WOOLWICH 26 1 48

Soils Report 79-12
Woolwich - Sagadahoc County
Station 46 Bridge
26-1(48)
March 1979

3039

Maine Department of Transportation

Materials & Research Division

Soils Section

SUBSURFACE INVESTIGATION FOR THE PROPOSED WIDENING OF STATION 46 STRUCTURE WHICH CARRIES U. S. ROUTE 1 OVER THE MAINE CENTRAL RAILROAD TRACKS IN THE TOWN OF WOOLWICH

Sagadahoc County | Project 26-1(48) | Soils Report 79-12

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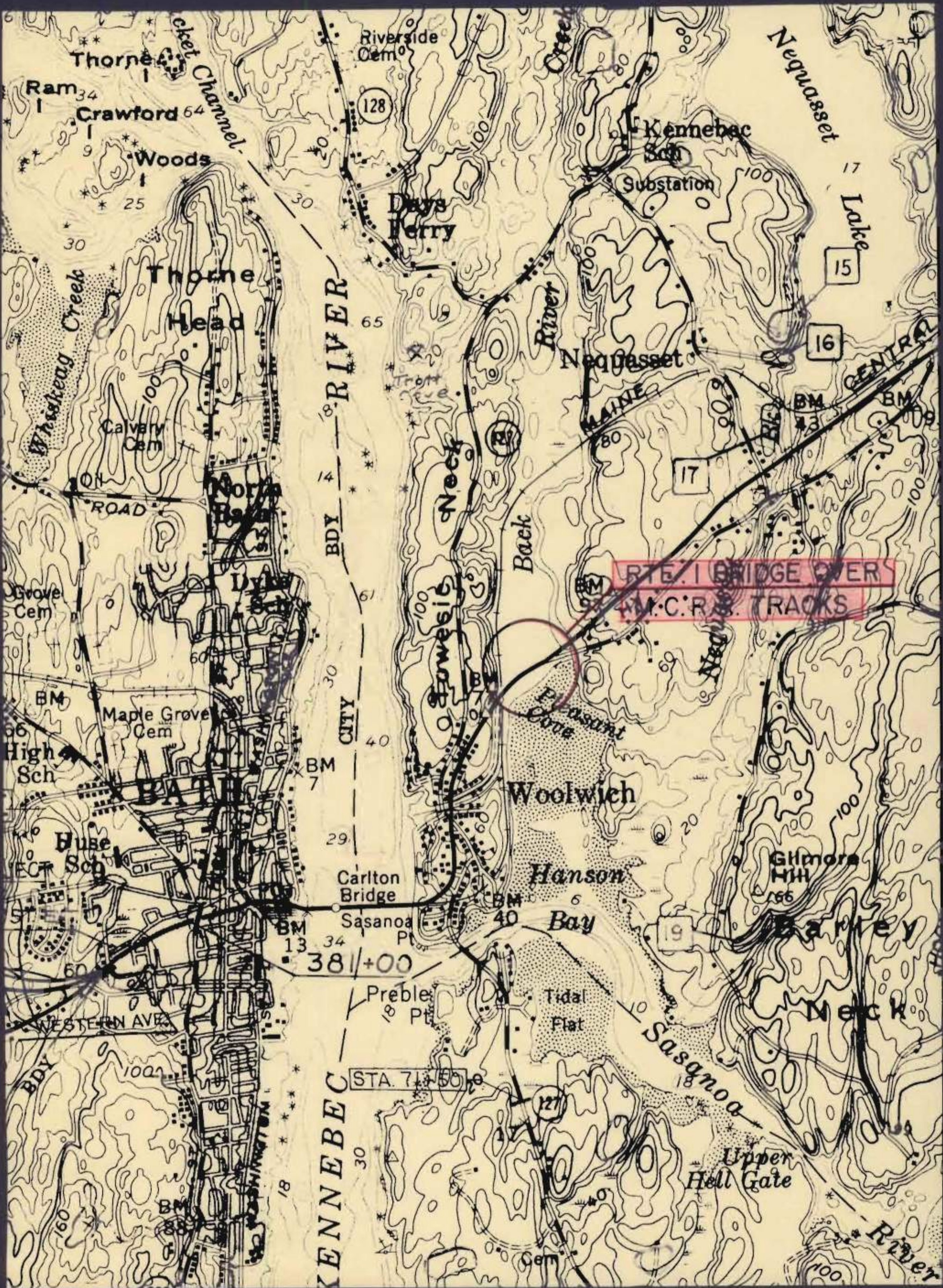

Thorne
Ram
Crawford
Woods
Channel
Riverside Cem
128
Days Ferry
Kennebec Sch
Substation
Nequasset Lake
15
16
Thorne Head
Whiskeag Creek
KENNEBEC RIVER
BDY
CITY
Back River
Nequasset
MAINE CENTRAL
17
Calvary Cem
North Bath
ROAD
Grove Cem
Neck
RTE. 1 BRIDGE OVER
M.C.R.R. TRACKS
Pleasant Cove
Maple Grove Cem
High Sch
BATH
Huse Sch
Woolwich
Carlton Bridge
Hanson Bay
Sasanoa Pt
381+00
Preble Pt
Tidal Flat
Sasanoa River
19
STA. 71+50
WESTERN AVE
127
Gilmore Hill
Upper Hell Gate
Cem

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INTRODUCTION

It is proposed to widen a structure which carries U. S. Route 1 over the Maine Central Railraod's tracks in Woolwich, Maine. This structure is referred to as Station 46, and is located about 3/4 mile north of the Carlton Bridge on Route 1. The existing structure is a high bridge supported on eight towers which are founded on pile bents. The bridge will be widened by extending each abutment and tower to the east.

