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Field vane tests were carried out to determine the undrained shear strength of the cohesive strata. Bedrock was proven at both borings put down on Line 'C', by obtaining AXT size rock core samples.

The groundwater conditions at the sites were determined by installing one sealed piezometer at each site. This information was supplemented by recording the water level in the open

cont'd. /4 ...

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

boreholes at the remaining boring locations.

The locations and elevations of all the borings were surveyed in the field by personnel from the Kingston Regional Engineering Surveys Section and are shown on Drawings 68-F-65A (Line 'B') & 68-F-65B (Line 'C'), together with the estimated stratigraphical profile at the respective sites. The elevations given in the report for Lines 'B' & 'C' are referenced to arbritrary datums established on a benchmark at either site; the location of the benchmarks are shown on Drawings No. 68-F-65A and B.

All samples were visually examined and identified upon recovery and again in the laboratory. Following these examinations, laboratory testing was carried out on selected representative samples to determine the physical properties of the overburden, namely

Natural Moisture Contents

Bulk Densities

Atterberg Limits

Grain-Size Distributions

Organic Contents

Undrained Shear Strengths

Consolidation Characteristics

The results of these tests are plotted on the Record of Borelog sheets and summarized on Figures 2 to 10, inclusive, contained in Appendix I of this report.

cont'd. /5 ...

4. SUBSOIL CONDITIONS:

4.1) General:

The soil conditions across both sites consist generally of a surficial layer of fibrous peat followed by a clayey silt to silty clay stratum, which is underlain by a glacial till deposit composed of a heterogeneous mixture of clay, silt, sand and gravel. The glacial till is in turn underlain by shaly dolomite bedrock (Line 'C', Hwy. #416).

While the soil types encountered across both sites are generally similar there are marked differences in thickness and consistency (or relative density) of the various stratums and these are described in detail as follows.

4.2) Line 'B' (Refer to Drawing 68-F-65A)

This site is surficially covered with a soft black to brown fibrous peat ranging in thickness from 6 inches to 3 feet. At BH's #1 and 2 and Probe #5 the peat is underlain by a 2 to 2½ foot thick layer of loose brown to grey silty sand.

Underlying the surficial deposits of peat and silty sand is the predominant overburden stratum across the site, composed of a grey clayey silt to silty clay with a trace of sand; this stratum is of the order of 21 feet in thickness. Occasional thin (¼") silt seams were encountered throughout the stratum. Grain size distribution curves for samples of the cohesive material are shown on Figure #2 in the Appendix of this report.

Atterberg limit tests, carried out on the clayey stratum, are summarized on the Plasticity Chart Figure #4.

cont'd. /6 ...

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

4.2) Line 'B' (Refer to Drawing 68-F-65A)

This testing indicates that the plasticity of the stratum ranges from low to intermediate, with the corresponding natural water content generally at or slightly above the liquid limit. The undrained shear strength testing carried out on the clay stratum is plotted on Figure #5. This testing gave values which range from greater than 2,000 p.s.f., immediately below the surficial deposits, to as low as 400 p.s.f. with depth. Based on these results it is estimated that the consistency of the deposit ranges from very stiff, within a desiccated zone located immediately below the surficial deposits, to soft immediately above the glacial till.

The consolidation characteristics of the stratum were determined by carrying out a laboratory test, the results of which are plotted on Figure #6. Based on this testing it is estimated that the deposit is preconsolidated by about 1,200 p.s.f. in excess of the existing overburden pressure.

The clayey silt is underlain by a basically cohesive glacial till composed of a heterogeneous mixture of very stiff to hard clayey silt sand and gravel. This deposit was not fully penetrated by either of the borings put down, it was however, proven for depths in excess of 21 feet. Occasional boulders up to 2 feet in size were encountered throughout the deposit; it was often necessary to use diamond drilling techniques to advance the borings past such boulders. Typical grading curves for samples of the glacial till are shown on Figure #3.

cont'd. /7 ...

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

4.3) Line 'C': (See Drawing 68-F-65B)

The surficial cover, in the immediate vicinity of the existing railway embankment, is composed of soft black to brown fibrous peat varying from 2 to 14 feet in thickness. The approximate limits of this swampy area is shown on Drawing 68-F-65B.

As is the case at Line 'C' the peat is underlain by the clayey silt to silty clay stratum. The thickness of the stratum varies from 27 to 50 feet, being thinnest in the areas where the peat is encountered.

The physical properties of the stratum as determined by field and laboratory testing, are summarized on the following figues.

Plasticity Chart - Figure 7.

Undrained Shear Strength Profile - Figure 8.

Consolidation Characteristics - Figures 9 and 10.

The plasticity and consolidation characteristics are similar to those discussed in 4.2); the undrained shear strength profile is, however, significantly different. In general the undrained shear strength of the stratum ranges from 300 p.s.f. near the surface, increasing with depth to about 1,100 p.s.f. At. BH#7, located outside the limits of the swamp, the upper 6 feet of the stratum is desiccated; the undrained shear strength values in this zone are as high as 2,000 p.s.f. Based on these results it is estimated that the

cont'd. /8 ...

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

4.3) Line 'C': (See Drawing 68-F-65B) (cont'd.) ... consistency of the stratum varies from soft to stiff, while the desiccated zone at BH#7 is in the very stiff range.

The silty clay is in turn underlain by the very stiff to hard cohesive glacial till discussed in sub-section 4.2). The thickness of this deposit varies from 15 to 22 feet at the boring locations. The glacial till is in turn underlain by sound shaly dolomite bedrock at depths of between 60 and 65 feet below ground surface.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during the period of the investigation in i) sealed piezometers installed in BH#2 (Line 'B') and BH#8 (Line 'C') and ii) the open boreholes at the remaining locations. These observations indicate that the groundwater level is generally about 3 feet below ground surface. In the swampy areas in the vicinity of Line 'C' the water level is slightly higher, being about 1 to 2 feet below ground level.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General

It is proposed to construct twin parallel overhead structures to carry the N.B.L. and S.B.L. of Hwy. #416 over the C.P.R. tracks. Two possible alignments are being considered, namely Line 'B' and 'C'. At this stage the details of the

cont'd. /9 ...

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

6.1) General: (cont'd.) ...

proposed structures have not been specified. It is known, however, that the structures will be of the order of 36 feet in width accommodating two 12 foot wide paved lanes. Further, the associated approach embankments may extend as high as 30 feet above the existing ground surface.

Similar stratigraphy was encountered along either alignment. The surficial cover is composed of peat, which is underlain by a soft compressible clayey silt to silty clay stratum. The clayey stratum is in turn underlain by a competent glacial till followed by sound shaly dolomite bedrock. The thickness of the peat and clayey silt complex is greater in the vicinity of Line 'C' than at Line 'B'.

The presence of a soft and compressible cohesive stratum at a relatively shallow depth requires that steps must be taken to ensure overall stability of the approach embankments, and that the structure must be supported on piled foundations.

It will be necessary to carry out additional borings in the field when the final design details are available. Recommendations given in this report are, therefore, to be regarded as conditional only, and as such, are subject to revision at a later date when and if new information becomes available.

cont'd. /10 ...

6. DISCUSSION AND RECOMMENDATIONS:

6.2) Stability and Settlement Considerations - Approach Embankments.

The organic material, beneath the proposed embankments should be sub-excavated and disposed of prior to placing fill, in accordance with current D.H.O. specifications. The sub-excavation so formed should be backfilled with suitable granular fill.

The stability of the embankment sections was assessed, in terms of total stresses, both manually and by the use of the electronic computer. In addition, analyses were carried out to estimate the consolidation settlement induced in the compressible clayey silt stratum by the embankment surcharge loading. The results of these analyses, carried out for the embankments proposed at Lines 'B' and 'C', are shown on Figure #1, in the Appendix. A brief resume for each alignment follows:

The assumptions made in the stability computations, carried out at either site, are summarized on Figure #1. The results of the computations are presented in the following table.

cont'd. /11 ...

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

6.2) Stability and Settlement Considerations - Approach Embankments.

LINE 'B'		LINE 'C'	
Max. H± of Fill 'H' (ft.)	*Length of Berm 'L' (ft.)	Max. H± of Fill 'H' (ft.)	*Length of Berm 'L' (ft.)
15	NIL	11	NIL
20	45	15	30
25	65	20	48
30	80	22	55

Note:
Double berms required for H > 22 feet, H=30' requires twin 55' Long Berms.

From the above table it can be seen that berms are required for fills in excess of 15 and 11 feet at the Line 'B' and Line 'C' crossing, respectively. If fills higher than this are employed the span of the structure will have to be increased over that proposed to accommodate the berm requirements in the longitudinal direction. Consideration should, therefore, be given to limiting the fill heights.

A graph showing the predicted consolidation settlement under various heights of fill is also shown on Figure #1. Typical results are given in the following table.

* Single Berm at mid-height unless otherwise noted.

cont'd. /12 ...

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

6.2) Stability and Settlement Considerations - Approach Embankments.

Period Following Construction	Settlement 'S' (Inches)			
	LINE 'B'		LINE 'C'	
	'H'=15 ft.	'H'=30 ft.	'H'=15 ft.	'H'=30 ft.
6 months	3"	15"	2"	13"
1 year	4"	21"	3"	20"
2 years	5"	27"	4"	27"
5 years	(Total consolidation) (settlement within 2) (years)		6" (Total consolidation) (settlement within 5) (years)	40"

Based on the above table it can be seen that the consolidation settlement will take place at a relatively rapid rate. Therefore, if scheduling allows, it would be advantageous to construct the embankments prior to installation of the structures, particularly if the higher heights of fill are adopted.

6.3) Structure Foundations:

Because of the soft and compressible nature of the subsoil, the structure piers and abutments at either site should be supported on end-bearing piles driven to practical refusal in the competent glacial till deposit. For estimating purposes, for instance, if a 12BP74 steel H-pile is driven to the following tip elevations

LINE 'B' - elevation 460

LINE 'C' - elevation 540

it may be designed for a safe load of 90 tons/pile.

cont'd. /13 ...

6. [illegible] (cont'd.) ...

6.3 Structure Foundations:

All organic material located within the plan limits of pier footings should be sub-excavated and the excavation so formed backfilled with granular fill, as discussed previously. No major dewatering problems are anticipated during construction of the pier footings.

7. SUMMARY:

A preliminary foundation investigation for the overhead structures at two alternate crossings of Hwy. #416 and the existing C.P.R. (Line 'B' and 'C'), in the township of South Gower, County of Grenville, is reported.

The subsoil across both sites consists generally of a surficial layer of peat underlain by a soft compressible clayey silt to silty clay stratum, which in turn is underlain by a competent glacial till followed by dolomitic limestone bedrock. The thickness of the peat and compressible clayey silt is greater along Line 'C'. The groundwater level is within 2 to 3 feet of existing ground surface at both sites.

