SIDNEY I 95 6 13

58/12

SIDNEY - KENNEBEC COUNTY

SOILS REPORT

I-95-6(13)

LYONS ROAD STRUCTURE

58-12

Please Reply to:

Soils Laboratory
B1 Lord Hall
U of Maine
Orono, Maine

April 21, 1958

Mr. Vaughan M. Daggett
Chief Engineer
State Highway Commission
Augusta, Maine

Re: Lyons Road Structure

Dear Mr. Daggett:

We are enclosing six (6) copies of the report entitled "Subsurface Investigation for Lyons Road Structure, Interstate Highway Project, Sidney, Maine," dated April 1958.

Very truly yours,

Fred M Boyce

Frederick M. Boyce, Jr.
Soils Laboratory

FMB:ac

Encl.

SUBSURFACE INVESTIGATION FOR
LYONS ROAD STRUCTURE
INTERSTATE HIGHWAY PROJECT
SIDNEY, MAINE

State Highway Commission

Soils Division

April 1958

INDEX

SUBSURFACE INVESTIGATION FOR

LYONS ROAD STRUCTURE

INTERSTATE HIGHWAY PROJECT

SIDNEY, MAINE

INTRODUCTION

The subsurface conditions at the proposed location for the two (2) bridge structures to carry the Lyons Road traffic over the Northbound and Southbound Lanes, has been investigated by means of twelve (12) core borings and four (4) rod soundings. These borings were made in March 1958 and the locations for the borings, together with the resulting soils profile, is shown on Sheet No. 1. Transverse sections at each Abutment and Pier location are shown on Sheet No. 2. Boring notes are shown on Sheets 3 and 4. The detail sheets for the borings are shown on Sheets 5 to 10 inclusive. Design data for spread footings are shown on Sheets 11 and 12. The proposed crossing is three quarters (3/4) of a mile west along the Lyons Road from Route 104, or River Road (so called).

GENERAL CONDITIONS

A rather shallow ledge surface (within ten (10) feet of the surface) was noted except at the two extreme abutments, one on the eastern end and the other on the westerly end. On these two (2) ends the ledge drops more than twenty (20) feet from the ground surface. The general shape of the ledge profile is that of a fold; that is, the ledge has been squeezed together. The squeezing causes a vertical alignment of the fine grained particles and as such, cleavage or breakage easily occurs. This is greatest at the ends and was noted by poor recovery of the ledge cores. The ledge under the piers and middle abutments is, however, firm and should provide adequate support for direct contact pressures of the piers and abutments. Allowable bearing values for this ledge would be twenty to thirty (20-30) tons per square foot, with the lower range to be used on end bearing piles.

The overburden at the top of this fold is a firm weathered silty clay with the sand content increasing with depth. At either end, a layer of compact silty sand appears below which appears a hard pebbly silt. Because the weathered silty clay will consolidate slightly under additional loading, and also because of the proximity to a good ledge surface, it is recommended that the bridge substructures be supported directly on ledge and at the deeper end by end frictional piles driven through the fill or on spread footings placed in the dense silty sand and gravel.

SUBSTRUCTURE DETAIL REPORT

Interstate - Southbound Lane

Abutment No. 1 and Approach Fill. Borings 5 and 12 (Sheets 7 and 10) and transverse section (Sheet 2) show the existing soils profile under the proposed location of Abutment No. 1. If the abutment is constructed after the approach fill is made, it is recommended that the abutment be supported through the use of frictional piles. It is believed that piles may be driven to elevation 193. Jetting may be helpful in reaching this elevation. Because of the normal fluctuation of the ground water table, wooden piles are not recommended. Spread footings could be used provided the footing is placed in the dense silty sand and gravel layer, five (5) feet below the surface. A graph (Sheet 11) has been made showing the design pressures in relationship with the width of footing at the five (5) foot depth. The footing pressure could be increased 0.5 tons per square foot for each additional foot of depth below five (5) feet. The fill behind the abutment should perform satisfactorily with good compaction in the fill a necessity.

Pier No. 1. Boring 1 (Sheet 5) and the transverse profile (Sheet 2) show the existing subsurface profile. A sounding was made at the opposite end of the pier location to show any dipping of the ledge surface. To minimize frost action, the footing should be placed five (5) feet below the surface and since the ledge surface is but three and one half (3½) feet deeper, it is recommended that the pier be supported directly on bedrock.

Pier No. 2. Boring 4 (Sheet 6) and the transverse profile (Sheet 2) show the existing soils profile at Pier No. 2. A rod sounding was made at the opposite end of this pier location to show any dipping of the ledge surface. As can be seen from the transverse profile, a good ledge surface was noted only five to six (5-6) feet below the ground surface. It is recommended that Pier No. 2 be supported directly on the ledge surface.

Abutment No. 2 and Fill. Borings 6 and 11 (Sheets 7 and 10) and the transverse profile (Sheet 2) show the soils profile at the proposed location of Abutment No. 2. As can be seen from the profile, the ledge surface was only six (6) feet below the surface. It is recommended that the abutment be supported directly on the ledge surface. If the fill is to be placed before the abutment is constructed, it is believed end bearing piles could be driven through the fill and to the ledge surface. Wooden piles are not recommended due to the fluctuation of the ground water table. The approach fill should be adequately supported by the stiff weathered silty clay. Good compaction in the fill is, however, a necessity.

Interstate - Northbound Lane

Abutment No. 1. Borings 7 and 10 (Sheets 8 and 9) and the transverse profile (Sheet 2) show the underlying soils profile at Abutment No. 1. Since a uniform ledge surface was noted five (5) feet below the surface, it is recommended that the abutment be supported directly on the ledge surface. If the abutment is to be placed after the fills are made, end bearing piles should be able to penetrate to the ledge surface. Wooden piles are not recommended due to the normal fluctuation of the ground water table. The approach fill behind the abutment should be adequately supported by the existing firm soils. Good compaction is a necessity.

Pier No. 1. Boring 3 (Sheet 6) and the transverse profile (Sheet 2) shows the subsurface profile at the proposed location of Pier No. 2. Ledge was noted six (6) feet below the surface on the south end of the pier and a rod sounding at the northerly end encountered a refusal (believed to be the ledge surface) eight and one half ($8\frac{1}{2}$) feet below the surface. Since a footing should be placed five (5) feet below the surface, it is recommended that Pier No. 2 be directly supported on the ledge surface.