Some consideration was given to replacing part of this structure with earth embankment since the structure bridges considerably more than just the railroad tracks. Soils Report 78-120, dated November of 1978, summarizes the soils investigation and analyses made to evaluate a proposal to replace five of nine bridge spans with an embankment. As pointed out in that report, any embankment built to replace the structure would be subject to large settlement and embankment stability would require either removal of some organic soil or the construction of counterbalancing toe berms adjacent to the fills.

Two washborings were made at this site by Chris Bark's washboring crew in April, 1978, and confirm the soils stratification shown on plans dated 1933. Rod soundings were added in the vicinity of Towers No. 1, No. 2 and No. 3 as well as Abutment No. 2 where indications were that ledge was relatively shallow and it was desired to better define the depth to ledge. These soundings were made by a crew under the supervision of Regional Geologist Lloyd Dickson. Dickson also made three backhoe tests to check the soils in a fill adjacent to the roadway north of the bridge.

Locations of the new explorations are indicated on the plan on Sheet 5. Also shown on Sheet 5 are the details of the two recent washborings and a stratified soils profile based on information shown on the 1933 plans plus

the findings of the new washborings. The master for this sheet is being provided to the Bridge Design Section for inclusion with the construction plans. Test pit locations were plotted on roadway plans and cross sections which are being forwarded to the Design Division.

GENERAL CONDITIONS

This bridge carries the highway over the Maine Central Railroad tracks and a deep deposit of soft soils which lies northeast of the railroad tracks.

The uppermost soil layer northeast of the railroad is soft brown slightly sandy organic silt. This organic silt deposit is about seven to fourteen feet thick. To Station 48+50± this organic silt is directly underlain by loose to medium gray sand and gravel, but beyond Station 48+50± the organic silt is underlain by a thin strata of hard gray clay which in turn is underlain by medium consistency gray silty clay which reaches a thickness of more than thirty feet. These compressible soils are separated from ledge by a thin layer of loose to medium density sand and gravel.

The existing approaches to the bridge have some cracks, with the pavement beyond the north end of the bridge containing more cracks as well as some noticeable rutting. South of the bridge at about Station 43+25± a utilities trench has been cut across the highway and subsequent consolidation of the trench backfill creates a noticeable bump. Pavement cracking has a random pattern sometimes referred to as alligator cracking as opposed to transverse cracking. The rideability of both approaches is superior to that of the bridge deck, which contains numerous patches and is quite rough.

SUBSTRUCTURE DETAILS

Abutment No. 1:

The centerline of bearing of this abutment is at Station 45+21.1 (existing centerline). No new explorations were made at this location,

but the soils stratification shown in the old plans indicate that ledge is shallow at this location, being at approximately Elevation 22±.

It appears that the existing abutment is setting on the ledge surface, and it is recommended that the abutment extension also be supported directly on ledge.

Tower No. 1:

The southerly leg of Tower No. 1, referred to on the 1933 plans as Bent No. 1, is at Station 45+61.1(existing centerline), and the northerly leg, Bent No. 2, is at Station 45+86.1. The ledge line shown on the old plans indicates ledge is at about Elevation +7± beneath Bent No. 1 and Elevation +3± beneath Bent No. 2. Rod soundings were made sixteen feet east of the legs of the existing tower and the sounding outside Bent No. 2 reached refusal at about Elevation +4±, indicating there is probably little change in ledge elevation between the existing tower and the proposed extension.

The 1933 plans indicate that the existing bents are supported directly on ledge and it is recommended that the proposed extension also be supported directly on ledge.

Tower No. 2:

Bent No. 3, the southerly leg of this tower, is at Station 46+26.1 (existing centerline) while Bent No. 4 is at Station 46+51.1. The 1933 ledge line indicates that ledge is slightly above Elevation 0 beneath Bent No. 3 and drops off to slightly below Elevation 0 below Bent No. 4. Two rod soundings were made sixteen feet east of the ends of the existing bents, and indicate that ledge must be a few feet lower beneath the proposed extension of this pier (about Elevation -2 beneath the south end and Elevation -5 beneath the north end). The old plans indicate that the existing bents are supported directly on the ledge surface, and it is recommended that the extension also be set on ledge.

Tower No. 3:

The bents supporting this tower are at Stations 47+06.1 and 47+31.1 (existing centerline), and recent rod soundings confirm the ledge line shown on the 1933 plans, indicating ledge will be at about Elevation -14 beneath the southernmost leg and at about Elevation -23 beneath the northerly leg of the proposed extension.

Piles should be driven to end bearing on ledge to support the extension for this tower. Because of the sloping ledge underlying this site, it is recommended that steel H-piles with reinforced tips be used.

Tower No. 4:

The southerly bent of this tower is at Station 47+91.5, and the northerly bent is at Station 48+16.5. No recent soils explorations were made for the extension of this tower, but washboring CB-16-73 was made about midway between Towers 3 and 4, and confirmed the ledge line shown on the old plan. From the ledge line on the old plan it appears that ledge is at about Elevation -26± beneath the southerly bent and drops to Elevation -30± beneath the northerly bent.

