#69-F-97

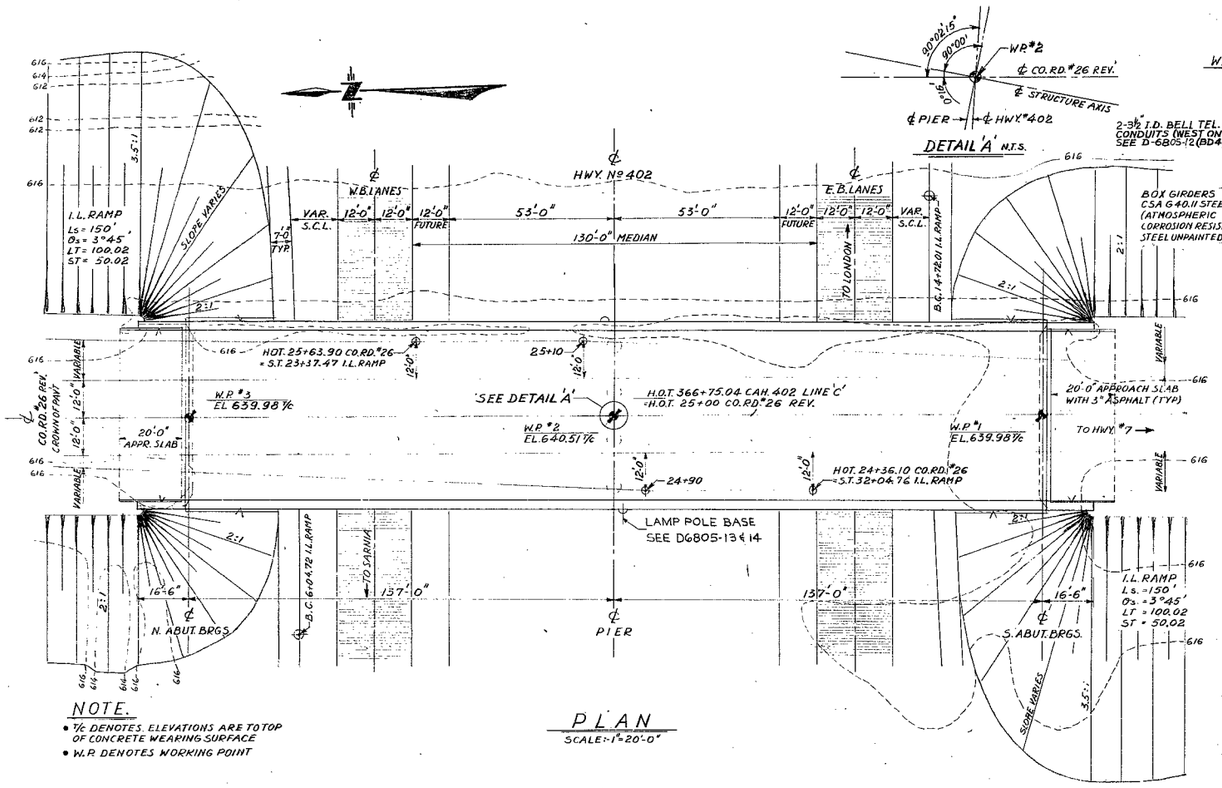
W.P. 43-66-10

H.W.Y. #402, LINE 'C';

AND C.A.H.

COUNTY ROAD #26

REVISION.

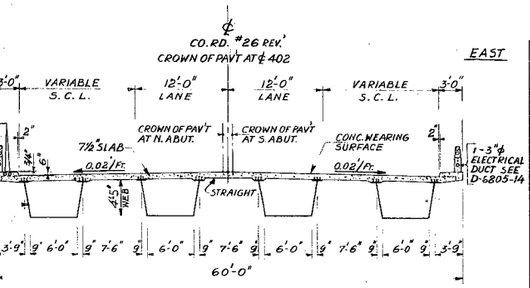


PLAN

SCALE:- 1"=20'-0"

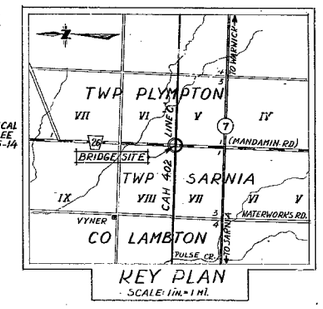
NOTE.

- ℄ DENOTES ELEVATIONS ARE TO TOP OF CONCRETE WEARING SURFACE
- W.P. DENOTES WORKING POINT



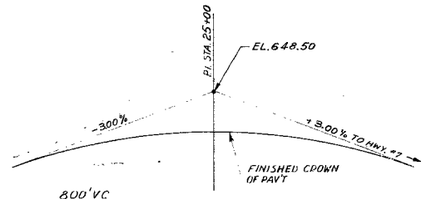
TYPICAL DECK SECTION

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



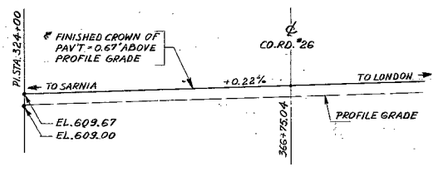
KEY PLAN

SCALE: 1 in. = 1 mi.



PROFILE OF CO.RD. #26

N. T. S.



PROFILE OF HWY. 402

N. T. S.

NOTES.

CLASS OF CONCRETE

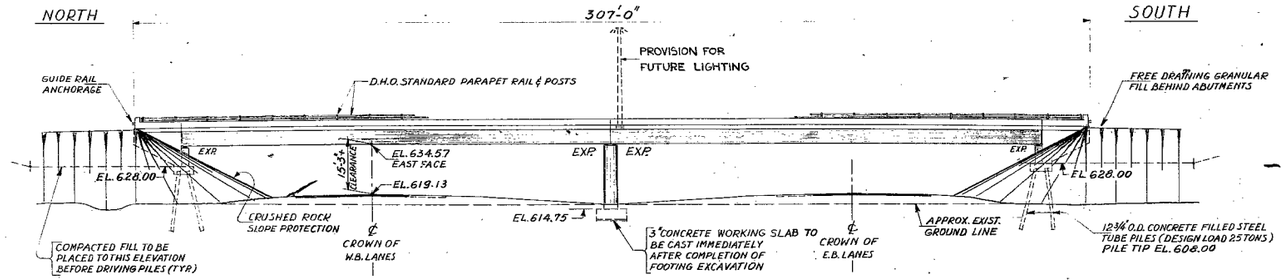
DECK, CURBS AND PARAPET WALLS	4000 psi
PIER COLUMNS	4000 psi
REMAINDER AND/OR AS NOTED ON DRAWINGS	3000 psi

CLEAR COVER ON REINF STEEL

FOOTINGS, ABUTMENTS, PIER COLUMNS, DECK: TOP 3", BOTT. 3"; CURBS, PARAPET WALLS, APPROACH SLABS, 1½" TOP, 1" BOTT. 2"
AND/OR AS NOTED ON DRAWINGS

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± ⅛ INCH. NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.



ELEVATION

SCALE:- 1"=20'-0"

LIST OF DRAWINGS

D-6805- 1 GENERAL LAYOUT
- 2 BOREHOLE LOCATIONS AND SOIL STRATA
- 3 FOUNDATION LAYOUT
- 4 ABUTMENTS
- 5 PIER
- 6 STRUCTURAL STEEL I
- 7 STRUCTURAL STEEL II AND BEARING DETAILS
- 8 DECK
- 9 PARAPET WALL DETAILS
- 10 STANDARD STEEL PARAPET RAIL
- 11 APPROACH SLABS
- 12 STANDARD DETAILS I
- 13 STANDARD DETAILS II
- 14 BRIDGE ELECTRICAL DETAILS

B.M. Elev. 617.48
GEODETIC DATUM: N & W IN S. ROOT OF 12" MAP. 178' LT. 366+99 LINE 'C'

