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CONSULTING ENGINEER & GEOLOGIST
250 BESSERER STREET
OTTAWA, ONT.

August 1, 1957.

REPORT OF SOIL INVESTIGATION AT SITE OF BRIDGE
ACROSS THE AZATIKA CREEK IN ALFRED TOWNSHIP

Introduction

This investigation was made at the site of an old bridge across the Azatika Creek. The present structure is in very bad shape, the North abutment (concrete) has tilted forward toward the creek and the deck (timber) is very weak. The site is close to the Ottawa River into which the creek drains, but, due to its proximity to the river, water levels after spring run off are the same as the river and there is very little flow.

Field Work Procedure

Since it was known that the area is underlain by a deposit of soft clay the main problem was to determine the depth to solid footing. Cone penetration tests were, therefore, conducted close to the present bridge piers, as shown on the attached sketch.

Drilling was done from the present bridge through holes in the decking which made the operation considerably easier.

The cone penetration test consists of driving a 2" diameter cone fitted to the end of AX drilling rods into the ground by means of a 140-lb. hammer dropped freely through 30 inches. The number of blows per foot of penetration is then recorded.

The attached Field Record sheets show the results of these tests.

Elevations were taken from the bridge deck at the North abutment (Elevation ~~100.0~~ arbitrarily chosen).

81.0

Observations

DATUM USED IN DESIGN OF BRIDGE

J.D.P.

Observations

(A) Penetration Resistance

In Hole No. 1, which was located at the North abutment, the resistance to driving the cone was extremely low for the first 19 feet below the creek bed. From there to refusal resistance was much higher but somewhat erratic indicating the presence of interbedded granular material.

In Hole No. 2, located at the South abutment, the cone penetrated very soft material for the first 10 feet and after that penetration resistance gradually increased to the bottom of the hole.

(B) Soil Types

In Hole No. 1, a very soft blue grey clay was encountered to a depth of 19 feet and this was followed by interbedded silt, sand and gravel with varying densities.

In Hole No. 2, a very soft blue grey clay was encountered to a depth of 10 feet which was followed by a medium soft clay to 17 feet and then interbedded material with gradually increasing density.

Conclusions and Recommendations

It is obvious, from the condition of the present bridge and the depth of very soft clay, that new bridge piers founded on footings would be useless. It is, therefore, recommended that creosoted timber piles be driven into the more solid strata below. The piles should be driven until they encounter a resistance corresponding to a safe load of twenty tons, according to the formula:

$$Q = \frac{2WH}{s + c}$$

Where	Q	=	Safe design load on the pile in lbs.
"	W	=	Weight of the ram of the pile driver in lbs.
"	H	=	Height of fall of the ram in feet.
"	s	=	Penetration of the pile in inches under the last blow of the hammer.
"	c	=	A constant equal to 1.0 for a drop hammer and 0.1 for a steam hammer.

For wooden piles

For wooden piles driven by hammers delivering 15,000 foot-pounds of energy the final number of blows per inch of penetration should be not more than 4. The estimated length of piles for the North and South abutments is 40 feet taken from the water level at the time of the investigation.

This should correspond to an elevation of 47.0 at the tip of the pile.

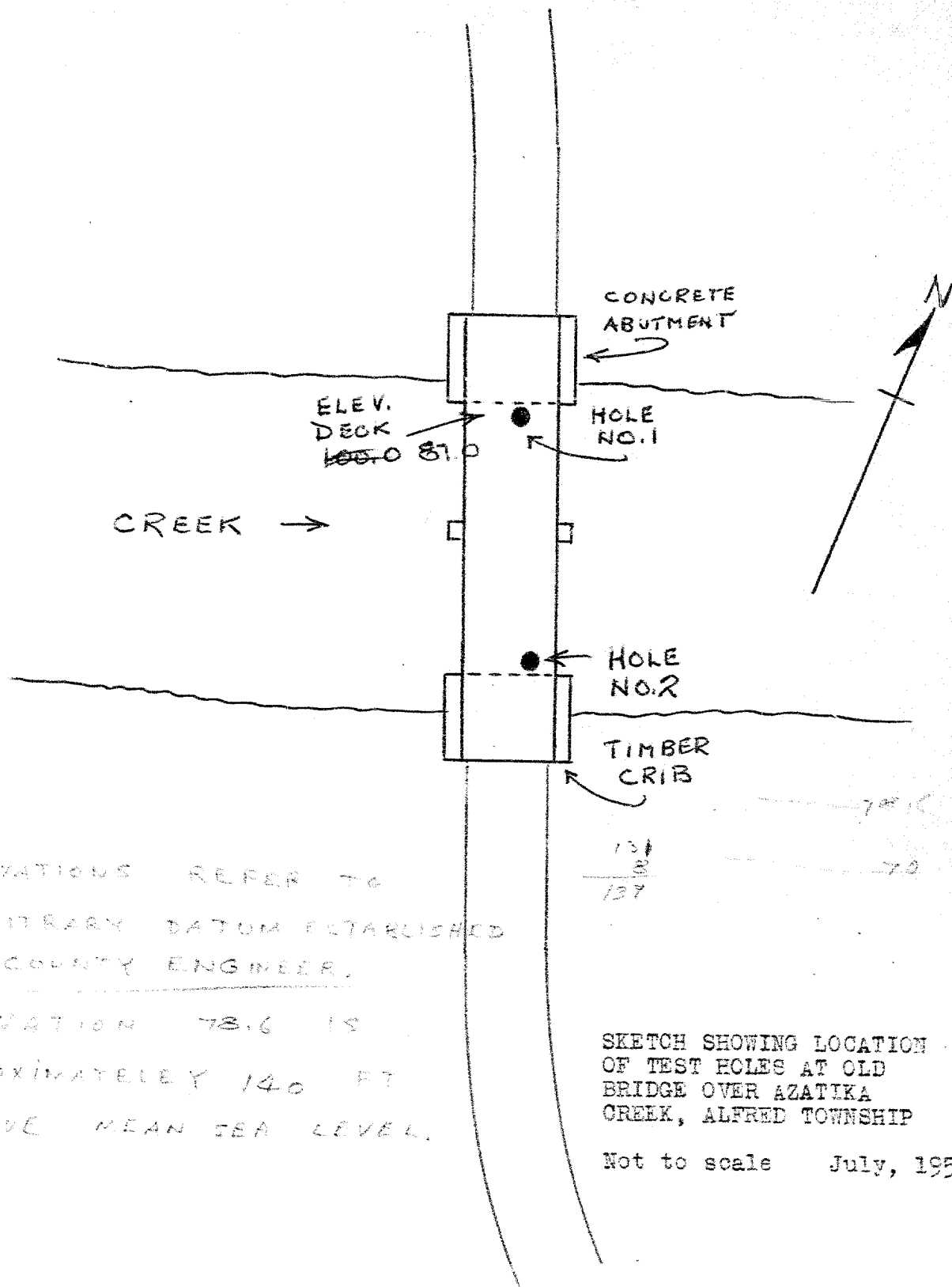
²
34.0



J. D. Paterson, P. Eng.



20004
15



ELEVATIONS REFER TO
ARBITRARY DATUM ESTABLISHED
BY COUNTY ENGINEER.

ELEVATION 78.6 IS
APPROXIMATELY 140 FT
ABOVE MEAN SEA LEVEL.

SKETCH SHOWING LOCATION
OF TEST HOLES AT OLD
BRIDGE OVER AZATIKA
CREEK, ALFRED TOWNSHIP

Not to scale July, 1957

Rain
Cool

Page 1 of 4

Client Russell County

Date June 25/57.

Borehole No. 1 A Elevation 79.5 46.5 North Abutment

Job Location 5 1/2 miles east of Alfred

Job Name Bridge over Creek

Driller Johnston

Coring 2.5 ft. 140 30

DEPTH (ft.)		SOIL DESCRIPTION		PEN. TEST SAMPLES	
1		Very soft Clay		Pushed	
0	1	To depth of 19 Ft.		79.5 46.5	
1	2			"	
2	3			"	
3	4			"	
4	5			"	
5	6			1	
6	7			1	
7	8			1	
8	9			4	
9	10			3	
10	11			3	
11	12			3	
12	13			2	
13	14			3	
14	15			2	
15	16			3	
16	17			3	
17	18			6	
18	19			30	
19	20	Interbedded Silt, Sand and Gravel to Refusal.		59.5 46.5	
20	21			26	
21	22			30	
22	23			35	
23	24			34	
24	25			48	
25	26			62	
26	27			48	
27	28			44	
28	29			37	
29	30			54	
30	31			43	
31	32			40	
32	33			40	
33	34			35	
34	35			37	
35	36			50	
36	37			37	

(Continued)

REMARKS Cone Penetration Test.
Soil classification below 20 feet based on penetra- Elev. 87.0 June 25/57
tion resistance - no samples. 74.0

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

2 4

Client Russell CountyDate June 25/57.Borehole No. 1 Elevation 795 66.5 North AbutmentLoc Location 5 1/2 miles east of AlfredLoc Name Bridge over CreekDrillers JohnstonDiameter 140 30

37	38	Interbedded Silt, Sand	40
38	39		36
39	40	and Gravel to Refusal.	48
40	41		48
41	42		94
42	42.5	Hard packed Till or Bedrock. Refusal.	

~~37.0~~ 24.0

PRIVATE

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

J. D. Paterson, P.Eng.

Sunny
Hot

Client: Russell County

3 4
June 26/57.

Borehole No. 2 Elevation ~~77.0~~ 64.0 Location: South Abutment
Job Location: 5 1/2 miles east of Alfred
Job Name: Bridge over Creek
Driller: Johnston
Savings: 140 30

DEPTH feet	FROM 10 TO	SOIL DESCRIPTION	FOR 100T CONE PENETRATION	REMARKS
0	1	Very soft Clay	Pushed	77.0 64.0
1	2	" " "	"	
2	3	" " "	"	
3	4	" " "	"	
4	5	" " "	"	
5	6	" " "	5	
6	7	" " "	6	
7	8	" " "	7	
8	9	" " "	7	
9	10	" " "	8	
10	11	Medium soft Clay	10	
11	12	" " "	10	67.0 54.0
12	13	" " "	10	
13	14	" " "	12	
14	15	" " "	12	
15	16	" " "	13	
16	17	" " "	13	
17	18	Interbedded Silt and Clay	13 21	57.0 46.0
18	19	" " "	19	
19	20	" " "	18	
20	21	" " "	21	
21	22	" " "	21	
22	23	" " "	21	
23	24	" " "	21	
24	25	" " "	21	
25	26	" " "	18	
26	27	" " "	22	
27	28	" " "	32	
28	29	Silt, Sand & Gravel	24	49.0 36.0
29	30	" " "	33	
30	31	" " "	30	
31	32	" " "	26	
32	33	" " "	26	
33	34	" " "	27	
34	35	" " "	26	
35	36	" " "	26	40.0 27.0
		Sand and Gravel		
		to bottom of hole.		

(Continued next page)

REMARKS: Cone Penetration Test. Soil classification below 20 feet based on penetration resistance only - Elev. ~~57.0~~ 74.0 June 26/57.
no samples.

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

JOHN D. PATERSON

Consulting Engineer

Location

Temperature

Bores with

Bores delay

FIRST BOREHOLE FOUND 1900

Page No

4 of 4

Date:

June 26/57.

City:

Russell County

Borehole No. 2

Elevation:

~~77.0~~ 64.0

Location

South Abutment

Job Location:

5 1/2 miles east of Alfred

Job Name:

Bridge over Creek

Drillers:

Johnston

Drill Type

Casing:

0 H.P.

Size 3

In. dia

Blower

140 lbs

30

in. dia

Depth, feet

Drill Description

Penetration Samples

Elevation

Depth, feet

Bottom and Penetration

Penetration Type

36
37
38
39
40
41
42
43
44
45
4637
38
39
40
41
42
43
44
45
46
47Interbedded Sand & Gravel to
bottom of hole28
44
40
40
39
37
39
40
65
68
85~~30.0~~ 17.0

REMARKS:

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

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OVER

$$Q_a = \frac{\bar{N} A_s}{100}$$

$$= \frac{15(6)(3.5)}{100} = 3.15$$

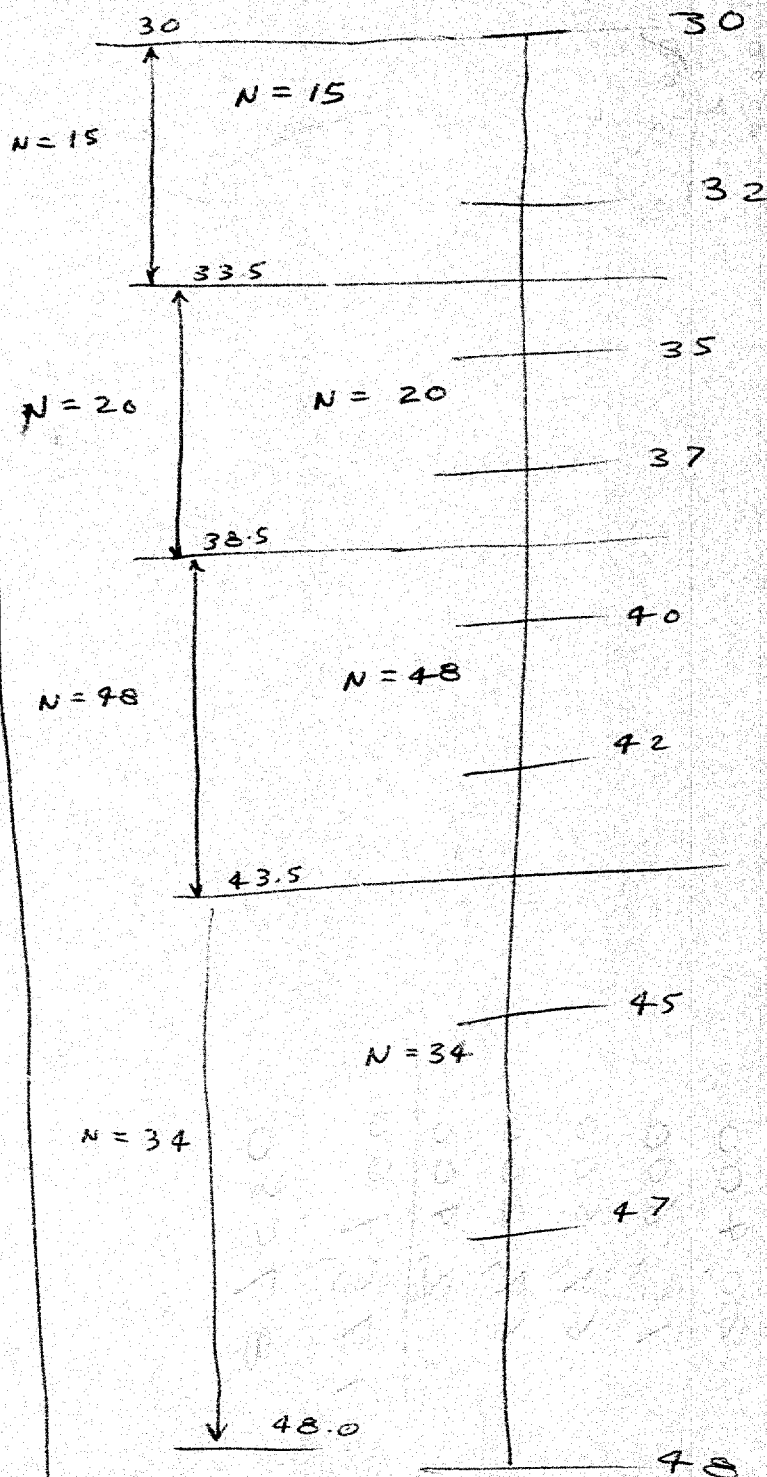
$$Q_a = \frac{20(6)(5)}{100} = 6.00$$

$$Q_a = \frac{48(6)(5)}{100} = 14.40$$

$$Q_a = \frac{34(6)(4.5)}{100} = 9.20$$

$$\begin{array}{r} 34.75 \\ 2000 \\ \hline 6950000 \end{array}$$

$$34.75$$



$$\begin{array}{r}
 20,400 \\
 15,600 \\
 69,500 \\
 67,200 \\
 \hline
 = 2,400 \\
 \hline
 175,100 \\
 87.550
 \end{array}$$

$$\begin{array}{r}
 2500 \\
 + 9 \\
 \hline
 22,500
 \end{array}$$

$$\begin{array}{r}
 68 \\
 \hline
 20,300 \\
 \hline
 20,300
 \end{array}$$

$$\begin{array}{r}
 52 \\
 \hline
 300 \\
 \hline
 15,600
 \end{array}$$

$$\begin{array}{r}
 40,200 \\
 \hline
 4700 \\
 \hline
 67,200
 \end{array}$$

Field Boring Log

Driller	Hours Work	Hours Delay	Footage
1	10	10	10
2	10	10	10
3	10	10	10
4	10	10	10
5	10	10	10
6	10	10	10
7	10	10	10
8	10	10	10
9	10	10	10
10	10	10	10
11	10	10	10
12	10	10	10
13	10	10	10
14	10	10	10
15	10	10	10
16	10	10	10
17	10	10	10
18	10	10	10
19	10	10	10
20	10	10	10
21	10	10	10
22	10	10	10
23	10	10	10
24	10	10	10
25	10	10	10
26	10	10	10
27	10	10	10
28	10	10	10
29	10	10	10
30	10	10	10
31	10	10	10
32	10	10	10
33	10	10	10
34	10	10	10
35	10	10	10
36	10	10	10
37	10	10	10
38	10	10	10
39	10	10	10
40	10	10	10
41	10	10	10
42	10	10	10
43	10	10	10
44	10	10	10
45	10	10	10
46	10	10	10
47	10	10	10
48	10	10	10
49	10	10	10
50	10	10	10
51	10	10	10
52	10	10	10
53	10	10	10
54	10	10	10
55	10	10	10
56	10	10	10
57	10	10	10
58	10	10	10
59	10	10	10
60	10	10	10
61	10	10	10
62	10	10	10
63	10	10	10
64	10	10	10
65	10	10	10
66	10	10	10
67	10	10	10
68	10	10	10
69	10	10	10
70	10	10	10
71	10	10	10
72	10	10	10
73	10	10	10
74	10	10	10
75	10	10	10
76	10	10	10
77	10	10	10
78	10	10	10
79	10	10	10
80	10	10	10
81	10	10	10
82	10	10	10
83	10	10	10
84	10	10	10
85	10	10	10
86	10	10	10
87	10	10	10
88	10	10	10
89	10	10	10
90	10	10	10
91	10	10	10
92	10	10	10
93	10	10	10
94	10	10	10
95	10	10	10
96	10	10	10
97	10	10	10
98	10	10	10
99	10	10	10
100	10	10	10