Pier No. 2. Boring 2 (Sheet 5) and the transverse profile (Sheet 2) shows the soils profile under the proposed location of Pier No. 2. At the north end of the pier the ledge surface was noted eight and one half ($8\frac{1}{2}$) feet below the surface while a rod sounding encountered a refusal surface (believed to be the ledge surface) at the same depth on the southerly end. It is recommended that Pier No. 2 be supported directly on the ledge surface.

Abutment No. 2 and Eastern Approach Fill. Borings 8 and 9 (Sheets 8 and 9) and the transverse profile (Sheet 2) shows the existing soils profile at the proposed location of Abutment No. 2. Since any footing placed in the silty clay layer would undergo some settlement, the footing should be placed approximately ten (10) feet below the surface (elevation 180) in the medium density firm silty sand and gravel. Spread footings could be used and a graph has been drawn (Sheet 12) relating the width and contact pressure at the ten (10) foot depth. For each additional foot below the ten feet the footing is placed, the contact pressure could be increased 0.5 tons per square foot. If the fill is placed before the abutment is constructed, then piles are recommended. It is believed with the aid of jetting, piles may be driven to elevation 180. Since the ground water table fluctuates, wooden piles are not recommended. The existing firm weathered silty clays should adequately support the approach fills.

SUMMARY

Since the ledge surface was at a shallow depth at all the pier locations, it is recommended that the piers be supported direct on bedrock. Elevation of ledge at these piers are as follows:

Southbound Lane	North End	South End
Pier 1	194	194
Pier 2	194	195
Northbound Lane		
Pier 1	185	186.5
Pier 2	182.5	182.5

If the abutments are to be placed after the approach fills have been constructed, it is recommended that these abutments be supported by piles. Since the ground water table fluctuates, wooden piles are not recommended. The elevation to which it is believed the piles may be driven are as follows:

Southbound Lane	North End	South End
Abutment 1	195	195
Abutment 2	193 (ledge)	192 (ledge)
Northbound Lane		
Abutment 1	190 (ledge)	189 (ledge)
Abutment 2	181	178

Spread footings could be used on the two (2) extreme abutments where a dense brown silty sand and gravel layer was encountered. Sheets 11 and 12 have been drawn showing the design pressures in relationship to the width of footings.

Since the ledge surface was noted within six and one half (6½) feet of the surface at the middle two (2) abutments, some thought might be given to placing the abutments directly on the shallow ledge surface. Unit pressure should not exceed thirty (30) tons per square foot.

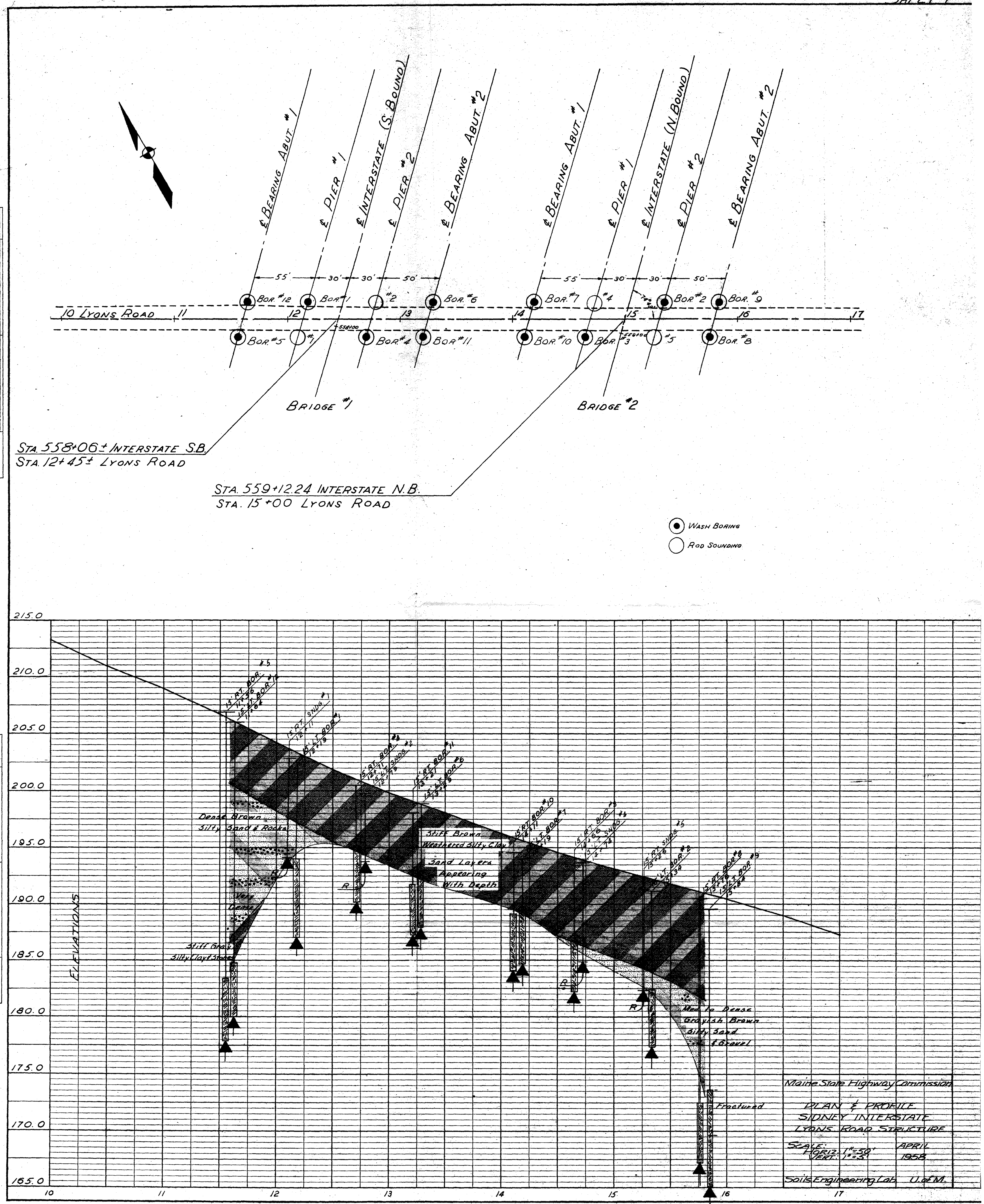
Good compaction in the approach fills will help eliminate the differential settlement between the rigid abutment and the flexible fill.