REVISIONS		
DATE	BY	DESCRIPTION

PRINT RECORD

No.	FOR	DATE

FOR REDUCED PLAN USE SCALE BELOW

0 1 2 3

← 3 INCHES ON ORIGINAL PLAN →

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

69-F-97

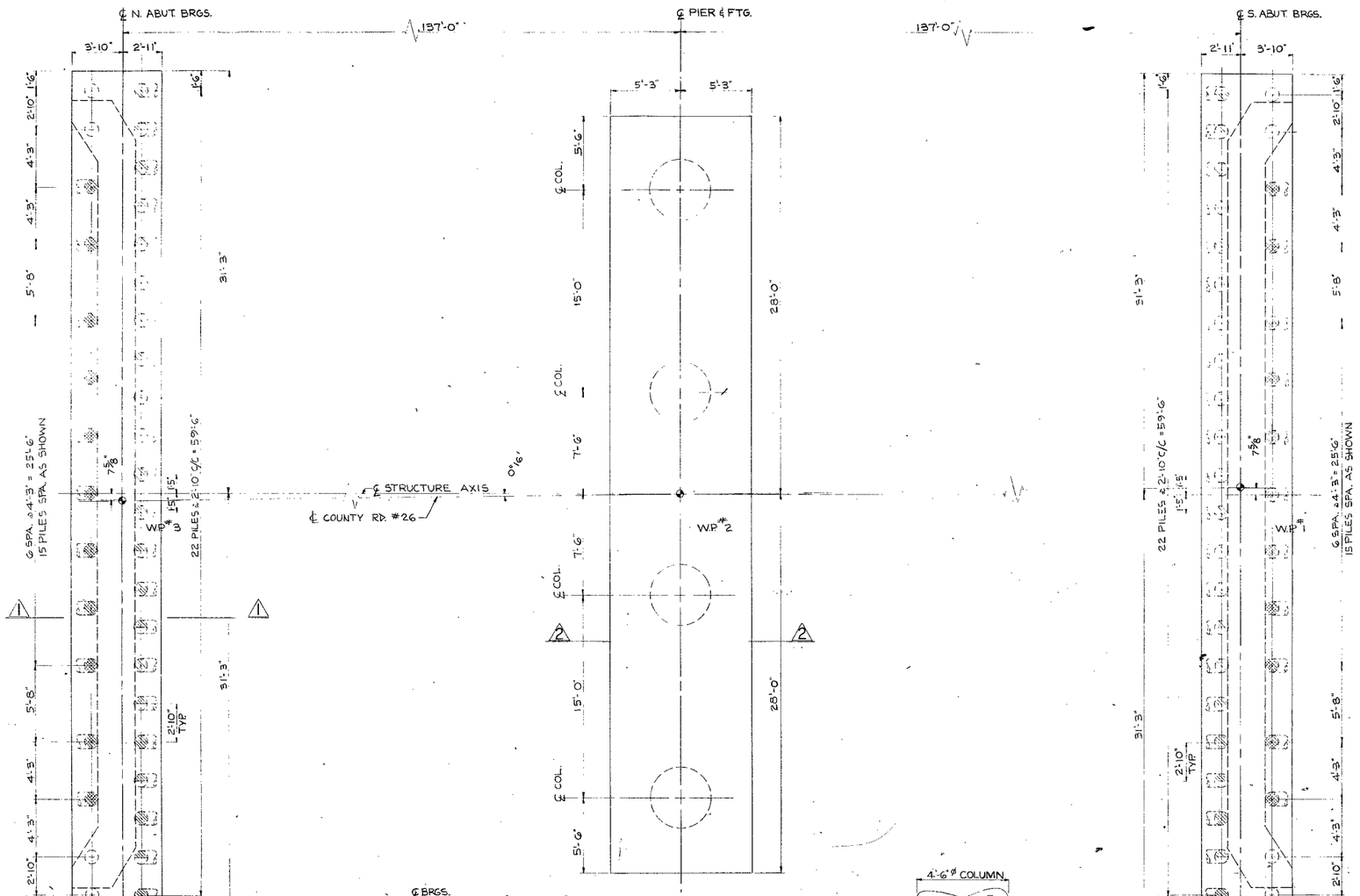
COUNTY RD. #26 INTERCHANGE U'PASS

KING'S HIGHWAY No. 402 LINE 'C' — DIST. No. 1
CO. LAMBTON
TWP. SARNIA — LOT 1 — CON. VII

GENERAL LAYOUT

APPROVED _____ BRIDGE ENGINEER

DESIGN	J.L.K.	CHECK	J.Sz/K.R.	SITE No. 14-347	W.P. No. 43-66-10
DRAWING	J. Sz.	CHECK	J.L.K.	CONTRACT Nos.	
DATE	DEC/1970	LOADING	H520-44	DRAWING No.	D-6805-1



PLAN
SCALE: 1/4" = 1'-0"

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

2
SCALE: 3/8" = 1'-0"

PILES SUPPLIED

LOCATION	NO.	LENGTH	TYPE
N. ABUT.	37	20'-0"	12¾" O.D. STEEL TUBE PILES x 0.250" WALL THICK.
S. ABUT.	37	20'-0"	

LEGEND

- PILE BATTER 3:1
- PILE BATTER 5:1
- PILE BATTER 8:1
- PILE DRIVEN VERTICAL

NOTES

- DIMENSIONS & PILE LAYOUT SIMILAR FOR BOTH ABUTMENT FOOTINGS.
- PILE SPACING TO BE MEASURED AT UNDERSIDE OF FOOTING.
- ALL PILES ARE 12¾" O.D. x .250" WALL STEEL TUBE PILES.
- TUBE PILES TO BE FILLED WITH 3000 P.S.I. CONCRETE AFTER INSTALLATION & INSPECTION.
- PILES SHALL BE DRIVEN IN ACCORDANCE WITH BD 86-7, BUT IN NO CASE SHALL BE DRIVEN BELOW EL. 608.00 FOR BD STD'S. SEE D-6805-13

PRINT RECORD

No.	FOR	DATE

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

REVISIONS

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE OFFICE

16-F-97

COUNTY RD #26 INTERCHANGE U'PASS

KING'S HIGHWAY No. 402 — DIST. No. 1
CO. LAMBTON
TWP. SARNIA — LOT 1 — CON. VII

FOUNDATION LAYOUT

APPROVED _____ BRIDGE ENGINEER

DESIGN	T.S./H.Z.S.	CHECK	J.L.K.	SITE No. 14-347	W.P. No. 43-66-10
DRAWING	B.M°G.	CHECK	T.S./H.Z.S.	CONTRACT Nos.	
DATE	DEC. 70	LOADING	H-20-44	DRAWING No.	D-6805-3

TRANSLAM 1100-10-70

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Office.

From: Foundation Section,
Materials and Testing Office,
Room 107, Lab. Building.

Attention:

Date: December 29, 1969

JAN - 5 1970

Our File Ref.

In reply to

Subject:

FOUNDATION INVESTIGATION REPORT
For
Proposed Underpass at the
Crossing of Co. Rd. 26 Rev. and
C.A.H. 402, Line 'C' Co. of Lambton
District #1 (Chatham)
W.J. 69-F-97 -- W.P. 43-66-10

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 contact our Office.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

AGS/jm
Attach.
cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
W. Sonnenberg
F. C. Brown
A. R. Watt
J. Roy
B. A. Singh

Foundation Files
Gen. Files

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FOUNDATION INVESTIGATION REPORT
For
Proposed Underpass at
Crossing of Co. Road 26 Rev.
and C.A.M. 402, Line 'C" Co. of Lambton
District #1 (Chatham)
W.J.69-F-97 -- W.P. 43-66-10

1. INTRODUCTION:

A request for a foundation investigation at the site of the proposed new bridge at the location above was received from Mr. A. P. Watt in a memo dated October 29, 1969.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the location of the proposed structure. Presented in this report are the results of this investigation, together with recommendations for the future structure foundations and approach embankments.

2. DESCRIPTION OF THE SITE:

The site is located on Lambton Co. Rd. #26 (Mandamin Rd.), 3/4 mile North of Highway #7.

The surrounding area is farmland and the topography is flat.

Physiographically the site is located in the region referred to as the St. Clair Clay Plain.

3. FIELD INVESTIGATION PROCEDURE:

A total of six boreholes and twelve dynamic cone penetration tests were carried out during the course of the field

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work. Four of the boreholes were sampled down to bedrock and rock cores were taken in two of these; the remaining two of the four were curtailed when practical refusal was reached. Two of the boreholes were taken down to a depth of 40 ft. only.

Boring was achieved by means of a Penn auger and diamond drilling equipment adapted for soil sampling purposes. Undisturbed samples were recovered using 2" I.D. Shelby tubes which were either pushed by hand or hydraulically. Disturbed samples were recovered using split spoon samples which were driven into the soil according to the requirements of the Standard Penetration Test. Where possible field vane tests were carried out at elevations 18" below sample depths.

Samples were visually examined in the field and subsequently in the laboratory.

The locations and elevations of the boreholes were surveyed in the field by London Region Engineering Surveys Section and are shown in Drawing 69-F-97A which accompanies this report.

4. LABORATORY TESTS

Laboratory tests were carried out on selected samples to determine Atterberg Limits, natural moisture contents, grain size distribution, bulk density and unconfined shear strength.

The results of tests carried out in the field and laboratory are plotted on the borehole logs which form part of this report.

5. SOIL TYPES AND CONDITIONS:

5.1) General:

The subsoil consists of a stratum of clayey silt with

some sand and traces of gravel 40 feet thick overlying a layer of silty clay with some sand and traces of gravel and 12 - 28 ft. thick and finally clayey silt again down to bedrock which was found at a depth of 106 ft.

5.2) Clayey Silt with some sand and traces of Gravel:

This material extends from the ground surface to a depth of around 40 ft. i.e., to the top of the silty clay layer. It appears again below the silty clay layer and extends down to the bedrock.