Borehole No. _____ Elevation _____ Height Datum Above Ground _____

Remarks: PLAN & ELEVATION OF BHI & PILES TO BE TESTED

Depth From	Feet. To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
		12" B.P. 53		
		← 7'-2 3/4" × 7'-4 1/2" →		
		1 2 3		
		9'5"		
		4'-0" BHI → 4'5" of L		
		23.16		
		12"		
		105'		
		105'		
		74'-7"		
		Water level - end of day		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 16 SEP 60
Job No. 60-F-85
W. P. No.
Location AZATIK

Driller	Hours Work	Hours Delay	Footage
1	10	0	100
2	10	0	100
3	10	0	100
4	10	0	100
5	10	0	100
6	10	0	100
7	10	0	100
8	10	0	100
9	10	0	100
10	10	0	100
11	10	0	100
12	10	0	100
13	10	0	100
14	10	0	100
15	10	0	100
16	10	0	100
17	10	0	100
18	10	0	100
19	10	0	100
20	10	0	100
21	10	0	100
22	10	0	100
23	10	0	100
24	10	0	100
25	10	0	100
26	10	0	100
27	10	0	100
28	10	0	100
29	10	0	100
30	10	0	100
31	10	0	100
32	10	0	100
33	10	0	100
34	10	0	100
35	10	0	100
36	10	0	100
37	10	0	100
38	10	0	100
39	10	0	100
40	10	0	100
41	10	0	100
42	10	0	100
43	10	0	100
44	10	0	100
45	10	0	100
46	10	0	100
47	10	0	100
48	10	0	100
49	10	0	100
50	10	0	100
51	10	0	100
52	10	0	100
53	10	0	100
54	10	0	100
55	10	0	100
56	10	0	100
57	10	0	100
58	10	0	100
59	10	0	100
60	10	0	100
61	10	0	100
62	10	0	100
63	10	0	100
64	10	0	100
65	10	0	100
66	10	0	100
67	10	0	100
68	10	0	100
69	10	0	100
70	10	0	100
71	10	0	100
72	10	0	100
73	10	0	100
74	10	0	100
75	10	0	100
76	10	0	100
77	10	0	100
78	10	0	100
79	10	0	100
80	10	0	100
81	10	0	100
82	10	0	100
83	10	0	100
84	10	0	100
85	10	0	100
86	10	0	100
87	10	0	100
88	10	0	100
89	10	0	100
90	10	0	100
91	10	0	100
92	10	0	100
93	10	0	100
94	10	0	100
95	10	0	100
96	10	0	100
97	10	0	100
98	10	0	100
99	10	0	100
100	10	0	100

Borehole No. 1 Elevation _____ Height Datum Above Ground _____
 FILE NO. _____

Remarks: DRIVING RECORD

Depth From	Feet. To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
		4300 LB HAMMER FALLING ABOUT 10 FT.		
			AVERAGE	
		DEPTH BLOWS/FT.	DEPTH BLOWS/FT	REBOUND
			DEPTH	REBOUND
		68 START 0	87 10	97' 0.36"
		69 10	88 10	78 0.23"
		70 9	89 12	
		71 8	90 11	
		72 9	91 12	
		73 10	92 11	
		74 8	93 12	
		75 7	94 12	
		76 7	95 12	
		77 9	96 14	
		78 8	97 13	
		79 8	98 14	
		80 7	99 18	
		81 8	100 18	
		82 8	101 18	
		83 7	102 18	
		84 10		
		85 9		
		86 8		
		Water level- end of day		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 16 SEP 60
Job No. 60-F-85
W.P. No.
Location AZATIKA CREEK BRIDGE

R. CONSTANTINEA
Driller F. E. JOHNSON
Hours Work
Hours Delay
Footage

Borehole No. 1 Elevation 78.6 Height Datum Above Ground 0

Remarks:

Depth From	Feet To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
0	5'-0"	DRIVE NX CASING - WASH BROWN CLAY - FILL		
5'-0"	7'-0"	STD PEN. TEST BROWN CLAY - SOFT TO MED. STIFF. INT. PLASTICITY	S.S. 1	1-2-4-6
5'-0"	10'-0"	DRIVE NX CASING - WASH BROWN CLAY - FILL		
10'-0"	12'-0"	STD PEN. TEST SAME AS S.S. 1	S.S. 2	0-1-3-5
	13'-6"	VANE - 26 LBS EACH SCALE AT 12" REMOULD - 12 LBS EACH SCALE AT 3" SAME AS S.S. 1		1040 } 120 } 8.7
10'-0"	15'-0"	DRIVE NX CASING - WASH BROWN CLAY - FILL		
15'-0"	17'-0"	STD PEN. TEST SAME AS S.S. 1 TO 16'-7" B.G.E. 16'-7" - 17'-0" DK. GR. - DK. GREY SOFT CLAY - MARINE CLAY - SEE S.S. 3	S.S. 3	1-2-2-3
		Water level - end of day		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 16 SEP 60
Job No. 60-F-85
W. P. No.
Location AZATIKA

R.CONSTANTINEAL
Driller F.E. JOHNSON
Hours Work
Hours Delay
Footage

Borehole No. 1 Elevation 736 Height Datum Above Ground

Remarks :

[illegible]

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 20 SEP 60
Job No. 60-F-85
W. P. No.
Location AZATIKA CREEK BRIDGER. CONSTANTINEAU
Driller F.E. JOHNSON
Hours Work
Hours Delay
FootageBorehole No. 1 Elevation 78.6 Height Datum Above Ground 0

Remarks:

Depth From	Feet To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
15'	20'	DRIVE NX CASING - GR. CL. SOFT		
20'	22'	PUSH DOWN SHELBY TUBE BY HAND GR. SOFT CLAY	C.T. 4	
22'	23'-6"	VANE - 16 LBS EACH SCALE AT 6" REMOULD - 11 LBS EACH SCALE AT 3" SOFT GR. CL.		320 } 2.9 110 }
23'	25'	DRIVE NX CASING - WASH. AS ABOVE		
25'	28'-5"	PUSH DOWN SHELBY TUBE BY HAND GR. CL. - SOFT - MARINE	C.T. 5	
28'-5"	29'-8"	VANE - 42 LBS EACH SCALE AT 3" REMOULD - 12 LBS EACH SCALE AT 3" GR. CL. - SOFT - MARINE CL.		420 } 3.2 130 }
29'-8"	30'	DRIVE NX CASING - WASH - GR. SOFT CLAY TO 29'-8"		
30'	32'	STD PEN. TEST 140 LB HAMMER FALLING 30" GR. V.F. SA. - MANY MIKA PARTICLES	C.E. 6	8-8-7-8 (15)
		Water level - end of day		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

R. CONSTANTINEAU

Date 20 SEP 60

Job No. 60-F-85

W. P. No.

Location AZATIKA CREEK BRIDGE

Driller F.E. JOHNSON

Hours Work

Hours Delay

Footage

Borehole No. 1 Elevation 78.6 Height Datum Above Ground 0

Remarks :

Depth From	Feet To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
35	38	DRIVE NX CASING - WASH - GR. V.F. SA. MANY MICA FLEKES.		(10)
35	37'	STD PEN TEST GR.V.F. SAND - APPEARS WHITE WHEN DRIED	S.S.7	11-10-10-12
35	40	DRIVE NX CASING - WASH - AS ABOVE		(40)
40	41 $\frac{1}{2}$ '	STD PEN TEST - 10% RECOVERY GREY V.F. SAND		16-21-27
40	45	DRIVE NX CASING - WASH - GR. V.F. SA.		(34)
45	47'	STD. PEN. TEST	S.S.8	7-12-22-28
45	46	DRIVE NX CASING		
0	50	PUT DOWN BX CASING - FILL CASING WITH WATER		15 30 40 49 11 4) 11 27
		Water level - end of day		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 21 SEP 60
Job No. 60-F-85
W.P. No.
Location AZATIKIA CREEK BRIDGE

R. CONSTANTINEAU
Driller F.E. JOHNSON
Hours Work
Hours Delay
Footage

Borehole No. 1 Elevation 78.6 Height Datum Above Ground 0

Remarks:

Depth From	Feet. To	Description	Sample No.	Blows Per Ft.
		Water level - start of day 2' BELOW EXCASING		
		L.C. AT 48' ABOVE BOTTOM OF HOLE.		
		W.L. DROPPED 2' IN 4 1/2 HOURS		
		EX CASING TO 50' - WASH		
		GRIVE SA. TO 48' B.G.L.		
48'	50'	GR.		
50'	51'-3"	PUSH DOWN SHELBY TUBE WITH BAR	S.T. 9	
		& WRENCHES		
		GR. MED. STIFF CL. LOW - MED PLAST.		
		CHECK IN LAB!		
50'	53'	DRIVE BY CASING - WASH - GR. CL.		
		MED STIFF.		
53'	55'	STD PEN TEST - GR. MED. STIFF CL.	SS. 10	3-5-7-9
	60'	DRIVE BY CASING BY WASHING		
		AHEAD - GR. CL.		
60'	61'-3"	PUSH DOWN SHELBY TUBE BY HAND,	S.T. 11	
		WRENCHES & BAR. GR. STIFF CLAY		
	62'-9"	VANE - 50 LBS EACH SCALE AT 12"		> 2000
		NO SHEAR - STIFF GR. CL.		
		Water level - end of day		

MINISTRY OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

R. CONSTANTINEAU

Date 22 SEP 60
Job No. 60-F-85
W.P. No.
Location AZATIKA CREEK BRIDGE

Driller
Hours Work
Hours Delay -- 2
Footage

Borehole No. 1 Elevation 78.6 Height Datum Above Ground c

Remarks :

Depth From	Feet. To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
60	65	DRIVE BX CASING - WASH - GR. CL.		
65	67	STD PEN TEST - 2 JARS 65'-0" - 65'-6" GR. SA. CL. → A & B 65'-6" - 66'-8" - GR. V.F. SAND 66'-8" - 67'-0" MIXT. OF GR. & RED CL. MED. STIFF	S.S. 12	3-6-9-10
65	70	DRIVE BX CASING - WASH GR. SA. CL. & CL. SA. → 68'-0" B.C.E. 68'-0" - 70'-0" GR. & RED BR. CL.		
70	71'-6"	PUSH DOWN SHELLEY TUBE BY WRENCH & BAR - SMHBOD	S.T. 13	
70	75	DRIVE BX CASING - WASH - GR. CL.		
75	76'-3"	PUSH DOWN SHELLEY TUBE WITH WRENCH & BAR - GR. MED. STIFF CL.	S.T. 14	
75	80	DRIVE BX CASING - WASH - GR. CL.		
80	81'	PUSH DOWN BX CASING - WASH GR. CL. MED. STIFF	S.T. 15	
		Water level - end of day		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 22 SEP 60
Job No. 60-F-85
W. P. No.
Location AZATIKA

R. CONSTANTINEAD
Driller F. E. JOHNSON
Hours Work
Hours Delay
Footage

Borehole No. 1 Elevation 78.6 Height Datum Above Ground 0

Remarks :

[illegible]

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 23 SEP 60
Job No. 60-F-85
W.P. No.
Location AZATIKA CREEK BRIDGE

R. CONSTANTINEA
Driller F.E. JOHNSON
Hours Work
Hours Delay
Footage

Borehole No. 1 Elevation 78.6 Height Datum Above Ground 0

Remarks :

Depth From	Feet. To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
95	100	DRIVE BX CASING - WASH GR CL - STIFF		
100	102.5	PUSH DOWN SHELBY TUBE WITH BAR & WRENCHES - GR. STIFF CL.	S.T. 18	
100	105	DRIVE BX CASING - WASH - GR CL. MED. STIFF		
105	107	STD PEN TEST - STIFF GR. CL.	SS. 10	2-3-6-7
105	110	DRIVE BX CASING - WASH - GR CL. - STIFF		
110	111.5	PUSH DOWN SHELBY TUBE WITH BAR & WRENCHES - GR CL. STIFF.	S.T. 20	
		END OF BHI		
		Water level - end of day		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 16 & 17 SEP 60
Job No. 60-F-85
W. P. No.
Location AZATIKA CREEK BRIDGE

Driller
Hours Work
Hours Delay
Footage

Borehole No. 2 Elevation _____ Height Datum Above Ground _____
PILE

Remarks: DRIVING RECORD

Depth From	Feet. To	Description	Sample No.	Blows Per Ft.
		Water level - start of day		
		4300 LB HAMMER FALLING ABOUT 10 FT		
		DEPTH BLOWS/FT DEPTH BLOWS/FT		
		30' PILE 45' PILE		
		5 FT DROP		
	15'-20'	10 47 7	70	13
	20'-25'	11 48 9	71	13
	25'-30'	40 49 9	72	11
	31	5 50 11	73	8
	32	7 51 11		
	33	6 52 10	(REBOUND) INC.	
	34	7 53 10		
	35	7 54 11		
	36	7 55 11		
	10 FT DROP	56 11		
	37	5 57 9		
	38	5 58 10		
	39	5 59 10		
	40	5 60 10		
	41	5 61 9		
	42	6 62 8		
	43	6 63 9		
	44	6 64 11		
	45	8 65 10		
	46 (0.33")	7 66 14 *		
		67 14 *		
		Water level - end of day 68 14 *		
		69 (0.18") 13 *		
		* 5' DROP		

DEPT. OF HIGHWAYS ONTARIO
MATERIALS & RESEARCH SECTION

Field Boring Log

Date 16 SEP 60
Job No. 60-F-85
W.P. No.
Location

AZATIKA CREEK BRIDGE

Driller
Hours Work
Hours Delay
Footage

Borehole No. 3 Elevation _____ Height Datum Above Ground _____
PILE

Remarks: DRIVING RECORD

Depth From	Feet. To	Description		Sample No.	Blows Per Ft.
		Water level - start of day			
		4300 LB HAMMER FALLING ABOUT 10'			
		DEPTH	BLOWS/FT	DEPTH	BLOWS/FT
		35	8	57	15
		36	10	58	13
		37	10	59	14
		38	11	60	14
		39	15	61	10
		40	10	62	12
		41	12	63	11
		42	15	64	12
		43	18	65	11
		44	14	66	7
		45	18	67	8
		46	15 9	68	8
		47	18 10	69	7
		48	14 10	70	7
		49	14 11	71	8
		50	12 15	72	6
		51	10	73	6
		52	12	74	6
		53	18	75	7
		54	15	76	6
		55	14	77	6
		56	15	78	6
		Water level - end of day		101	

PILE LOADING TEST

AZATIKA CREEK BRIDGE

STA 5+20 ; 7.2' LT OF $\frac{1}{2}$

60-F-85

DRIVEN 17 SEP 60

TESTED 18 SEP 60 ✓

PILE 12" BP 53, 56' long

74.6' LONG; TIP ELEV. 145.6 ✓

Bearing Pile

No Ruck

N.B.C.

$$R = \frac{4nWh}{s + c/2}$$

$$n = \frac{W + e^2P}{W + P}$$

$$e = 0.4$$

$$W = 4300 \text{ LBS}$$

$$P = 53 \times 75 + 500$$

$$= 3975 + 500$$

$$= 4475 \text{ LBS}$$

$$n = \frac{4300 + (0.4)^2 4480}{4300 + 4480}$$

$$= \frac{4300 + 717}{4300 + 4480}$$

$$= \frac{5017}{8780}$$

$$= 59\%.$$

$$S = \frac{12}{13} = 0.924 \text{ in./blow}$$

$$C = 0.18 \text{ in.}$$

$$h = 0.8(5) = 4 \text{ ft.}$$

$$\begin{array}{r} 4480 \\ \times .16 \\ \hline 717 \\ 4300 \\ \hline 5017 \\ 4300 \\ 4480 \\ \hline 8780 \end{array}$$

C. C. PARKER AND ASSOCIATES LIMITED

CONSULTING PROFESSIONAL ENGINEERS

**HAMILTON - LONDON
ONTARIO, CANADA**

OUR REF: 831-20-102

C. C. PARKER
D. C. CRAMM
J. S. R. BECK
H. P. CONNOR
H. C. NIXON
I. M. WALLACE

795 Main Street West,
Hamilton, Ontario,
June 14, 1960.

T. Stelman

foundation files

Mr. L. G. Soderman,
Soils Branch,
Department of Highways Ontario,
Parliament Buildings,
Toronto, Ontario.

Dear Sir:

Re: Azatika Creek Bridge - Counties of Prescott and Russell

We are enclosing one copy each of the Soils Reports prepared by J. D. Paterson and a later report prepared jointly by J. D. Paterson and R. C. Gauthier.

A copy of the report prepared by the National Research Council will be forwarded as soon as it is available.

Yours very truly,

C. C. Parker and Associates Limited,

D. C. Cramm

D. C. Cramm, P. Eng.,
Bridge Department Manager.

DCC-pn
Encl.



June 17, 1960.

C.C. Parker & Associates Limited,
795 Main Street West,
Hamilton, Ontario.

Attention: Mr. D.C. Gramm

Re: Azatika Creek Bridge - County
of Prescott and Russell

Dear Sir:

We have reviewed the preliminary design drawings P-1 and P-2 submitted by C.C. Parker & Associates Ltd., on the above mentioned bridge.

The only comment about the design is the slope of the creek bed. It should be as gentle as possible and a parabolic shape of the creek bed should be the best final solution. On the drawing P-2 a bank slope of even 1:1 is indicated, which is undoubtedly too steep.

It is clearly visible from the drawings that the new ground level differs only slightly from the original, a fact which is recommendable.

Yours truly,


T. Stermac
Foundation Office Engineer

TS/tt

c.c. Fdn. Section
A. Kleinsteinber
Files



CABLE ADDRESS "RESEARCH"
IN YOUR REPLY PLEASE QUOTE
FILE NO. **M43-4-18**
YOUR REFERENCE

NATIONAL RESEARCH COUNCIL
CANADA

DIVISION OF
BUILDING RESEARCH

OTTAWA 2.