Report Prepared by Fred M. Boyce Jr.

Report Approved by William R. Gorrill

William R. Gorrill
Soils Engineer

SHEET #1



Maine State Highway Commission

PLAN & PROFILE
SIDNEY INTERSTATE
LYONS ROAD STRUCTURE

SCALE: HORIZ. 1"=50' VERT. 1"=5'

APRIL 1958

Soils Engineering Lab. U. of M.

PLATE 1 - PLAN - PROFILE O.P.R.

NOTE:
All ground surfaces assumed. Distance between borings measured along piers. Piers cross ℄ at skew.

Maine State Highway Commission

TRANSVERSE PROFILES

SIDNEY INTERSTATE
LYONS ROAD STRUCTURE

Scale
Horiz. 1" = 10'
Vert. 1" = 5'

Apr. 1958

Soils Engineering Lab. U. of M.

SHEAR AND WATER CONTENT NOTES

Shear Notes:

1. Field vane shear strengths indicated thus: ●
2. Laboratory vane shear strengths indicated thus: x
3. One half unconfined compressive strengths indicated thus: o
4. Strengths beyond range of plot indicated at right edge of plot by numerical values and symbols thus: 1.62●
5. Field vane shear strengths in excess of capacity of equipment indicated thus: —●→
6. Laboratory vane shear strengths in excess of capacity of equipment (1.0 T/sf) indicated thus: —x→
7. Field vane shear strengths in excess of capacity of equipment and beyond range of plot indicated at right edge of plot thus: 1.50(+)●
8. Laboratory vane shear strength in excess of capacity of equipment (1.0T/sf) and beyond range of plot indicated at right edge of plot thus: 1.00 (+)x

Water Content Notes:

1. Natural water contents, given as percent of dry weight, are indicated thus: o
2. Plastic and liquid limits are indicated thus: ⊗ — — —x
3. Ignition losses are given as percent of dry weight.

BORING NOTES	LOG SHEETS	DETAIL SHEETS
1. All samples and vanes are made ahead of casing.		
2. Scales and casing size as noted on drawings.		
3. Ground water table indicated thus:		
4. Number of blows of 275# hammer falling 18 inches required to drive extra heavy casing one foot thus:	40	(Graphical)
5. Location and designation of "dry" samples taken in S&H sampler #1290s indicated thus:	1 D	ID
6. Location and designation of "dry" samples taken in 2" O.D. 16 ga. seamless tubing indicated thus:	1 C	IC
7. Location and designation of "dry" samples taken in 3½" O.D. 16 ga. seamless tubing indicated thus:	1 U	IU
8. Location and designation of wash samples indicated thus:	1 W	IW
9. Unsuccessful attempts to secure dry sample indicated thus, followed by type of sampler:	M D	M_D
10. Location of field vane test indicated thus:		
11. Number of blows of 275# hammer falling 15" required to drive spoon or tubing one foot indicated thus:	20	(Graphical)
12. Sampling spoon or seamless tubing driven by static weight of drill rods and 275# hammer indicated thus:	H	H
13. 3½" O.D. "dry" samples taken with piston sampler.	P	P
14. Natural water contents, given as percent of dry weight are indicated thus:	31% 20	Graphical
15. Bottom of boring indicated thus:		
16. Refusal of drill rods or casing indicated thus:	R	R
17. Percent recovery of rock core by diamond bit thus:	71%	71%

