SIDNEY 1-95 6

SIDNEY - KENNEBEC COUNTY

SOILS REPORT

I-95-6( )

TOWN FARM STRUCTURE 58-11

58/11

SUBSURFACE INVESTIGATION FOR THE TOWN FARM STRUCTURE ON THE INTERSTATE HIGHWAY IN SIDNEY, MAINE

State Highway Commission

Soils Division

April 1958

INDEX

SUBSURFACE INVESTIGATION FOR

THE TOWN FARM STRUCTURE ON

THE INTERSTATE HIGHWAY IN

SIDNEY, MAINE

INTRODUCTION

A subsurface investigation has been made at the site of the proposed crossing of the Interstate Highway and the Town Farm Road in Sidney, Maine. This site was investigated by means of eight (8) core borings made in March 1958. The location of these borings, together with the resulting soils profile, is shown on Sheet No. 1. Boring notes are shown on Sheets 2 and 3. The Boring Detail Sheets are shown on Sheets 4 through 9 inclusive. Design data for spread footings are shown on Sheets 10 and 11. The proposed crossing is 0.9 miles west along the Town Farm Road from Route 104 or River Road.

GENERAL CONDITIONS

The ledge surface dips sharply to the east from a depth of sixteen (16) feet on the westerly end to near fifty (50) feet on the easterly end. Ledge cores indicate the ledge to be sound, but with vertical cleavage. This is similar to the ledge noted along the other structures except that the Interstate Highway has moved further to the east with a result that the overburden is much thicker. Allowable bearing pressures for this ledge would be twenty (20) tons per square foot. The top twelve (12) feet of the overburden is a very stiff silty clay, below which appears a sandy gravel and boulder mixture in a medium density. On the deepest borings, a hard silty clay layer again appears.

SUBSTRUCTURE REPORT

Abutment No. 1

As can be seen by the transverse profile on Sheet 1, the stiff silty clay was noted on the southerly side of the Town Farm Road and did not appear on the northerly side. Ledge was noted sixteen (16) feet below the surface on the northerly end and nineteen (19) feet below the surface on the southerly end. Any footing placed in the sandy silt or stiff silty clay layer above elevation 167 would undergo some settlement. Since this would entail digging nearly fourteen (14) feet to place a footing, it would take but an additional three (3) or four (4) feet to reach bedrock. If the abutment is to be constructed after the approach fill is completed, piles are recommended. It is believed the piles should be able to reach the ledge surface. Since the frictional resistance will be high, jetting may be helpful in reaching the ledge surface. Because the ground water table fluctuates, steel or cast in place concrete piles are recommended. The fill behind the abutment should perform satisfactorily with good compaction a necessity.

Pier No. 1

Boring 1 (Sheet 4) shows the underlying soil conditions at the northerly end of Pier No. 1. It is believed that at the southerly end of the Pier, the same conditions exist with the possibility that the ledge surface is two (2) feet deeper. No soundings were made at the opposite end due to the high driving resistance. Any structure placed on the gray weathered silty clay layer (approximately fifteen (15) feet deep) would undergo a small amount of settlement (more than an inch). Spread footings would then have to be placed sixteen (16) feet below the surface in underlying medium dense brown sand. The ledge surface is only six (6) feet deeper. A graph has been drawn (Sheet 10) showing the design pressures in relationship to the width of the footing when the latter is placed sixteen (16) feet below the surface. If the substructure is to be placed on piles, it is believed piles can easily be driven into the medium dense brown sand at elevation 163, and possibly with jetting could continue down the remaining three (3) feet to ledge. Since the ground water table fluctuates, wooden piles are not recommended.

Pier No. 2

Boring 2 (Sheet 4) was located at the site of Pier No. 2. The silty clay layers extend to elevation 165. Below this layer is a medium to dense bouldery gravel sand. Any footing placed in the weathered silty clay would undergo minor settlement and thus the footing should be placed below this depth or piles could be used. It is believed that piles will have difficulty penetrating much below elevation 165. The graph drawn (Sheet 10) for the spread footing at Pier No. 1 could also be used for this pier, provided the footing is placed sixteen (16) feet below the surface. The design pressure could be increased one quarter ($\frac{1}{4}$) of a ton per square foot for each additional foot below this elevation the footing is placed.

Pier No. 3

Boring 3 (Sheet 5) was made at the northerly end of Pier No. 3. As was noted in Pier No. 2, any footing placed in the silty clay layer would undergo minor settlement. Spread footings are not recommended, since the bottom of any footing would have to be placed in the medium density brown sandy silt and gravel, (elevation 161.5) and this would entail a nineteen (19) foot excavation. It is recommended that piles be used. Due to the normal fluctuation of the ground water table, cast in place concrete piles or steel piles are recommended. It is believed these piles will be able to penetrate to elevation 155 and with the use of jetting could probably reach the ledge surface five (5) feet deeper at elevation 150.

Pier No. 4

Boring 4 (Sheet 6) was made at the southerly end of Pier No. 4. The stiff silty clay layer was not noted at this boring, nor was it noted in Borings 5 and 6 located to the east at Abutment No. 2. The top layer of sandy silt extends to elevation 169.5 and since this silt will consolidate under loading, it is recommended either piles or spread footings placed eight (8) feet below this surface in medium dense coarse brown sand be used. The design pressures for the spread footings placed at the eight (8) foot depth are shown on Sheet 11. For each foot the footing is placed below eight (8) feet, the pressure can be increased one half (½) tons per square foot. If piles are used, it is believed that they can be driven into the lower portion of this sand layer in the vicinity of elevation 155 and possibly with jetting, an additional five (5) feet to elevation 150. Since frictional resistance may be high, and because of the normal fluctuation of the ground water table, cast in place concrete piles or steel piles are recommended.

Abutment No. 2

Abutment No. 2 was investigated by Boring 5 and 6 (Sheets 7 and 8). The sandy silt layer previously noted at Pier No. 2 decreases in thickness to a maximum depth of six (6) feet below the surface. Since the stratification dips steeply to the south, any footing should be placed below elevation 167. This would mean a twelve (12) foot excavation on the northerly end and a six (6) foot excavation on the southerly end. Spread footings with contact pressures as shown on Sheet 11 could be used. The heel and toe pressures should not exceed the recommended design pressures. If the abutment is to be placed after the fill is constructed, piles are recommended. Cast in place or steel piles are recommended due to the normal fluctuation of the ground water table and the high driving resistance. It is believed that piles can be driven through the fill and into the medium dense brown sand and gravel with the minimum amount of depth (elevation 165) and probably with jetting to elevation 155. The fill behind this abutment should perform satisfactory with a minor amount of settlement due to the compression of the sandy silt. It is, however, recommended that these approach fills be made of control density to avoid the bump between the rigid bridge foundation and the flexible fill.

