SACO RIVER AND CAMP ELLIS BEACH

SECTION 111 SHORE DAMAGE MITIGATION STUDY

APPENDIX D

GEOTECHNICAL DESIGN

US Army Corps
of Engineers®
New England District

Camp Ellis, Saco, ME
Section 111 Shore Protection
Geotechnical Design Appendix

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CAMP ELLIS, SACO, ME
SECTION 111 SHORE PROTECTION
GEOTECHNICAL DESIGN APPENDIX

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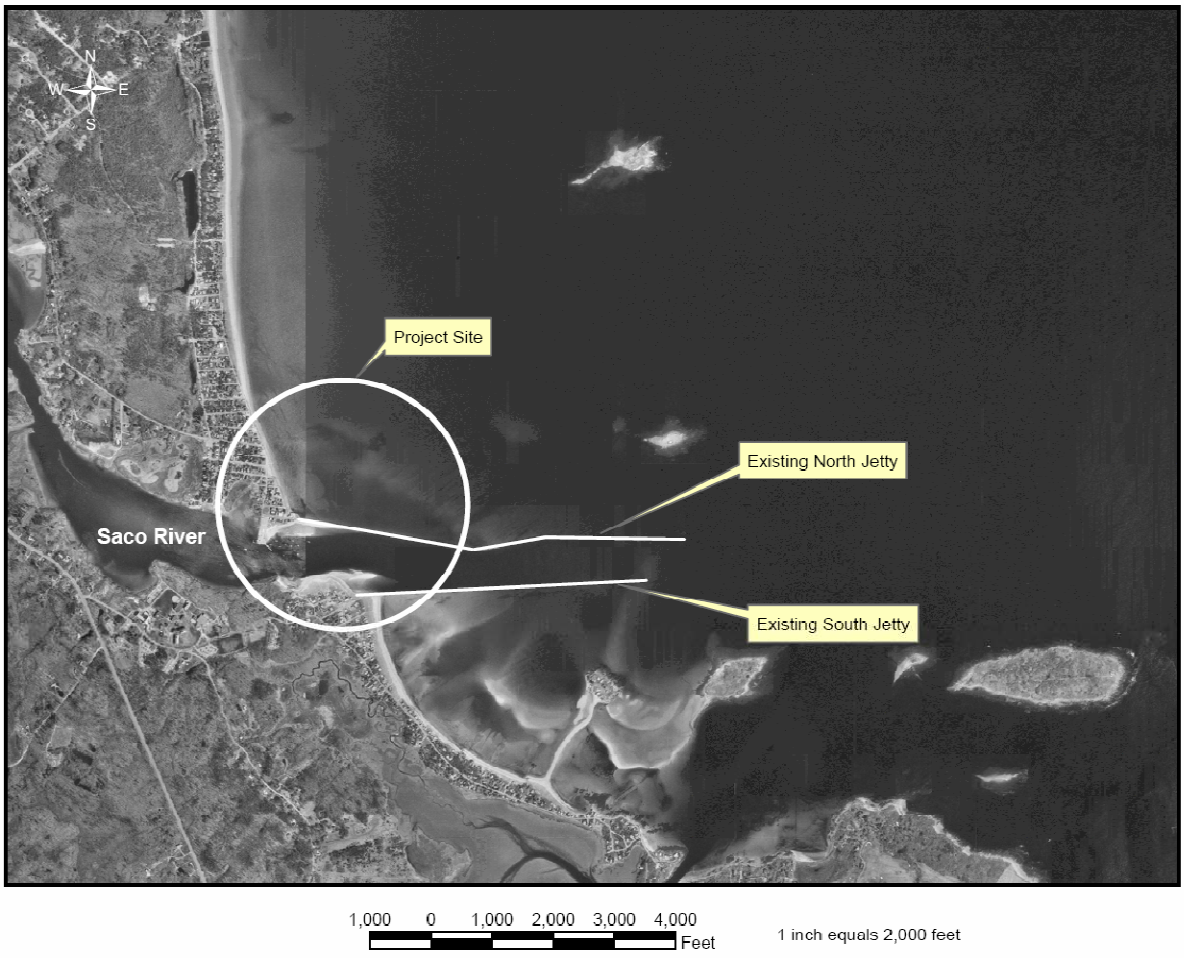
1. GEOTECHNICAL DESIGN

1.1 Project Information

1.1.1 Location

Camp Ellis Beach is located in Saco, Maine, about 16 miles south of Portland, Maine. The Saco River Federal Navigation Project consists of an 8-foot deep channel that varies from 100 to 200 feet wide. The channel is protected by a 4,800-foot long jetty to the south, and a 6,600-foot long jetty to the north. Camp Ellis Beach lies adjacent to the north jetty and extends 2,500 feet north to Ferry Beach.

Figure 1 – Location Map



1.1.2 Existing Problem

Coastal storms have caused severe shoreline erosion along Camp Ellis Beach and the loss of over 30 homes. At the request of the city of Saco, the New England District is conducting a study to find a remedy to this ongoing erosion. Alternative solutions are being analyzed using a computer model developed by Woods Hole Group under contract to the Corps. The model is examining the effects of structures, including jetty spurs, breakwaters and T-groins, on wave climate, currents and erosion.

There are currently two alternatives being given serious consideration; Alternative 6, which includes construction of a spur off of and perpendicular to the North Jetty, and Alternative 25A, which includes a smaller jetty spur and two detached near shore breakwaters. Both alternatives include beach nourishment in addition to the stone structures.

1.2 Explorations

1.2.1 General

A total of 20 foundation borings were performed offshore and on land at various locations throughout the project. A plan showing the locations of all of the borings, along with the Alternative 25A and Alternative 6 stone structures, is shown on Plates 1 and 2. The purpose of these borings was to determine subsurface conditions for the design of several different structural alternatives being considered for the protection of Camp Ellis Beach from future erosion.

Geologic profiles were created along five baselines as shown on Plates 1 and 2: along the centerline of the jetty spur (profile A), across the proposed jetty spur locations (profile B), along the centerline of the detached breakwaters (profile C), a profile extending from shore out to boring FD-05 to illustrate the variations in the geology, and Profile E, to illustrate subsurface changes in the offshore. The profiles are shown on Plates 4-9.

1.2.2 Foundation Materials

The general subsurface conditions encountered at the boring locations consist loose to medium dense SANDS with silt and gravel, over a compressible layer of organic SILT/CLAY and/or a layer of lean CLAY, underlain by a layer of medium dense/dense SAND with silt and gravel. The compressible silt/clay layers vary widely in thickness throughout the project site, as is shown on Plate 3. Detailed boring logs are shown in Attachment E.

Poorly Graded Sand with Silt to Silty Sand (SP to SM) – All of the borings encountered a sand layer at or near the mudline or ground surface. This layer was typically 2.0 to 5 feet thick, except near the north navigation jetty (10 ft thick) and on Camp Ellis Beach, where the layer was around 20 ft thick. The layer was typically mostly fine sand with 10-15% non-plastic fines. N-values in this layer ranged from 3 to 36 blows per foot (bpf).

Lean Clay (CL) – Fifteen of the twenty borings encountered a layer of lean clay below the poorly graded sand. This layer ranged in thickness from 4 to greater than 82 feet thick. The clay was thickest in borings performed closest to shore and on Camp Ellis Beach. Offshore borings conducted towards the north at the project site tended to encounter thicker layers of the clay, whereas borings towards the south of the project tended to have less of the lean clay (Profiles C, D, and E). N-values in this layer ranged from weight of rods/weight of hammer to 14 bpf with most of the N-values being weight of rods or weight of hammer for the full 24-inches of sample penetration. However, boring FD-11 encountered an 8 foot layer of lean clay which had N-values of 17-18, likely due to the presence of sand lenses within the clay matrix. Consolidation tests indicate that the material is slightly overconsolidated (OCR~2).

Sandy Organic Silt/Clay (OL/OH) – A layer of low to high plasticity sandy silt/clay with organics was encountered below the poorly graded sand in three borings performed near the north jetty (FD 04, FD-14 and FD-20). This layer was encountered at depths ranging from 9 to 13 feet below mudline and was 30 to 33 feet thick. This layer consisted of varying amounts of silt/clay and fine sand with peat fibers and shells. This layer was dark gray and had a strong marine organic odor. This may be sediment from the historic river channel, which cut through this area prior to

construction of the jetties. N-values in this layer ranged from weight of hammer to 7 bpf. Consolidation tests on this material indicate that it is slightly overconsolidated (OCR~2).

Well Graded Sand with Silt and Gravel to Silty Sand with Gravel (SW-SM) – This layer was encountered in seven of the twenty borings, typically below the organic silt/clay and lean clay layers, although three of the seven borings also had a layer of this material above the more compressible layers. This layer ranged from 23 to 43 feet thick. This layer consisted of well graded sand with about 10% to15% non-plastic fines. N-values in this layer ranged from 13 bpf to refusal.

Poorly Graded Sand with Silt (SP to SM) – This layer was encountered below the organic silt or lean clay in sixteen of the twenty borings. This layer ranged in thickness from 2 feet to 45 feet. Seven of the twenty borings were terminated in this layer. This layer varied from a fine sand with silt to a well-sorted sand with silt and gravel. N-values in this layer ranged from 7 to 61 bpf with typical values in the range of 10 to 25 bpf.

Refusal (Possible Bedrock) – Refusal was encountered in ten of the twenty borings. Refusal was encountered in the borings at depths ranging from 25 feet to 50 feet. Bedrock was not cored in any of the borings. Fragments of black rock were observed in the tip of the sampler or in the drill water return for six of the ten boring refusals.

1.2.3 Profiles

a) Profile A: Profile A, along the centerline of the Alternative 25A jetty spur, is shown on Plate 4. This profile includes borings FD-19 and FD-20. FD-20 encountered a 33 ft thick layer of organic silt/clay at a depth of 10 ft, underlain by a 33 ft layer of lean clay. However, FD-19 (100 ft away from the end of the proposed jetty spur) only encountered a 5 ft layer of lean clay at a depth of about 20 ft, and no organic silt. An undisturbed tube sample of the organic silt was taken at FD-20 (17-19 ft depth). Consolidation tests showed this material to be overconsolidated (OCR~2), which is expected as the original shoreline likely extended out past the location of FD 20 several hundred years ago. The approximate location of the shoreline in 1864 is shown on Plates 1-3.

b) Profile B: Profile B (Plate 5) includes a cross section of the proposed Alternative 6 and 25A jetty spurs. All three borings in this profile show a layer of medium dense sand about 10 ft thick, over a layer of low to high plasticity organic clay/silt of varying thickness. As noted above, a substantial layer of lean clay was encountered below the organic silt in FD 20. Lean clay was not encountered in FD 14; however, the boring was terminated prematurely, and may not have gone deep enough to encounter the lean clay layer, if it is in fact present at this location.

c) Profile C: Profile C is offset about 1,500 ft from and is roughly parallel to the shoreline, This profile extends through the approximate centerline of the two detached breakwaters of Alternative 25A (Plate 6). At boring FD-10, approximately 600 ft north of the northern detached breakwater, a significant layer of the lean clay was encountered (~55 ft). However, only a 5 ft layer of lean clay was encountered in FD-13, followed by a medium dense/dense sand with silt. At FD-17, near the southern end of the north breakwater, no clay was encountered; however, it may be that this boring did not extend far enough to encounter the clay layer, if it exists at this point. Further south, a layer of the lean clay was encountered at a depth of about 10 ft. This clay was much stiffer than the WOR/WOH clay encountered elsewhere, with N values of 17-18. The higher blow counts may have been due to the presence of thin sand layers in this clay.

d) Profile D: Profile D is located about 800 ft north of the northern detached breakwater of Alternative 25A (Plate 7). This profile illustrates the extensive layer of soft lean clay that exists throughout the northern extents of the project site. Offshore, the layer is 50-60 ft thick, and is overlain by a 5 ft thick layer of medium dense sand with silt. Boring FD-07, conducted on the beach, encountered a significantly thicker layer of lean clay, extending for at least 80 ft; the last 30 ft were significantly sandier, but still had low blow counts.

e) Profile E: Profile E extends from the shoreline out to boring FD-17 (Plate 8). Lean clay was encountered in borings FD-8 and FD-12, but not FD-17. However, comparing FD-17 to FD 12, it appears that FD-17 may not have extended far enough into the subsurface to encounter the lean clay, if it in fact exists at FD-17.

1.2.4 Laboratory Testing

A total of 191 split spoon samples and 8 undisturbed tube samples were collected. The split spoon samples were visually classified both in the field and in the lab - no other laboratory classification was performed on these samples.

For the 8 undisturbed tube samples collected, grain size analysis (sieve and hydrometer) and Atterberg limits were performed. With the exception of the sample collected at FD-20, all of the samples were classified as CLAY, with moderate to high plasticity (CL/CH). The sample collected at FD-20 was classified as an elastic sandy SILT (MH), although it should be noted that the Atterberg limit results plotted just above the "A" line in the plasticity chart, indicating that it is only marginally a silt. The grain size and Atterberg limits test results are included in Attachment A. The detailed lab reports are included as Attachment F.

In addition to the physical classification, consolidated undrained (CU) triaxial tests were performed on seven of the eight tube samples collected. The results of these tests are summarized in Attachment A.

Consolidation tests were performed on four of the eight samples. The results are analyzed in Attachment C, and presented in detail in Attachment F. The consolidation tests did show that the lean clay is moderately overconsolidated (OCR~2).

1.3 Structure Design

1.3.1 General

Basic configuration of the stone structure cross sections, side slopes of the armor stone, and the configuration of the toe berms was developed by Water Management Section, and is detailed in the Coastal Engineering Appendix. Typical sections are shown on Plates 9 through 13. Structures consist of two layers of armor stone, 2 layers of underlayer stone, and two layers of marine mattresses with a geotextile filter fabric that will be used as bedding underneath the stone.

1.3.2 Stone Gradations

In the coastal hydraulic analysis performed by the NAE Water Management Section (WMS), design wave heights were calculated for the two alternatives being considered (Alt. 25A and Alt. 6). The median weight W_{50} of armor stone and toe stone was calculated for the jetty spur head and trunk (Alt. 25A and 6), and the detached breakwaters (Alt. 25A). Per guidance in USACE (2006), the range of armor stone sizes is determined based on 75% to 125% of the median armor stone weight W_{50}. The median underlayer stone size is 10% of the median armor stone size; per USACE (2006), the range of underlayer stone sizes is determined based on 70% to 130% of the median underlayer stone weight W_{50}. Toe stone range is also

70% to 130% of the median toe stone weight W_{50}. Stone size ranges for each of the alternatives being considered is shown below. All stone sizes were rounded to the nearest 100 lbs. Tables 1 and 2 show stone size gradations for all armor and underlayer stone materials to be used.

Table 1 – Stone Sizes for Alternative 25A

	Location where used	W_{50} (lbs)	Range (lbs) Min	Max
Armor Stone I	Breakwater Trunk	14,000	10,500	17,500
Armor Stone II	Breakwater Head	17,500	13,200	21,900
Armor Stone III	Jetty Spur Trunk, Exist. Jetty Reinforcement	20,500	15,400	25,700
Armor Stone IV	Jetty Spur Head	25,700	19,300	32,200
Toe Stone I	Breakwaters and Exist. Jetty Reinforcement	4,500	3,200	5,900
Toe Stone II	Jetty Spur	5,500	3,900	7,200
Underlayer Stone I	Breakwater Trunk	1,400	900	1,800
Underlayer Stone II	Breakwater Head, Jetty Spur Trunk	1,800	1,300	2,400
Underlayer Stone III	Jetty Spur Head	2,600	1,800	3,400

Table 2 – Stone Sizes for Alternative 6

	Location where used	W_{50} (lbs)	Range (lbs) Min	Max
Armor Stone III	Jetty Spur Trunk, Exist. Jetty Reinforcement	20,500	15,400	25,700
Armor Stone IV	Jetty Spur Head	25,700	19,300	32,200
Toe Stone I	Exist. Jetty Reinforcement	4,500	3,200	5,900
Toe Stone II	Jetty Spur	5,500	3,900	7,200
Underlayer Stone II	Jetty Spur Trunk	1,800	1,300	2,400
Underlayer Stone III	Jetty Spur Head	2,600	1,800	3,400

All stone structures will be constructed on marine mattresses placed directly on the sea bottom. Marine mattresses are discussed in more detail in later sections.

1.3.3 Marine Mattresses

Marine mattresses are rock-filled containers constructed of high-strength geogrid as shown in Photo 1. Geogrid panels are laced together to form mattress-shaped baskets that are filled with small stones similar to construction of gabions. The Triton Marine Mattress System was developed by the Tensar Corporation, but the system is not patented, and the mattresses could be constructed using similar geogrid products from another manufacturer.

Typical width for a single marine mattress is 5 ft, with a thickness of 12 inches. Mattresses can be varying lengths up to 35 ft. Assuming the stone fill has a volumetric weight of about 110 lb/cu ft, a 35-ft long, 5-ft-wide, 1-ft-thick mattress weighs approximately 9.6 tons. Mattresses are assembled and filled on land using a vertical form (Photo 2 and 3), and then picked up on one end for placement (Photo 4). The high-strength geogrid has sufficient strength to permit rock-filled mattresses up to 35 ft in length to be hoisted from one end for placement at the project site. The cellular construction of the mattress using internal diaphragms maintains the uniform thickness of the stone fill material during the lifting and placement operations (Photo 3). Once constructed, completed mattresses can be stacked until ready to be transported to the project site via barge or flatbed truck (Photo 5).

Photo 1 – Closeup of filled mattress

Photo 2 – Form used to fill mattresses on land

Photo 3 – View from top of form showing internal web structure of mattress

Photo 4 – Hoisting filled mattress for placement

Photo 5 – Completed mattresses stacked prior to being placed

Marine mattresses were chosen for the breakwater and jetty design in lieu of traditional bedding stone for the following reasons:

a) The jetty spur and breakwaters are to be constructed in relatively shallow water. Traditional bedding stone would be subject to wave energy at low tide, making it very difficult to consistently place and spread bedding stone prior to placement of underlayer and armor stone. It is expected that much of the placed stone would be dispersed by wave energy before the larger stone layers could be placed. Marine mattresses can be placed much more accurately and effectively, and will be able to withstand limited exposure to wave energy until the underlayer and armor stones are placed.

b) For the proposed spur and breakwater design, several layers of varying sizes of bedding stone would be required to provide adequate filters between the armor stone and the sandy seabed in the project area. Geotextile fabric would likely be required to meet filter criteria, and it is impractical to install geotextile on a seabed in a high energy wave environment. Using marine mattresses, a nonwoven geotextile fabric can be attached to the bottom of each mattress to be placed directly on the seabed, providing filtering and stability (Photo 6). Geotextile will probably have an AOS of 70; this will be determined during final design phase.

c) The presence of two layers of marine mattresses will provide structure stability, and may help reduce expected settlement by distributing loads more evenly.

Photo 6 – Geotextile fabric attached to bottom of mattress

1.3.4 Settlement

Consolidation settlement of compressible foundation layers due to construction of Alternative 25A and 6 jetty spur, as well as the Alternative 25A detached breakwaters was determined. The process involved calculating the stress increase in the foundation clay materials due to construction of the stone structures. The calculated stress increase was used, along with laboratory test data, to calculate the expected settlement . The maximum expected settlement underneath the Alt. 25A and Alt. 6 jetty spurs is **0.6 ft**. For the south breakwater, maximum settlement is expected to be **0.3 ft**, and under the north breakwater **0.2 ft**. This magnitude of settlement is not expected to significantly affect long-term stability of the stone structures, as the armor stones will move and reconfigure themselves as the structure settles. Additionally, the long-term loss of up 0.6 ft of crest elevation should not significantly diminish the intended function of the structures.

Detailed calculations are shown in Attachments B and C.

1.3.5 Stability Analysis

Slope and foundation stability for the Alternative 25A and 6 jetty spur and the Alternative 25A detached breakwaters were evaluated using the Geostudio SLOPE/W 2007 program. Structures were evaluated for stability for two cases: immediately post-construction (undrained case), and the fully drained (long-term) case where excess pore water pressures have fully dissipated.

There is currently no USACE criteria for foundation or slope stability for rubblemound structures. Minimum factors of Safety for Rock Fill Dams are given in EM1110-2-1902 (USACE, 2003) and are shown in Table 4 below:

Table 4: Minimum Required Factors of Safety: New Earth and Rock Fill Dams (After USACE, 2003)

Analysis Condition	Required Minimum Factor of Safety
Post Construction (Undrained)	1.3
Long Term (Fully Drained)	1.5

It is noted that the proposed breakwaters at Camp Ellis serve a different function than a rock fill dam, and that a stone breakwater can withstand significantly more deformation than an earth and rock fill dam and still function adequately. These minimum factors of safety were used as a starting point for the design of the stone breakwaters, with the understanding that they may be somewhat conservative when applied to a stone breakwater.

Table 5 below shows a summary of the stability analysis runs with calculated factors of safety. Details of the analysis, along with resultant failure circles are shown in Attachment D on the Plates indicated.

Table 5 – Summary of SLOPE/W Runs

Structure	FS[2]	Failure Mode	Plate
Fully Drained Long-Term Case (min. FS=1.5)			
Jetty Spur[1] Head	1.9	Failure in elastic silt	D-4
Jetty Spur Trunk	1.8	Failure in elastic silt	D-5
North Breakwater Head (N. End)	1.6	Failure in clay	D-10
North Breakwater Head (S. End)	1.9	Shallow failure in sand	D-17
North Breakwater Trunk (N. End)	**1.4**	**Failure in clay**	**D-12**
North Breakwater Trunk (S. End)	1.7	Shallow failure in sand	D-15
South Breakwater Head	1.9	Shallow failure in sand	D-19
South Breakwater Trunk	1.6	Shallow failure in sand	D-21
Post Construction Undrained Case (min. FS=1.3)			
Jetty Spur Head	1.3	Failure in elastic silt	D-6
Jetty Spur Trunk	1.3	Failure in elastic silt	D-7
North Breakwater Head (N. End)	1.4	Failure in clay	D-11
North Breakwater Head (S. End)	1.9	Shallow failure in sand	D-18
North Breakwater Trunk (N. End)	**1.2**	**Failure in clay**	**D-13**
North Breakwater Trunk (S. End)	1.7	Shallow failure in sand	D-16
South Breakwater Head	1.5	Failure in clay	D-20
South Breakwater Trunk	1.5	Failure in clay	D-22

[1] Jetty spur calculations apply to the Alt. 6 and Alt. 25A jetty spurs.

[2] Factor of Safety values calculated using Morgenstern-Price Method

For most cases, the calculated factors of safety against foundation failure were equal to or above the minimum required by EM1110-2-1902. The exception was the north breakwater trunk section, where the calculated factors of safety were marginally less than the minimum required. This is not of significant concern, in view of the conservative shear strength parameters used and the fact that the criteria for

embankment dams are more rigid than for a rubble mound breakwater; a breakwater can withstand more deformation than an embankment and still function well. The presence of a toe berm on both sides of the structure generally increased stability and resistance to foundation failure, as is seen in the results for the north head section, where the calculated FS were higher than for the trunk section. Additionally, marine mattresses will be placed under all structures to provide additional stability and foundation support. Note that marine mattresses contribution to stability was conservatively ignored in these analyses.

2. CONSTRUCTION CONSIDERATIONS

It is expected that the majority of the construction will be performed from spud barges with cranes. Marine mattresses can be manufactured offsite, possibly in nearby Portland Harbor, and transported to the site via barge. All stone materials will also be transported to the site via barge. The Town Dock at Saco will be used primarily for shuttling personnel to the work site; given the dense residential area, it is unlikely that the existing roads will be able to handle the high volume of truck traffic that would be needed to transport materials to the site, and it is uncertain if the dock could support heavy loads of stone and other materials.

Mattresses will be placed in two layers; the mattresses in the first layer will be placed perpendicular to the mattresses in the second layer in order to provide additional stability. It is expected that a maximum of 100 linear feet of mattress will be allowed to be placed before the underlayer and armor stone must be placed on top. Preliminary investigations show that there are quarries nearby that will be able to provide all necessary stones; it is suggested that a Geologist and Geotechnical Engineer from NAE do a more thorough investigation of nearby quarries during final design.