The top 13 feet of the deposit is very stiff to hard in consistency and has moisture contents lying at or below the plastic limit, indicating dessication by weathering. Below this depth the moisture content increases together with a decrease in strength as will be gone into in more detail later.

The 'N' values of the deposit as determined by the Standard Penetration Test range from 12 blows/ft. to 47 blows/ft. indicating a consistency of stiff to hard.

The properties of the material as found by laboratory tests are as below:-

Grain size distribution	Gr. 1-6%, Sa 12-22% Si.42-51% Cl. 29-37%
Liquid Limit	24% - 35%
Plastic Limit	14% - 21%
Moisture Content	12% - 20%
Bulk Density	125.5 - 134 p.c.f.
Field Vane	700 p.s.f - >2000 p.s.f.
Unconfined shear strength	500 p.s.f. - 3685 p.s.f.
Quick Triaxial shear str.	600 p.s.f. - 1600 p.s.f.
Sensitivity	1.9 - 5.0

...4

A plot of Plasticity Index/Liquid limit is shown on Fig.(1) and Grain size distribution in Fig.(2).

Shear Strength. - Results from the field vane tests together with results of Unconfined Compression and Quick Triaxial Tests are plotted on Fig.(3). These show that the shear strength is in excess of 2000 p.s.i. within the dessicated crust; below this level the shear strength decreases to a minimum of 550 p.s.i. at elev. 565; below the latter level the shear strength begins to increase.

5.3) Silty Clay

This material was found within the clayey silt layer of thickness varying between 12 ft. thick at BH #2 to 27 ft. at BH #7, the upper level of the stratum was lying some 40 ft. below ground level.

Shelbies only were taken in this deposit and hence the consistency can be only estimated at a value of 'Stiff'.

Properties of the material as found by laboratory tests are as below:

Grain Size Distribution	Gr.0% Sa.0% Si. 52% Cl. 48%
Liquid Limit	40% - 47%
Plastic Limit	18% - 25%
Moisture Content	35% - 38%
Bulk Density	114 - 115 p.c.f.

A plot of Plasticity Index/Liquid Limit is shown in Fig. 4 and Grain Size distribution in Fig. 5.

Shear Strength - For design purposes it is convenient to consider the strengths of the clayey silt layer and the silty clay layer together; this has been done in (5.2).

5.4) Bedrock

Bedrock was proved in B.H.'s #2 and #7 by coring with B.X. core barrel and was found to be black shale. The elevation of the top of the bedrock varied only slightly from 509.8 in B.H.#11 to 511.5 in B.H. #2.

6. GROUND WATER LEVELS

The water levels as recorded in the boreholes at the time of the field investigation are as below:

B.H. #2	610.6	B.H. #7	607.5
B.H. #3	612.0	B.H. #10	613.8
B.H. #6	616.3	B.H. #11	611.1

It must be noted that the above water levels may not represent the true ground water levels due to the relatively impermeable nature of the subsoil and the short duration of the fieldwork.

7. DISCUSSION AND RECOMMENDATIONS:

7.1) General

It is proposed to erect an underpass which would carry Co. Rd. #26 over new Hwy. 402 line C. The structure will consist of 5 spans of lengths 35 ft, 73 ft, 73 ft, 73 ft, 35 ft, and will have a profile grade approximately 22' above the proposed Highway 402 grade.

As described earlier the subsoil consists of a deep deposit of clayey silt and silty clay some 105' thick overlying black shale bedrock. The upper twelve feet of the deposit is dessicated and has a consistency ranging from very stiff to hard, below this the strength of the material decreases until it

...6

reaches a minimum value at approximately elev. 565, beyond this point the strength increases.

7.2) Foundations for the Structure

(a) Abutments and Piers on spread footings

The abutments and piers can be supported on spread footings located within the dessicated zone, i.e., at or above elev. 603.0. It is recommended that the footings be placed at elev. 611.0: at this elevation a safe bearing capacity of 3T/sq.ft. may be assumed for design purposes. The dessicated zone is susceptible to softening on contact with water; it is therefore recommended that the base of the footing excavations be protected by a concrete working slab immediately on exposure.

All foundations should be protected against frost action by a minimum earth cover of 4 feet.

No dewatering problems are anticipated.

From experience with similar structures and subsoil conditions in the Sarnia area, the estimated maximum settlement under the pier footings will not exceed 1½".

(b) Perched Abutments on short piles

A second alternative would be to place the abutments within the approach fill and to support them on short piles driven through the fill and some 8 feet into the dessicated layer. In the case of 12 3/4"O.D. steel tube piles a safe design load of 25 tons/pile may be assumed for design purposes.

The above recommendation regarding design loads on the tube pile is based on results from similar structures in the immediate area with similar subsoil conditions. A full scale pile loading test will be carried out in the area in the early part of

...7

1970 at which time a more accurate recommendation can be given regarding this type of foundation.

(c) Abutments on spread footings within the fill

A third alternative would be to place the abutments on spread footings placed on well compacted, suitable granular material within the approach fills. A safe design load of 2T/sq.ft. may be assumed. The granular material should consist of G.B.C. class 'A' and should be fully compacted according to current D.H.O. Standards.

A detailed construction scheme is shown in Fig. 6 of the Appendix.

Regardless of which of the above methods, (a), (b) or (c) is adopted for the abutment settlements in the order of 4" can be expected underneath them. This Figure being based on experience with similar structures and subsoil conditions in the Sarnia area.

Differential settlements between the abutments and the piers will be in the order of 3" and this should be accomodated in the structure design.

(d) End bearing piles

A fourth alternative would be to support the abutments and piers on steel 'H' piles driven to bedrock for 12 BP.@ 53, a safe design load of 70T/pile may be assumed.

7.3) Approach Fills

The shear strength of the subsoil is such that no stability problems are anticipated for a 22' high embankment with 2:1 side slopes.

Experience with similar structures having similar subsoil conditions in the immediate area has shown that long term

settlement in the order of 4 - 5" can be anticipated. To eliminate the effect of differential settlements between the abutments and pier footings it is recommended that the approach fills be built as far in advance of the structure as possible.

The fill should consist of well compacted acceptable material and should piles be required to be driven through the approach fill it should not contain grain sizes larger than 3" in this portion.

The topsoil should be removed in accordance with D.H.O. Standards within the construction area.

8. MISCELLANEOUS

The field investigation was carried out during the period Nov.3/69 - Nov. 10/69, under the supervision of Mr. G. Allen, Project Foundation Engineer, who also prepared this report. Equipment used was owned and operated by Dominion Soil Investigation Ltd., and G. Wimpey and Co. Ltd.

This report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

December, 1969

APPENDIX I

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26 Sta. 23+55 32' Lt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 3, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_p / WATER CONTENT w / WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
616.2	Ground Level									
0.0						610				
605.4										
10.8	End of Cone Test					600	100/10"			

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26 Sta 23+55 39' Rt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 6, 7 & 10, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger CHECKED BY JC

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT
617.0	Ground Level				
0.0	Clayey Silt with some sand and traces of gravel Very stiff to Hard		1	SS	26
			2	SS	44
			3	SS	40
			4	SS	42
			5	SS	28
			6	SS	26
			7	TW	PH
			8	TW	PH
			9	TW	PH
578.0					
39.0	Silty Clay Stiff		10	TW	PH
566.0					
51.0	Clayey Silt with some sand traces of gravel Stiff to Hard		11	TW	PH
			12	TW	PH
			13	TW	PH
			14	TW	PH
			15	TW	PH
511.5					
105.5	Black shale bedrock		16	RC	60%
509.5					
107.5					

ELEV SCALE: 610, 600, 590, 580, 570, 560, 550, 540, 530, 520, 510

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

SHEAR STRENGTH P.S.F.
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL x LAB. VANE
1000 2000

100/10"
s1.9
s1.8
+s5.0
+s3.0
+s2.2
o3,685

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

WATER CONTENT %
15 30 45

BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
	▼ 610.6 6-19-46-29
131	
130	
114	
131	
130	
134	

FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26 Sta. 23+90 32' Lt. ORIGINATED BY GA
W.P 43-66-10 BORING DATE November 6 & 7, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT (20 40 60 80 100) / SHEAR STRENGTH P.S.F. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE) (1000 2000)	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w / WATER CONTENT % (15 30 45)	BULK DENSITY γ P.C.F.	REMARKS / GR. SA. SI. CL.
616.1	Ground Level									
0.0	Clayey Silt with some sand and traces gravel Stiff to Hard		1	SS	22					▼ 612.0
			2	SS	46	610				
			3	SS	47		100/11"			
			4	SS	20					2-22-43-33
			5	SS	36	600				
			6	TW	PH		+ s1.7		131	
			7	TW	PH	590	+ s1.6			
			8	TW	PH		+ s1.8		131	
578.0			9	TW	PH	580	+ s3.3			
38.1	Silty Clay Stiff		10	TW	PH		+ s2.4			
573.1										
43.0	End of Borehole					570				