Stability computations carried out indicate that berms will be required for fills in excess of 15 and 11 feet at Line 'B' and 'C', respectively. Consolidation settlement will be induced in the compressible foundation subsoil due to the embankment loading. The magnitude of this settlement will be larger at Line 'C', for any given fill height.

cont'd. /14 ...

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

The structures will have to be supported on end-bearing piles driven to practical refusal in the competent glacial till, as discussed in the report. No major dewatering problems are anticipated for the pier footing excavations.

From a foundation point of view Line 'B' would be the most suitable alignment for the following reasons:

a) the thickness of the surficial fibrous peat is significantly less, and thus the sub-excavation required will be less.

b) the compressible stratum is more competent and thus the berms required, for any given height of fill, are shorter; in addition the predicted settlements are less.

8. MISCELLANEOUS:

The field work, performed between August 26 and 30, 1968, was supervised by Mr. W. Hutton, Project Foundation Engineer. This report was written by Mr. Hutton and Mr. B.T. Darch, Senior Foundation Engineer.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

The equipment used was provided and operated by the F. E. Johnston Drilling Company Limited.

October 1968

APPENDIX I

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

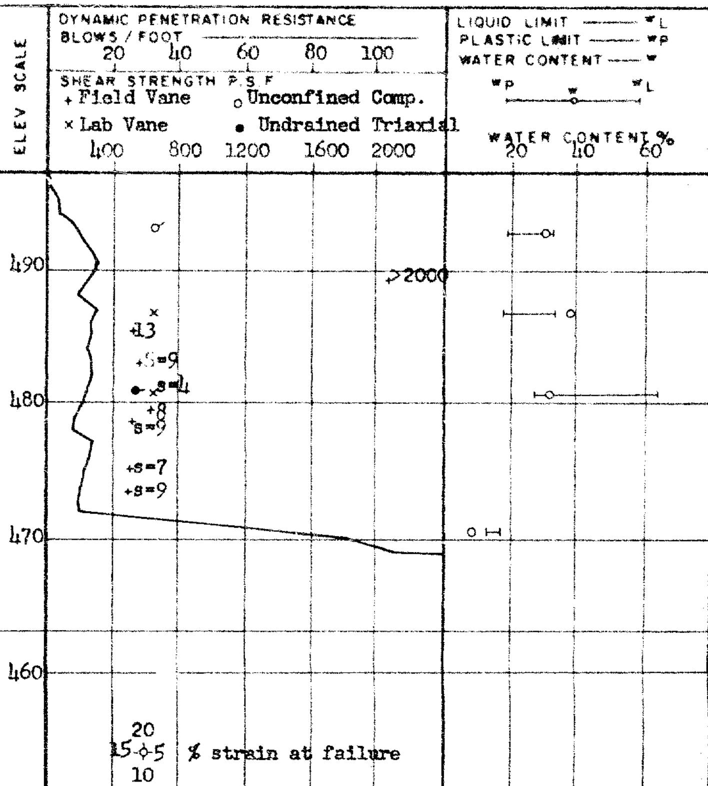
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1 Line 'B'

FOUNDATION SECTION

JOB	68-F-65	LOCATION	Sta. 100 + 77 ℄ Line B o/s 5' Lt.	ORIGINATED BY	WH
W.P.	6-66	BORING DATE	August 22, 1968	COMPILED BY	TC
DATUM	Assumed	BOREHOLE TYPE	Diamond Drill - Washboring	CHECKED BY	[signature]

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	BULK DENSITY γ P.C.F.	REMARKS Gr.Sa.Si.Cl
497.0	Ground Level						
496.0 / 1.0	Peat Soft Dark Brown						
494.0	Silty sand. Loose. Grey		1	SS	5		▼ 495.
3.0	Clayey silt to clay with trace of sand. Occ. thin (¼") silt seams throughout. Firm Grey		2	TW	PM	123	0 2 70 28
			3	TW	PM		
			4	TW	PM	111	
			5	TW	PM		
			6	TW	PM	94	
			7	TW	PM		
472.0 / 25.0	Glacial Till Het. mix. of clay, silt, sand & gravel. occ. boulders up to 16" in diam. Hard or Dense to very dense. Grey.		8	SS	40		29 21 45 5
			9	BX RC	47% Rec		
			10	SS	52		
463.0 / 34.0	End of Borehole		11	BX RC	46% Rec		
			12	SS	35/0"		



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 68-F-65 LOCATION Sta. 102 + 40 ℄ Hwy. 416 Line B ORIGINATED BY WH

W.P. 6-66 BORING DATE August 27, 1968 COMPILED BY TC

DATUM Assumed BOREHOLE TYPE Diamond Drill - Washboring CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE
498.2	Ground Level					
	Peat, Soft, Black					
0.5 / 495.2	Silty sand. Loose. Light brown.					
3.0	Clayey silt to silty clay with trace of sand, occ. thin (¼") silt seams throughout. Stiff to soft. Grey		1	TW	PM	490
			2	TW	PM	
			3	SS	4	
			4	TW	PM	
			5	TW	PM	
			6	TW	PM	480
			7	TW	PM	
473.9						
24.3	Glacial Till Het. mixture of clay, silt, sand & gravel with occ. boulders up to 2' in diam. throughout. Hard or dense to very dense. Grey.		8	SS	42	470
			9	RC	100%	
			10	RC		
			11	SS	114	
			12	RC	16%	
			13	RC	8%	
			14	RC	BX	
			15	SS	171	
			16	BX RC	5%	460
			17	SS	115	
453.2			18	BX T	5%	
			19	SS	109	
45.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P S F + Field Vane ○ Unconfined × Lab Vane ● Undrained Triaxial 400 800 1200 1600 2000

+3.0 ×s=3 +7.0 +s=11 +8.0 +4.0 +6.0 +9.0 + 2000

LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w w_P w w_L

WATER CONTENT % 20 40 60

BULK DENSITY P C F	REMARKS
	Gr. Sa. Si. Cl
117	▼ 495.4
	0 1 (99)
	Org. 1.2%
100	
101.5	0 1 36 65
	12 30 49 9
	Piez. Tip El. 454.2

20 15 10 5 % axial strain at failure

66-4546

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO 3, 4, 5 & 6 (PROBES) FOUNDATION SECTION

JOB 68-F-65 LOCATION Sta. 100 + 20 ℄ Line 'B' ORIGINATED BY WH

W P 6-66 BORING DATE August 29, 1968 COMPILED BY WH

DATUM Assumed BOREHOLE TYPE Manual CHECKED BY

SOIL PROFILE ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100 / SHEAR STRENGTH PSF + Field Vane 400 800 1200 1600 2000	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % 20 40 60	BULK DENSITY γ PCF	REMARKS
495.5	Ground Level									Gr.Sa.Si.Cl
0.0	Peat Firm Black						+3.0			
1.5	End of Probe #3					490				
							PROBE # 4 STA. 99+00 ℄ Line 'B'			
497.5	Ground Level									
495.5	Peat Firm Black						+4.0			▼ 496.0
2.0	Clayey silt with some sand, Occ.silt seams		1	SS	PM		+s=4			
493.0	stiff. Grey.		2	SS	PM					
4.5	End of Probe #4					490				
							PROBE #5 STA. 98+00 ℄ Line 'B'			
497.0	Ground Level									
494.7	Peat Soft Black		1	SS	PM		+3.5	49.6%		Org.75.5%
2.3	Silty sand. Grey.		2	CS						0 63 36 1
3.0	Endof Probe #5									
							PROBE #6 STA. 97+00 ℄ Line "B"			
497.0										
0.0	Peat Soft Black		1	SS	PM		+s=3			
	Clayey silt,Firm.Grey		2	SS	PM		+s=2 +s=3			
3.3	End of Probe #6					490				

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 7 Line 'C'

FOUNDATION SECTION

JOB 68-F-65 | LOCATION Sta. 198 + 50 ℄ Hwy. 416 Line C o/s 50' Lt. | ORIGINATED BY TC
W.P 6-66 | BORING DATE August 26, 1968 | COMPILED BY TC
DATUM Assumed | BOREHOLE TYPE Diamond Drill - Washboring | CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE
599.4	Ground Level					
0.0	Clayey silt to silty clay with occ. thin (½") silt seams and organic inclusions throughout.		1	CS		
			2	TW	PM	
			3	SS	PM	
			4	TW	PM	590
			5	SS	PM	
			6	TW	PM	
			7	SS	PM	580
	Very stiff to firm.		8	TW	PM	
	Brown to grey.		9	SS	PM	570
			10	TW	PM	
			11	SS	PM	560
			12	TW	PM	
549.7						
49.7	Glacial Till Het mix. of clay, silt, sand & gravel. Very stiff to hard or Dense to very dense. Grey		13	SS	27	550
			14	SS	102/8"	
			15	SS	100/4"	540
535.2						
64.2	Shaley dolomite bedrock		16	AXT RC	76% Rec.	
529.8	Sound Grey					530
69.6	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 20 40 60 80 100

SHEAR STRENGTH P S F
+ Field Vane - Unconfined Comp.
× Lab Vane • Undrained Triaxial
400 800 1200 1600 2000

+4.5 +2000 ×s=3 +5.0 +s=6 +7.5 +4.5 +6.0 +8.0 +7.0 +s=10 +s=6 +s=6 +8.0 +8.0 +s=8 +s=6 +4.0 +3.0

LIQUID LIMIT ——— w_L
PLASTIC LIMIT ——— w_P
WATER CONTENT ——— w
w_P w w_L
WATER CONTENT % 20 40 60

BULK DENSITY γ P C F	REMARKS
116	Gr.Sa.Si.Cl
114.5	Org. content 0.5%
110.5	
104.5	
113.5	Org.content 0.9%
107	
	45 40 11 4

20
15 ◇ 5 % strain at failure
10

FORM DB-MT-126
66-454p

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 8 Line 'C'

FOUNDATION SECTION

JOB 68-F-65 LOCATION Sta. 201 + 30 Ø Hwy. 416 Line C o/s 50' Rt. ORIGINATED BY TC
W.P. 6-66 BORING DATE August 27, 1968 COMPILED BY TC
DATUM Assumed BOREHOLE TYPE Diamond Drill - Washboring CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE
596.8	Ground Level					
0.0	Peat		1	CS		
	Very soft to soft		2	SS	PM	590
	Black		3	SS	PM	
586.3						
10.5	Clayey silt to silty clay with occ. thin ½" silt seams and organic inclusions throughout.		4	TW	PM	
			5	SS	PM	580
			6A	SS	PM	
	Soft to stiff.		7	TW	PM	570
	Grey		8A	SS	PM	
558.8			9A	SS	PM	560
38.0	Glacial Till		10	SS	34	
	Het. mixture of clay, silt, sand & gravel.		11	SS	49	550
	Hard or dense to very dense.		12	SS	132	
	Grey.		13	SS	60/2"	540
536.6			14	SS	100/2"	
60.2	Shaley dolomite Bedrock		15	AXT RC	61% Rec	
531.2	Sound Grey					
65.6	End of Borehole					530

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT
20 40 60 80 100

SHEAR STRENGTH P S F
+ Field Vane ○ Unconfined
× Lab Vane ● Undrained Triaxial
400 800 1200 1600 2000

+S=3
+S=3
+S=6
+4.0
+S=5
+S=8
+S=13
+15.0
+S=23
+5.0
.0

LIQUID LIMIT ——— wL
PLASTIC LIMIT ——— wP
WATER CONTENT ——— w
wP w wL
WATER CONTENT %
20 40 60

297%

BULK DENSITY
γ PCF

100

REMARKS
Gr.Sa.Si.Cl

▼ 594.0

Org. Content 26.7%

0 2 58 40

11 19 60 10

Piez. Tip El. 535.