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10 X 10 PER INCH

EUGENE DIETZGEN CO.
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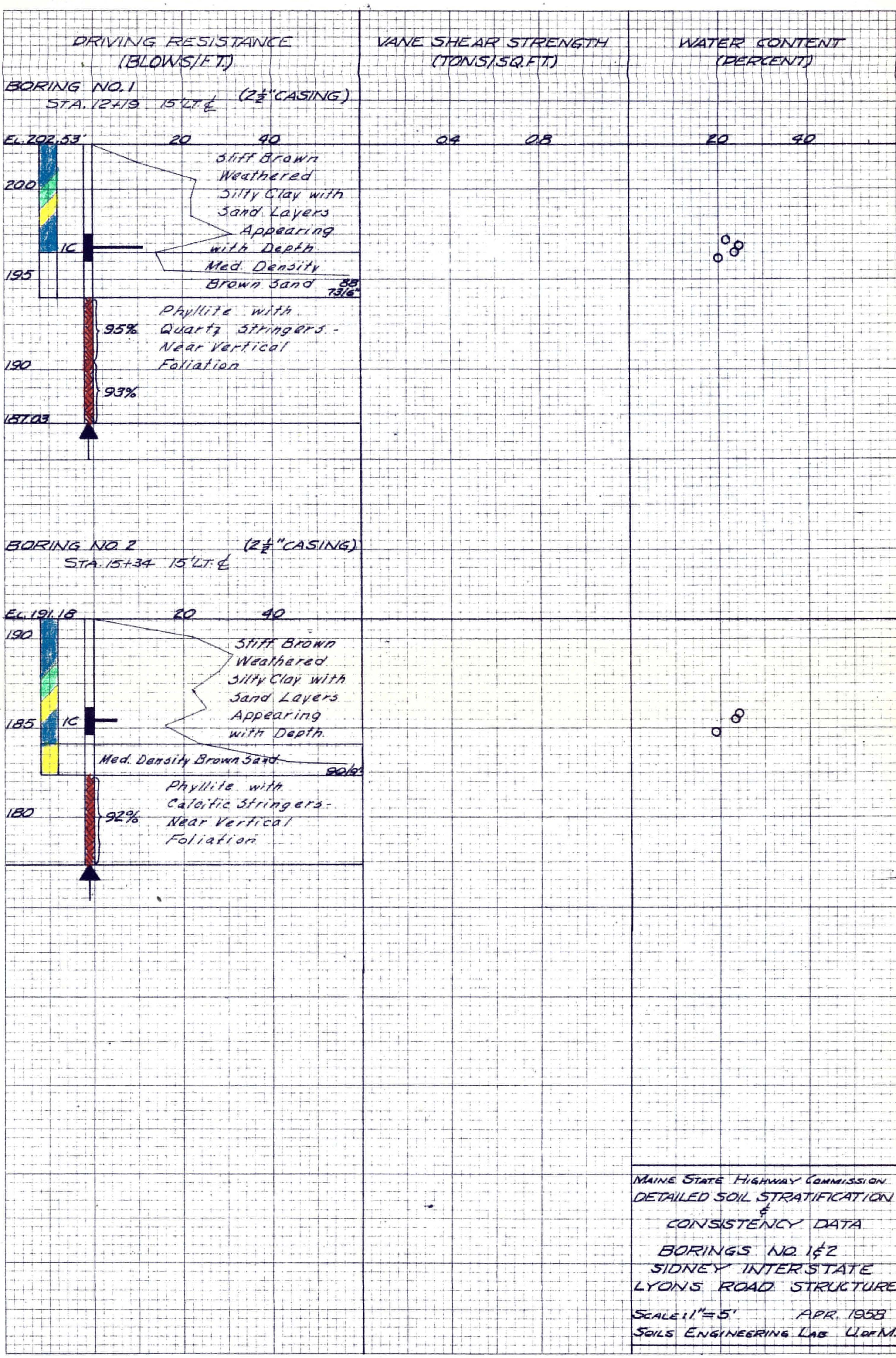
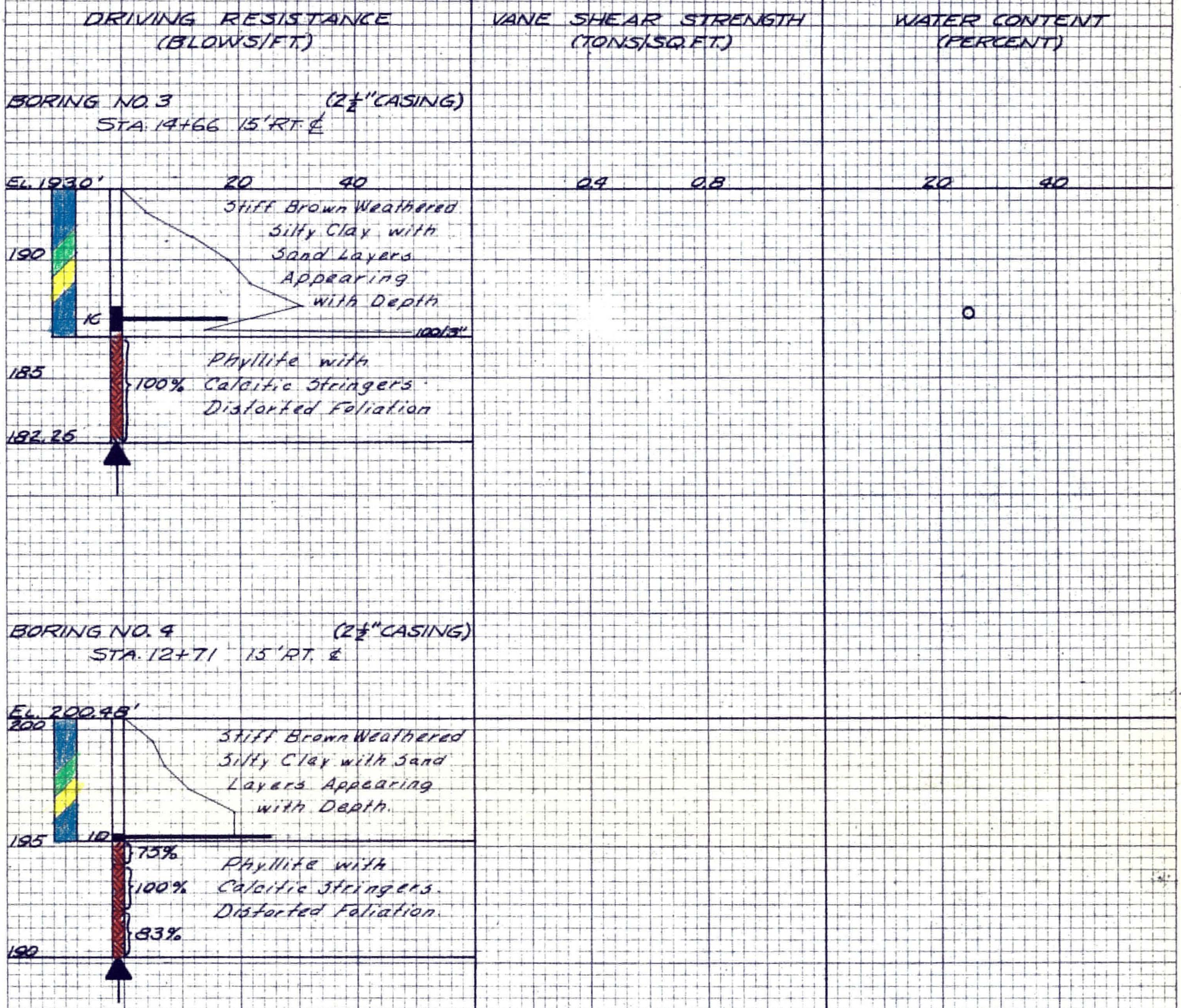


SHEET #5



MAINE STATE HIGHWAY COMMISSION
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA

BORINGS NO. 3 $ 4
SIDNEY INTERSTATE
LYONS ROAD STRUCTURE

SCALE: 1" = 5'   APR. 1958
SOILS ENGINEERING LAB U. OF M.