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26 Sta. 23+90 39' Rt. ORIGINATED BY GA

W.P. 43-66-10 BORING DATE November 3, 1969 COMPILED BY GA

DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY [illegible]

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w / WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
616.9	Ground Level									
0.0						610				
607.1										
9.8	End of Cone Test						100/10"			
						600				

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26 Sta 24+63 32' Lt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 3, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w w_P w w_L WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE				
615.9	Ground Level									
0.0						610				
603.1							100/10"			
12.8	End of Cone Test					600				

FORM OB-MT-[redacted] (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd 26 Sta. 24+63 39' Rt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 4, 5 & 6, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY [illegible]

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
616.7	Ground Level					
0.0	Clayey Silt with some sand and traces of gravel Very Stiff to Hard		1	SS	17	
			2	SS	23	610
			3	SS	30	
			4	SS	27	
			5	SS	36	600
			6	TW	PH	
			7	TW	PH	590
			8	TW	PH	
			9	TW	PH	580
578.0						
38.7	Silty Clay Stiff		10	TW	PH	
			11	TW	PH	570
555.0			12	TW	PH	
61.7	Clayey Silt with some sand and traces gravel Stiff to Hard					560
			13	TW	PH	
						550
			14	TW	PH	
						540
						530
						520
			15	SS	47	
511.0	Hammer bouncing b'rck					
105.7	End of Borehole					510

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
1000 2000

+sl.7
+sl.8
+sl.8
+sl.5
+sl.6

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT % 15 30 45

BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
	▽ 616.3
134	1-17-48-34
129	
127	
131	

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Road 26, Sta. 25+36 32' Lt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 5, 6 & 7, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY AR

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT (20 40 60 80 100) / SHEAR STRENGTH P.S.F. (1000 2000)	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % (15 30 45)	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
615.8	Ground Level									
0.0	Clayey Silt with some sand and traces of gravel Firm to Hard		1	SS	34	610				▼ 607.5
			2	SS	77					
			3	SS	37					
			4	SS	30					
			5	SS	25	600	100/9"			
			6	TW	PM		+ >		131	
			7	TW	PM	590	+ s2.0		131	
			8	TW	PM		+ s1.9			
578.0			9	TW	PM	580	+ s1.8		130	
37.8	Silty Clay Stiff		10	TW	PM		+ s4.3			
			11	TW	PM	570	+ s2.0		115	
			12	TW	PM	560	+ s2.2			0-0-52-48
550.0						550				
65.8	Clayey Silt with some sand & traces of gravel Stiff to Hard		13	TW	PM					
			14	TW	PM	540			130	
			15	TW	PM/12"	530				
510.3						520				
105.5	Black shale					510				
505.3	Bedrock		16	RC	100%					
110.5	End of Borehole									

FORM OB-MT-[illegible]6 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Road 26, Sta. 25+36 39' Rt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 3, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL △ FIELD VANE × LAB. VANE	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w (w_o w w_L) WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
616.8	Ground Level									
0.0										
						610				
606.8										
10.0	End of Cone Test									
						600				

FORM OB-MT 26 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26, Sta. 26+09 32' Lt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 3, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY AC

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L / PLASTIC LIMIT w_p / WATER CONTENT w	BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB. VANE	WATER CONTENT %		GR. SA. SI. CL.
615.7										
0.0						610				
602.7										
13.0	**End of Cone Test**					600				

FORM OB-MT-136 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 10

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26 Sta 26+09 39' Rt. ORIGINATED BY GA
W.P 43-66-10 BORING DATE November 3 & 4, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

ELEV / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE
616.8	Ground Level					
0.0	Clayey Silt with some sand and gravel; Stiff to Hard		1	SS	13	610
			2	SS	49	
			3	SS	38	
			4	SS	30	600
			5	SS	19	
			6	TW	PH	
			7	SS	18	590
			8	TW	PH	
578.0			9	TW	PH	580
38.8	Silty Clay Stiff		10	TW	PH	
573.8						
43.0	End of Borehole					570

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB. VANE
1000 2000

100/10"
+s1.8
+s1.9
+s2.3
+s2.6

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
WATER CONTENT %
15 30 45

BULK DENSITY γ P.C.F.
131.5
129

REMARKS
613.8
1-12-51-36
GR. SA. SI. CL.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 11

FOUNDATION SECTION

JOB	69-F-97	LOCATION	County Rd. 26 Sta 26+44 32' Lt.	ORIGINATED BY	GA
W.P.	43-66-10	BORING DATE	November 4, 5 & 6, 1969	COMPILED BY	GA
DATUM	Geodetic	BOREHOLE TYPE	Washboring, NX Casing	CHECKED BY	[illegible]

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE
615.6	Ground Level					
0.0	Clayey Silt with some sand and traces Gravel Stiff to Hard		1	SS	12	610
			2	SS	34	
			3	SS	51	
			4	SS	35	
			5	SS	28	600
			6	TW	PM	
			7	TW	PM	590
			8	TW	PM	
578.0			9	TW	PM	580
37.6	Silty Clay Stiff		10	TW	PM	570
			11	TW	PM	
560.0						
55.6	Clayey Silt with some sand traces of gravel Stiff to Hard		12	TW	PM	560
			13	TW	PM	550
			14	TW	PM	540
			15	TW	PH	530
						520
509.8	Hammer bouncing-poss-					510
105.8	ibly Bedrock End of Borehole					

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT
20 40 60 80 100

SHEAR STRENGTH P.S.F.
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
1000 2000

100/11"
+s2.1
+s1.9
+s3.0
+s3.3
+s4.5

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %
15 30 45

BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
	▽ 611.1
	4-17-42-37
131.5	
131	
125.5	
126	

FORM OB-MT[illegible]6 (REV. 1969) OFFICE REPORT [illegible]N SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

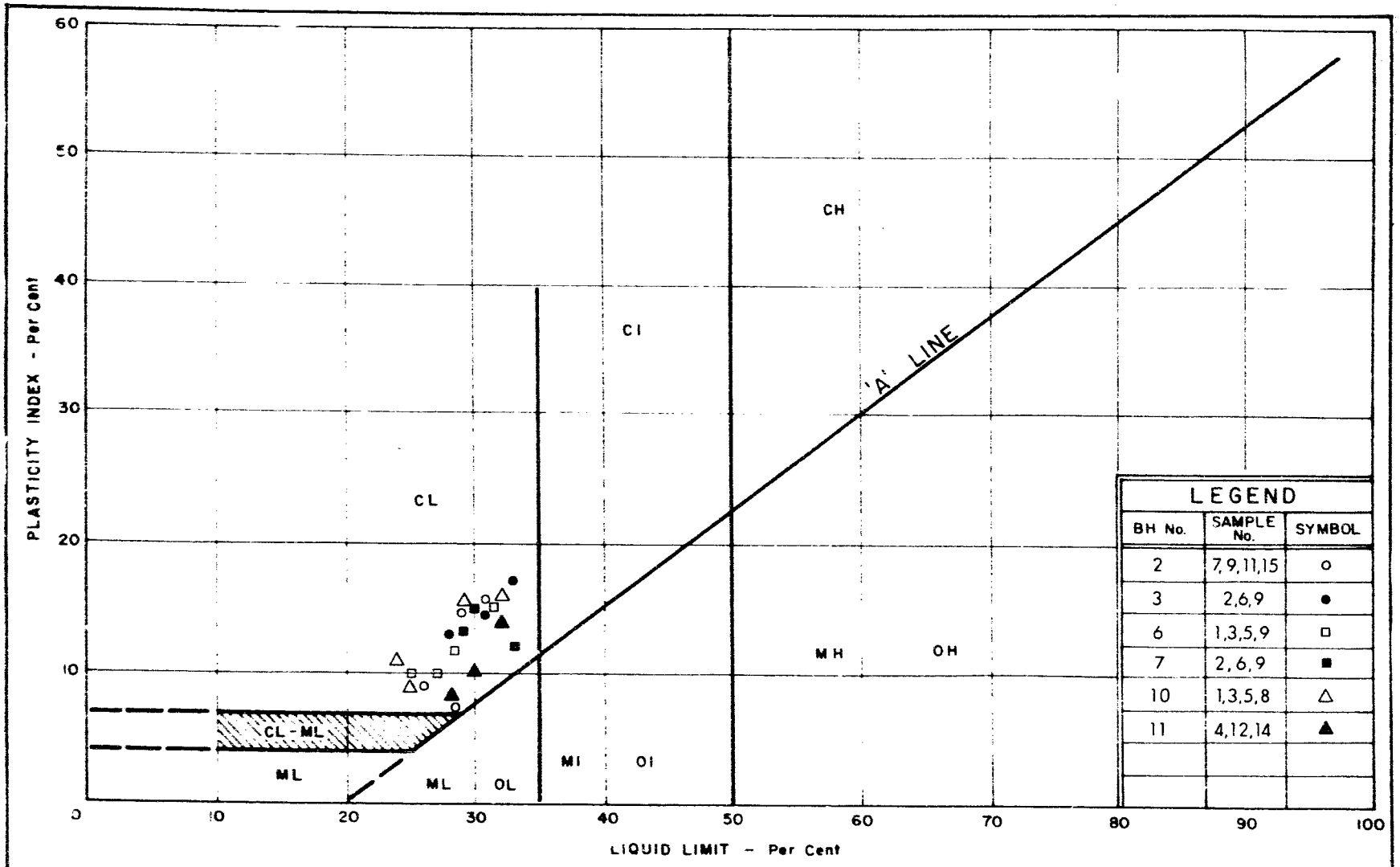
RECORD OF BOREHOLE No. 12

FOUNDATION SECTION

JOB 69-F-97 LOCATION County Rd. 26 Sta 26+44 39' Rt. ORIGINATED BY GA
W.P. 43-66-10 BORING DATE November 3, 1969 COMPILED BY GA
DATUM Geodetic BOREHOLE TYPE Cone Penetration Test CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w w_P w w_L WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH 616.8	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE				GR.SA.SI.CL.
0.0										
608.9						610				
7.9	End of Cone Test									
						600				