SUMMARY

The ledge surface dips sharply to the east. If the abutments are to be constructed after the approach fills are completed, piles are recommended. It is believed that piles on the western end can be driven to the ledge surface elevation 165. Piles on the eastern abutment would be stopped in the brown sand and gravel at elevation 165 and possibly with jetting an additional ten (10) feet to elevation 155.

If the abutments are constructed prior to the approach fill, the western abutment could be placed directly on bedrock seventeen (17) feet below the surface and on the easterly abutment spread footings could be used as shown on Sheet 11.

Piers 1, 2, and 4 could be supported by spread footings placed sixteen (16), sixteen (16), and eight (8) feet respectively below the surface, with bearing pressures as shown on Sheets 10 and 11. Since a spread footing would have to be placed nineteen (19) feet below the surface at Pier No. 3, piles are recommended.

The depth to which piles could be driven is as follows:

Pier	Elevation
1	163 and possibly with jetting to ledge 160
2	165
3	155 and possibly with jetting to ledge 150
4	155 and possibly with jetting to 150.

Since the frictional resistance will be high and the ground water table fluctuates, wooden piles are not recommended.

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

Report Prepared by Fred M Boyce Jr.

Report Approved by William R. Gorrill
William R. Gorrill
Soils Engineer

PLATE 1 - PLAN - PROFILE O.P.R.& R.E. STANDARD
KEUFFEL & ESSER CO., NEW YORK.

SHEAR AND WATER CONTENT NOTES

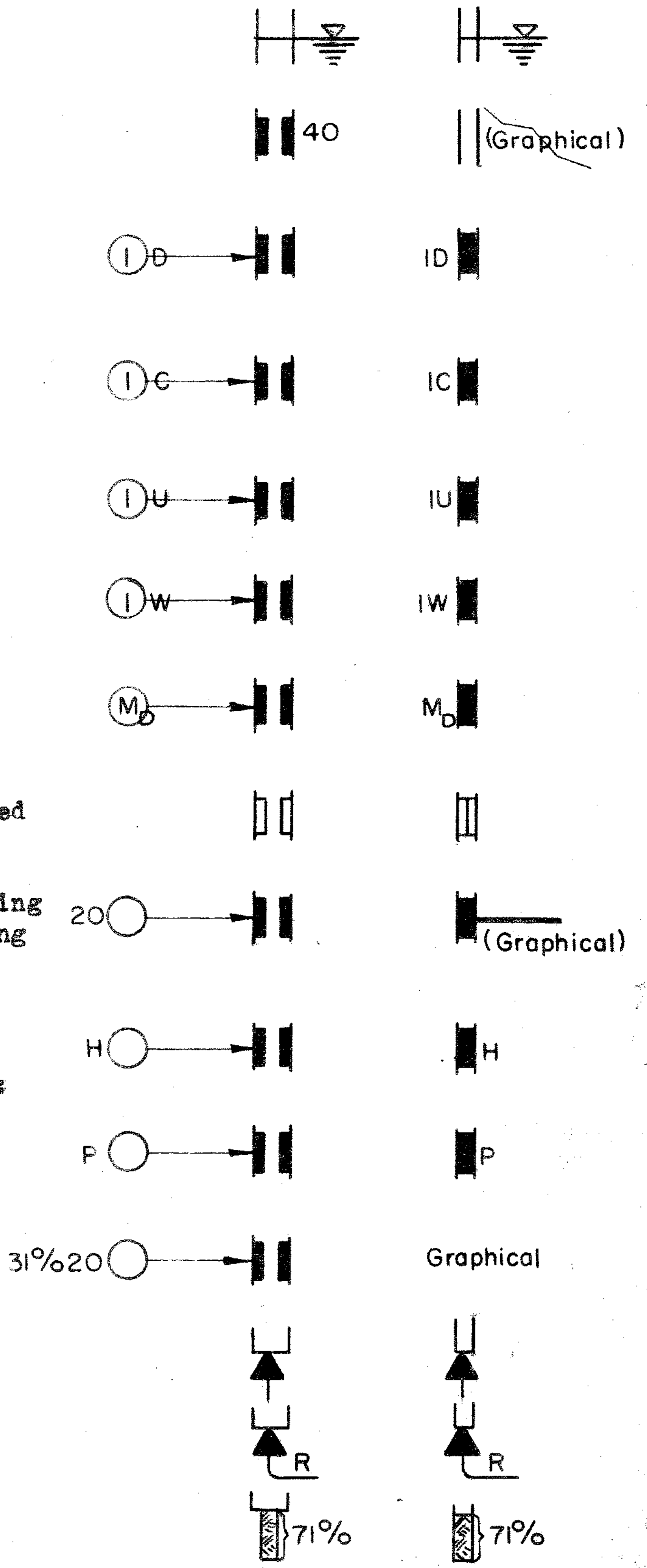
Shear Notes:

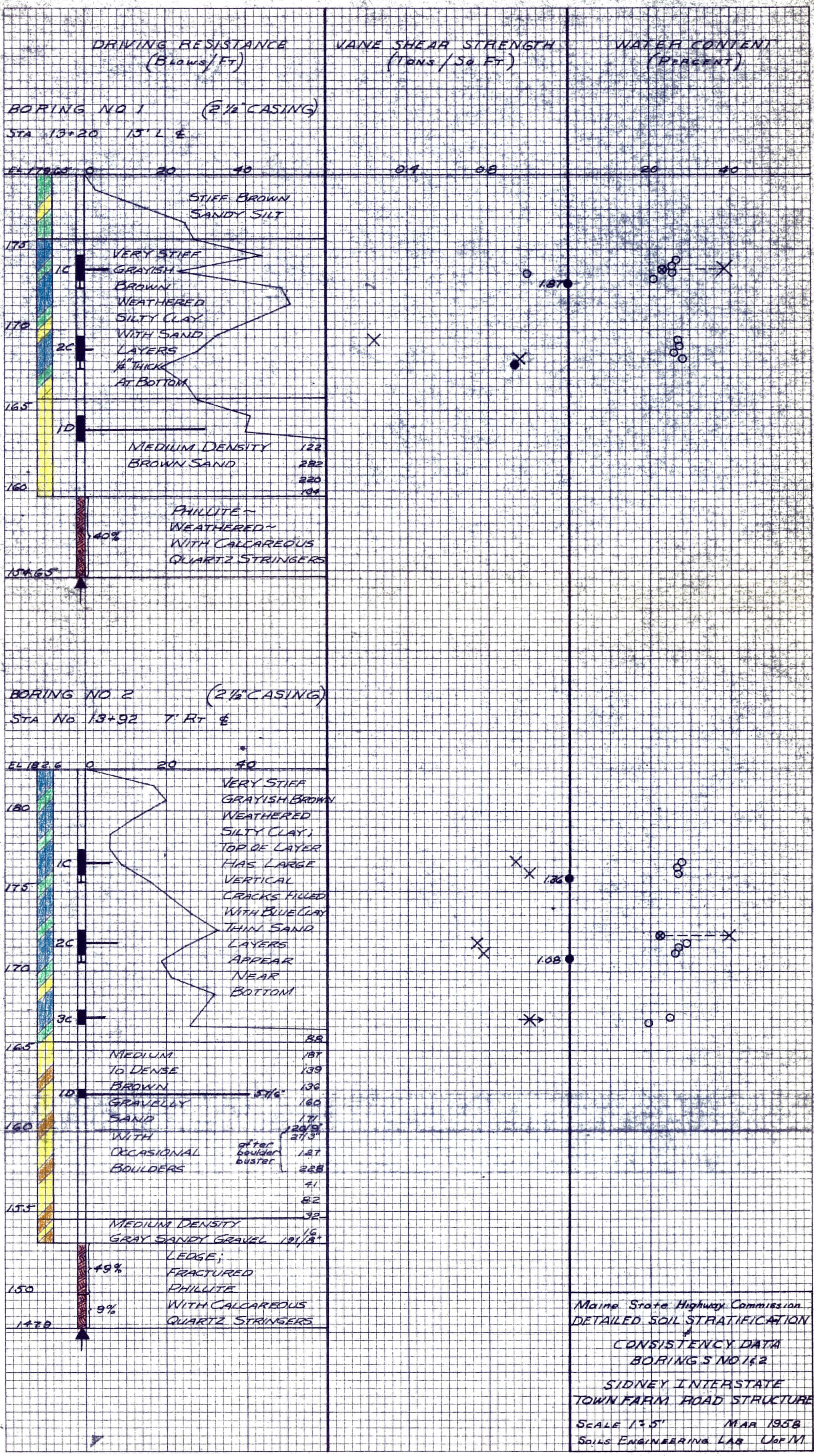
1. Field vane shear strengths indicated thus: ●
2. Laboratory vane shear strengths indicated thus: x
3. One half unconfined compressive strengths indicated thus: o
4. Strengths beyond range of plot indicated at right edge of plot by numerical values and symbols thus: 1.62●
5. Field vane shear strengths 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:

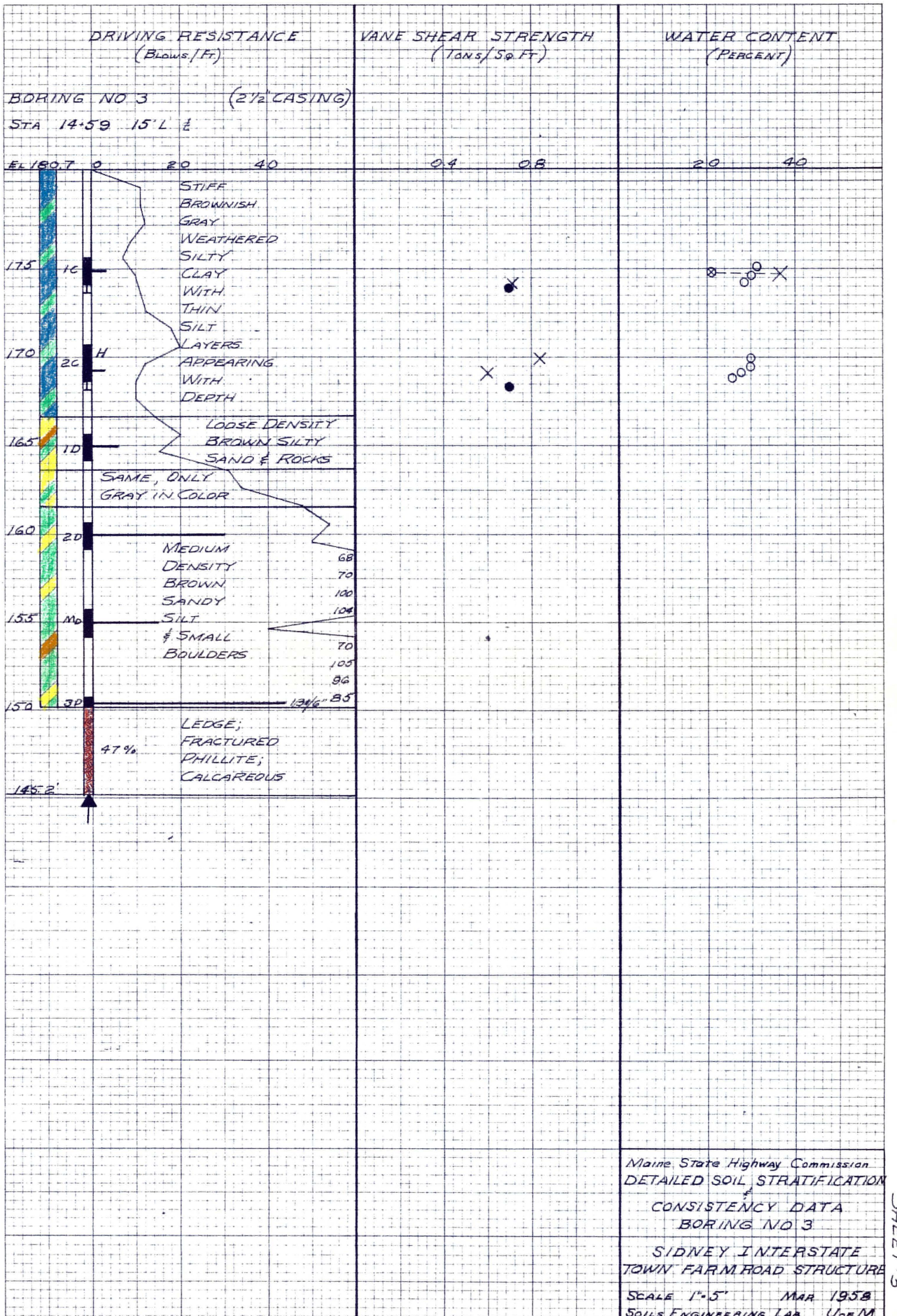
1. Natural water contents, given as percent of dry weight, are indicated thus: o
2. Plastic and liquid limits are indicated thus: ⊗ — — —x
3. Ignition losses are given as percent of dry weight.