20
15 ◇ 5 % strain at failure
10

FORM DB-MT-126
66-4548

OFFICE REPORT ON SOIL EXPLORATION

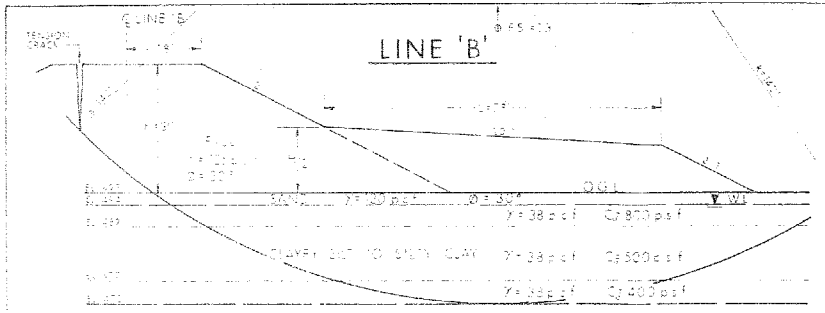
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 9 & 10 (PROBES)

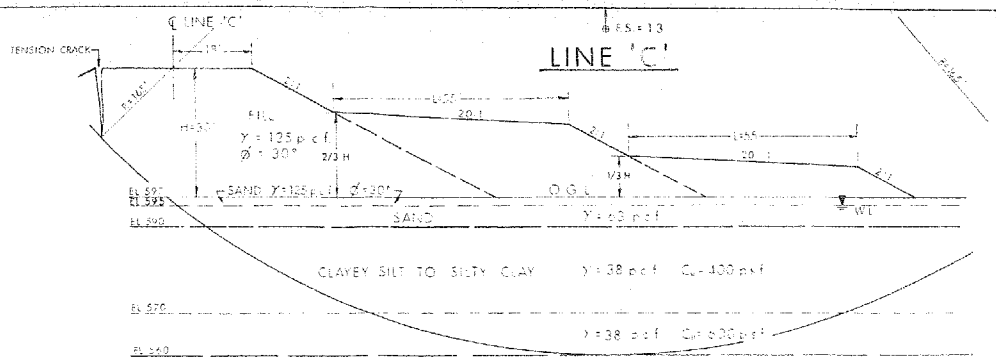
FOUNDATION SECTION

JOB 68-F-65 LOCATION Sta. 200 + 40 ℄ Line 'C' o/s 50' Lt. ORIGINATED BY WH
W P 6-66 BORING DATE August 30,1968 COMPILED BY TC
DATUM Assumed BOREHOLE TYPE Probe CHECKED BY

SOIL PROFILE ELEV. DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT / SHEAR STRENGTH P S F + Field Vane (400 800 1200 1600 2000)	LIQUID LIMIT w_L / PLASTIC LIMIT w_p / WATER CONTENT w (WATER CONTENT % 20 40 60)	BULK DENSITY γ PCF	REMARKS
597.3	Ground Level									
595.5	Peat Soft Black		1	SS	PM		+3.0 +4.0	o		0 17 61 22
1.8 2.3	~~Silty sand to clayey~~ silt. Stiff Grey		2	SS	PM					
	End of Probe					590				
							PROBE #10 STA. 199+20 ℄ Line 'C' o/s 50' Rt.			
596.8	Ground Level									
0.0	Peat		1	SS	PM		+s=4			Org. Content
			2	SS	PM		+s=3.0 +s=2.0	34% o		69.5%
	Soft to stiff		3	SS	PM		+s=2	44.2% c		67.4%
	Black to Brown		4	SS	PM	590	+2.0 +s=3			60.9%
586.8	Clayey silt to silt.		5	SS	PM		+2.0			
584.8	Grey.		6	SS	PM			o		
12.0	End of Probe					580				

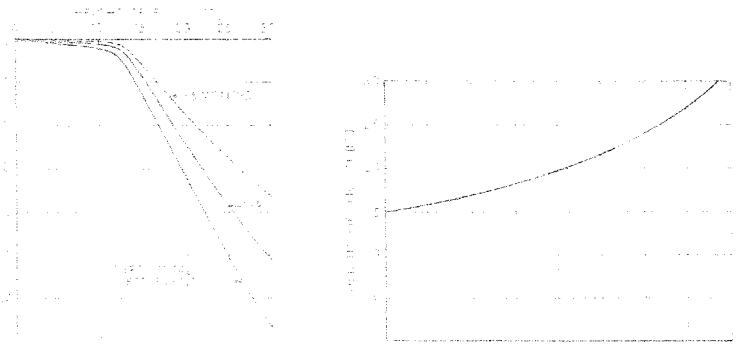


TRANSVERSE SECTION



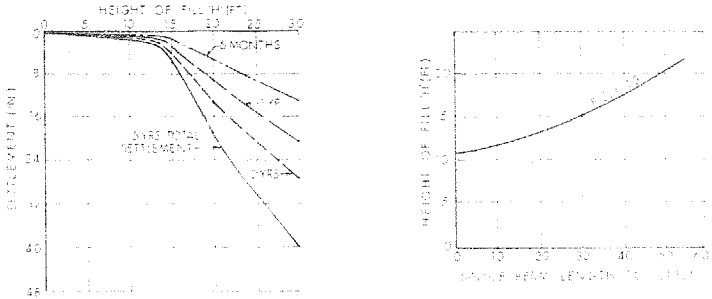
TRANSVERSE SECTION

NOTE
DOUBLE BERMS REQUIRED FOR FILL HEIGHT IN EXCESS OF 22 FT. FOR A 30 FT. FILL TWIN BERMS KEPT IN LENGTH OF 20 FT.