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Camp Ellis, Saco Maine Shoreline Protection
Profile Baselines
(Alternative 25A Shown)

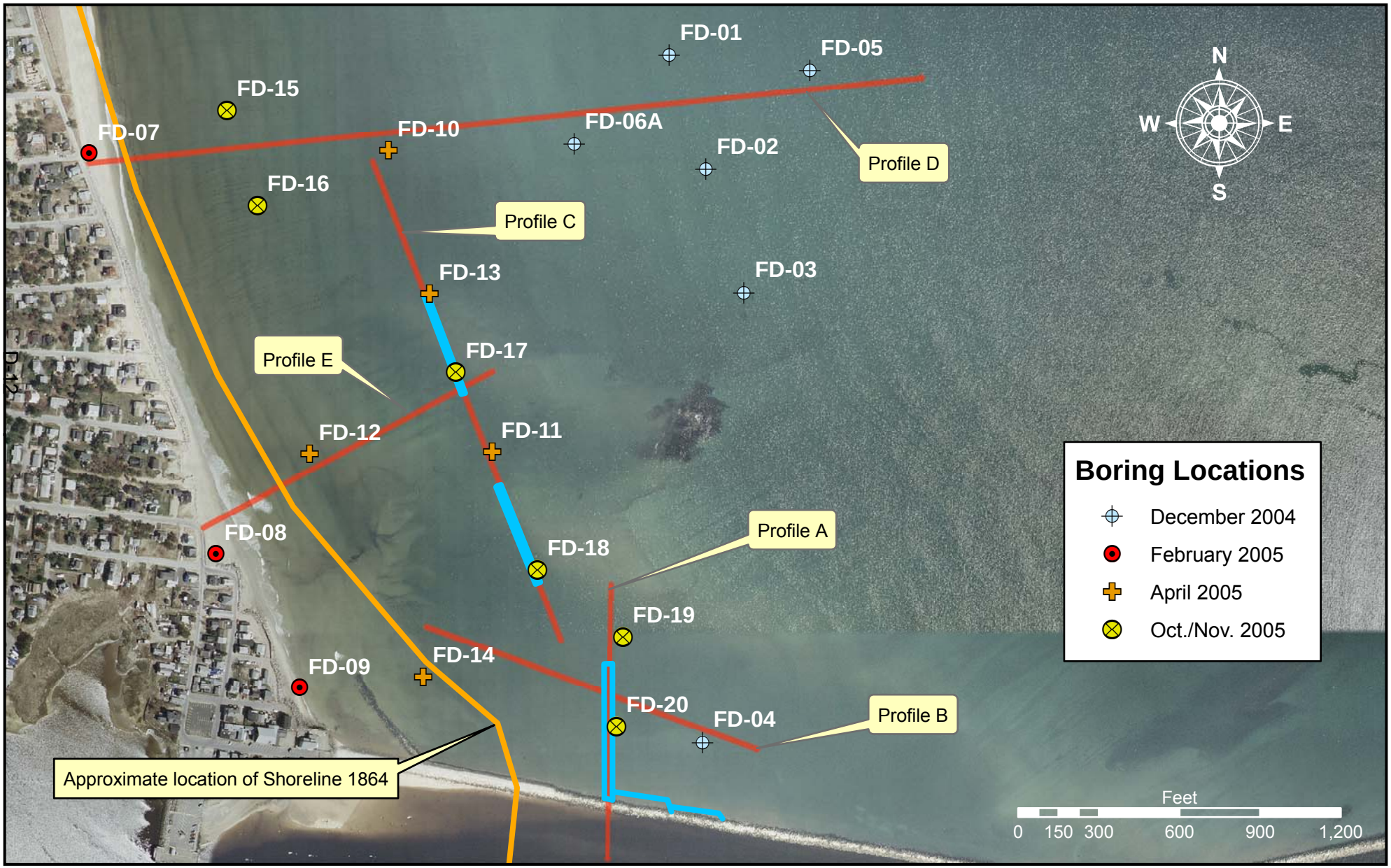


PLATE 1

US Army Corps of Engineers®
New England District

Camp Ellis, Saco Maine Shoreline Protection
Profile Baselines
(Alternative 6 Shown)

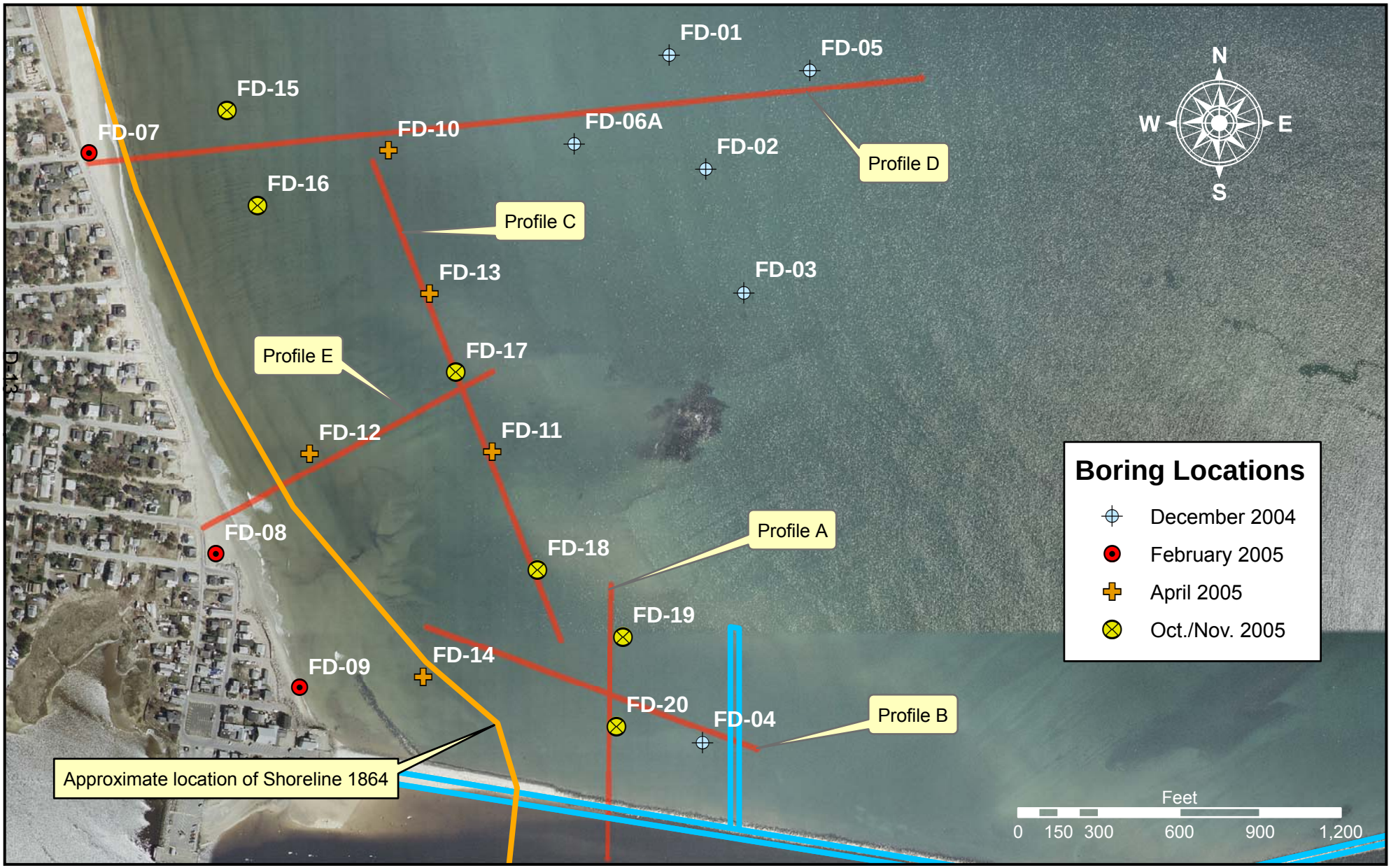


PLATE 2

2. Calculate consolidation settlement for each compressible layer underneath the jetty spur.

a) To calculate settlement in overconsolidated clays, Holtz and Kovacs presents the following equations:

$$If \quad \sigma'_{vo} + \Delta\sigma_v < \sigma'_p$$

$$S_c = \frac{C_r H_o}{1+e_o} \log \frac{\sigma'_{vo} + \Delta\sigma_v}{\sigma'_{vo}}$$

$$If \quad \sigma'_{vo} + \Delta\sigma_v > \sigma'_p$$

$$S_c = \frac{C_r H_o}{1+e_o} \log \frac{\sigma'_p}{\sigma'_{vo}} + \frac{C_c H_o}{1+e_0} \log \frac{\sigma'_{vo} + \Delta\sigma_v}{\sigma'_p}$$

Where
H_o= initial depth of compressible layer
e_o=initial void ratio
σ'_{vo}=initial vertical effective stress at center of compressible layer
$\Delta\sigma_v$= stress increase at center of compressible layer due to breakwater construction
σ_p' = maximum past pressure (from Casagrande construction)
C_r,C_c=coefficients of recompression and virgin compression

At the middle of the silt layer, directly below the centerline of the foundation z=26.5 ft BGS,

depth z_{sand}=10 ft, depth z_{silt}=16.5 ft.

γ_{sand}=125 pcf, γ_{silt}=115 pcf

$$\sigma'_{vo} = (\gamma_{sand} - \gamma_{water}) \bullet z_{sand} + (\gamma_{silt} - \gamma_{water}) \bullet z_{silt}$$

$$\sigma'_{vo}=(125-64)\times 10+(115-64)\times 16.5$$

$$\sigma'_{vo}= 1.45 \text{ ksf}$$

As calculated previously, the change in vertical stress due to the jetty spur construction at a depth of z=26.5 ft BGS is:

$$\Delta\sigma_v= 1.78 \text{ ksf}$$

$$\sigma'_{vo}+\Delta\sigma_v= 3.23 \text{ ksf} > \sigma_p'=2.80 \text{ ksf}$$

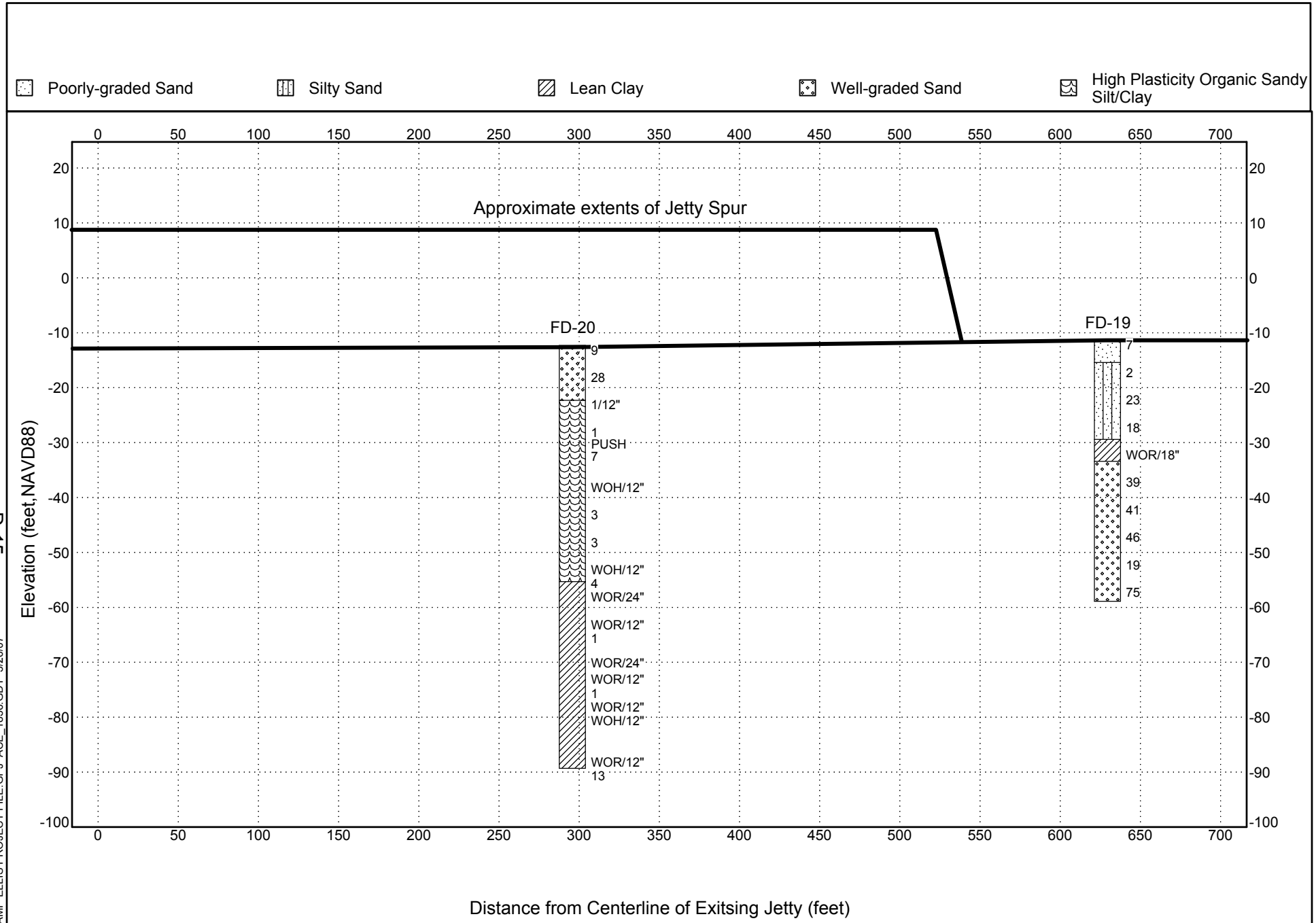
Therefore, settlement in the silt layer is calculated by:

$$S_c = \frac{C_r H_o}{1+e_o} \log \frac{\sigma'_p}{\sigma'_{vo}} + \frac{C_c H_o}{1+e_0} \log \frac{\sigma'_{vo} + \Delta\sigma_v}{\sigma'_p}$$

e_o=1.22, H_o=33 ft

$$S_c = \frac{0.033\times 33}{1+1.22} \log \frac{2.8}{1.45} + \frac{0.38\times 33}{1+1.22} \log \frac{1.45+1.78}{2.80}$$

$$S_{c\ (silt)}=0.49 \text{ ft}$$

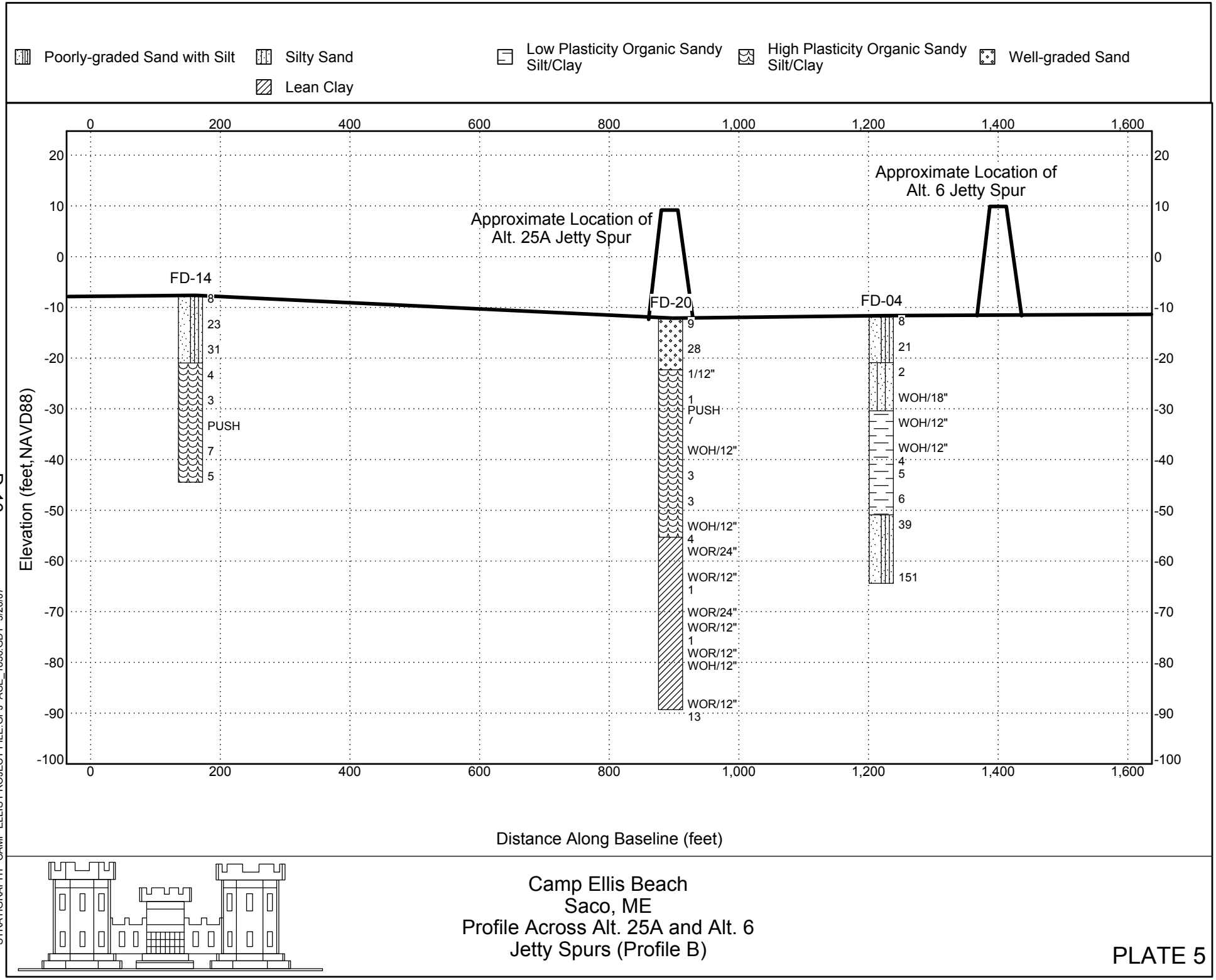


D-15

STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 3/26/07

Camp Ellis Beach
Saco, ME
Profile Along Centerline of Alt. 25A Jetty Spur
(Profile A)

PLATE 4

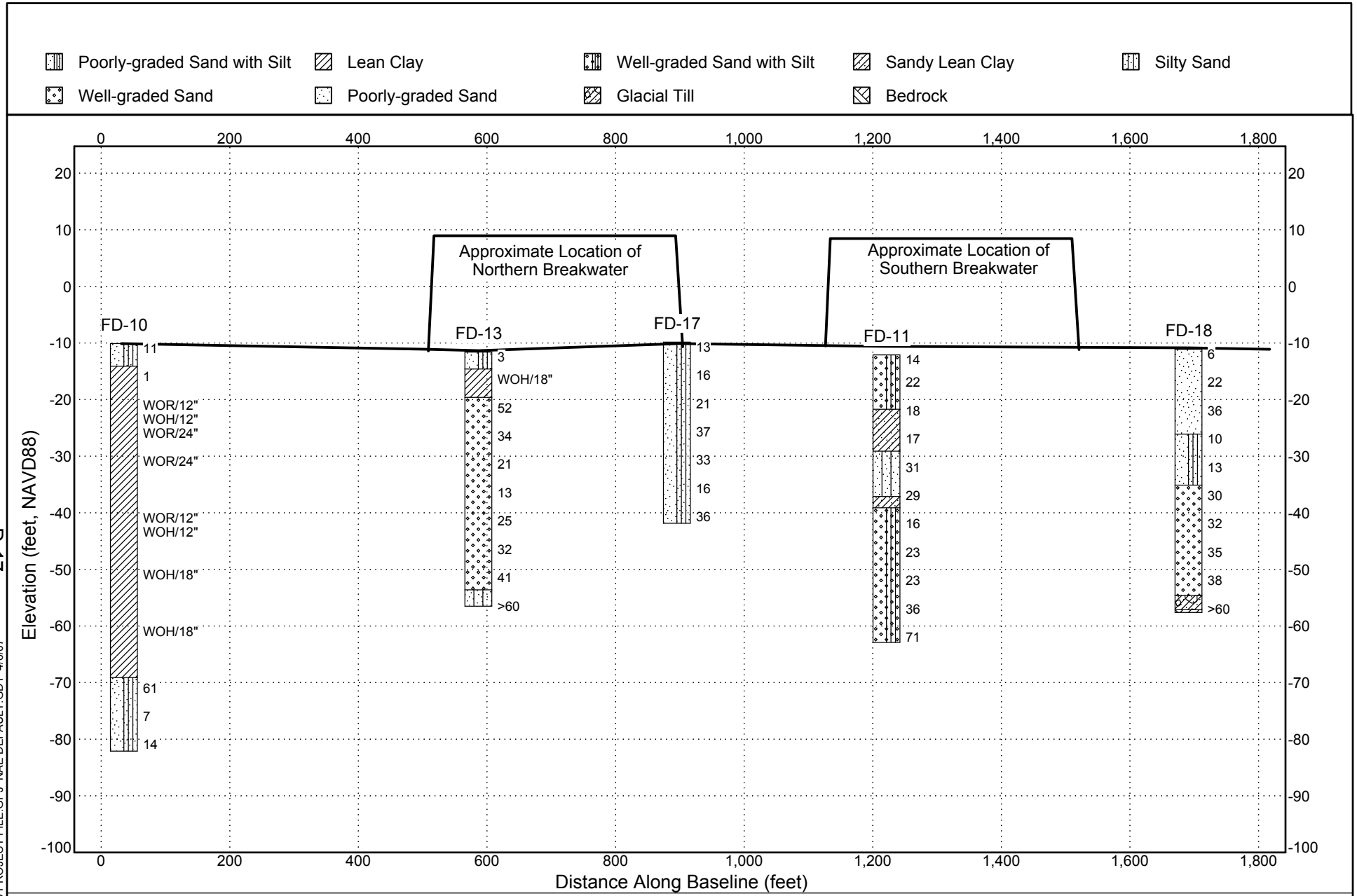


D-16

STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 3/26/07

Camp Ellis Beach
Saco, ME
Profile Across Alt. 25A and Alt. 6
Jetty Spurs (Profile B)

PLATE 5

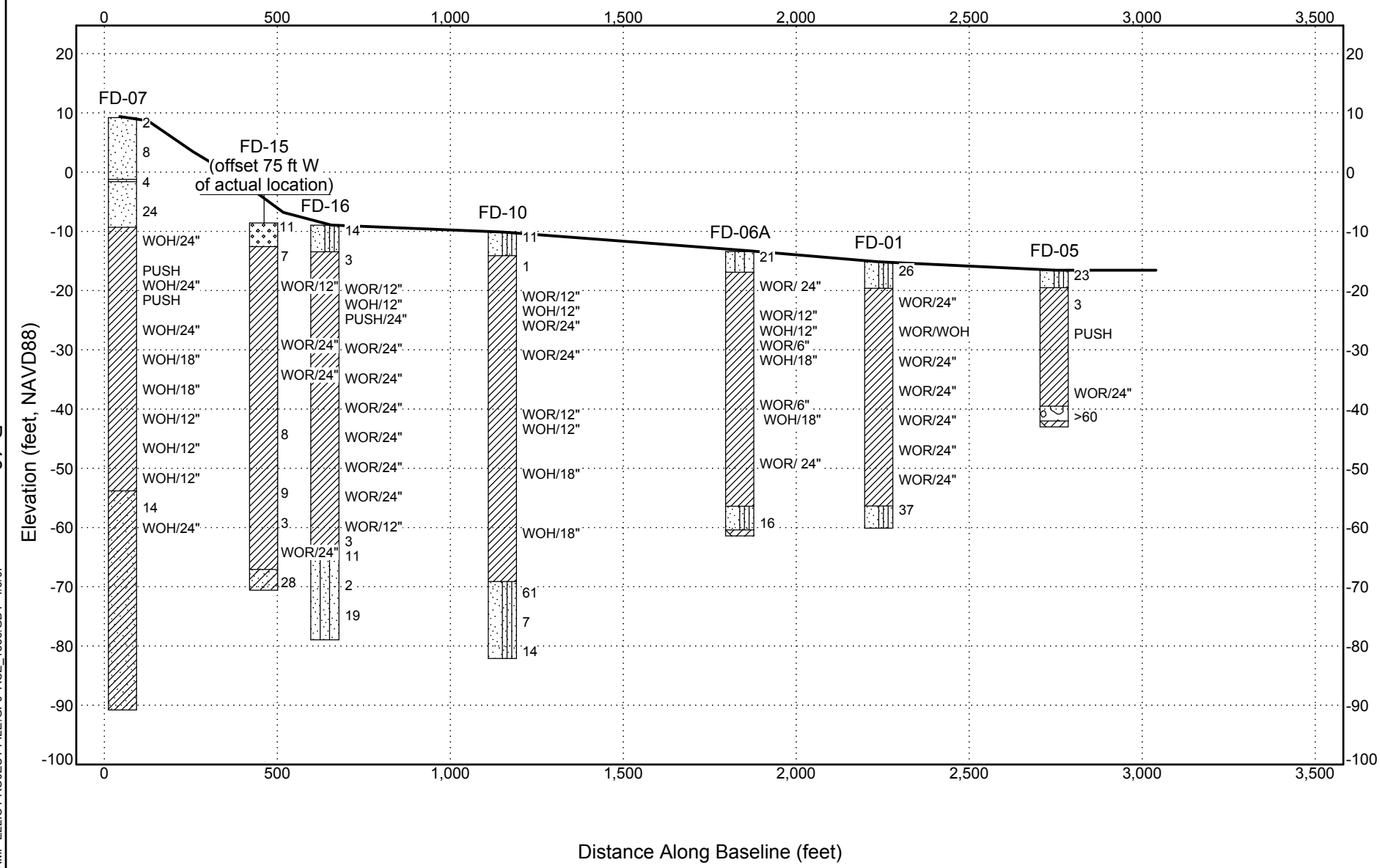


Camp Ellis Beach
Saco, ME
Profile Along Centerline of
Detached Breakwaters (Profile C)

PLATE 6

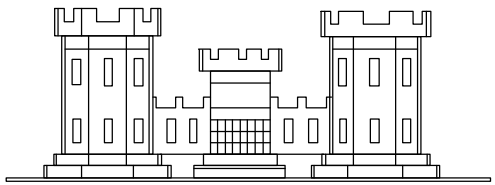
Poorly-graded Sand with Silt | Lean Clay | Poorly-graded Gravel | Bedrock | Silty Sand

Poorly-graded Sand | Peat | Sandy Lean Clay | Well-graded Sand | Clayey Sand



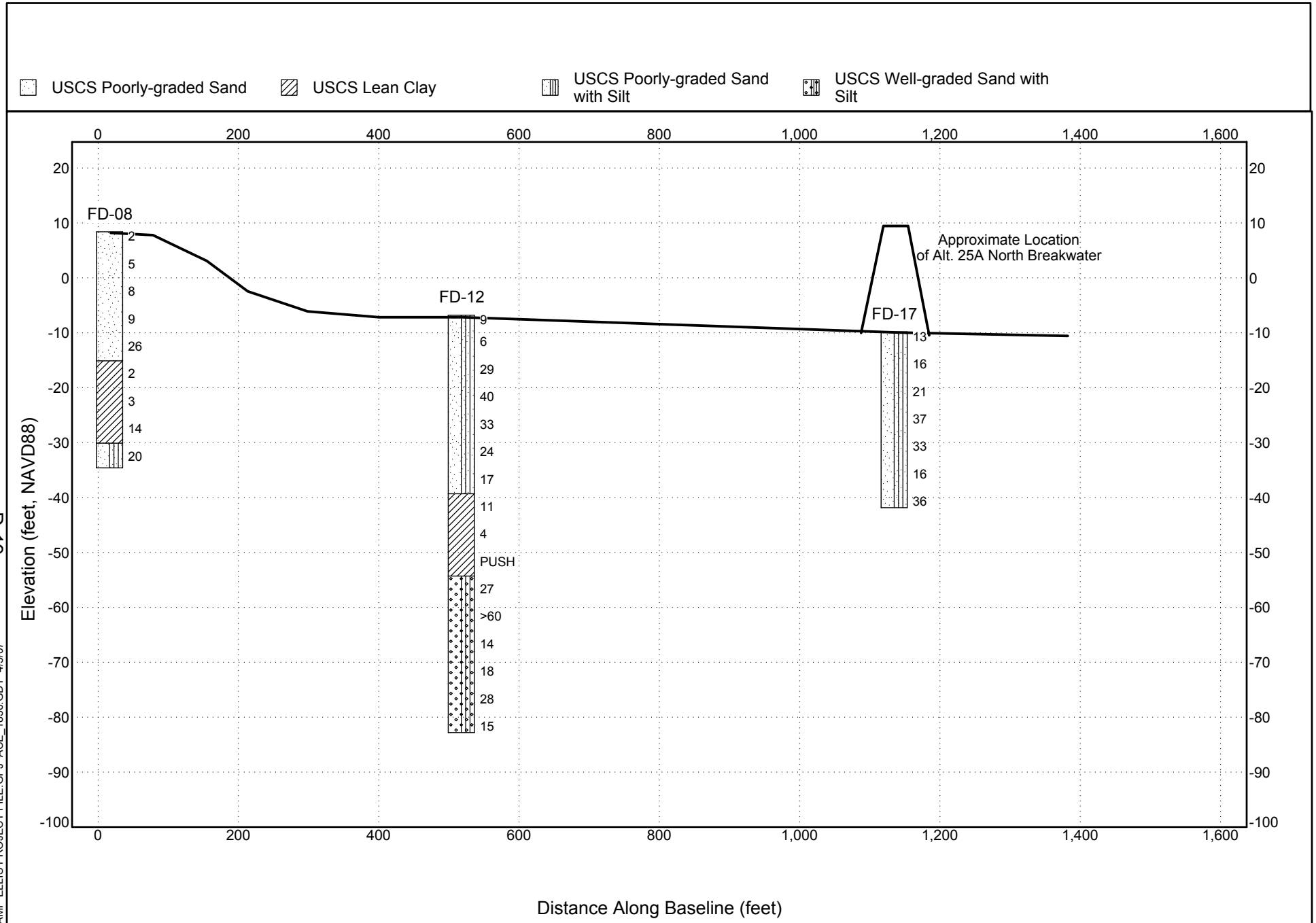
D-18

STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 4/6/07



Camp Ellis Beach
Saco, ME
Profile D

PLATE 7

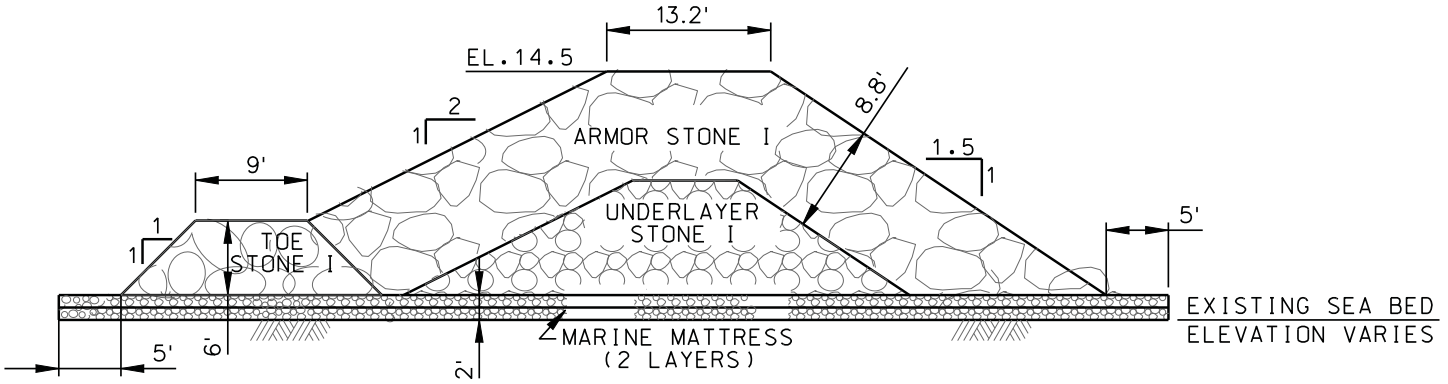


Camp Ellis Beach
Saco, ME
Profile E

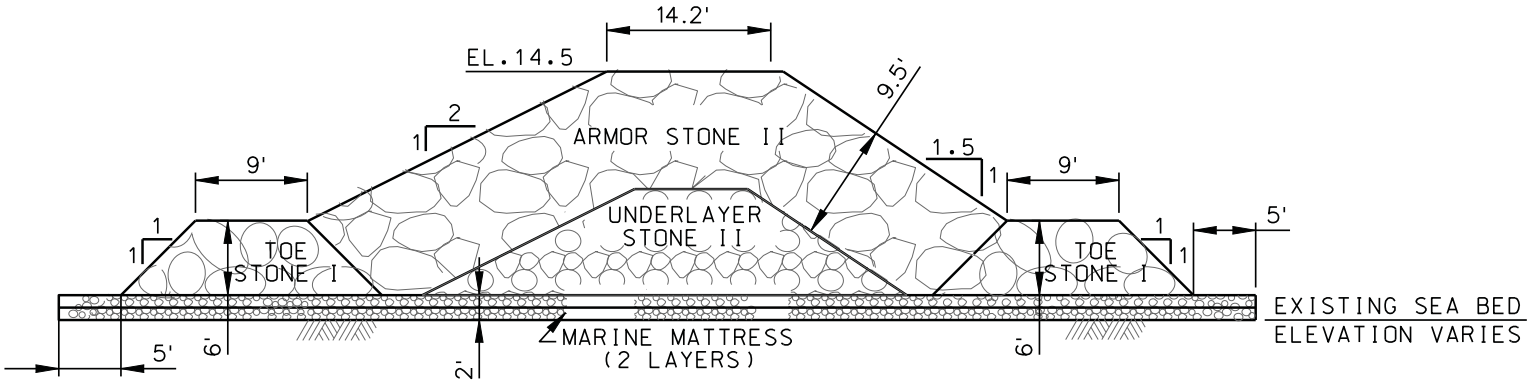
PLATE 8

D-19

STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 4/5/07



ALTERNATE 25A
SECTION-(BREAKWATERS # 1 AND # 2- TRUNK)