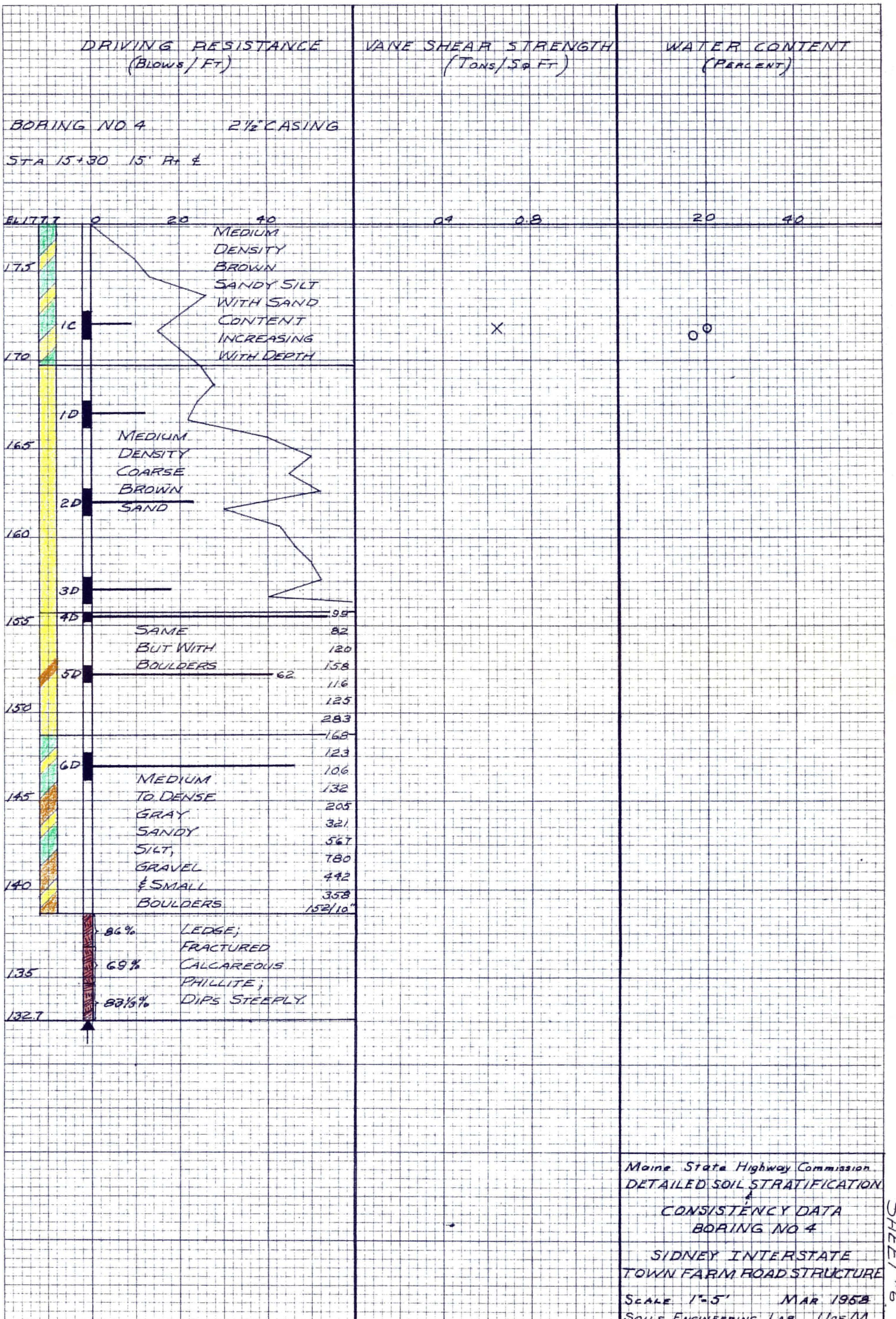
BORING NOTES	LOG SHEETS	DETAIL SHEETS
1. All samples and vanes are made ahead of casing.		
2. Scales and casing size as noted on drawings.		
3. Ground water table indicated thus:		
4. Number of blows of 275# hammer falling 18 inches required to drive extra heavy casing one foot thus:	40	(Graphical)
5. 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%