The pile driving records indicate the piles driven for the existing tower probably reached the ledge surface, and it is recommended that the proposed extension be supported on end bearing piles. Because of the slope of the ledge, steel H-piles with points would seem the best choice.

Tower No. 5:

Bents supporting this tower are at Stations 48+76.9 and 49+01.9 (existing centerline). No new explorations were done for the proposed extension of this tower, but from the old plans it appears that the ledge will be at about Elevation -47± beneath the southerly leg and at about Elevation -55± beneath the northerly leg.

Pile driving records indicate piles for Tower No. 5 penetrated to ledge, and it is recommended that the extension for this tower also be supported on end-bearing piles.

Tower No. 6:

The southerly bent supporting this tower is at Station 49+62.3, and the northerly bent is at Station 49+87.3 (existing centerline). A wash-boring made about midway between Tower No. 5 and Tower No. 6 reached ledge at Elevation -85, and a note on the 1933 plans indicates ledge is at Elevation -107.9 at Station 50+00.

The pile driving records indicate that piles approximately sixty feet long were driven for support of this tower. Thus, these piles do not penetrate through the gray silty clay underlying this tower. There is some evidence that this tower has undergone some settlement. To avoid movement of the extension relative to the existing tower, it is recommended that the extension of this tower be supported on end-bearing piles. Since the piles supporting the existing tower do not penetrate through the compressible clay, there is a danger that driving the new piles may cause soil disturbance and thereby movement of the existing tower. Thus, steel H-piles should be used for support of this extension (minimum displacement), and it is recommended that holes be pre-augered to Elevation -40 for these piles.

Tower No. 7:

Bents supporting this tower are at Stations 50+47.7 and 50+72.7 (existing centerline). No new soils explorations were made for the extension of this tower, but notes on the 1933 plans indicate that ledge is at Elevations -107.4 and -107.3 at Stations 50+00 and 50+75 respectively. Since the pile driving records indicate that piles driven for support of this tower were only sixty± feet long it is obvious that they stopped in the underlying medium gray silty clay. It would be expected that a substructure unit thus

supported would experience some settlement, and when each of the beams was surveyed to determine if there had been any movement of the structure, it appeared that this tower had settled slightly.

As explained in the discussion of Tower No. 6, there is some possibility that the driving of the piles for the extension of this tower might cause sufficient disturbance of the underlying soils to cause additional movement of the existing tower. To prevent such movement of the existing tower, it is recommended that holes be preaugered to Elevation -40 at the pile locations for the extension of this tower. Also, steel H-piles should be used for support of the extension since they have minimum cross-sectional area and will cause the least disturbance of the underlying soils. Piles for supporting the extension of this tower should be driven to end bearing on the ledge surface (Elevation -107.5±) to prevent possible movement of the extension.

Tower No. 8:

Bents supporting this tower are located at Station 51+22.7 and Station 51+47.7 (existing centerline). No new soils explorations have been made, but the ledge line shown on the old plans indicates that the ledge surface slopes sharply beneath this tower, being at Elevation -107.3 at Station 50+75, but at approximately Elevation -41 beneath the northerly bent of this tower (Station 51+47.7).

It appears from the pile driving records that piles for the southerly bent of this tower were about sixty feet long, and would not have penetrated through the underlying gray silty clay; whereas, the piles driven for the northerly bent apparently penetrated through the underlying clay to refusal.

It is recommended that the extension of this tower be supported on steel H-piles driven to refusal. Because piles for the existing southerly bent apparently stop in the gray silty clay, the piles for the southerly

extension should be installed in holes preaugered to Elevation -40. Because the ledge surface apparently slopes steeply beneath this tower, the piles should have points.

Abutment No. 2:

The centerline of bearing of this, the northerly abutment, is at Station 51+97.7 (existing centerline). A rod sounding was made eighteen feet east of the easterly end of the existing abutment. This boring reached refusal at a depth of 19.6 feet, or at approximately Elevation -13.6, which is about ten feet lower than the ledge elevation indicated at this abutment on the 1933 plans.

The old plans indicate that this abutment is setting directly on the ledge surface, and the extension should also derive its support from the ledge. This extension might be supported directly on ledge, but this would require extra excavation. A more economical method of support might be to extend concrete pedestals to ledge, or drive short heavy cross section H-piles to ledge.

APPROACH FILLS

In conjunction with the widening of this structure about 1350 feet of the approach roadway will be reconstructed, consisting of 800± feet southerly of the bridge, and 550± feet northerly of the bridge.

No soils explorations were attempted to ascertain the thickness and condition of the existing base, but according to old plans there should be eight inches of crushed gravel base and eighteen inches of gravel base beneath a three inch bituminous concrete surface in the roadway south of the bridge. North of the bridge the pavement section apparently consists of nine inches of crushed gravel and twelve inches of gravel base beneath three inches of bituminous concrete surface course.

The existing pavement beyond both ends of this bridge contains many cracks randomly spaced, sometimes referred to as alligator cracking. In addition, some rutting of the pavement is discernable north of the bridge. A utilities trench of some type has been excavated across the highway south of the bridge (Station 43+25±) and has settled, causing a noticeable bump. In a discussion with David Rand, pavement specialist, he indicated that he thought the cracking and rutting of the pavement was a result of insufficient thickness of bituminous concrete, and did not necessarily indicate an inadequate base thickness. Thus, it is not considered necessary to rebase the portion of the roadway being reconstructed, but it will be necessary to remove some of the crushed gravel to allow additional thickness of bituminous concrete, unless the finish grade can be raised sufficiently to allow placing an overlay. The required thickness of bituminous concrete for the traffic loading imposed should be determined using the standard pavement design procedure.