ALTERNATE 25A
SECTION-(BREAKWATERS # 1 AND # 2- HEAD)

GRAPHIC SCALE:
10 0 10 20

US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

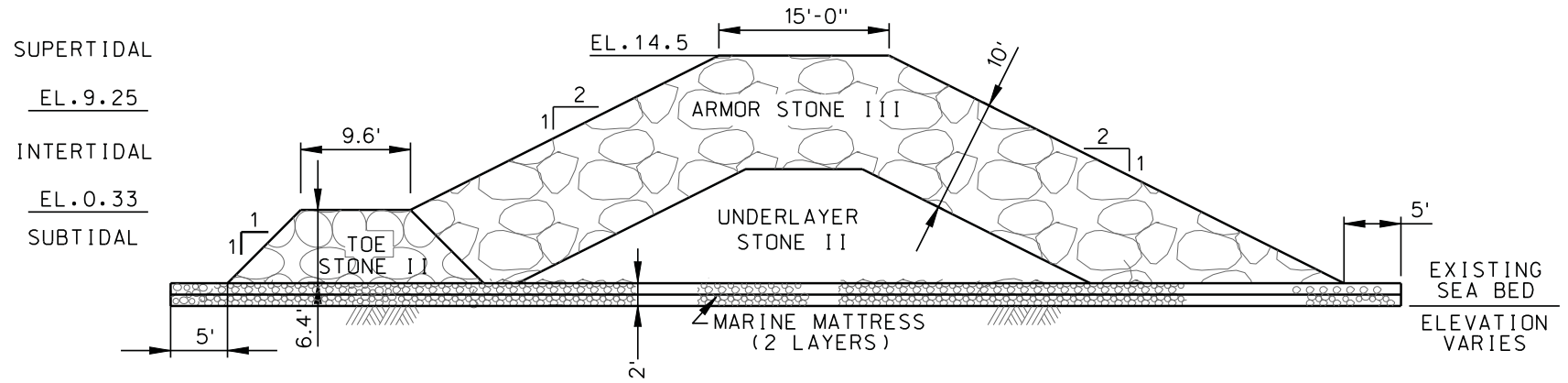
BREAKWATER
SACO, MAINE

ALTERNATIVE 25A AND 2
SECTIONS-BREAKWATER S#1

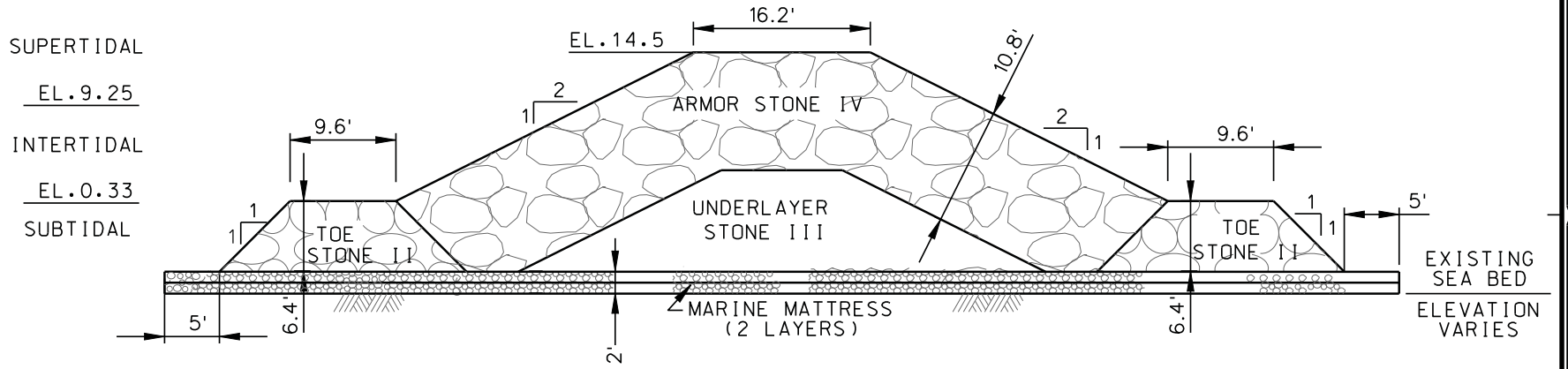
SHEET IDENTIFICATION NUMBER
C-301

D-20

PLATE 9



ALTERNATE 25A
SECTION-(SPUR TRUNK)



ALTERNATE 25A
SECTION-(SPUR HEAD)

GRAPHIC SCALE:
10 0 10 20

US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

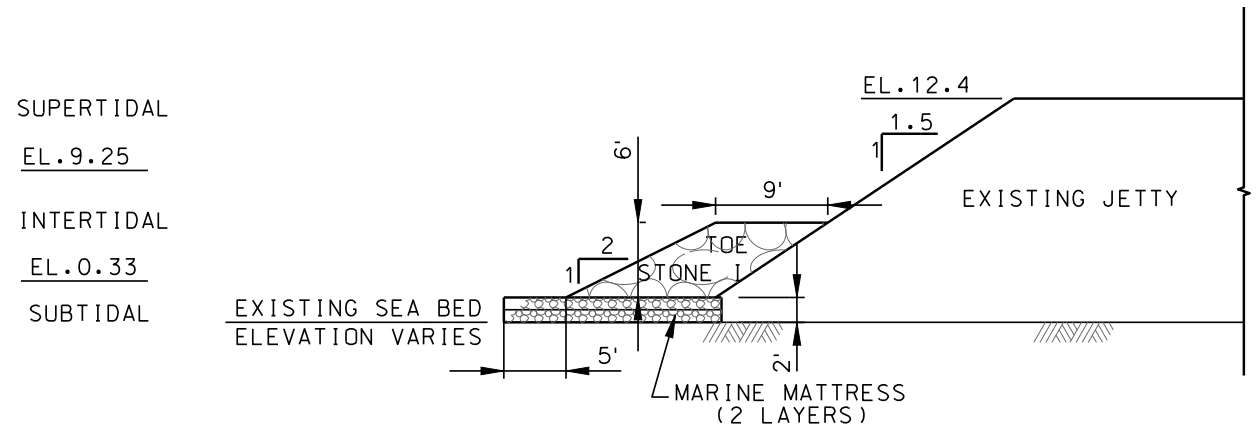
BREAKWATER
SACO, MAINE

ALTERNATIVE 25A
SECTIONS-SPUR

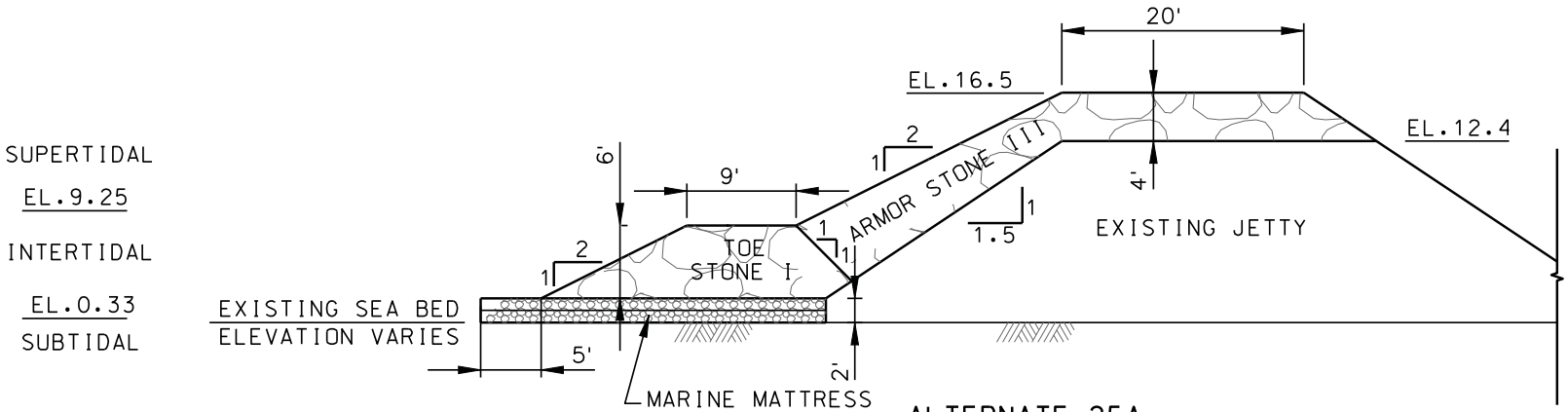
SHEET IDENTIFICATION NUMBER
C-302

D-21

PLATE 10



ALTERNATE 25A
SECTION-NORTH JETTY
(TOE REINFORCEMENT)



ALTERNATE 25A
SECTION-NORTH JETTY
(ARMOR REINFORCEMENT)

GRAPHIC SCALE:
10 0 10 20

US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

DESIGNED BY: B. P.
DRWN BY: A.W.C
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE:
FILE NAME: ESHYC-303.DGN
SIZE: ARCH B
SCALE: 1"=10'-0"
PLOT DATE: 7/14/2010

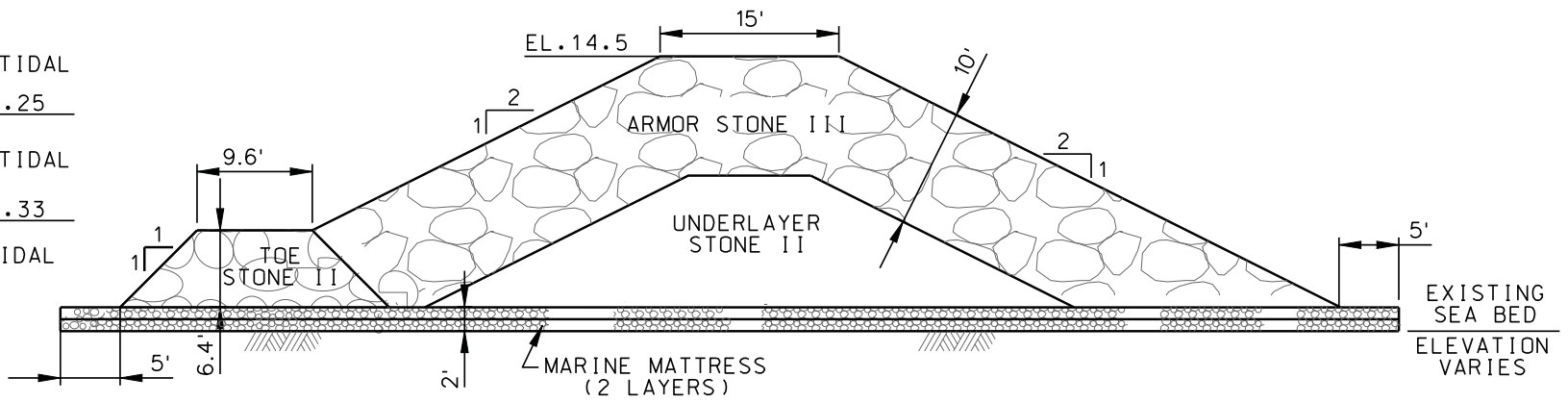
BREAKWATER
SACO, MAINE

ALTERNATIVE 25A
SECTIONS-NORTH JETTY

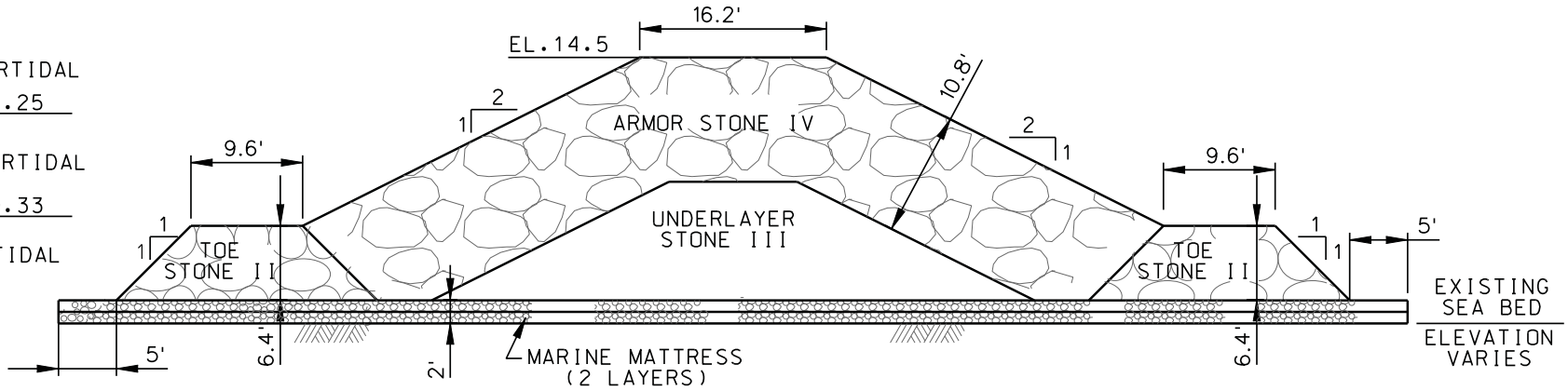
SHEET IDENTIFICATION NUMBER
C-303

D-22

PLATE 11



ALTERNATE 6
SECTION-(SPUR TRUNK)



ALTERNATE 6
SECTION-(SPUR HEAD)

GRAPHIC SCALE:
10 0 10 20

US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

DESIGNED BY: B. P.
DRN BY: A.W.C.
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE:
FILE NAME: SBWC-304.DGN
SCALE: 1"=10'-0"
PLOT DATE: 7/14/2010
SIZE: ANSI B

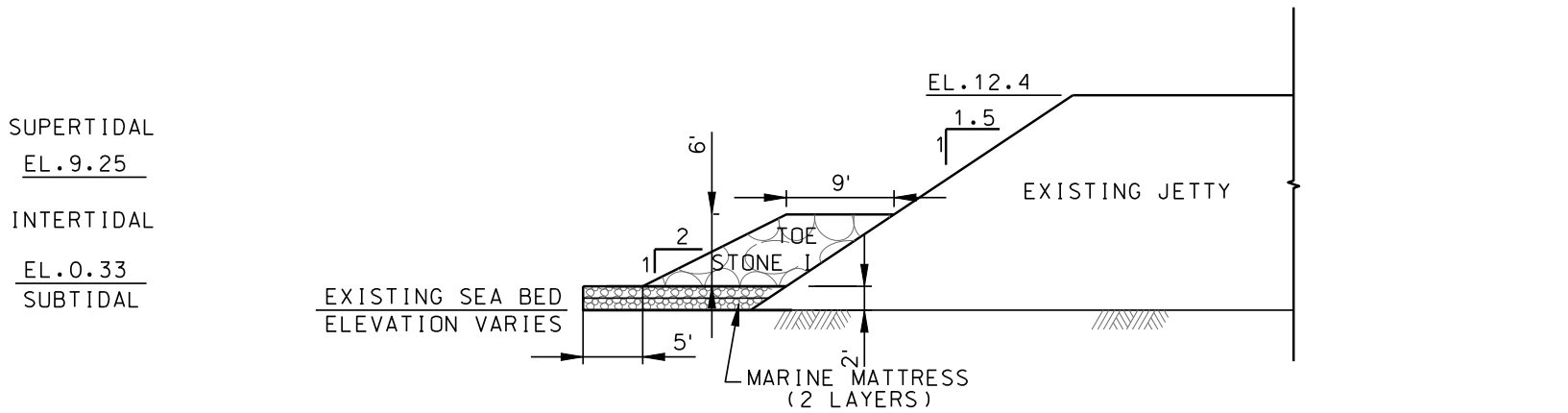
BREAKWATER
SACO, MAINE

ALTERNATIVE 6
SECTIONS-SPUR

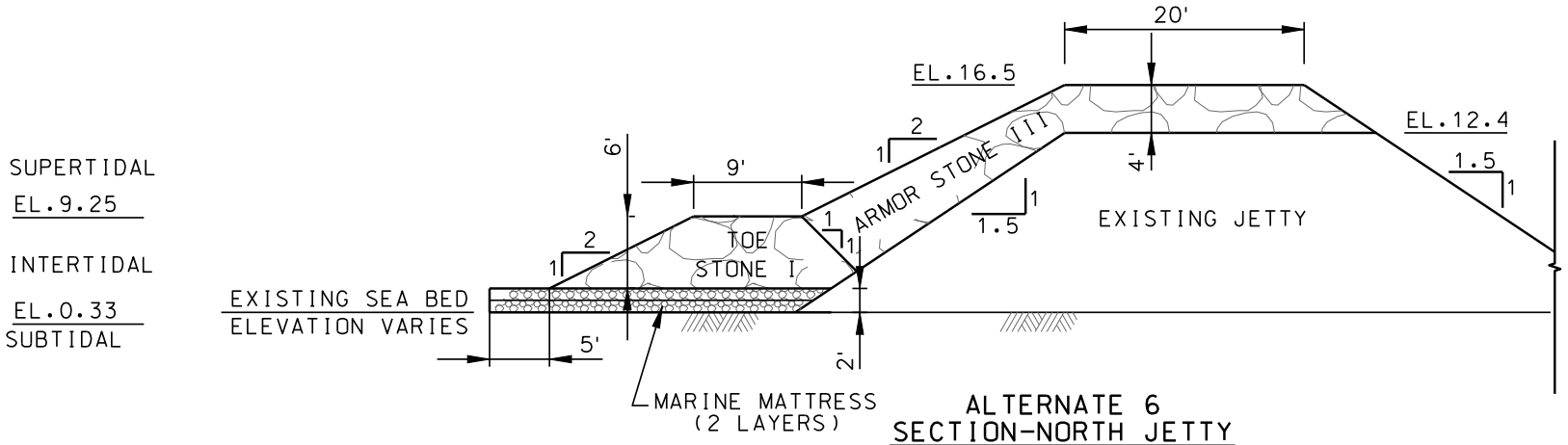
SHEET
IDENTIFICATION
NUMBER
C-304

D-23

PLATE 12



ALTERNATE 6
SECTION-NORTH JETTY
(TOE REINFORCEMENT)



ALTERNATE 6
SECTION-NORTH JETTY
(ARMOR REINFORCEMENT)

GRAPHIC SCALE:
10 0 10 20

US ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS

DESIGNED BY: B. P.
DRN BY: A.W.C.
CKD BY:
SUBMITTED BY:
DATE:
SOLICITATION NO.:
CONTRACT NO.:
DRAWING CODE:
FILE NAME: 05NHC305.DGN
SCALES: AS NOTED
PLOT DATE: 7/14/2010

BREAKWATER
SACO, MAINE

ALTERNATIVE 6
SECTIONS-NORTH JETTY

SHEET IDENTIFICATION NUMBER
C-305

D-24

PLATE 13

CAMP ELLIS, SACO, ME
SECTION 111 SHORE PROTECTION
GEOTECHNICAL DESIGN APPENDIX
ATTACHMENT A
SUMMARY OF SUBSURFACE INVESTIGATIONS

US Army Corps of Engineers®
New England District

Camp Ellis, Saco Maine Shoreline Protection
Profile Baselines
(Alternative 25A Shown)

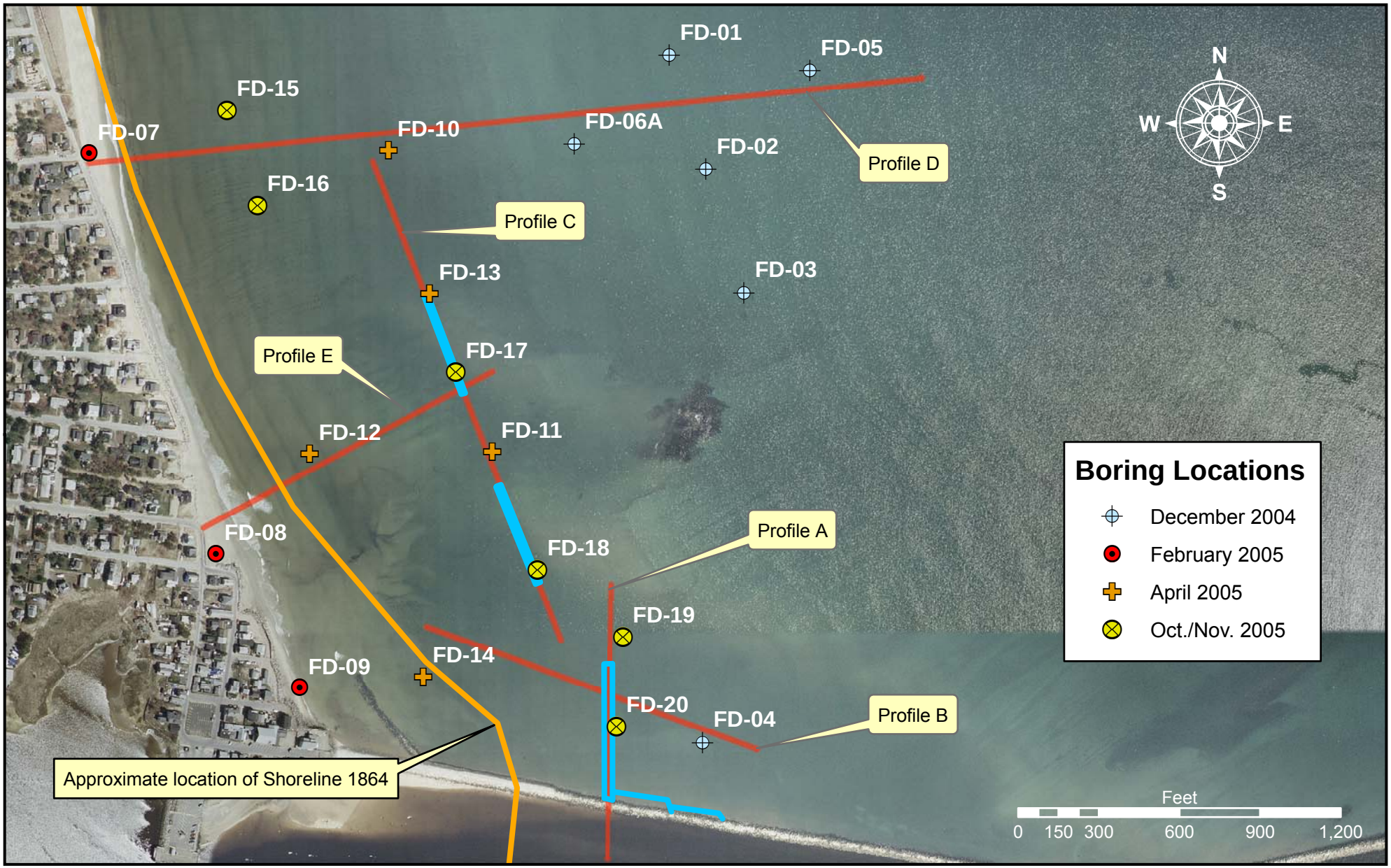


Figure A-1

US Army Corps of Engineers®
New England District

Camp Ellis, Saco Maine Shoreline Protection
Profile Baselines
(Alternative 6 Shown)