TIME RATE OF SETTLEMENT

BERM REQUIREMENTS

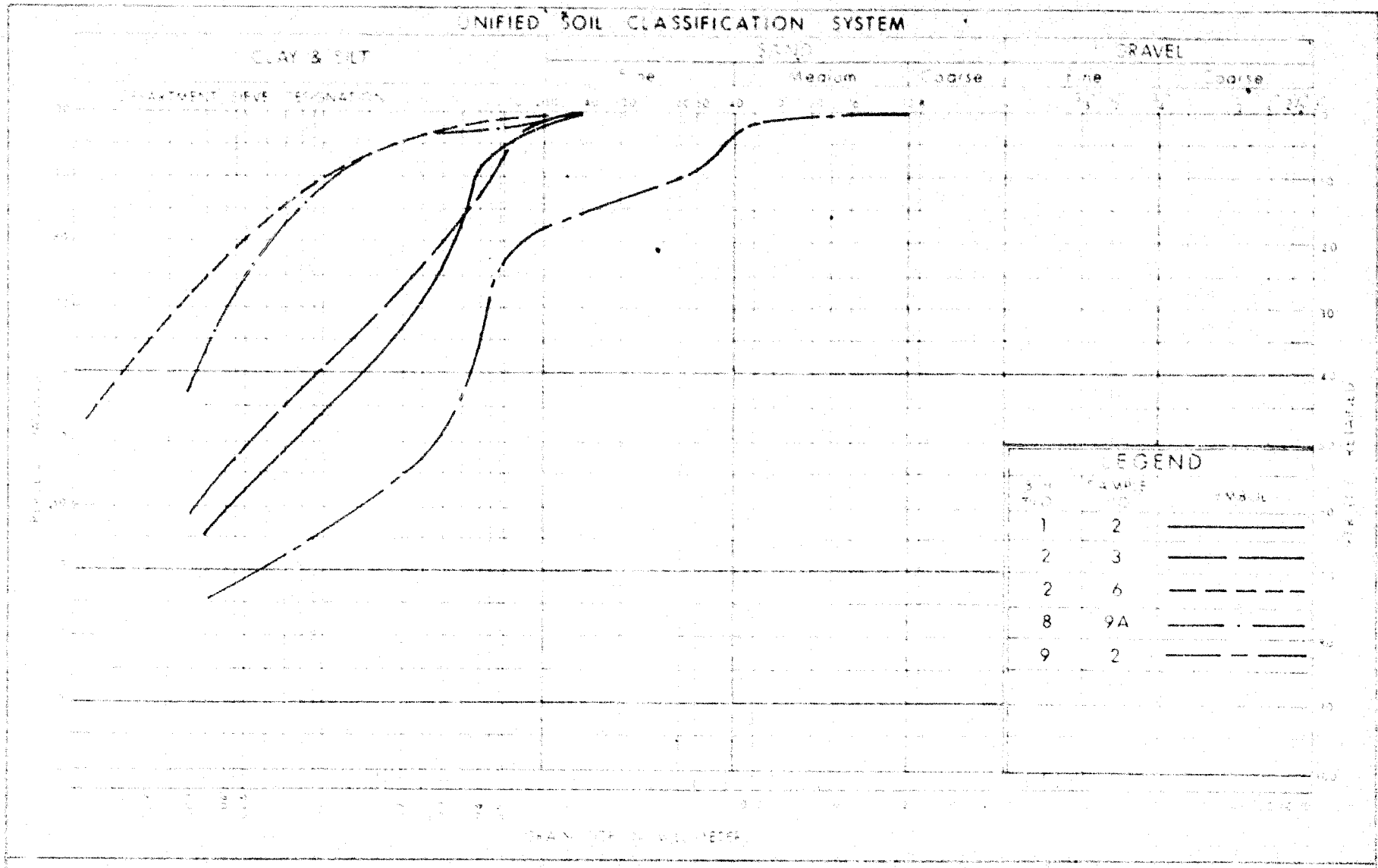


TIME RATE OF SETTLEMENT

BERM REQUIREMENTS

MATERIALS TESTING DIVISION

SUMMARIZED RESULTS OF
STABILITY & SETTLEMENT ANALYSES

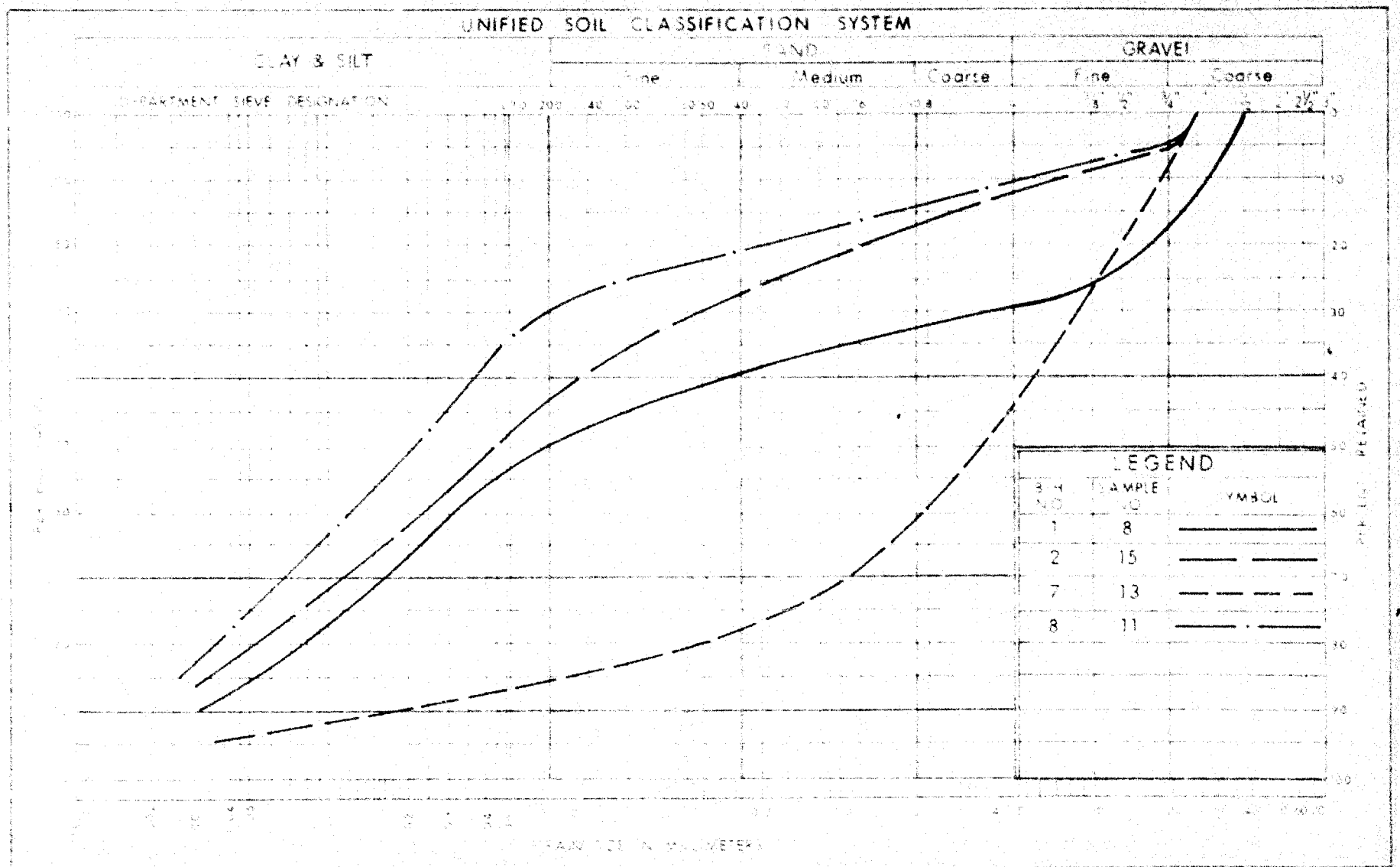


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION
CLAYEY SILT TO SILTY CLAY

DATE 6-66
JOB No 68-F-65
FIG 2

FORM 08 M7 - 17
REV APR 1965

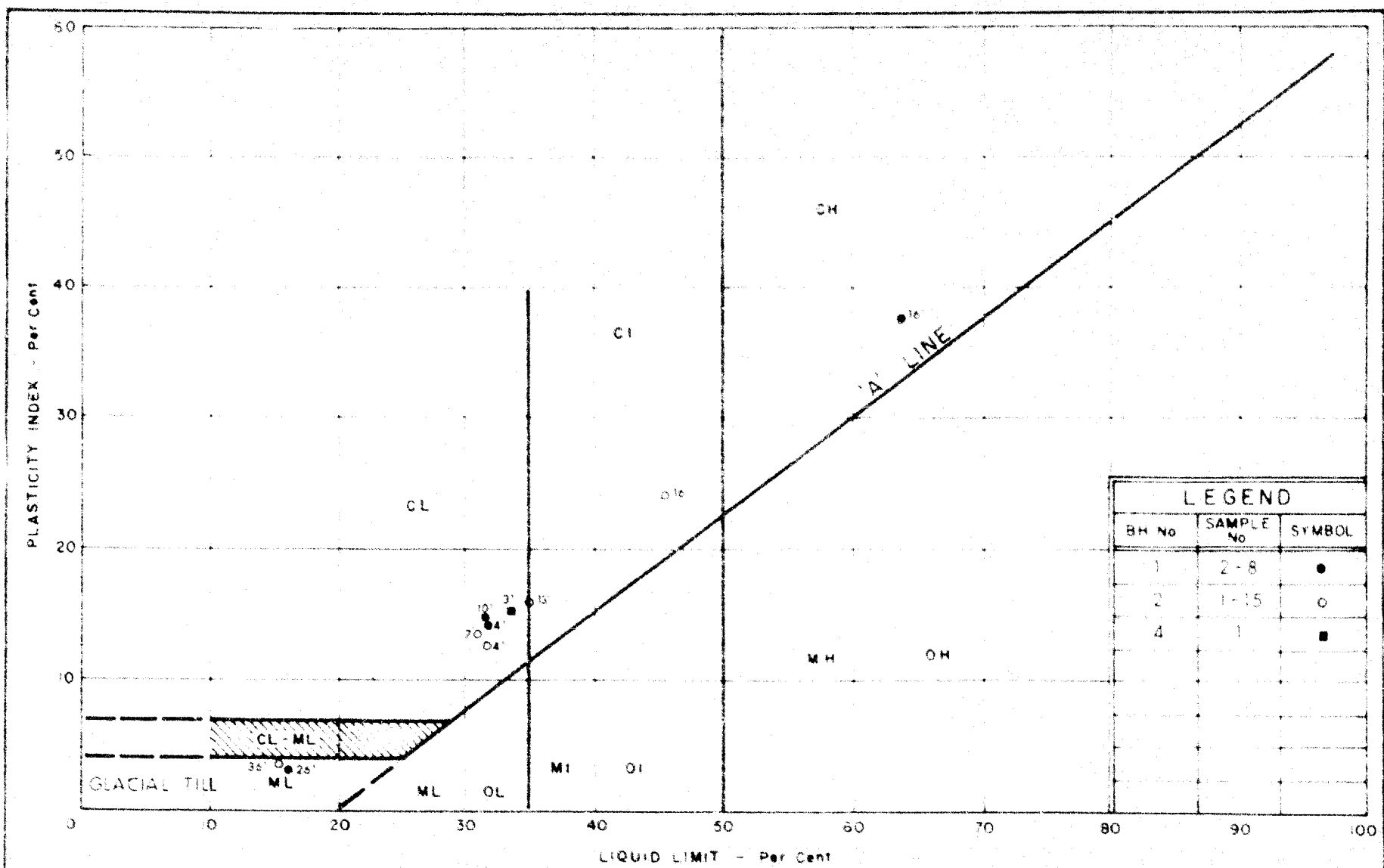


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION
HET. MIXTURE OF CLAY, SILT, SAND & GRAVEL (GLACIAL TILL)

M.P. No.	6-66
JOB No.	68-F-65
	FIG 3

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

WP No. 6 - 66

JOB No. 68 - F - 65 LINE 'B'