Three backhoe test pits were made left of centerline at Stations 54+00, 55+50, and 56+50 to determine the composition of a fill adjacent to the existing roadway. These test pits encountered principally granular material described in the field as gravelly sand or gravel and sand and containing some broken ledge, cobbles, and pieces of old pavement. Half a dozen samples were taken from these test pits and only two of these contained significant minus #200 material. Thus, this material adjacent to the road's base material should be quite permeable. The water table was encountered at the bottom of the test pit made at Station 55+50 (about Elevation 0).

SUMMARY

After considering the replacement of a portion of the Station 46 bridge over the Maine Central Railroad with an embankment it was decided, because

the existing structure bridges a deep deposit of poor soils, to widen the existing structure by extending the abutments and eight towers supporting it to the east.

Two washborings were made to sample the underlying organic silt and silty clay and to verify the ledge line shown on the 1933 plans for the existing bridge. A few rod soundings were also added east of the existing towers and the northerly abutment where ledge was believed to be relatively shallow.

From the old plans it appears that the abutments were founded directly on ledge, and it is recommended that the extension of the southerly abutment be supported directly on the ledge. A sounding made east of the northerly abutment indicated that ledge is about ten feet lower beneath the extension than beneath the existing abutment, and it may not be practical to set the extension of this abutment on the ledge surface. Either concrete pedestals extending to ledge or short stiff H-piles could be used for support of the extension of Abutment No. 2.

Most of the proposed tower extensions should be supported on end-bearing piles driven to the ledge surface. Because of the slope of the ledge surface, steel H-piles with reinforced points are recommended at Tower No. 3, No. 4, and the north leg of No. 8. To minimize disturbance of the subsoils, and avoid causing movement of the existing towers, which are supported on piles that don't penetrate through the medium consistency gray silty clay, it is recommended that piles for the extensions of Tower No. 6, No. 7 and the southerly leg of No. 8 be installed in holes preaugered to Elevation -40.

Towers No. 1 and No. 2 are apparently supported directly on the ledge surface, and it is recommended that their proposed extensions also be set on ledge.