26 March 1959

Mr. J. Morin,
County Engineer,
United Counties of Prescott
and Russell,
Plantagenet, Ontario.

Dear Jean:

We have completed our study of the bridge abutment failure at Azatika Creek and have pleasure in sending you three copies of our SPX Report number 81, describing this work.

During the course of the study, we have discussed the failure with Mr. Jack Paterson, consulting engineer, and with the soils engineers of the Ontario Department of Highways. I would suggest therefore that you might forward one copy of our report to Mr. Paterson and one copy to Mr. Alex Rutka of the Materials and Research Section, Department of Highways of Ontario, Parliament Buildings, Toronto.

We hope that you will find this report useful in your reconstruction work. We would be grateful to hear from you about the reconstruction of the bridge.

Yours sincerely,

Carl B. Crawford,
Head,
Soil Mechanics Section

GBC:rs1



59-2427

$$R = \frac{4(0.59)(4300)(4)}{0.924 + 0.18\frac{1}{2}}$$

$$\begin{array}{r} 0.924 \\ 0.09 \\ \hline 1.114 \end{array}$$

$$= \frac{16(0.59)(4300)}{1.114}$$

$$\begin{array}{r} 3000 \\ 15 \\ \hline 45000 \end{array}$$

$$= 36400 \text{ lbs.}$$

$$= \underline{18.2 \text{ tons}}$$

$$U_R = 3(18.2) = 54.6 \text{ tons}$$

E.N.R. formula

$$R = \frac{2W_r H}{S + 1.0}$$

$$S.F. = 6$$

$$= \frac{2(4300)(5)(12)}{0.924 + 1.0}$$

$$\begin{array}{r} 8600 \\ 60 \\ \hline 516000 \\ 258000 \end{array}$$

$$= 270,000$$

$$U = \frac{270,000}{6} = 45 \text{ tons}$$

BBC

$$R = \frac{1.7 E}{S + 0.1 \sqrt{\frac{W_p}{W_r}}} = \frac{1.7(4300)5}{0.924 + 0.1 \sqrt{\frac{4480}{4300}}}$$

JOHN D. PATERSON, B.SC., P.ENG.

CONSULTING ENGINEER AND GEOLOGIST

250 BESSERER STREET
OTTAWA 2, ONT.

June 13th, 1958.

Mr. John Morin, P.Eng.,
County Engineer,
Counties of Prescott & Russell,
Plantagenet, Ontario.

Dear Mr. Morin,

Attached you will find Two Copies of a Joint
Report by Mr. R. C. Gauthier, P.Eng., and myself.

Enclosed, also, you will find the drawings
which you gave us the other night — with a pencil sketch
of the suggested new sill beam.

We would suggest that you take complete
measurements of the slide for record purposes.

We would be glad to hear from you when your
remedial work has been completed, or, if you would like
any further assistance, please do not hesitate to call.

Yours very truly,



J. D. Paterson, P. Eng.

NOTES ON FAILURES IN APPROACH FILLS FOR NEW BRIDGE ACROSS
AZATIKA CREEK, ALFRED TOWNSHIP.

Examination of the failure by sliding in the approach fills of the new bridge across the Azatika Creek in Alfred Township was made by the undersigned, (Raymond C. Gauthier, P. Eng., and J. D. Paterson, P. Eng.), on June 10th, 1958.

Failure has occurred in the approach fills on both sides of the creek.

The south side failure caused a semi-circular portion of the fill to slide toward the river. The curved plane of failure extends from the end of the southeast wing wall to the approximate centreline of the road. This wing wall was moved out of line approximately two inches.

The worst failure occurred in the north approach fill. In this case, the place of failure extended across the fill from the northeast wing wall and the northwest wing wall was included in the area of failure. This wing wall was cracked, pushed out of line and the end has dropped down several inches. Included in the dropped portion of the fill was the old concrete bridge abutment, which dropped approximately five feet.

Two of the old bridge wooden trestle bents were included in the area of uplift and these were raised up three or four feet, causing the bridge to be humped in the middle. Part of the plane of failure of this slide is parallel to the north shoreline of the creek.

The material used in the approach fills was a dried-out silty clay, which is not believed to have contributed (by its nature) to the failures. The fill at its junction with the bridge deck (north end) and between the wing walls has dropped approximately two and one half feet.

Both failures occurred when a heavy bulldozer, which was used to build up the fills, was in operation. The failure at the north side occurred as the bulldozer was approaching the bridge with the final touch-up quantities, and the time from the start of failure until the soil came to rest was about five minutes.

The plane of failure of the north approach fill probably extends downward some 20 feet below the original height of the fill and shear failure of the soft clay probably occurred at the interface between the soft clay and the much harder inter-bedded granular soils below. Condition of the three piles supporting the northwest wing wall is difficult to ascertain but they must either be bent out of line or sheared off since considerable movement has occurred.

The plane

The plane of failure of the south approach probably extends downward some 15 feet below the original height of the fill and shows considerably less vertical and horizontal displacement than the north approach failure.

CONCLUSIONS:

In the original soil investigation for the bridge, laboratory soil tests were not made on the overlying soft clay since this condition was known beforehand and the information desired mainly was the depth required to reach soil suitable to support friction piles and the approximate length of pile required.

It is our belief that failure in the approach fills has been caused by overloading of the soft layer of sensitive clay which extended from the creek bed down for some 10 to 19 feet. The shear strength of this clay is probably in the range of 250 to 500 psf, and, allowing for a factor of safety of three, the maximum safe loading was probably less than 500 psf. Since between 10 and 15 feet of compacted fill weighing at least 100 lbs. per cu. ft. was placed on it, say 1,000 to 1,500 lbs. per sq. foot was added and failure in shear occurred. Two additional factors which probably contributed to failure were (1) the position of the old concrete North abutment which added to the imbalance and (2) vibration set up by the bulldozer in building up and compacting the fill since the underlying clay is of the sensitive type.

REMEDIAL PROCEDURE:

Since equilibrium of the forces which caused failure has probably been reached it is felt that the fill may now be brought back to grade.

In order to bring some relief from earth pressures to the wing walls, it is suggested that a sill beam be placed across the roadway at the end of the retaining walls and the timber deck extended from the breast wall to the sill beam.

The fill should slope from the sill beam to the breast wall.

Drainage should be provided back of the breast wall.

In view of the severe vertical cracking which has taken place at the junction of the wing wall and the breast wall, the suggestion made by Mr. Morin to tie in both walls by means of tie rods should be carried out.

The timber piles under the wing walls have, undoubtedly, been subjected to severe stresses due to the shifting of the soil mass. However, it is thought that they are still capable of supporting the vertical load of the retaining wall.

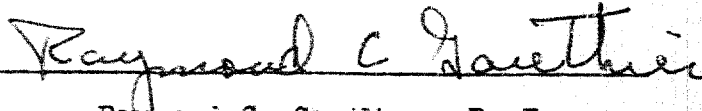
The remedial


OVER

The remedial measures outlined do not constitute a correction of the conditions encountered at this site.

Although new slides are not anticipated there is no guarantee that they shall not occur again.

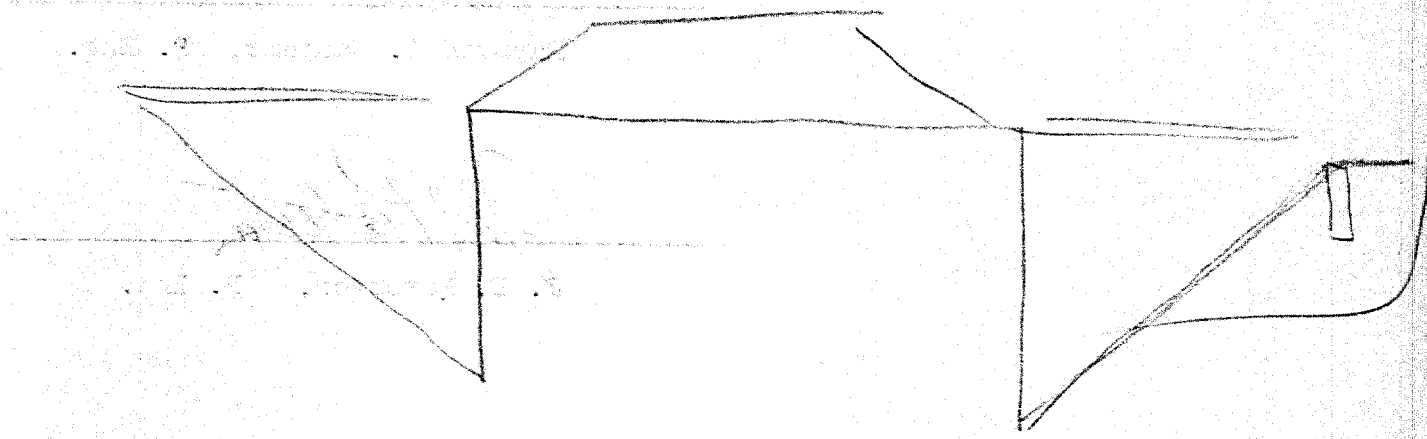
A sketch of the suggested sill beam appears in pencil on a copy of the bridge drawings, which we are returning to you herewith.


Raymond C. Gauthier, P. Eng.


J. D. Paterson, P. Eng.

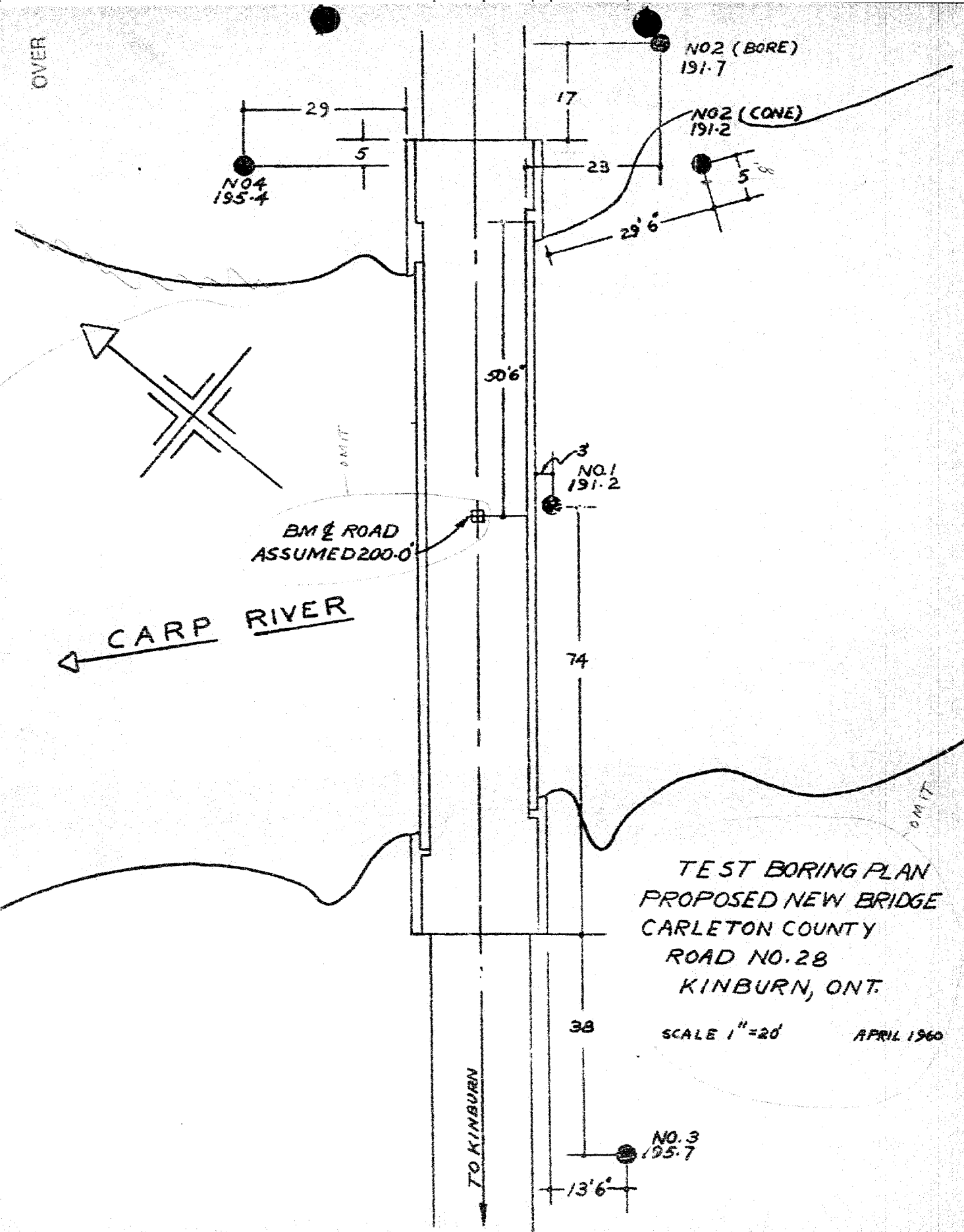
Ottawa, June 13th, 1958.

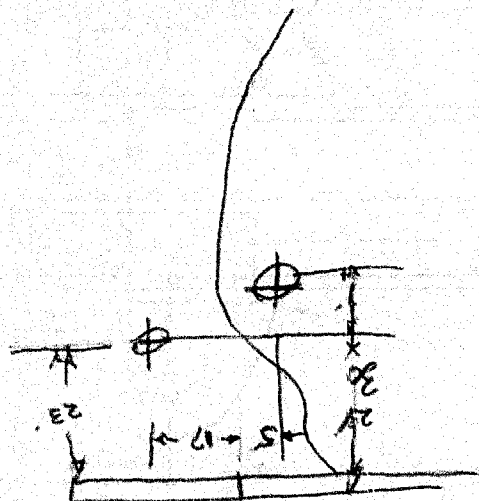
The purpose of this study is to determine the effect of the concentration of the solution on the rate of reaction. The reaction is the decomposition of hydrogen peroxide into water and oxygen gas. The rate of reaction is measured by the volume of oxygen gas produced over a period of time. The concentration of the solution is varied by changing the volume of the solution used. The results of the experiment are shown in the graph below.

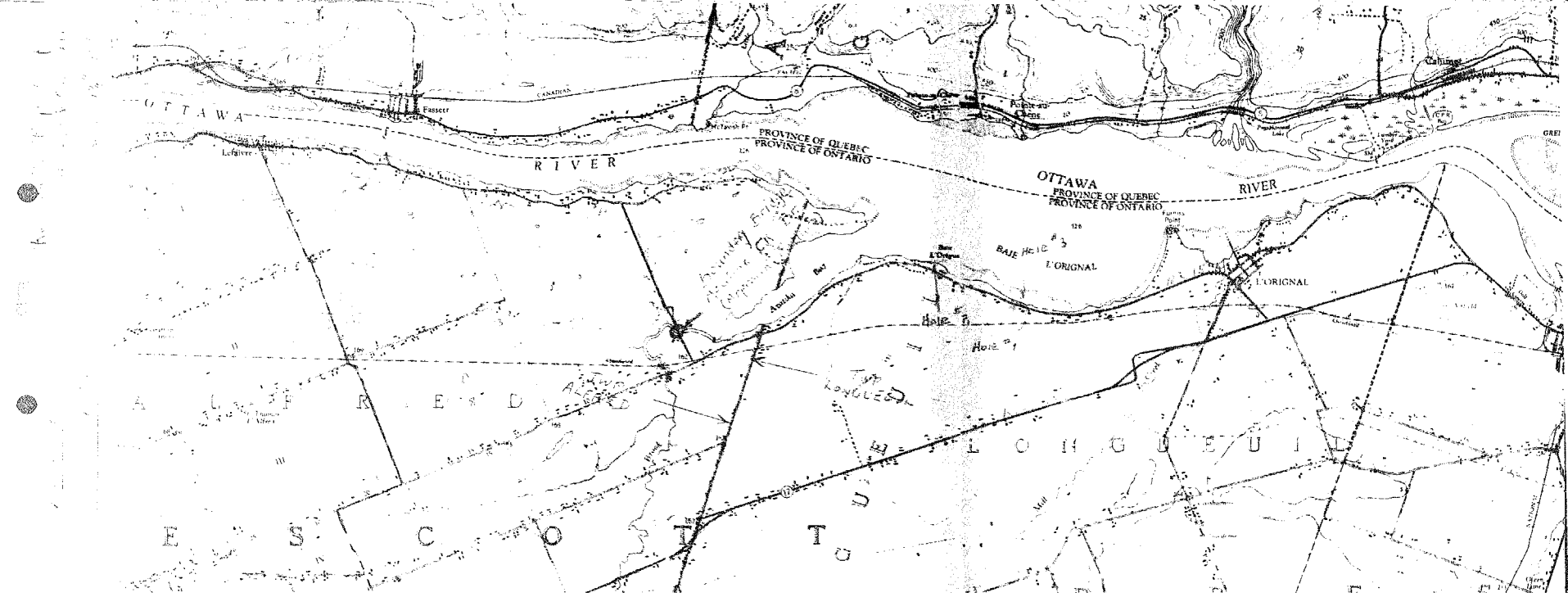


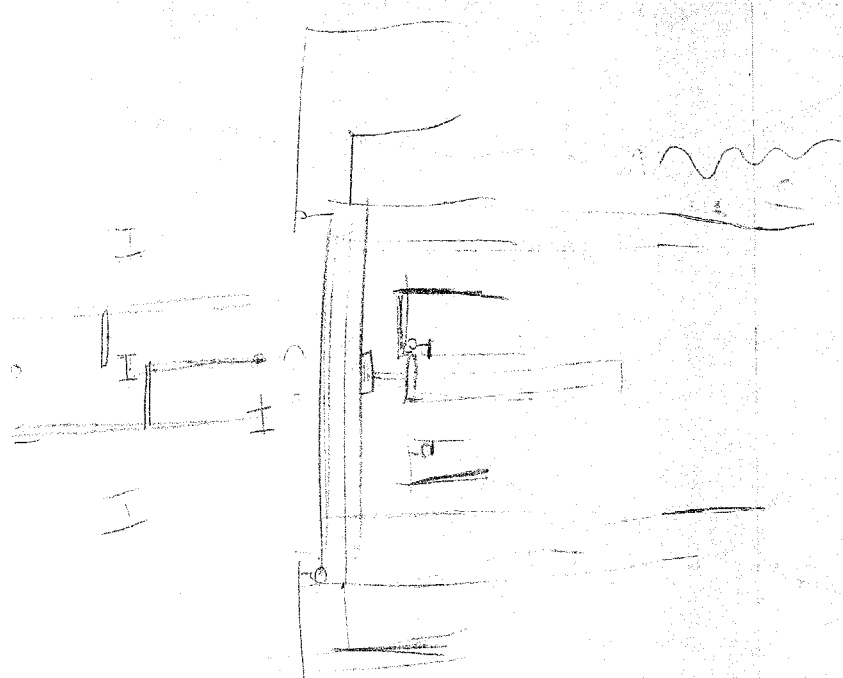
Graph showing the volume of oxygen gas produced over time for different concentrations of hydrogen peroxide solution.