FIG 4

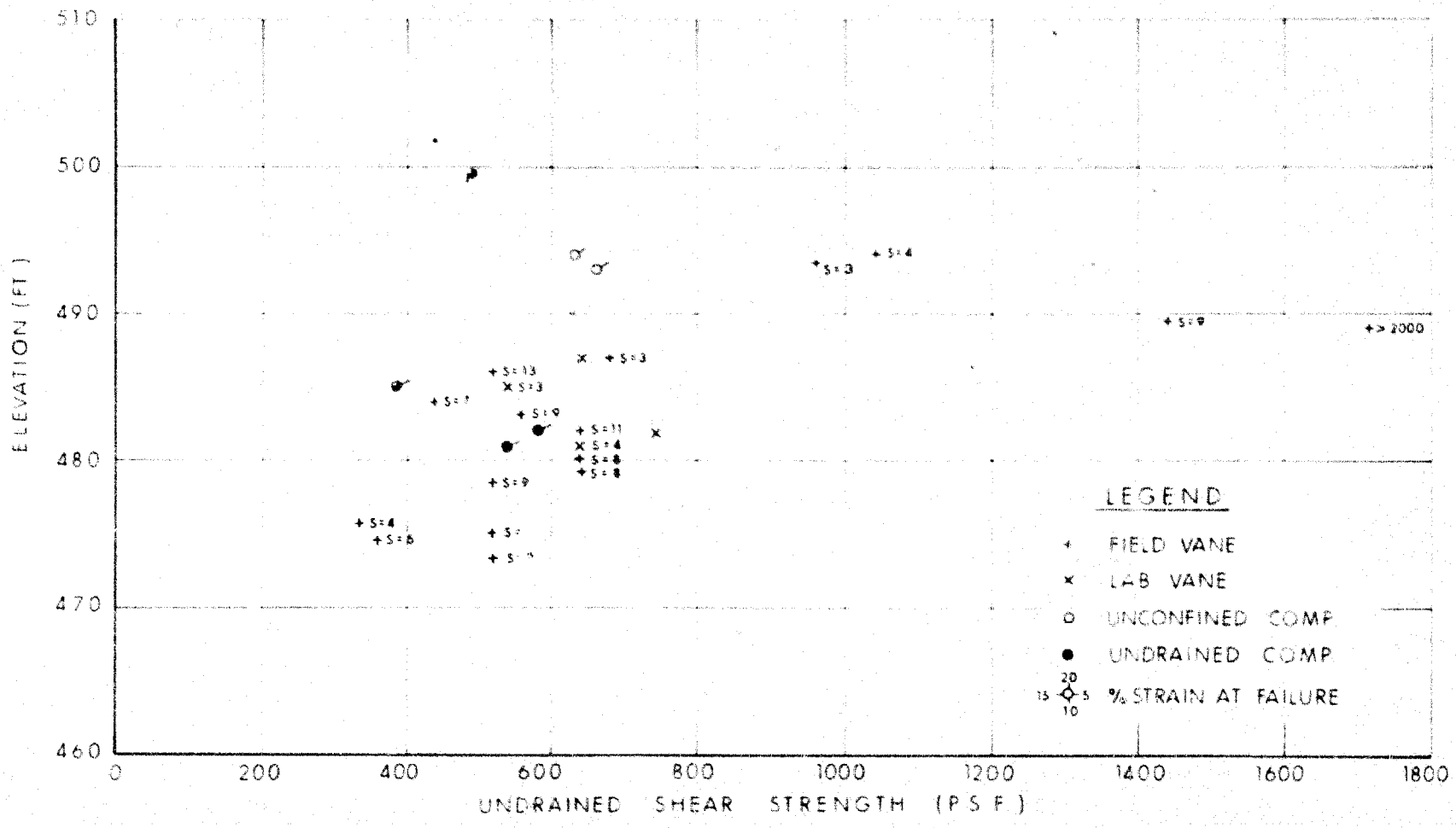


FIG 5

VOID RATIO vs PRESSURE

W_L = 45·0 %
W_P = 21·0 %
W = 28·3 %
C_c = 0·88

BORE HOLE 2
SAMPLE 6
DEPTH 16'-3"
ELEV. 482·0

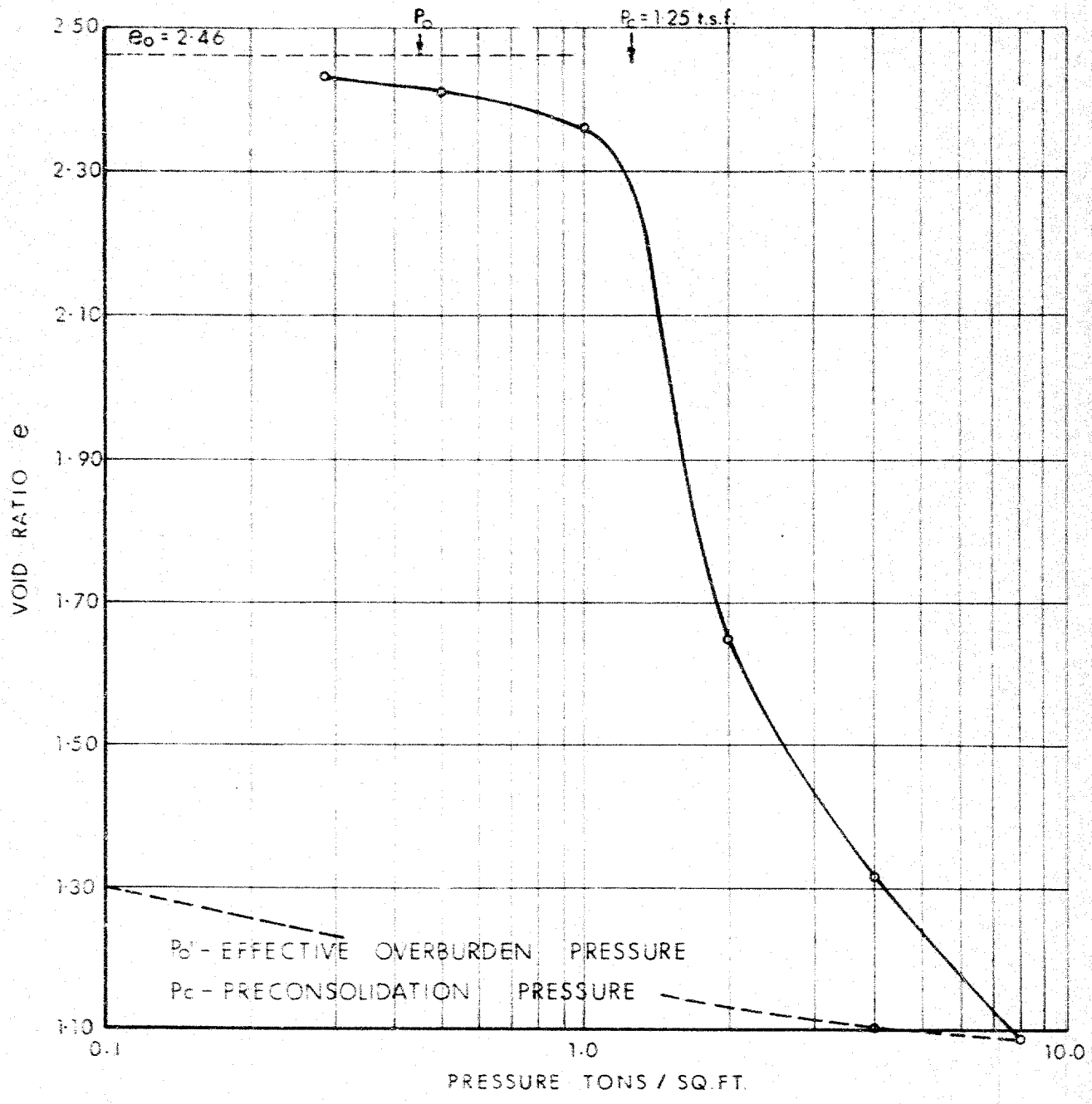
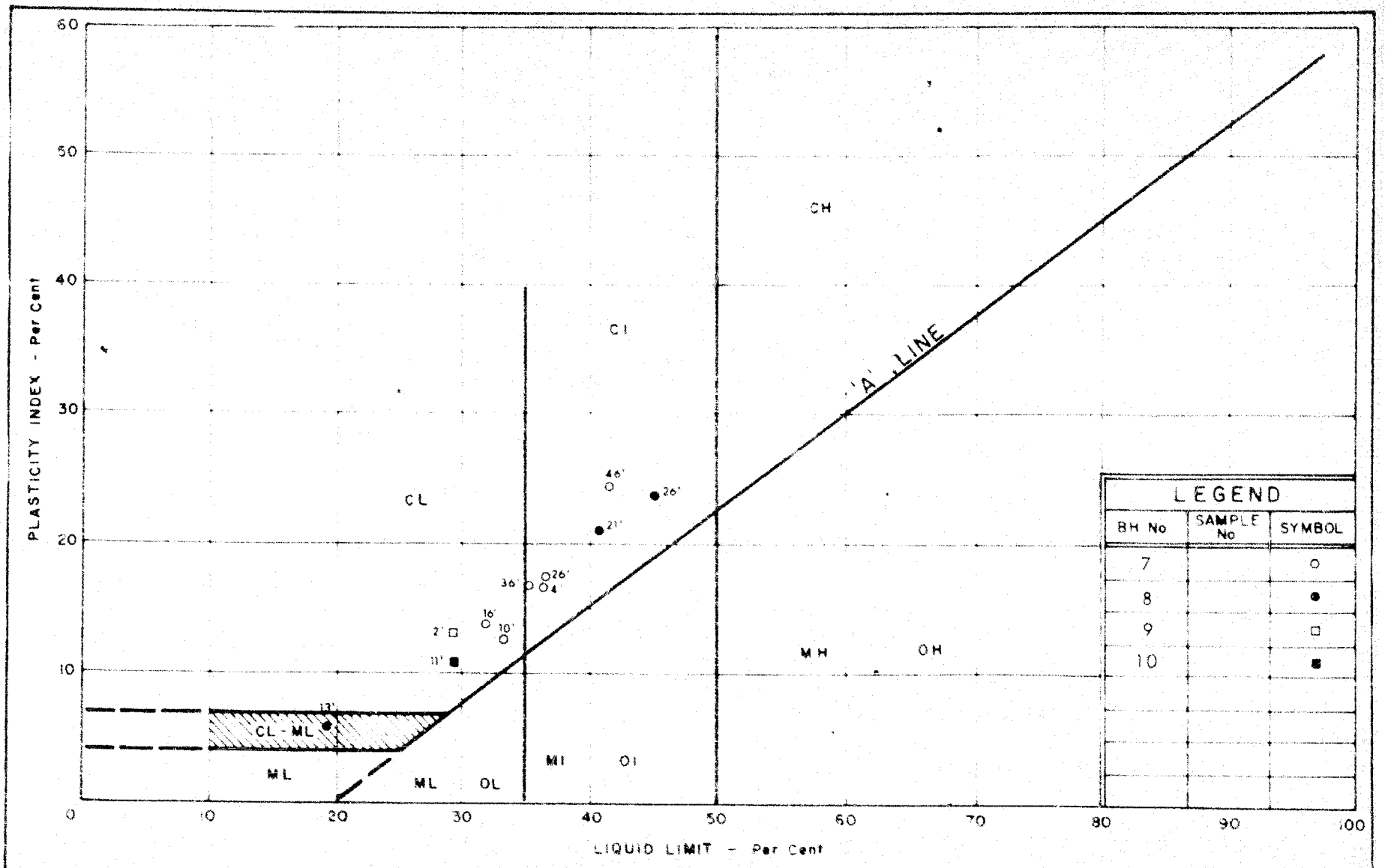


FIG. 6

FORM 08-MT-52
REVISED JULY, 1966



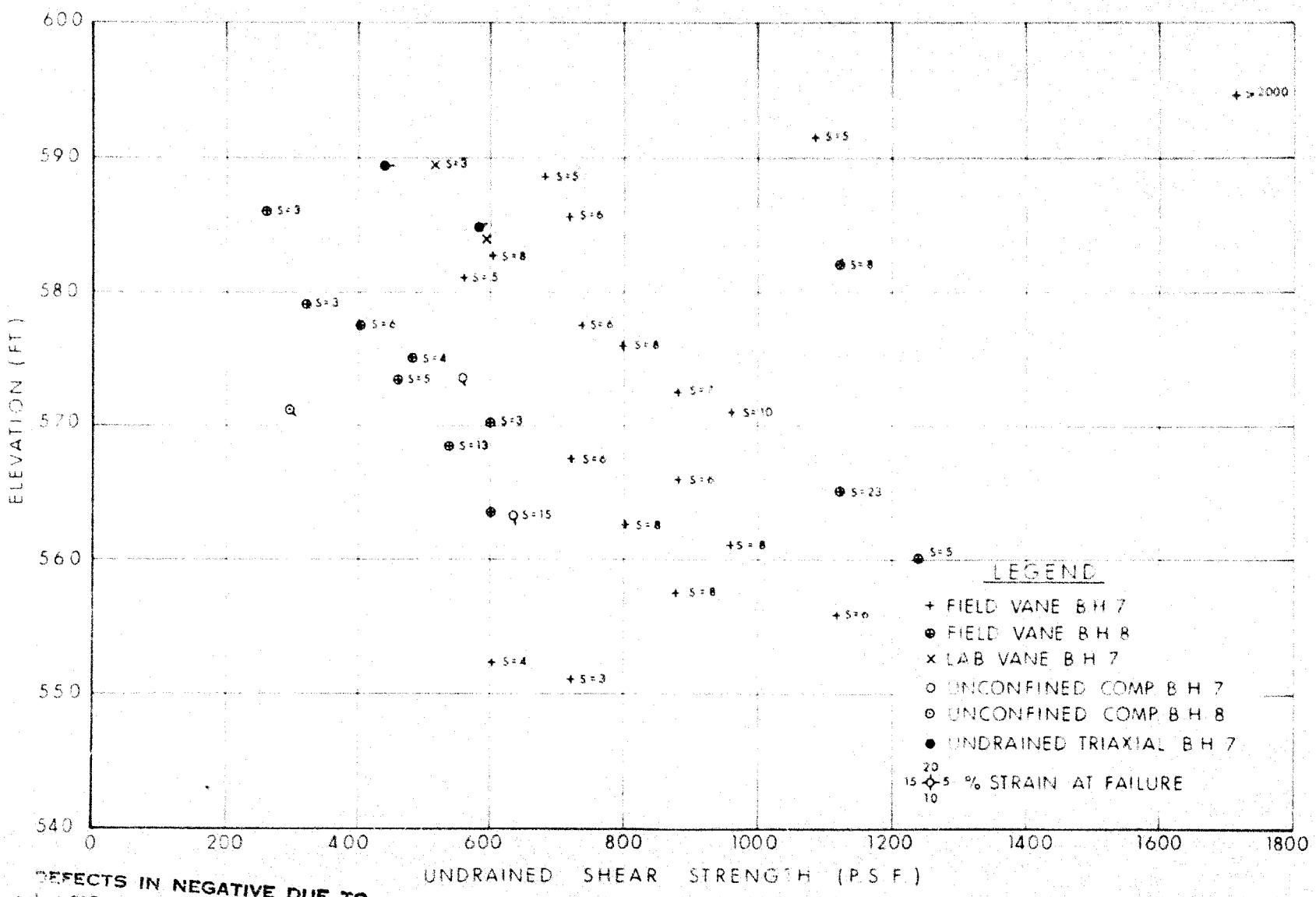
DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART

