STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0016

Janet T. Mills
GOVERNOR

Bruce A. Van Note
COMMISSIONER

August 16, 2023
Subject: Long Creek #2 & Red Brook Bridge Rehab
State WIN: 020535.00 &023601.00
Location: **South Portland**
Amendment No. 1

Dear Sir/Ms.:

Make the Following changes to the Bid documents:

CHANGE on page 15 "NOTICE TO CONTRACTORS", the bid opening date in the first paragraph from "August 16, 2023" to read "**August 23, 2023** ". Make this change in pen and ink.

The following questions have been received:

Question: With the complexity of the temporary structural support for the project it would be helpful if soils data was available for the immediate area of the existing structural plate pipe. Are there boring logs available or a geotechnical report for this project location that would aid in the development of the temporary structural support?

Response: Please see the added Geotech reports for the area.

Question: Upon initial site investigation it was determined that there is already a concrete invert lining in the bottom section of the existing structural plate pipe. Is it the intention of this contract to remove the existing concrete before casting the new liner, and if so under which item will this work be paid?

Response: The existing invert lining shall be removed prior to installation of the proposed invert lining. Payment for this work shall be considered incidental to item 502.325 Structural Concrete Invert Lining.

Consider these changes and information prior to submitting your bid on **August 23, 2023**.

Sincerely,

George M. A. Macdougall P.E.
Contracts & Specifications Engineer

Soils Report 67-09
Red Brook Culvert &
South Portland Ramps
I-295-3(13)
February 1967

Maine State Highway Commission

Soils Division

67-09

SUBSURFACE INVESTIGATION FOR THE PROPOSED CONSTRUCTION OF RED BROOK CULVERT, UTILITY BUILDING, AND RAMPS BETWEEN THE MAINE TURNPIKE AND WESTBROOK STREET IN THE TOWN OF SOUTH PORTLAND CUMBERLAND COUNTY

Project I-295-3(13)

February 1967

TABLE OF CONTENTS

INTRODUCTION

The proposed design of I-295 between the Maine Turnpike and a point north of Westbrook Street and for the U. S. 1 Connector between Westbrook Street and U. S. 1 and Scarboro has been awarded to the Consultants for Design; Howard, Needles, Tammen, and Bergendoff. The Consultants submitted preliminary construction plans and at structure sites boring plans. Field work for these explorations was undertaken by the Soils Division with a copy of the field notes being sent directly to the Consultants' Augusta and Boston offices. As the sections were completed, complete soils reports were prepared with 6 copies of the report being sent to the Augusta headquarters of the Maine State Highway Commission and 1 copy of the report being sent to the Consultants' Augusta and Boston offices.

Reports submitted to date include the following:

Westbrook Street Bridge

U. S. Rt. 1 over I-295 SBL

U. S. Rt. 1 SBL over Broadway

U. S. Rt. 1 NBL over Broadway

U. S. Rt. 1 over Maine Turnpike Spur

Ramp TPS over I-295

I-295 Main Line Maine Turnpike to Westbrook Street

U. S. Rt. 1 Connector Westbrook Street to Scarboro Town Line

This report summarizes the findings and all the remaining ramps which have not been reported on previously. These include:

Red Brook Box Culvert beneath Ramp TPS and I-295

Ramp TPS

Ramps TPS 1 through 4

Ramps BW-1 & BW-2

Broadway and Westbrook Excavation areas

Utility Building

INTRODUCTION

Red Brook Culvert

A subsurface investigation has been completed for the proposed construction of 2 box culverts and channel diversions of Red Brook in South Portland, Maine. The first structure crosses beneath Ramp TPS at Station 16+65 which is at Station 10+00 of the culvert alignment. A channel diversion is then proposed to the second culvert crossing beneath the main line of Interstate 295 at Station 107+00 which is on Station 12+56 of the culvert alignment. These culverts, as well as the ramp and main line, are part of an over-all design awarded to the Consultants; Howard, Needles, Tammen, and Bergendoff.

A plan sheet showing the locations of 6 proposed borings was forwarded from the Consultants to the Soils Division in July of 1966. These borings, consisting of 3 washborings and 3 auger borings, were completed in September of 1966. A revised plan for a proposed relocation of Red Brook was received in September requesting 3 borings at each culvert site. A boring crew, under the supervision of Clark Taylor, completed these 6 washborings in December. A copy of the field boring locations was forwarded to the Consultants' Augusta and Boston offices in December. In January, 1967 the proposed diversion channel was investigated under the direction of Mr. George Eaton's geology crew. This survey consisted of rod soundings along the diversion channel to disprove the ledge surface.

This report has been proposed to summarize the field and laboratory conditions as encountered at the requested locations of the Consultants. This report, therefore, completes the soils explorations relative to the 2 structures and diversion channels.

GENERAL CONDITIONS

As noted in the introduction, a revised plan has been made to relocate the Red Brook. In comparing the foundation data, it is apparent that the new location provides more of a foundation problem than that originally proposed. Ledge should be more extensive, and along the culvert beneath I-295 half of the footing will be on solid rock, while the other half will be on a slightly compressible gravelly sand. This provides a rigid against a semi-rigid foundation and will induce shearing and cracking in the box at the transition of the 2 materials.

In the remainder of the relocation, soft silts and buoyant sands should be anticipated as well as some ledge. These materials should not cause any major foundation problem although the soft and buoyant soils may be tricky to excavate while the ledge will be costly.

DETAILED CONDITIONS

Ramp TPS Box Culvert

The structure, a 10.5 x 16 box culvert, is located at Station 16+65 on Ramp TPS and between Stations 9+32 and 10+73 of the culvert and diversion channel alignment.

Washborings BB-1, BB-2, and BB-3 of Sheet 3 in the illustrations were taken for this structure. These borings indicated ledge excavation would be required to reach the proposed subgrade. The depth of ledge excavation appears to vary from 1.5 to 8 feet in depth as shown on the soils profile, Sheet 2 of the illustrations. The excavated overburden along the centerline of the proposed culvert is anticipated to consist of a stiff consistency brown clayey silt becoming sandy with depth. The excavated soil at either end of the culvert consists of 2 to 3 feet of brown sand.

Since the box culvert is anticipated to be on ledge, no problems are anticipated with the allowable bearing capacity. There appears to be less ledge excavation required along the old line.

I-95 Main Line Box Culvert

This structure, a 10.5 x 16 box culvert, is located at Station 107+00 on the Main Line of I-295 which is between Stations 11+84 and 13+26 of the culvert and diversion channel alignment. The invert elevation is 30.6 with the outlet being at elevation 29.9.

Washborings BB-4, BB-5, and BB-6, Sheet 3 of the illustrations, were taken for this structure. These borings indicated a bedrock subgrade along the left of centerline and out to Station 12+75 on the right of centerline as shown on Sheet 1 of the illustrations. Approximately 50 feet of remaining subgrade should consist of a gray silty gravelly sand. This granular soil extends approximately 13 feet below the subgrade at the outlet end of the culvert where the ledge surface was again encountered. The structural earth excavation should also consist of the granular soil mentioned above. The rigid ledge surface, along with the compressible gravel, poses a foundation problem. A major tension plane should develop over the ledge gravel line. The old alignment was better foundation-wise.

Channel Diversion

A channel diversion is proposed from near the culvert beneath the turnpike spur and continuing for approximately 1500 feet which includes the proposed box culverts. The longest section of channel diversion is proposed from the outlet of the box culvert beneath the main line of I-295 and continuing parallel approximately 100 feet left of the main line of I-295. This channel diversion is shown in plan on Sheet 8, and the profile is on Sheet 7 of the illustrations.

Washborings and rod soundings indicate ledge excavation should be anticipated between the proposed culverts which is approximately 100 feet in length. However, the ledge surface appears to decline rapidly from Station 12+70 indicating that ledge excavation is not anticipated beyond this station. A series of rod soundings were taken from Station 13+50 to Station 23+50 with all of these explorations penetrating below the assumed limits of excavation. The soils were found to consist of soft to medium consistency clays through much of this area. The rod sounding blow counts indicate softer soils beyond Station 18+50 as shown on the profile on Sheet 7. A shallow peat layer may be encountered on the surface overlying the clay soils. Also, a fill area consisting of junk cars was encountered for an approximate 100 foot section between Stations 20+00 and 21+00.

INTRODUCTION

Ramp TPS

A series of 11 washborings and 1 auger boring were utilized between Stations 16+00 and 24+00 to determine the soils profile. These washborings were the structure borings for Red Brook culvert and for the structures carrying Ramp TPS over the main line of I-295. Also, 4 additional washborings, AC-66, to 69 (Sheets 4 and 5) were obtained left and right of Stations 22+00 and 24+00 by Mr. Arden Carlisle's washboring crew. A soils profile is shown on Sheet 1 of the illustrations. Additional auger borings were obtained by Mr. George Eaton's geology crew during January of 1967.

DETAILED CONDITIONS

A maximum embankment height of 22 feet is proposed at Station 17+25. The subsoils consist mainly of a variable thickness sand layer underlain by a var-

iable 4 to 12 foot brown weathered silty clay layer. The clay layer is of stiff consistency characterized by shear strengths of 1 ton per sq.ft. or greater with natural water contents of 25 percent or less in most instances. At Station 24+00, washborings AC-66 and AC-67 indicate a 5 foot layer of medium consistency silty clay with shear strengths of 0.25 tons/sq.ft. and natural water contents of up to 45 percent. However, a maximum shear diagram, shown on Sheet 6, indicates this material to be of sufficient strength to support the proposed embankment even though a substantial embankment is proposed. Also, a layer of sand and very stiff clay overlies the softer clays which would tend to distribute the stresses, thus preventing a shear problem or major change in volume reduction due to the substantial fill proposed. The clay is underlain by a dense brown to gray sand and gravel. The ledge surface was found to be quite variable, with ledge being encountered at elevation 31, Station 19+50, and at elevation 20, Station 18+00.

A continued plan andprofile of Ramp TPS between Stations 24+00 and 39+00 is shown on Sheet 2 of the illustrations. Since shallower fills of 4 to 8 feet are proposed through this section, only shallow auger borings were obtained to check the depth of sand and for possible surficial organic deposits.

The geologist did not find organic deposits within the construction limits of the roadway. The subsoils through this section are anticipated to be similar to the soils east of Red Brook culvert with the overlying sand layer increasing in depth.

TPS RAMPS

TPS-1

Ramp TPS 1 connects Route 1 connector with the Turnpike Spur. A geology crew, under the direction of Mr. George Eaton, was sent to this area to obtain subsurface information for the ramps in January of 1967. This information

consists of several very shallow auger borings which prove that there is a 3 foot layer of sand throughout the area. Therefore, the subsurface woil conditions must be assumed from the information for U. S. Route 1 connector.

At Station 11+00 of this ramp the fill height is about 22 feet. Since this section of the ramp between Station 10+00 and Station 12+00 is very close to U. S. Route 1, the large toe fills recommended in the soils report for Route 1 should provide the necessary stability. However, between Station 12+00 and Station 14+00, the large toe fill recommended for U. S. Route 1 is needed, assuming the same soft clay layer exists. (A sketch showing this toefill design is included as Sheet 14). At Station 14+00, the fill height has dropped to a height of 14 feet, and the ramp fill embankment from here to where it connects with the Turnpike Spur should be stable as proposed.

TPS-2

Ramp TPS-2 connects U. S. Route 1 Connector with the Maine Turnpike Spur (see plan on Sheet 11). As seen on the profile on Sheet 12, the maximum fill height which occurs on this ramp is 10 feet, and no stability problems should occur. There is a 3 foot layer of sand below the very thin layer of humus.

TPS-3

Ramp TPS-3 is a long ramp which connects the Turnpike Spur and the northbound lane of Route 1 Connector. At Station 10+00 near the Turnpike Spur, the grade line is just above the ground line, and up to Station 20+00 the fill height remains very low. However, a +1.55 percent grade brings the embankment height to 15 feet at Station 27+00. At Station 30+00, the embankment height is 19 feet. Station 27+00 to Station 29+00 should be provided with toe berms to provide stability. Assuming soil stratification is similar to that beneath U. S. Route 1 Connector, the toe berm design recommended in that soils report should be used. In that report a shear analysis at Station 156+00 indicated that a 14 foot high embankment would be stable. For embankment heights larger

than 14 feet, a toe berm 100 feet long by 12 feet high was recommended. A sketch showing this toe berm is included as Sheet 14. Station 29+00 to Station 30+00 is adjacent to Route 1, and the toe berm for Route 1 will provide stability for this section of the ramp.

TPS-4

This ramp connects the southbound lane of U. S. Route 1 Connector with the Turnpike Spur (see plan on Sheet 11). The fill embankment is high at Station 10+00, but a -3.32 percent grade quickly brings the fill height down to 10 feet at Station 15+00. Station 10+00 to Station 11+50 is very near U. S. Route 1 Connector, and any stability problem will be taken care of by the toe berm recommended in the soils report for Route 1. The embankment height at Station 12+00 is 18 feet. A shear analysis at Station 172+00 of Route 1 Connector indicated an 18 foot embankment should not shear. (See soils report for U. S. Route 1 Connector, January 1967).

BW RAMPS

BW-1

This ramp connects Broadway with the northbound lane of U. S. Route 1 Connector. Station 10+00 to Station 17+00 is a fill section. The fill height at Station 11+00 is 17 feet, but has dropped on a -3.37 percent grade to 10 feet at Station 14+00. In a soils report covering U. S. Route 1 shear analysis at Station 154+00 indicated that an 18 foot embankment had a safety factor of 1.3. Assuming soils stratification does not vary radically, no stability problems are anticipated on this ramp.

Station 17+00 to Station 19+00 is a cut section. The depth of cut is shallow, and the material excavated will be mainly sand. However, at Station 19+00, the subgrade will be a gray clay silt which should be undercut 3 feet and replaced with granular material.

BW-2

Ramp BW-2 connects Broadway and the southbound lane of U. S. Route 1 Connector. Station 10+00 to Station 12+00 is a cut section. The cut is quite shallow, and the material within the cut is a brown sand.

Station 12+00 to Station 21+00 is a fill embankment. The grade is +3.2 percent followed by +2.0 percent and brings the fill height to 22 feet at Station 21+00. The fill height at Station 16+00 is only 13 feet. Therefore, the section of this ramp where the fill height is large enough to cause a stability problem is that section which runs parallel to U. S. Route 1 and should be taken care of by the toe berm recommended for U. S. Route 1 in the soils report submitted in January 1967.

BROADWAY CUT UNDER U.S. RTE. 1 CONNECTOR

A soils profile using the structure borings for the U. S. Route 1 Connector bridge is shown on Sheet 10 of the illustrations. The soils in this area consist of approximately 8 feet of medium density brown sand underlain by 19 feet of alternate layers of gray sand and silty clay. This clay soil is then underlain by 21 feet of medium consistency very sensitive gray silty clay.

A cut varying between 4 to 6 feet in depth is proposed through this area. This means that only 1 to 2 feet of brown sand should be encountered below the subgrade. The underlying sand and clay soil has a very poor bearing capacity which might cause a traffic problem due to pumping of the subgrade. Therefore, it is recommended that this area be undercut by a minimum of 3 feet and replaced with granular soils. Also, underdrain is recommended at least along one side of the roadway. By lowering the water table and providing an adequate base, this should eliminate the temporary traffic problem.

BROADWAY CUT AT THE INTERSECTION OF WESTBROOK STREET

A very shallow cut of less than 1 foot is proposed along centerline in this area. The underlying sand layer varies between 4 to 6 feet in depth. Below this material a layer of silty sand and clay silt soil was encountered. Therefore, since the proposed cut is shallow, the sand layer should be thick enough to provide adequate bearing capacity for the subgrade. However, underdrain may be needed through this section at least along one side of the roadway.

UTILITY BUILDING

A utility building is proposed about 80 feet left of the Maine Turnpike Spur centerline at about Station 29+00. Locations for 2 borings were submitted to our office on a plan in September, 1966. This boring plan is shown on Sheet 19 of the illustrations. Boring AC-61 was taken at boring location 1, and AC-62 was taken at boring location 2. The details for these 2 borings are shown on Sheets 15 and 16, respectively. A consolidation test was run on Boring AC-61, Sample 1U, and included as Sheet 17 of the illustrations.

The borings indicate the soil stratification below the proposed location of this building consists of a 6 foot layer of loose density reddish brown sand which is underlain by about 20 feet of medium to soft consistency gray silty clay with black spots and streaks. This clay is laminated and has a few sand lines near the bottom of the layer. Below the clay and overlying the ledge surface is approximately 16 feet of medium density gray sand and gravel. Ledge was cored at a depth of 43 feet.

Settlement analysis, assuming P = 2 tons/ sq.ft., was done at the center of the building. Using the stress curves on Sheet 18, a settlement of 0.3 feet was estimated. This settlement should occur quite rapidly with 50

percent occurring in approximately 4 months. Since the amount of settlement is relatively small and should occur quite rapidly, settlement should present no great problem.

Report Submitted by Earl Wilde and Gary Baker

Report Approved by

UTILITY BUILDING

RAMP TPS

CHANNEL RELOCATION

EXISTING TWIN 8'-8' BOX CULVERTS

RAMP BW

Red Brook

BROADWAY

Clark Pond

US RTE. 1 CONN. SB

US RTE. 1 CONN. NB

Cut area

Cut area

D.I.

D.I.