SHEET #6

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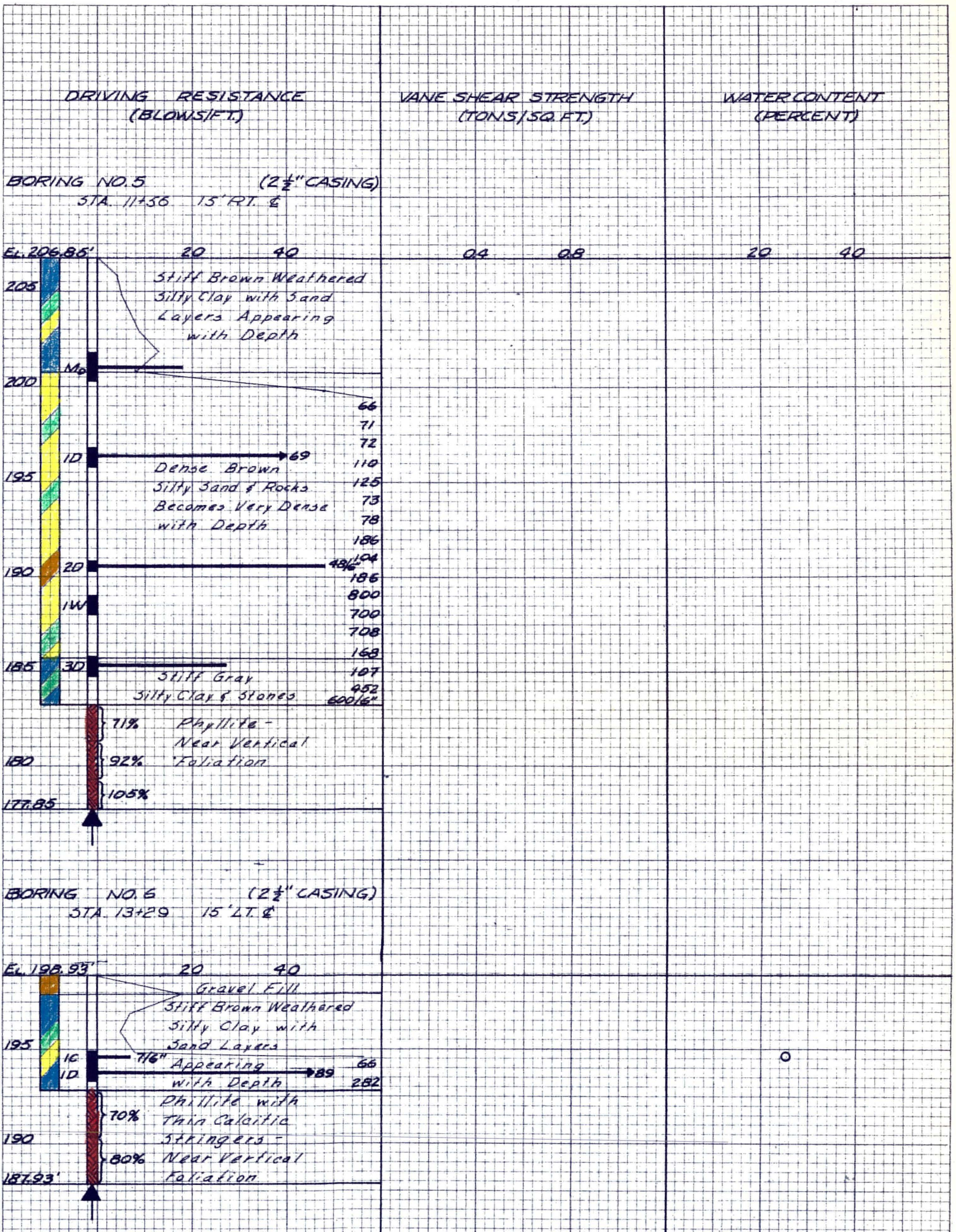

MAINE STATE HIGHWAY COMMISSION
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA
BORINGS NO. 5 & 6
SIDNEY INTERSTATE
LYONS ROAD STRUCTURE
SCALE: 1" = 5'   APR. 1958
SOILS ENGINEERING LAB   U of M.