DEFECTS IN NEGATIVE DUE TO
REPRODUCTION OF ORIGINAL DOCUMENT

W.P. No. 6-66
JOB No. 68-F-65 LINE 'C'
FIG. 7

UNDRAINED SHEAR STRENGTH vs ELEVATION



DEFECTS IN NEGATIVE DUE TO
...TION OF ORIGINAL DOCUMENT

FIG. 8

68-F-65 LINE 'C'

VOID RATIO vs PRESSURE

W_L = 32·0 %
W_P = 18·3 %
W = 48·5 %
C_c = 0·787

BORE HOLE 7
SAMPLE 6
DEPTH 16'-3"
ELEV. 583·2

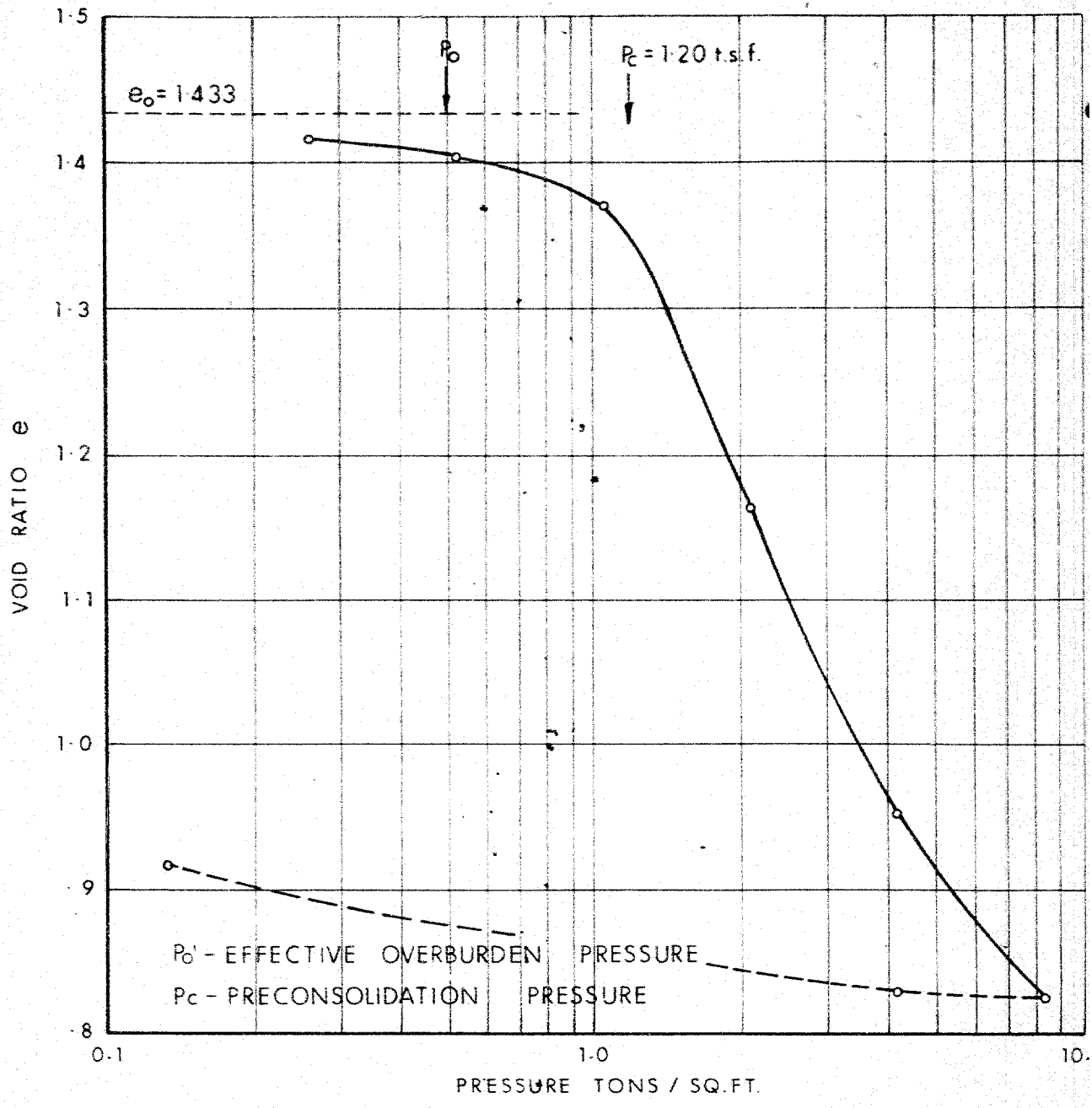
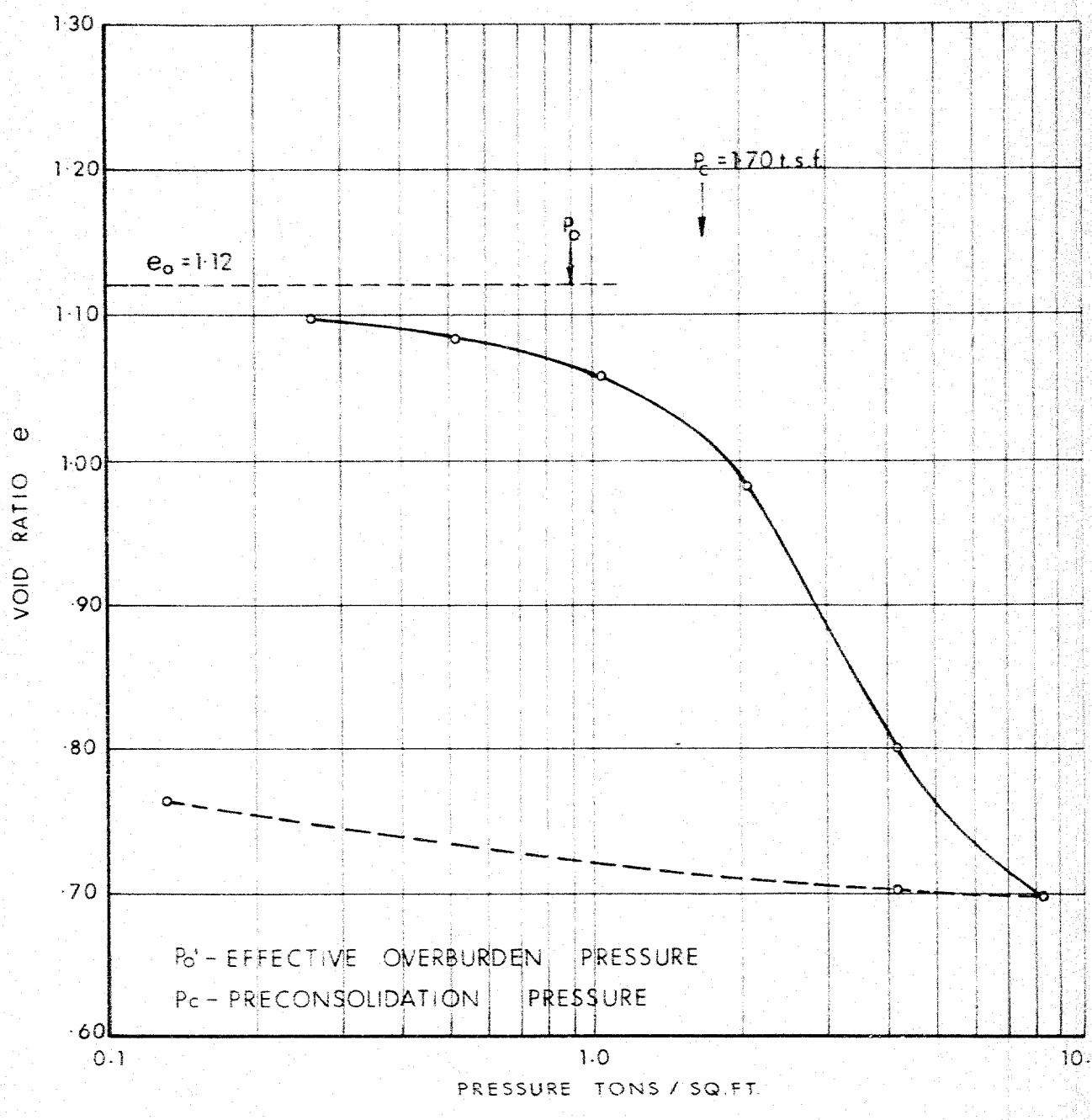


FIG. 9

VOID RATIO vs PRESSURE

W_L = 35·4 %
W_P = 18·5 %
W = 37·9 %
C_c = 0·60

BORE HOLE 7
SAMPLE 10
DEPTH 36'
ELEV. 563·4



DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

FIG. 10

68-F-65 LINE

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 :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ FT.	DENSENESS	'N' BLOWS / FT.
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
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
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
$\log_{10} a$. $\log a$	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 (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

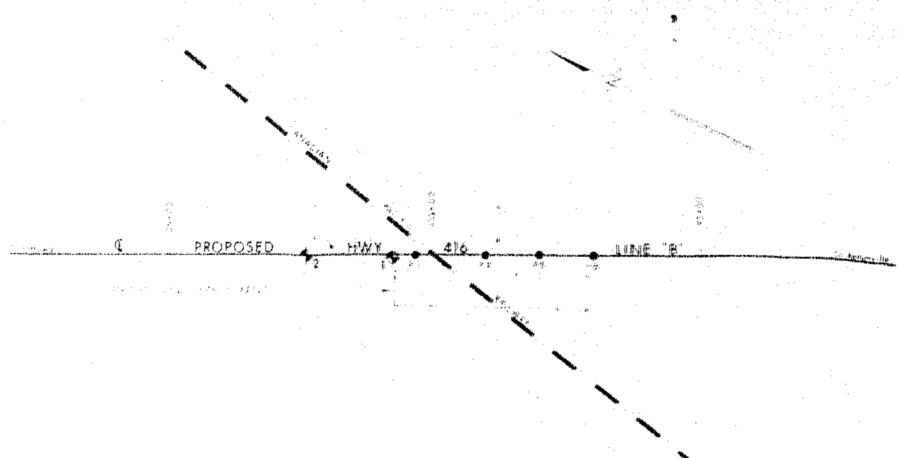
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