RAMP BW1

RAMP BW2

RAMP TPS-1

RAMP TPS-2

RAMP TPS-3

RAMP TPS-4

DITCH

DITCH

TURNPIKE SPUR

WEST BROOK

SOUTH PORTLAND
SCARBORO

END PROJECT U-01-1(12)

NOTE:

AIRPHOTOS USED:
HCAI-21-8 TO 21-11
HCAI-22-10 TO 22-12
HCAI-23-12 TO 23-14
FLOWN 4-30-65 AT 1"=500'

B. P. R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		1	

TURNPIKE SPUR

RAMP T.P.S.

Red Brook

I-295 MAINLINE

BROOK

BB-7 BB-8 BB-9 BB-10 BB-11 BB-12 AC-66 AC-67 AC-68 AC-69

BB-7 & BB-8

BB-9 & BB-10

BB-11 & BB-12

AC-68 & AC-69

AC-66 & AC-67

TOPSOIL

LOOSE BROWN SAND

STIFF CONSISTENCY BROWN SILTY CLAY

DENSE BROWN SAND & GRAVEL

(GRAY CLAYEY SILT)

BROWN CLAYEY SILT

ROCKY SANDY SILTY TOPSOIL

MEDIUM DENSITY GRAY GRAVELLY SILTY SAND

MEDIUM DENSITY GRAY GRAVELLY SILTY SAND

RAMP TPS

PLATE 1—PLAN & PROFILE O. P. R. & B. E. STANDARD
281 C1 IMPERIAL CLOTH, PRINTED IN U.S.A.
EUGENE DIETZGEN CO., CHICAGO

B. P. R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		2	

I-295 MAINLINE

TURNPIKE SPUR

RAMP TPS

AC-66

AC-67

Dense fine gray sand
Med dk brn sand
Stiff olive brn weathered clay

Med gray fine sand
Loose dk - brn silty sand E-282
Dense brown coarse grain sand
Stiff olive brn gray weathered clay
Medium gray clay
Med dark gray clay w/sea shells
E-283

Dense fine gray sand
Loose dk brn sand
Dense reddish brn sand
Dense lt brn saturated sand

Dense fine gray sand
Loose dark brown rocky sand
as E-282
Med brn med to coarse grained sand
?
Med stiff dark gray clay

LAYERS of fine gray sand and medium uniform rel brn sand
Med coffee colored sand E-284
Med brn saturated sand
Med brn clay stiff
Med soft gray clay

Layers of dense fine gray sand and med brn sand

Humus
Dense fine gray sand
Medium brown sand

RAMP TPS

PLATE 1--PLAN & PROFILE O. P. R. & R. E. STANDARD
261 C1 IMPERIAL CLOTH, PRINTED IN U.S.A.

BORING NOTES

All samples and vanes are made ahead of casing

Water elevation

Number of blows required to drive extra heavy casing one foot with 400 ft. lbs. of energy per blow

Location of sample or sample attempt

Number and type of dry sample

1D S & H Sampler # 1290's

1C 2" O.D. 16 ga. seamless tubing

1U 3½" O.D 16 ga. seamless tubing

1W Wash sample and number

MD Unsuccessful sample attempt and type of sampler

Number of blows required to drive spoon or tubing one foot with 350 ft. lbs. of energy per blow

H Sampling spoon or seamless tubing driven by static weight of drill rods and hammer

P Piston sampler

Field vane test

Bottom of boring (may not be bottom of soil strata)

Refusal of drill rods or casing (may not be ledge)

71% Locations cored by diamond bit and per cent recovery of rock

SHEAR NOTES

● Field vane shear strengths

X Laboratory vane shear strengths

→ Shear strengths in excess of capacity of equipment

o One half unconfined compressive strengths

WATER CONTENT NOTES

o Natural water contents, given as per cent of dry weight

⊗---X Plastic and liquid limits

Ignition losses are given as per cent of dry weight

SML-201(9-62)

BORING AC-66 STATION 24+00 22'LT RAMP T.P.S.

CASING SIZE	DRIVING RESISTANCE Blows/Ft.	VANE SHEAR STRENGTH Tons/Sq.Ft.	WATER CONTENT Percent
4"	20 40	0.4 0.8	20 40

ELEV.

1U — BROWN TOPSOIL

BROWN SAND

MEDIUM CONSISTENCY BROWN WEATHERED SILTY CLAY WITH SANDY AREAS & LINES

2U — H

3U — H — STIFF CONSISTENCY GRAY CLAYEY SILT WITH PEBBLY SAND AREAS

1D — LOOSE DENSITY GRAV SILTY SAND & GRAVEL

>WASHED AHEAD

ELEVATION

BORING AC-67 STATION 24+00 20'RT. RAMP T.P.S.

CASING SIZE 4"

ELEV.

BROWN TOPSOIL

74

BROWN SAND

75

MEDIUM CONSISTENCY BROWN 98
WEATHERED SILTY CLAY 90
WITH SANDY AREAS & LINES

1U

67

2U

LOOSE DENSITY GRAY SILTY SAND & GRAVEL

>WASHED AHEAD

MAINE STATE HIGHWAY COMMISSION
SOILS LABORATORY

DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA
BORINGS AC-66 & AC-67

SOUTH PORTLAND
RAMP TPS

DATE: DECEMBER 1966

SHEET NO. 4

SML-201(9-62)

BORING AC-68 STATION 22+00 20' RT.

CASING SIZE	DRIVING RESISTANCE Blows/Ft.	VANE SHEAR STRENGTH Tons/Sq.Ft.	WATER CONTENT Percent
4"	20 40	0.4 0.8	20 40

ELEV.

1U

DARK BROWN TOPSOIL

BROWN SAND

STIFF CONSISTENCY BROWN WEATHERED SILTY CLAY WITH SAND LINES AND LAYERS

2U

MEDIUM DENSITY GRAY SILTY SAND AND GRAVEL

WASHED AHEAD

BORING AC-69 STATION 22+00 20' LT.

CASING SIZE 4"

ELEV.

BROWN MUCKY TOPSOIL

BROWN SAND

BROWN CLAYEY SILTY SAND — 98, 88

1U

90

BROWN SILTY GRAVEL — 88, 112, 140

ELEVATION

MAINE STATE HIGHWAY COMMISSION
SOILS LABORATORY

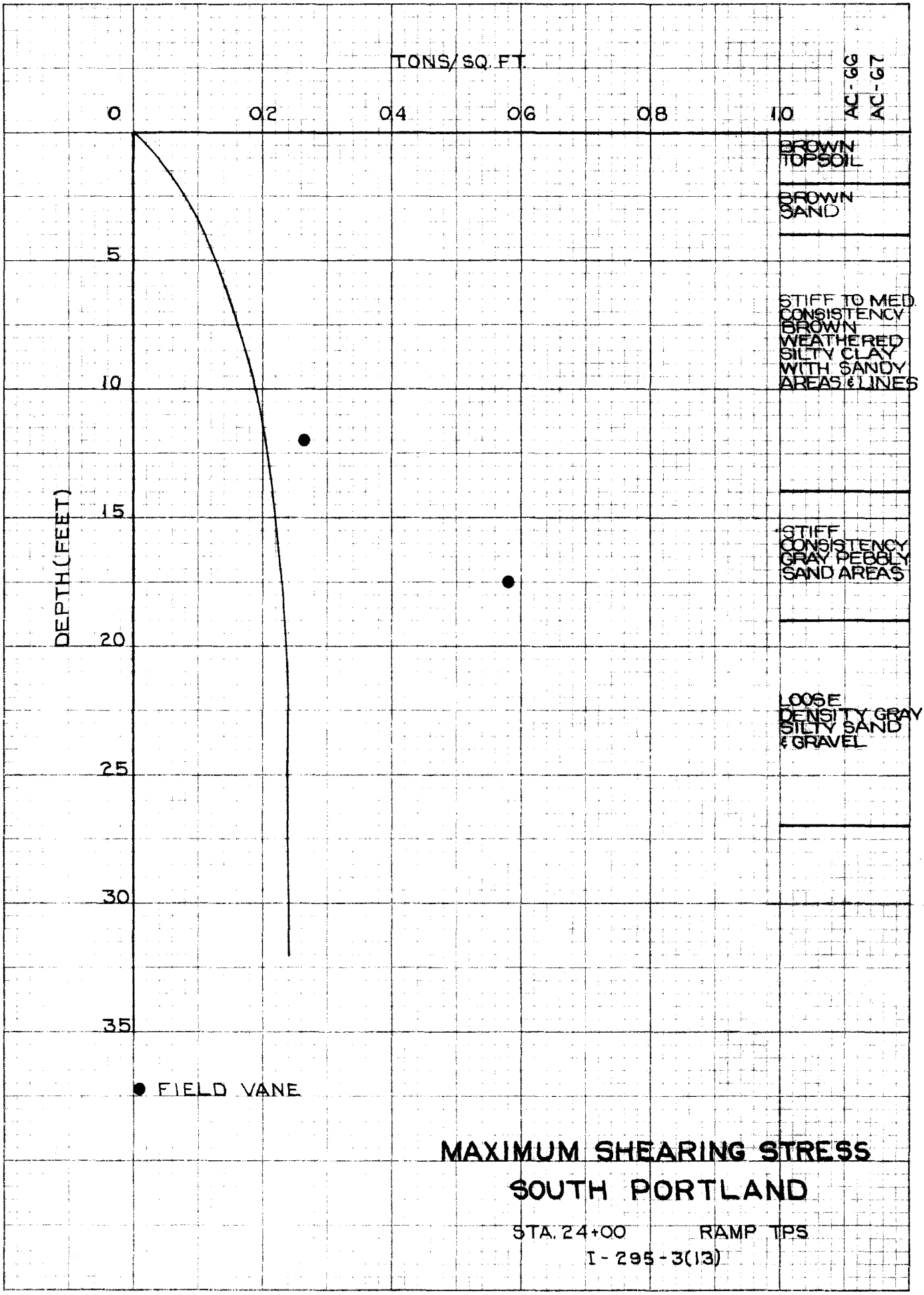
DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA

BORINGS AC-68 & AC-69

SOUTH PORTLAND
RAMP TPS

DATE: DECEMBER 1966

SHEET NO. 5

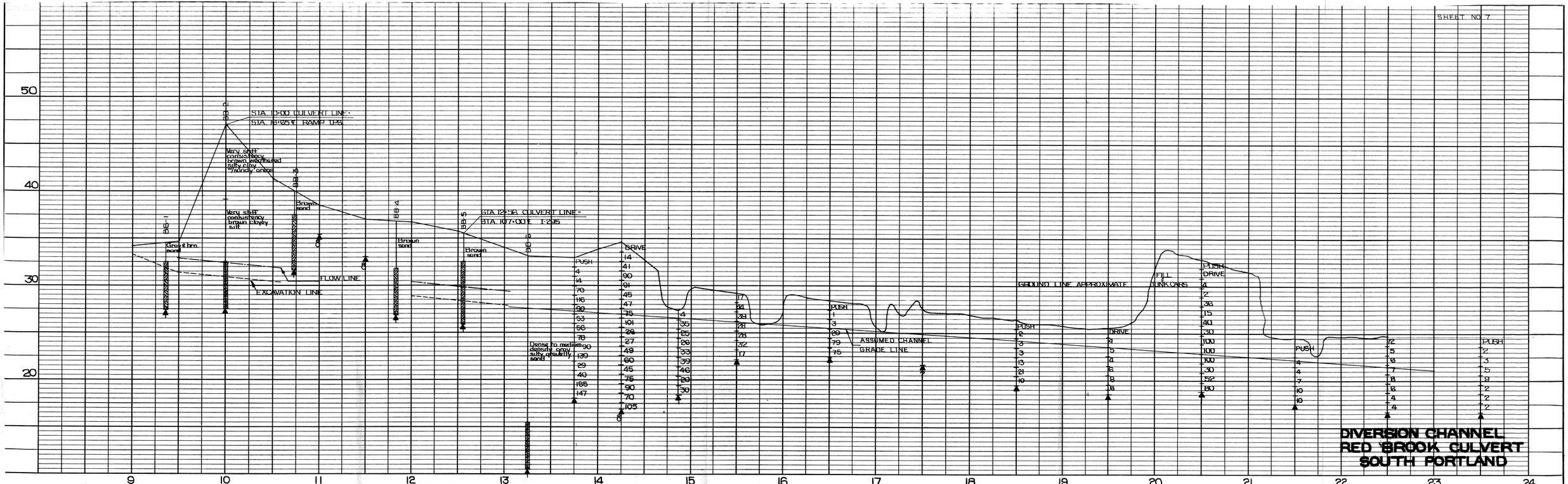


MAXIMUM SHEARING STRESS

SOUTH PORTLAND

STA. 24+00 RAMP TPS

I-295-3(13)



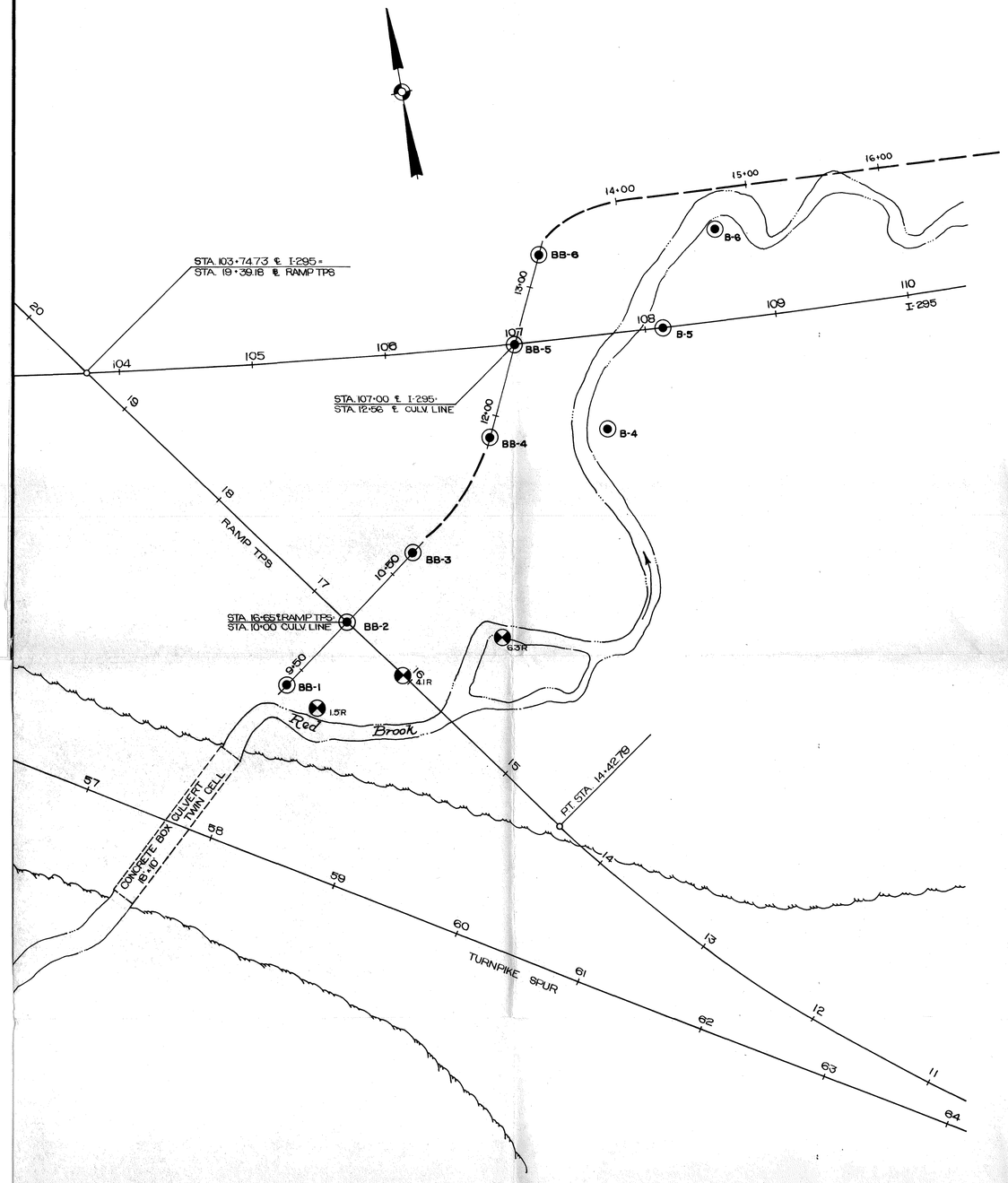
DIVERSION CHANNEL
RED BROOK CULVERT
SOUTH PORTLAND

PLATE 1—PLAN & PROFILE C. P. R. & R. E. STANDARD
261 C1 IMPERIAL CLOTH. PRINTED IN U.S.A.
EUGENE DIETZGEN CO., CHICAGO

B. P. R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		8	

TRANSVERSE SECTIONS

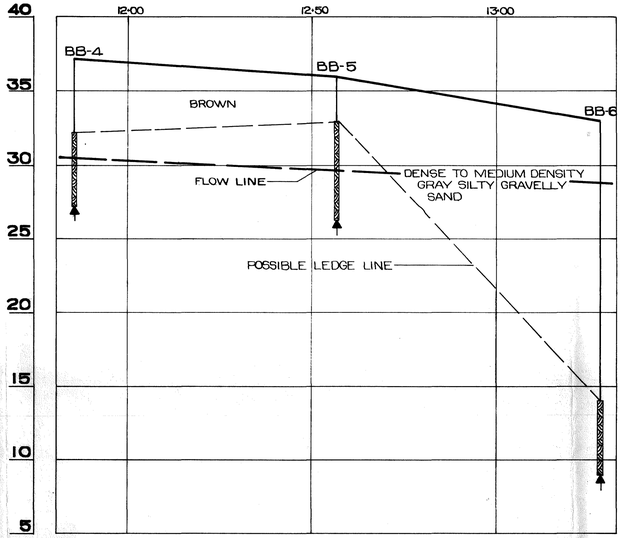
SCALE: 1" = 20' HORIZ.
1" = 5' VERT.