OVER









AZATIKIA CREEK

12-H Pile 5316/11

Pile Tip elev + 3.5

Suggest driving piles to elev 39.0

then capacity should be checked by

Hiley Equation.

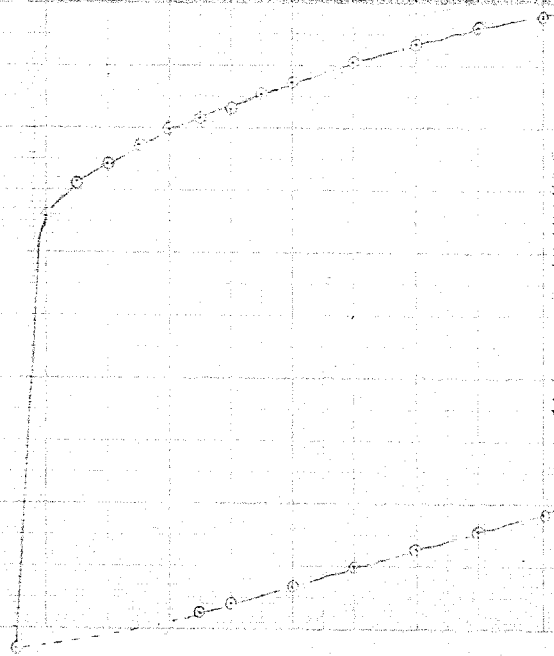
① measure rebound

② measure penetration/blow using 4300 lb hammer
5' drop.

LOAD-TONS

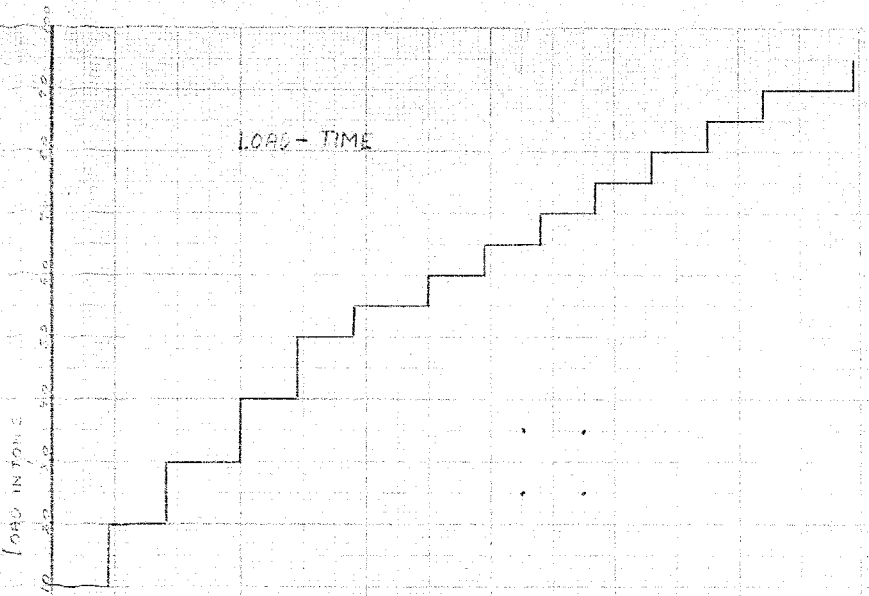
10 15 20 25 30 35 40 45

LOAD-MOVEMENT

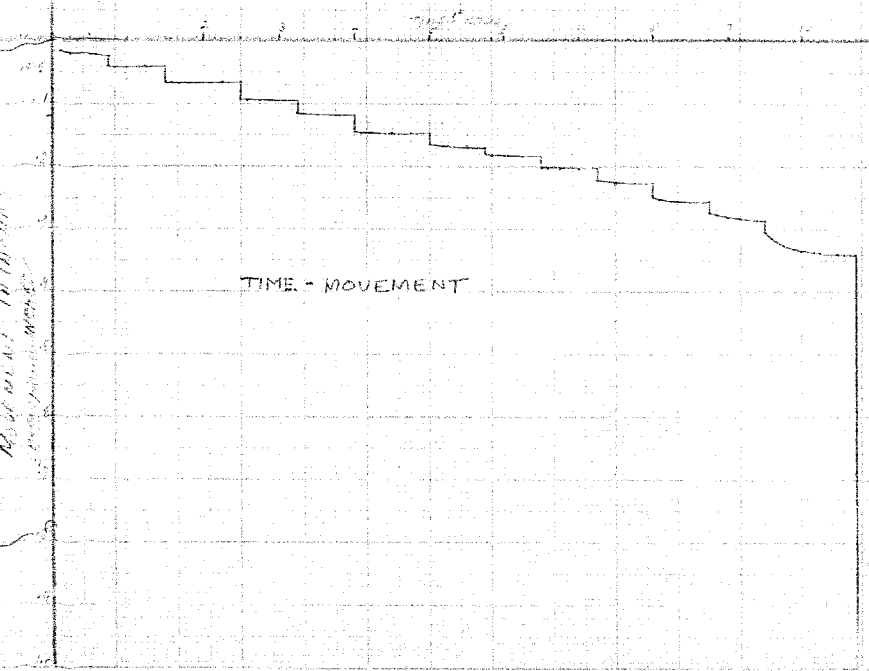


MOVEMENT IN INCHES

LOAD-TIME

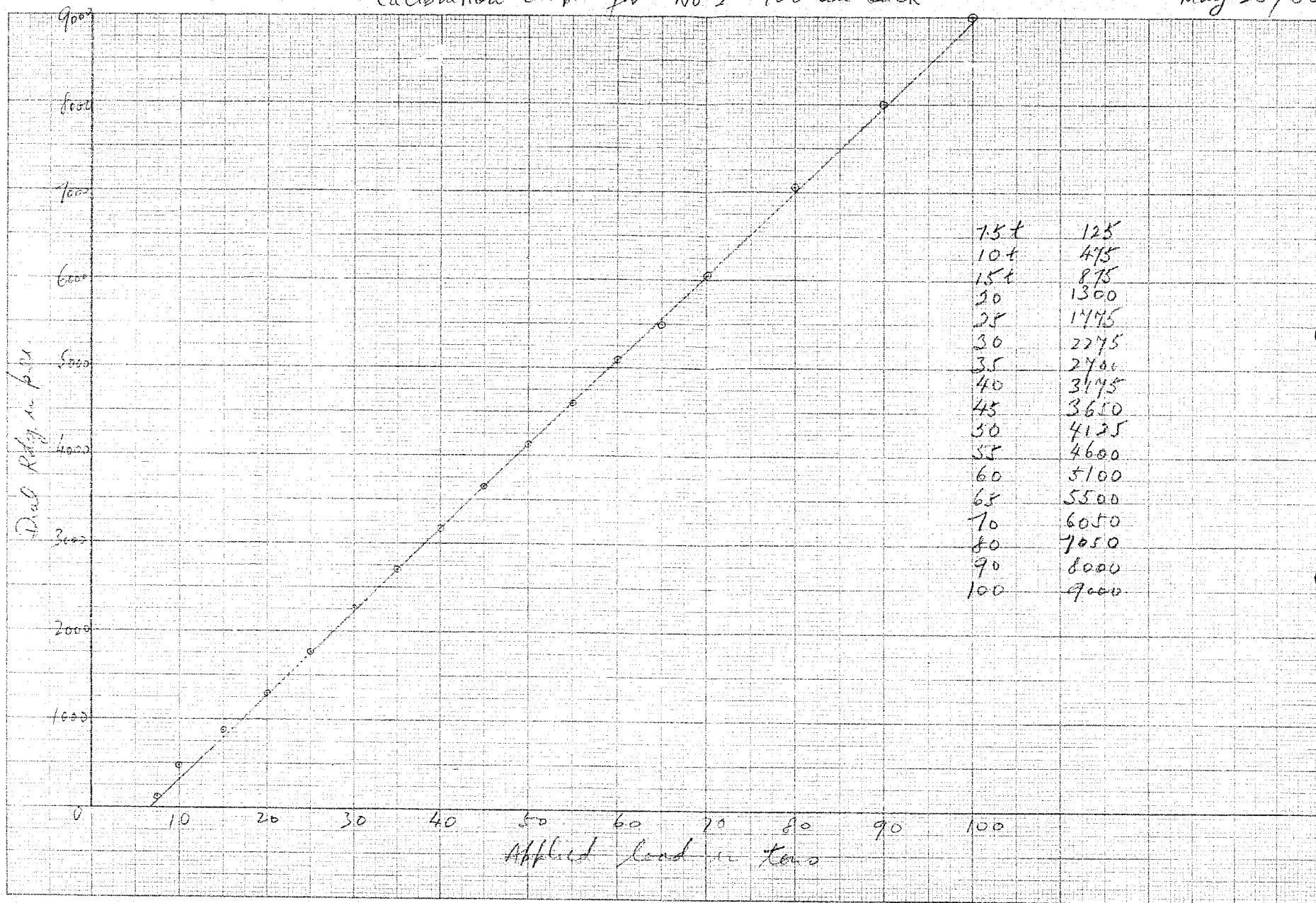


TIME - MOVEMENT



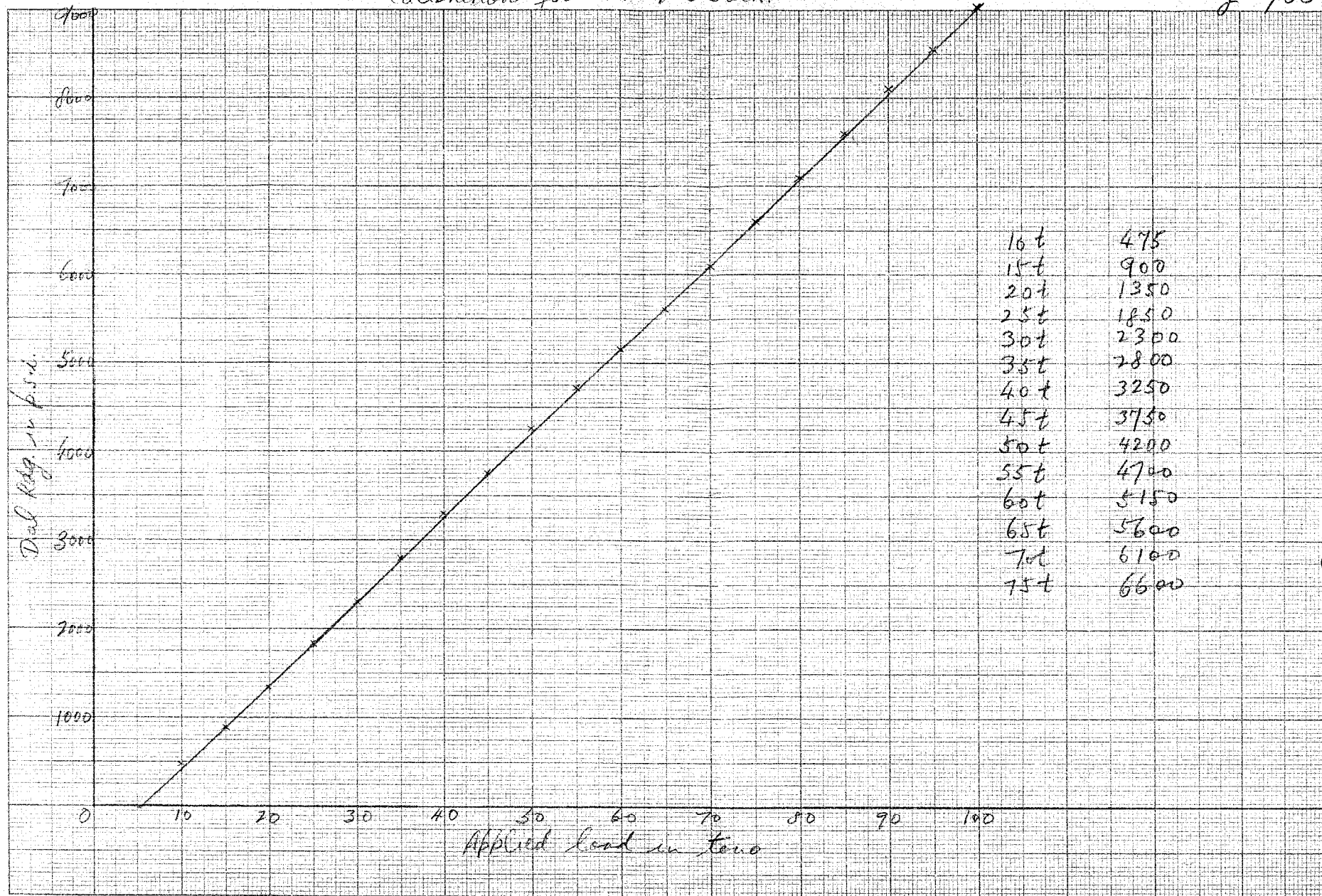
Calibration Graph for No 2 100 ton Jack

May 25/60.



Calibration for No. 2 100 Sack.

May 11/60



Name --- Azatika Creek Bridge

Job Number --- 60-F-85

Hwy --- county road

District --- Ottawa

County --- Prescott

Township --- Alfred

Contractor --- Bertrand & Frère Construction Co. Ltd

Date Started --- 15 SEP 60

Date Completed --- 20 SEP 60

} 1 pile

Subsoil Conditions 30 ft. of marine clay over
18 ft. of fine sand over silty clay.

Type of Pile 12 BP 53 x 74'-7"

Method of loading jacking against reaction
beam held by two anchor piles.

Cost of Test

Salaries, travelling and living expenses 427.00

Driving, skilled labour, materials 600.00

Total --- 1027.00

AZATIKA CREEK BRIDGE

60-F-85

DETERMINE ULTIMATE LOAD FOR 12 BP 53

$$Q_a = 4(1)(17)(300) \\ = 20,400 \text{ LBS}$$

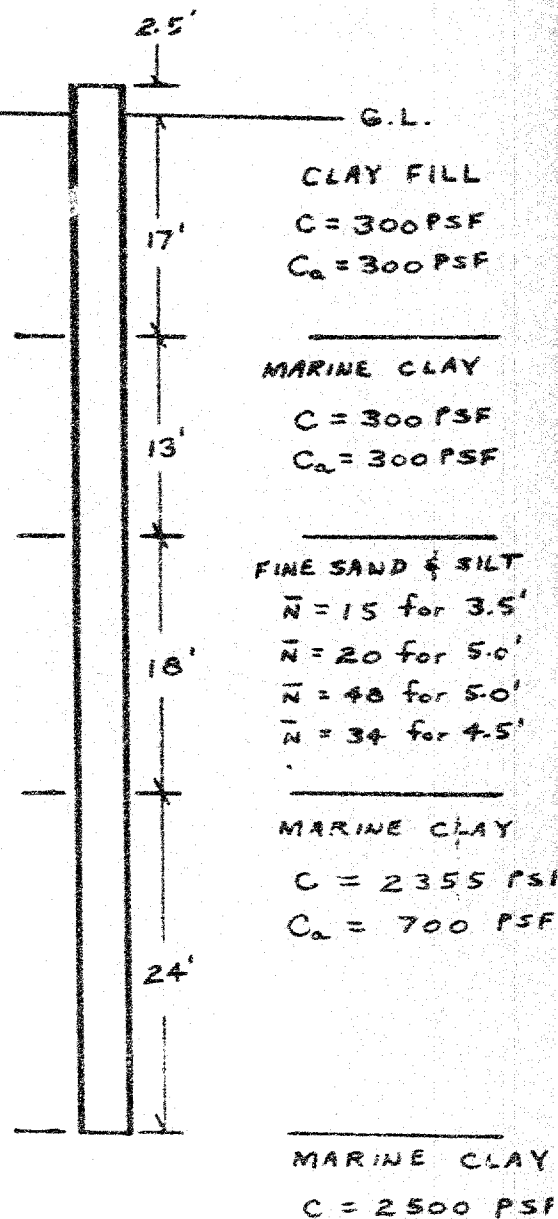
$$Q_a = 4(1)(13)(300) \\ = 15,600 \text{ LBS}$$

$$Q_a = \sum \frac{\bar{N} A_s}{100} \\ = 69,500 \text{ LBS}$$

$$Q_a = 4(1)(24)(700) \\ = 67,200 \text{ LBS}$$

$$Q_b = \frac{9(15.58)(2500)}{144} \\ = 2,400 \text{ LBS}$$

$$Q_f = N_c A_b C_b + \sum Q_a \\ = 87.5 \text{ tons}$$





ONTARIO
DEPARTMENT OF HIGHWAYS

110 Lisgar Street,
Ottawa, Ontario,
March 4, 1960.

Mr. A. Rutka,
Materials and Research Section,
Department of Highways,
Toronto, Ontario.

For the attention of Mr. L. Soderman


Dear Sir: Re: Prescott and Russell Counties,
Stability of Soils - Ottawa River
West of L'Orignal - Twp. of Longueuil

We are forwarding to you to-day a copy of the report of Messrs. Butts, Ross & Associates, Ltd. of Ottawa in connection with the results obtained by Mr. E. O. Butts in the boring of three test holes as above together with a photo-copy of the topographical map of the area.

You will recall that we were speaking with you on the phone about six weeks ago relative to the slides that have been occurring along County Road #15A. This section of the road has been a county road for the last few months only (B/L approved Oct. 1, 1959) and both Mr. Morin, the County Engineer, and we in this office, were against taking this road into the County Road System. However, as far as the County Road is concerned in this section, it can be relocated to the south a few hundred yards on an abandoned railway line.