FORM OB-MT-252
REVISED JUL[illegible]1966



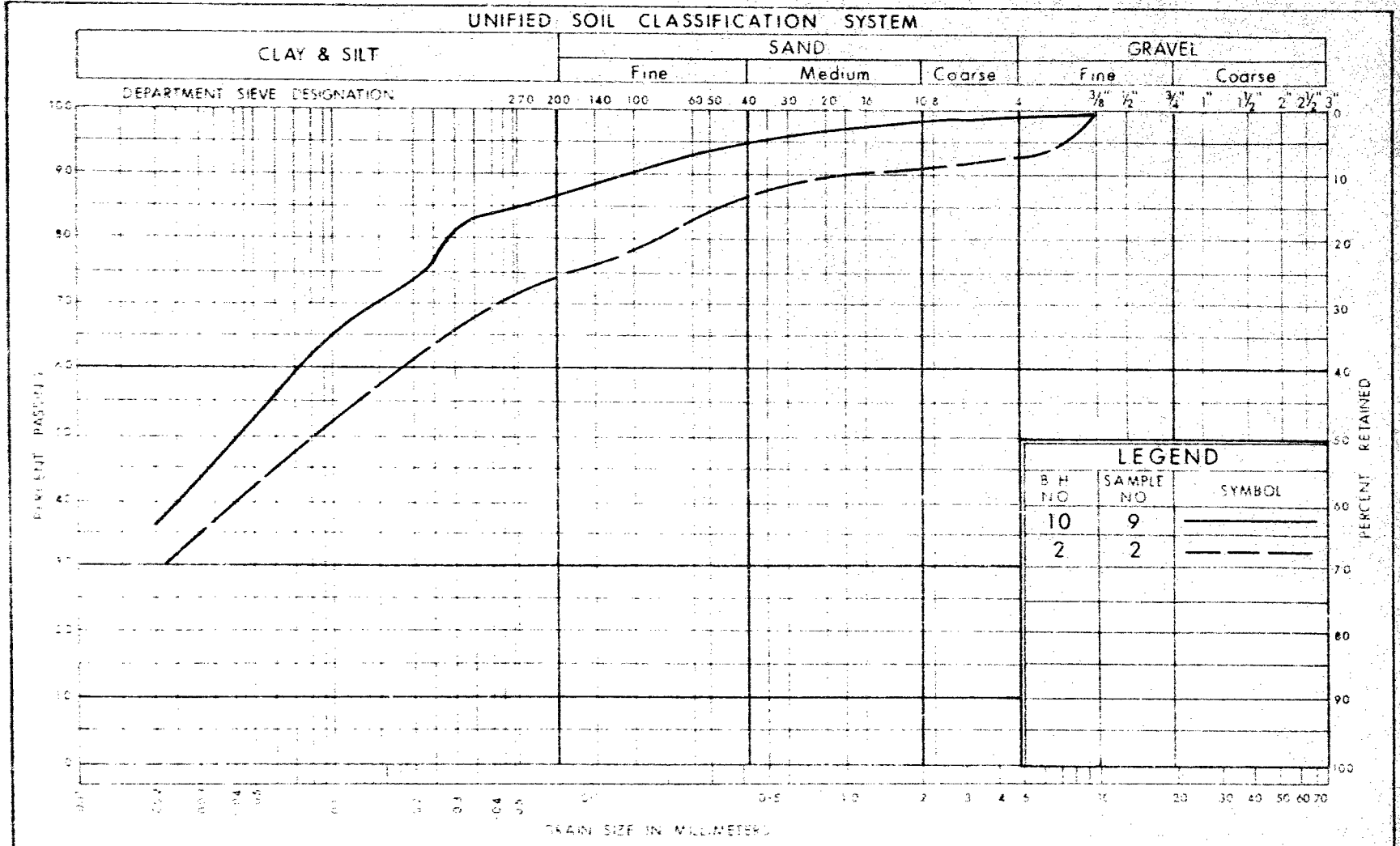
DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART

CLAYEY SILT

W.P. No.	43-66-10
JOB No.	69-F-97
	FIG. 1

FORM 08 MT - 17
REV. APR. 965



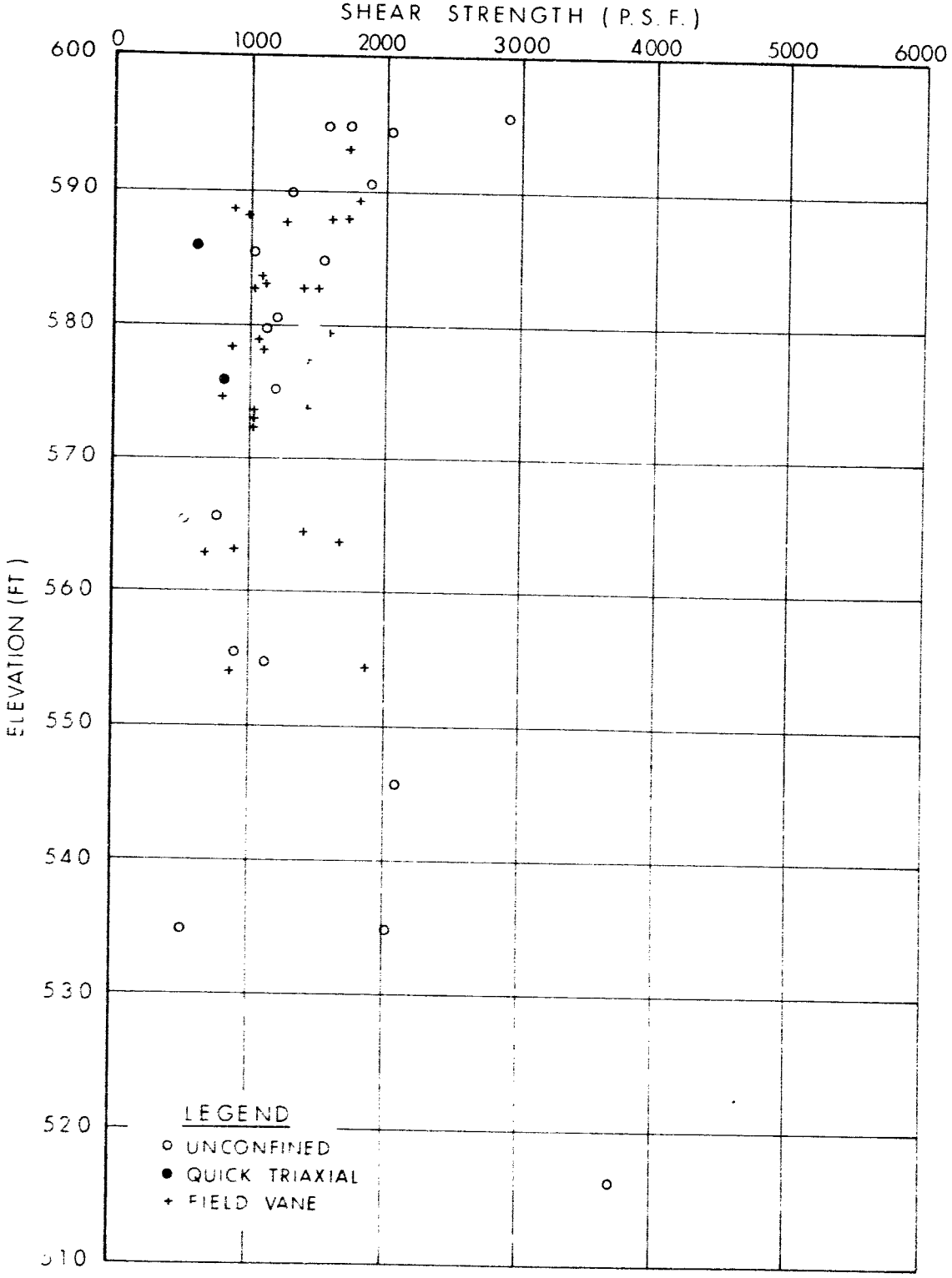
DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION

CLAYEY SILT

SOME SAND & TRACES OF GRAVEL

W.P. No.	43 - 66 - 10
JOB No.	69 - F - 97
	FIG. 2

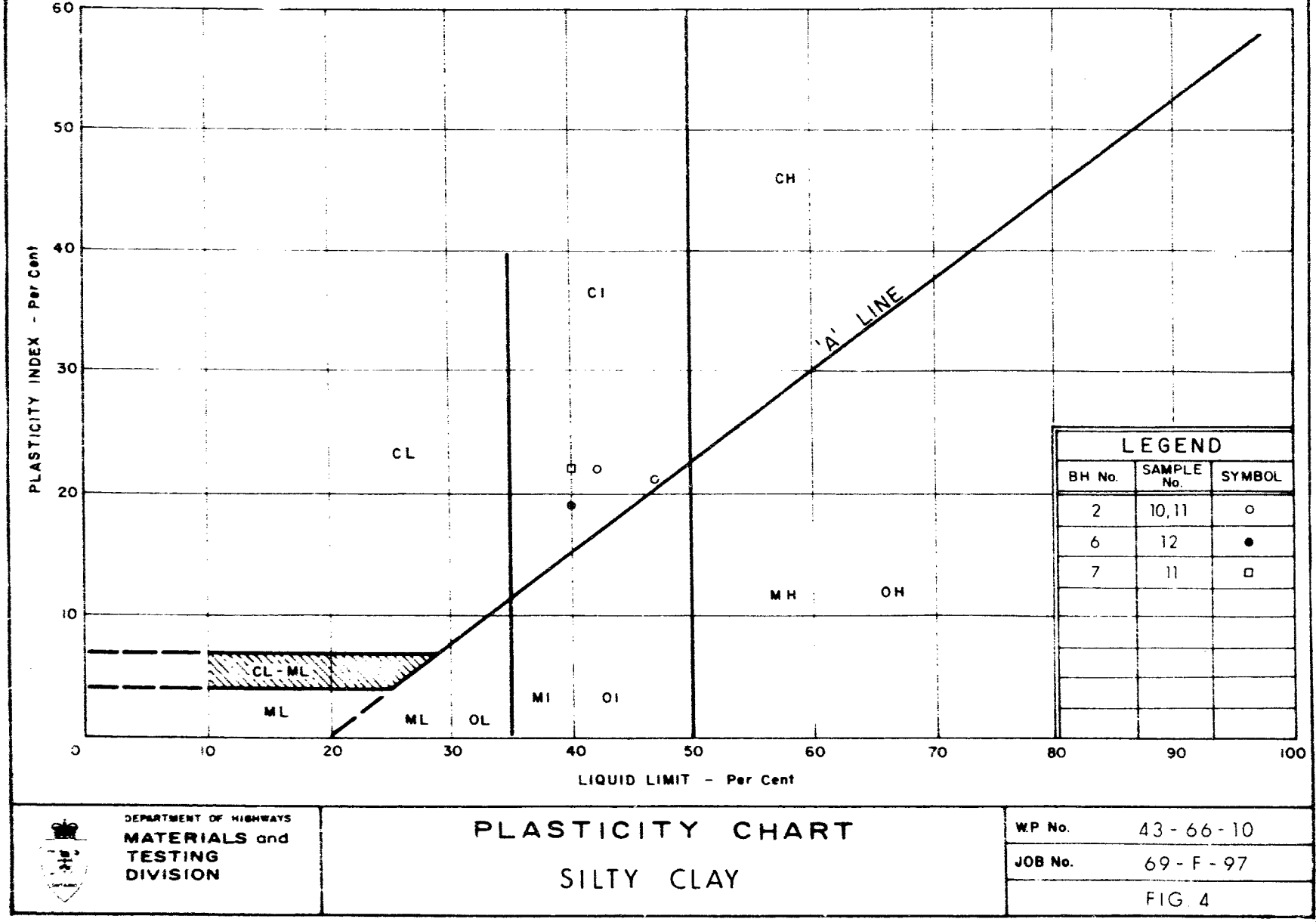


ELEVATION VS SHEAR STRENGTH

FIG. 3

69-F-97

FORM 08-MT-252
REVISED JULY [illegible] 966



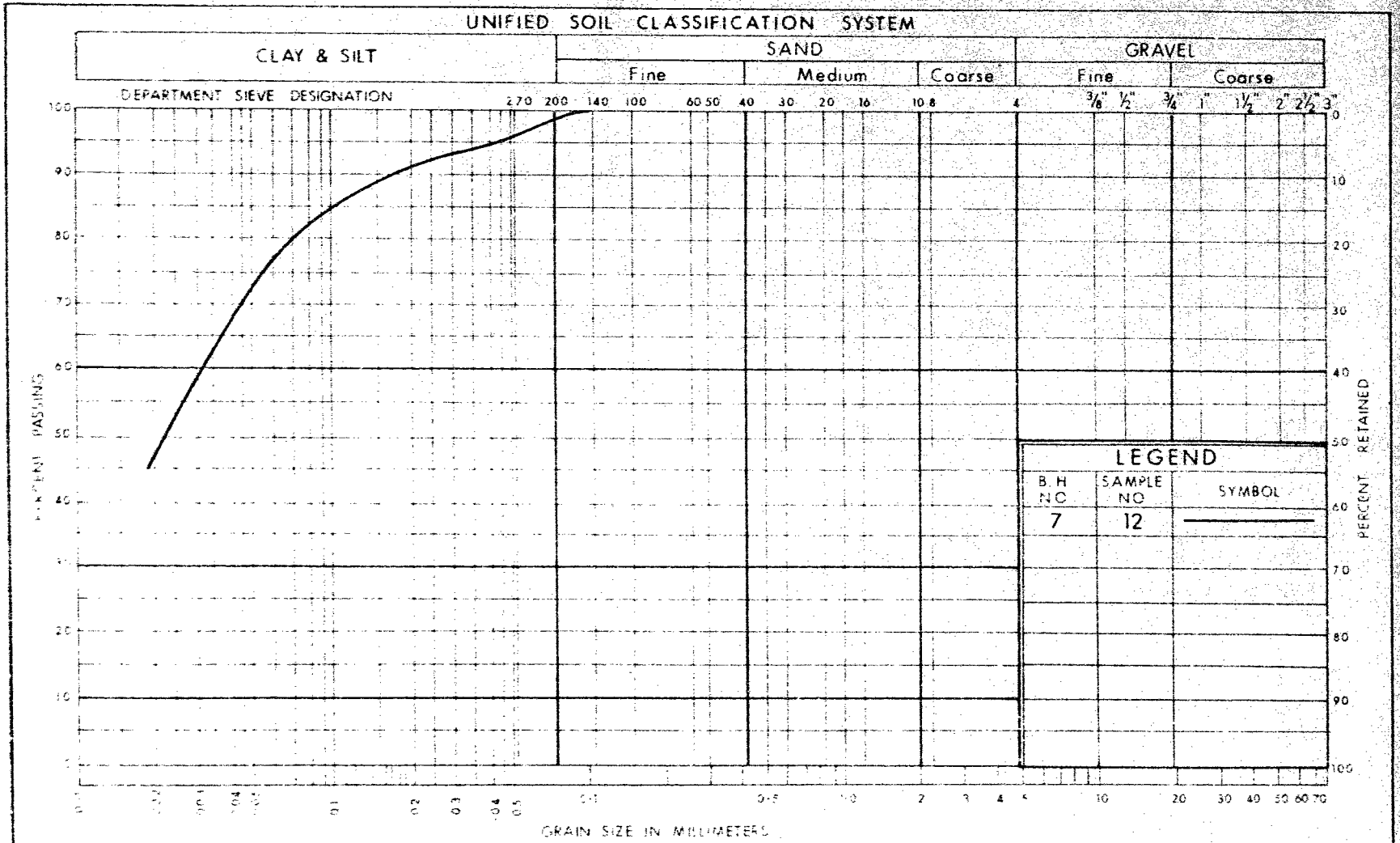
DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