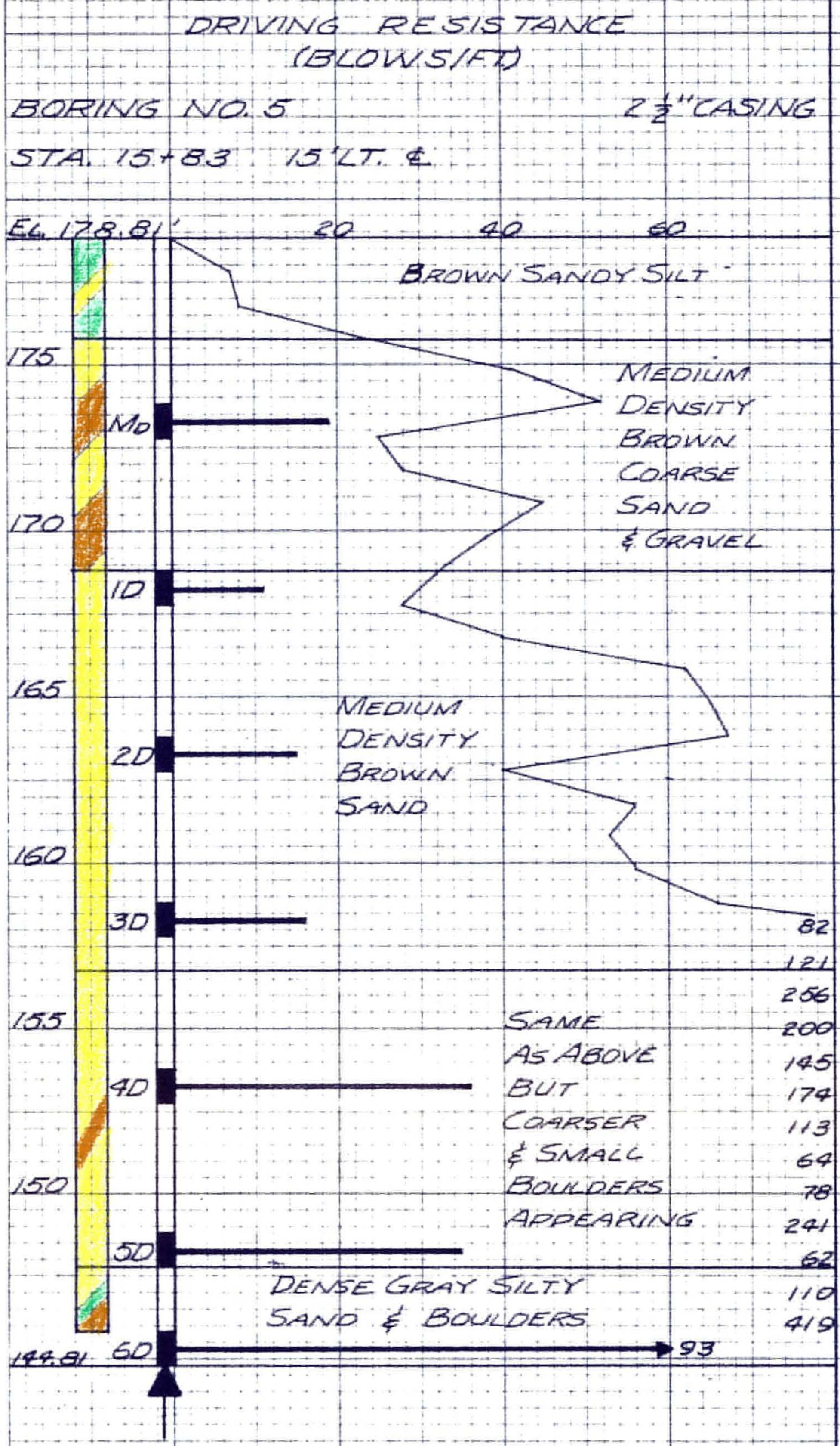



DRIVING RESISTANCE (BLOWS/FT)
VANE SHEAR STRENGTH (TONS/SQ FT)
WATER CONTENT (PERCENT)
BORING NO 1 (2½" CASING)
STA 13+20 15' L ℄
EL 179.65 0 20 40
0.4 0.8
20 40
STIFF BROWN SANDY SILT
175
1C
VERY STIFF GRAYISH BROWN WEATHERED SILTY CLAY WITH SAND LAYERS ¼" THICK AT BOTTOM
1.87
170
2C
165
1D
MEDIUM DENSITY BROWN SAND
122
282
220
194
160
PHILLITE ~ WEATHERED ~ WITH CALCAREOUS QUARTZ STRINGERS
40%
154.65
BORING NO 2 (2½" CASING)
STA NO 13+92 7' RT ℄
EL 182.6 0 20 40
180
VERY STIFF GRAYISH BROWN WEATHERED SILTY CLAY; TOP OF LAYER HAS LARGE VERTICAL CRACKS FILLED WITH BLUE CLAY THIN SAND LAYERS APPEAR NEAR BOTTOM
1C
1.36
175
2C
1.08
170
3C
165
MEDIUM TO DENSE BROWN GRAVELLY SAND WITH OCCASIONAL BOULDERS
88
187
139
136
160
171
20/8" 27/3"
127
228
41
82
32
1D
SPT 16"
160
after boulder buster
155
MEDIUM DENSITY GRAY SANDY GRAVEL
16
191/8"
LEDGE; FRACTURED PHILLITE WITH CALCAREOUS QUARTZ STRINGERS
49%
9%
150
147.9
Maine State Highway Commission
DETAILED SOIL STRATIFICATION & CONSISTENCY DATA
BORINGS NO 1 & 2
SIDNEY INTERSTATE
TOWN FARM ROAD STRUCTURE
SCALE 1" = 5'
MAR 1958
SOILS ENGINEERING LAB
U of M