Prepared by Guy L. Baker

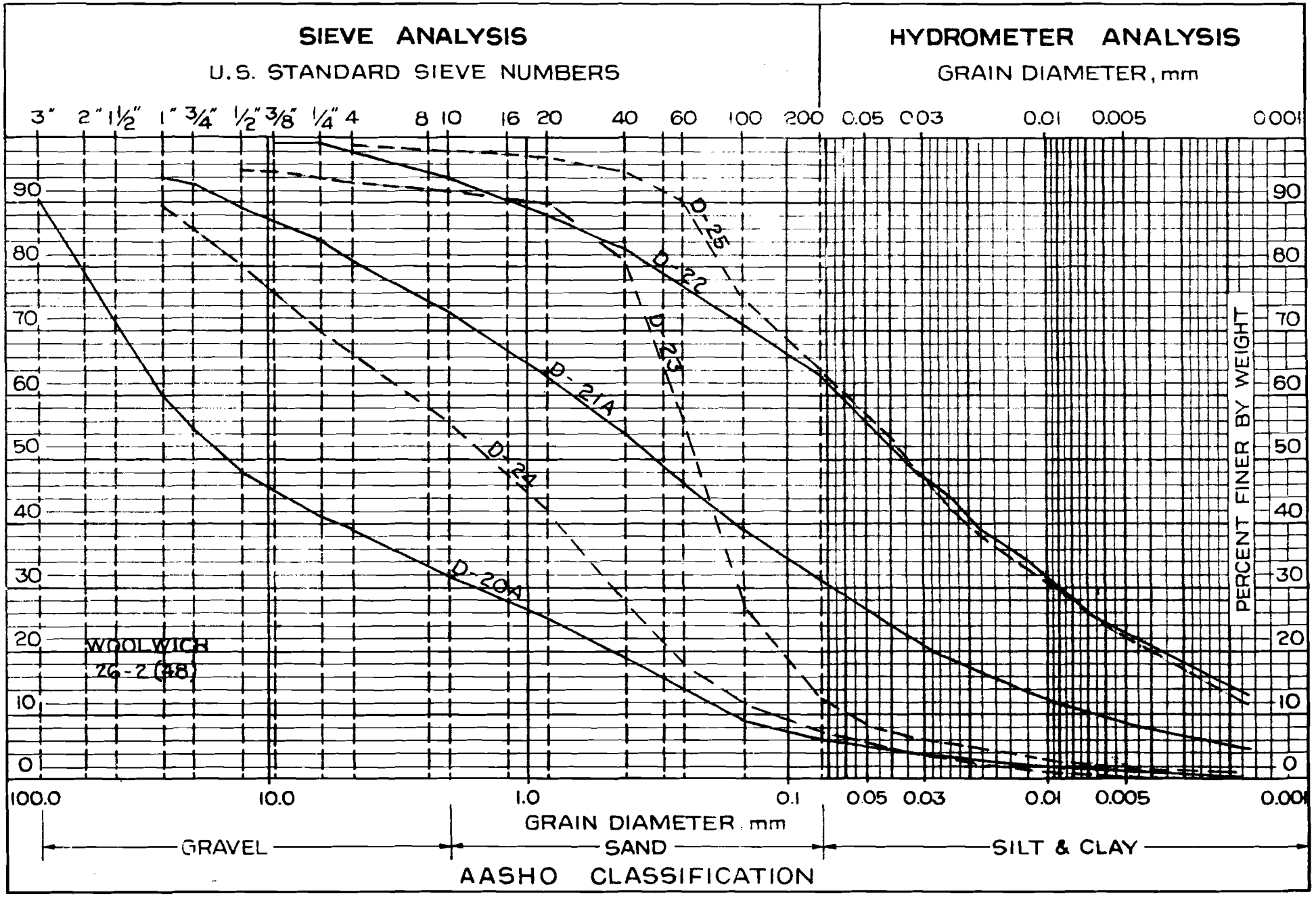
Guy L. Baker
Assistant Soils Engineer

TOWN(S) WOOLWICH PROJ. NO. 26-1(48)

STATION	OFFSET	DEPTH	SAMPLE NO.	G.S SHEET	W.C.	L.L	P.I.	IGN.	pH	CLASSIFICATION	
										AASHTO	FROST
54+00	23'LT.	0.8-1.9	D-20A	1	9				6.9	A-1-a	0
54+00	23'LT.	2.7-4.0	D-21A	1	11				7.0	A-2-4	III
54+00	23'LT.	2.7-4.0	D-22	1	14				7.3	A-4	IV
55+50	22.5'LT.	2.2-3.2	D-23	1	14				5.7	A-2-4	II
55+50	22.5'LT.	3.2-5.2	D-24	1	10				6.6	A-1-b	0
56+50	18.5'LT.	2.1-2.5	D-25	1	28	23.8	8.2		6.5	A-4	IV

Classification of these soil samples in accordance with AASHTO Classification System M-145-49. This classification is followed by the "Frost Susceptibility Rating" from zero (frost free) to Class IV (highly Frost susceptible. The "Frost Susceptibility rating" is based upon the MDOT and Corps of Engineers Classification Systems.

SML - 106 (12/66)



STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

GRAIN SIZE DISTRIBUTION CURVES

BUREAU OF HIGHWAYS
MATERIALS & RESEARCH DIVISION

SHEET NO. 1

LEGEND

PLAN SYMBOLS


ROD SOUNDING


AUGER BORING


BORING & SOUNDING


POWER AUGER


WASH BORING


SEISMIC : SHOT LOCATION

RESISTIVITY : TEST LOCATION

TEST PIT

LEDGE ON SURFACE

EXPLORATION NOTES


WATER LEVEL

BLOWS PER FOOT - ROD SOUNDINGS

MATERIAL & SAMPLE NO. - AUGER BORING

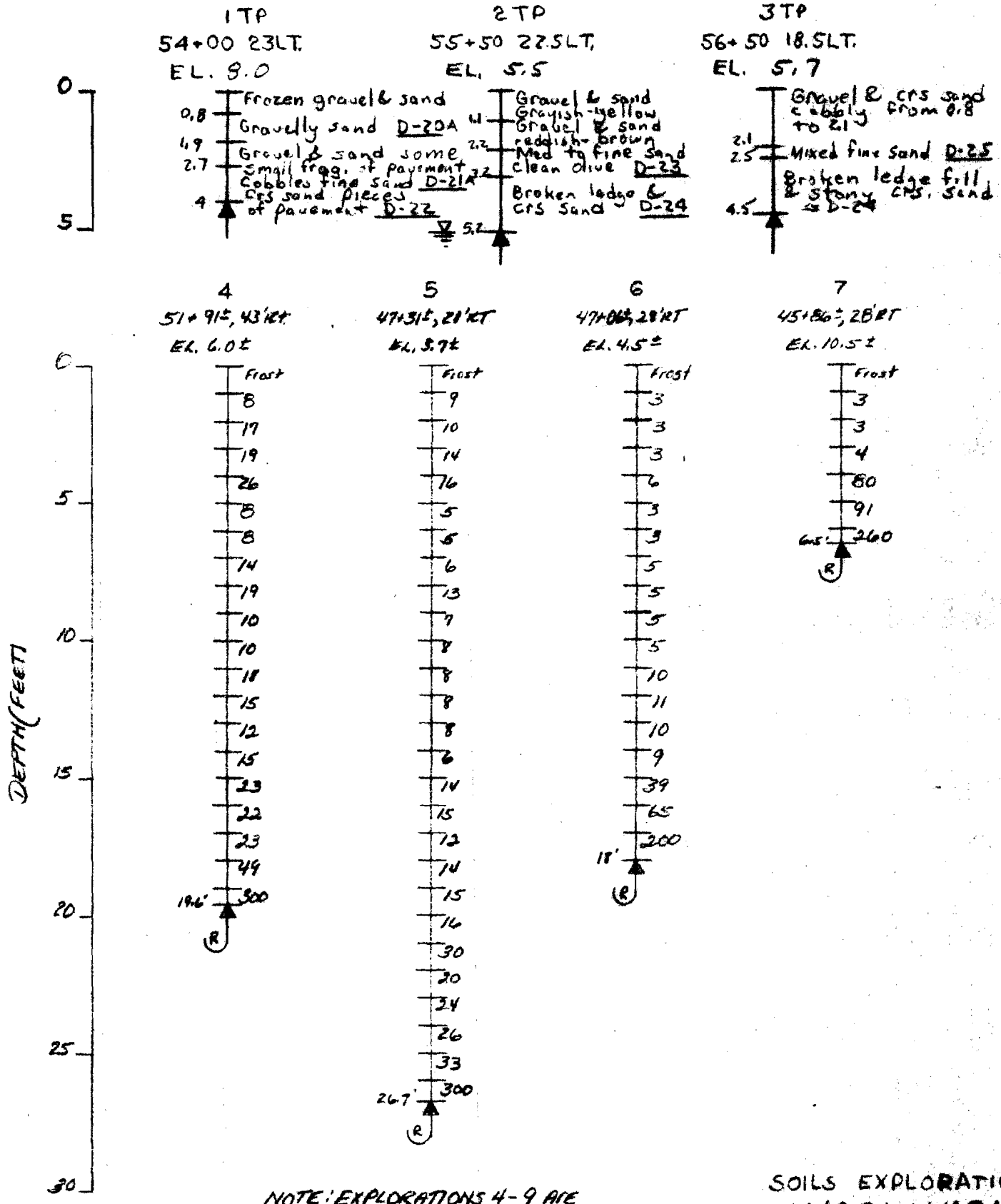
DEPTH OF MATERIAL CHANGE (IN FEET)