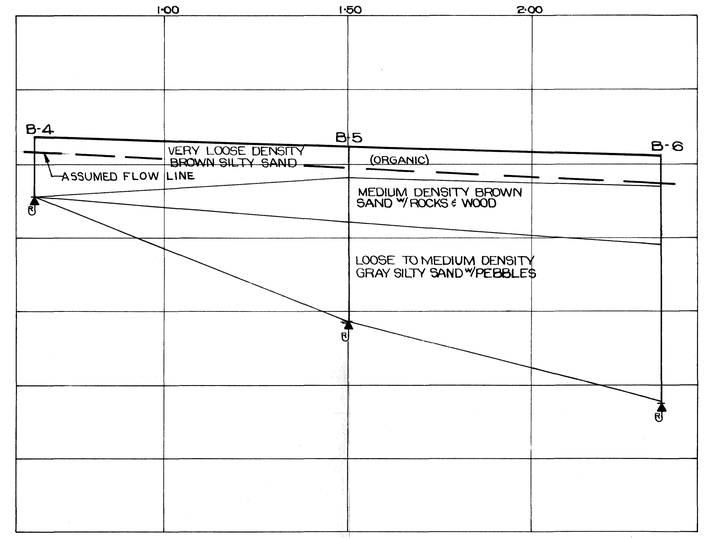
PLAN
SCALE: 1" = 50'

RED BROOK UNDER I-295

RELOCATED LINE

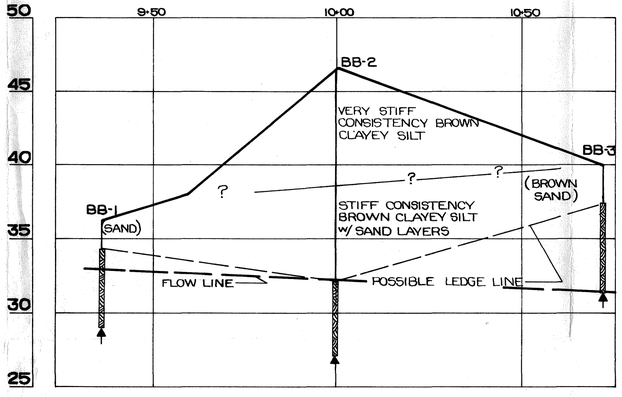


OLD LINE

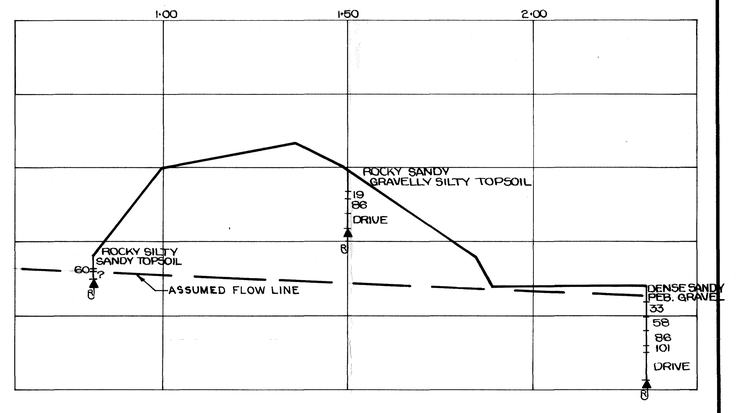


RED BROOK UNDER RAMP TPS

RELOCATED LINE



OLD LINE



DESIGN—
TRACE—
CHECK—

BRIDGE NO.
SURVEY—
PLOT—

STATE HIGHWAY COMMISSION
BRIDGE DIVISION

RED BROOK
UNDER
I-295 & RAMP TPS
IN THE TOWN OF
SOUTH PORTLAND
CUMBERLAND COUNTY

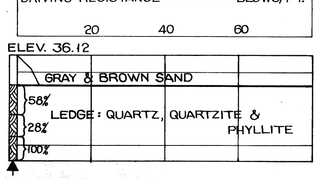
FOUNDATION SURVEY

SHEET OF AUGUSTA, MAINE

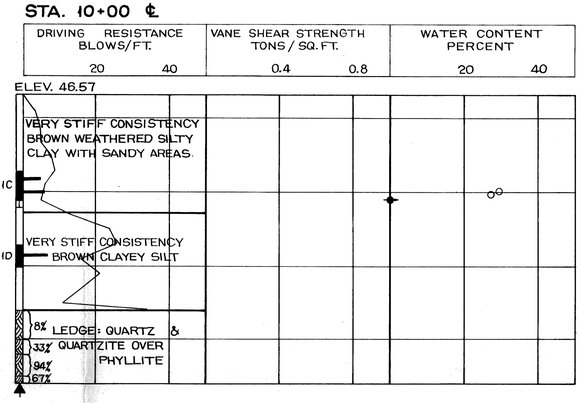
B. P. R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		9	

50
45
40
35
30
25
20
15

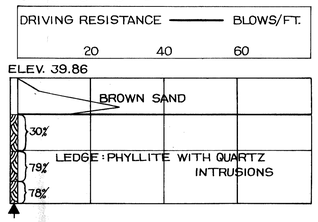
BB-1
STA. 9+35 ℄



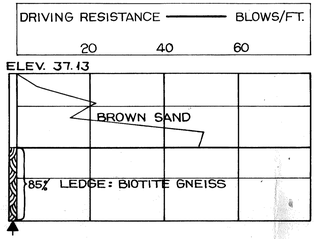
BB-2
STA. 10+00 ℄



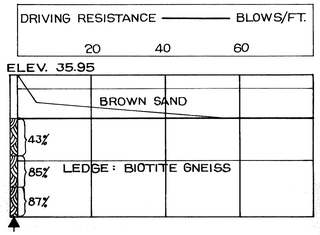
BB-3
STA. 10+73 ℄



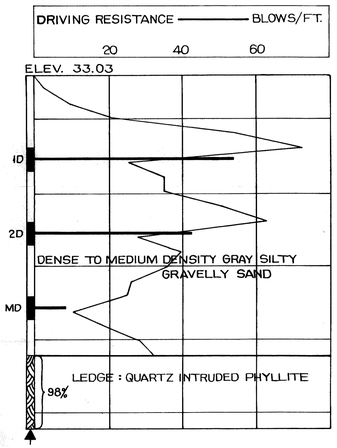
BB-4
STA. 11+84 ℄



BB-5
STA. 12+56 ℄

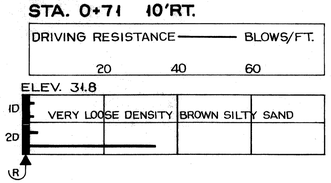


BB-6
STA. 13+26 ℄

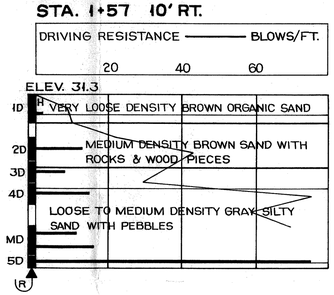


35
30
25
20
15

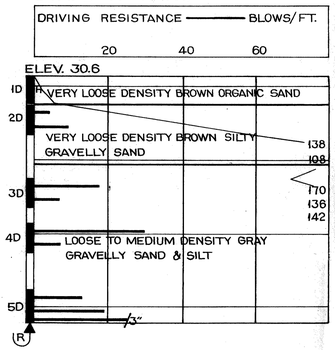
B-4
STA. 0+71 10'RT.



B-5
STA. 1+57 10' RT.



B-6
STA. 2+41 10'RT.



BORING NOTES

- ALL SAMPLES AND VANES ARE MADE AHEAD OF CASING
- NUMBER OF BLOWS REQUIRED TO DRIVE EXTRA HEAVY CASING ONE FOOT WITH 400 FT. LBS. OF ENERGY PER BLOW
- LOCATION OF SAMPLE OR SAMPLE ATTEMPT
- NUMBER AND TYPE OF DRY SAMPLE
  - 1D S & H SAMPLER @ 1290's
  - 1C 2" O.D. 16 GA. SEAMLESS TUBING
  - MD UNSUCCESSFUL SAMPLE ATTEMPT AND TYPE OF SAMPLER
- NUMBER OF BLOWS REQUIRED TO DRIVE SPOON OR TUBING ONE FOOT WITH 350 FT. LBS. OF ENERGY PER BLOW
- SAMPLING SPOON OR SEAMLESS TUBING DRIVEN BY STATIC WEIGHT OF DRILL RODS AND HAMMER
- FIELD VANE TEST
- BOTTOM OF BORING (MAY NOT BE BOTTOM OF SOIL STRATA)
- REFUSAL OF DRILL RODS OR CASING (MAY NOT BE LEDGE)
- R) 71% LOCATIONS CORED BY DIAMOND BIT AND PER CENT RECOVERY OF ROCK

SHEAR NOTES

- o FIELD VANE SHEAR STRENGTHS
- → SHEAR STRENGTHS IN EXCESS OF CAPACITY OF EQUIPMENT

WATER CONTENT NOTES

- o NATURAL WATER CONTENTS, GIVEN AS PER CENT OF DRY WEIGHT

DESIGN– TRACE– CHECK–	BRIDGE NO. SURVEY– PLOT–

STATE HIGHWAY COMMISSION
BRIDGE DIVISION

RED BROOK
UNDER
I-295 & RAMP TPS
IN THE TOWN OF
SOUTH PORTLAND
CUMBERLAND COUNTY
FOUNDATION SURVEY

SHEET OF AUGUSTA, MAINE

Pm called
2-24-69
on Broadway

6" Bit
6" Crush
24" Sand
undercut 3 feet more

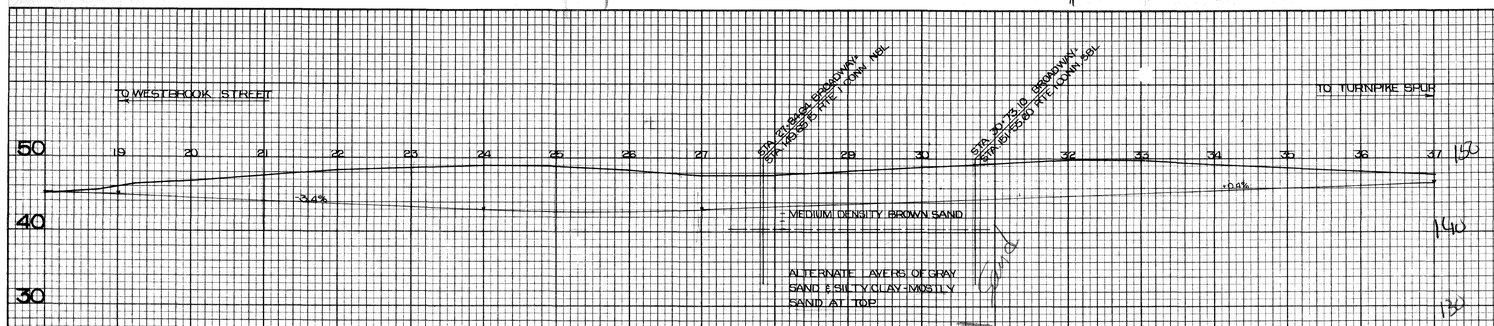
3' Section

72' wide

Center Iron 3½' below S.O.

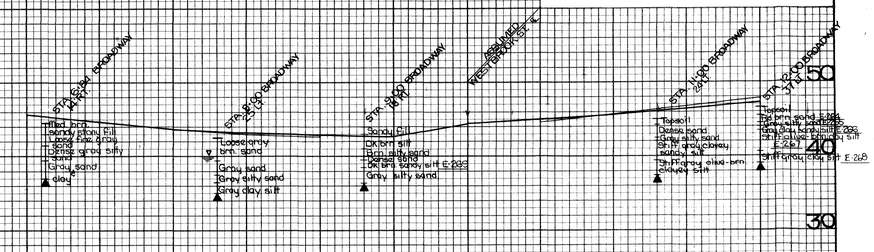
142.8
139.8

B. P. R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		10	



BROADWAY CUT UNDER U.S. RTE. 1 CONN.

SCALE: 1"=100' HORIZ.
1"=10' VERT.

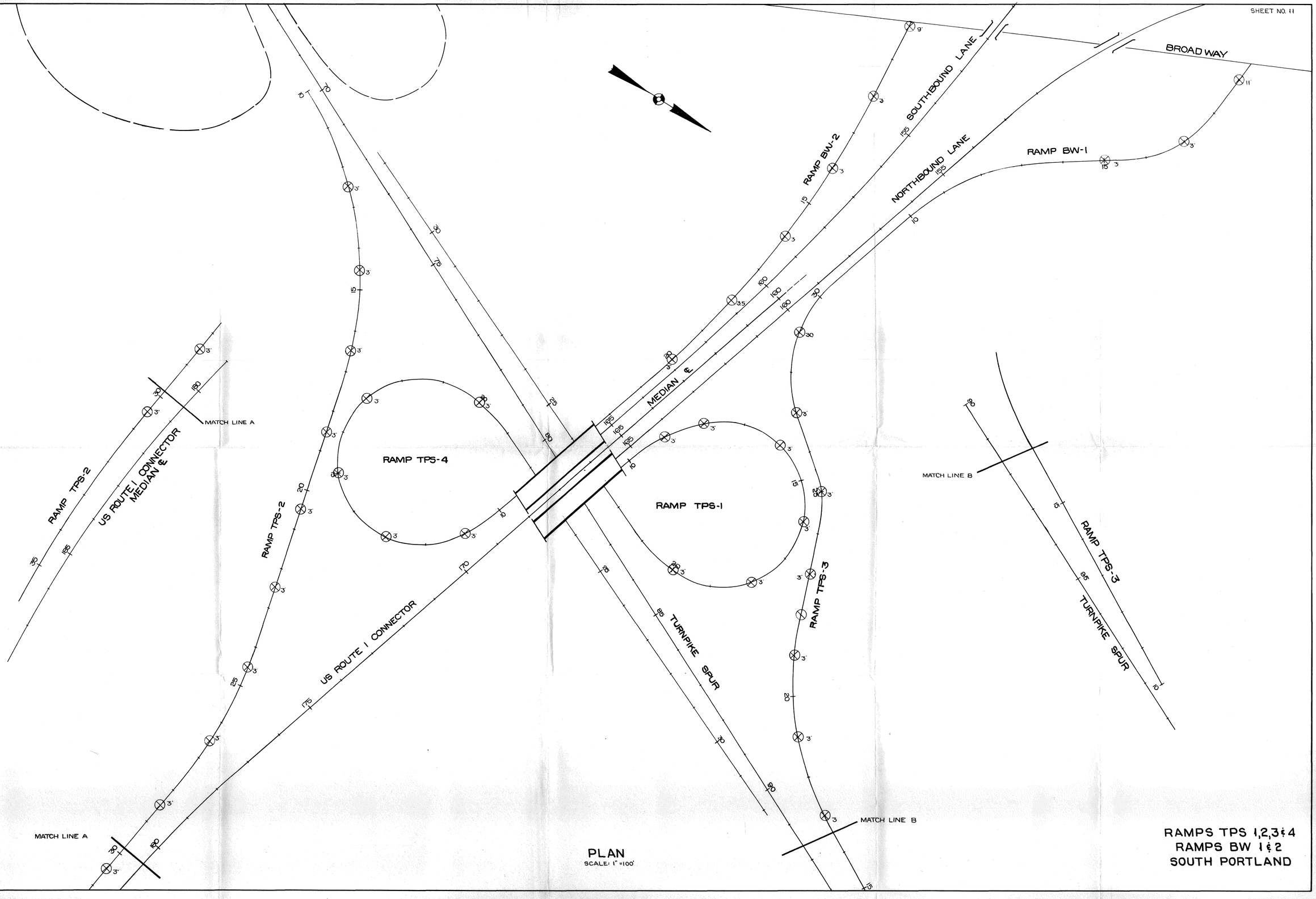


3'00 2'00 1'00 0+00 1+00 2+00

BROADWAY CUT AT WESTBROOK ST. INTERSECTION

SCALE: 1"=50' HORIZ.
1"=10' VERT.