SHEET #7

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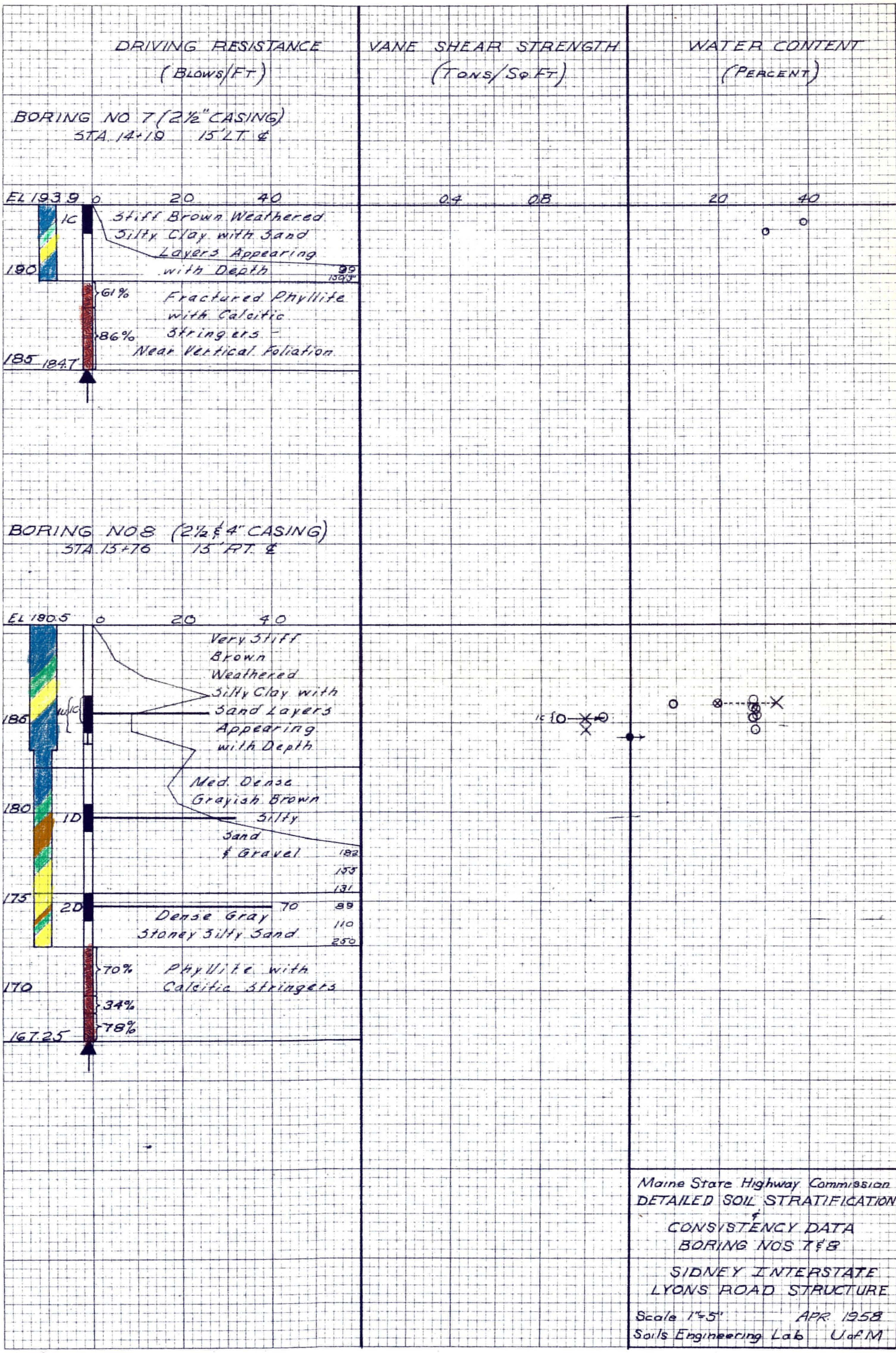
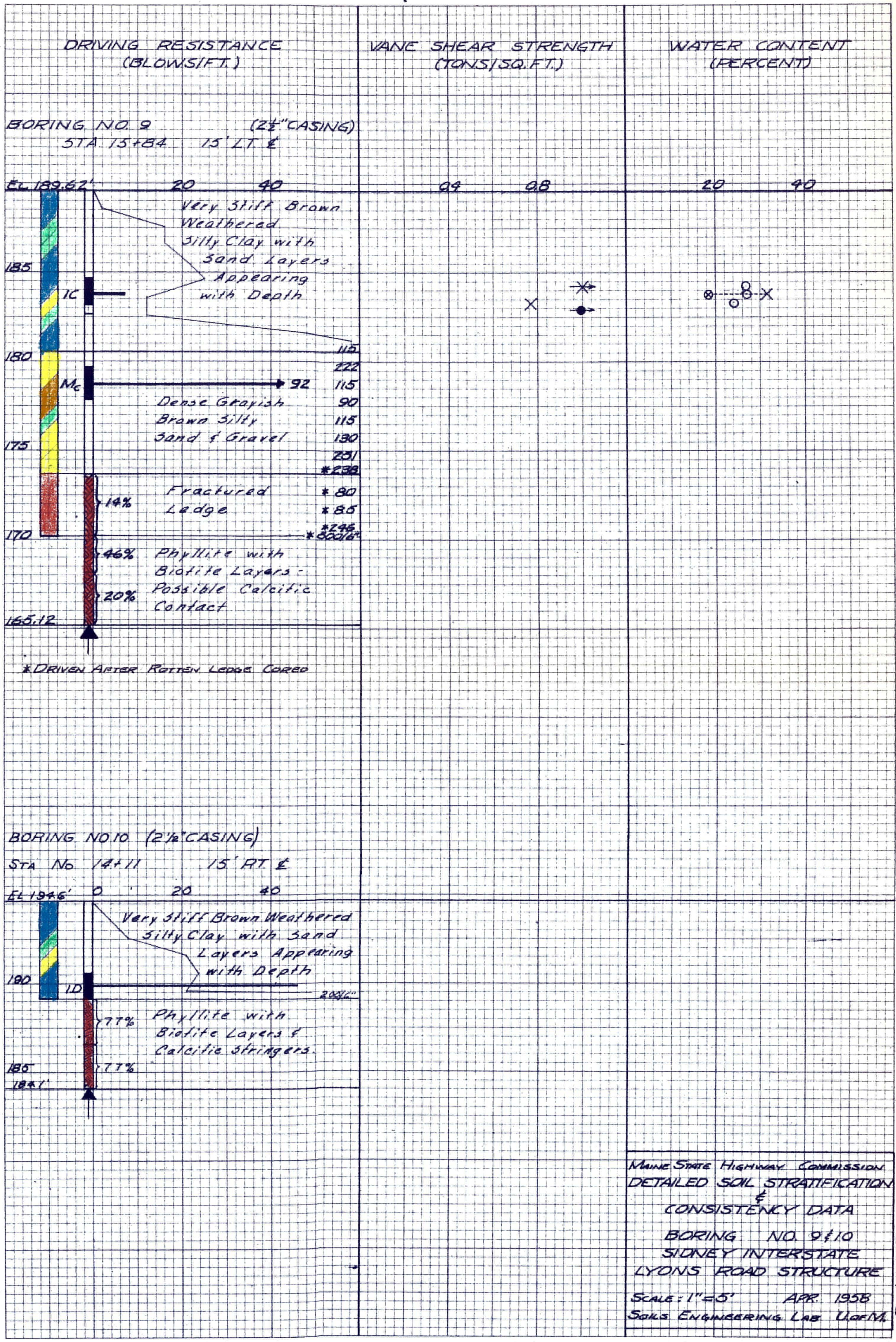


Maine State Highway Commission
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA
BORING NOS 7 & 8