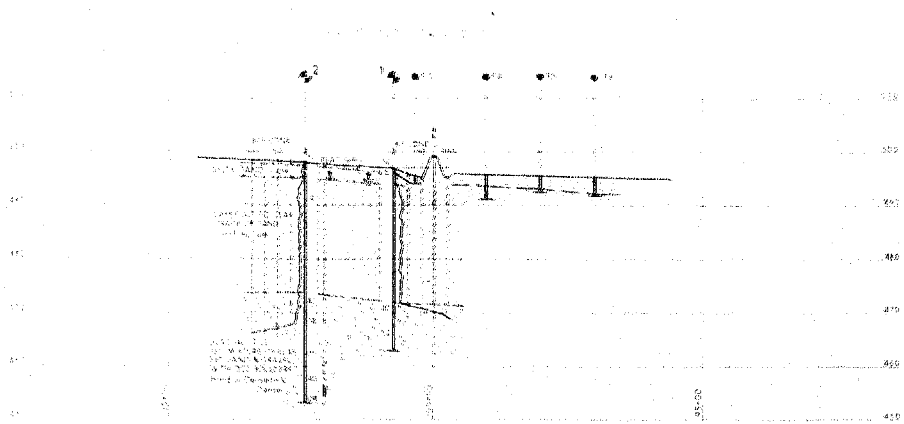
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

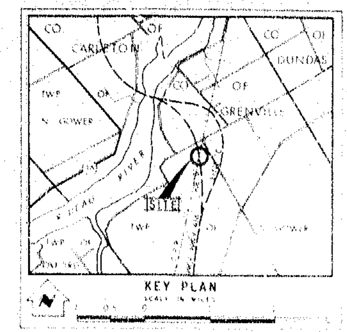
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



PLAN



℄ PROFILE



KEY PLAN

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation
- Probe Hole
- Piezometer

NO	ELEVATION	STATION	OFFSET
1	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]
P3	[illegible]	[illegible]	[illegible]
P4	[illegible]	[illegible]	[illegible]
P5	[illegible]	[illegible]	[illegible]
P6	[illegible]	[illegible]	[illegible]

B.M. ASSUMED ELEV. 500.0

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.

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

CANADIAN PACIFIC RAILWAY

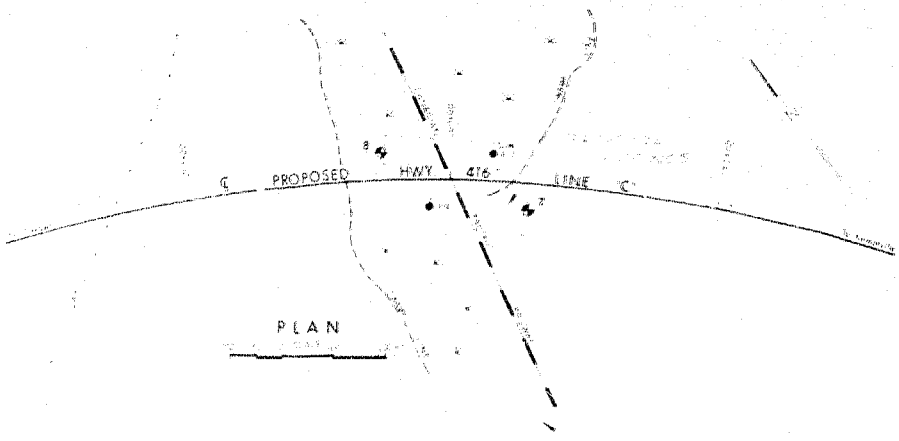
KING'S HIGHWAY NO. 416 LINE 'B' DIST NO. 9

CO. GRENVILLE

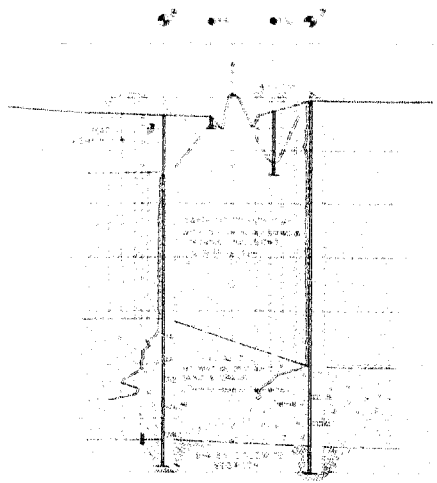
TWP. S. GOWER LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D B.F.	CHECKED	W.P. NO.	M.&T. DRAWING NO. 68 - F - 65A
DRAWN	CHECKED	JOB NO. 68-F-65	
DATE OCT. 1968		SITE NO.	BASIC DRAWING NO.
APPROVED		CONT. NO.	



PLAN



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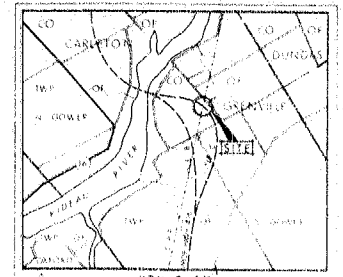


KEY PLAN

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation
- Probe Hole
- Piezometer

NO	ELEVATION	STATION	OFFSET

B.M. ASSUMED ELEV. 600.0'

- 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.

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
MATERIALS & TESTING DIVISION SOILS SECTION

CANADIAN PACIFIC RAILWAY

KING'S HIGHWAY NO. 416 LINE 'C' DIST NO. 9
CO. GRENVILLE
TWP. S. GOWER LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITTED	CHECKED	W.P. NO.	W.P.I. DRAWING NO.
DRAWN S.O.	CHECKED	JOB NO. 68-F-65	68-F-65B
DATE APRIL 1968		SITE NO.	MATERIALS DRAWING NO.
APPROVED		CONT. NO.	

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. J. L. Forster,
Regional Functional Planning Engr.,
Kingston.

From: Materials & Testing Division,
Kingston.

Date: June 3rd, 1968.

Our File Ref.

In reply to

Subject:

Re: Hwy. 416, W.P. 6-66,
Railway Crossing N. of Kemptville,
District 9, Ottawa.

Soundings have been carried out on the third alternative proposal for the railway crossing as requested in your memo May 22nd.

The general soil conditions at this crossing are also very poor for construction of a high embankment and structure. Approximately 13' of firm sandy silt overlies soft to firm silty clay. Hand soundings penetrated to a depth of 45'. A muck deposit consisting of 14' of muck over the soft to firm silty clay occurs from 100' to 300' west of the railway. A plan is attached indicating all three lines investigated to date. The logs of sufficient soundings are also attached to indicate the general conditions at each crossing.

It is felt that the cost of constructing stable approach embankments at any of these crossings will be very high. A preliminary foundation investigation will be required in order to assess the most economical crossing. The preliminary foundation investigation should be initiated by the Bridge Office.

H. A. Meyer

for J. E. Gruspier,
Regional Materials Engineer.

HAM/jk

c.c. G. Scott
A. G. Stermac
G. A. Wrong

Line 'B'

Station 99+00 - Centreline

0 - 6"	Water
6"- 30"	Fi. Fib. Muck
30"- 96"	Wet Firm Cl. Si.
96"-108"	Sat. Soft Cl. Si.
108"-10'	Wet Firm Cl. Si.
10'-20'	Sat. Soft. Cl. Si.
20'-24'	Sat. Soft. Sa. Cl. Grav'ly
24' N.F.P.	Blds.

Station 93+00 - Centreline

0 - 12"	Muck
12"- 30"	Wet Si. Fi. Sa. T.G.
30"-66"	Wet Firm Cl. Si.
66"-16.5'	Sat. Soft F. Si. Cl.
16.5'	N.F.P. Bld.

Station 89+00 - Centreline (in Creek)

0 - 6"	Water
6"-18"	Sat. Si. F. Sa.
18"-66"	Wet Firm Si. Cl.
66"-31.5'	Sat. Soft. Si. Cl.
31.5	N.F.P. dense Sa.

Line 'C'

Station 197+00 - Centreline

0 - 10"	Br. S. Tps.
10"- 14'	Wet Firm Sa. Si.
14'- 44'	Sat. Soft Si. Cl.
44'	N.F.P. Firm Cl.

Station 198+00 - 400' Lt.

0 - 12"	Br. Si. Tps.
12"- 14'	Wet Firm Sa. Si. with occ. Si. F. Sa. layers 68-LE-41 M @ 4'
14'- 30'	Sat. Soft Si. Cl.
30'	N.F.P. Firmer than above.

Station 200+15 - 15' RT. (on railway embankment)

0 - 36"	Si. Grav.
36"- 84"	Si. F. Sa.
84"- 90"	Si. Org.
90"-13'	Wet Firm Sa. Si.
13'-15'	Sat. Soft. Si. Cl.

Cont'd.....

Station 202+00 - Centreline

0 - 14' Amorphus Woody Muck
14'- 21'+ Sat. Soft. Si. Cl.

Station 201+00 - 100' RT.

0 - 18" Br. Si. Tps.
18"- 14' Wet Firm Sa. Si.
14'- 45' Sat. Soft. Si. Cl.
45' N.F.P. Firm. Cl.