What does cause us some concern is the fact that the new power dam at Carillon will raise the water level of the Ottawa River some nine feet and we are afraid that many places of residence along the river will be undermined by further slides. It is realized that this is a matter/our field but at the same out of time it is something to be considered.

On the attached map we have shown the site of the Boundary Bridge which is in the same general area. This is where the slips and slides occurred in the bridge approaches in 1958. Mr. John D. Paterson and the National Research Council (DBR) investigated this site. We understand that you are still considering just what should be done in this location.


A. H. Rabb,
Dist. Mun. Eng'r.

Attach.
c.c. Mr. J. V. Ludgate

Lead Weld Lead Weld

5t	0 (45)		75t	125 (45)	
10t	250	200		375	750
15t	800	750		800	
20t	1250	1300		1300	1150
25t	1750			1800	
30t	2250	2250		2250	2100
35t	2700			2750	
40t	3200	3050		3200	3050
45t	3700			3700	
50	4150	4100		4150 - 4000	
55	4600	4550		4600	
60	5120			5100 - 4950	
65	5550	5600		5550	
70	6050			6050 - 5900	
75	6520	6550		6520	
80	7050			7050	7000
85	7500	7550			
90	8000	8000		8000	8000
95					
100	9000			9000	

.... load

7.5t 125

10t 175

15t 275

20t 375

25t 475

30t 575

35t 675

40 775

45 875

50 975

55 1075

60 1175

65 1275

70 1375

80 1575

90 1775

Determine ultimate load for 12 BF 53 driven
as shown below.

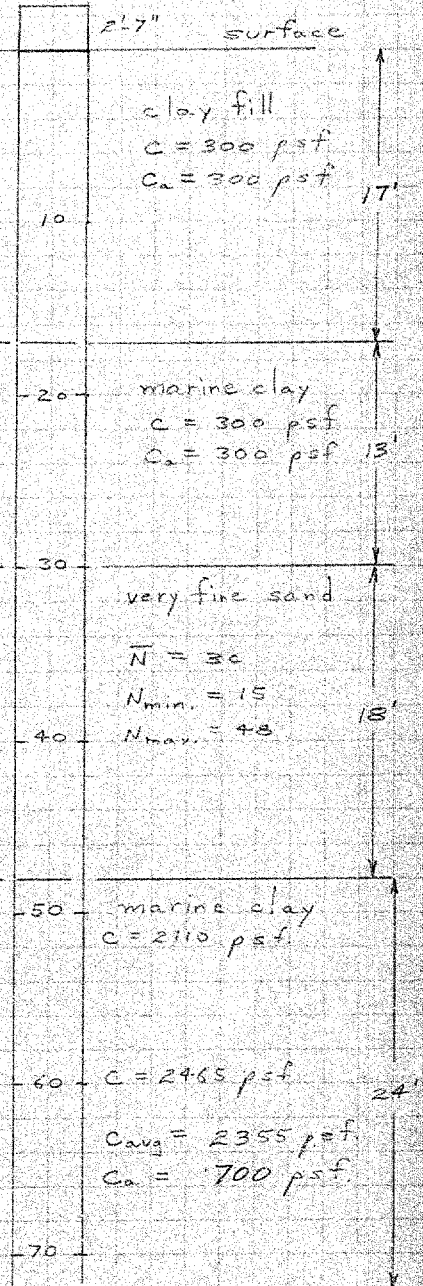
$$\begin{aligned} Q_a &= A_s C_a \\ &= 4(17)(300) \\ &= 20,400 \text{ LBS} \end{aligned}$$

$$\begin{aligned} Q_a &= A_s C_a \\ &= 4(13)(300) \\ &= 15,600 \text{ LBS} \end{aligned}$$

$$\begin{aligned} Q_a &= \frac{\bar{N} A_s}{100} \quad (\text{upper limit} = 0.5 \text{ t.s.f.}) \\ &= \frac{30(6)(18)}{100} \quad (\text{use } 6 \text{ sides}) \\ &= 32.4 \text{ tons} \quad [4 \text{ sides} = 21.6] \end{aligned}$$

$$\begin{aligned} Q_a &= A_s C_a \\ &= 4(24)(700) \\ &= 67,200 \text{ LBS} \end{aligned}$$

$$\begin{aligned} Q_b &= N_c A_b C_b \\ &= \frac{9(15.58)(2800)}{144} \\ &= 2430 \text{ LBS} \end{aligned}$$



$$\begin{aligned} C &= 2500 \text{ psf} \\ &\frac{118.6}{34.10} \\ &\frac{34.10}{34.6} \end{aligned}$$

[73.1] x

$$Q_f = Q_b + \sum Q_a = 83.9 \text{ tons}$$

PILE 2

TIME	Δt MIN.	JACK	LOAD TONS	DIAL NO. 1	Δ_1	DIAL NO. 2	Δ_2	$\frac{\Delta_1 + \Delta_2}{2}$	REMARKS
2:45		5500	65	.816	.184	.825	.175	.179	
2:50	5			.814	.186	.824	.176	.181	
3:00	15			.814	.186	.824	.176	.181	
3:15	30			.810	.190	.823	.177	.1835	
3:30	45			.808	.192	.823	.177	.1845	✓
3:30		6050	70	.790	.210	.805	.195	.2025	
3:35	5			.788	.212	.803	.197	.2045	
3:45	15			.785	.215	.802	.198	.2065	
4:00	30			.784	.216	.801	.199	.2075	
4:15	45			.782	.218	.800	.200	.209	✓
4:15		6520	75	.770	.230	.787	.213	.2215	
4:20	5			.766	.234	.783	.217	.2255	
4:30	15			.764	.236	.782	.218	.227	
4:45	30			.762	.238	.780	.220	.229	
5:00	45			.762	.238	.780	.220	.229	✓
5:00		7050	80	.743	.257	.763	.237	.2447	
5:05	5			.740	.260	.758	.242	.251	
5:15	15			.735	.265	.755	.245	.255	
5:30	30			.732	.268	.752	.248	.258	
5:45	45			.730	.270	.751	.249	.2595	✓
5:45		7480	85	.716	.284	.737	.268	.2735	
5:50	5			.712	.288	.733	.267	.2755	
6:00	15			.708	.292	.730	.270	.281	
6:15	30			.704	.296	.725	.275	.2855	
6:30	45			.702	.298	.723	.277	.2875	✓
6:30		8010	90	.684	.316	.705	.295	.3055	
6:35	5			.675	.325	.695	.305	.315	
6:45	15			.663	.337	.684	.316	.3265	
7:00	30			.655	.345	.676	.324	.3345	
7:15	45			.651	.349	.672	.328	.3385	
7:30	60			.650	.350	.670	.330	.340	
7:45	75			.649	.351	.669	.331	.341	✓
7:45	?	8450	95	.634	.366	.654	.346	.356	
7:50				.622	.378	.642	.358	.368	

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

PILE 2 UNLOADING

TIME	Δt MIN.	JACK	LOAD TONS	DIAL No. 1	Δ_1	DIAL No. 2	Δ_2	$\frac{\Delta_1 + \Delta_2}{2}$	REMARKS
7:46		5500	65	.018		.029		.9765	
7:50	4			.018		.029			
8:00	14			.018	.982	.029	.971	.9765	✓
8:00		5100	60	.028		.050			
8:05	5			.028		.051			
8:15	15			.028	.971	.050	.950	.9605	✓
8:15		4125	50	.056		.079			
8:20	5			.056		.079			
8:25	10			.056	.942	.079	.921	.9325	✓
8:25		3175	40	.088		.110			
8:30	5			.088		.110			
8:40	15			.088		.110			
8:50				.088	.971	.110	.890	.9005	✓
8:50		2275	30	.115		.139			
8:55	5			.115		.139			
9:00	10			.115	.985	.138	.862	.9015	✓
9:05		1300	20	.144		.166			
9:10	5			.144		.167			
9:15	10			.144	.866	.167	.833	.8495	✓
9:20		475	10	.172		.195			
9:25	5			.172		.195			
9:30	10			.172	.828	.195	.805	.8115	✓
9:35		0	0	.193	.801	.220	.780		
9:40	5			.201	.799	.223	.777		
9:45	10			.202	.795	.224	.776		
10:00	25			.202	.799	.225	.775	.7915	
8:35	AM TUE			.211	.799	.231	.769	.779	

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

TIME	ΔE MIN.	JACK	LOAD TONS	DIAL No. 1	Δ 1	DIAL No. 2	Δ 2	$\frac{\Delta_1 + \Delta_2}{2}$	REMARKS
9:00				1.000		1.000			
				.982		.985			
9:05	(5)	475	(1)	.980	.020	.985	.015	(.015)	
9:15	15			.977	.023	.984	.016	.0195	
9:30	30			.975	.025	.984	.016	.0205	
9:45	45			.975	.025	.984	.016	(.0205)	✓
9:48		1300	(2.0)	.956	.044	.966	.034	.039	
9:50	2			.955	.045	.965	.035	.040	
10:00	12			.955	.045	.965	.035	.040	
10:15	27			.955	.045	.965	.035	.040	
10:30	42			.955	.045	.965	.035	(.040)	✓
10:30		2275	(3.0)	.929	.071	.939	.061	.066	
10:35	5			.929	.071	.939	.061	.066	
10:45	15			.926	.074	.938	.062	.068	
11:00	30			.926	.074	.938	.062	.068	
11:15	45			.926	.074	.938	.062	.068	
11:30	60			.926	.074	.938	.062	(.068)	✓
11:30				.940	.160	.912	.088	.094	
11:35	5	3175	(4.0)	.899	.101	.911	.089	.095	
11:45	15			.898	.102	.911	.089	.0955	
12:00	30			.898	.102	.911	.089	.0955	
12:15	45			.898	.102	.911	.089	.0955	✓
12:15		425	(5.0)	.870	.130	.880	.120	.125	
12:20	5			.868	.132	.879	.121	.127	
12:30	15			.865	.135	.877	.123	.129	
12:45	30			.865	.135	.877	.123	.129	
1:00	45			.864	.136	.877	.123	.1295	✓
1:40			(5.5)	.849	.151	.861	.139	.145	
1:05	5	4600		.844	.153	.860	.140	.1465	
1:15	10			.847	.153	.859	.141	.1470	
1:30	30			.846	.154	.857	.143	.1485	
1:45	45			.845	.155	.858	.142	.1485	
2:00	60			.845	.155	.858	.142	(.1485)	✓
2:00		5100	(6.0)	.830	.170	.842	.158	.164	
2:05	5			.830	.170	.840	.160	.165	
2:15	15			.829	.171	.838	.162	.1665	
2:30	30			.829	.171	.837	.163	.167	
2:45	45			.828	.172	.837	.163	(.1705)	✓

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

AZATIKA CREEK

Dense very fine sand

Average $N = 30$

BLOWS/FT ≈ 7 for 4300 LB HAMMER FALLING 5'

" 5 " " " " 10'

Rebound ≈ 0.33 "

Hiley Formula

$$R = \frac{4nWh}{S + \frac{C}{2}}$$

R = allow load

n = efficiency

W = wt of hammer

h = height of fall

S = penet. per blow

C = rebound

$$n = \frac{W + e^2 P}{W + P}$$

P = wt. of pile + helmet

$e = .35$ for above hammer

$$n = \frac{4300 + (0.35)^2 ((75)(53) + 400)}{4300 + ((75)(53) + 400)}$$

$$= \frac{4300 + .122 (4375)}{4300 + 4375} \times 100 = 56\%$$

$$S = \frac{12}{5} = 2.4" \text{ per blow}$$

$$H = 0.8 h$$

$$= 0.8 (10) = 8 \text{ ft.}$$

$$R = \frac{4(.56)(4300)8}{2.4 + \frac{.33}{2}} \times \frac{1}{2000}$$

$$= \underline{\underline{15.0 \text{ tons}}}$$

for $s = 1''$ per blow.

$$H = 0.8h$$

$$\text{for } h = 5' \quad H = 0.8(5) = 4 \text{ ft.}$$

$$R = \frac{4(.86)(4300)4}{1 + 0.17} \times \frac{1}{2000}$$
$$= \underline{\underline{29.5 \text{ tons}}}$$

for 40 ft piles

$$s = 12/9 = 1.33 \text{ inches / blow}$$

$$C = 0.33$$

$$n = \frac{4300 + (0.33)(40)(53) + 400}{4300 + (40)(53) + 400}$$

$$= \frac{4300 + 310}{4300 + 2520} \times 100\%$$

$$= 68\%$$

$$R = \frac{4(.68)(4300)4}{1.33 + 0.17} \times \frac{1}{2000}$$

$$= \underline{\underline{15.5 \text{ tons}}} \quad \text{for, S.F.} = 2 \quad R = \underline{\underline{23 \text{ tons}}}$$

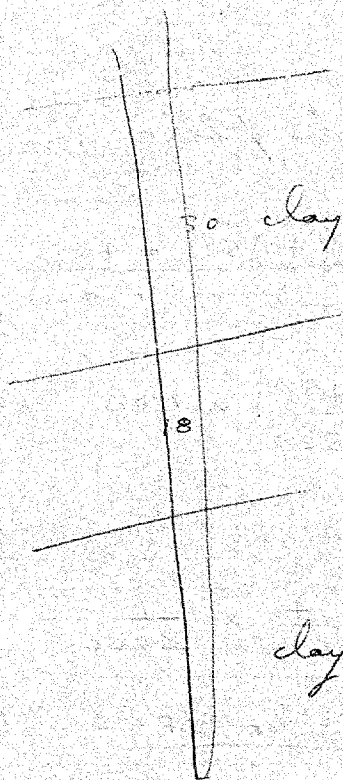
for $s = 1$ inch per blow.

$$R = \frac{4(.68)(4300)4}{1. + 0.17} \times \frac{1}{2000}$$

$$= \underline{\underline{20.4 \text{ tons}}}$$

for S.F. = 2.

$$R = \underline{\underline{30 \text{ tons}}}$$



TIME	Δt MIN.	JACK	LOAD TONS	DIAL	Δ	REMARKS
8:00 A.M.				.0500		
	0	175	10	.0575	.0075	
9:05	5			.0575	.0075	
9:15	15			.0580	.0080	
9:30	30			.0580	.0080	
9:45	45			.0580	.0080	
9:48	0	1300	20	.0685	.0185	
9:50	2			.0685	.0185	
10:00	12			.0695	.0195	
10:15	27			.0695	.0195	
10:30	42			.0695	.0195	
10:30	0		30	.0855	.0355	
10:35	5			.0855	.0355	
10:45	15			.0855	.0355	
11:00	30			.0855	.0355	
11:15	45			.0855	.0355	
11:30	60			.0855	.0355	
11:30		375	40	.1000	.0500	
11:35	5			.101	.0510	
11:45	15			.1012	.0512	
12:00	30			.1012	.0512	
12:15	45			.1012	.0512	
2:15		4125	50	.1178	.0678	
2:20	5			.1184	.0684	
2:30	15			.1197	.0697	
2:45	30			.1205	.0705	
1:00	45			.1209	.0709	
1:00		4500	55	.1289	.0789	
1:05	5			.1298	.0798	
1:15	15			.1306	.0806	
1:30	30			.1318	.0818	
1:45	45			.1316	.0816	
2:00	60			.1320	.0820	
2:00		5100	50	.1390	.0890	
2:05	5			.1408	.0908	
2:15	15			.1422	.0922	
2:30	30			.1432	.0932	
2:45	45			.1446	.0946	

PILE 3

.1500
.0500
 .1000

Time	Δt min	Jack psi	Load tons	Dial	Δ	Remarks
2:45		5500	65	.1500	.1000	
2:50	5			.1506	.1006	
3:00	15			.1518	.1018	
3:15	30			.1520	.1020	
3:30	45			.1526	.1026	
3:30		6050	70	.1610	.1110	
3:35	5			.1625	.1125	
3:45	15			.1634	.1134	
4:00	30			.1642	.1142	
4:15	45			.1650	.1150	
4:15		6520	75	.1702	.1202	
4:20	5			.1725	.1225	
4:30	15			.1737	.1237	
4:45	30			.1740	.1240	
5:00	45			.1748	.1248	
5:00		7050	80	.1826	.1326	
5:05	5			.1850	.1350	
5:15	15			.1862	.1362	
5:30	30			.1872	.1372	
5:45	45			.1880	.1380	
5:45		7480	85	.1948	.1443	
5:50	5			.1957	.1457	
6:00	15			.1973	.1473	
6:15	30			.1985	.1485	
6:30	45			.1995	.1495	
6:30		8000	90	.2070	.1570	
6:35	5			.2096	.1596	
6:45	15			.2115	.1615	
7:00	30			.2126	.1626	
7:15	45			.2133	.1633	
7:30	60			.2149	.1649	
7:45	75			.2159		
7:45		8450	95	.2195	.1695	
7:46				.2215	.1715	
8:00						
8:15						
8:30						

UNLOADING

TIME	Δt MIN.	JACK	LOAD TONS	DIAL	Δ	REMARKS
7:46		5500	65	.1893		
7:50	5			.1892		
8:00	15			.1890		
8:00		5100	60	.1855		
8:05	5			.1841		
8:15	15			.1840		
8:15		4125	50	.1688		
8:20	5			.1684		
8:25	10			.1682		
8:25		3175	40	.1520		
8:30	5			.1513		
8:40				.1513		
8:50		2275	30	.1378		
8:55	5			.1370		
9:00	10			.1372		
9:05		1300	20	.1225		
9:10	5			.1217		
9:15	10			.1215		
9:20		475	10	.1087		
9:25	5			.1080		
9:30	10			.1076		
9:35		0	0	.0942		
9:40	5			.0936		
9:45	10			.0929		
10:00	25			.0922		
8:35 AM TUE				.0915		