SHEET #4

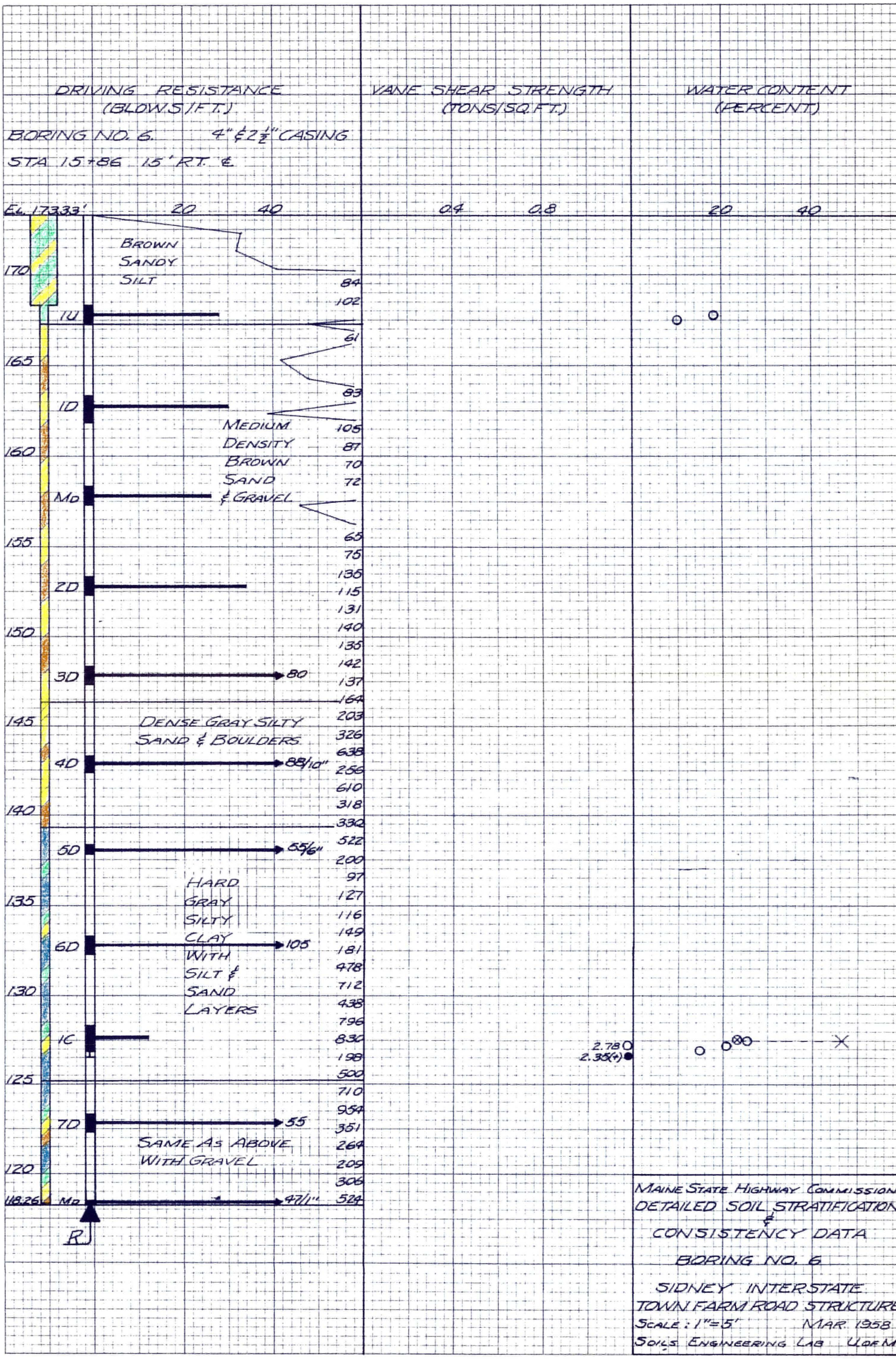

DRIVING RESISTANCE
(BLOWS/FT)
VANE SHEAR STRENGTH
(TONS/SQ FT)
WATER CONTENT
(PERCENT)
BORING NO 3
(2½" CASING)
STA 14+59 15' L ℄
EL 180.7
0
20
40
0.4
0.8
20
40
STIFF BROWNISH GRAY WEATHERED SILTY CLAY WITH THIN SILT LAYERS APPEARING WITH DEPTH
175
1C
170
2C
H
LOOSE DENSITY BROWN SILTY SAND & ROCKS
165
1D
SAME, ONLY GRAY IN COLOR
160
2D
MEDIUM DENSITY BROWN SANDY SILT & SMALL BOULDERS
68
70
100
104
155
MD
70
105
96
150
3D
138/6"
85
LEDGE; FRACTURED PHILLITE; CALCAREOUS
47%
145.2'
Maine State Highway Commission
DETAILED SOIL STRATIFICATION & CONSISTENCY DATA
BORING NO 3
SIDNEY INTERSTATE
TOWN FARM ROAD STRUCTURE
SCALE 1"=5'
MAR 1958
SOILS ENGINEERING LAB
U OF M
SHEET #5


DRIVING RESISTANCE
(BLOWS / FT)
VANE SHEAR STRENGTH
(TONS/SQ FT)
WATER CONTENT
(PERCENT)
BORING NO 4
2½" CASING
STA 15+30 15' RT ℄
EL 177.7
0
20
40
0.4
0.8
20
40
175
170
165
160
155
150
145
140
135
132.7
1C
1D
2D
3D
4D
5D
6D
MEDIUM
DENSITY
BROWN
SANDY SILT
WITH SAND
CONTENT
INCREASING
WITH DEPTH
MEDIUM
DENSITY
COARSE
BROWN
SAND
SAME
BUT WITH
BOULDERS
62
99
82
120
158
116
125
283
168
123
106
132
205
321
567
780
442
358
152/10"
MEDIUM
TO DENSE
GRAY
SANDY
SILT,
GRAVEL
& SMALL
BOULDERS
86%
69%
83⅓%
LEDGE;
FRACTURED
CALCAREOUS
PHILLITE;
DIPS STEEPLY
Maine State Highway Commission
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA
BORING NO 4
SIDNEY INTERSTATE
TOWN FARM ROAD STRUCTURE
SCALE 1"=5'
MAR 1958
SOILS ENGINEERING LAB
U of M
SHEET #6