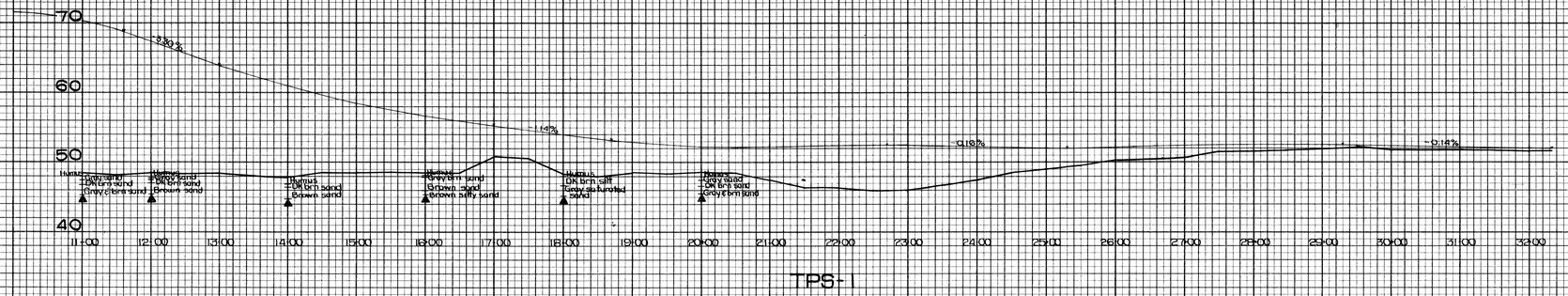
BROADWAY CUT PROFILES



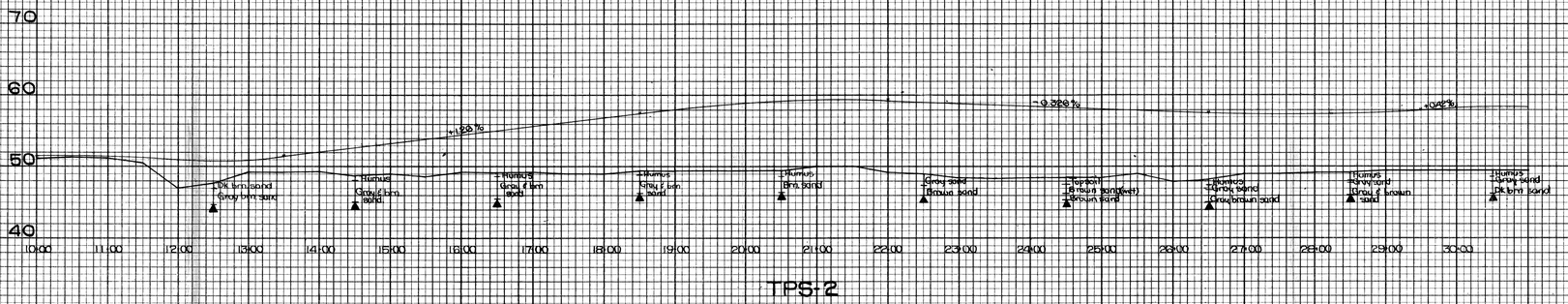
PLAN
SCALE: 1" =100'

RAMPS TPS 1,2,3 & 4
RAMPS BW 1 & 2
SOUTH PORTLAND

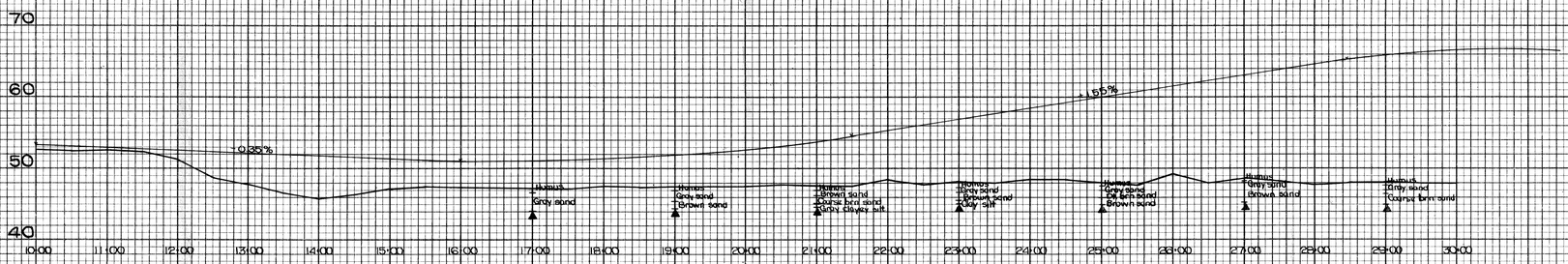
B. P. R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		12	



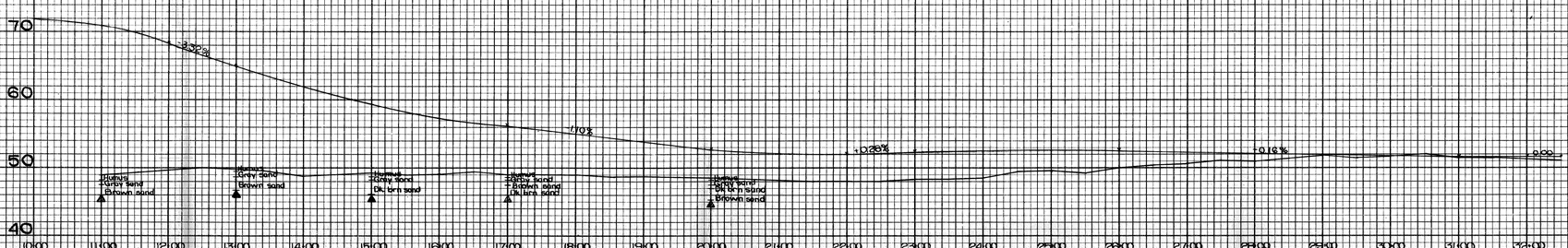
TPS-1



TPS-2



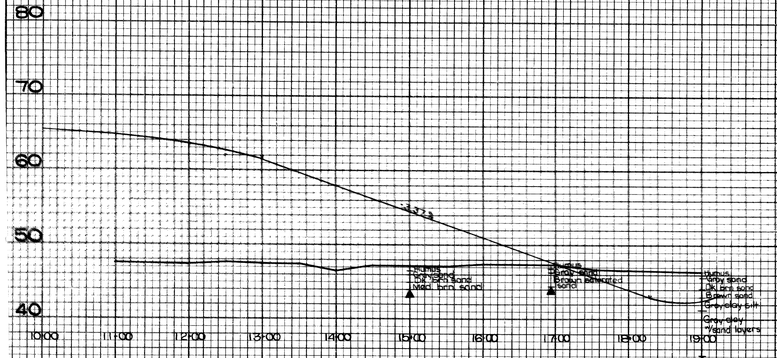
TPS-3



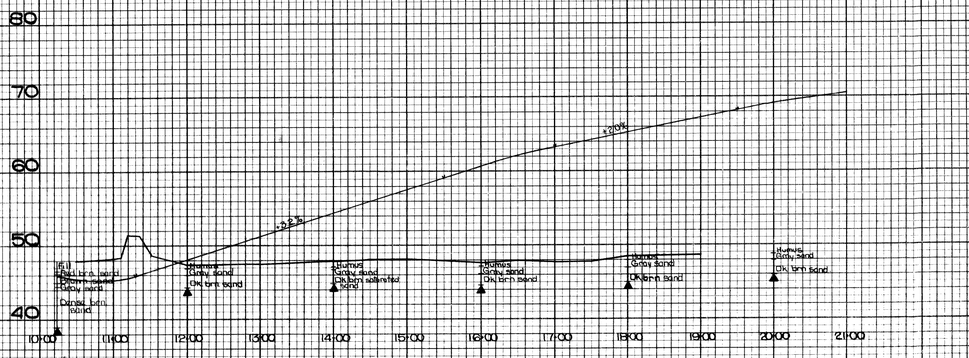
TPS-4

RAMPS TPS 1-4
SOUTH PORTLAND

Printed in U.S.A.
On IMPERIAL Tracing Cloth



BW-1



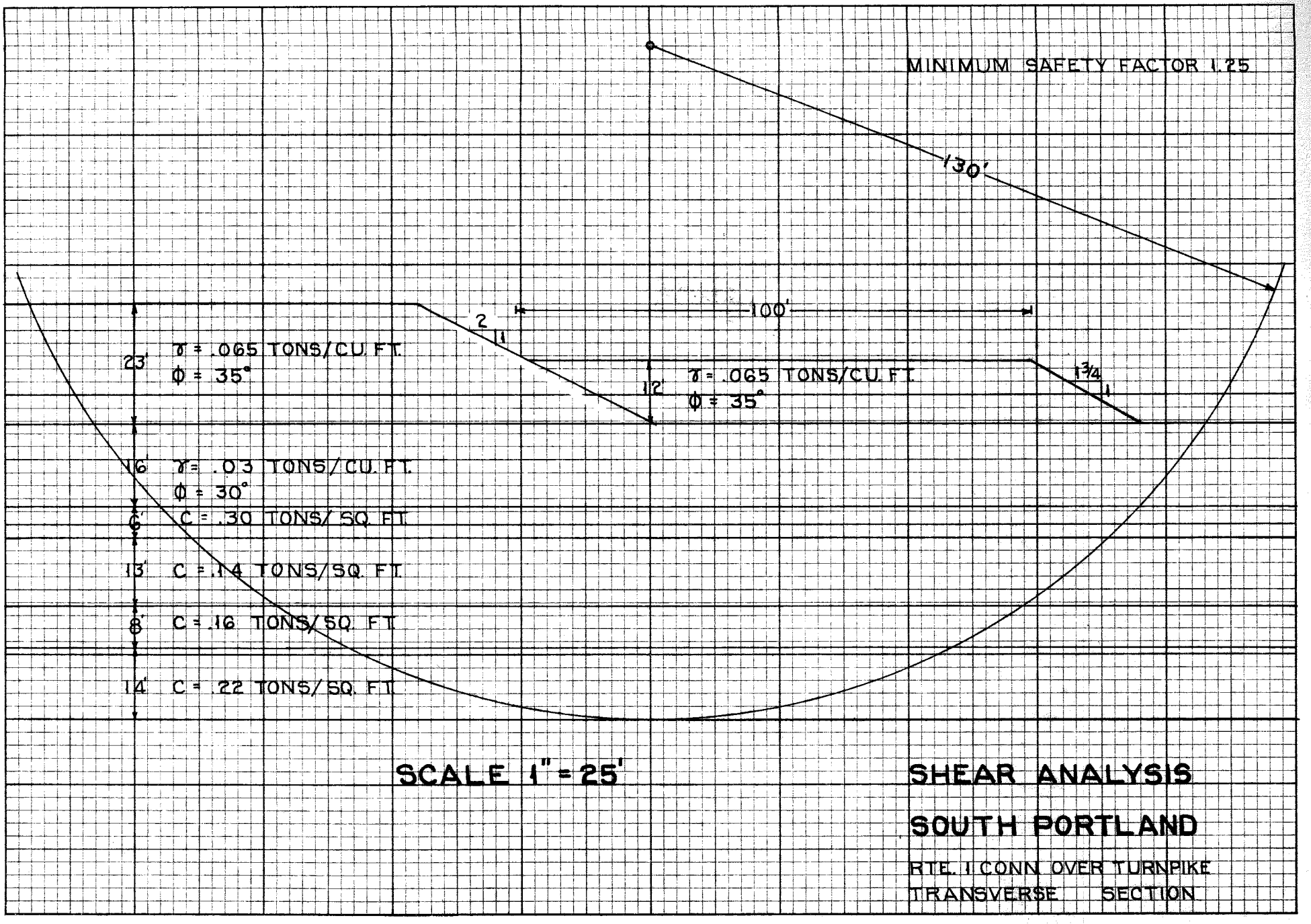
BW-2

RAMPS BW 1 & 2
SOUTH PORTLAND

Printed in U.S.A.
On IMPERIAL Tracing Cloth

PLATE 3 CROSS SECTION B P R STANDARD
EUGENE DIETZGEN CO., CHICAGO - NEW YORK

Printed in U.S.A.
On IMPERIAL Tracing Cloth



SCALE 1" = 25'

SHEAR ANALYSIS

SOUTH PORTLAND

RTE. 1 CONN. OVER TURNPIKE
TRANSVERSE SECTION

SHEET NO. 14

BORING AC-61 STATION 28+80 105' LT.

CASING SIZE 4"	DRIVING RESISTANCE Blows/Ft. 20 40	VANE SHEAR STRENGTH Tons/Sq.Ft. 0.4 0.8	WATER CONTENT Percent 20 40

ELEV. 55.0

ELEVATION

50 — 1D — LOOSE DENSITY REDDISH BROWN SAND

45 — 1U — H

40 — 2U — H — STIFF TO SOFT CONSISTENCY SENSITIVE GRAY SILTY CLAY WITH BLACK SPOTS, STREAKS & BANDS. LAMINATED AND A FEW SAND LINES & AREAS NEAR BOTTOM

35 — 3U — H

30 — 4U — H

25 — MU — MEDIUM DENSITY LAYERED GRAY SAND & GRAVEL

20 — MD

15 — MD — 69, 155, 248

12.0 — 29%, 95%, 100% — LEDGE: PHYLLITE WITH HIGH ANGLE FOLIATION

7.0

MAINE STATE HIGHWAY COMMISSION
SOILS LABORATORY

DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA

BORING AC-61

UTILITY BUILDING
SOUTH PORTLAND

DATE: 11-8-66

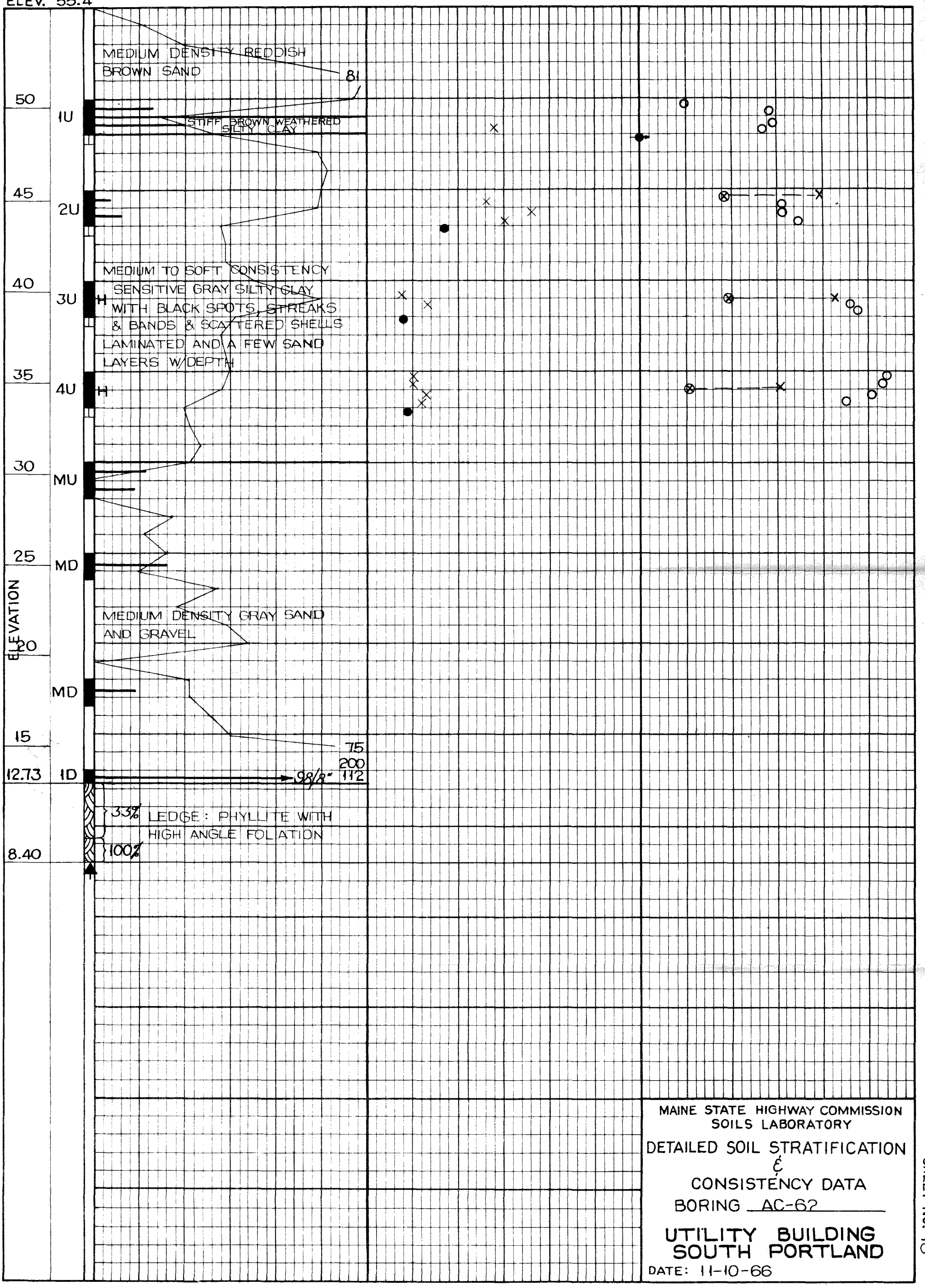
SHEET NO. 15

SML-201(9-62)

BORING AC-62 STATION 29+00 81'LT.