PILE 1

05 - 1000
01 - 1000
001 - 1000
0000 - 1000

Time	Δt (min)	Jack $\frac{\text{LBS}}{\text{IN}^2}$	Load TENS	Dial	Δ	Remarks
9:00 A.M.				.0000		
	0	475	10	.0100	.0100	
9:05	5			.0100	.0100	
9:15	10			.0105	.0105	
9:30	15			.0100	.0100	
9:45	15			.0100	.0100	
9:48	0	1300	20	.0195	.0195	
9:50	2			.0195	.0195	
10:00	10			.0195	.0195	
10:15	27			.0195	.0195	
10:30	42			.0195	.0195	
10:30	0	2275	30	.0325	.0325	
10:35	5			.0330	.0330	
10:45	15			.0330	.0330	
11:00	30			.0330	.0330	
11:15	45			.0330	.0330	
11:30	60			.0330	.0330	
11:30		3175	40	.0440	.0440	
11:35	5			.0445	.0445	
11:45	15			.0442	.0442	
11:50	30			.0442	.0442	
12:15	45			.0442	.0442	
12:15		4125	50	.0575	.0575	
12:20	5			.0585	.0585	
12:30	15			.0598	.0598	
12:45	30			.0600	.0600	
1:00	45			.0604	.0604	
1:00		4600	55	.0667	.0667	
1:05	5			.0680	.0680	
1:15	15			.0686	.0686	
1:30	30			.0693	.0693	
1:45	45			.0694	.0694	
2:00	60			.0696	.0696	
2:00		5100	60	.0770	.0770	
2:05	5			.0777	.0777	
2:15	15			.0787	.0787	
2:30	30			.0792	.0792	
2:45	45			.0785	.0785	

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

TIME	Δt MIN.	JACK	LOAD TONS	DIAL	Δ	REMARKS
2:45		5500	65	.0840	.0840	
2:50	5			.0843	.0843	
3:00	15			.0856	.0856	
3:15	30			.0853	.0853	
3:30	45			.0858	.0858	
3:30		6050	70	.0940	.0940	
3:35	5			.0946	.0946	
3:45	15			.0957	.0957	
4:00	30			.0972	.0972	
4:15	45			.0978	.0978	
4:15		6520	75	.1033	.1033	
4:20	5			.1047	.1047	
4:30	15			.1056	.1056	
4:45	30			.1065	.1065	
5:00	45			.1071		
5:00		7050	80	.1160	.1160	
5:05	5			.1167	.1167	
5:15	15			.1180	.1180	
5:30	30			.1192	.1192	
5:45	45			.1203	.1203	
5:45		7480	85	.1262	.1262	
5:50	5			.1275	.1275	
6:00	15			.1290	.1290	
6:15	30			.1310	.1310	
6:30	45			.1323		
6:30		8000	90	.1410	.1410	
6:35	5			.1430	.1430	
6:45	15			.1450	.1450	
7:00	30			.1465	.1465	
7:15	45			.1476	.1476	
7:30	60			.1483		
7:45	75			.1488		
7:45		8450	95	.1541	.1541	
7:46				.1555	.1555	

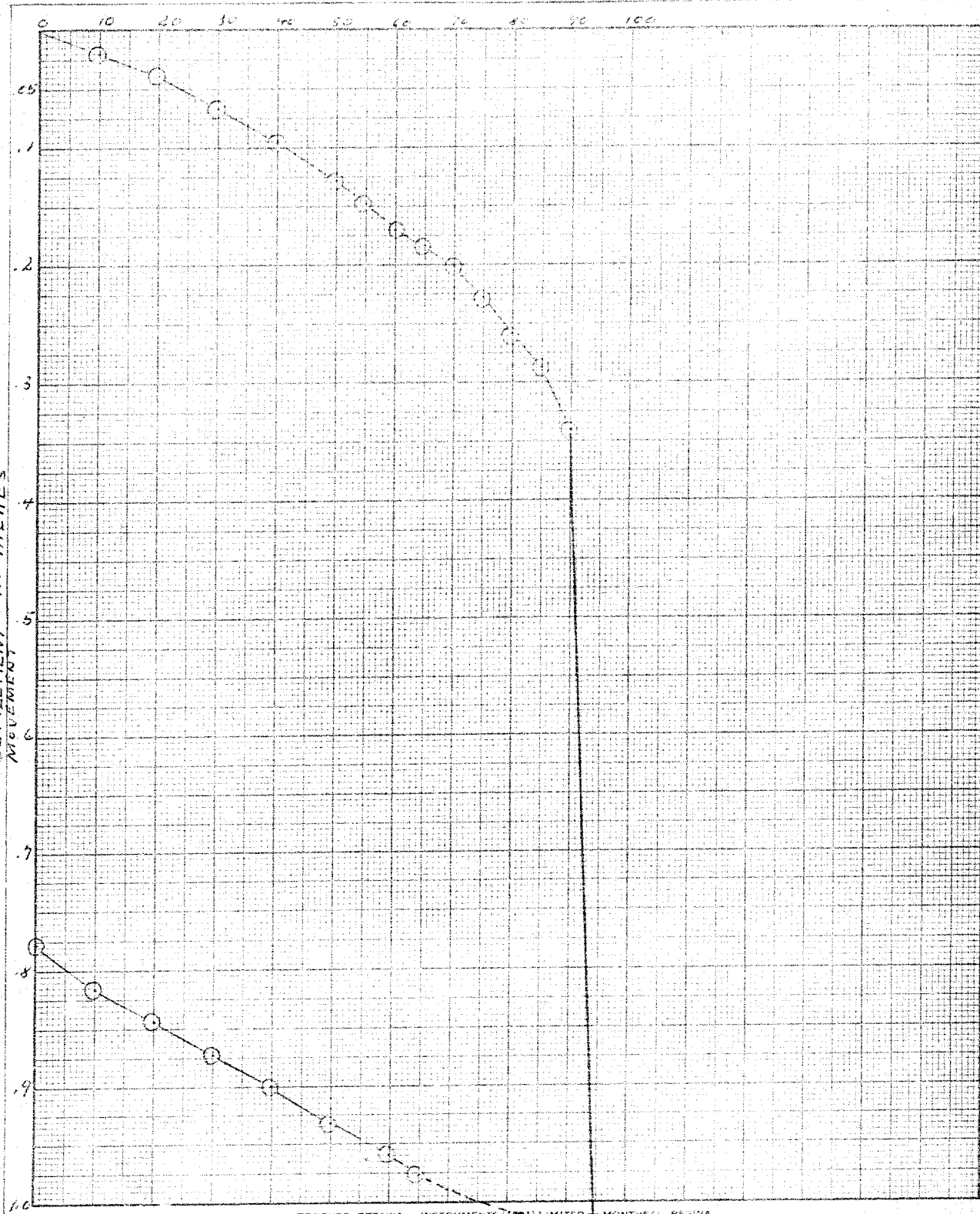
UNLOADING PILE 1

Time	Δt min	Jack psi	Load tons	Dial	Δ	Remarks <i>Pile</i>
7:46		5500	65	.1188		
7:50	5			.1188		
8:00	15			.1188		
8:00		5100	6	.1185		
8:05	5			.1135		
8:15	15			.1135		
8:15		4125	50	.1000		
8:20	5			.1000		
8:25	10			.1000		
8:25		3175	40	.0863		
8:30	5			.0860		
8:40	15			.0860		
8:45	20			.0860		
8:50		2275	30	.0740		
8:55	5			.0735		
9:00	10			.0735		
9:05		1300	20	.0615		
9:10	5			.0615		
9:15	10					
9:20		475	10	.0495		
9:25	5			.0495		
9:30	10			.0495		
9:35		0	0	.0335		
9:40	5			.0385		
9:45	10			.0385		
10:00	25			.0380		
8:35				.0440		

LOAD IN TONS

1911-12

SETTLEMENT IN INCHES
MOVEMENT

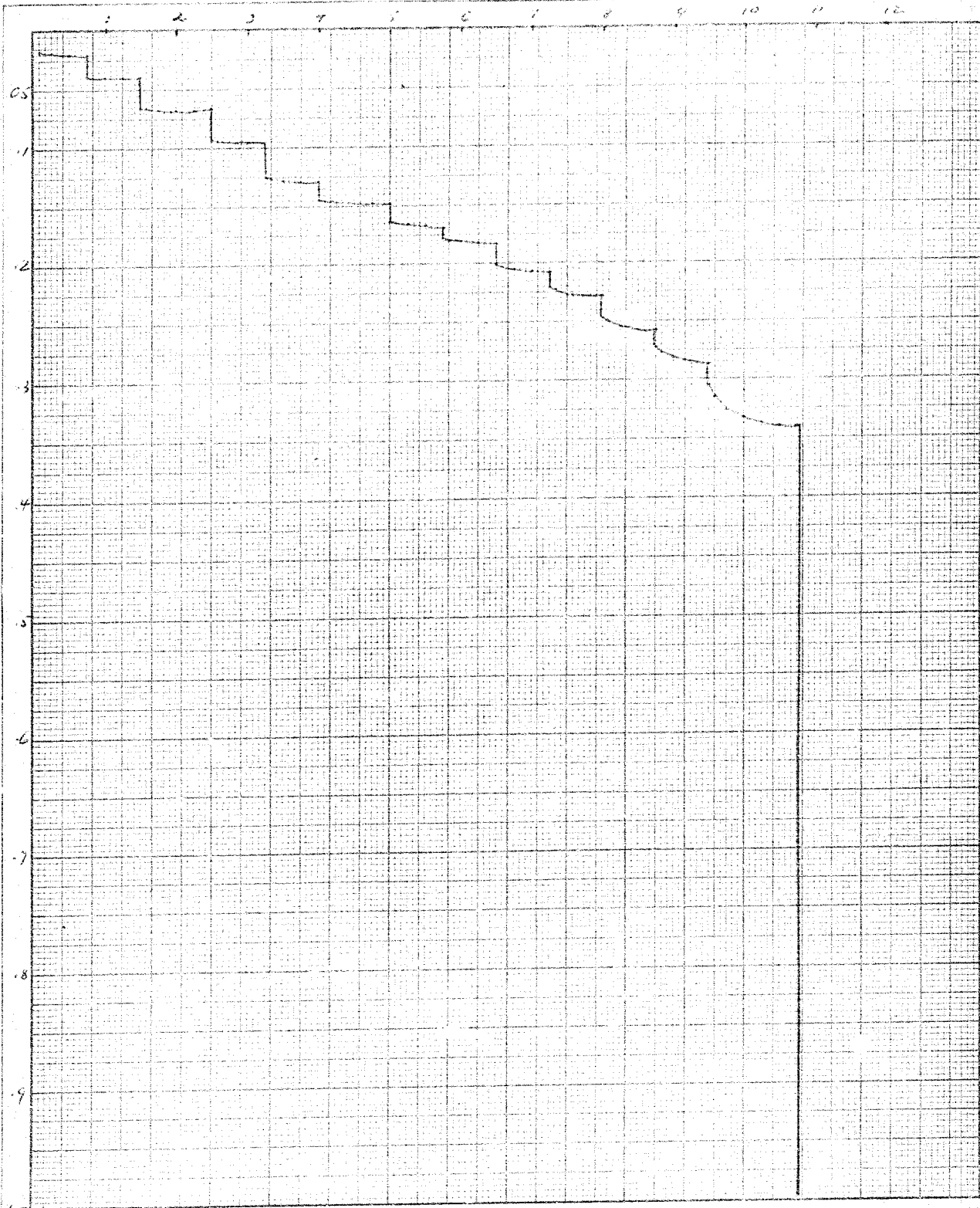


AZATKA CREEK

PILE NO. 2

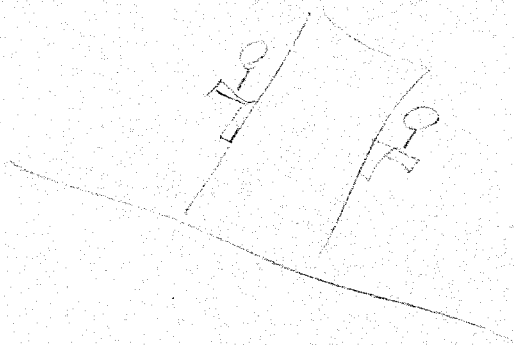
TIME IN HOURS

SETTLEMENT IN IN.



3
1
10
5
5
5

1/1



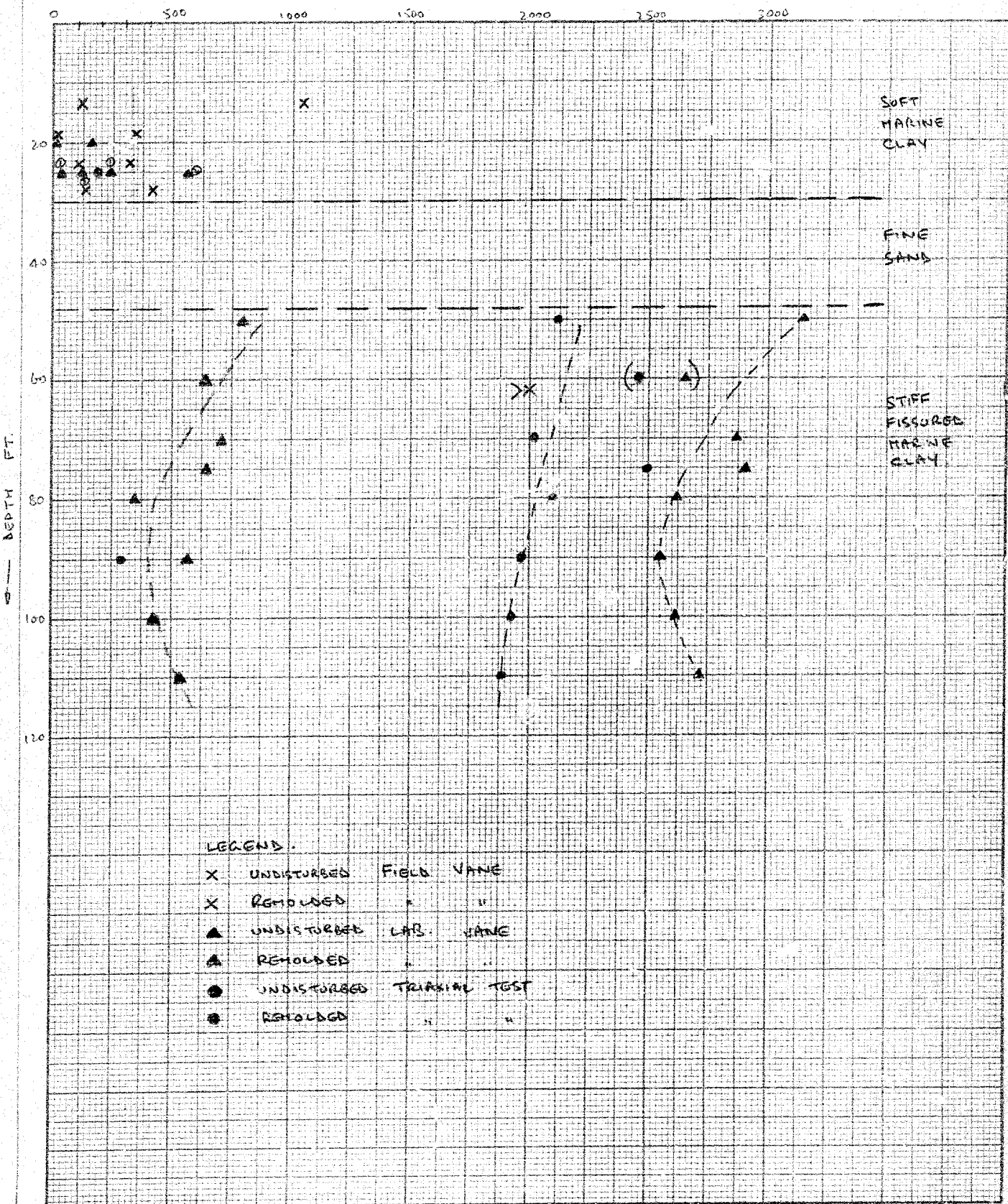
SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-85

W.P. _____

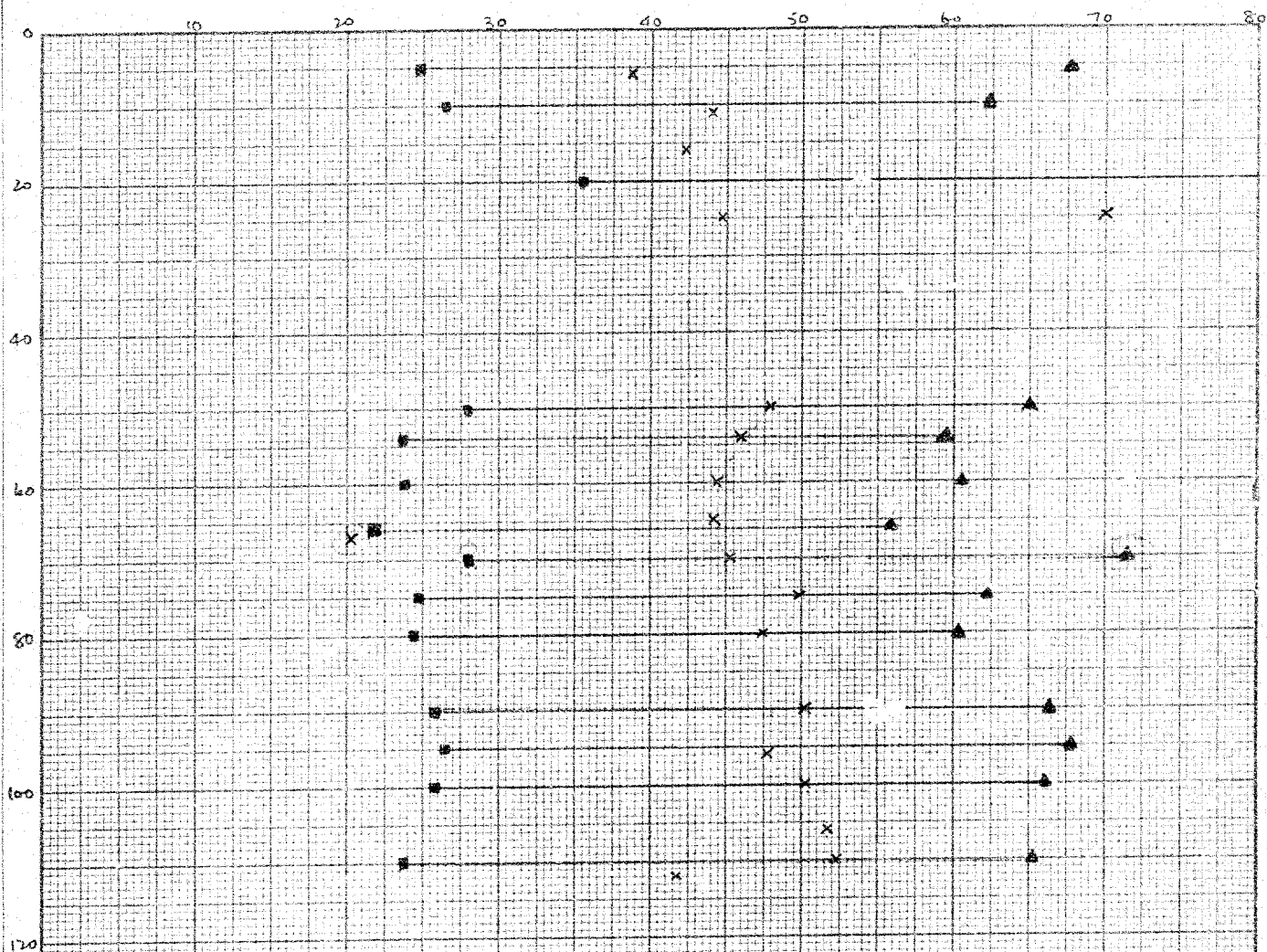
HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S19	105'-107'	Silty clay-Marine. Stiff. Gray	9	51.8	-	-	-	-	
	T20	110'-111.3'	"	P	47.1	23.6	65.2	1790	108	
			S. denotes split spoon							
			T. " shelby tube							