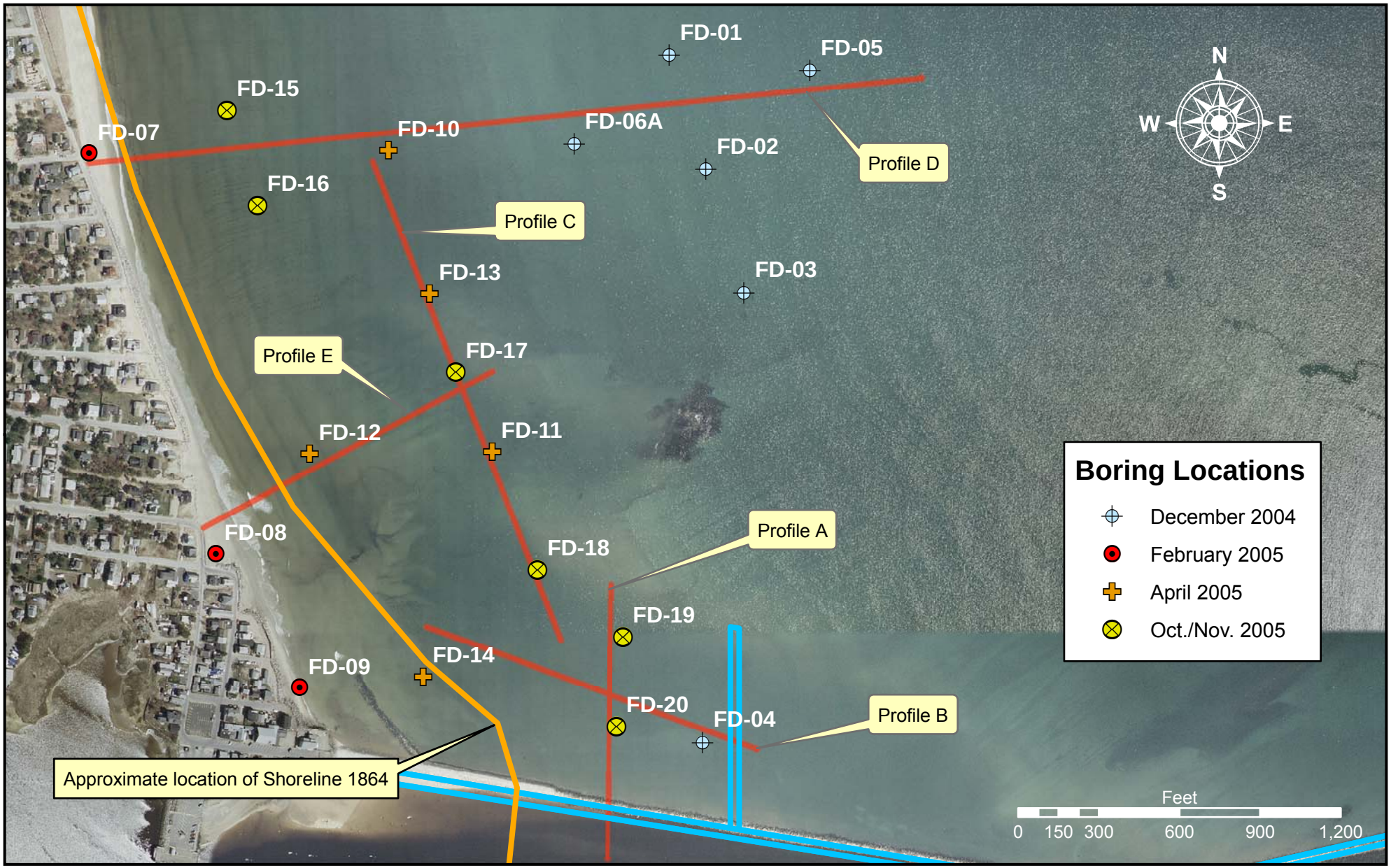
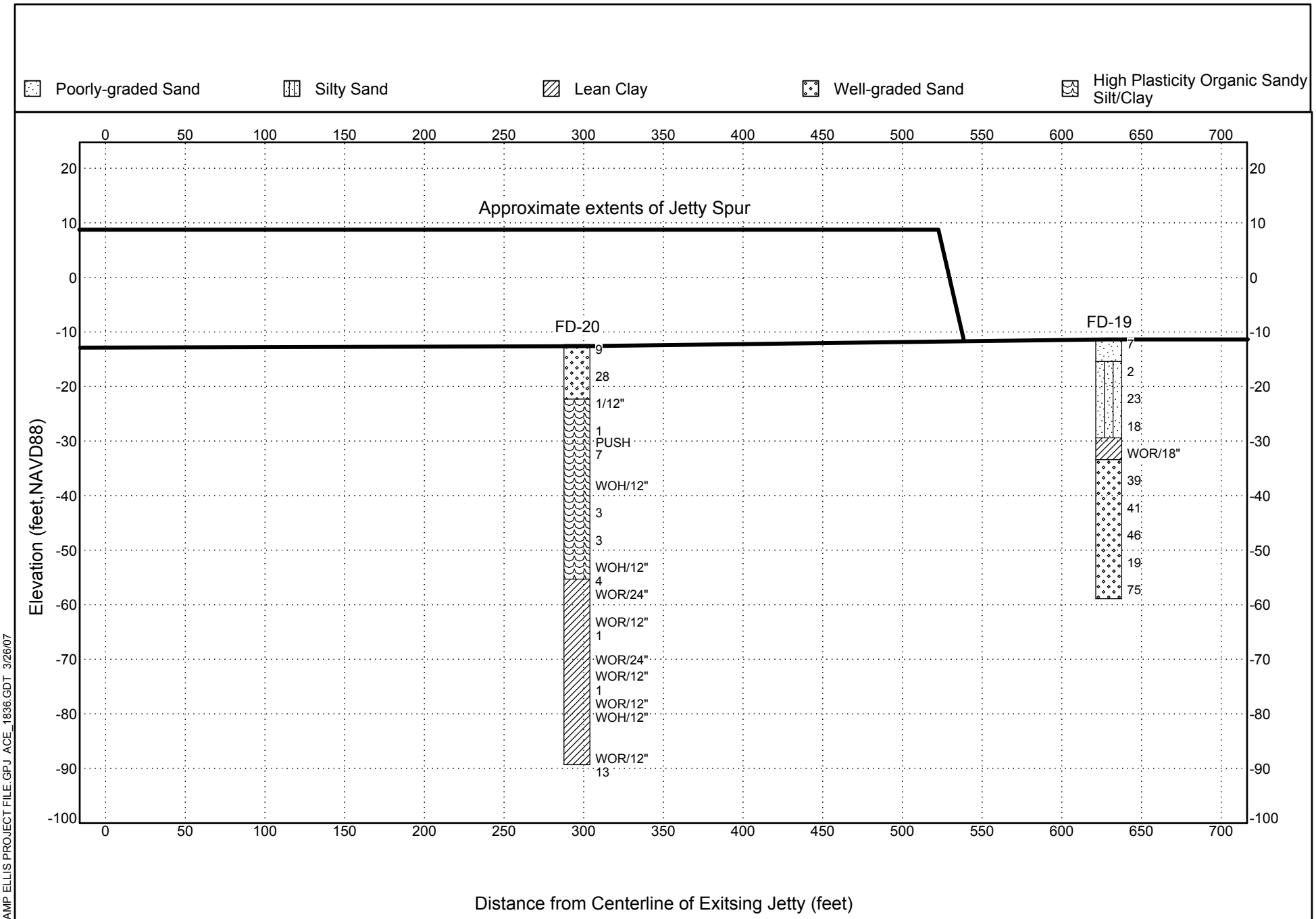


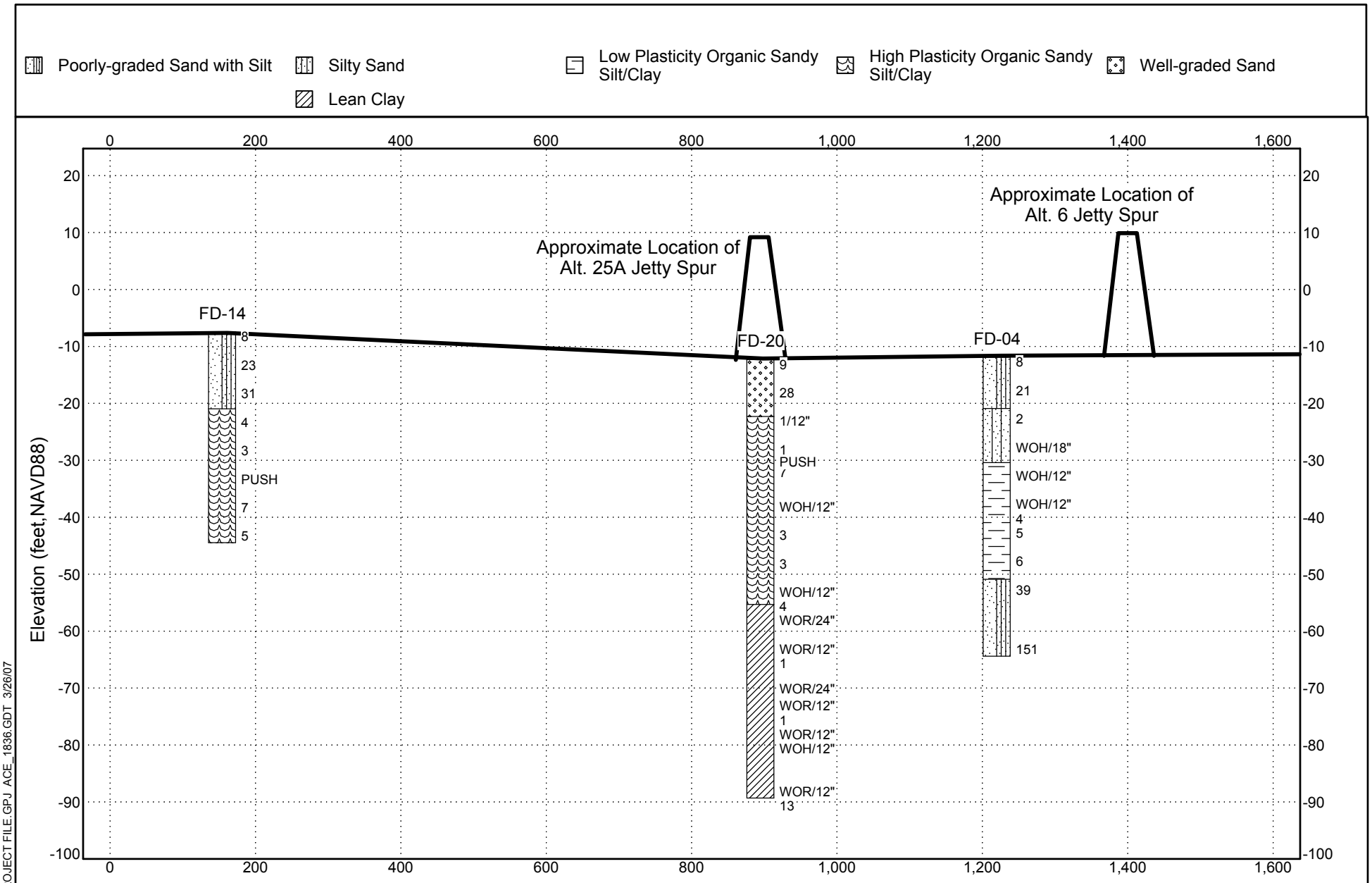
Figure A-2



STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 3/26/07

Camp Ellis Beach
Saco, ME
Profile Along Centerline of Alt. 25A Jetty Spur
(Profile A)

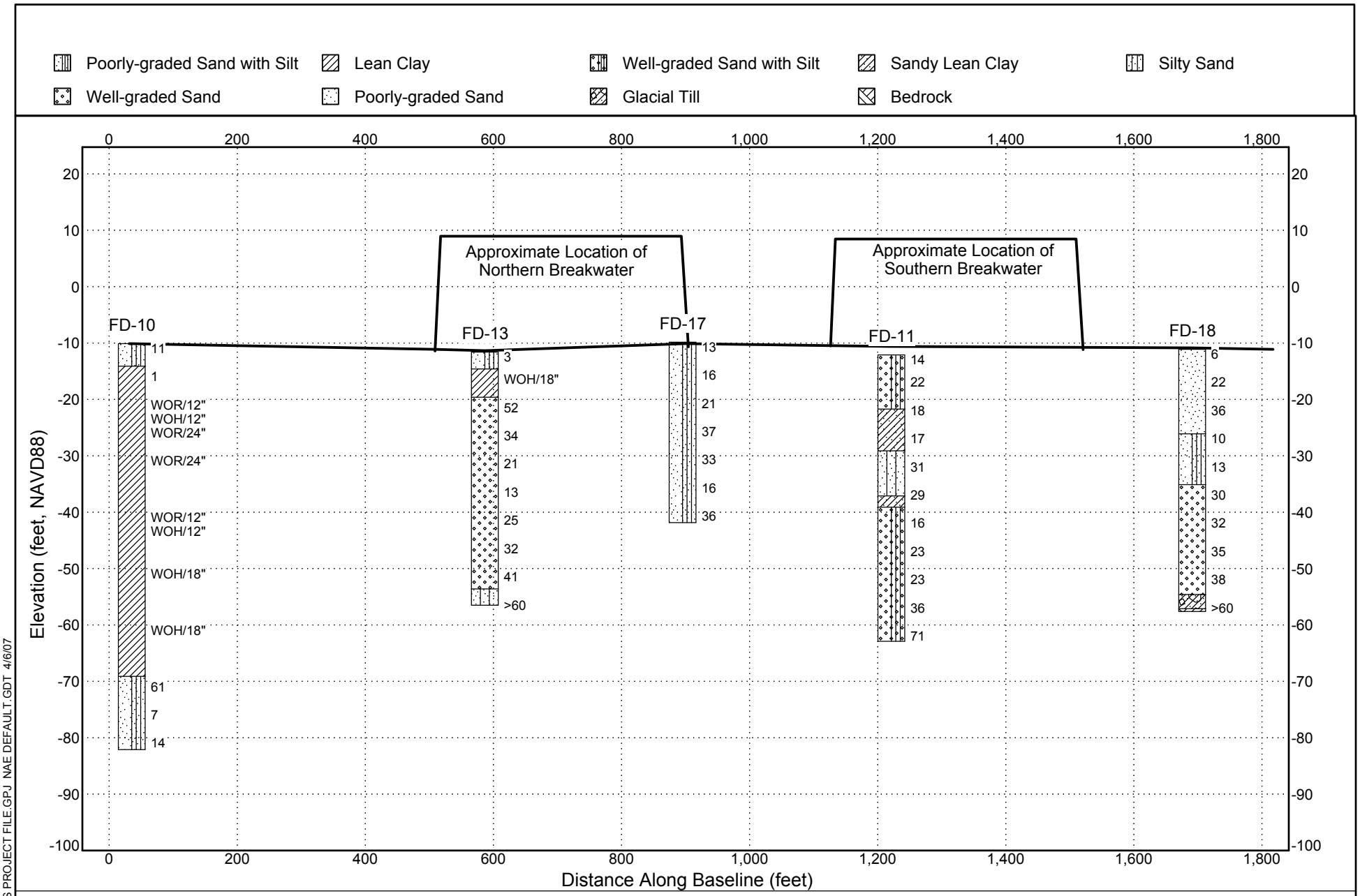
Figure A-3



STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 3/26/07

Camp Ellis Beach
Saco, ME
Profile Across Alt. 25A and Alt. 6
Jetty Spurs (Profile B)

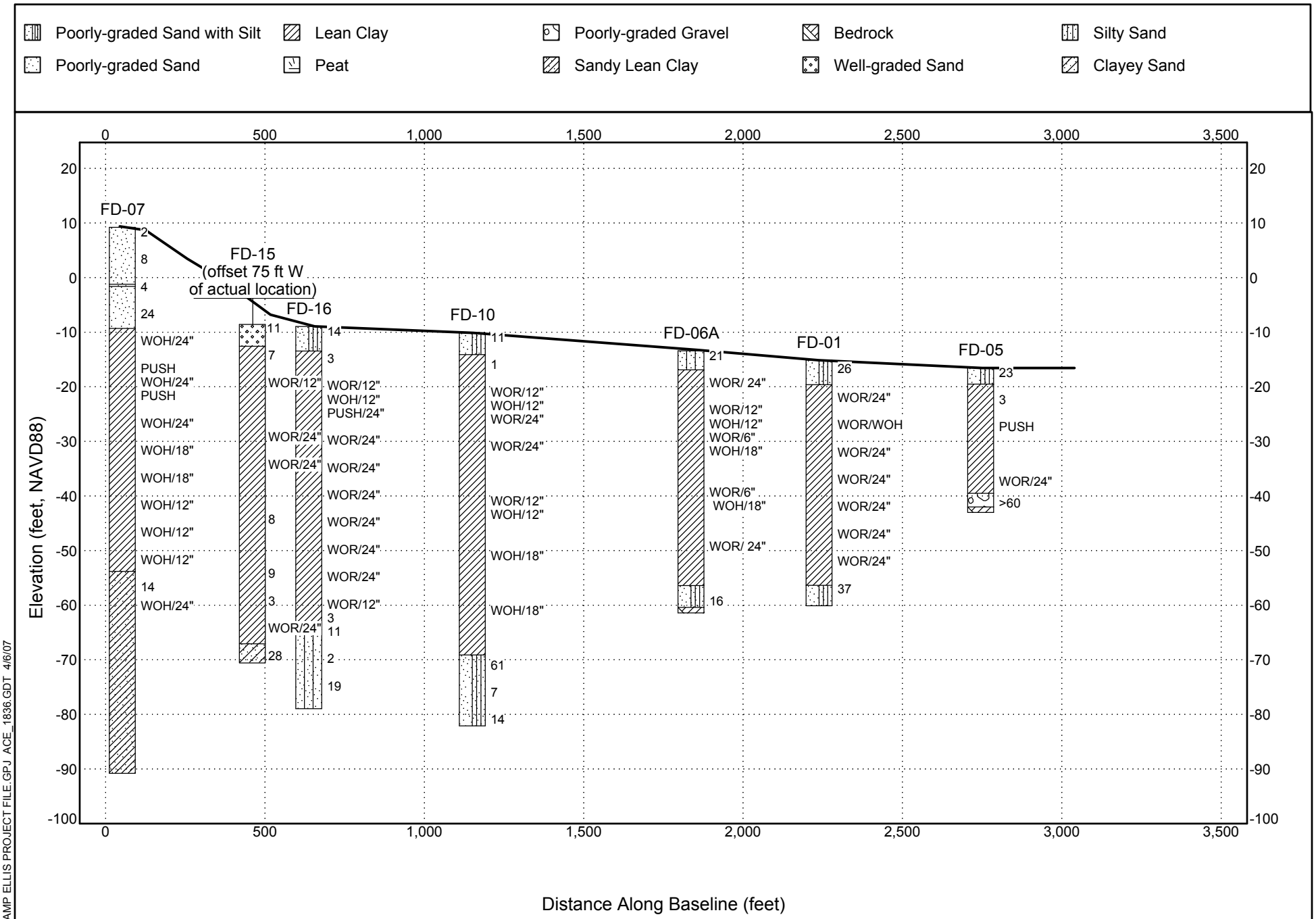
Figure A-4



Camp Ellis Beach
Saco, ME
Profile Along Centerline of
Detached Breakwaters (Profile C)

Figure A-5

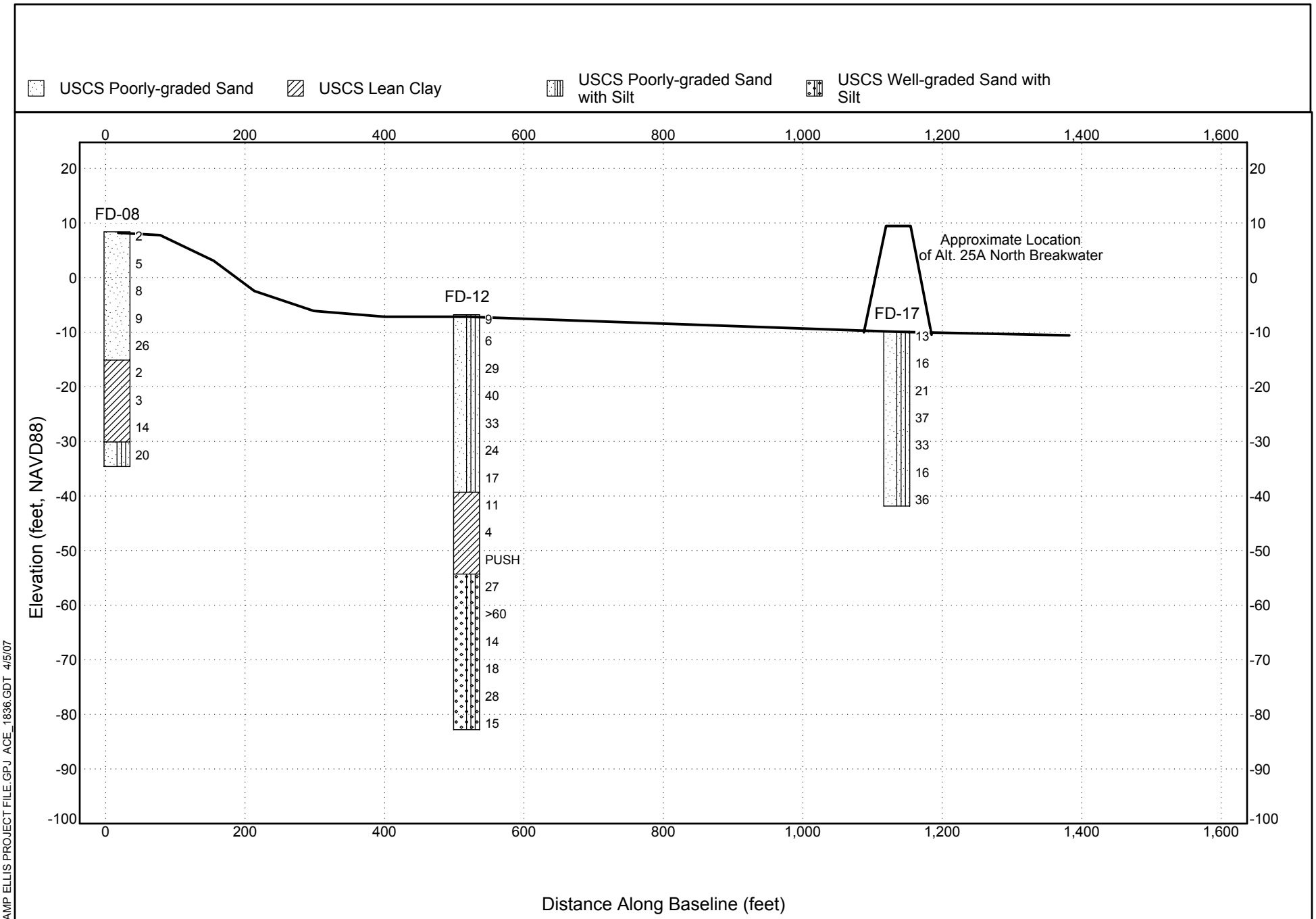
STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ NAE DEFAULT.GDT 4/6/07



STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 4/6/07

Camp Ellis Beach
Saco, ME
Profile D
D-30

Figure A-6



STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 4/5/07

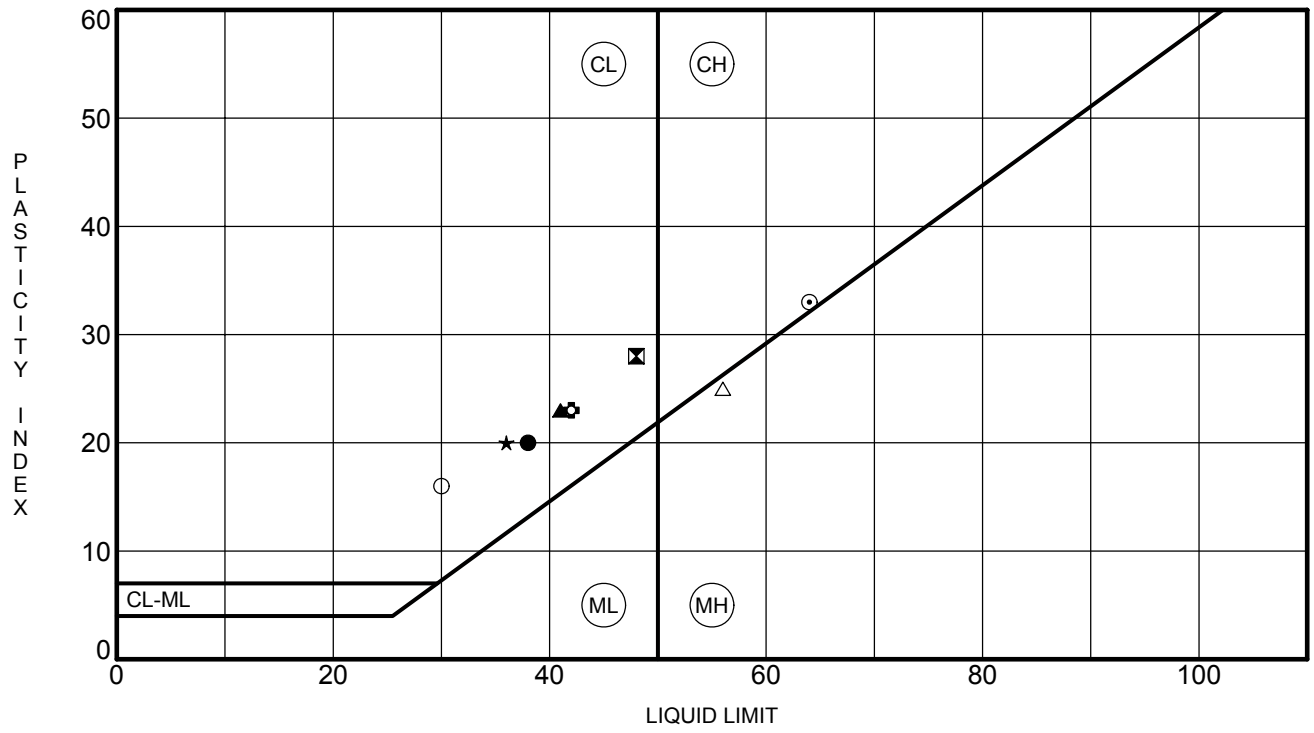
Camp Ellis Beach
Saco, ME
Profile E
D-31

Figure A-7

US Army Corps of Engineers®
New England District

Camp Ellis, Saco Maine Shoreline Protection
Extents of Clay/Silt Layer
(Alternative 25A Shown)

Figure A-8



Specimen Identification/Depth			LL	PL	PI	Fines	Classification
●	**FD-02**	**10.0**	**38**	**18**	**20**	**97.8%**	**Moist, Dark Gray Clay (CL)**
⊠	**FD-05**	**10.0**	**48**	**20**	**28**	**97.7%**	**Moist, Dark Gray Clay (CL)**
▲	**FD-07**	**30.0**	**41**	**18**	**23**	**98.5%**	**Moist, Olive Gray Clay (CL)**
★	**FD-12**	**44.0**	**36**	**16**	**20**	**99.7%**	**Moist, Gray Clay (CL)**
⊙	**FD-14**	**25.0**	**64**	**31**	**33**	**91.5%**	**Moist, Dark Olive Gray Clay (CH)**
✿	**FD-15A**	**10.0**	**42**	**19**	**23**	**99.7%**	**Moist, olive brown clay (CL)**
○	**FD-16**	**15.0**	**30**	**14**	**16**	**95.1%**	**Moist, olive Gray Clay (CL)**
△	**FD-20**	**17.0**	**56**	**31**	**25**	**60.7%**	**Moist, dark olive gray sandy elastic silt (MH)**

US Army Corps of Engineers®
New England District

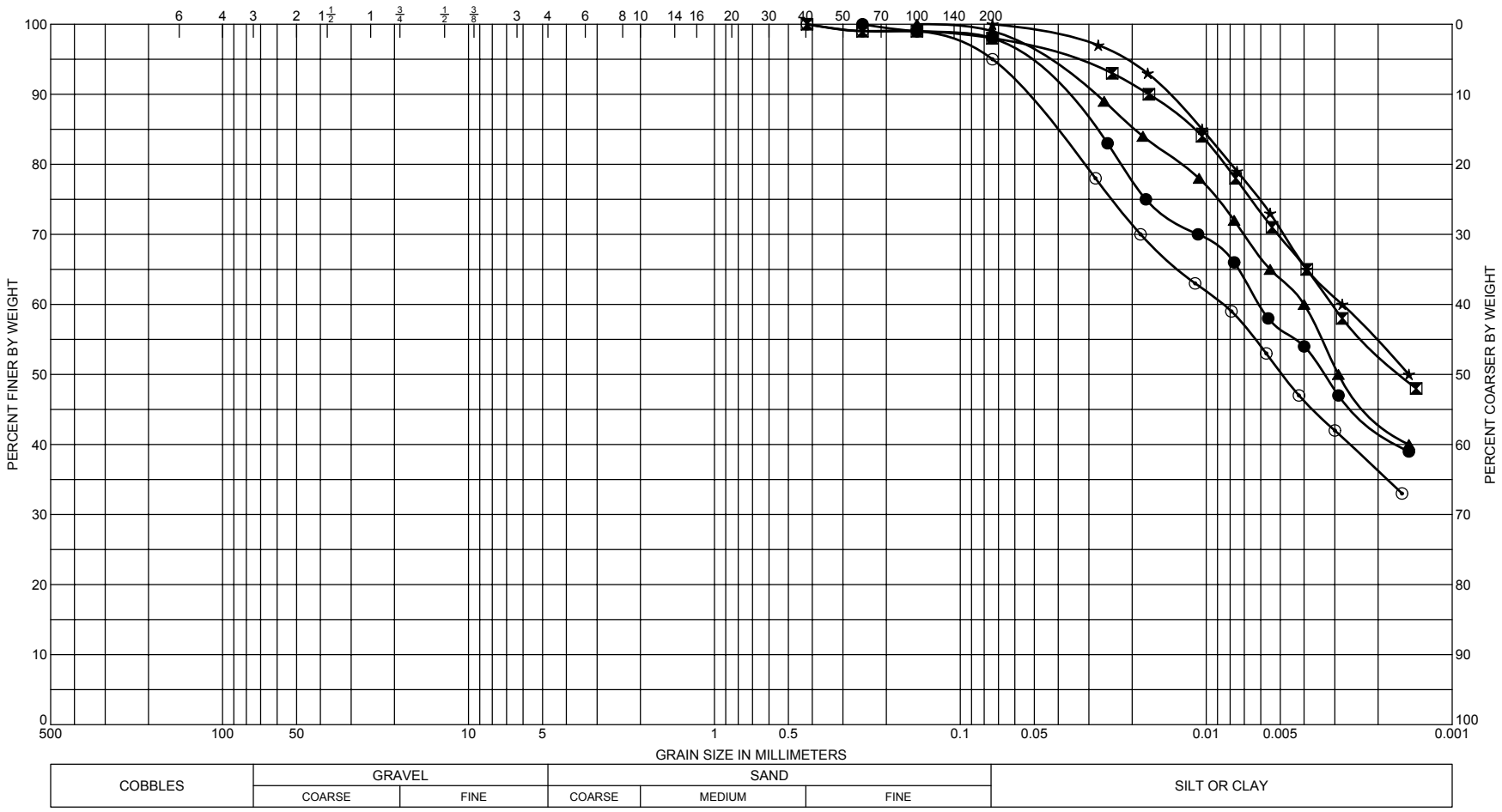
ATTERBERG LIMITS RESULTS

Project: Camp Ellis Beach

Location: Saco, ME

Number:

Figure A-9



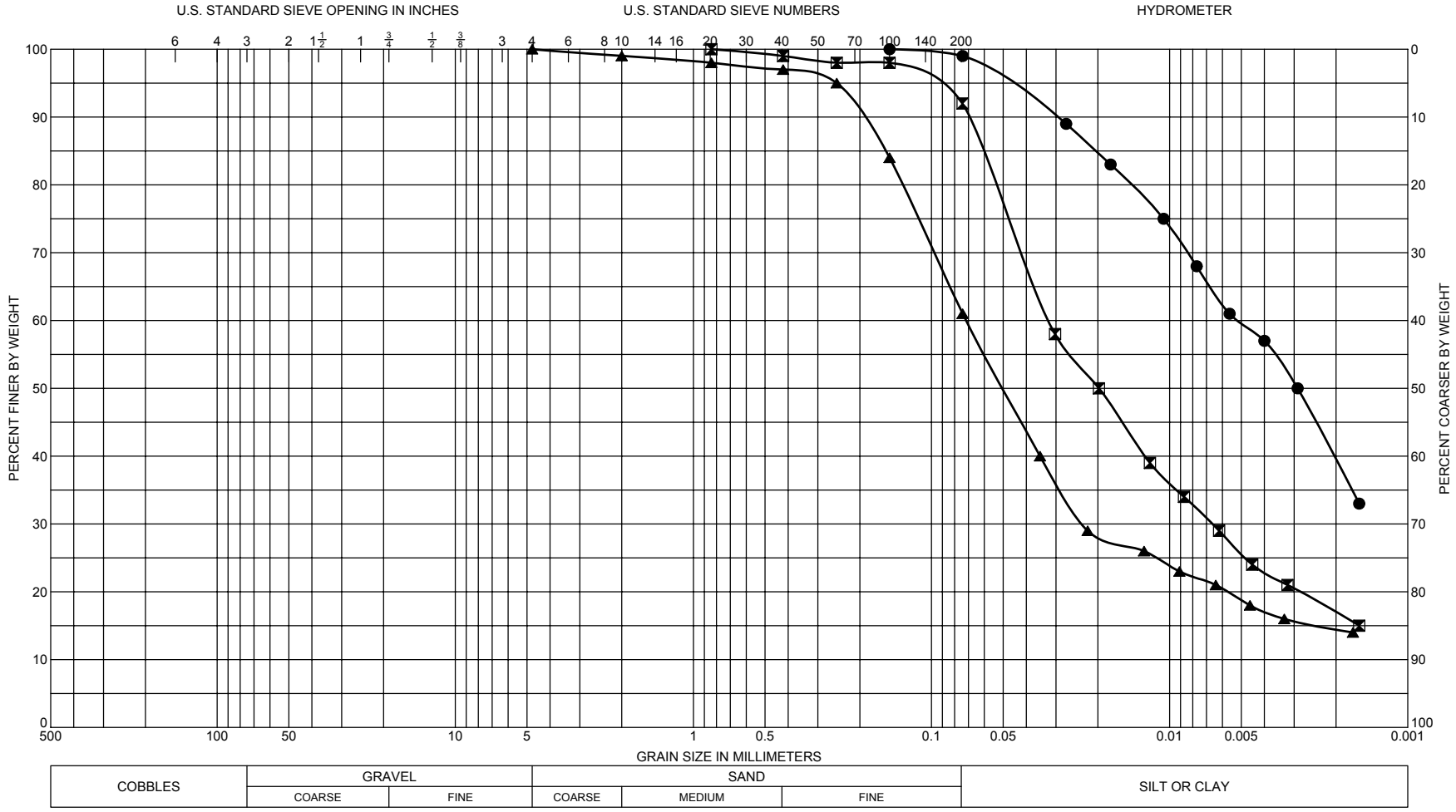
Sample No.	Elev / Depth	Classification	Nat w %	LL	PL	PI
● FD-02, U-1	10-12	Moist, Dark Gray Clay (CL)	32.7	38	18	20
⊠ FD-05, U-1	10-12	Moist, Dark Gray Clay (CL)	42.0	48	20	28
▲ FD-07, U-2	30-32	Moist, Olive Gray Clay (CL)	28.0	41	18	23
★ FD-15A, U1	10-12	Moist, olive brown clay (CL)	39.0	42	19	23
⊙ FD-16, U1	15-17	Moist, olive Gray Clay (CL)	28.0	30	14	16

GRADATION CURVES

Project	Camp Ellis Beach
	Saco, ME
Area	Lean Clay Layer
Boring No.	FD-02, FD-05, FD-07, FD-15A, FD-16
Date	4/18/07

ENG FORM 1 MAY 63 **2087**

Figure A-10



Sample No.	Elev / Depth	Classification	Nat w %	LL	PL	PI
● FD-12, U-1	10-12	Moist, Gray Clay (CL)	34.0	36	16	20
⊠ FD-14, U-1	25-27	Moist, Dark Olive Gray Clay (CH)	53.0	64	31	33
▲ FD-20, U1	17-19	Moist, dark olive gray sandy elastic silt (MH)	53.0	56	31	25

GRADATION CURVES

Project	Camp Ellis Beach
	Saco, ME
Area	Near Existing Jetty
Boring No.	FD-12, FD-14, FD-20
Date	4/18/07

ENG FORM 1 MAY 63 **2087**

Figure A-11

CAMP ELLIS, SACO, ME
SECTION 111 SHORE PROTECTION
GEOTECHNICAL DESIGN APPENDIX
ATTACHMENT B
STRESS INCREASE CALCULATIONS

OBJECTIVE: Calculate the expected stress increase due to construction of the Alternative 25A jetty spur at various points along the base of the cross section, at the middle of each compressible layer.

Figure B-1 below shows the typical jetty spur cross-section. Subsurface conditions are based on data from boring FD-20 (location shown on Figure B-2, following page). At the spur location, there is about a 10 ft layer of medium dense sand, underlain by a 33 ft layer of elastic sandy silt, and then a 33 ft layer of lean clay. More detail and profiles are included in Part A.

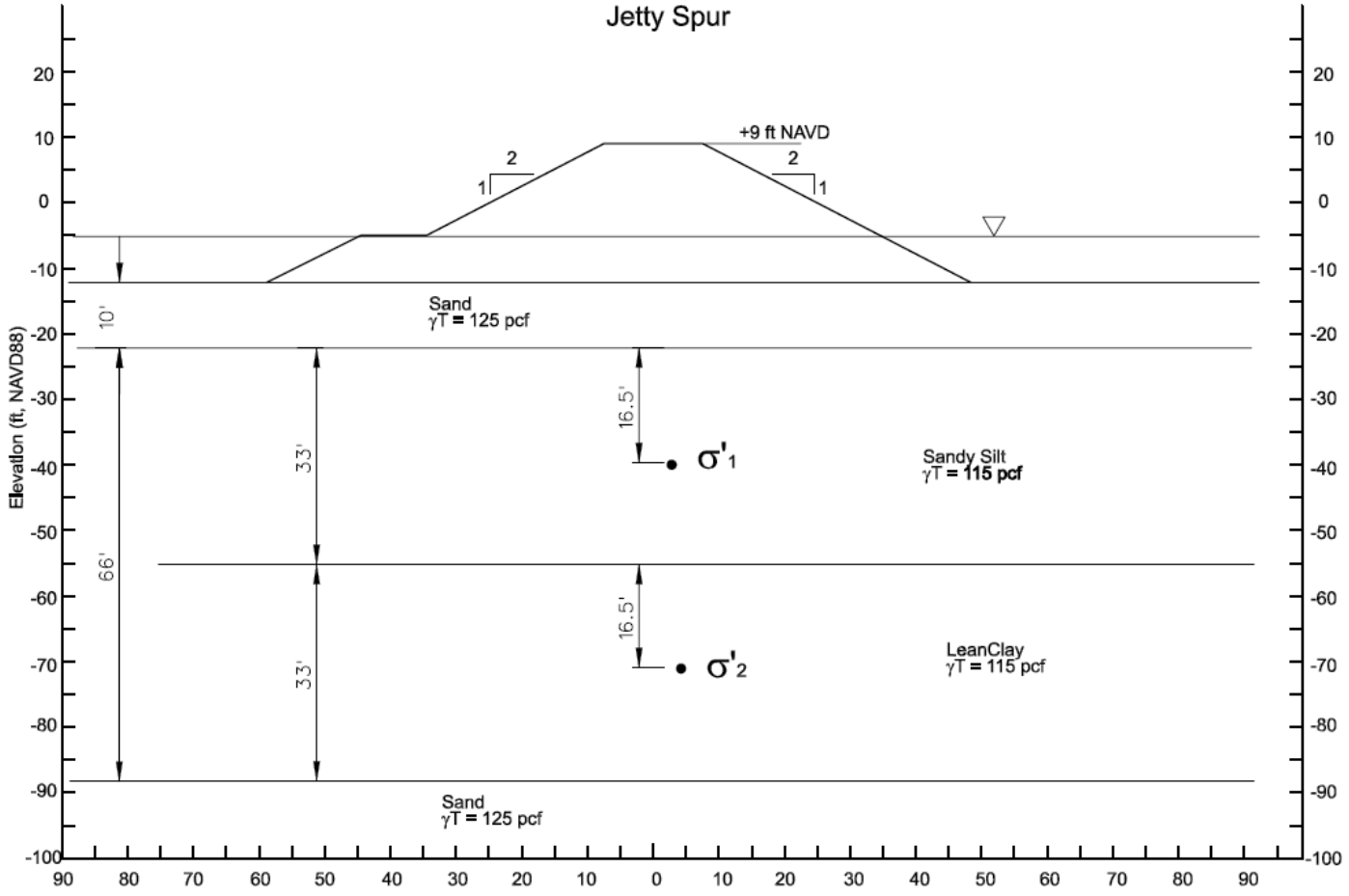


Figure B-1: Typical Jetty Spur Cross Section

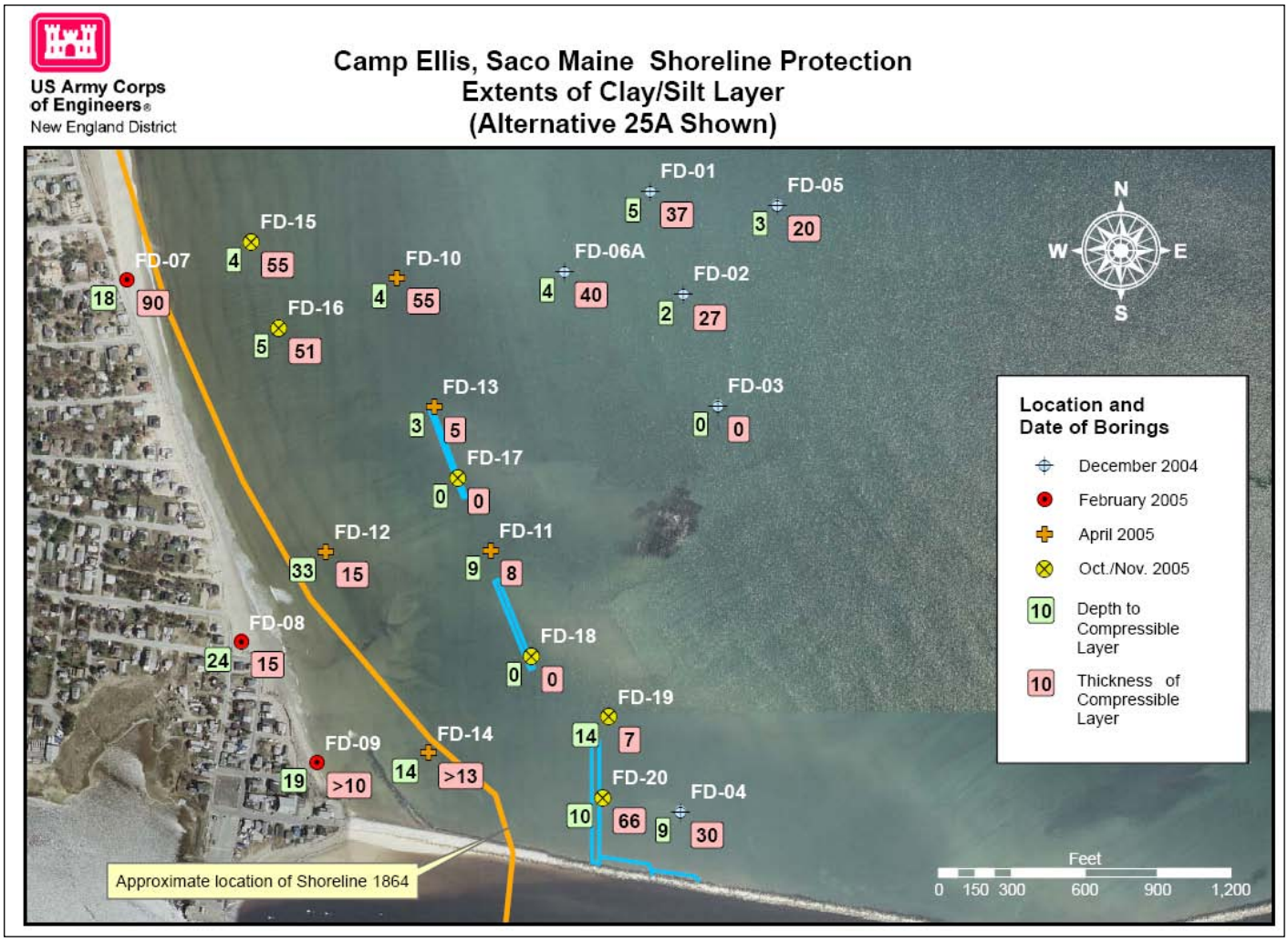
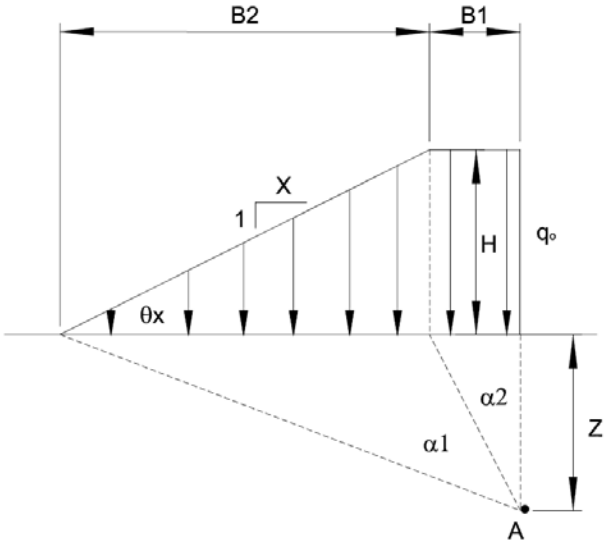

US Army Corps of Engineers
New England District
Camp Ellis, Saco Maine Shoreline Protection
Extents of Clay/Silt Layer
(Alternative 25A Shown)
FD-01
5
37
FD-05
3
20
FD-15
4
55
FD-07
18
90
FD-10
4
55
FD-06A
4
40
FD-02
2
27
FD-16
5
51
FD-13
3
5
FD-03
0
0
FD-17
0
0
FD-12
33
15
FD-11
9
8
FD-08
24
15
FD-18
0
0
FD-19
14
7
FD-09
19
>10
FD-14
14
>13
FD-20
10
66
FD-04
9
30
Approximate location of Shoreline 1864
N
W
E
S
Location and Date of Borings
December 2004
February 2005
April 2005
Oct./Nov. 2005
10 Depth to Compressible Layer
10 Thickness of Compressible Layer
Feet
0 150 300 600 900 1,200

Figure B-2

PROCEDURE:

1. Calculate stress increase using method presented in Das (1995).

   a) From Das, to find stress increase caused by an embankment with height H at point A, at depth z:



$$\Delta\sigma_A = \frac{q_o}{\pi}\left[\left(\frac{B_1+B_2}{B_2}\right)(\alpha_1+\alpha_2) - \frac{B_1}{B_2}(\alpha_2)\right]$$

where

$$q_o = \gamma H$$

$$\alpha_{1(radians)} = \tan^{-1}\left(\frac{B_1+B_2}{z}\right) - \tan^{-1}\left(\frac{B_1}{z}\right)$$

$$\alpha_{2(radians)} = \tan^{-1}\left(\frac{B_1}{z}\right)$$

A simplified cross-section for the jetty spur is shown on Figure B-3 below. The small toe berm has been removed to simplify calculations; it is not expected to significantly add to overall stress increase. It is broken in two at the centerline; as each half of the cross section contributes to the stress increase at point A, we need to determine the stress increase at points A1 and A2, then add them together to get the total stress increase caused by the jetty spur at depth z=26.5 ft below the centerline of the spur.

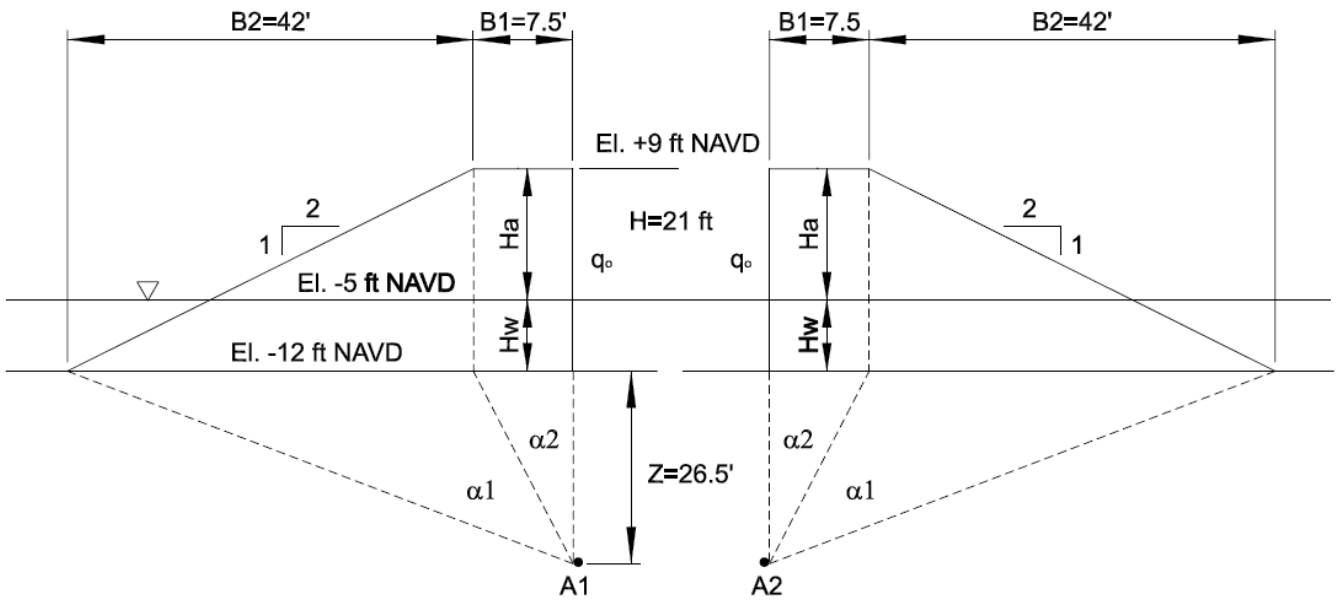


Figure B-3

Determine unit weight of Rock Fill:

porosity of rock fill in place = 25%

ρ_{rock}=165 lb/ft^3, $\gamma_{saltwater}$=64 lb/ft^3

Unit weights:

γ_{sat}=140 pcf, γ_{dry}=125 pcf

$$q_o=H_w\times(\gamma_{sat}-\gamma_{saltwater})+H_a\times\gamma_{dry}=7x(140-64)+14x125=\underline{\mathbf{2.28\ ksf}}$$

Then:

$$\alpha_{1(radians)}=\tan^{-1}\left(\frac{B_1+B_2}{z}\right)-\tan^{-1}\left(\frac{B_1}{z}\right)$$

$$\alpha_1=\tan^{-1}((7.5+42)/26.5)-\tan^{-1}(7.5/26.5)=0.803$$

$$\alpha_{2(radians)}=\tan^{-1}\left(\frac{B_1}{z}\right)$$

$$\alpha_2=\tan^{-1}(7.5/26.5)=0.276$$

$$\Delta\sigma_{A1}=\frac{q_o}{\pi}\left[\left(\frac{B_1+B_2}{B_2}\right)(\alpha_1+\alpha_2)-\frac{B_1}{B_2}(\alpha_2)\right]$$

$$\Delta\sigma_{A1}=\frac{2.28}{\pi}\left[\left(\frac{7.5+42}{42}\right)(0.803+0.276)-\frac{7.5}{42}(0.276)\right]=0.89\ \text{ksf}$$

$$\Delta\sigma_A = \Delta\sigma_{A1} + \Delta\sigma_{A2} = 2\times \Delta\sigma_{A1}$$

$\underline{\Delta\sigma_A = 1.78\ ksf}$

Determine distribution of stress increase under the entire jetty spur. Points A through E are shown on Figure B-4.

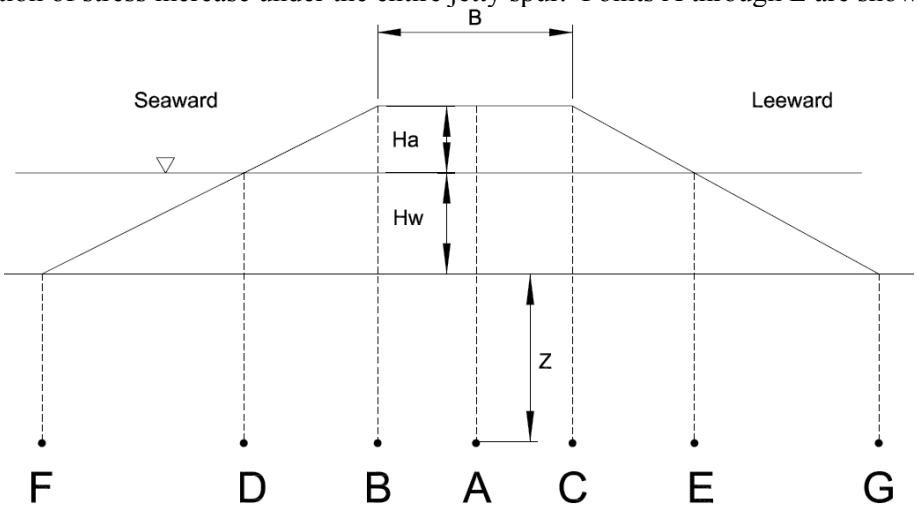


Figure B-4

For points B and C, $\Delta\sigma$ will be the same. To determine the stress increase at point B, the cross section is separated as shown in Figure B-5:

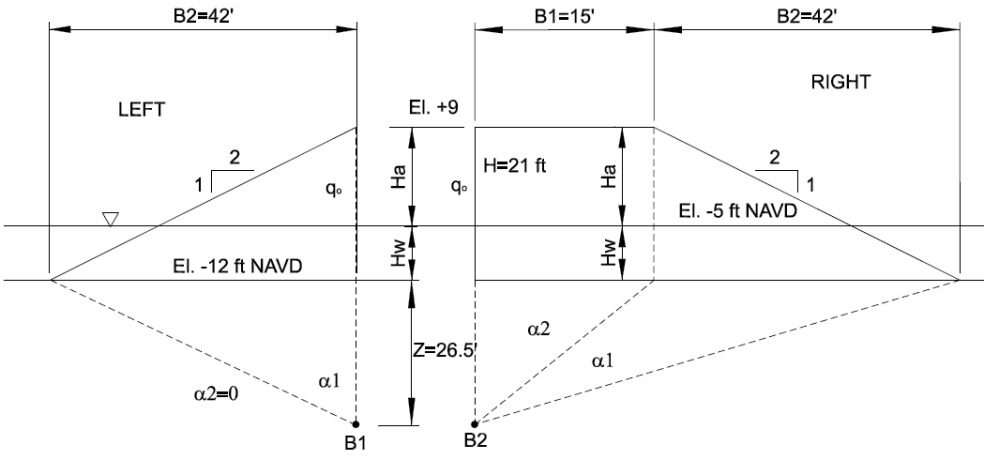


Figure B-5

At point B_1, B1=0, B2=42, $\alpha_2=0$

$$\Delta\sigma_{B1} = 0.73\ ksf$$

At point B_2, B1=15, B2=42

$$\Delta\sigma_{B2} = 0.99\ ksf$$

$\underline{\Delta\sigma_B = \Delta\sigma_C = 1.72\ ksf}$

For points D, E, F, and G, the calculation is a bit more complicated (Das, 1995, p. 204-205). At point D and E (immediately below the point where the slope intersects MLLW):

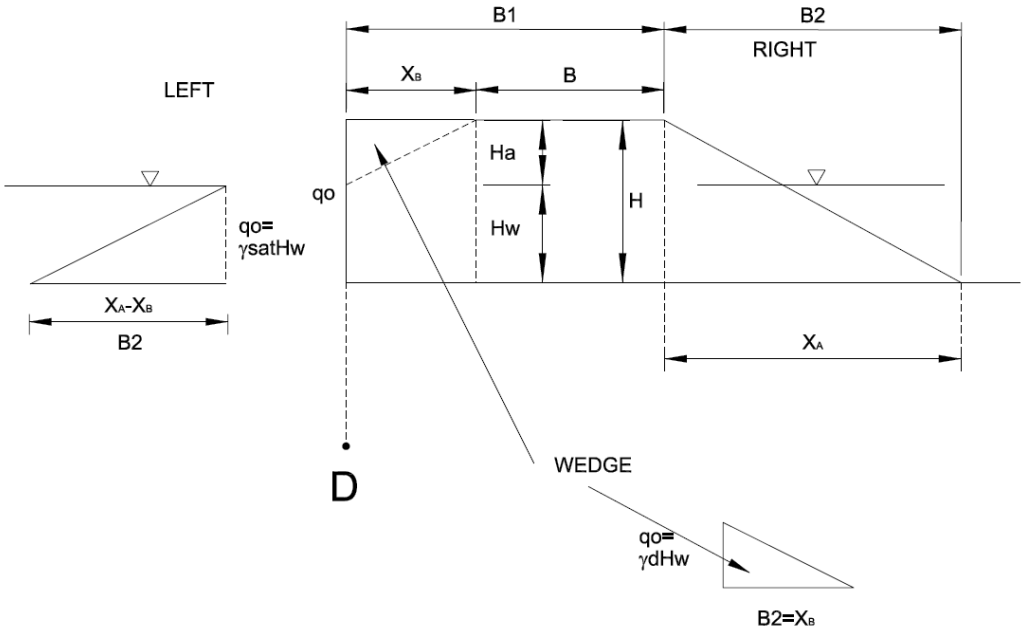


Figure B-6

The stress increase from simplified embankment geometry on the "left" and "right" sides is calculated. Then the stress increase from the theoretical "wedge" is calculated and subtracted from the left and right summation (Figure B-6).

At point F and G (Figure B-7),

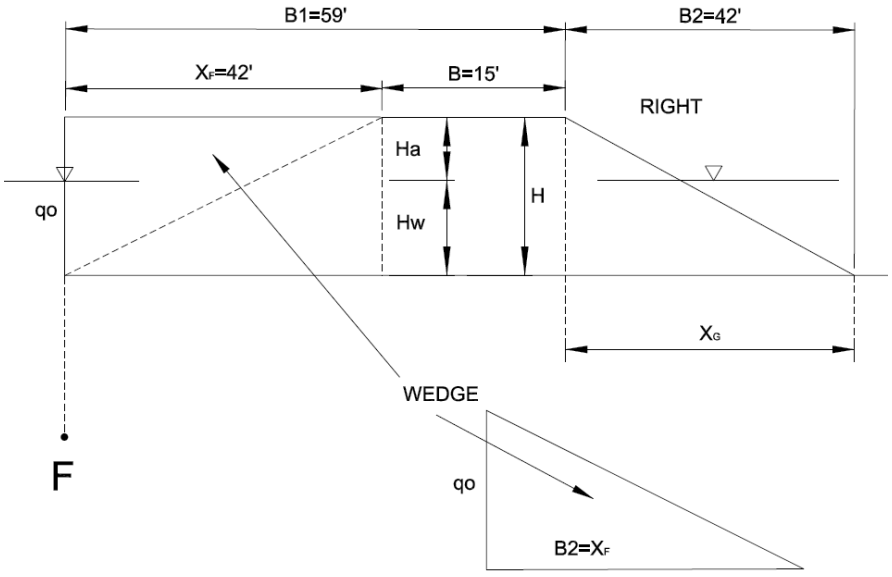


Figure B-7

Note that at points F and G, we only need to calculate the stress increase on one side, and subtract out the increase caused by the wedge.