BOTTOM OF EXPLORATION


REFUSAL


LEDGE

EXPLORATIONS 1-7
TEST PITS

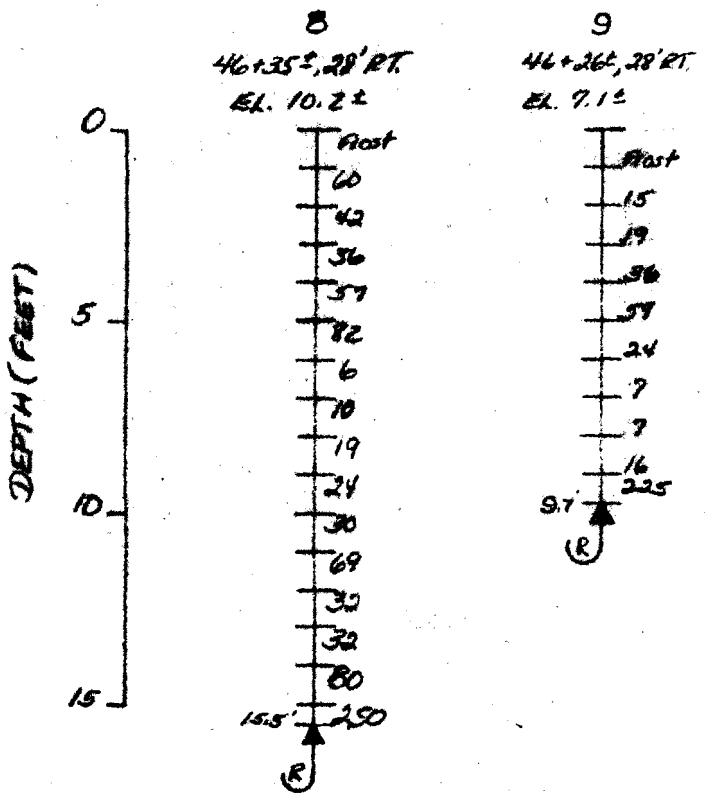


NOTE: EXPLORATIONS 4-9 ARE TAKEN FROM EXISTING ℄

SOILS EXPLORATIONS
WOOLWICH
26-1(48)