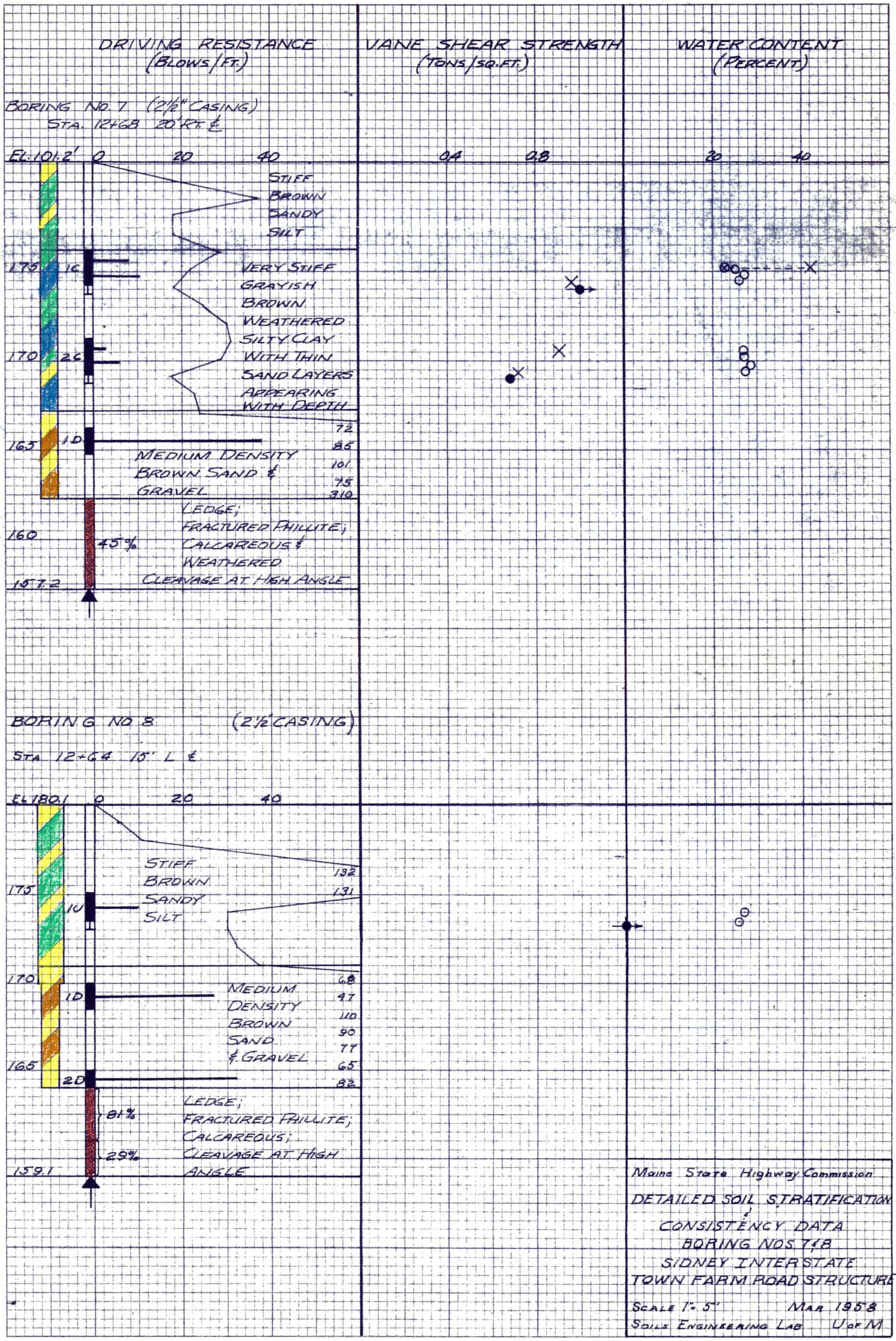
MAINE STATE HIGHWAY COMMISSION
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA
BORING NO. 5
SIDNEY INTERSTATE
TOWN FARM ROAD STRUCTURE
SCALE: 1" = 5' MAR. 1958
SOILS ENGINEERING LAB U. of M.

SHEET #7



MAINE STATE HIGHWAY COMMISSION
DETAILED SOIL STRATIFICATION & CONSISTENCY DATA
BORING NO. 6
SIDNEY INTERSTATE
TOWN FARM ROAD STRUCTURE
SCALE: 1"=5' MAR. 1958
SOILS ENGINEERING LAB U. OF M.