The summary table below shows results of calculations for points A through F in the silt layer and the clay layer underneath the silt.

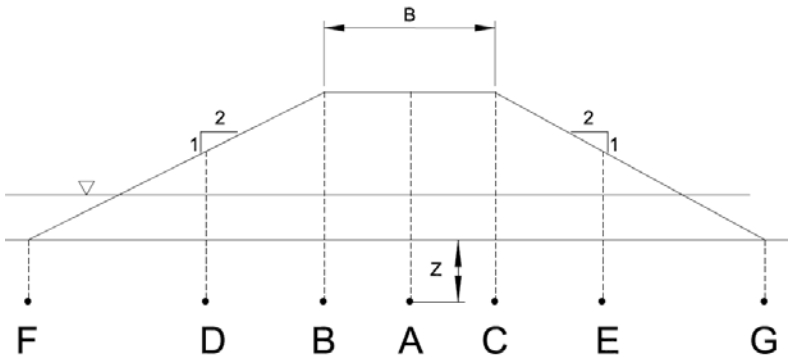


Table B1 - Alt. 25A Jetty Spur

		Structure Height H=		21	ft	Middle of Silt Layer				Middle of Clay Layer			
		Crest Width B=		15	ft	z=	26.5	ft		z=	59.5	ft	
Point	Dist. from CL (ft)	Side	q_o (ksf)	B1 (ft)	B2 (ft)	α_1	α_2	$\Delta\sigma_{(1)}$ (ksf)	$\Delta\sigma_{(TOT)}$ (ksf)	α_1	α_2	$\Delta\sigma_{(2)}$ (ksf)	$\Delta\sigma_{(TOT)}$ (ksf)
A	0	left	2.28	7.5	42	0.803	0.276	0.89	1.78	0.569	0.125	0.58	1.16
		right	2.28	7.5	42	0.803	0.276	0.89		0.569	0.125	0.58	
B	7.5	left	2.28	0	42	1.008	0.000	0.73	1.72	0.615	0.000	0.45	1.14
		right	2.28	15	42	0.621	0.515	0.99		0.517	0.247	0.69	
C	7.5	left	2.28	15	42	0.621	0.515	0.99	1.72	0.517	0.247	0.69	1.14
		right	2.28	0	42	1.008	0.000	0.73		0.615	0.000	0.45	
D	35.5	left	0.53	0	14	0.486	0.000	0.08	0.74	0.231	0.000	0.04	0.74
		right	2.28	43	42	0.250	1.018	1.11		0.334	0.626	0.95	
		wedge	1.75	0	28	0.813	0.000	0.45		0.440	0.000	0.25	
E	35.5	left	2.28	43	42	0.250	1.018	1.11	0.74	0.334	0.626	0.95	0.74
		right	0.53	0	14	0.486	0.000	0.08		0.231	0.000	0.04	
		wedge	1.75	0	28	0.813	0.000	0.45		0.440	0.000	0.25	
F	49.5	left	0.00	0	0	0.000	0.000	0.00	0.39	0.000	0.000	0.00	0.56
		right	2.28	57	42	0.174	1.136	1.12		0.266	0.764	1.01	
		wedge	2.28	0	42	1.008	0.000	0.73		0.615	0.000	0.45	
G	49.5	left	2.28	57	42	0.174	1.136	1.12	0.39	0.266	0.764	1.01	0.56
		right	0.00	0	0	0.000	0.000	0.00		0.000	0.000	0.00	
		wedge	2.28	0	42	1.008	0.000	0.73		0.615	0.000	0.45	

The conditions at the location of the Alt. 6 jetty spur are similar to those at the Alt. 25A jetty spur. It is therefore assumed that the stress increases for the Alt. 25A spur will be the same at the location of the Alt. 6 spur.

For the southern detached breakwater, the subsurface is significantly different. There is only a 8 ft layer of lean clay, which is stiffer than the clay encountered elsewhere at the project (N-values of 17-18). A 10 ft layer of silty sand lies above the clay, with a dense sand below the clay, as shown below (Figure B-8). This cross section is based primarily on boring FD-11.

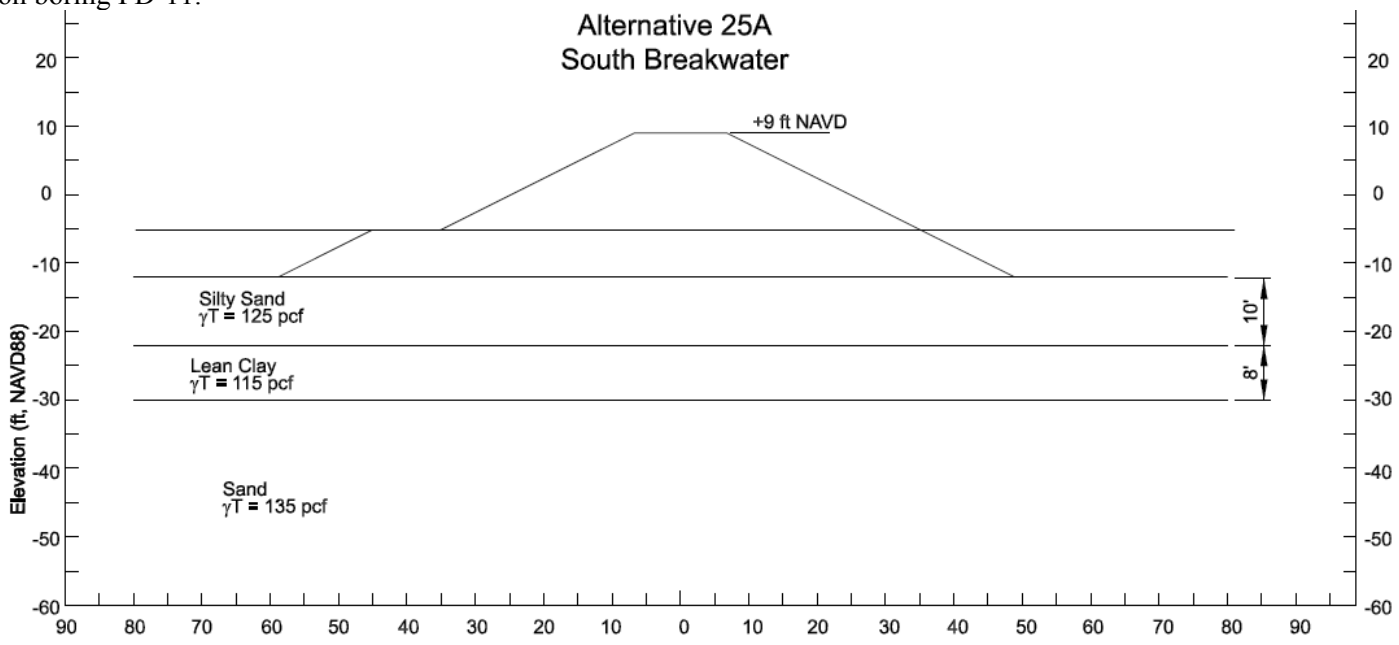


Figure B-8

Stress increases at the center of the clay layer are presented in the table below:

Table B2 - Alt. 25A South Breakwater

		Structure Height H=			21	ft	Middle of clay layer			
		Crest Width B=			15	ft	z=	14	ft	
Point	Dist. from CL (ft)	Side	q_o (ksf)	slope (1V:X H)	B1 (ft)	B2 (ft)	α_1	α_2	$\Delta\sigma_{(1)}$ (ksf)	$\Delta\sigma_{(TOT)}$ (ksf)
A	0	left	2.05	2	7.5	42	0.803	0.492	0.94	1.88
		right	2.05	2	7.5	42	0.803	0.492	0.94	
B	7.5	left	2.05	2	0	42	1.249	0.000	0.82	1.81
		right	2.05	2	15	42	0.510	0.820	0.99	
C	7.5	left	2.05	2	15	42	0.510	0.820	0.99	1.81
		right	2.05	2	0	42	1.249	0.000	0.82	
D	35.5	left	0.30		0	14	0.785	0.000	0.08	0.48
		right	2.05		43	42	0.152	1.256	1.02	
		wedge	1.75		0	28	1.107	0.000	0.62	
E	35.5	left	2.05		43	42	0.152	1.256	1.02	0.48
		right	0.30		0	14	0.785	0.000	0.08	
		wedge	1.75		0	28	1.107	0.000	0.62	
F	49.5	left	0.00		0	0	0.000	0.000	0.00	0.21
		right	2.05		57	42	0.100	1.330	1.02	
		wedge	2.05		0	42	1.249	0.000	0.82	
G	49.5	left	2.05		57	42	0.100	1.330	1.02	0.21
		right	0.00		0	0	0.000	0.000	0.00	
		wedge	2.05		0	42	1.249	0.000	0.82	

For the north breakwater, the clay layer is only 5 ft thick, and is covered by a 3 ft layer of silty sand (Figure B-9). Dense well-graded sand is under the clay layer as shown below. Additional detail is included in the geotechnical boring program summary (Section A).

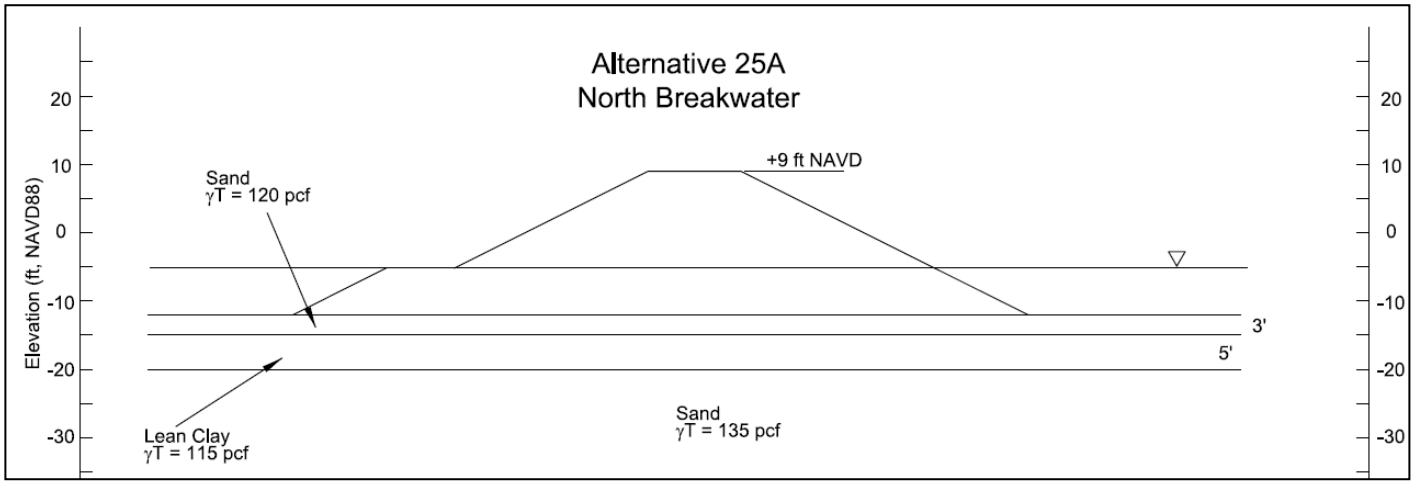


Figure B-9

Stress increases at the middle of the clay layer are summarized in the table below:

Table B3 - Alt. 25A North Breakwater

		Structure Height H=			21 ft		Middle of clay layer			
		Crest Width B=			15 ft		z=	5.5 ft		
Point	Dist. from CL (ft)	Side	q_o (ksf)	slope (1V:X H)	B1 (ft)	B2 (ft)	α_1	α_2	$\Delta\sigma_{(1)}$ (ksf)	$\Delta\sigma_{(TOT)}$ (ksf)
A	0	left	2.28	2	7.5	42	0.522	0.938	1.13	2.26
		right	2.28	2	7.5	42	0.522	0.938	1.13	
B	7.5	left	2.28	2	0	42	1.441	0.000	1.05	2.18
		right	2.28	2	15	42	0.255	1.219	1.14	
C	7.5	left	2.28	2	15	42	0.255	1.219	1.14	2.18
		right	2.28	2	0	42	1.441	0.000	1.05	
D	35.5	left	0.53		0	14	1.196	0.000	0.20	0.58
		right	2.28		43	42	0.063	1.444	1.14	
		wedge	1.75		0	28	1.377	0.000	0.77	
E	35.5	left	2.28		43	42	0.063	1.444	1.14	0.58
		right	0.53		0	14	1.196	0.000	0.20	
		wedge	1.75		0	28	1.377	0.000	0.77	
F	49.5	left	0.00		0	0	0.000	0.000	0.00	0.09
		right	2.28		57	42	0.041	1.475	1.14	
		wedge	2.28		0	42	1.441	0.000	1.05	
G	49.5	left	2.28		57	42	0.041	1.475	1.14	0.09
		right	0.00		0	0	0.000	0.000	0.00	
		wedge	2.28		0	42	1.441	0.000	1.05	

REFERENCES:

Das, Braja M. Principles of Foundation Engineering, Third Edition (1995) PWS Publishing Company.

CAMP ELLIS, SACO, ME
SECTION 111 SHORE PROTECTION
GEOTECHNICAL DESIGN APPENDIX
ATTACHMENT C
SETTLEMENT CALCULATIONS

OBJECTIVE: Calculate the expected consolidation settlement of compressible foundation layers due to construction of Alternative 25A jetty spur.

Figure C-1 below shows the typical jetty spur cross-section. Subsurface conditions are based on data from boring FD-20 (location shown on Figure C-2, following page). At the spur location, there is about a 10 ft layer of medium dense sand, underlain by a 33 ft layer of organic sandy silt, and then a 33 ft layer of lean clay.

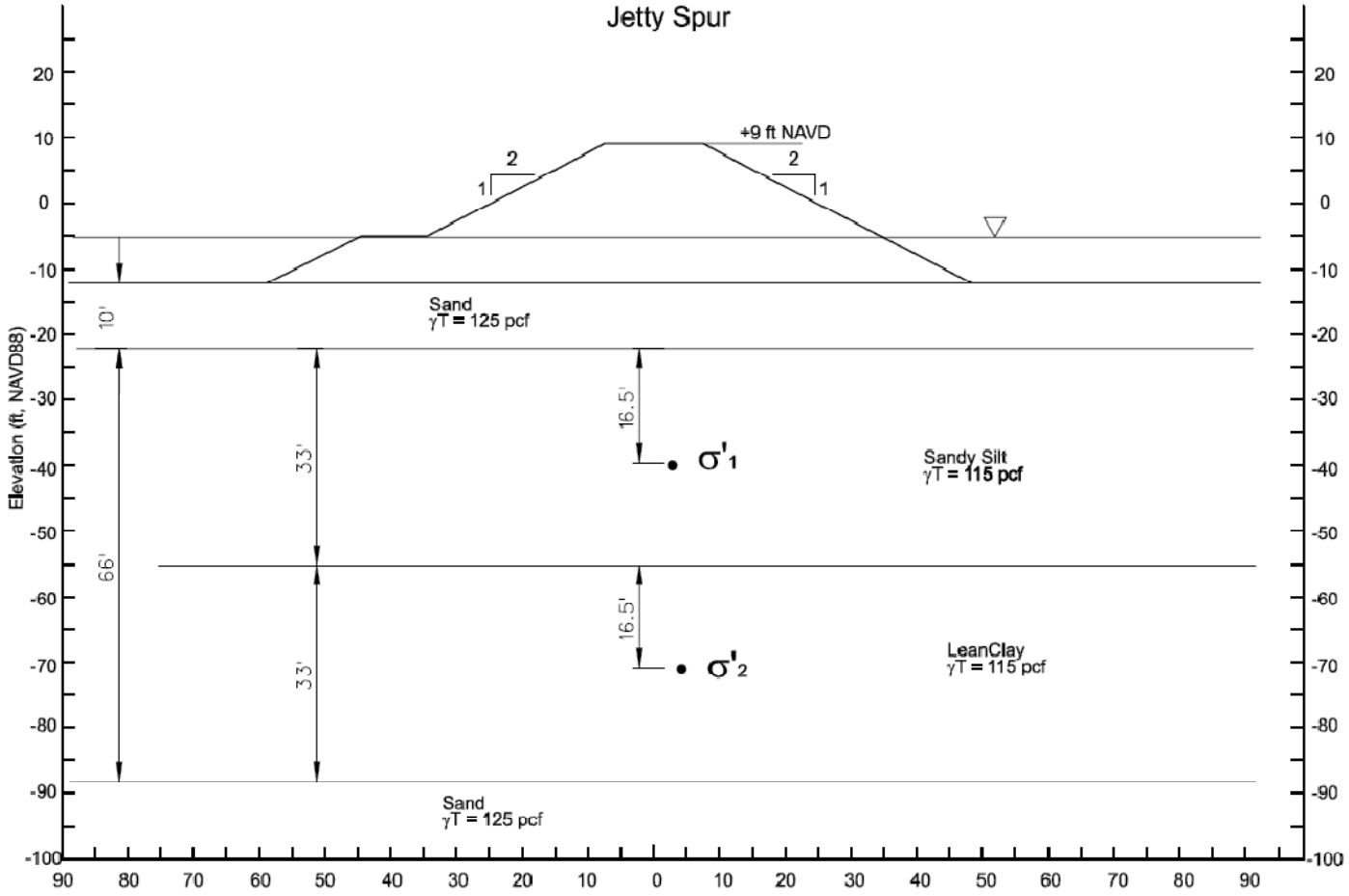


Figure C-1

PROCEDURE:

1. Determine consolidation parameters from tests on undisturbed samples.

   a) At FD-20, an undisturbed sample of the sandy silt was taken at a depth of 17-19 ft BGS. Although an undisturbed sample of the lean clay was not taken at FD-20, a tube of lean clay was collected at FD-12 at a depth of 44-46 ft BGS, which is very similar to the lean clay encountered in the deeper portion of FD-20. Consolidation test data for each of these samples is plotted on Figures 3 and 4.

   In order to determine consolidation parameters, the first step is to determine the existing effective overburden stress at each sample depth:

Figure C-2: Alt. 25A Shown in Blue, Alt. 6 Shown in Red

For FD-20 17-19' deep (organic sandy silt):

depth z_{sand}=10 ft, depth z_{silt}=8 ft.

γ_{sand}=125 pcf, γ_{silt}=115 pcf

$$\sigma'_{vo} = (\gamma_{sand} - \gamma_{water}) \bullet z_{sand} + (\gamma_{silt} - \gamma_{water}) \bullet z_{silt}$$

σ'_{vo}=1.02 ksf

A plot of vertical effective stress vs. void ratio for the FD-20 consolidation test is shown in Figure C-3.

For FD-12, 44-46' deep (lean clay):

depth z_{sand}=32 ft, depth z_{clay}=13 ft.

γ_{sand}=125 pcf, γ_{clay}=115 pcf

$$\sigma'_{vo} = (\gamma_{sand} - \gamma_{water}) \bullet z_{sand} + (\gamma_{clay} - \gamma_{water}) \bullet z_{clay}$$

σ'_{vo}=2.62 ksf

Figure C-4 shows a plot of vertical effective stress vs. void ratio for the FD-12 consolidation test.

b) Using the Casagrande Construction (Holtz and Kovacs, p. 296), determine the maximum past pressure σ_p'

As shown on Figure C-3 (FD-20), σ_p'=2.8 ksf > σ'_{vo}=1.02 ksf; therefore, the soil is overconsolidated. This makes sense, as the shoreline has receded several hundred feet over the last few centuries; it is likely that the original shoreline was historically at or very near the location of FD-20.

As shown on Figure C-4 (FD-12), σ_p'=5.3 ksf >σ'_{vo}=2.62 ksf; therefore, the soil is overconsolidated. This makes sense, as the shoreline has receded several hundred feet over the last few centuries; it is likely that the original shoreline was historically at or very near the location of FD-12.

c) Because the soil is overconsolidated, the parameters C_c (virgin compression) and C_r (recompression) need to be determined. They are determined graphically using the Schmertmann method (Holtz and Kovacs, p. 332-333) of establishing the slopes of the field virgin compression curve (C_c) and the recompression curve (C_r).

As illustrated in Figure C-3 (FD-20):

$$C_r = 0.033 \text{ and } C_c = 0.38$$

In Figure C-4 (FD-12):

$$C_r = 0.053 \text{ and } C_c = 0.46$$

FD-20 Consolidation Curve

In-Situ Depth 17-19 ft

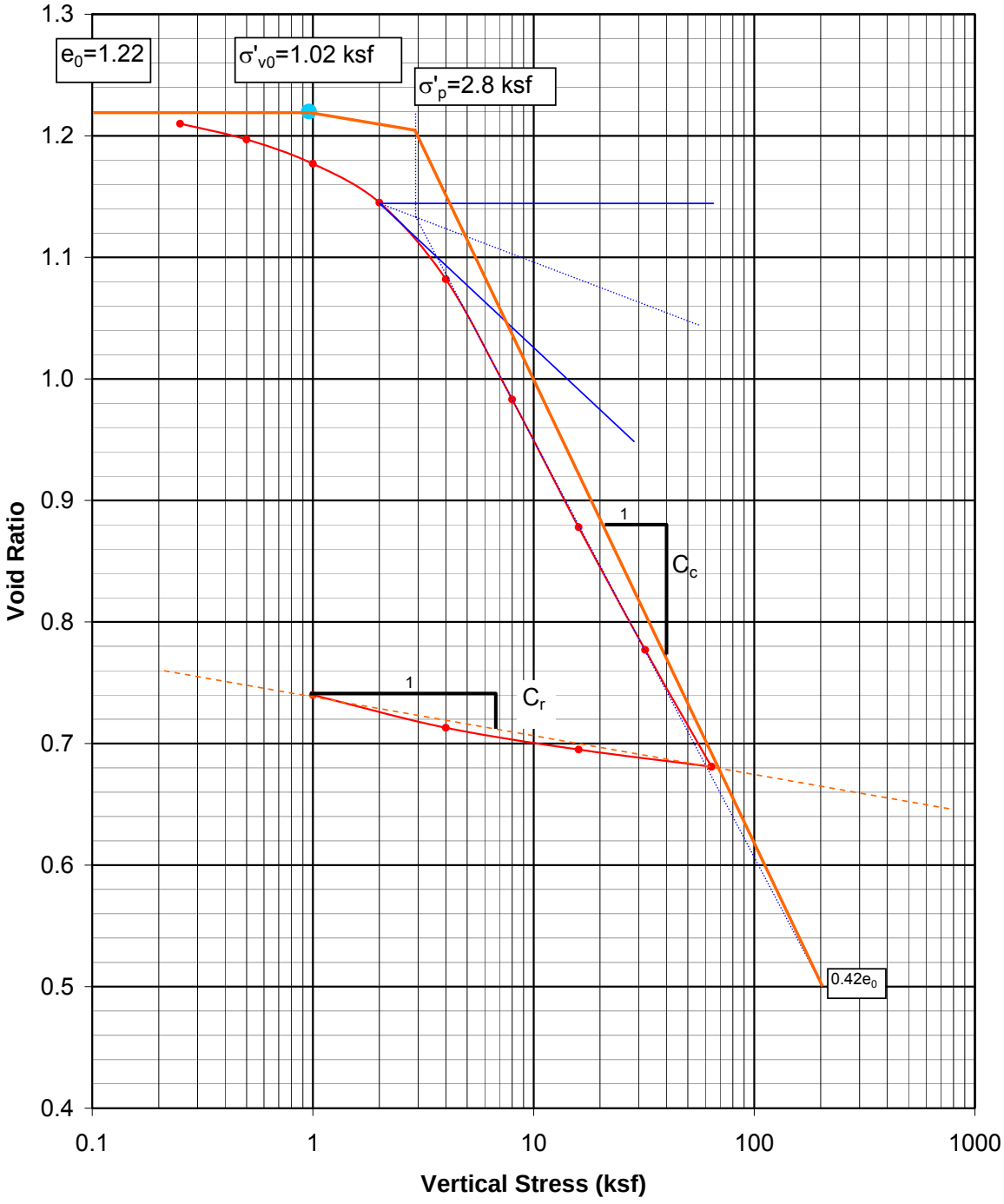


Figure C-3

FD-12 Consolidation Curve

In-Situ Depth 44-46 ft

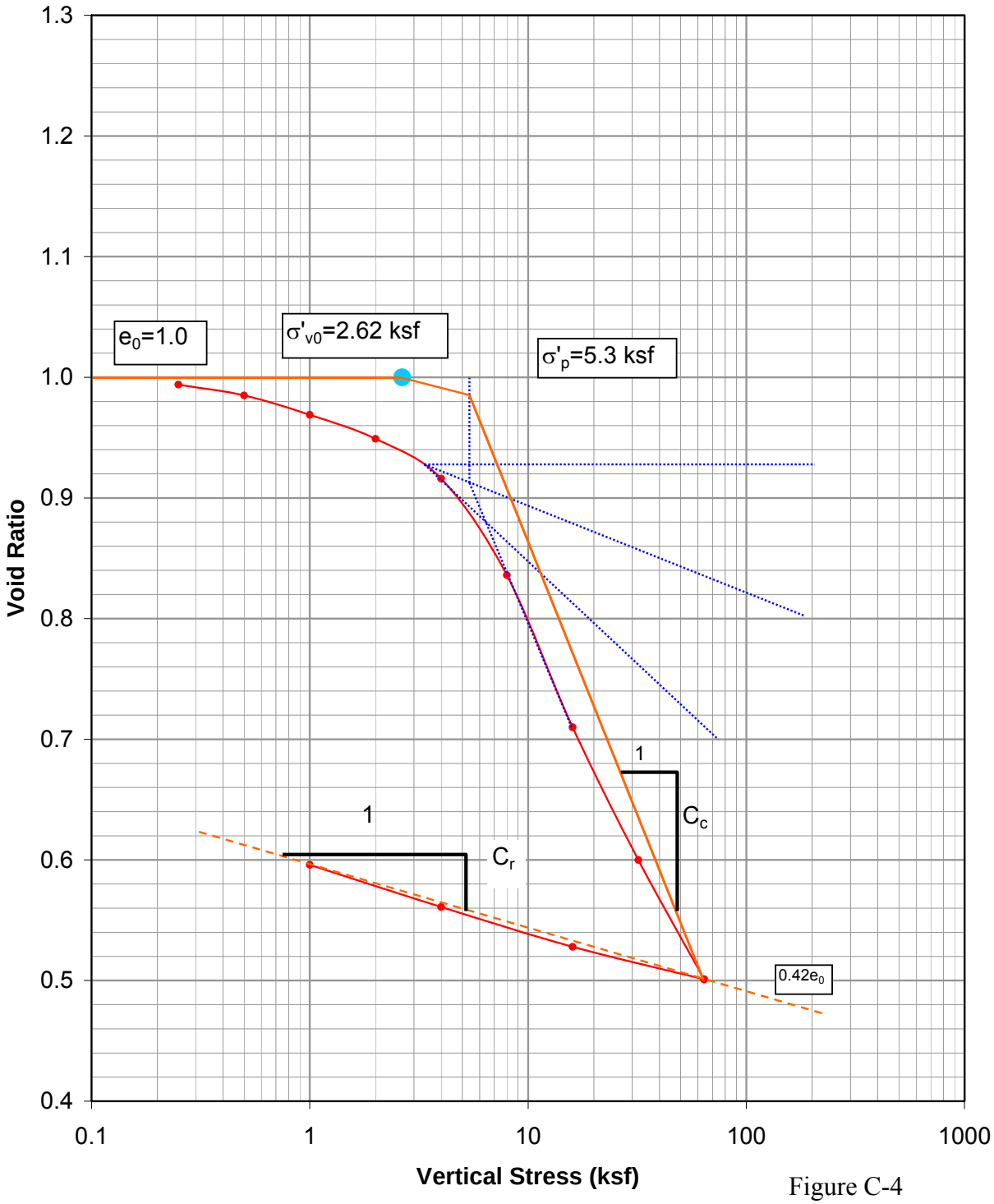


Figure C-4

2. Calculate consolidation settlement for each compressible layer underneath the jetty spur.

a) To calculate settlement in overconsolidated clays, Holtz and Kovacs presents the following equations:

$$If \quad \sigma'_{vo} + \Delta\sigma_v < \sigma'_p$$

$$S_c = \frac{C_r H_o}{1+e_o} \log \frac{\sigma'_{vo} + \Delta\sigma_v}{\sigma'_{vo}}$$

$$If \quad \sigma'_{vo} + \Delta\sigma_v > \sigma'_p$$

$$S_c = \frac{C_r H_o}{1+e_o} \log \frac{\sigma'_p}{\sigma'_{vo}} + \frac{C_c H_o}{1+e_0} \log \frac{\sigma'_{vo} + \Delta\sigma_v}{\sigma'_p}$$

Where
H_o= initial depth of compressible layer
e_o=initial void ratio
σ'_{vo}=initial vertical effective stress at center of compressible layer
$\Delta\sigma_v$= stress increase at center of compressible layer due to breakwater construction
σ_p' = maximum past pressure (from Casagrande construction)
C_r,C_c=coefficients of recompression and virgin compression

At the middle of the silt layer, directly below the centerline of the foundation z=26.5 ft BGS,

depth z_{sand}=10 ft, depth z_{silt}=16.5 ft.