CASING SIZE 4"	DRIVING RESISTANCE Blows/Ft. 20 40	VANE SHEAR STRENGTH Tons/Sq.Ft. 0.4 0.8	WATER CONTENT Percent 20 40

ELEV. 55.4



MAINE STATE HIGHWAY COMMISSION
SOILS LABORATORY

DETAILED SOIL STRATIFICATION
&
CONSISTENCY DATA

BORING AC-62

UTILITY BUILDING
SOUTH PORTLAND

DATE: 11-10-66

SHEET NO. 16

K+E SEMI-LOGARITHMIC 359-81LG
KEUFFEL & ESSER CO. MADE IN U.S.A.
4 CYCLES X 150 DIVISIONS

ELAPSED TIME IN MINUTES

DIAL READING IN INCHES

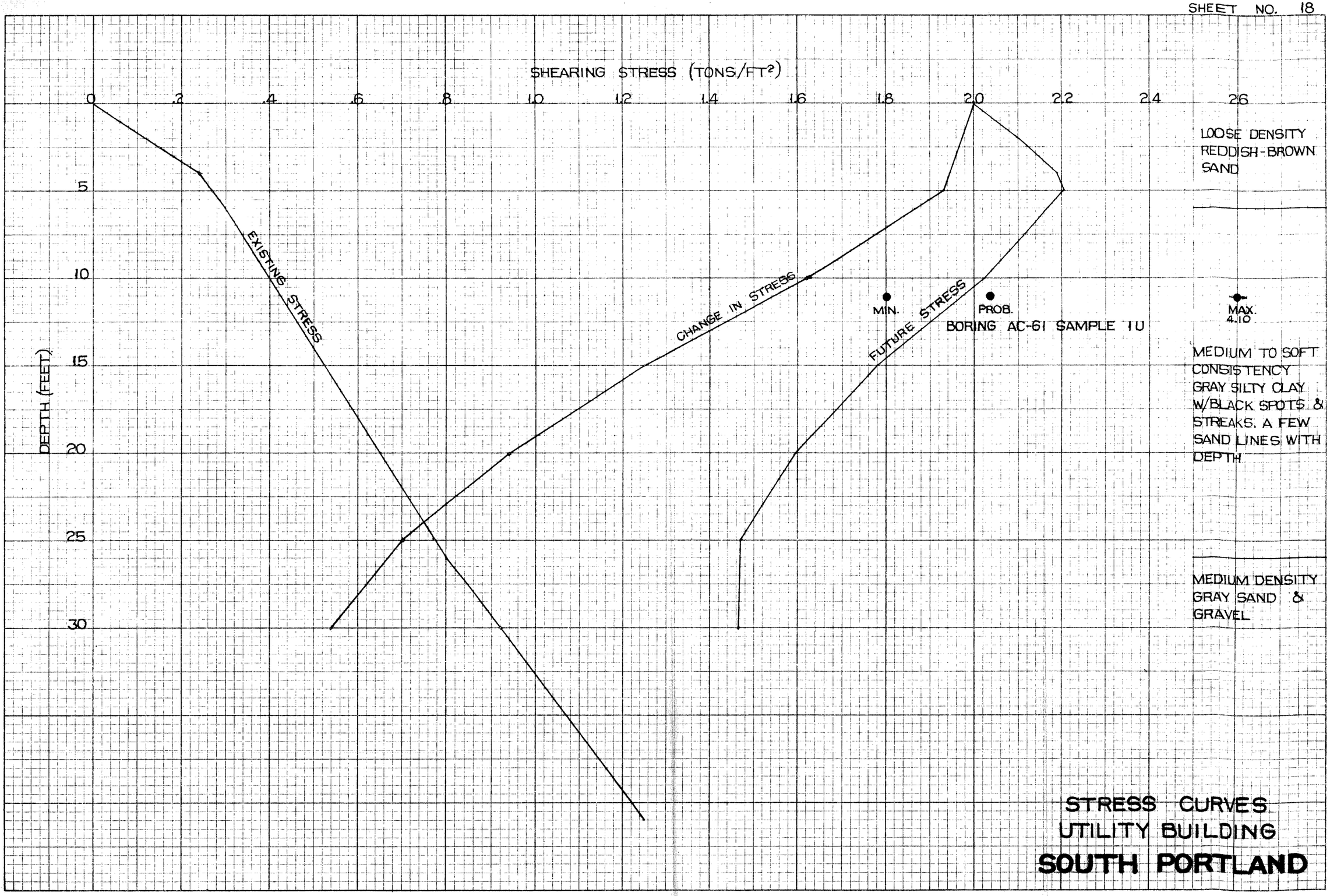
VOID RATIO (e)

PRESSURE (TONS/SQ.FT.)

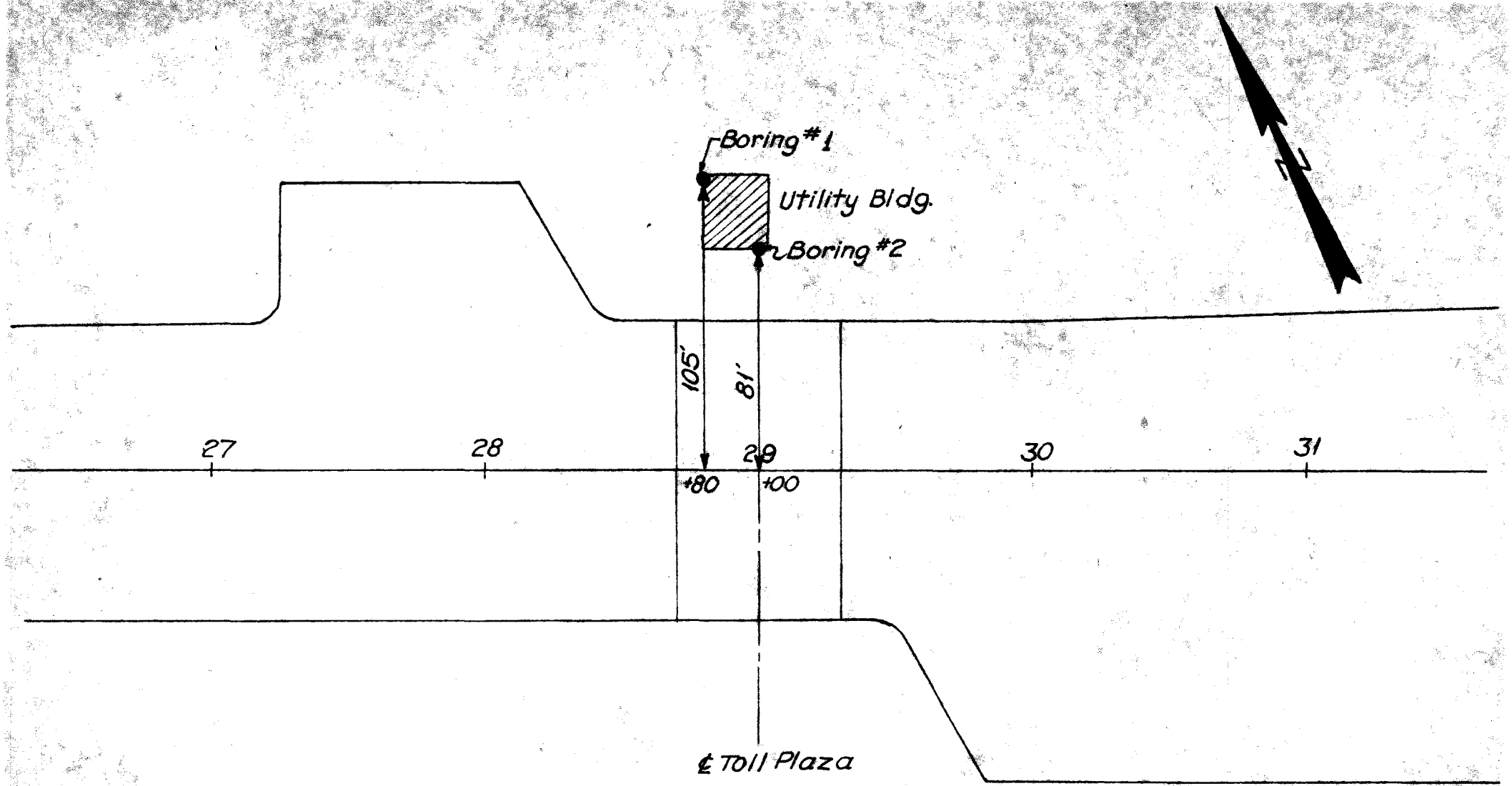
0.0764 TONS/SQ.FT.
0.1731 TONS/SQ.FT.
0.3462 TONS/SQ.FT.
0.6925 TONS/SQ.FT.
1.385 TONS/SQ.FT.
2.77 TONS/SQ.FT.
5.54 TONS/SQ.FT.
8.31 TONS/SQ.FT.
12.465 TONS/SQ.FT.

MAINE STATE HIGHWAY COMMISSION
TIME - CONSOLIDATION - CURVES
PRESSURE - VOID RATIO DIAGRAM
PORTLAND
BORING AC- 61-66 SAMPLE 10
DECEMBER, 1966 LC- 121
SOILS ENGINEERING LAB

SHEET NO. 17



STRESS CURVES
UTILITY BUILDING
SOUTH PORTLAND



UTILITY BLDG. BORINGS
SOUTH PORTLAND TOLL PLAZA

SHEET NO. 19

70-05

Soils Report
I-295 Over Red Brook (Station 88+00)
South Portland - Cumberland County
Project I-295-3 (~~13~~)(44)
February 1970

MAINE STATE HIGHWAY COMMISSION

MATERIALS & RESEARCH DIVISION

Subsurface Investigation for the Proposed Construction of a Box Culvert to Carry Red Brook Beneath I-295 In South Portland Cumberland County

Advertised 10/28/70

open 11/18/70

Project I-295-3 (13)

February 1970

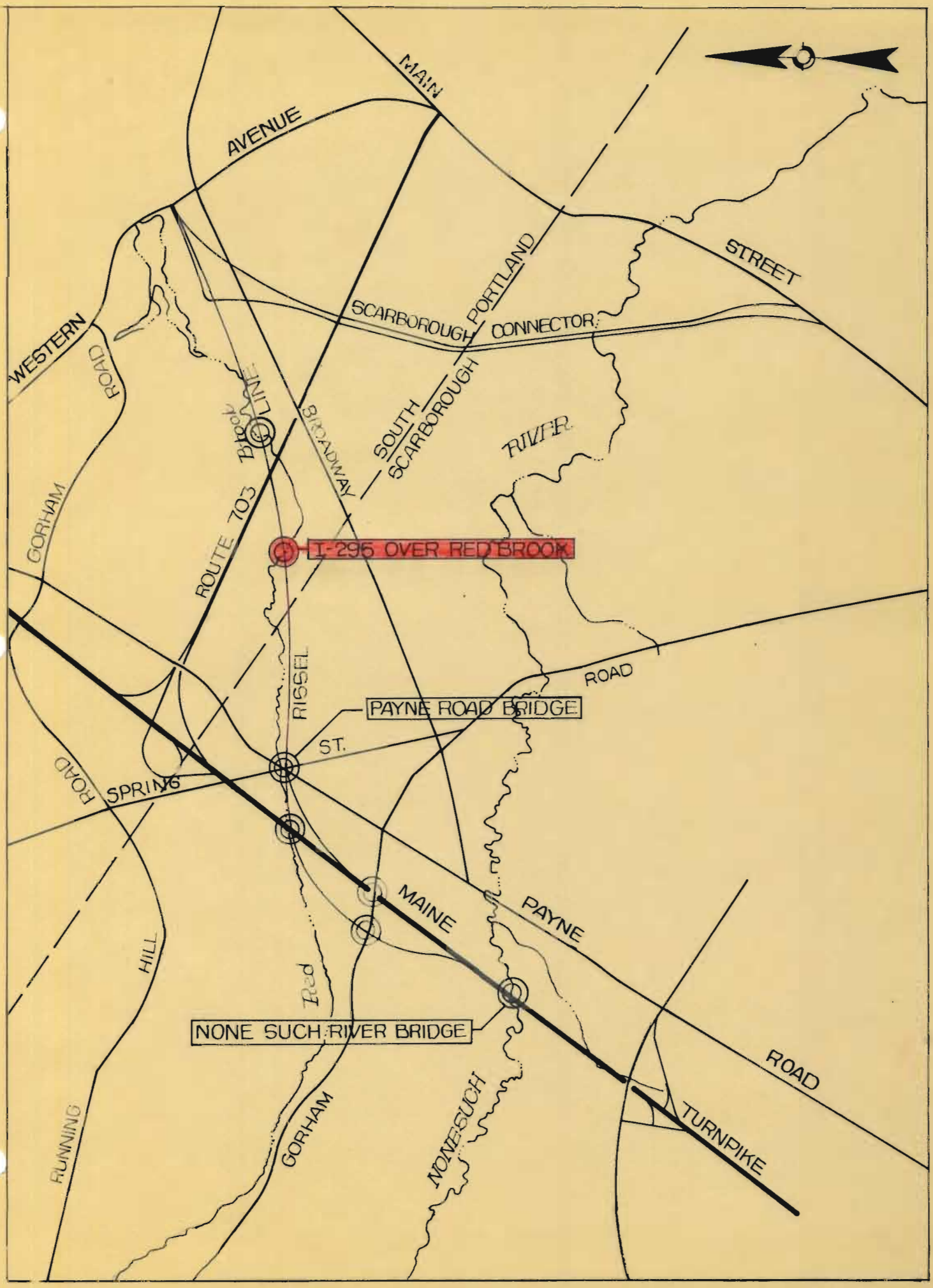

MAIN
AVENUE
STREET
PORTLAND
SCARBOROUGH CONNECTOR
WESTERN
ROAD
BLOCK LINE
BROADWAY
SOUTH
SCARBOROUGH
RIVER
GORHAM
ROUTE 703
I-295 OVER RED BROOK
RISSEL
ROAD
PAYNE ROAD BRIDGE
ST.
SPRING
ROAD
MAINE
PAYNE
HILL
Red
NONE SUCH RIVER BRIDGE
ROAD
RUNNING
GORHAM
NONESUCH
TURNPIKE

TABLE OF CONTENTS

INTRODUCTION

It is proposed to provide a box culvert to carry the flow of Red Brook beneath the so-called Rissel Line in the vicinity of station 87+80. The centerline of the proposed culvert is nearly perpendicular to the centerline of I-295.

Two washborings were made on the centerline of the proposed culvert at locations designated by the consulting firm of Howard, Needles, Tammen and Bergendoff. These borings were completed during May 1969 by a MSHC boring crew under the supervision of Mr. C. A. Taylor.

A foundation survey sheet has been prepared by the Soils Section showing a plan of the area with borings located, a profile along the culvert centerline showing the underlying soils stratification, and boring details showing the stratification at individual borings as well as some of the index properties of the various soil strata encountered. A copy of this foundation survey sheet is included in the illustrations at the back of this report. Copies of the washboring logs were provided for the use of the consulting firm of Howard, Needles, Tammen and Bergendoff in the summer of 1969. Copies of this soils report will also be forwarded to them along with the original of the foundation survey sheet.

GENERAL CONDITIONS

Red Brook is a meandering waterway which generally parallels the proposed alignment of Interstate 295 lying north of it until it crosses the proposed centerline at station 87+80. A total of four box culverts are necessary to carry this brook beneath the mainline and ramps.

At the proposed culvert location discussed in this report (station 87+80) Red Brook lies at the bottom of a wide gully and the underlying soil stratification consists of a thick layer of loose brown sand and gravel underlain by a transition zone of sand and clay layers which is in turn underlain by soft to medium consistency very sensitive gray silty clay. Below this clay layer and above the bedrock surface is a thin layer of sand and gravel.

SUBSTRUCTURE DETAILS

Red Brook Culvert (station 87+80):

The proposed culvert centerline crosses the I-295 centerline at station 87+80 on a 10 degree skew, or nearly at a right angle.

As seen on sheet 1 the culvert alignment is underlain by a thin layer of silty peat. This peat is about 4.0 feet thick at the north end of the proposed culvert, but thins to only 2.0 feet at the south end. It is recommended that this organic layer be completely removed so that the culvert can be bedded in the underlying sand and gravel. Below this surficial peat brown sand and gravel extends to a total depth of 20 to 30 feet below the ground surface. A transition zone of layered clay and sand seperates the sand from an underlying deposit of very sensitive medium consistency gray silty clay. This gray silty clay deposit extends to nearly 70 feet below ground surface on the north end and to slightly more than 90 feet on the south end of this culvert. Below the gray silty clay and over the ledge surface is a layer of sand and gravel. This sand layer was found to be thicker on the south end than the north end of this

culvert, and the ledge surface slopes quite steeply from north to south.

Since there is a relatively thick deposit of gray silty clay beneath this gully, both stability and settlement were checked. A stability analysis was run and indicates that the proposed embankment should be stable. A summary of this analysis is shown on sheet 2. Using the stress curves on sheets 3 through 5 and the consolidation data summarized on sheets 6 to 10, computations were done to estimate settlement at the right and left shoulder breaks as well as at the centerline. It is estimated that about 2.1 feet of settlement can be anticipated at the right shoulder break (south end of culvert), approximately 1.7 feet of settlement is estimated at the left shoulder break (north end of culvert) and about 2.75 feet of settlement is expected at centerline. Thus, it is expected that approximately five inches of differential settlement can be anticipated between the shoulder breaks. However, another facet of this problem which must be recognized is the different time required for the settlement to occur. Because the thickness of the clay deposit is different at each end of the culvert, the longest drainage path is different, and the settlement at the north end of the culvert should occur more rapidly than at the south end. Even though ultimately the south end of the culvert will settle more than the north end, for a number of years the settlement at the north end will be in excess of that at the south end. This is shown graphically on sheet 11. The flow of Red Brook through this culvert will be from north to south. It is recommended that this culvert be laid at a grade great enough to allow the upstream end to settle 1½ inches more than the downstream end. From station 86+00 to station 89+00 the proposed embankment height is nearly constant (16 ± feet). Since this area is underlain by essentially

a constant thickness of clay, it seems unlikely that the amount of settlement would vary greatly. Thus, it is anticipated that the embankment between stations 86+00 and 89+00 will settle some 2 + feet. Thus, supporting this box on end bearing piles would result in a bump. The settlement involved is long-term and cannot be eliminated prior to paving. Thus, it is recommended that a culvert be designed to structurally withstand two feet of settlement and be placed with the expectation that it will settle as the roadway does. If it is not economically feasible to design a box culvert to meet this criteria, it is suggested that the possibility of using two or more metal culverts in lieu of a box be considered. Whatever is designed, it is imperative that the amount of settlement be taken into account when deciding on size.

SUMMARY

Soil investigation has been completed for a proposed box culvert which would carry the flow of Red Brook beneath I-295 at station 87+60. Two washborings encountered a soil stratification of sand over layered clay and sand underlain by marine clay which is underlain by sand and then bedrock.