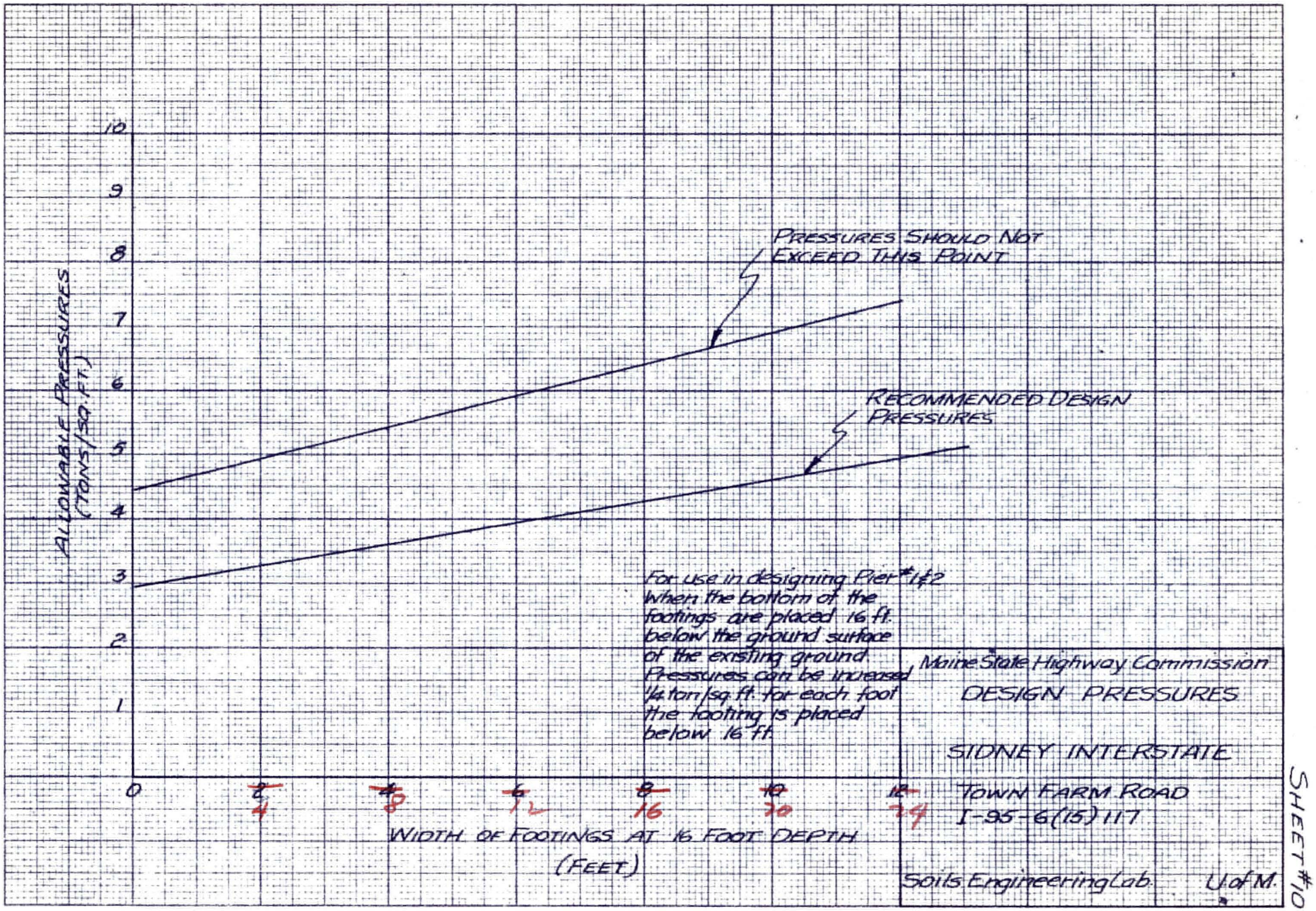
SHEET #8

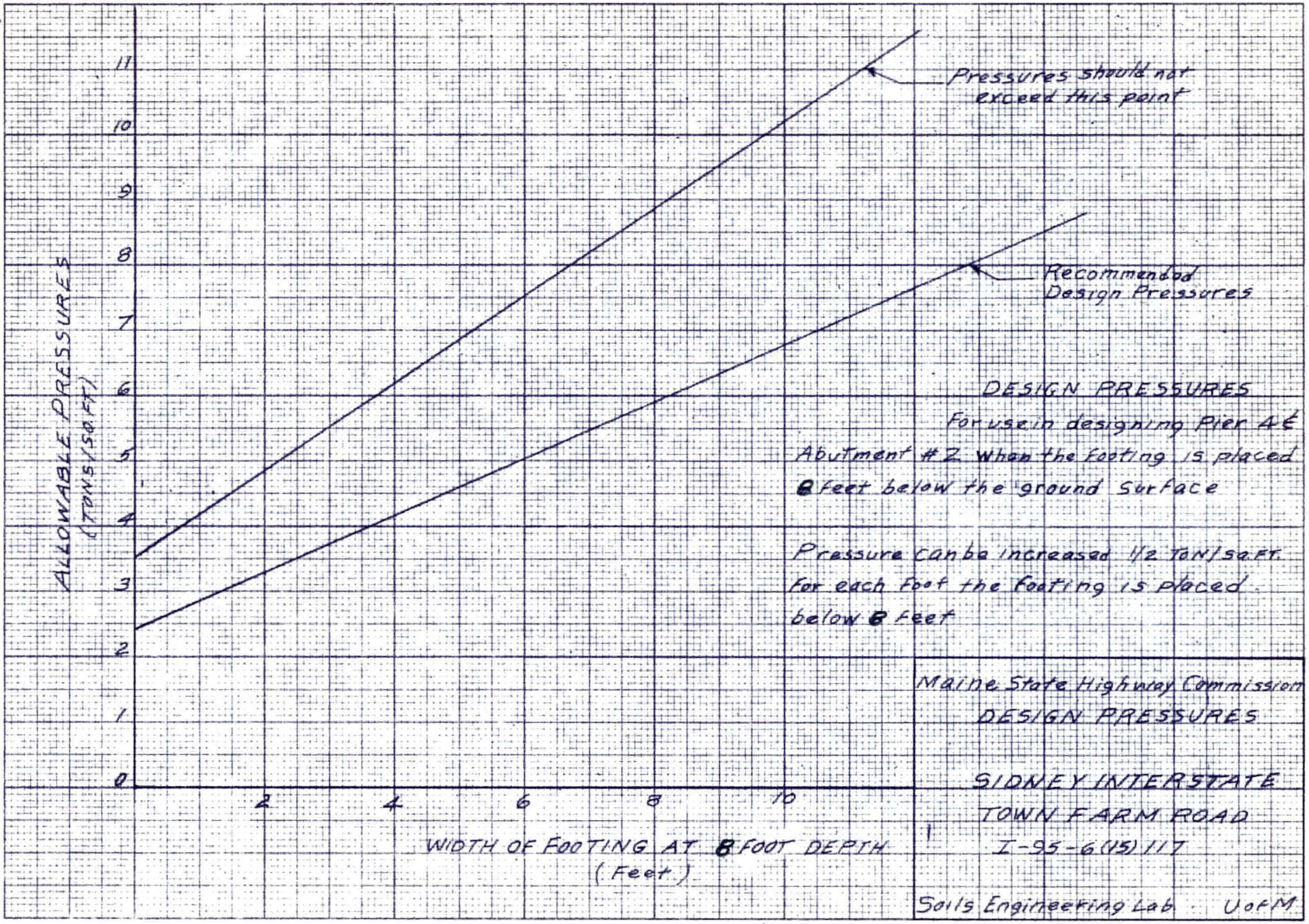

DRIVING RESISTANCE
(BLOWS/FT.)
VANE SHEAR STRENGTH
(TONS/SQ.FT.)
WATER CONTENT
(PERCENT)
BORING NO. 7 (2½" CASING)
STA. 12+68 20' RT. ℄
EL. 181.2'
0
20
40
0.4
0.8
20
40
STIFF
BROWN
SANDY
SILT
175
1C
VERY STIFF
GRAYISH
BROWN
WEATHERED
SILTY CLAY
WITH THIN
SAND LAYERS
APPEARING
WITH DEPTH
170
2C
72
165
1D
85
MEDIUM DENSITY
BROWN SAND &
GRAVEL
101
75
310
LEDGE;
FRACTURED PHILLITE;
160
45%
CALCAREOUS &
WEATHERED
157.2
CLEAVAGE AT HIGH ANGLE
BORING NO 8 (2½" CASING)
STA 12+64 15' L ℄
EL 180.1
0
20
40
STIFF
BROWN
SANDY
SILT
132
175
131
1U
170
68
1D
MEDIUM
DENSITY
BROWN
SAND
& GRAVEL
47
110
90
77
165
65
2D
82
LEDGE;
81%
FRACTURED PHILLITE;
CALCAREOUS;
29%
CLEAVAGE AT HIGH
159.1
ANGLE
Maine State Highway Commission
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA
BORING NOS 7&8
SIDNEY INTERSTATE
TOWN FARM ROAD STRUCTURE
SCALE 1"= 5'
MAR 1958
SOILS ENGINEERING LAB
U OF M

SHEET #9

NO 340 20 DIETZGEN GRAPH PAPER
20 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U. S. A.




ALLOWABLE PRESSURES (TONS/SQ.FT.)
0
1
2
3
4
5
6
7
8
9
10
11
2
4
6
8
10
WIDTH OF FOOTING AT 8 FOOT DEPTH (Feet)
Pressures should not exceed this point
Recommended Design Pressures
DESIGN PRESSURES
For use in designing Pier 4 & Abutment #2 when the footing is placed 8 feet below the ground surface
Pressure can be increased 1/2 TON/SQ.FT. for each foot the footing is placed below 8 feet
Maine State Highway Commission
DESIGN PRESSURES
SIDNEY INTERSTATE
TOWN FARM ROAD
I-95-6(15)117
Soils Engineering Lab U of M

SHEET NO. 11