I

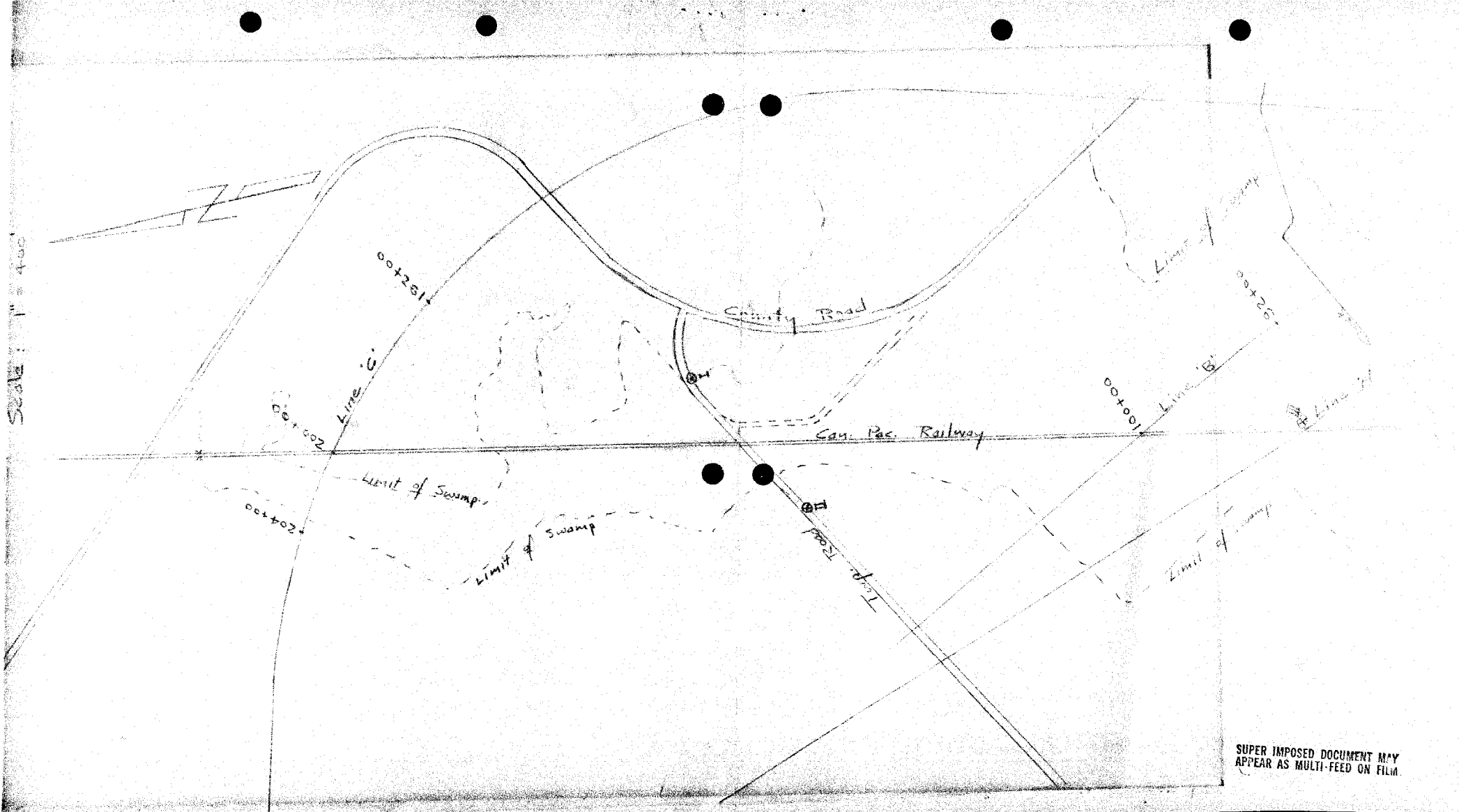
0 - 2' Fi. Grav.
2'- 11' Fi. Fib. Muck
11'-35' Sat. Soft. Si. Cl.
35'- N.F.P. Firm Cl.

II

0 - 1' Fi. Grav.
1'- 3' Fi. Fib. Muck
3'-12' Wet Firm Sa. Si.
12'-25' Sat. Soft. Si. Cl.
25' N.F.P. Firm Cl.

III

0 - 36" Muck
36"- 13' Wet Firm Si. Cl. with V.F. Sa. & Si. layers
13'- 37' Sat. Soft. Si. Cl.
37'-38' Sat. Soft. Sa. Cl. Till
38' - N.F.P. Till



DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. G. Stermac
Principal Foundation Engineer
Materials and Testing Division
Downsview.

Attention: Mr. M. Devata

From: Materials and Testing Division
Kingston

Date: April 30, 1968

Our File Ref.

In reply to

Subject:

Re: W.P. 6-66, Hwy. 416,
Railway Crossing N. of Kemptville,
District 8, Kingston

We have indicated on the attached plan the proposed Hwy. 416 crossing of the railway north of Kemptville. You will note that this site is just south of the Rideau River crossing where you carried out a preliminary foundation investigation (W.P. 252-66) in March, 1967.

We have checked the general area of this crossing and established what appears to be the best crossing. The soundings at this crossing penetrated through a firm silty clay layer to a stiff silty clay at depths between 4' and 10' at this crossing. The soundings to the north and south however, penetrated through a soft silty clay layer below the firm clay layer to depths up to 44'.

We would therefore request that a preliminary foundation investigation be carried out to prove this crossing, particularly since the soundings were stopped in the stiff silty clay layer. Engineering Surveys will be staking the proposed line during the week of May 6 - 10, 1968.

H. A. Meyer

for: J. E. Gruspier
Regional Materials Engineer

HAM:mgm

cc: J. L. Forster
G. A. Wrong

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. G. Scott,
Bridge Division Engineer,
Kingston.

From: Materials & Testing Division,
Kingston.

Date: May 6th, 1968.

Our File Ref

In reply to

Subject:

Re: Hwy. 416, W.P. 6-66,
Railway Crossing N. of Kemptville,
District 8, Kingston.

Attached is correspondence relative to field work carried out by this office at the request of Mr. J. L. Forster.

As discussed with you earlier, the preliminary foundation investigation is required on the proposed alignment to determine its feasibility. Would you please include this in your request for the structure site to the Foundation Section at your earliest convenience.

While we have requested this investigation of the Foundation Section, Mr. Stermac felt it should be channelled through your office so that you may add your requirements to it.

J. E. Gruspier,
Regional Materials Engineer.

JEG/jk

Attached

c.c. A. G. Stermac
J. L. Forster
G. A. Wrong

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. G. Stermac
Principal Foundations Engineer
Materials and Testing Division
Downsview

From: Materials and Testing Division
Kingston

Date: May 7, 1968

Our File Ref.

In reply to

Subject:

Re: W.P. 6-66, Hwy. 416,
Railway Crossing N. of Kemptville

Further to our memo of April 30th, 1968, we are sending the log of borings indicated on the attached plan.

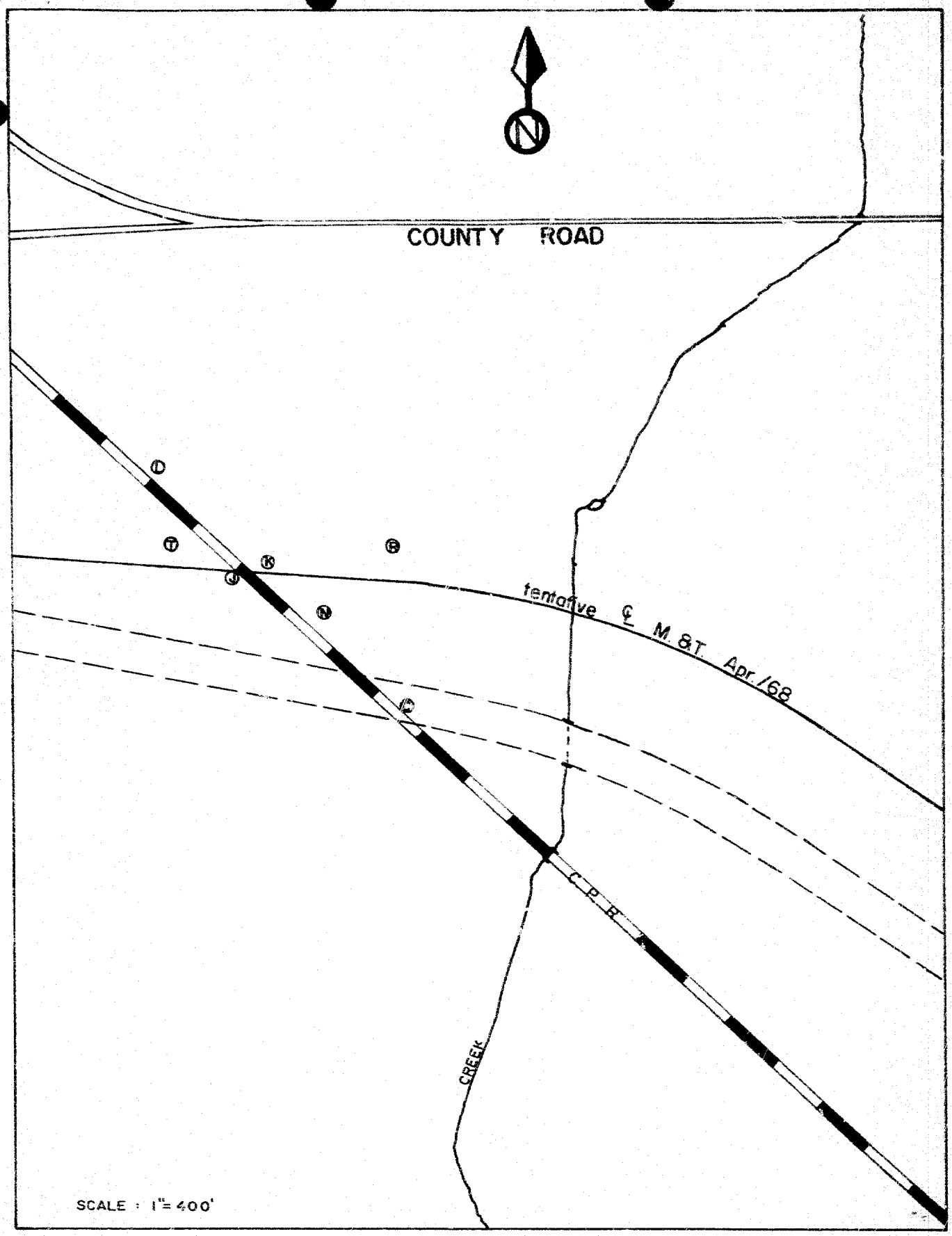
H. A. Meyer

for: J. E. Gruspier
Regional Materials Engineer

HAM:mgm

Attch.

J	-	0 - 12"	Muck
		12"- 48"	Wet Firm Si. Cl.
		48"	N.F.P. Blds.
K	-	0 - 18"	Muck
		18"- 72"	Wet Firm Si. Cl.
		72"	N.F.P. V. Stiff Cl.
L	-	0 - 12"	Muck
		12"- 13'	Wet Firm Si. Cl.
		13'- 23'	Sat. Soft Si. Cl.
		23'	N.F.P. Blds.
N	-	0 - 18"	Muck
		18"- 72"	Wet Firm Si. Cl.
		72" -15'	Sat. Soft Si. Cl.
		15'	N.F.P. Till
R.	-	0 - 24"	Muck
		24"- 10'	Wet Firm Si. Cl.
		10'	N.F.P. Stiff Cl.
T.	-	0 - 12"	Muck
		12"- 60"	Wet Firm Si. Cl. with V.F. Sa. and Si. Layers
		60"	N.F.P. Stiff Cl.
C.	-	0 - 36"	Muck
		36"- 13'	Wet Firm Si. Cl. with V.F. Sa. and Si. Layers
		13'-37'	Sat. Soft Si. Cl.
		37'- 38'	Sat. Soft Sa. Cl. Till
		38'	N.F.P. Till


COUNTY ROAD
tentative ℄ M. & T. Apr./68
C P R
CREEK
SCALE : 1"= 400'