PLASTICITY CHART

SILTY CLAY

W.P No. 43 - 66 - 10
JOB No. 69 - F - 97
FIG. 4

FORM OB MT - 17
REV APR 1965



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION

GRAIN SIZE DISTRIBUTION

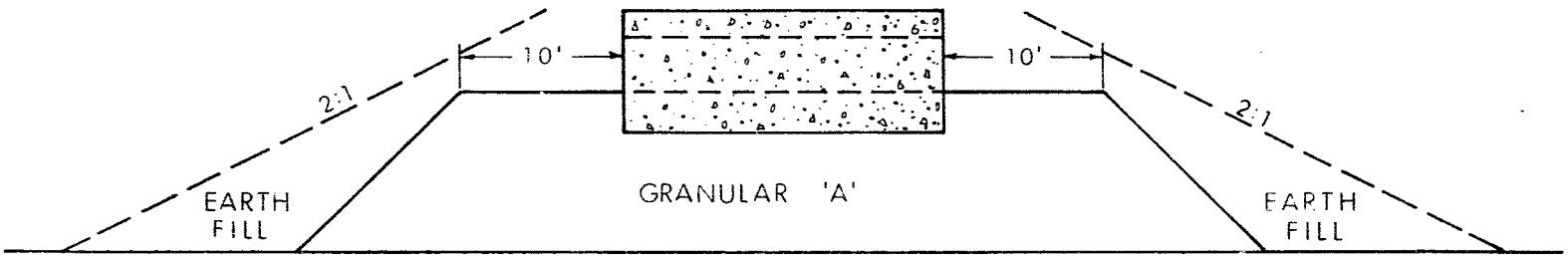
SILTY CLAY

W.P. No. 43 - 66 - 10

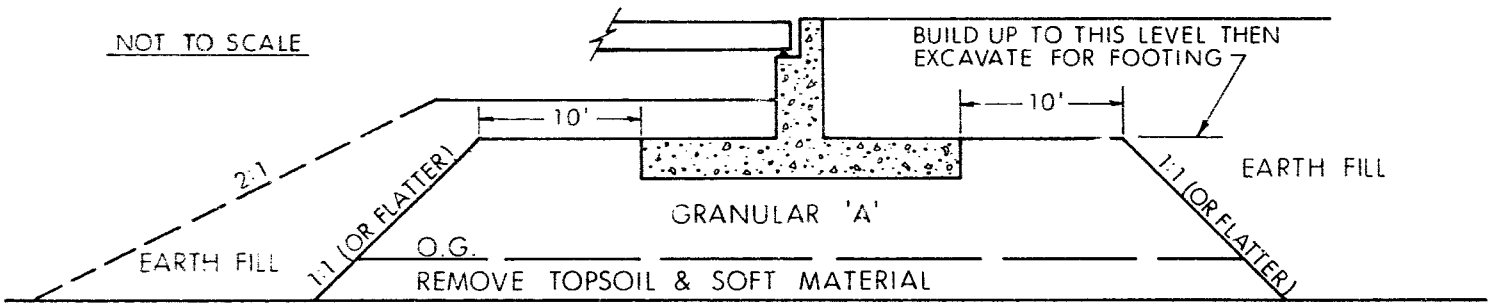
JOB No. 69 - F - 97

FIG. 5

ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



X - SECTION



LONGITUDINAL SECTION

NOTES

1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.

2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT D.H.O. STANDARDS.

3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.

FIG. 6

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

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 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
$\log_{10} a$ 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 (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

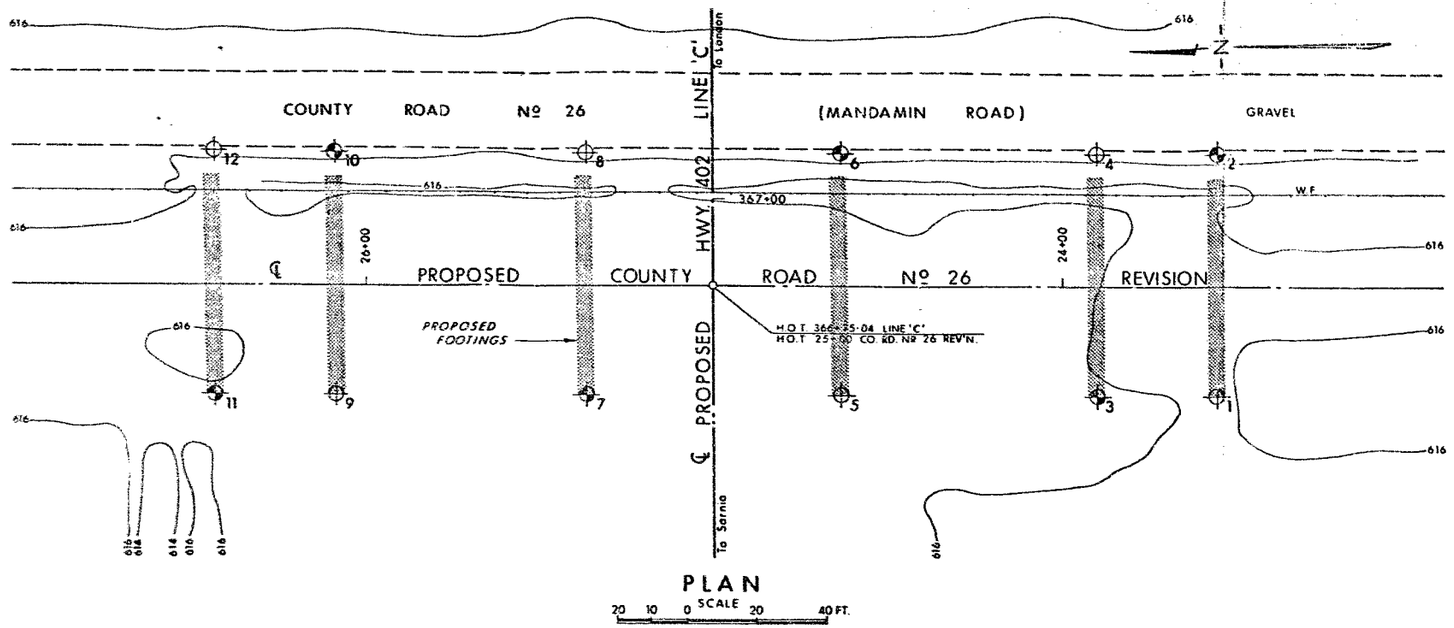
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

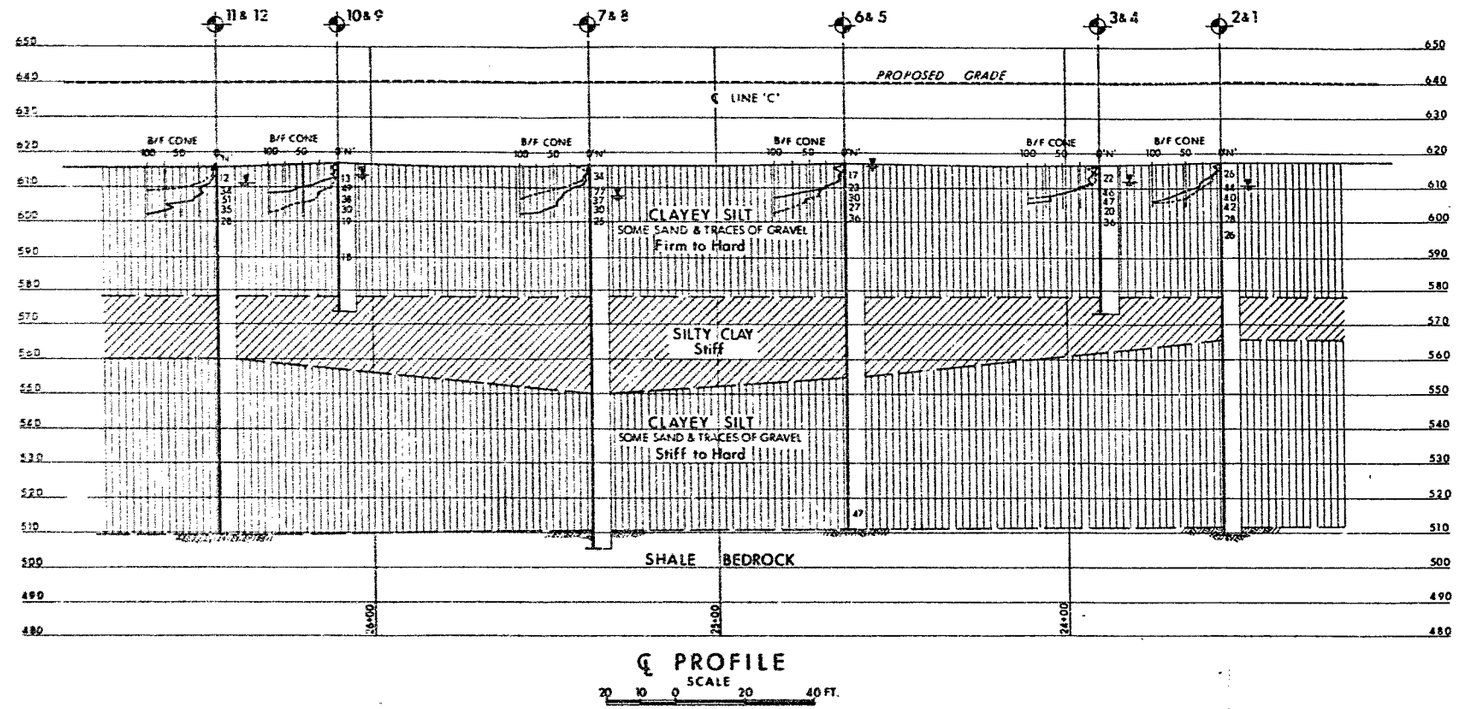
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY. DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

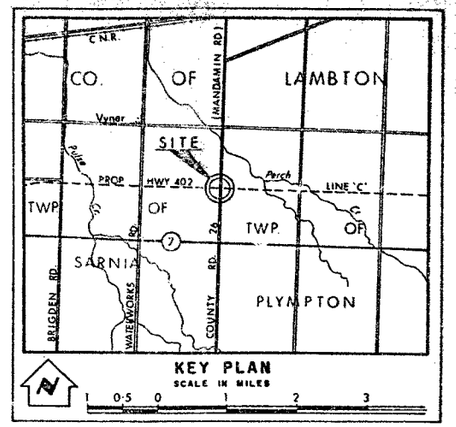
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



PLAN
SCALE 20 10 0 20 40 FT.