γ_{sand}=125 pcf, γ_{silt}=115 pcf

$$\sigma'_{vo} = (\gamma_{sand} - \gamma_{water}) \bullet z_{sand} + (\gamma_{silt} - \gamma_{water}) \bullet z_{silt}$$

σ'_{vo}=(125-64)×10+(115-64)×16.5

σ'_{vo}= 1.45 ksf

As calculated previously, the change in vertical stress due to the jetty spur construction at a depth of z=26.5 ft BGS is:

$\Delta\sigma_v$= 1.78 ksf

$\sigma'_{vo}+\Delta\sigma_v$= 3.23 ksf > σ_p'=2.80 ksf

Therefore, settlement in the silt layer is calculated by:

$$S_c = \frac{C_r H_o}{1+e_o} \log \frac{\sigma'_p}{\sigma'_{vo}} + \frac{C_c H_o}{1+e_0} \log \frac{\sigma'_{vo} + \Delta\sigma_v}{\sigma'_p}$$

e_o=1.22, H_o=33 ft

$$S_c = \frac{0.033 \times 33}{1+1.22} \log \frac{2.8}{1.45} + \frac{0.38 \times 33}{1+1.22} \log \frac{1.45+1.78}{2.80}$$

$S_{c\ (silt)}$=0.49 ft

At the middle of the silt layer, directly below the centerline of the foundation z=26.5 ft BGS,

depth z_{sand}=10 ft, depth z_{silt}=33 ft, depth into clay z_{clay}=16.5 ft.

γ_{sand}=125 pcf, γ_{silt}=115 pcf= γ_{clay}

$$\sigma'_{vo} = (\gamma_{sand} - \gamma_{water}) \bullet z_{sand} + (\gamma_{silt} - \gamma_{water}) \bullet z_{silt} + (\gamma_{clay} - \gamma_{water}) \bullet z_{clay}$$

$$\sigma'_{vo}=(125-64)\times 10+(115-64)\times 33+(115-64)\times 16.5$$

$$\sigma'_{vo}= 3.13 \text{ ksf}$$

For the clay layer below the silt layer, the change in vertical stress due to the jetty spur construction at a depth of z=59.5 ft BGS is:

$$\Delta\sigma_v = 1.16 \text{ ksf}$$

$$\sigma'_{vo}+\Delta\sigma_v = 4.29 \text{ ksf} < \sigma_p' = 5.3 \text{ ksf}$$

Therefore, settlement in the clay layer is calculated by:

$$S_c = \frac{C_r H_o}{1+e_o} \log \frac{\sigma'_{vo} + \Delta\sigma_v}{\sigma'_{vo}}$$

e_o=1.0, H_o=33 ft

$$S_c = \frac{0.053 \times 33}{1+1.0} \times \log\left(\frac{3.13+1.16}{3.13}\right)$$

$$S_{c\ (clay)}=0.12 \text{ ft}$$

$$S_{c\ (TOT)} = S_{c\ (silt)} + S_{c\ (clay)}$$

$$\mathbf{S_{c\ (TOT)} = 0.61 \text{ ft}}$$

Similar calculations were performed at various points underneath the jetty spur, using calculated stress increases presented in Part B. These results are printed in tabular form below. Settlements for the Alt. 6 jetty spur are expected to be similar to these values, so no separate calculations were performed.

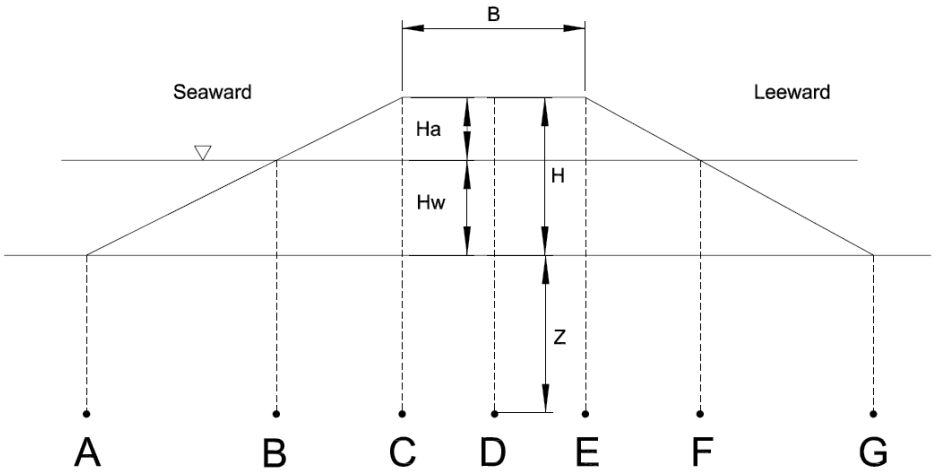


Table C1 - Settlement of Jetty Spur

		Parameters for Silt Layer					Parameters for Clay Layer				
Point	Dist. from CL (ft)	e_0	σ'_{vo} (ksf)	$\Delta\sigma^1$ (ksf)	σ'_p (ksf)	$\sigma'_{vo}+\Delta\sigma_v$ (ksf)	e_0	σ'_{vo} (ksf)	$\Delta\sigma^2$ (ksf)	σ'_p (ksf)	$\sigma'_{vo}+\Delta\sigma_v$ (ksf)
D	0.0	1.22	1.45	1.78	2.80	3.23	1.00	3.13	1.16	5.3	4.29
C	7.5	1.22	1.45	1.72	2.80	3.17	1.00	3.13	1.14	5.3	4.27
E	7.5	1.22	1.45	1.72	2.80	3.17	1.00	3.13	1.14	5.3	4.27
B	35.5	1.22	1.45	0.74	2.80	2.19	1.00	3.13	0.74	5.3	3.87
F	35.5	1.22	1.45	0.74	2.80	2.19	1.00	3.13	0.74	5.3	3.87
A	49.5	1.22	1.45	0.39	2.80	1.84	1.00	3.13	0.56	5.3	3.70
G	49.5	1.22	1.45	0.39	2.80	1.84	1.00	3.13	0.56	5.3	3.70

1. Stress Increase in Middle of Silt Layer Due to Breakwater Construction (calculated separately)
2. Stress Increase in Middle of Clay Layer Due to Breakwater Construction (calculated separately)

		Silt Layer (Cr and Cc from FD-20 Tests)				Clay Layer (Cr and Cc from FD-12 Tests)				
Point	Dist. from CL (ft)	C_r	C_c	H_{silt} (ft)	S_c (ft)	C_r	C_c	H_{clay} (ft)	S_c (ft)	Total S_c (ft)
D	0.0	0.0330	0.3800	33	0.49	0.0530	0.4600	33	0.12	**0.61**
C	7.5	0.0330	0.3800	33	0.44	0.0530	0.4600	33	0.12	**0.56**
E	7.5	0.0330	0.3800	33	0.44	0.0530	0.4600	33	0.12	**0.56**
B	35.5	0.0330	0.3800	33	0.09	0.0530	0.4600	33	0.08	**0.17**
F	35.5	0.0330	0.3800	33	0.09	0.0530	0.4600	33	0.08	**0.17**
A	49.5	0.0330	0.3800	33	0.05	0.0530	0.4600	33	0.06	**0.11**
G	49.5	0.0330	0.3800	33	0.05	0.0530	0.4600	33	0.06	**0.11**

Settlements were also calculated for the north and south detached breakwaters of Alt. 25A. The consolidation test results for the sample collected at FD-05 were used for these calculations. The test results are presented on Figure C-5 the next page.

FD-5 Consolidation Curve

In-Situ Depth 10-12 ft

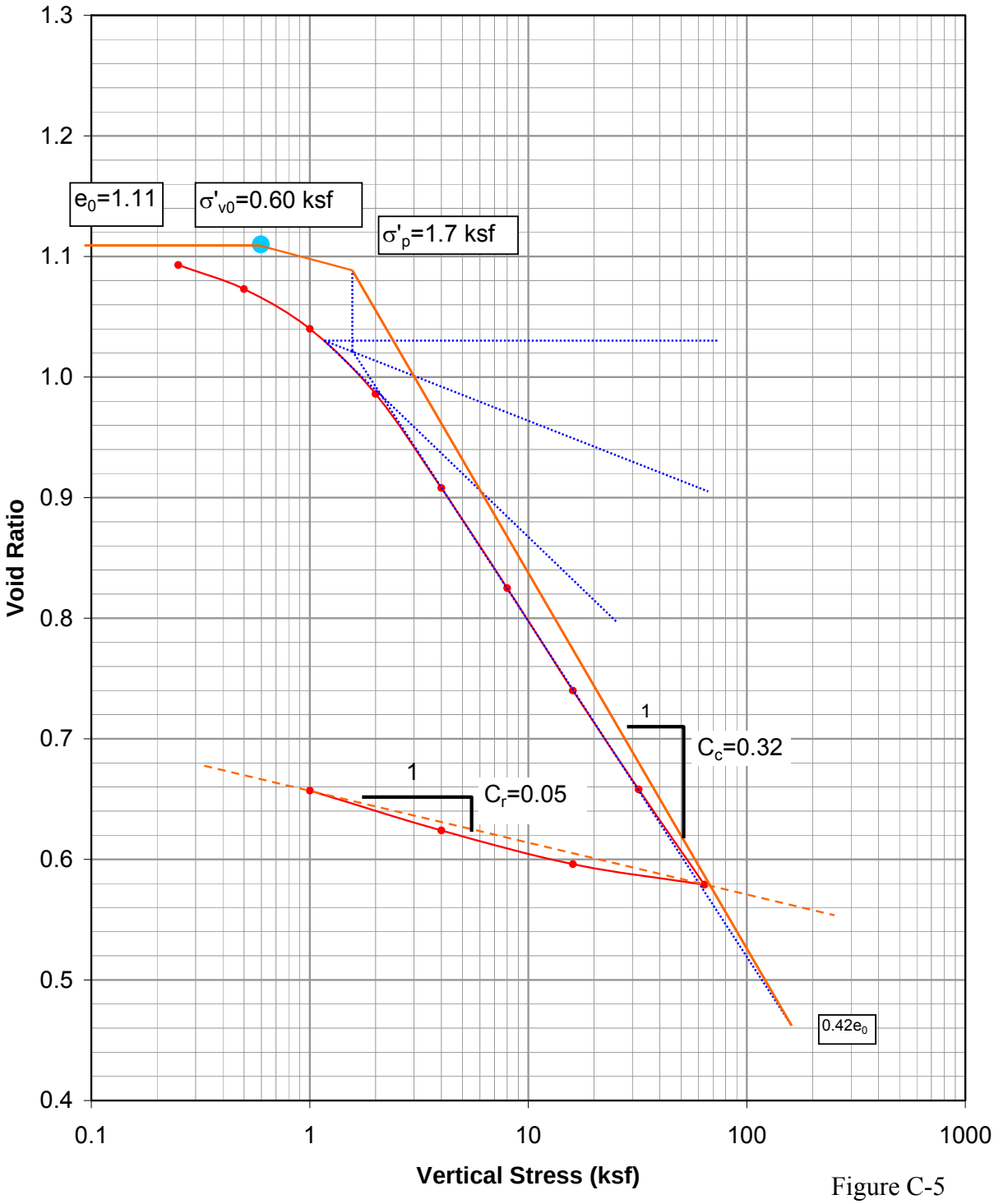


Figure C-5

For the south breakwater:

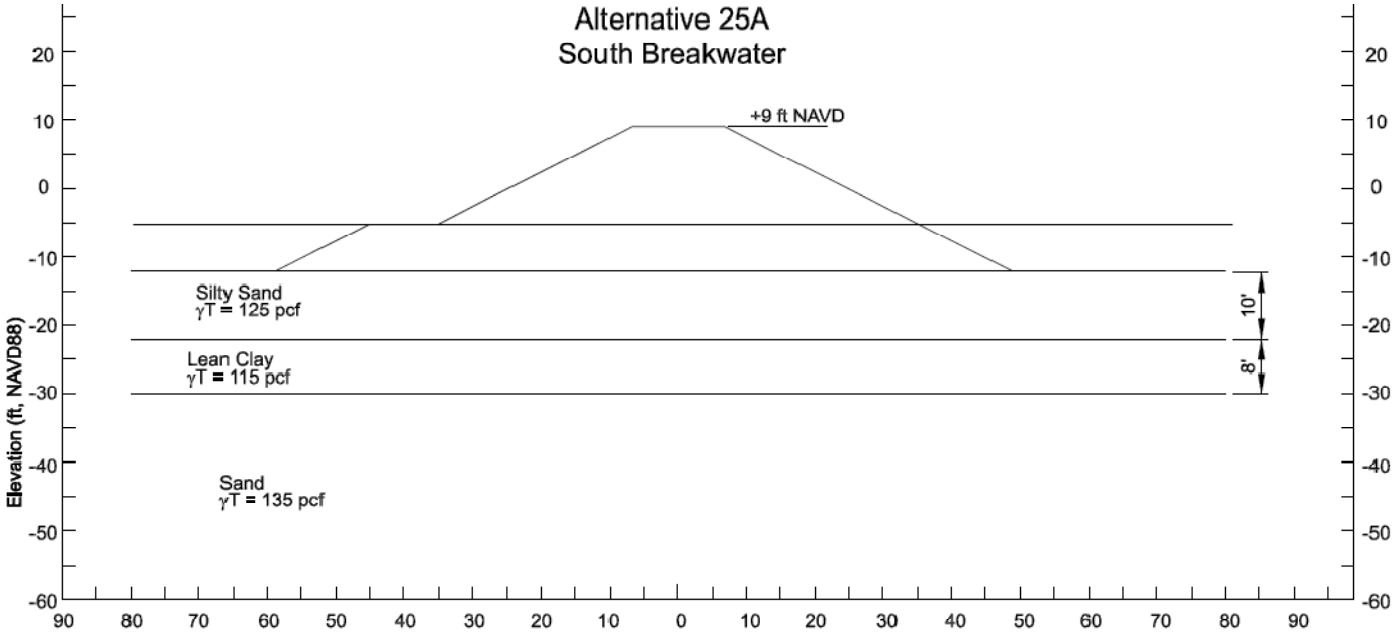


Table C2 - Settlement of South Breakwater

		Parameters for Clay Layer				
Point	Dist. from CL (ft)	e_0	σ'_{vo} (ksf)	$\Delta\sigma$ (ksf)	σ'_p (ksf)	$\sigma'_{vo}+\Delta\sigma_v$ (ksf)
D	0.0	1.10	0.81	1.88	1.70	2.70
C	7.5	1.10	0.61	1.81	1.70	2.42
E	7.5	1.10	0.61	1.81	1.70	2.42
B	35.5	1.10	0.61	0.48	1.70	1.09
F	35.5	1.10	0.61	0.48	1.70	1.09
A	49.5	1.10	0.61	0.21	1.70	0.82
G	49.5	1.10	0.61	0.21	1.70	0.82

		Clay Layer (Cr and Cc from FD-5 Tests)			
Point	Dist. from CL (ft)	C_r	C_c	H_{clay} (ft)	S_c (ft)
D	0.0	0.0500	0.3200	8	0.30
C	7.5	0.0500	0.3200	8	0.27
E	7.5	0.0500	0.3200	8	0.27
B	35.5	0.0500	0.3200	8	0.05
F	35.5	0.0500	0.3200	8	0.05
A	49.5	0.0500	0.3200	8	0.02
G	49.5	0.0500	0.3200	8	0.02

For the North breakwater:

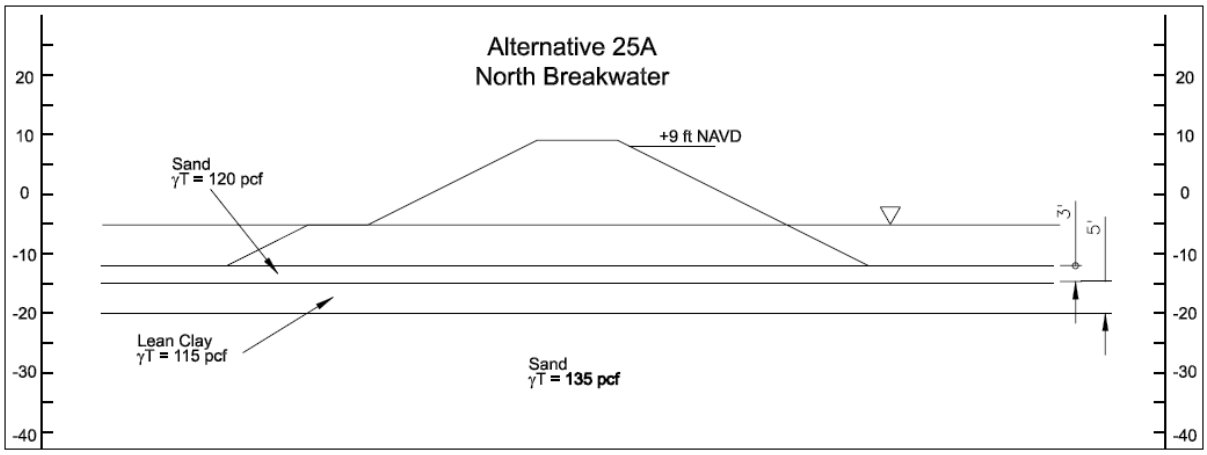


Table C3 - Settlement of North Breakwater

		Parameters for Clay Layer				
Point	Dist. from CL (ft)	e_0	σ'_{vo} (ksf)	$\Delta\sigma$ (ksf)	σ'_p (ksf)	$\sigma'_{vo}+\Delta\sigma_v$ (ksf)
A	0.0	1.10	0.74	2.26	1.70	2.99
C	7.5	1.10	0.61	2.18	1.70	2.79
E	7.5	1.10	0.61	2.18	1.70	2.79
B	35.5	1.10	0.61	0.58	1.70	1.19
F	35.5	1.10	0.61	0.58	1.70	1.19
A	49.5	1.10	0.61	0.09	1.70	0.70
G	49.5	1.10	0.61	0.09	1.70	0.70

		Clay Layer (Cr and Cc from FD-5 Tests)			
Point	Dist. from CL (ft)	C_r	C_c	H_{clay} (ft)	S_c (ft)
D	0.0	0.0500	0.3200	5	0.23
C	7.5	0.0500	0.3200	5	0.22
E	7.5	0.0500	0.3200	5	0.22
B	35.5	0.0500	0.3200	5	0.03
F	35.5	0.0500	0.3200	5	0.03
A	49.5	0.0500	0.3200	5	0.01
G	49.5	0.0500	0.3200	5	0.01

CONCLUSIONS:

The maximum expected settlement underneath the Alt. 25A and Alt. 6 jetty spurs is **0.61 ft**. For the south breakwater, maximum settlement is expected to be **0.3 ft**, and under the north breakwater **0.23 ft**. This magnitude of settlement is not expected to significantly affect long-term stability of the structure, nor should it impact the intended function of the stone structures.

REFERENCES:

Holtz, R. and Kovacs, W. An Introduction to Geotechnical Engineering (1981) Prentice Hall, Inc.

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SECTION 111 SHORE PROTECTION
GEOTECHNICAL DESIGN APPENDIX
ATTACHMENT D
STABILITY ANALYSIS

Update: 1/21/2011

OBJECTIVE: Evaluate slope and foundation stability for Alternative 25A jetty spur and detached breakwaters immediately post-construction (undrained case), as well as the fully drained (long-term) case where excess pore water pressures have fully dissipated. Insure that the calculated Factors of Safety (FS) meet the minimum required by USACE guidance.

PROCEDURE:

1. Determine Criteria for minimum required Factors of Safety for End-of Construction (undrained) and Long-Term (fully drained) cases according to USACE guidance.

a) Factors of Safety for Rock Fill Dams are given in EM1110-2-1902 (USACE, 2003) and are shown in Table D-1 below:

Table D-1: Minimum Required Factors of Safety: New Earth and Rock Fill Dams (After USACE, 2003)

Analysis Condition	Required Minimum Factor of Safety
Post Construction (Undrained)	1.3
Long Term (Fully Drained)	1.5

It is noted that the proposed breakwaters at Camp Ellis serve a different function than a rock fill dam, and that a stone breakwater can withstand significantly more deformation than an earth and rock fill dam and still function adequately. It is however reasonable to use these minimum factors of safety as a starting point for the design of the stone breakwaters, with the understanding that they may be somewhat conservative when applied to a stone breakwater.

2. Determine the design soil parameters and subsurface configuration that will be used in the stability analysis.

a) Geotechnical boring programs were conducted onshore and offshore at Camp Ellis in 2004 and 2005 (Plate D-1). The geotechnical boring program summary (Part A) discusses the extent of the subsurface exploration program, and includes several geologic profiles. Profiles A, B, and C, and E are of the most significance for this design.

b) A significant layer of compressible clay/silt exists through much of profiles A, B, and C; it is typically overlain by a 5-10 ft layer of fine-medium sand. A total of eight (8) undisturbed tube samples from this layer were collected during the boring program. Consolidated undrained (CU) triaxial tests were performed on seven of the eight tube samples collected. The results are presented in Table D-2 below. SPT N-values for split spoon samples were determined from the boring logs, and are plotted on Profiles A-C. No laboratory testing was performed on the split-spoon samples collected.

b) Most of the undisturbed tube samples were classified as lean CLAY (CL), with the exception of FD-14 and FD-20. At these locations, the material collected was much more plastic. At FD-14, the sample was classified as a fat CLAY (CH), and at FD-20 the sample was classified as a sandy elastic SILT (MH). Both of these samples had an organic odor, although organic content was not determined in the lab.

c) Design soil parameters:

1) Lean clay (CL): Table D-2 shows the results of CU triaxial tests performed on 4 tubes of lean clay. The average phi angle for the clay was 24.6°, with an average cohesion of 275 psf. The test results for FD-12 seem to be an outlier; the phi angle is lower than the other tests, but cohesion is much higher. Given that information, plus some engineering judgment, the lean clay was assigned a ϕ=24° and a unit

weight of 115 pcf. While the tests could be used to justify including a cohesion c' value for the model, cohesion was assumed to be zero to be more conservative.

Table D-2 - Summary of CU Triaxial Tests

Boring Number	Depth Interval (ft)	Sample Number	USCS	ϕ'	c' (psf)	γ_T (pcf)[1]
sandy clay/silt						
FD-14 25-2	7	U1	CH	34.9	190	N/A
FD-20 17-1	9	U1	MH	22.2	560	108
lean clay						
FD-02 10-1	2	U1	CL	26.1	115	N/A
FD-07 30-3	2	U2	CL	25.5	200	N/A
FD-12 44-4	6	U1	CL	19.6	705	117
FD-16 15-1	7	U1	CL	27.1	70	121

[1] Total unit weights determined from consolidation tests.

2) Elastic silt/clay (MH/CH): Triaxial tests on the high plasticity silt and clay materials in FD-20 and FD-14, respectively, had widely varying phi angles (Table D-2). The phi angle determined for the FD-14 sample is significantly higher than would be expected given the N-values recorded in the field while driving through this layer. Therefore, the silt/clay layer was assigned a ϕ=22°, and a unit weight of 110 pcf based on the FD-20 sample test results.

3) Silty sand (SM): The silty sand layer that lies above the clay/silt layer throughout the project ranged from 5-10 ft thick, with N-values ranging from 3-36 in borings in the immediate vicinity of the proposed structures, with an average of N=18. To determine an appropriate design phi angle, McGregor and Duncan (1998) present a table (Table D-3) that relates N values to phi values for a given soil. Assuming and average N=18, the silty sand layer was assigned a ϕ=33°.

Table D-3 Empirical values for ϕ, D_r, and unit weight based on SPT N-Value (McGregor and Duncan, 1998)

~~ption	Very loose	Loose	Medium	Dense	Very dense
Relative density D_r	0	0.15	0.35	0.65	0.85 1.00
Standard penetration no. N		4	10	30	50
Approx. angle of internal friction ϕ°†	25°–30°	27–32°	30–35°	35–40°	38–43°
Approx. range of moist unit weight, (γ) pcf	70–100‡	90–115	110–130	110–140	130–150

† After Meyerhof [9]. $\phi = 25 + 0.15D_r$ with more than 5 percent fines and $\phi = 30 + 0.15D_r$ with less than 5 percent fines. Use larger values for granular material with 5 percent or less fine sand and silt.

‡ It should be noted that excavated material or material dumped from a truck will weigh 70 to 90 pcf. Material must be quite dense and hard to weigh much over 130 pcf. Values of 105 to 115 pcf for nonsaturated soils are common.

4) Sand (SP, SW): A layer of well to poorly graded sand with gravel was encountered below the clay layer at FD-13 and FD-11, underneath the lean clay. This material had relatively high blow counts, (N-values of 13-52 bpf), average N=30. Using the same chart as referenced above for the silty sand, the sand layer was assigned a ϕ=35°.

d) Design Subsurface Profiles And Stability Analysis. Idealized subsurface profiles were created for the jetty spur and detached breakwaters of Alt. 25A based on borings conducted in the vicinity of these structures. Geostudio SLOPE/W 2007 was used to analyze the proposed structures for stability for two cases; the fully drained long-term case, and the post-construction undrained case, where a significant portion of the stress increase due to the embankment results in excess pore pressure in the fine-grained clay and silt.

1) Jetty Spur (Alt. 25A and Alt. 6): Design cross sections for the head and trunk of the Alt. 25A jetty spur are shown in Figure D-1. The cross sections for the Alt. 6 jetty spur are identical.