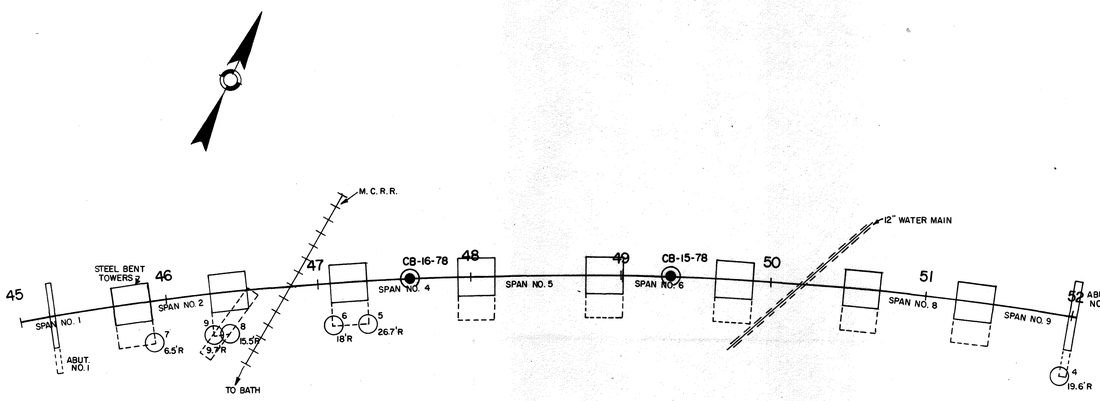
MARCH 1979

EXPLORATIONS 8 - 9

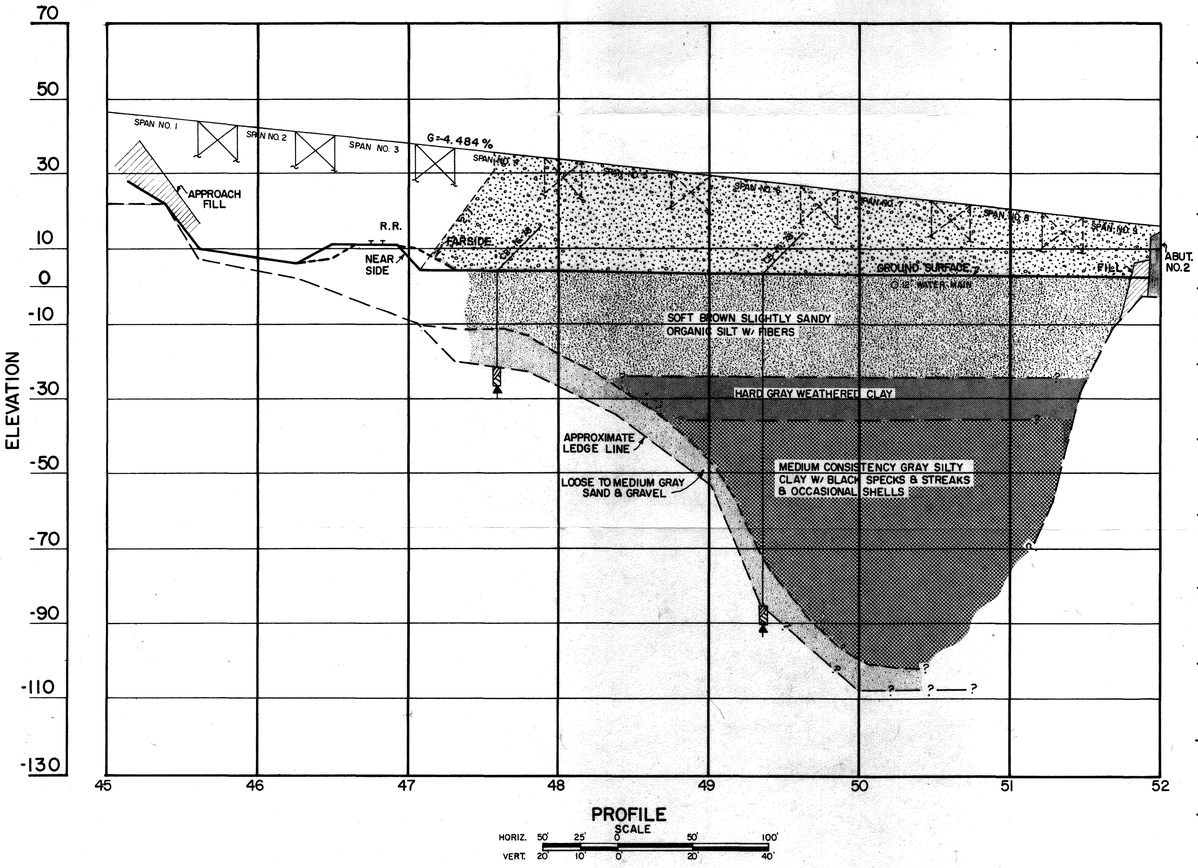


NOTE: EXPLORATIONS 8-9 are taken from existing ℄

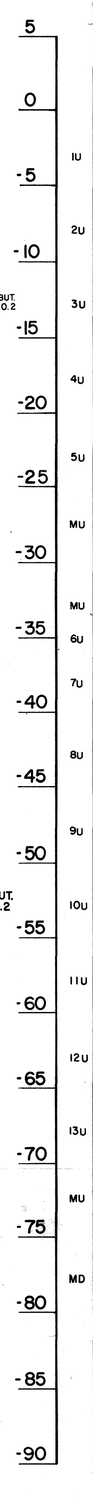
SOILS EXPLORATIONS
WOOLWICH
26-1 (48)