℄ PROFILE
SCALE 20 10 0 20 40 FT.



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, NOV. 1969

NO.	ELEVATION	STATION	OFFSET
1	616·2	23+55	32' LT.
2	617·0	23+55	39' RT.
3	616·1	23+90	32' LT.
4	616·9	23+90	39' RT.
5	615·9	24+63	32' LT.
6	616·7	24+63	39' RT.
7	615·8	25+36	32' LT.
8	616·8	25+36	39' RT.
9	615·7	26+09	32' LT.
10	616·8	26+09	39' RT.
11	615·6	26+44	32' LT.
12	616·8	26+44	39' RT.

– 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.

PRINT RECORD		
NO.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS – ONTARIO
MATERIALS & TESTING OFFICE – FOUNDATION SECTION

COUNTY ROAD Nº 26
(MANDAMIN ROAD)

KING'S HIGHWAY NO. 402 LINE 'C' DIST. NO. 1
CO. LAMBTON
TWP. SARNIA & PLYMPTON LOT 1 CON. V & VII

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D G.A.	CHECKED	W.P. NO. 43-66-10	M.B.T. DRAWING NO. 69-F-97A
DRAWN S.O.	CHECKED	JOB NO. 69-F-97	
DATE 16 DEC. 1969		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

REF. NO. E-4849-1

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: December 23, 1970

OUR FILE REF.

IN REPLY TO

SUBJECT: County Rd. #26 Interchange Underpass
W.P. 43-66-10, Site No. 14-347
Highway 402, District No. 1

69-F-97

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.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

30. Dec 70

The length of design load on piles should be confirmed by pile loading tests

A.L.B

21 Jan 71

DEPARTMENT OF HIGHWAYS ONT.

69 F 97

MEMORANDUM

To: Mr. A.G. Stermac,
Principal Foundation Engr.,
Mat. and Testing Office,
Lab. Bldg., DOWNSVIEW.

From: A.P. Watt,
Reg. Br. Planning Engr.,
London Regional Office.

Attention:

Date: October 29th, 1969.

Our File Ref.

In reply to

Subject:

W.P. 43-66-10, Bridge Site 14-347,
County Road #26 Interchange Underpass,
Highway 402,
District 1 - Chatham.

Would you kindly arrange to have a foundation investigation conducted at the above location.

I have enclosed two copies of the bridge site plan E-4849-1 with the probable footing locations marked in red. I have also enclosed one copy of the preliminary intersection design as prepared by Functional Planning, Southwestern Region, for your use.

A.P. WATT
Reg. Bridge Planning Engineer,
London Regional Office.

APW/ss
Attch.

c.c. S. McCombie.
A. Crowley.

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 50 F-34 SITE Mandaumin Rd BOREHOLE No. 6 GROUND ELEVATION

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1		2"		2	5	93	Nil	Dull	None to Slow	High	Earthy	Brown	Trace			
2								Dull	None	"	"		"		Clay silt	
3															Clay silt	
										"	"				Clay silt trace Sa	
															Clay silt	

NOTES:- VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT _____ SITE _____ BOREHOLE No. _____ GROUND ELEVATION _____

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69 F 97 SITE Mandaumin Rd BOREHOLE No. 7 GROUND ELEVATION

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE													
				GRAVEL	SAND	SILT & CLAY											
1	0.0 to 2.5	1/2"	Sub Ang.	1	8	91	High	Dull	None	High	Earthy	Brown	Strong			Clayey Silt with traces Sand, silt gravel	CL
2	5.0 to 7.5	1/8"			7	93	"	"	"	"	"	Motld Br Gr				Clayey Silt w traces Sa	CL
3	10.0 to 12.5	1/4"	Sub Rnd	1	7	92	"	"	"	"	"	Grey				Clayey Si. w trace Sand Gr	CL
4	15.0 to 17.5	1/2"	"	1	5	94			"	"	"	"				as above	CL
5	20.0 to 22.5	1/4"	"	1	4	95	"	"	"	"	"	"				Clayey Silt-SiCl + tr Sa & Gr	CL/CI

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69 F 97 SITE Mandamin Rd BOREHOLE No. 10 GROUND ELEVATION

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE													
				GRAVEL	SAND	SILT & CLAY											
1	3'0" 4'5"	1/4"	Sub R	5	20	75	Med	Dull	None	Med	Earthy	Brown	Strong			Clayey Silt, some Sa, tr Gravel	CL
2	6'0" 7'5"	1/4"	Sub R	2	8	90	High	"	None	High	"	Brown	"			Cl Silt, tr Sa & Gr	
3	9'0" 10'5"	1/4"	"	1	7	92	"	"	"	"	"	Grey	"			as above	CL
4	12'0" 13'5"	1/4"	"	1	5	94	"	"	"	"	"	Grey	"			as above	CL
5	15'0" 16'5"	1/2"	Sub R	10	5	85	High	Dull	None	High	"	Grey	"			Clayey Si Cl tr Sa & Gr	CL/CI
7	21'0" 22'5"	1/4"	"	2	7	91	"	Shiny	None	"	"	"	"			Silty Clay tr Sa & Gr	CI

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-97 SITE Mandaumin Rd BOREHOLE No. 11 GROUND ELEVATION

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3.0 4.5	1/2"	Sub R.	2	13	85	High	Shiny	None	High	Earthy	Mott Br-Gr.	Strong		Cl Si Si Cl some Sa tr Grav	CL CI
2	6.0 7.5	1/8"	"	-	8	92	"	Dull	"	"	"	Mott Br Grey	"		Clayey Silt sl tr Sa.	CL
3	9.0 10.5	1"	"	7	8	85	"	"	"	"	"	"	"		As above sl tr Grav	CL
4	12.0 13.5	1/8"	"	-	6	94	"	"		"	"	Grey	"		Cl Silt sl tr Sa	CL
5	15.0 16.5	1/2"	"	2	7	91	"	Dull-Shiny	"	"		Grey			Cl Silt Si Clay sl tr Sa tr Gr	CL CI

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 69 F 97 SITE Mandarin Rd BOREHOLE No. 2 GROUND ELEVATION

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3 0 4 5	3/4"	Sub Round	2	13	85	High	Shiny	None	High	Earthy	Mottled Brown Grey	Weak		Silty Clay, traces Sand & Gravel	CL
2	6 0 7 5	1/2"	Sub Round	4	7	89	"	Dull	None	"	"	Brown	Strong		Clayey Silt, traces Sa & Gr.	CL
3	9 0 9 5	1/4	Sub Ang	1	6	93	"	"	"	"	"	Grey	Strong		As above	CL
4	12 0 12 5	3/8"		1	5	94	"	"	"	"	"	"	"		" "	CL
5	15 0 15 5	1/8"	"	1	5	94	"	"	"	"	"	Grey	"		" "	CL
6	20 0 21 5	1/4"	Sub Round	1	5	94	"	"	"	"		Grey	"		" "	CL

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REMARKS:—

DEPARTMENT OF HIGHWAYS — ONTARIO

MATERIALS AND TESTING OFFICE

VISUAL CLASSIFICATION SHEET

PROJECT 60 F 97 SITE Mondamin Rd BOREHOLE No. 3 GROUND ELEVATION

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3 0 4 5	1/4"	Sub Round	1	15	84	High	Dull	None to slow	High	Earthy	Mottled Brown Grey	Med		Clayey Silt with some Sand, slt Gravel	CL
2	6 0 7 5	1/8"	"	-	5	95	"	"	None	"	"	Mottld Br Grey	Strong		Clayey Silt, traces Sand	CL
3	9 0 9 6	1/8"	"	-	5	95	"	"	"	"	"	"	"		as above	CL
4	12.0 13 5	1/4"	"	1	7	92	"	"	"	"	"	Grey	"		Clayey Si[illegible] slt Sand Gr	CL
5	12 0 13 5	1/4"	"	1	7	92	"	"	"	"	"	Grey	"		as above	CL

NOTES:— VISUAL CLASSIFICATION MUST BY CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:—