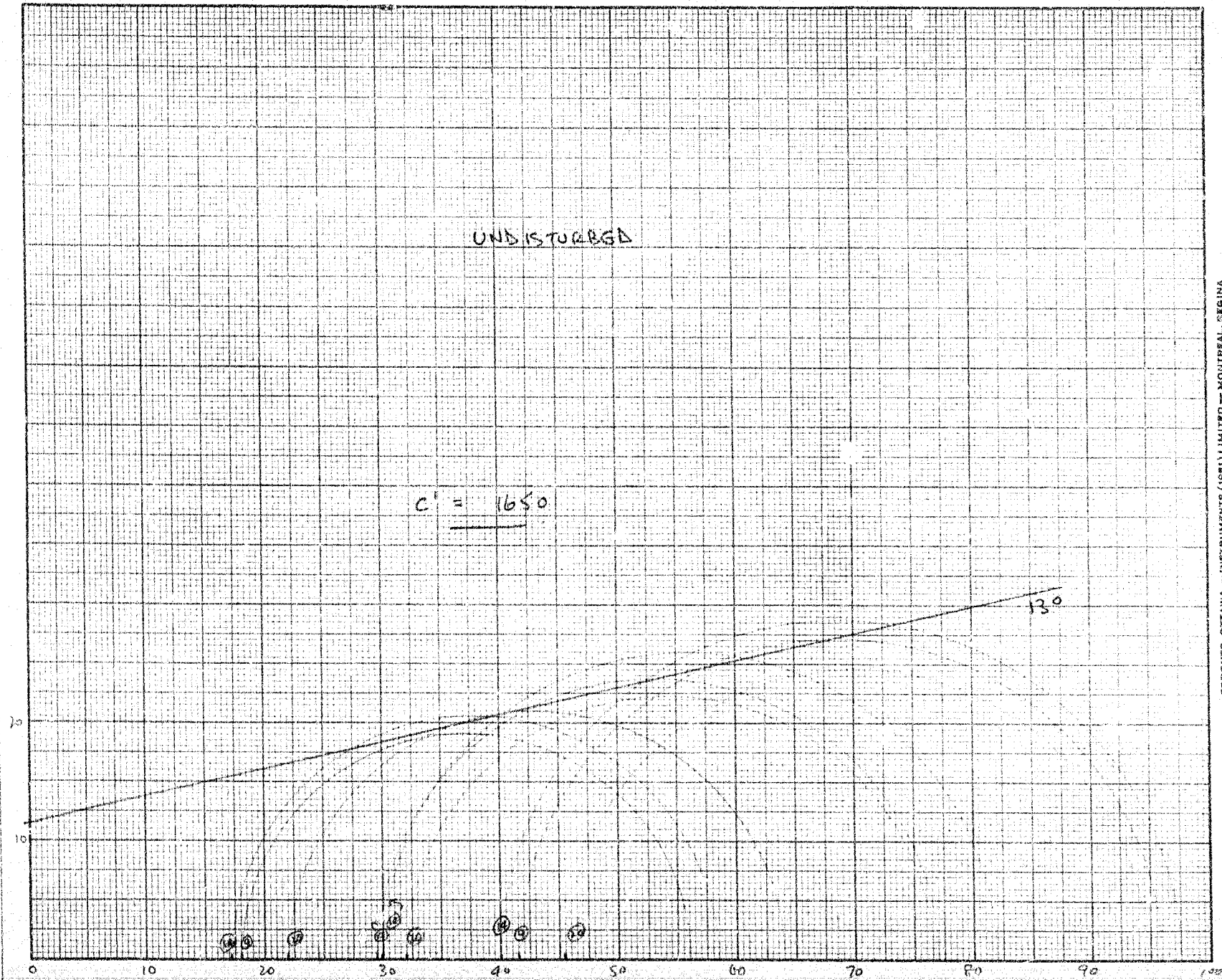
SHEAR STRENGTH LBS./SQ. FT. →



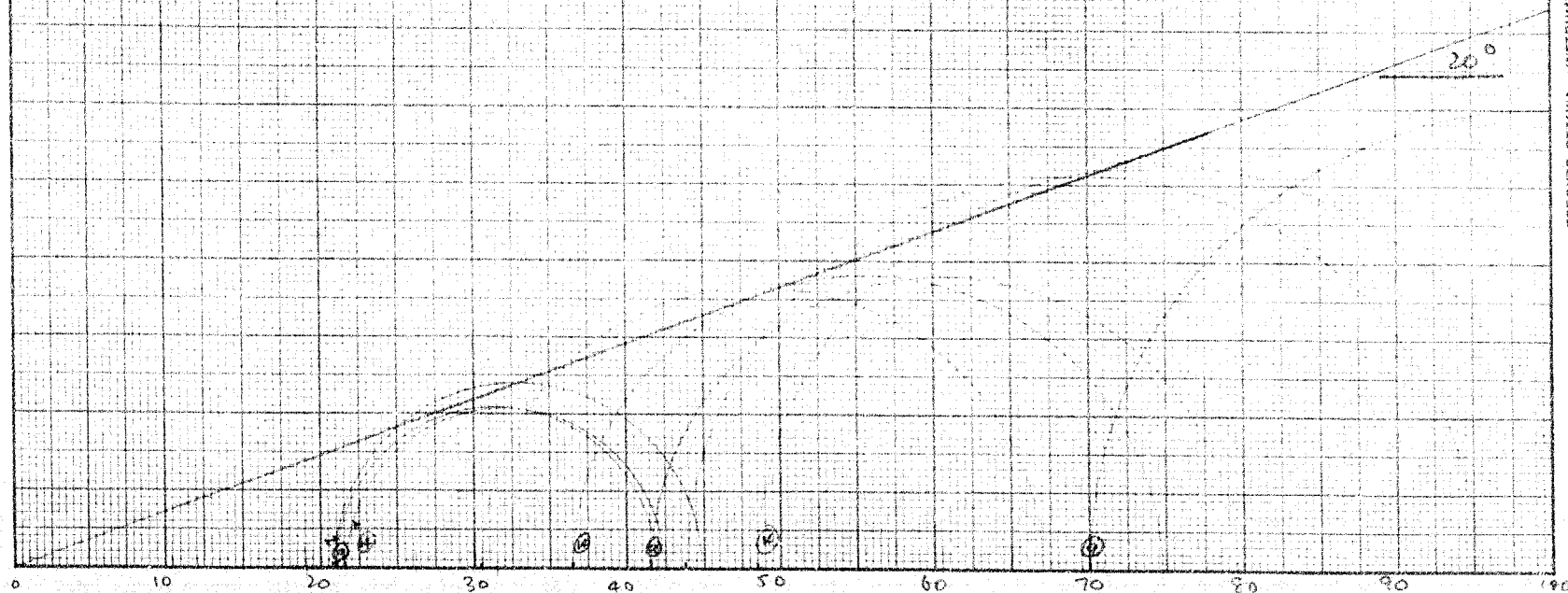
DEPTH FT.

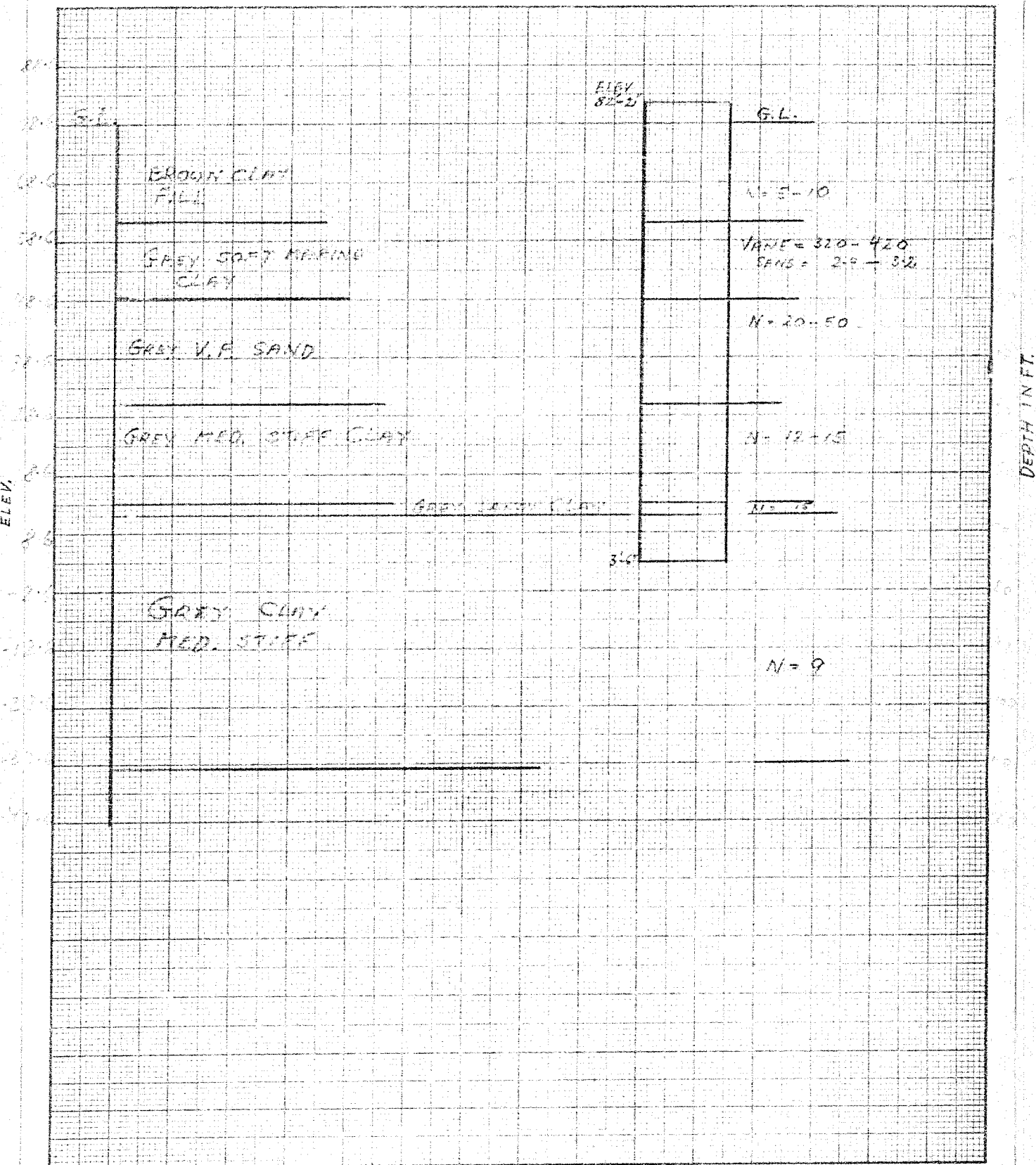
MOISTURE CONTENT %





REMODELLED





SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-85

W.P. _____

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'M RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	5'-7'	Silty clay-Fill soft brown	6	38.9	24.8	67.7	-	-	
	S2	10'-12'	"	4	44.0	26.5	62.4	-	-	
	VANE	13.5'	"	-	-	-	-	1040	-	Sens: 8.7
	S3	15'-17'	"	4	42.4	-	-	-	-	
	VANE	18.5'	Silty clay-marine soft grey	-	-	-	-	340	-	Sens: 17.0
	T4	20'-22'	"	P	96.5	35.5	113.6	-	-	
	VANE	23.5'	"	-	-	-	-	320	-	Sens: 2.9
	T5	25'-26.8'	"	P	44.8 70.0	-	-	-	-	
	VANE	28.3'	"	-	-	-	-	420	-	Sens: 3.2
	S6	30'-32'	Very fine silty sand. Medium to dense. Grey.	15	-	-	-	-	-	
	S7	35'-37'	"	20	-	-	-	-	-	
	S8	45'-47'	"	34	-	-	-	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-85

W.P. _____

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	T9	50'-51.3'	Silty clay-Marine. Very stiff. Grey	P	48.0	28.0	65.0	2110	109	
	S10	53'-55'	"	12	46.1	23.6	59.0	-	-	
	T11	60'-61.3'	"	P	44.2	23.9	60.6	2465	111	
	VANE	62.8'	"	-	-	-	-	>2000	-	
	S12	65'-67'	"	15	44.1 20.3	21.8 -	56.1 -	- -	- -	
	T13	70'-71.5'	"	P	45.4	28.0	71.5 (Lab-) (Vane) (2870)	-	-	
	T14	75'-76.3'	"	P	50.0	24.8	62.1	2500	-	
	T15	80'-81'	"	P	47.5	24.3	60.3	2100	109.5	
	T16	90'-91.3'	Silty clay-Marine. Stiff. Grey	P	50.2	25.9	66.5	1970	107	
	S17	95'-97'	Silty clay-marine. Stiff. Grey.	9	47.7	26.5	67.8	-	-	
	T18	100'-101.2'	"	P	50.3	25.8	66.1	1925	107	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-85

W.P. _____

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S19	105'-107'	Silty clay-Marine. Stiff. Grey	9	51.8	-	-	-	-	
	T20	110'-111.3'	"	P	47.1	23.6	65.2	1790	108	
			S. denotes split spoon							
			T. " shelby tube							

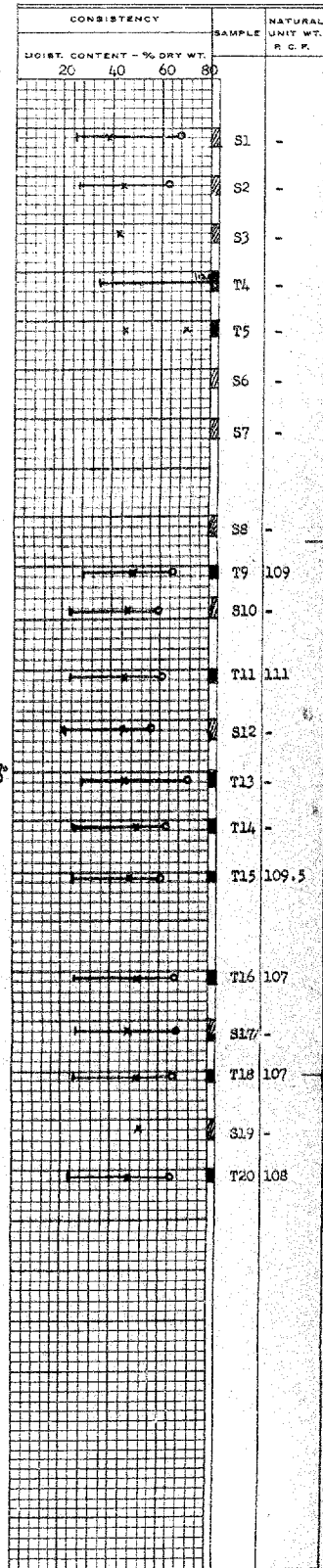
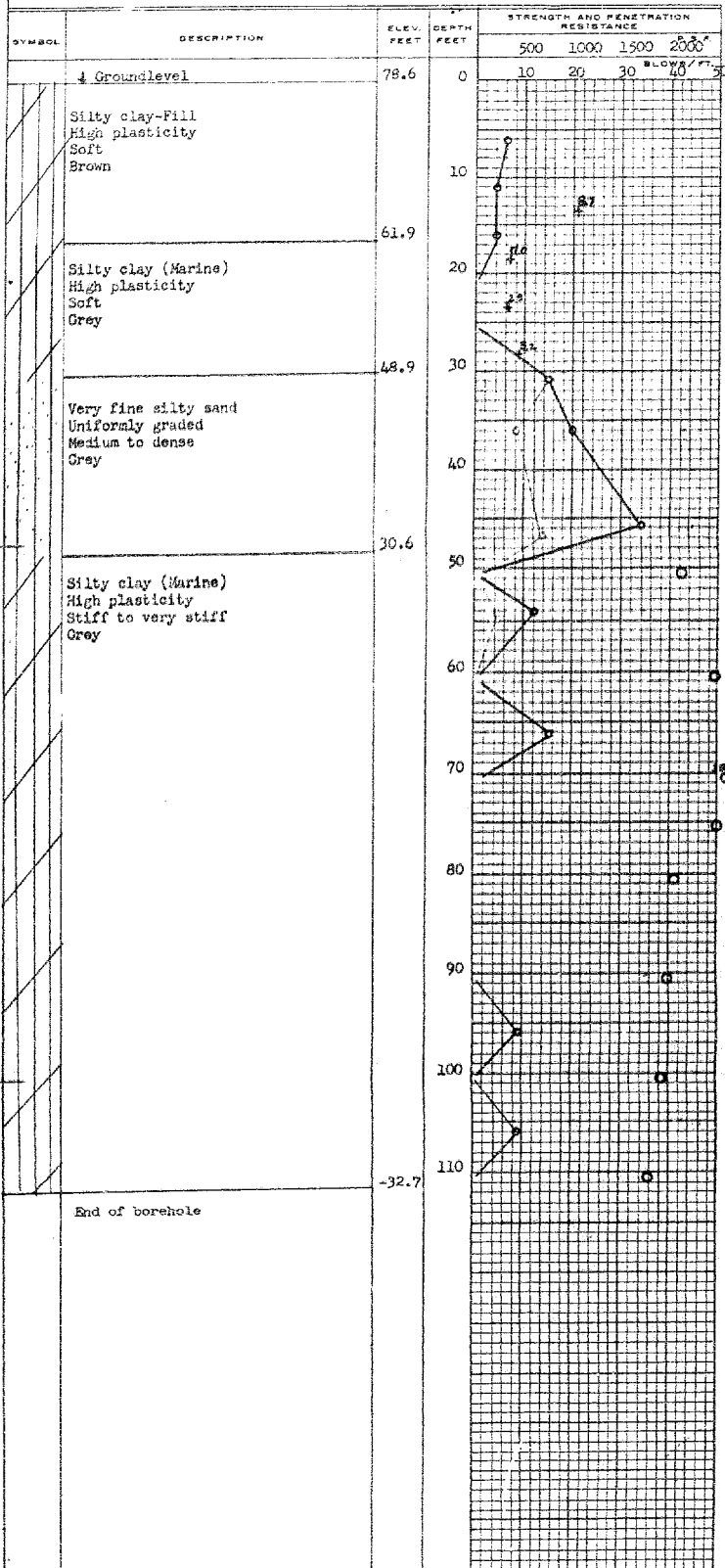
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. BORE HOLE NO. 1
JOB 60-P-85 STATION 5+10-4' Lt. of 6
DATUM 78.6' COMPILED BY B.K.
BORING DATE Sept. 16/60 CHECKED BY R.J.S.