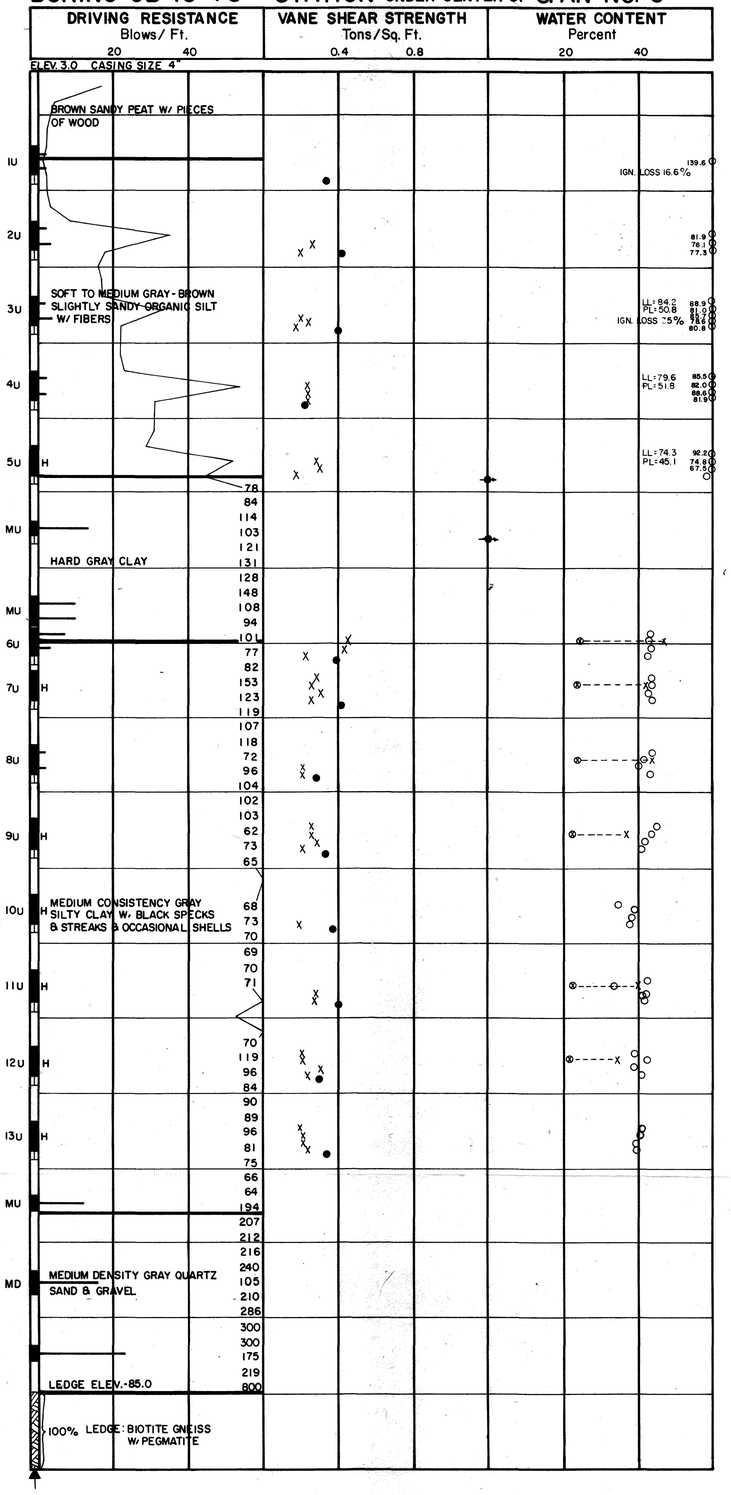
PLAN
SCALE
50' 25' 0 50' 100'



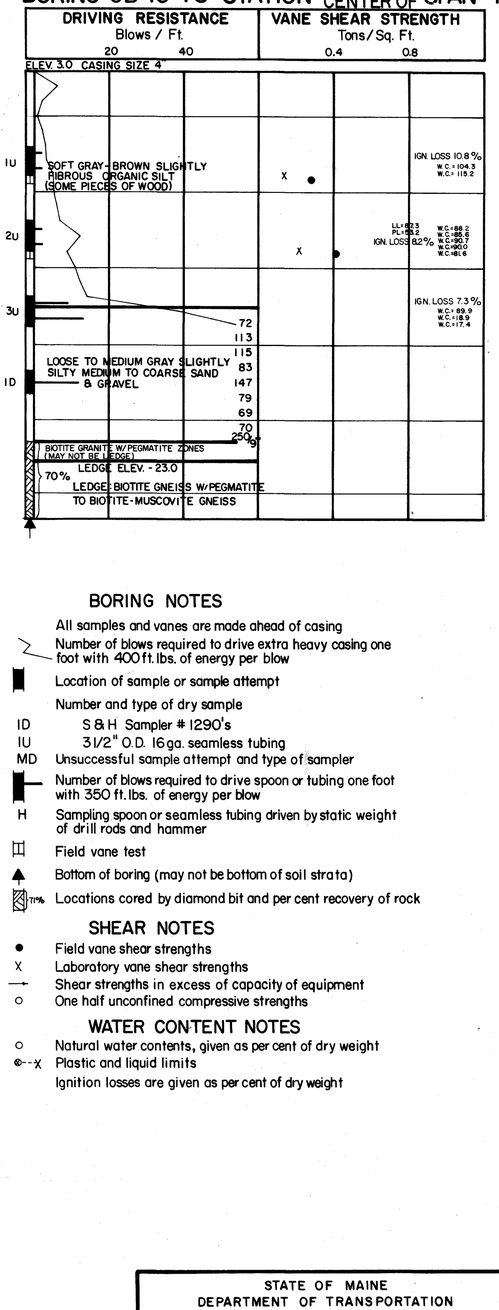
PROFILE
SCALE
HORIZ. 50' 25' 0 50' 100'
VERT. 20' 10' 0 20' 40'



BORING CB-15-78 STATION UNDER CENTER OF SPAN NO. 6



BORING CB-16-78 STATION UNDER CENTER OF SPAN 4



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
  - ID S & H Sampler # 1290's
  - IU 3 1/2" 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
- 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
- X Laboratory vane shear strengths
- → Shear strengths in excess of capacity of equipment
- ○ One half unconfined compressive strengths

WATER CONTENT NOTES

- ○ 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

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

ROUTE 1 BRIDGE
OVER
M. C. R. R. TRACKS
IN THE TOWN OF
WOOLWICH
SAGADAHOC COUNTY

FOUNDATION SURVEY

SHEET 7 OF 7 AUGUSTA, MAINE JAN. 1977

JANUARY 1968

203-1 2960