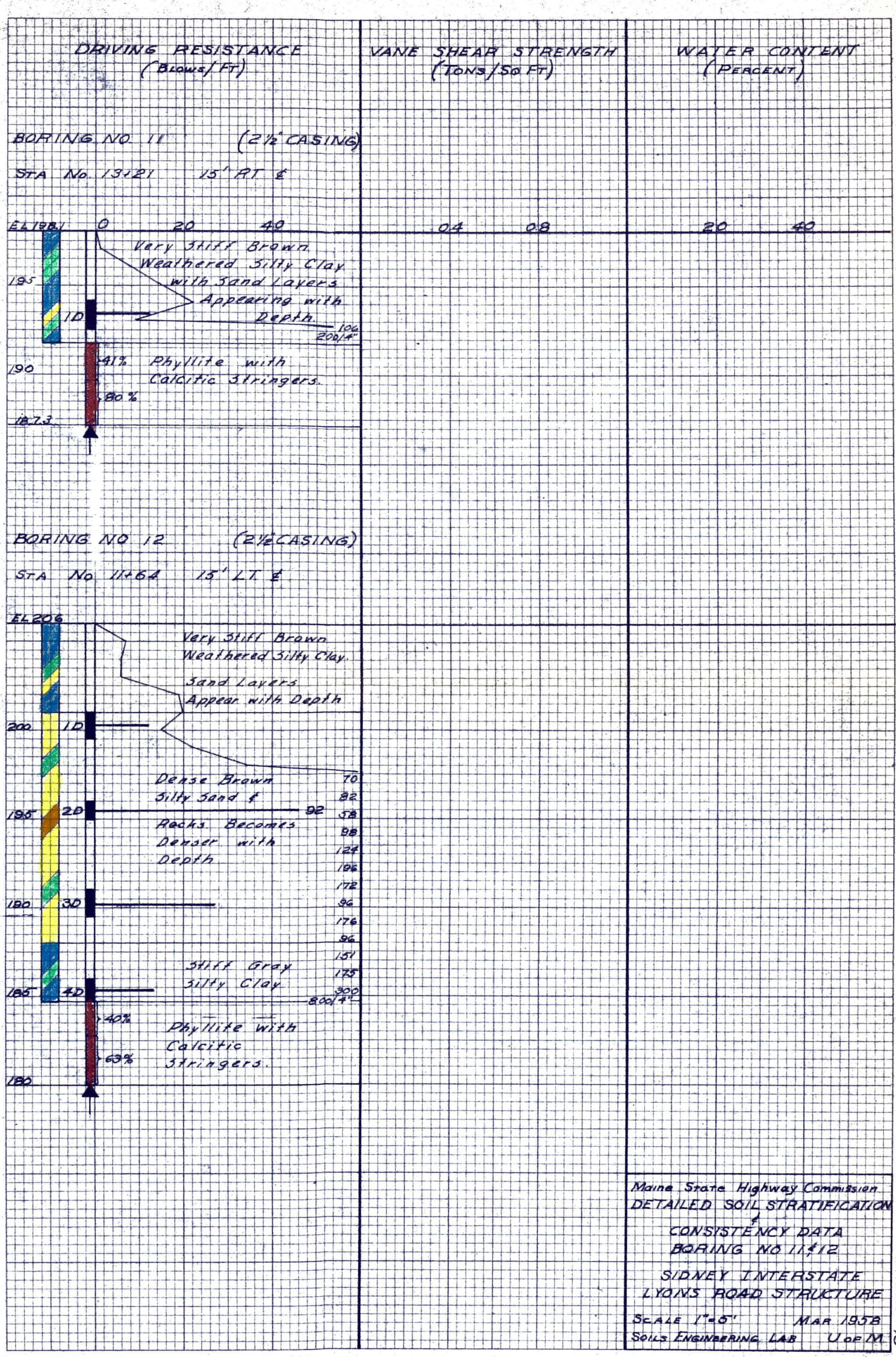
SIDNEY INTERSTATE
LYONS ROAD STRUCTURE

Scale 1"=5' APR 1958
Soils Engineering Lab U of M

SHEET #8


DRIVING RESISTANCE (BLOWS/FT.)
VANE SHEAR STRENGTH (TONS/SQ.FT.)
WATER CONTENT (PERCENT)
BORING NO. 9 (2½" CASING)
STA. 15+84 15' LT. ℄
EL. 189.62'
20
40
0.4
0.8
20
40
185
180
175
170
165.12
1C
Mc
92
Very Stiff Brown Weathered Silty Clay with Sand Layers Appearing with Depth
115
222
115
90
115
130
231
*238
Dense Grayish Brown Silty Sand & Gravel
Fractured Ledge
*80
*85
*246
*800/6"
14%
46%
20%
Phyllite with Biotite Layers - Possible Calcitic Contact
*DRIVEN AFTER ROTTEN LEDGE CORED
BORING NO. 10 (2½" CASING)
STA No 14+11 15' RT ℄
EL 194.6'
0
20
40
190
185
184.1'
1D
Very Stiff Brown Weathered Silty Clay with Sand Layers Appearing with Depth
200/6"
77%
77%
Phyllite with Biotite Layers & Calcitic stringers.
MAINE STATE HIGHWAY COMMISSION
DETAILED SOIL STRATIFICATION & CONSISTENCY DATA
BORING NO. 9 & 10
SIDNEY INTERSTATE
LYONS ROAD STRUCTURE
SCALE: 1" = 5'
APR. 1958
SOILS ENGINEERING LAB U. of M.