An analysis indicates there is no stability problem at this culvert. However, settlements of 1.7 feet at the left shoulder break (north end of culvert) and 2.1 feet of settlement at the right shoulder break (south end of culvert) are expected. As pointed out in the report, for several years the total settlement at the upstream end (north end) will be greater than at the downstream end (south end) due to the difference in rate of settlement,

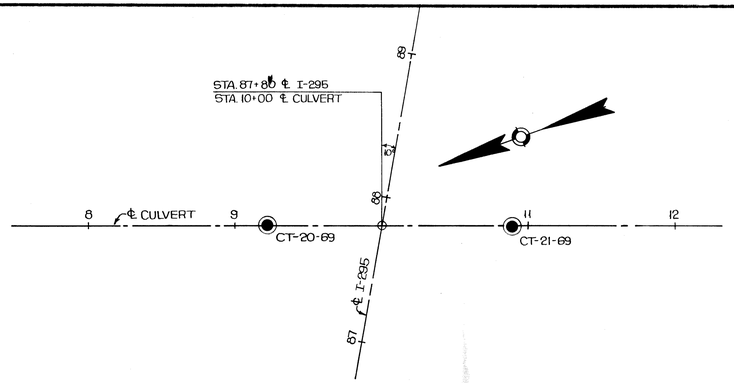
even though the south end will ultimately settle the most. Since this settlement is of a long-term nature it is recommended that a box culvert be designed which will be structurally capable of withstanding this settlement. It is recommended that this box be set at a grade which will allow for 1½ inches greater settlement at the upstream end than at the downstream end which will be the case for some time due to the difference in rate of settlement.

Because of the settlement expected it is suggested that the possibility of using two or more metal pipes rather than a concrete box be investigated. If metal pipes are substituted for a box, it is recommended that they be placed with a camber such that the culvert at centerline is one foot higher than the ends when placed. This will compensate for much of the differential settlement, although ultimately the culvert will probably have a slight sag.

Prepared by Guy L. Baker
Guy L. Baker
Area Asst. Soils Engineer

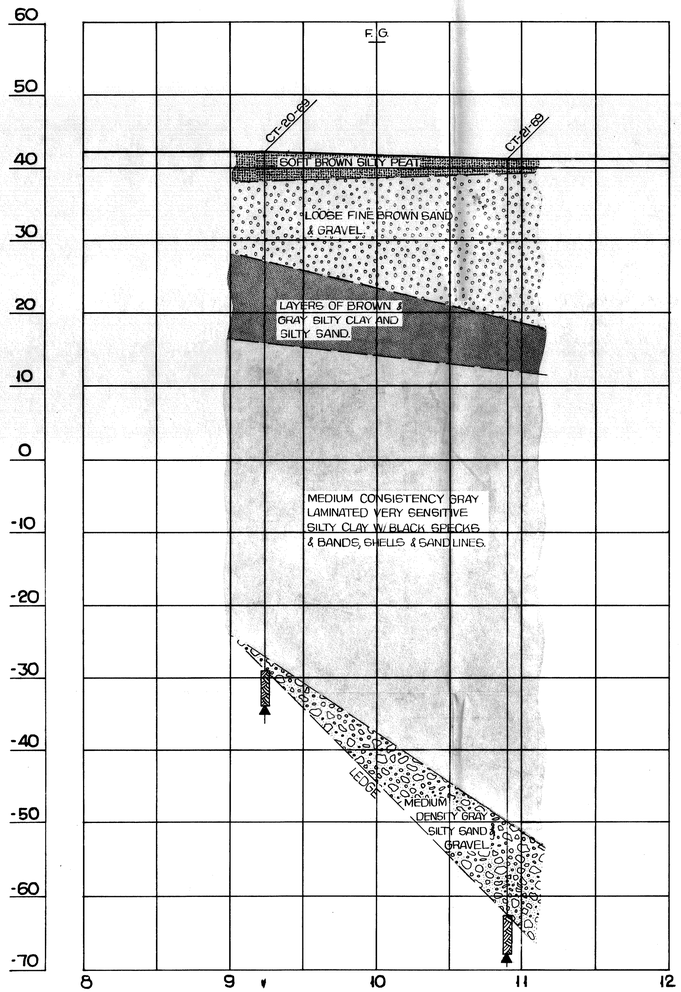
Approved by Melvin W. Morgan
Melvin W. Morgan
Soils Engineer

B.P.R. REG. NO.	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
1	MAINE		1	



PLAN

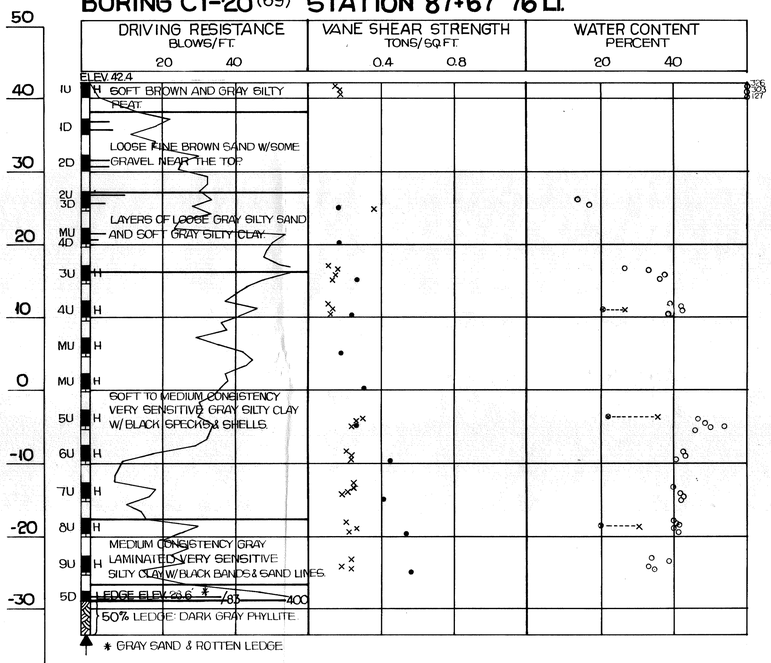
SCALE: 1"= 50'



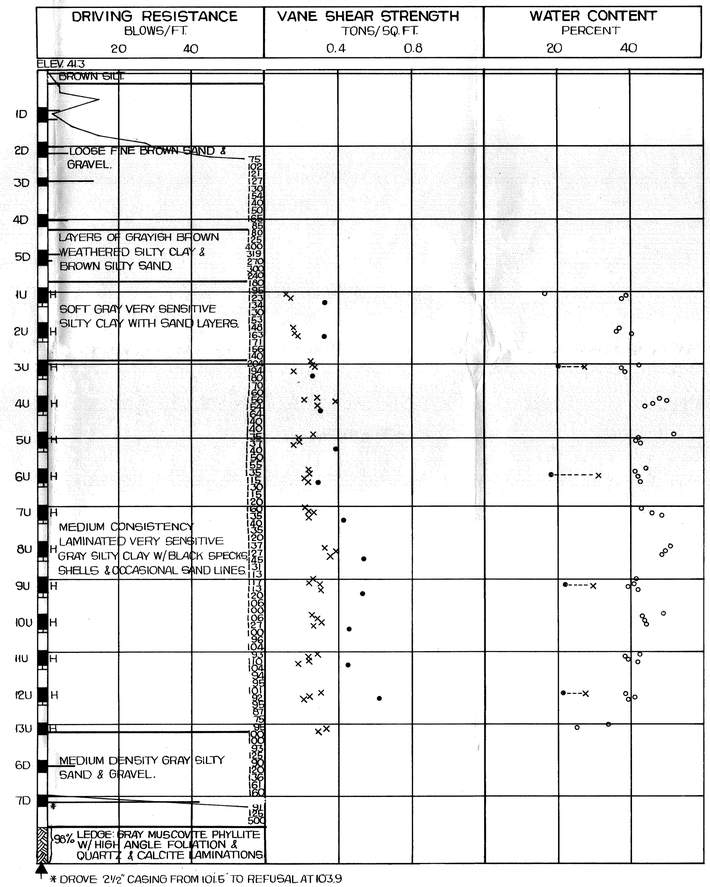
PROFILE

SCALE: 1"= 50' HORIZ.
1"= 10' VERT.

BORING CT-20 (69) STATION 87+67 76' LT.



BORING CT-21 (69) STATION 87+96 88' RT.



* DROVE 2½" CASING FROM 101.5' TO REFUSAL AT 103.9

BORING NOTES

ALL SAMPLES AND VANES ARE MADE AHEAD OF CASING.

WATER ELEVATION

N — NUMBER OF BLOWS REQUIRED TO DRIVE EXTRA HEAVY CASING ONE FOOT WITH 400 FT. LBS. OF ENERGY PER BLOW.

LOCATION OF SAMPLE OR SAMPLE ATTEMPT.

NUMBER AND TYPE OF DRY SAMPLE

1D — S & H SAMPLER @ 1290'S

1U — 3½ O.D. 16GA. SEAMLESS TUBING.

NUMBER OF BLOWS REQUIRED TO DRIVE SPOON OR TUBING ONE FOOT WITH 350 FT. LBS. OF ENERGY PER BLOW.

H — SAMPLING SPOON OR SEAMLESS TUBING DRIVEN BY STATIC WEIGHT OF DRILL RODS AND HAMMER.

FIELD VANE TEST

BOTTOM OF BORING (MAY NOT BE BOTTOM OF SOIL STRATA.)

71% — LOCATIONS CORED BY DIAMOND BIT AND PER CENT RECOVERY OF ROCK.

SHEAR NOTES

● FIELD VANE SHEAR STRENGTHS.

× LABORATORY VANE SHEAR STRENGTHS.

WATER CONTENT NOTES

o NATURAL WATER CONTENTS, GIVEN AS PER CENT OF DRY WEIGHT

⊗---× PLASTIC AND LIQUID LIMIT.

IGNITION LOSSES ARE GIVEN AS PER CENT OF DRY WEIGHT.

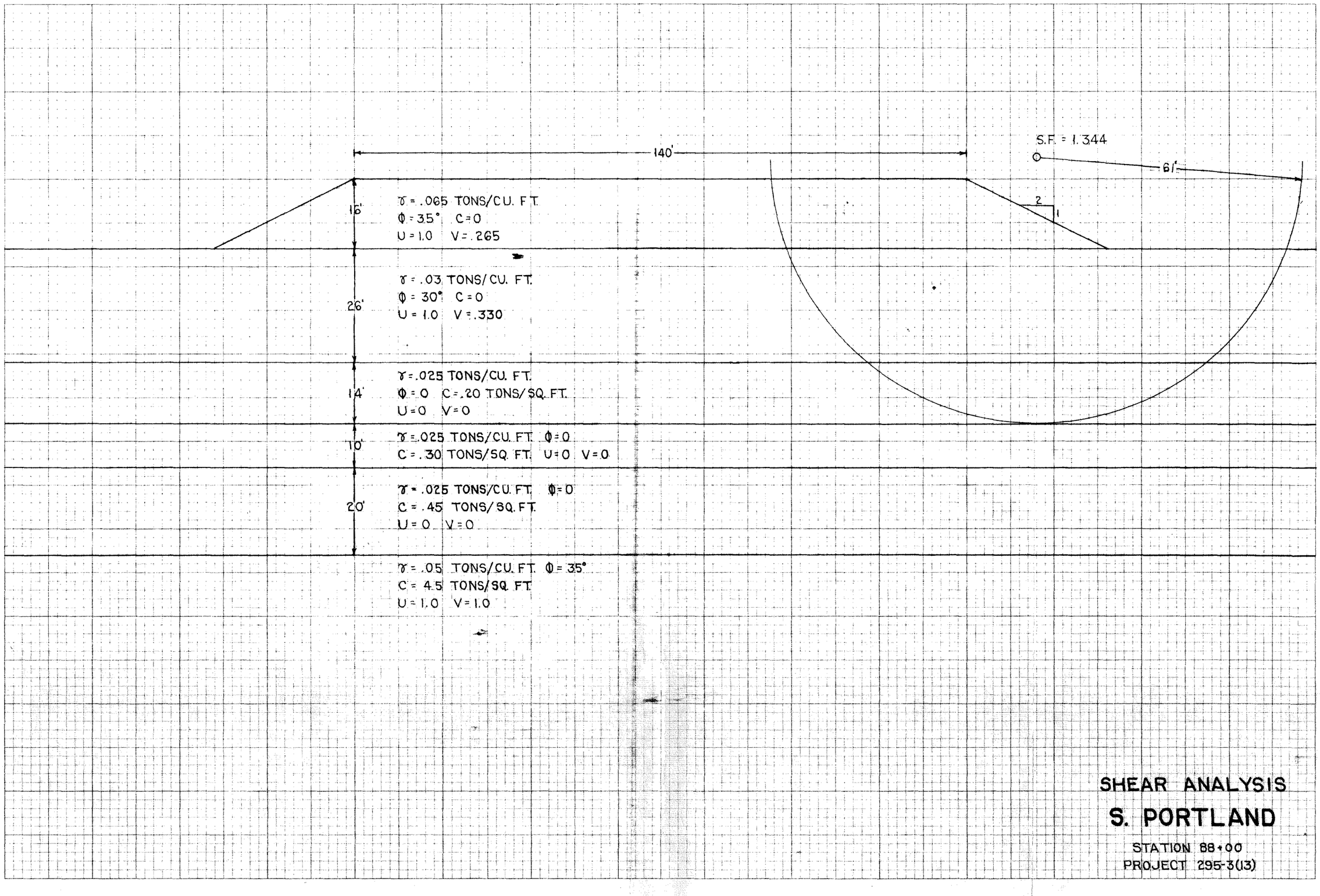
STATE HIGHWAY COMMISSION

I-295
OVER
RED BROOK
IN THE TOWN OF
SOUTH PORTLAND
CUMBERLAND COUNTY
FOUNDATION SURVEY

SHEET OF AUGUSTA, MAINE

JANUARY 1968

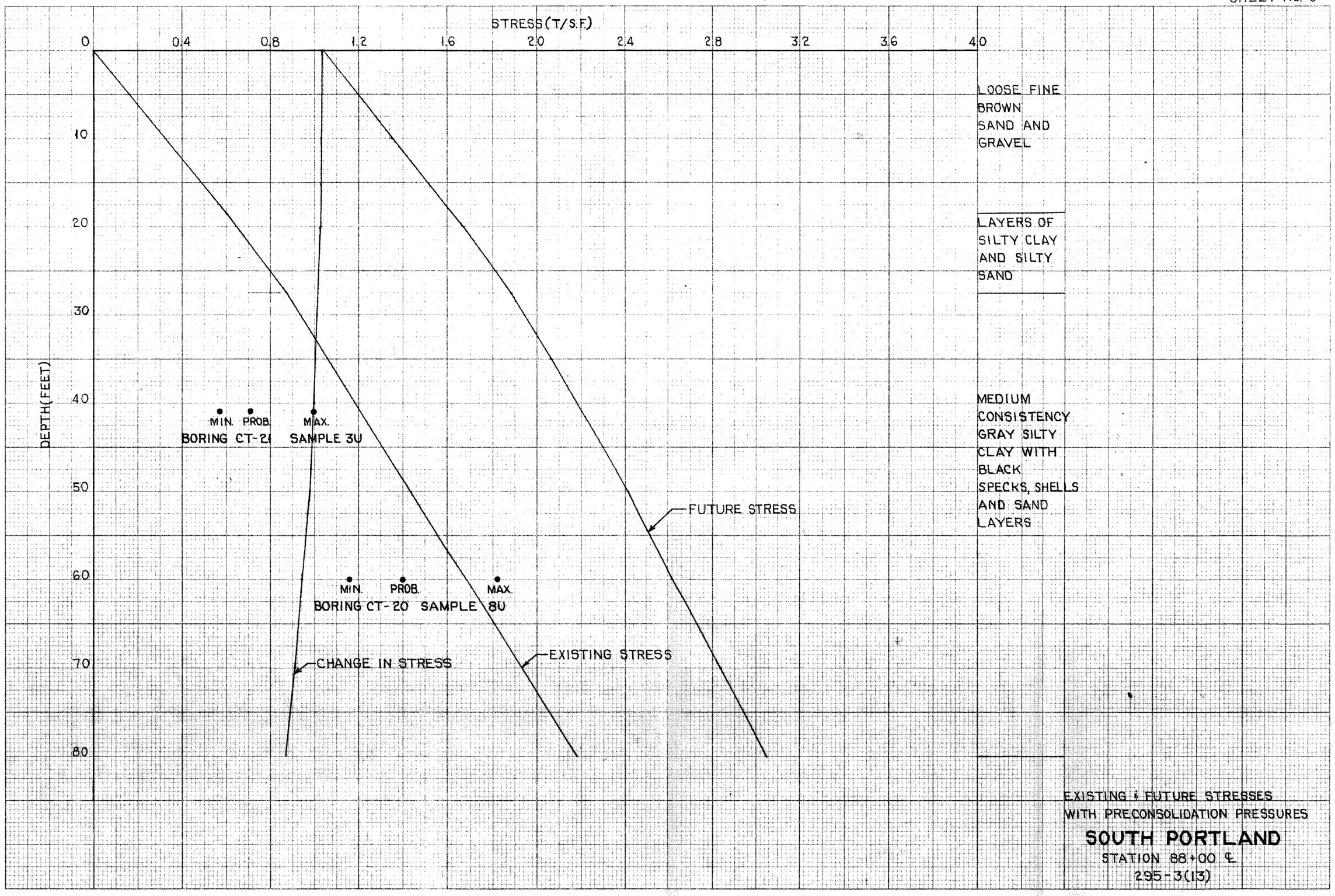
203-1 2080



SHEAR ANALYSIS

S. PORTLAND

STATION 88+00
PROJECT 295-3(13)