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

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) 0
VANE TEST (C) AND SENSITIVITY (S) +5
NATURAL MOISTURE AND LIQUIDITY INDEX LI
LIQUID LIMIT 0
PLASTIC LIMIT 0



SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-85

W.P. _____

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	5'-7'	Silty clay-Fill soft brown	6	38.9	24.8	67.7	-	-	
	S2	10'-12'	"	4	44.0	26.5	62.4	-	-	
	VANE	13.5'	"	-	-	-	-	1040	-	Sens: 8.7
	S3	15'-17'	"	4	42.4	-	-	-	-	
	VANE	18.5'	Silty clay-marine soft grey	-	-	-	-	340	-	Sens: 17.0
	T4	20'-22'	"	P	96.5	35.5	113.6	-	-	
	VANE	23.5'	"	-	-	-	-	320	-	Sens: 2.9
	T5	25'-26.8'	"	P	44.8 70.0	-	-	-	-	
	VANE	28.3'	"	-	-	-	-	420	-	Sens: 3.2
	S6	30'-32'	Very fine silty sand. Medium to dense. Grey.	15	-	-	-	-	-	
	S7	35'-37'	"	20	-	-	-	-	-	
	S8	45'-47'	"	34	-	-	-	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-85

W.P. _____

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH psi.	UNIT WEIGHT p.c.f.	REMARKS
1	T9	50'-51.3'	Silty clay-Marine. Very stiff. Grey	P	48.0	28.0	65.0	2110	109	
	S10	53'-55'	"	12	46.1	23.6	59.0	-	-	
	T11	60'-61.3'	"	P	44.2	23.9	60.6	2465	111	
	VANE	62.8'	"	-	-	-	-	>2000	-	
	S12	65'-67'	"	15	44.1 20.3	21.8 -	56.1 -	- -	- -	
	T13	70'-71.5'	"	P	45.4	28.0	71.5 (Lab-) (Vane) (2870)	-	-	
	T14	75'-76.3'	"	P	50.0	24.8	62.1	2500	-	
	T15	80'-81'	"	P	47.5	24.3	60.3	2100	109.5	
	T16	90'-91.3'	Silty clay-Marine. Stiff. Grey	P	50.2	25.9	66.5	1970	107	
	S17	95'-97'	Silty clay-marine. Stiff. Grey.	9	47.7	26.5	67.8	-	-	
	T18	100'-101.2'	"	P	50.3	25.8	66.1	1925	107	

SUMMARY OF FIELD & LABORATORY TESTS

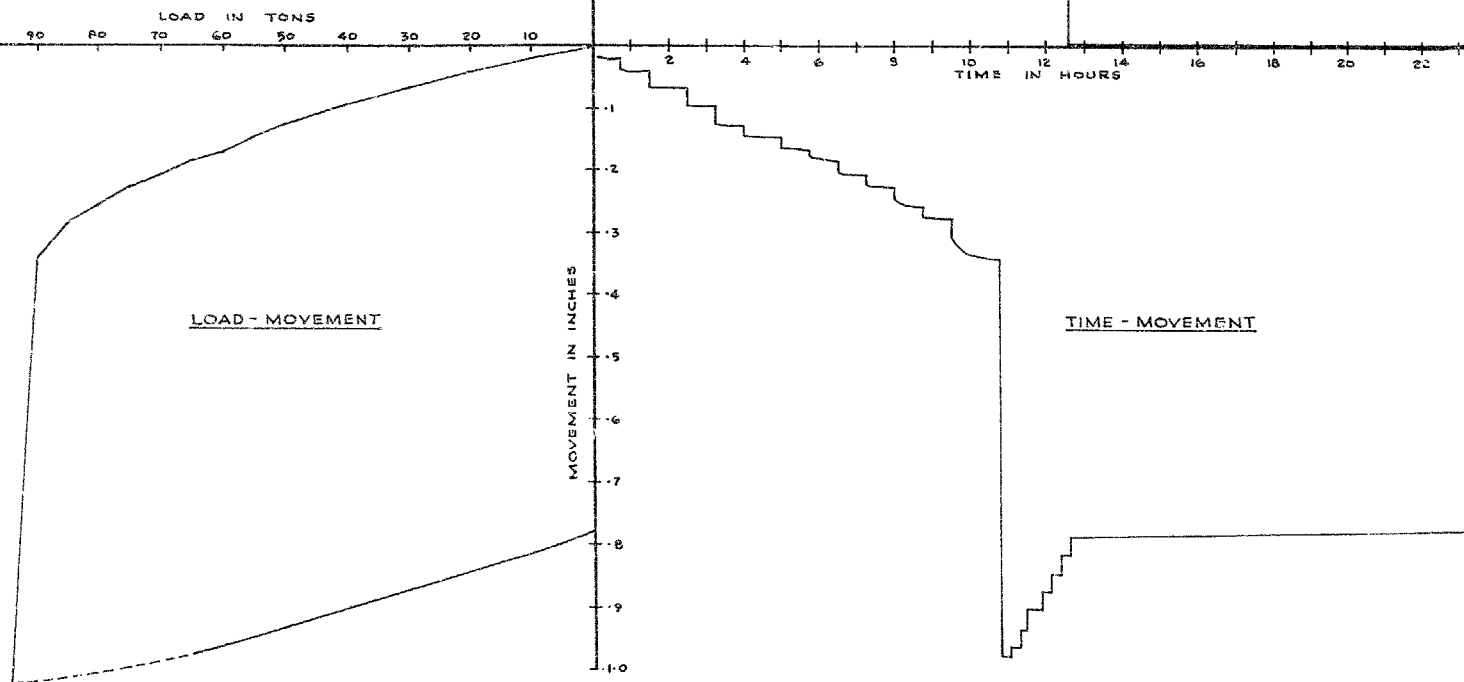
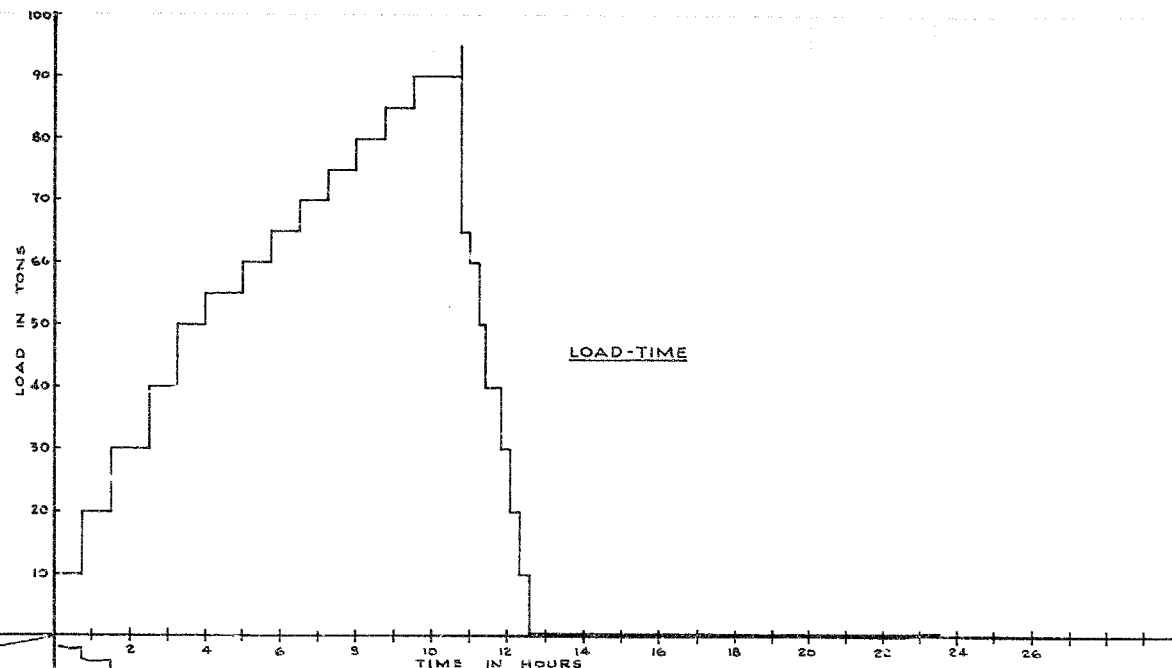
JOB 60-F-85

W.P. _____

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH P.S.I.	UNIT WEIGHT P.C.T.	REMARKS
1	S19	105'-107'	Silty clay-Marine. Stiff. Gray	9	51.8	-	-	-	-	
	T20	110'-111.3'	"	P	47.1	23.6	65.2	1790	108	
			S. denotes split spoon							
			T. " shelby tube							

PILE LOADING TEST
AZATIKA CREEK BRIDGE
STA. 5+20, 72' W. of E
60-F-85
DRIVEN - 17 SEPT. 60
TESTED - 19 SEPT. 60

PILE - 12 BP 53
74.6' LONG
TIP ELEV. 145.6



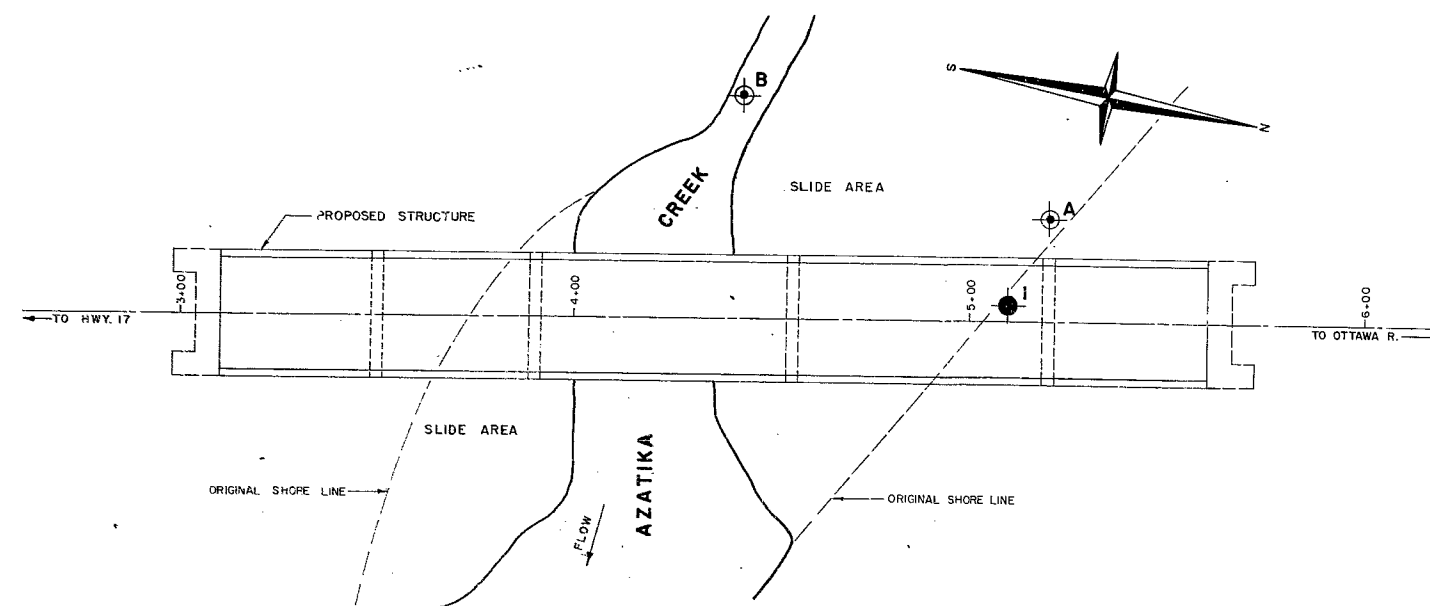
#60-F-85

AZATIKA CR.

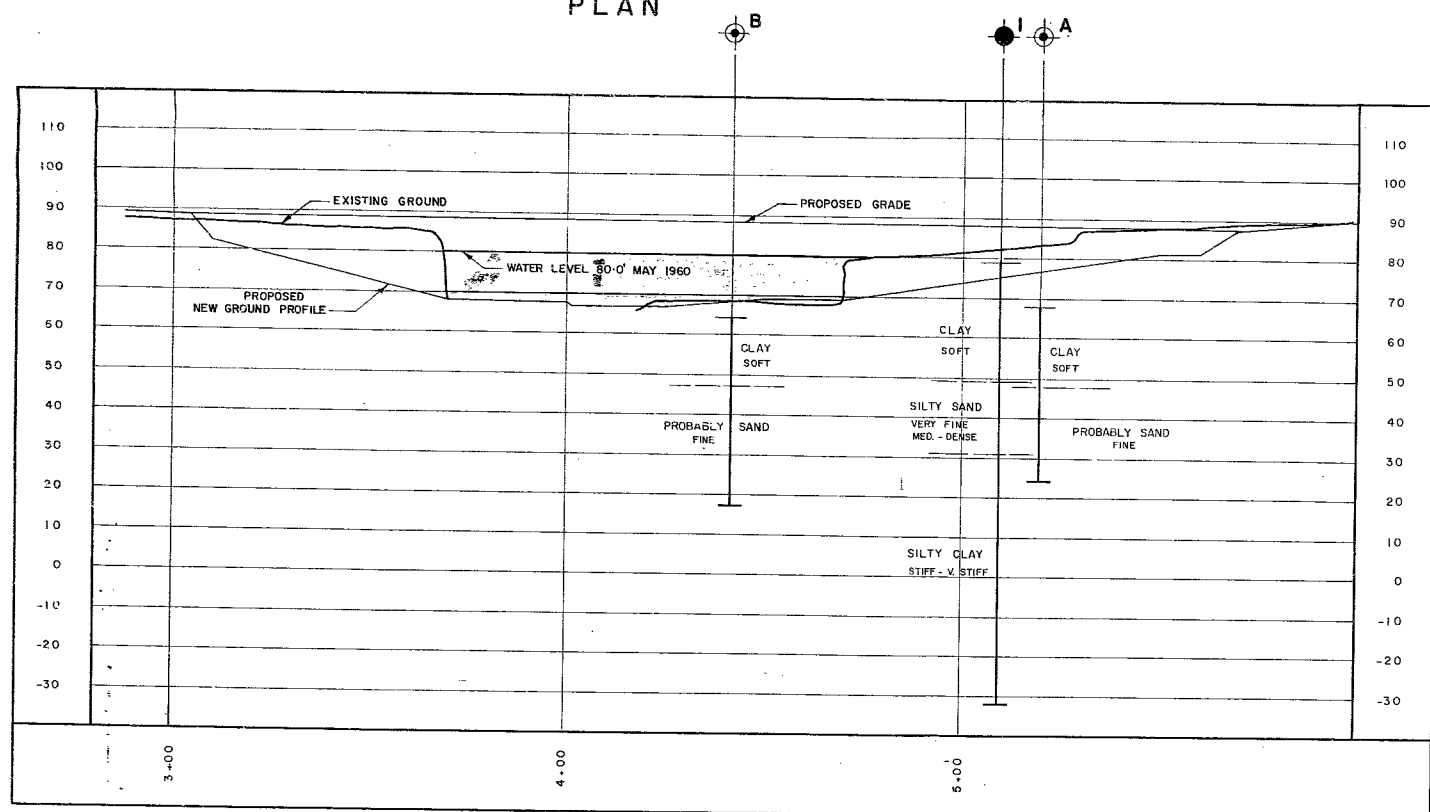
BRIDGE

5½ MILES E. OF

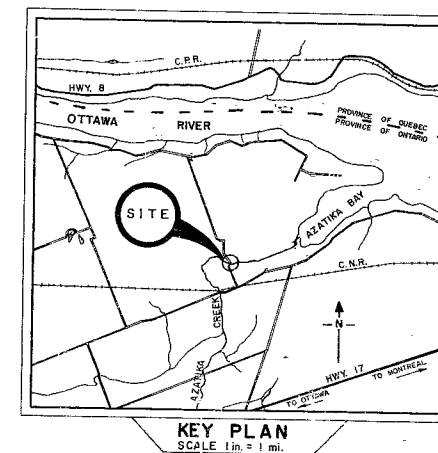
ALFRED



PLAN



PROFILE



LEGEND

- BORE HOLE - D.H.O.
- CONE PENETRATION - J.D. PATTERSON AUG. 1957

NOTE: ELEVATIONS REFER TO ARBITRARY DATUM ESTABLISHED BY COUNTY ENGINEER.
ELEVATION 78.6 IS APPROXIMATELY 140 FT ABOVE MEAN SEA LEVEL.

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.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
AZATIKA CREEK BRIDGE			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY.	DISTRICT	COUNTY	PRESCOTT
TOWNSHIP ALFRED	9	LOT	CDN. 3
LOCATION 5 MILES WEST OF L'ORIGINAL			
DRAWN BY: D. MUMFORD	CHECKED BY:	W.F.	
DATE 16 NOV. 1960	APPROVED BY:	DRAWING NO.	
SCALE 1 inch = 20 feet			60-F-85A