SHEET #9

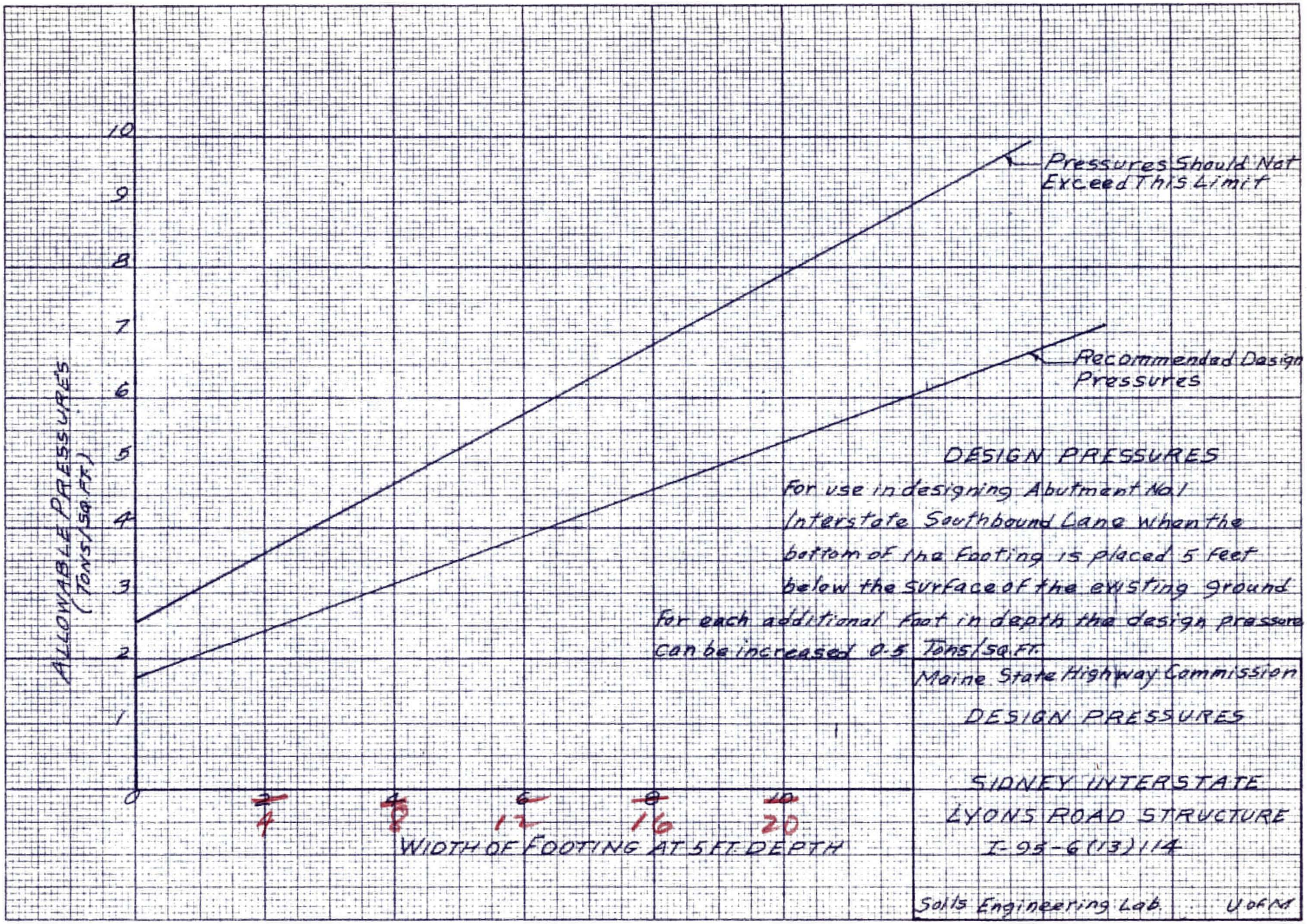


Maine State Highway Commission
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA
BORING NO 11 & 12

SIDNEY INTERSTATE
LYONS ROAD STRUCTURE

SCALE 1" = 5' MAR 1958
SOILS ENGINEERING LAB U of M

SHEET #10


10
9
8
7
6
5
4
3
2
1
0
ALLOWABLE PRESSURES
(TONS/SQ.FT.)
Pressures Should Not Exceed This Limit
Recommended Design Pressures
2 4 6 8 10
4 8 12 16 20
WIDTH OF FOOTING AT 5 FT DEPTH
DESIGN PRESSURES
For use in designing Abutment No. 1 Interstate Southbound Lane when the bottom of the Footing is placed 5 feet below the surface of the existing ground
For each additional foot in depth the design pressure can be increased 0.5 Tons/sq. ft.
Maine State Highway Commission
DESIGN PRESSURES
SIDNEY INTERSTATE
LYONS ROAD STRUCTURE
I-95-6(13)114
Soils Engineering Lab.
U of M

SHEET NO. 11

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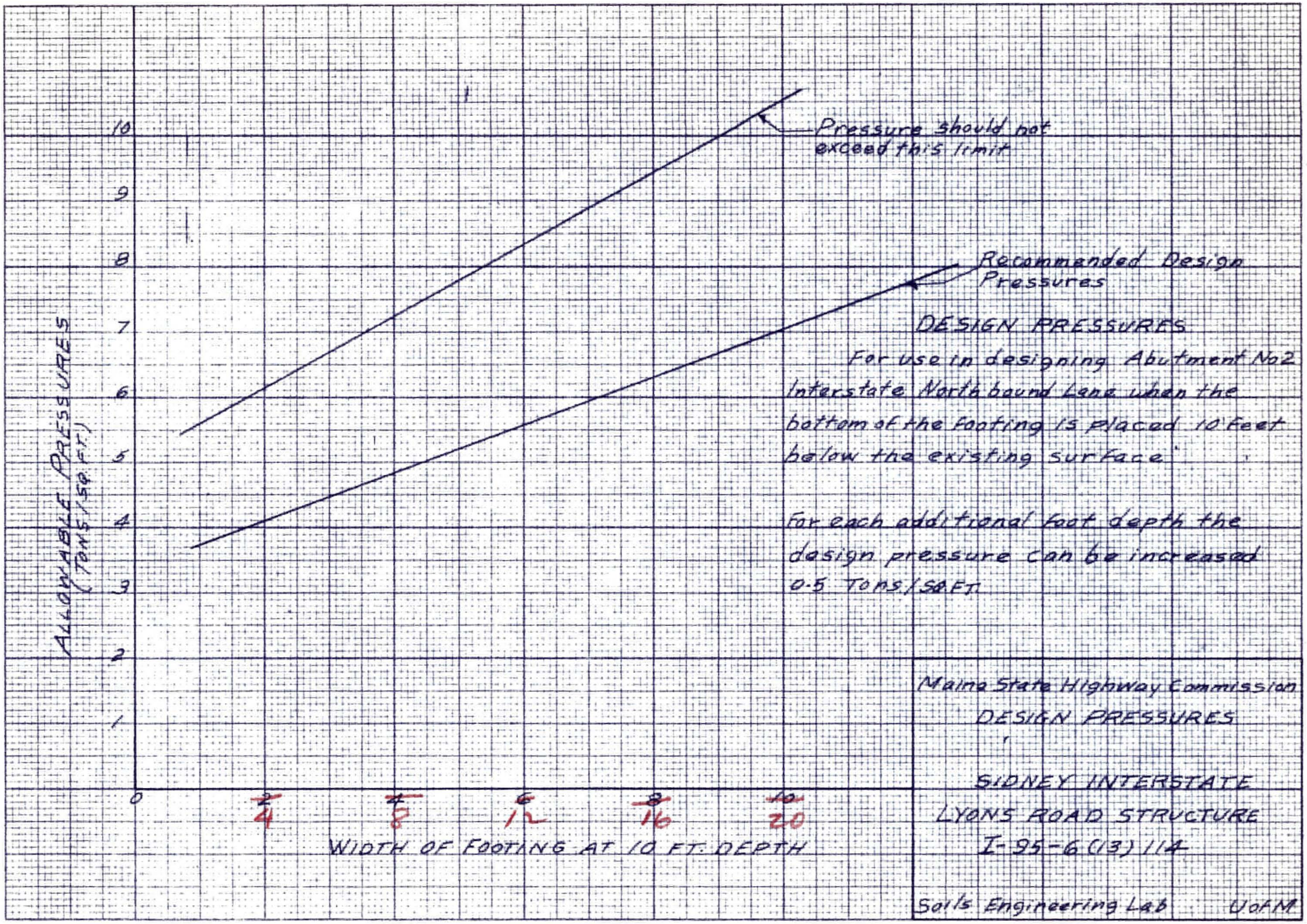

DESIGN PRESSURES

For use in designing Abutment No2 Interstate North bound Lane when the bottom of the Footing is placed 10' Feet below the existing surface.

For each additional foot depth the design pressure can be increased 0.5 Tons/SQ.FT.

Maine State Highway Commission
DESIGN PRESSURES

SIDNEY INTERSTATE
LYONS ROAD STRUCTURE
I-95-6(13)114

Soils Engineering Lab U of M

SHEET No. 12