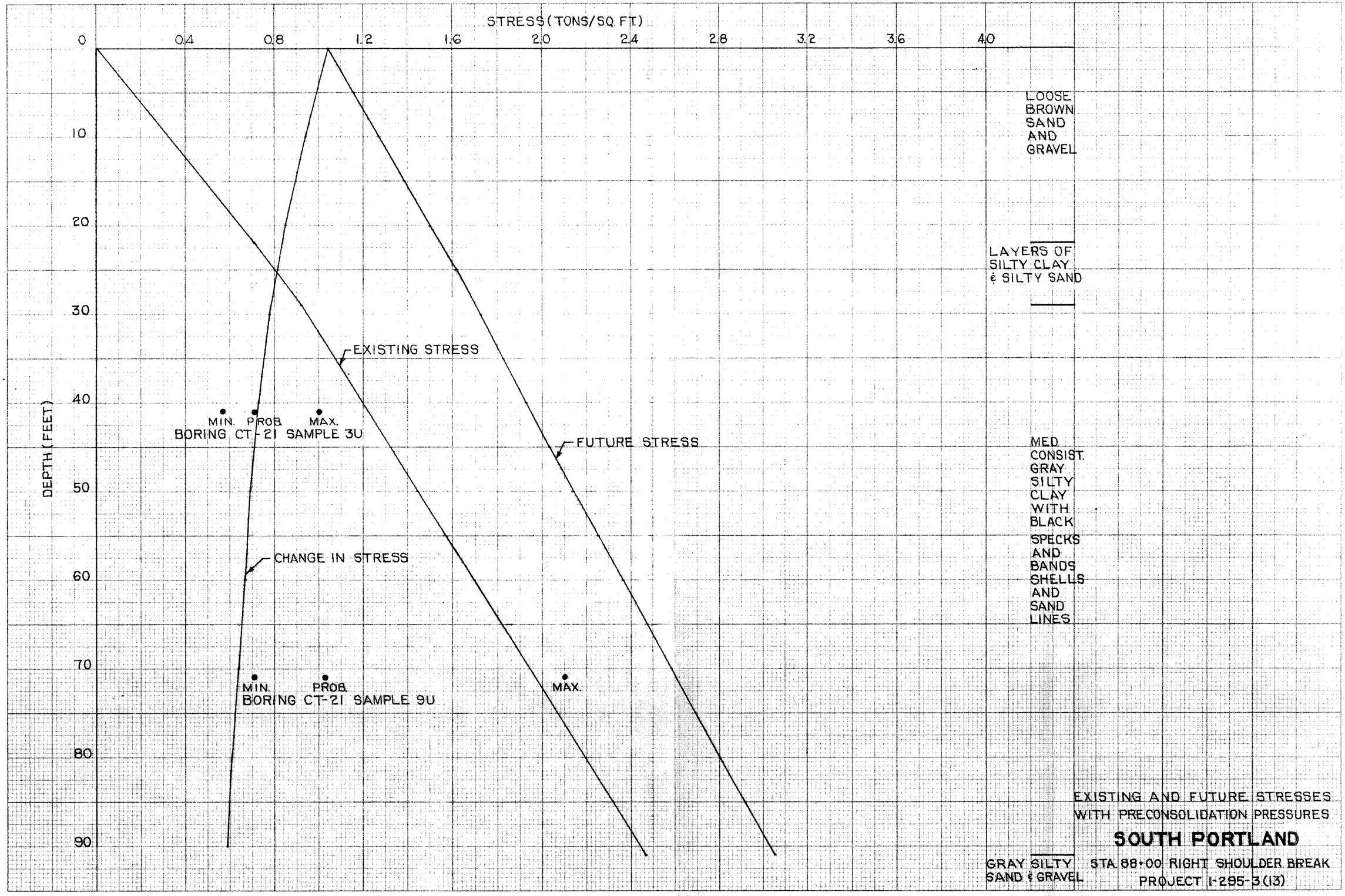


EXISTING & FUTURE STRESSES
WITH PRECONSOLIDATION PRESSURES

SOUTH PORTLAND

STATION 88+00 ℄

295-3(13)

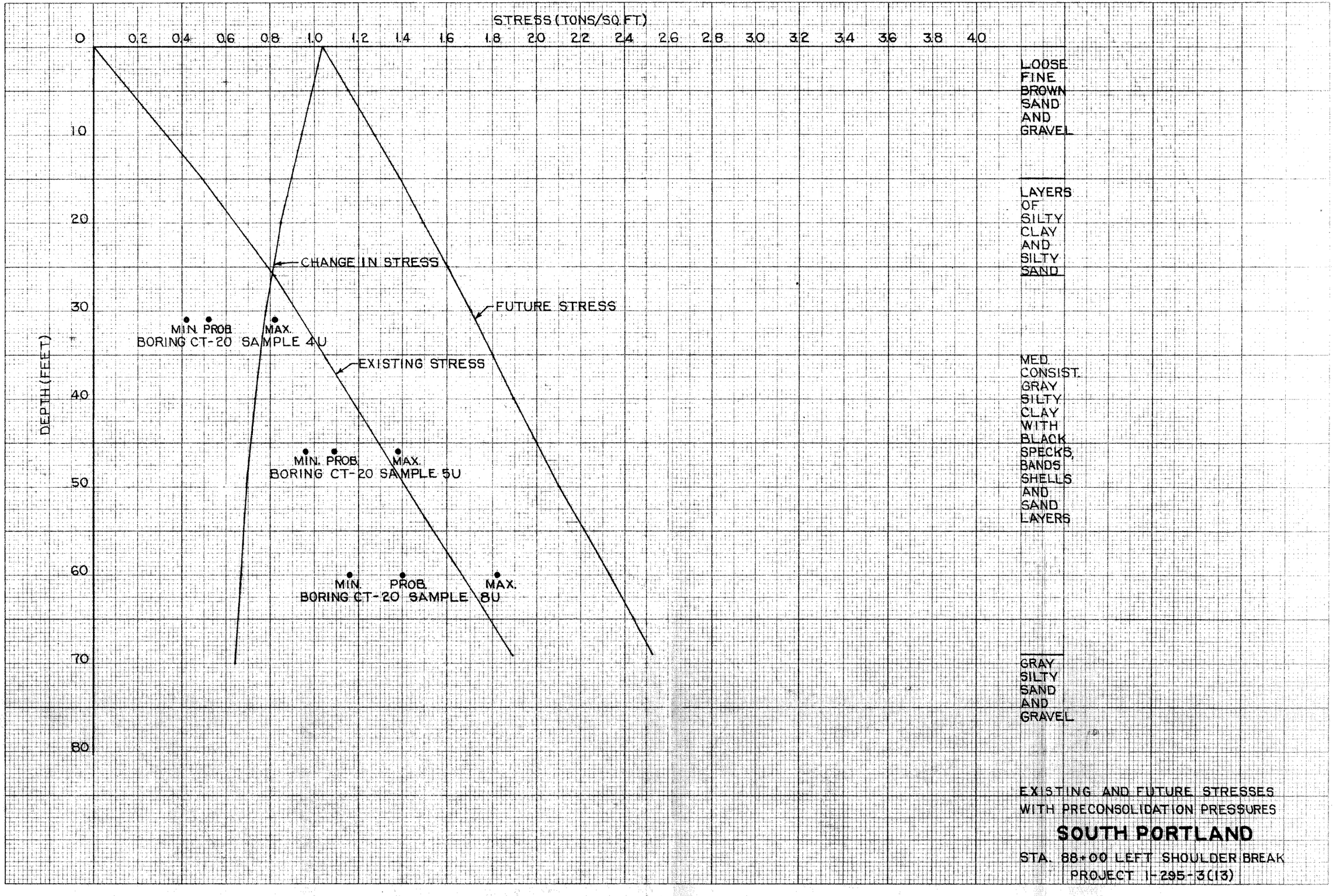


EXISTING AND FUTURE STRESSES WITH PRECONSOLIDATION PRESSURES

SOUTH PORTLAND

STA. 88+00 RIGHT SHOULDER BREAK

PROJECT I-295-3(13)



EXISTING AND FUTURE STRESSES
WITH PRECONSOLIDATION PRESSURES

SOUTH PORTLAND

STA. 88+00 LEFT SHOULDER BREAK
PROJECT I-295-3(13)

G = 2.73
h_i = .8566
h_s = .3771

WC_1 = 50
WC_2 = 38

Sensitive gray silty clay w/ black streaks
LL 26 PI 6.1 Vane .12

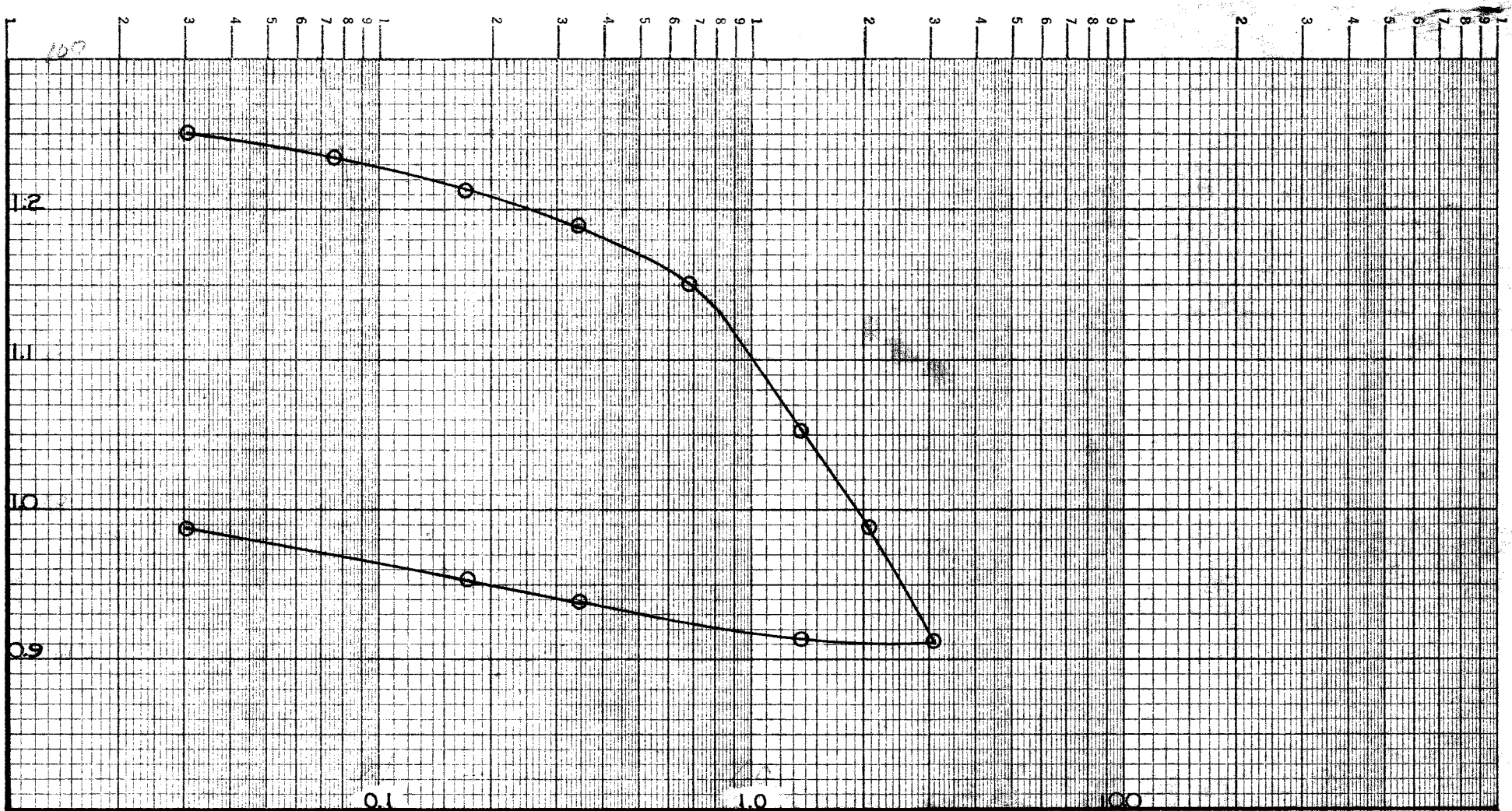
SEMI-LOGARITHMIC 359-81G
KEUFFEL & ESSER CO. MADE IN U.S.A.
4 CYCLES X 70 DIVISIONS

LC-46

e @ P_p = 1.204
C_c = 0.36

	Max.	Min.	Prob.
	0.80	0.42	0.52

C_v = 21½# 5# 10# 16# 22½#
55 200 37 18 22



MAINE STATE HIGHWAY COMMISSION
PRESSURE-VOID RATIO DIAGRAM

PORTLAND
295-3(13)

BORING CT-20-69 SAMPLE 4U
MAY 1969 LC-46
SOILS ENGINEERING LAB.

SHEET NO. 6

G = 2.81
WC_1 = 57
WC_2 = 43

h_i = .8723
h_s = .3411

LL 36.2
PI 14.1

Gray clay w/ black streaks

Vane .240

e @ P = 1.474
$\frac{P_c}{P}$ = 0.90

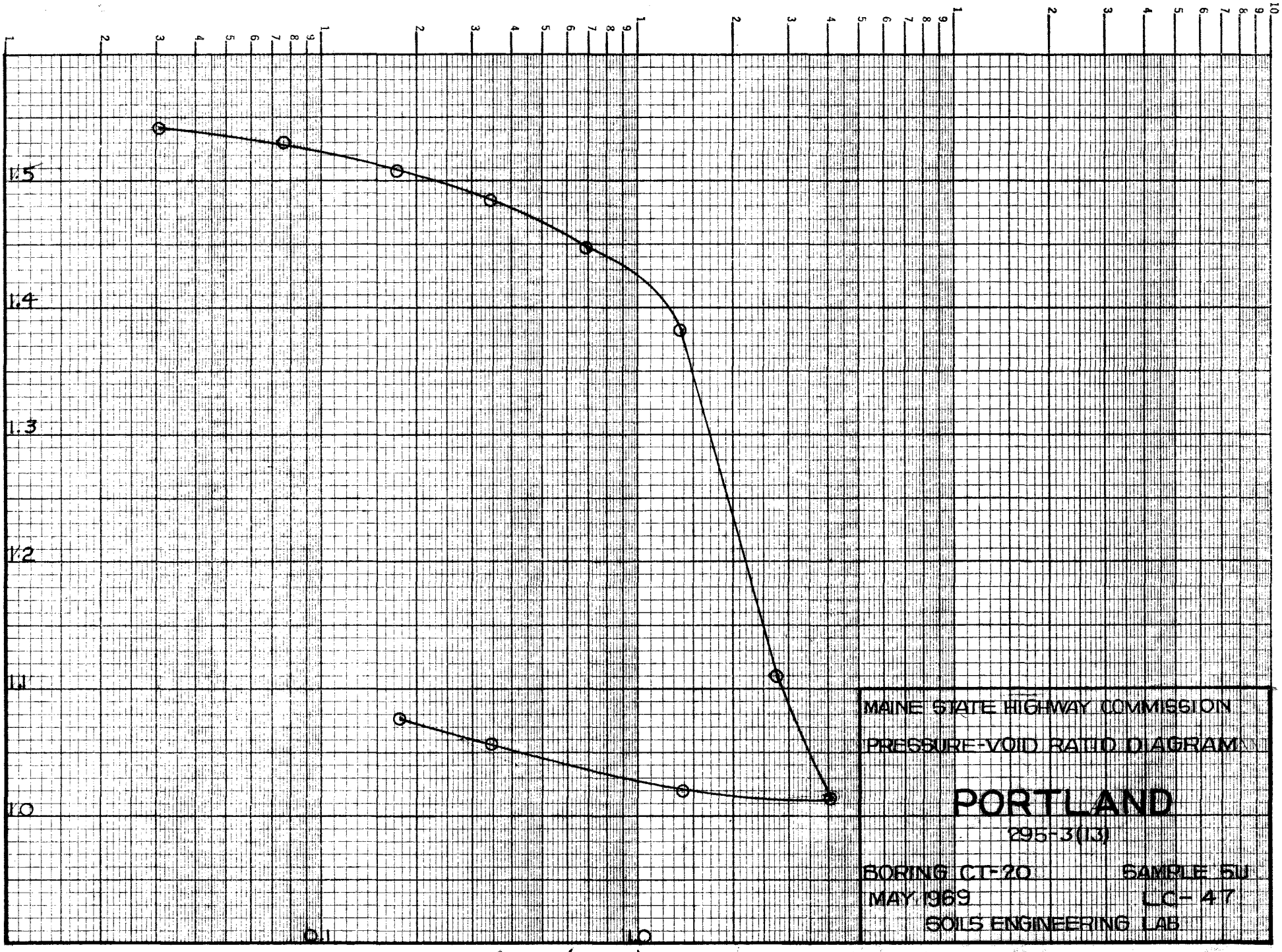
Max. Min. Prob.
1.38 0.96 1.09

C_v = 2½#
50

5# 10# 20# 30#
55 48 12 8

K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS 46 6012 MADE IN U.S.A. KEUFFEL & ESSER CO.

LC-47



MAINE STATE HIGHWAY COMMISSION

PRESSURE-VOID RATIO DIAGRAM

PORTLAND

295-3(13)

BORING CT-20 SAMPLE 5U

MAY 1969 LC-47

SOILS ENGINEERING LAB

SHEET NO. 7

G = 2.79
h_i = .8714
h_s = .3949

WC. - 44
5

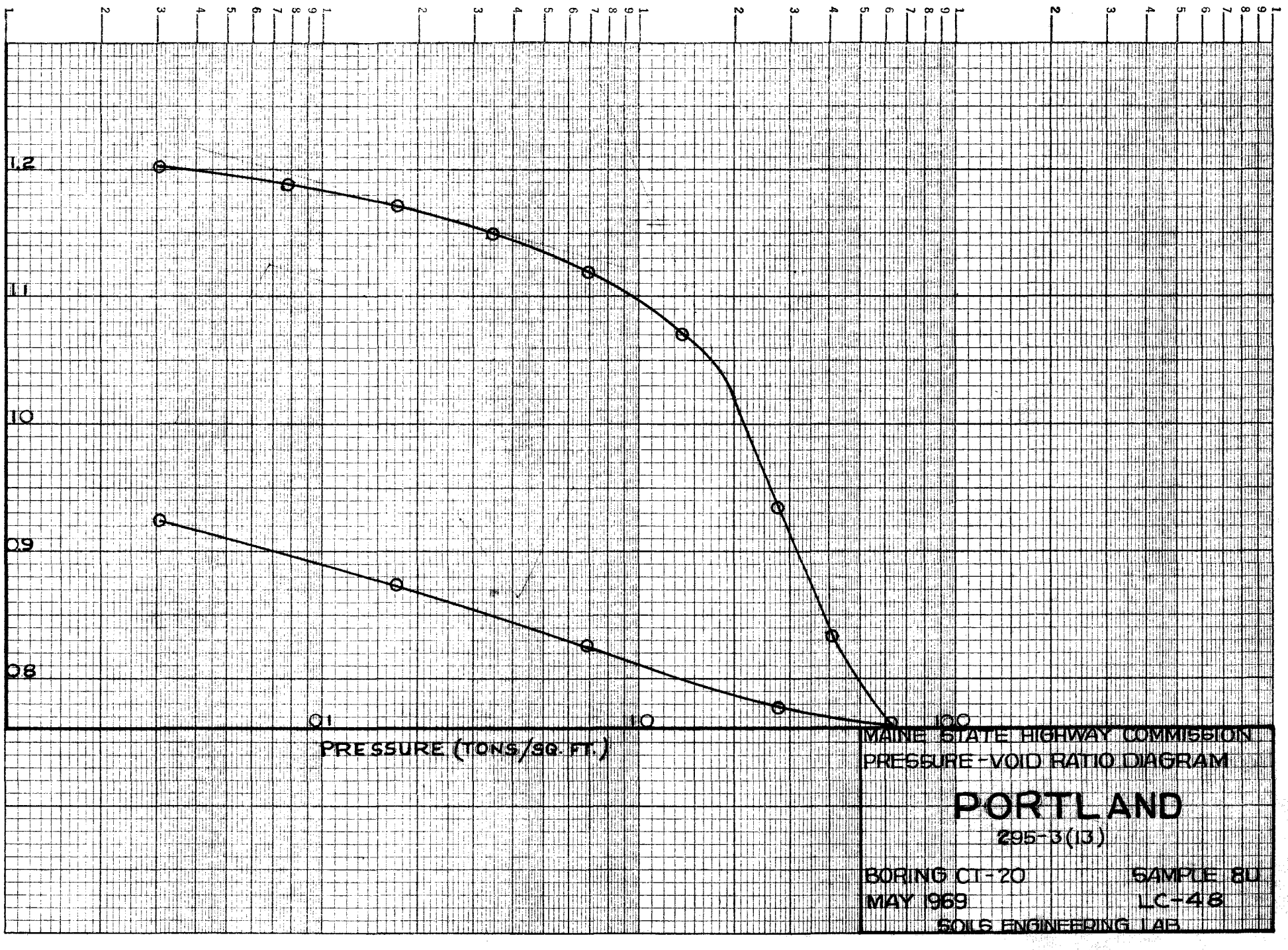
Gray clay w/ black specks
LL 41.8
PI 10.3
Vane. 2.16

SEMI-LOGARITHMIC 359-81G
KEUFFEL & ESSER CO. MADE IN U.S.A.
4 CYCLES X 70 DIVISIONS

e @ P_p = 1.109 Max. Min. Prob.
C_c = 0.60 1.82 1.16 1.40

C_v = 2½# 5# 10# 20# 30# 45#
40 65 60 25 13 30

LC-48



MAINE STATE HIGHWAY COMMISSION
PRESSURE - VOID RATIO DIAGRAM

PORTLAND

295-3(13)

BORING CT-20 SAMPLE 8U
MAY 969 LC-46
SOILS ENGINEERING LAB.

SHEET NO. 8

G = 2.76
h_i = .8857
h_s = .4084

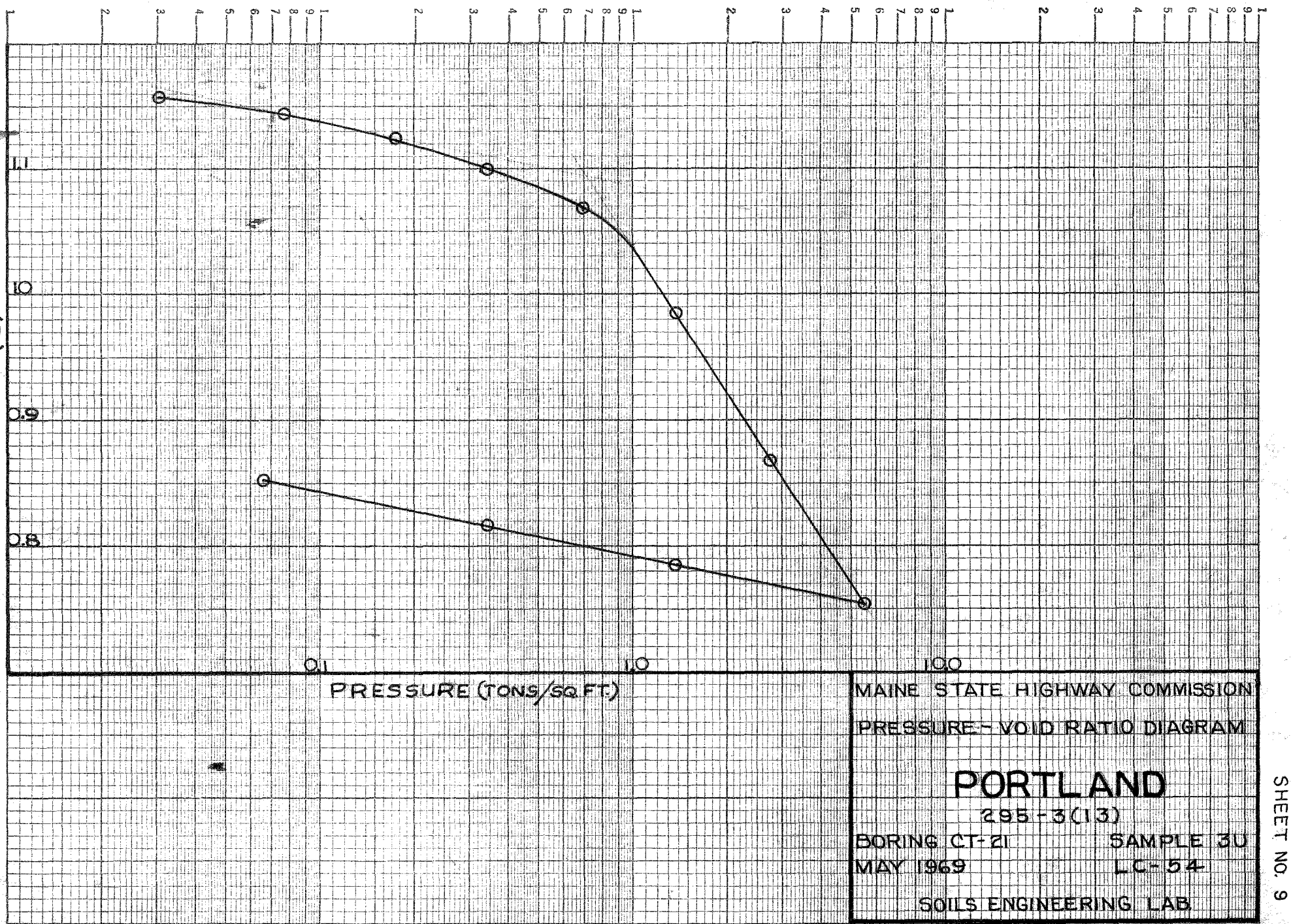
WC_1 = 42
WC_2 = 32

LL 28.0
PI 7.9

K+E SEMI-LOGARITHMIC 359-81G
KEUFFEL & ESSER CO. MADE IN U.S.A.
Vane .288 4 CYCLES X 70 DIVISIONS LC-54

e @ P_p = 1.094 Max Min Prob C_v = 21/2#
C_c = 0.38 1.0 0.57 0.71 42

5# 10# 20# 40#
87 72 45 45



MAINE STATE HIGHWAY COMMISSION

PRESSURE - VOID RATIO DIAGRAM

PORTLAND

295-3(13)

BORING CT-21 SAMPLE 3U

MAY 1969 LC-54

SOILS ENGINEERING LAB.

SHEET NO. 9

G = 2.80
h_i = .8579
h_s = .4047

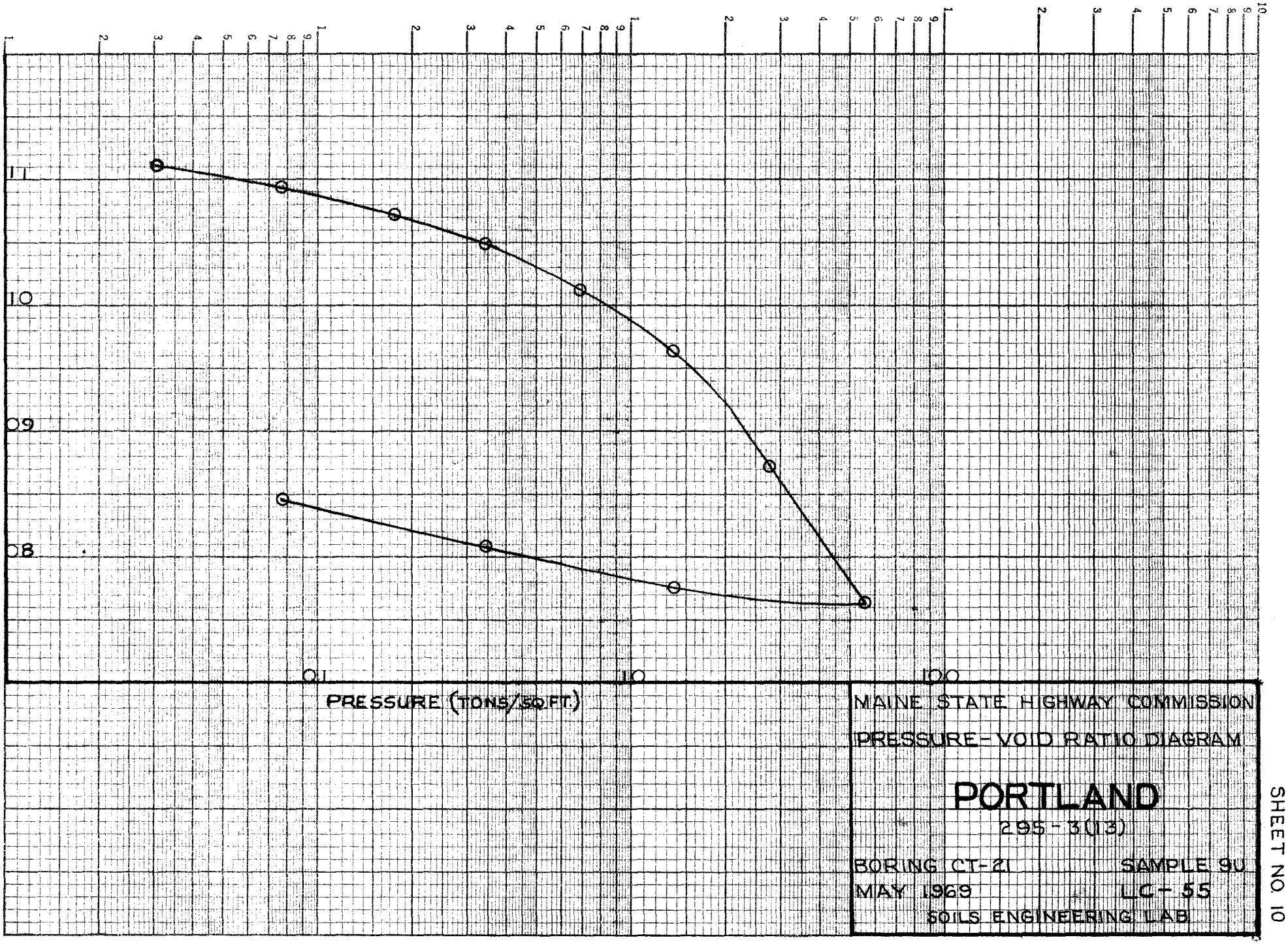
wc_1 = 42
wc_2 = 34

Sensitive gray silty clay w/a few shells
LL 30.
PI 7.9
vane .312

SEMI-LOGARITHMIC
4 CYCLES X 70 DIVISIONS
46 6012
MADE IN U.S.A.
KEUFFEL & ESSER CO.
LC-55

e @ p_p = 1.044
C_c = 0.36

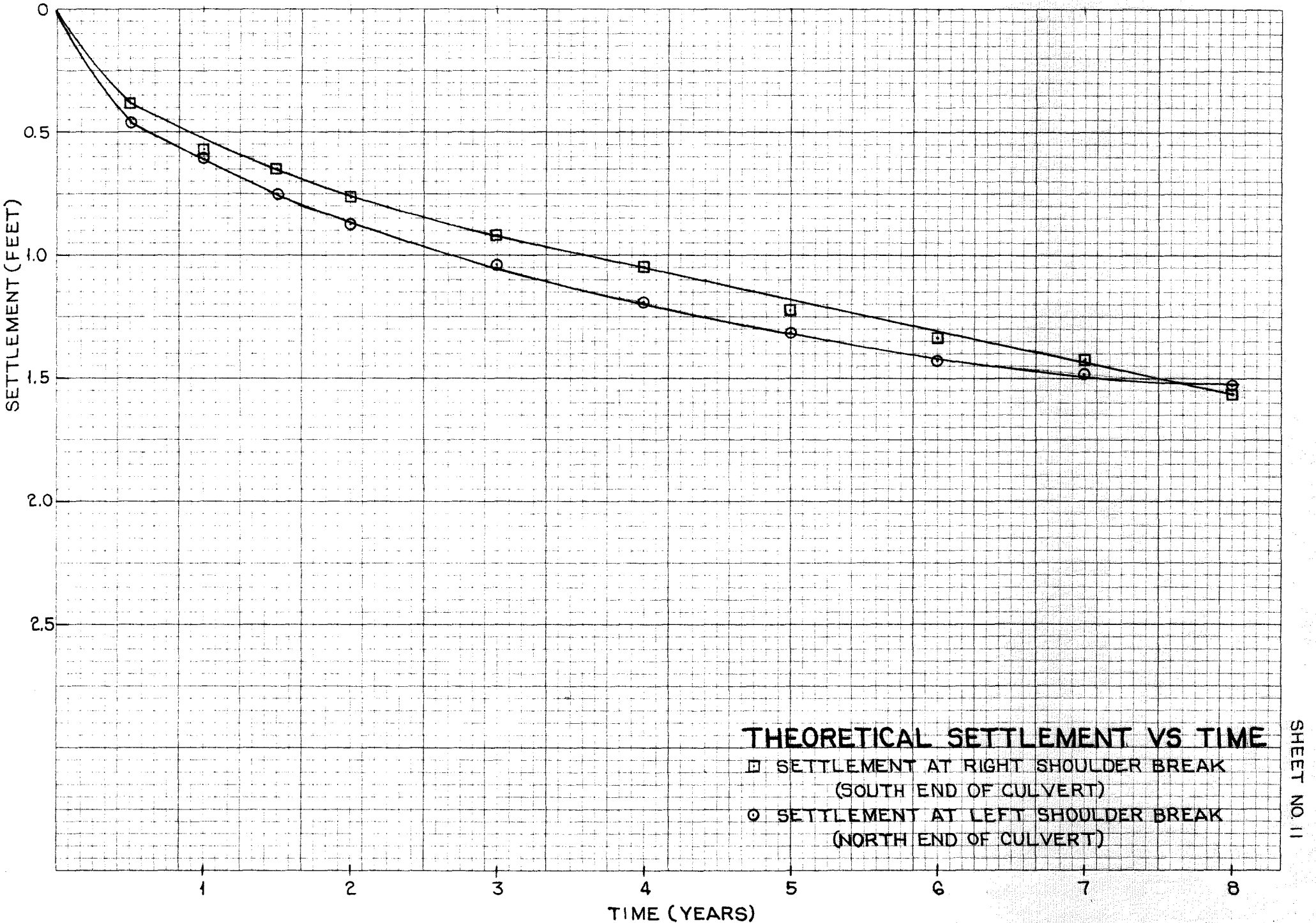
Max.	Min.	Prob.	C_v	2½#	5#	10#	20#	40#
2.10	0.71	0.93	43	40	65	35	45	



MAINE STATE HIGHWAY COMMISSION
PRESSURE-VOID RATIO DIAGRAM

PORTLAND
295-3(13)
BORING CT-21 SAMPLE 9U
MAY 1969 LC-55
SOILS ENGINEERING LAB

SHEET NO. 10



SHEET NO. 11