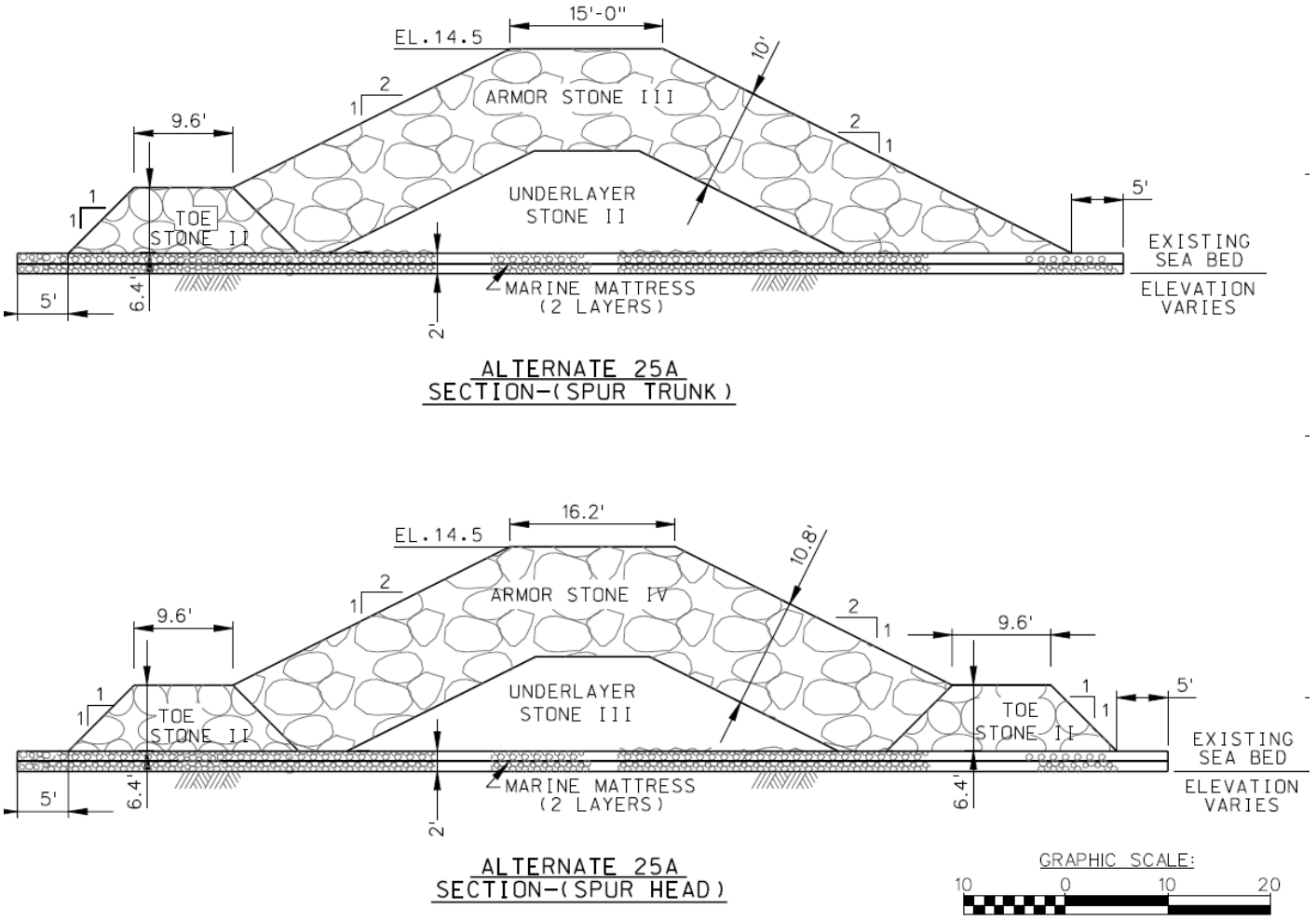


Figure D-1 – Alt. 25A and Alt. 6 Jetty Spur Cross Sections

Geologic profiles were created along the approximate centerline of the Alt. 25A jetty spur (Profile A, Plate D-2), and through the Alt.25A and Alt. 6 jetty spurs (Profile B, Plate D-3).

Based on these sections, as well as the geologic profiles, an idealized design subsurface was created in the SLOPE/W model. The strata include a 10 ft layer of medium dense sand, underlain by a 33 ft layer of elastic sandy silt, and then a 33 ft layer of lean clay. Soil properties were used as discussed above. While this section is more representative of the subsurface conditions at the Alt. 25A jetty spur, it was considered similar to the subsurface of the Alt. 6 spur. Therefore, the results for the 25A jetty are assumed applicable to the Alt. 6 spur.

The SLOPE/W model created for the jetty spur head section is shown in Figure D-2. The trunk section is identical with the exception that there is no toe berm on the landward (right) side of the structure. The water level was placed at MLLW to present a "worst case" where there would be minimal buoyancy of the rock fill.

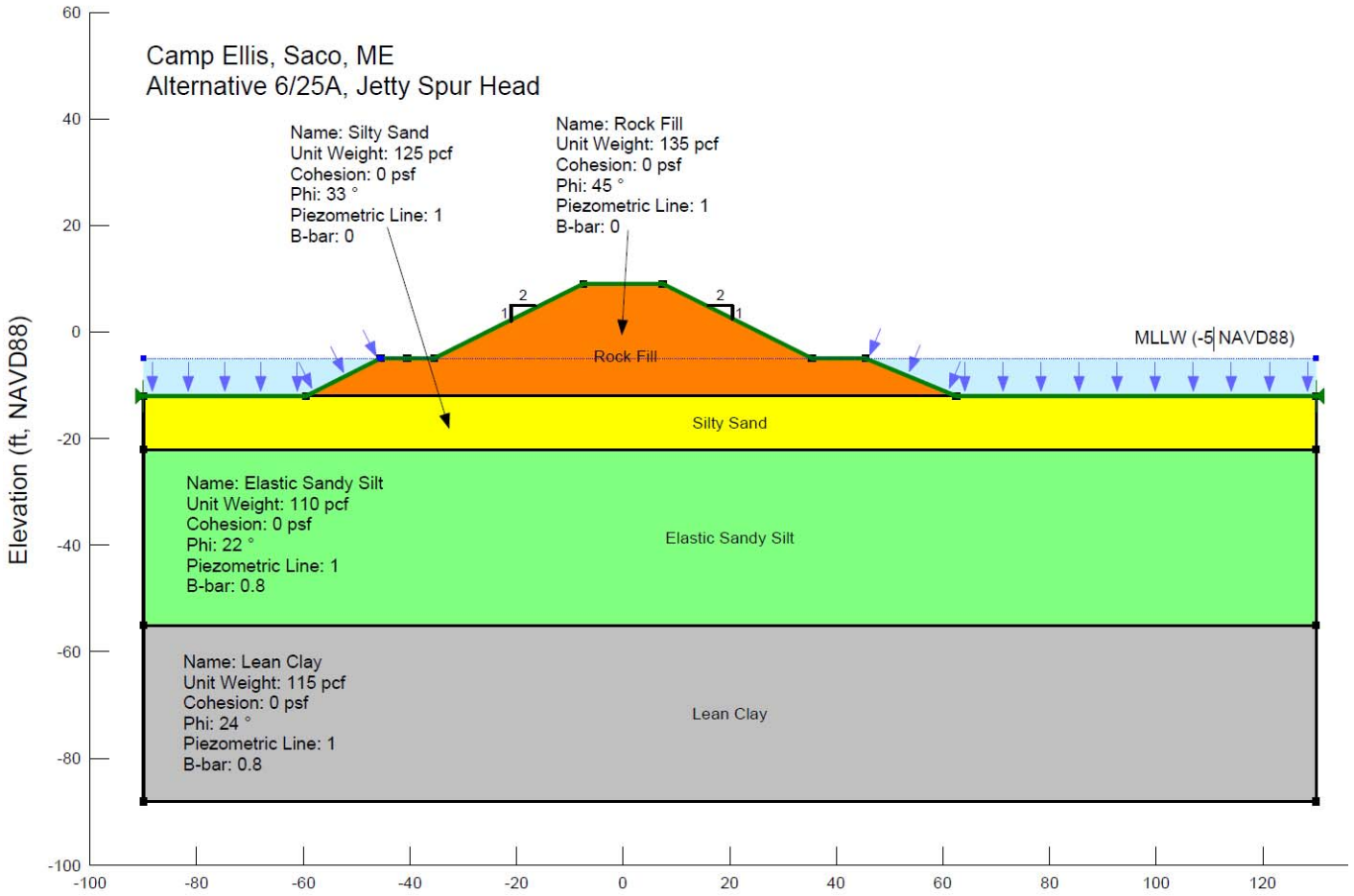


Figure D-2– SLOPE/W Model, Jetty Spur Head Section

The critical failure surface for the head section, determined using a grid and radius search, resulted in a failure circle passing through the silty sand and into the elastic silt with a FS=1.9. For the trunk section, the failure circle was identical, but had a FS=1.8. A plot showing the location of the failure circles is located on Plates D-4 and D-5.

For the undrained case immediately post-construction, SLOPE/W includes a method to simulate the magnitude of excess pore pressure generated by placing a load (in this case, a breakwater/embankment) on top of an existing soil matrix. The parameter B_{Bar} is defined as:

$$B_{Bar} = \frac{\Delta u}{\Delta \sigma_1}$$

Where Δu=excess pore pressure generated in soil layer due to:
$\Delta \sigma_1$=increase in vertical stress due to loading

If the entire embankment load was immediately placed on top of the layer, then B_{bar}=1. This is of course unrealistic. For this case, it can be assumed that pore pressures will start to dissipate as the embankment is constructed over several months time. Therefore, a B_{bar}=0.8 was used for the silty clay and lean clay layers under the jetty spur, assuming that approximately 20% of the excess pore pressure was dissipated at the end of construction (this is admittedly a conservative assumption, however, as the clay layers have a very long drainage path, a higher value for this parameter was used).

As shown on Plates D-6 and D-7, the critical failure circle passes through the silty sand and into the elastic silt layer, and has a FS=1.3 for both the head and trunk sections.

2) Alt. 25A North Breakwater Segment: The design cross sections for the head and the trunk of the northern breakwater are shown in Figure D-3 below.

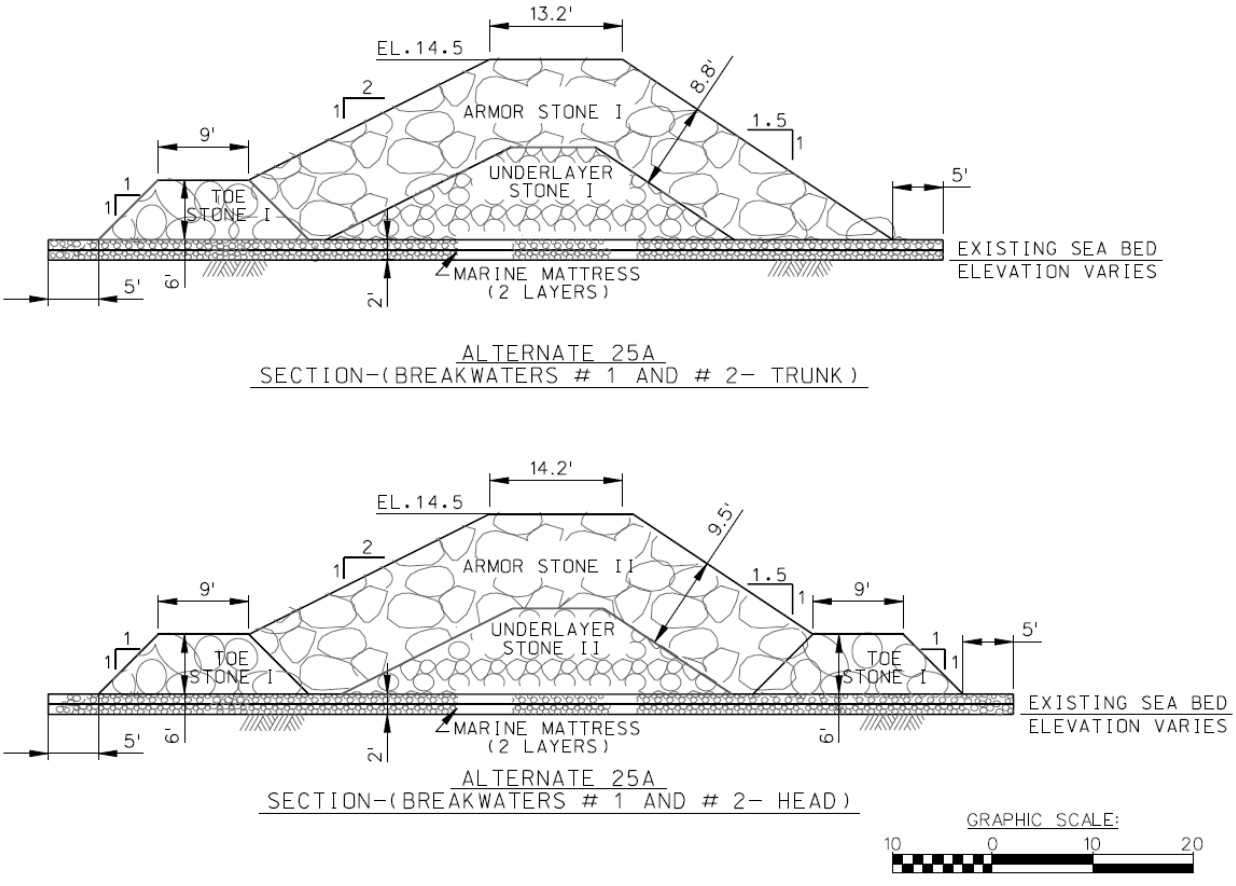


Figure D-3 – Alternative 25A Detached Breakwaters

Update: 1/21/2011

Soil profiles C and E (Plates D-8 and D-9) were used to develop the subsurface profiles for the north and south breakwaters. At the northern end of the north breakwater (head section), a 4 ft layer of lean clay was encountered (FD-13); however, at the south end of the north breakwater, no clay was encountered (FD-17). The simplified SLOPE/W cross section for the north head of the north breakwater is shown below.

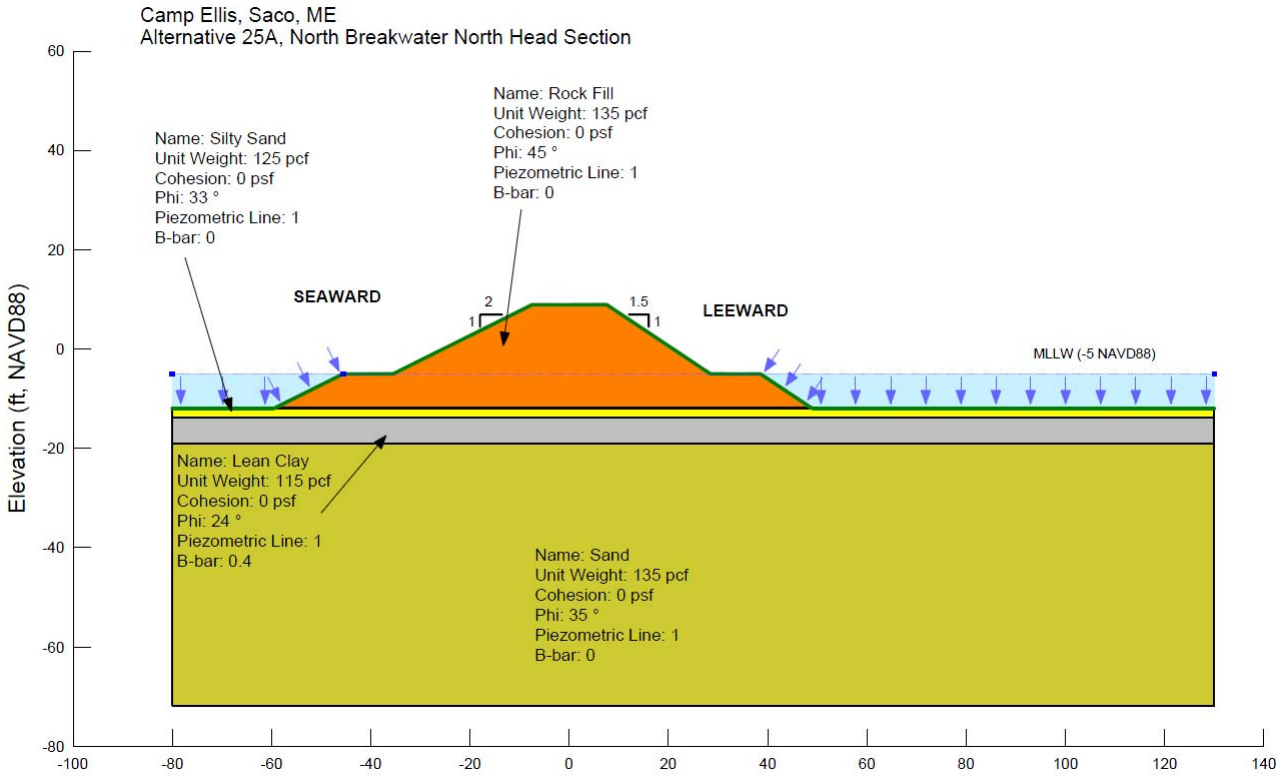


Figure D-4 SLOPE/W Model Section, North Breakwater, North Head

For this case, the lean clay was assigned a B_{Bar} value of 0.4. The rationale is that the clay layer is only 4 ft thick at this location, and is doubly drained; therefore, it is expected that more of the excess pore pressures generated by the embankment load would be dissipated at completion of construction. For the fully drained case, the critical failure surface passed through the lean clay and had a FS=1.6. For the undrained case, the location of the critical failure was, but had a FS=1.4. Failure circles for both cases are shown on Plates D-10 and D-11.

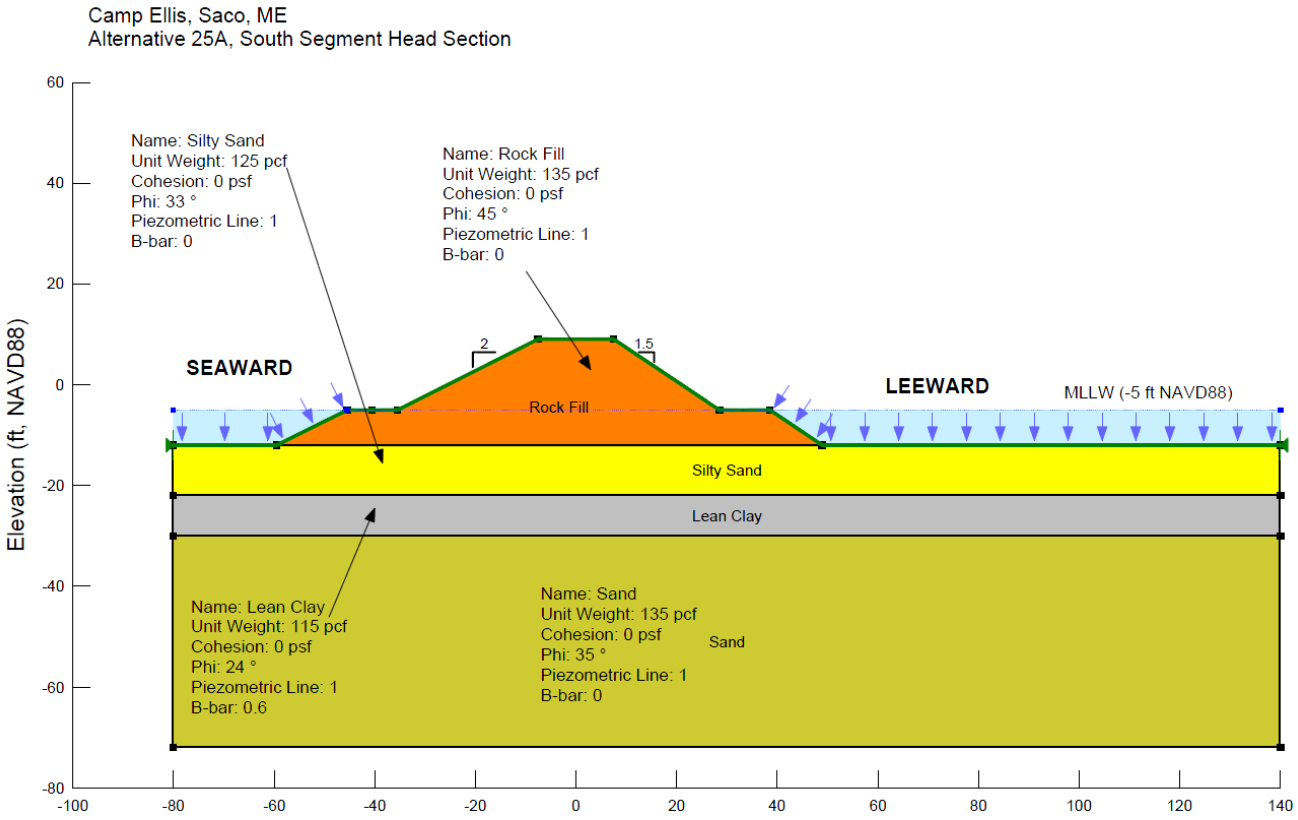
The boring information indicates that the thin shallow clay layer present at the north head of the north breakwater is limited to the head section only; progressing southward, clay was not encountered at FD-17 (south end of north breakwater). As the exact location where the clay layer ends is not known, an evaluation was performed for the trunk section (toe berm on seaward slope only) assuming it would be built on the same strata as was used to model stability of the head of the north breakwater. For the trunk section, the critical failure circle had a FS=1. 4 for the drained case. For the undrained case, the critical failure surface had a FS=1.2. These circles are shown on Plates D-12 and D-13.

The boring information did not indicate the presence of weak strata at the southern end of the north breakwater (FD-17). It is possible, however, that FD-17 did not go deep enough to encounter the clay layer. Looking at Profile E (Plate D-9), clay was encountered at FD-12 at El. -40 ft NAVD88. For the analysis of the southern trunk of the north breakwater, it was assumed that there was a 15 ft layer of lean

clay beginning at El.-40 ft NAVD88 (30 ft BGS). The critical failure surface was identical for the drained and undrained cases (Plates D-14 and D-15) with a FS=1.7.

Using the same subsurface profle as the previous analysis, the south head of the south breakwater was modeled. The failure circles were identical for the drained and undrained cases, FS=1.9 (Plates D-16 and D-17).

3) Alt 25A South breakwater: The design cross sections for the south breakwater head and trunk are the same as for the north breakwater. Based on the boring information shown on profile C, a simplified cross section was developed for the head and trunk sections of the south breakwater:



For the clay layer, B_{Bar}=0.6; the layer is 8 ft thick at this section and doubly drained, therefore, it is reasonable to assume that by the end of construction, 40% of the excess pore pressure would be dissipated. This value is slightly higher than that assumed for the clay layer underneath the north breakwater head section, as the clay layer is thicker here than at the north breakwater. For the fully drained case, the critical failure surface passed through the silty sand and had a FS=1.9. For the undrained case, the failure circle was deeper and extended into the lean clay with a FS=1.5. Failure circles for both cases are shown on Plates D-18 and D-19.

The subsurface for the trunk section was modeled the same as for the head section. For the fully drained case, the failure circle intersected the top of the silty sand, but was primarily contained within the breakwater structure and had a FS=1.6. For the undrained case, the failure circle extended into the lean clay layer, and had a FS=1.5 (Plates D-20 and D-21).

CONCLUSIONS:

a. Table D-4 below shows a summary of the stability analysis runs with calculated factors of safety. The resultant failure circles are shown on the plates indicated.

Table D-4 – Summary of SLOPE/W Runs

Structure	FS[2]	Failure Mode	Plate
Fully Drained Long-Term Case (min. FS=1.5)			
Jetty Spur[1] Head	1.9	Failure in elastic silt	D-4
Jetty Spur Trunk	1.8	Failure in elastic silt	D-5
North Breakwater Head (N. End)	1.6	Failure in clay	D-10
North Breakwater Head (S. End)	1.9	Shallow failure in sand	D-17
North Breakwater Trunk (N. End)	**1.4**	**Failure in clay**	**D-12**
North Breakwater Trunk (S. End)	1.7	Shallow failure in sand	D-15
South Breakwater Head	1.9	Shallow failure in sand	D-19
South Breakwater Trunk	1.6	Shallow failure in sand	D-21
Post Construction Undrained Case (min. FS=1.3)			
Jetty Spur Head	1.3	Failure in elastic silt	D-6
Jetty Spur Trunk	1.3	Failure in elastic silt	D-7
North Breakwater Head (N. End)	1.4	Failure in clay	D-11
North Breakwater Head (S. End)	1.9	Shallow failure in sand	D-18
North Breakwater Trunk (N. End)	**1.2**	**Failure in clay**	**D-13**
North Breakwater Trunk (S. End)	1.7	Shallow failure in sand	D-16
South Breakwater Head	1.5	Failure in clay	D-20
South Breakwater Trunk	1.5	Failure in clay	D-22

[1] Jetty spur calculations apply to the Alt. 6 and Alt. 25A jetty spurs.

[2] Factor of Safety values calculated using Morgenstern-Price Method

For almost all cases, the calculated factors of safety against foundation failure were equal to or above the minimum required by EM1110-2-1902. The exception was the north breakwater trunk section, where the calculated factors of safety were marginally less than the minimum required. This is not of significant concern, as the criteria for embankment dams are more rigid than for a rubble mound breakwater; a breakwater can withstand more deformation than an embankment and still function well. The presence of a toe berm on both sides of the structure generally increased stability and resistance to foundation failure, as is seen in the results for the north head section, where the calculated FS were higher than for the trunk section. Additionally, marine mattresses will be placed under all structures to provide additional stability and foundation support.

REFERENCES:

USACE Engineering Manual EM1110-2-1902 Stability of Dams (2003)

McGregor, J. and Duncan, J. Performance and Use of the Standard Penetration Test in Geotechnical Engineering Practice, Virginia Polytechnic Institute and State University, 1998

Camp Ellis, Saco, ME
Location of Borings in relation to Proposed Alternative 6 and 25A Structures

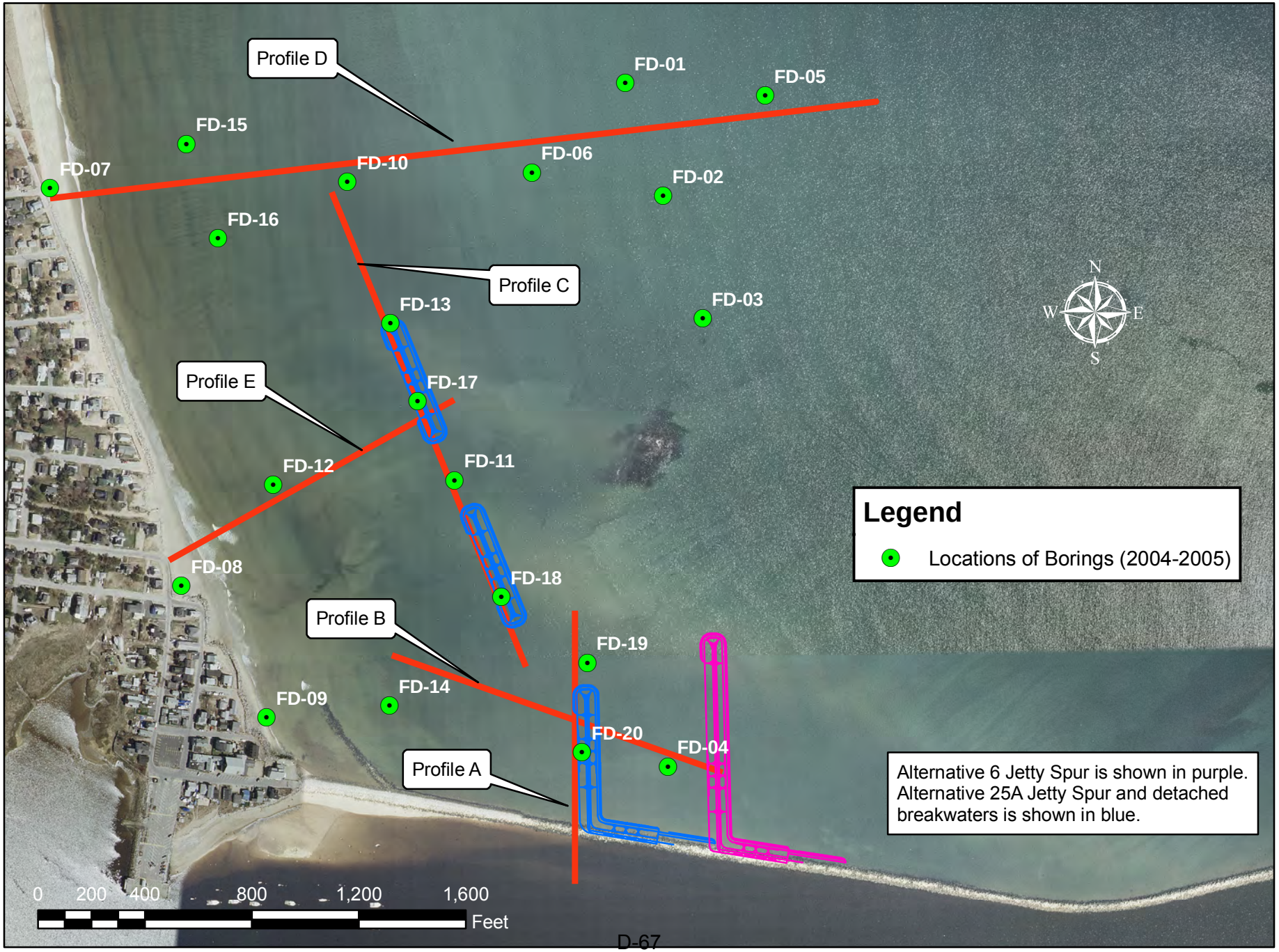
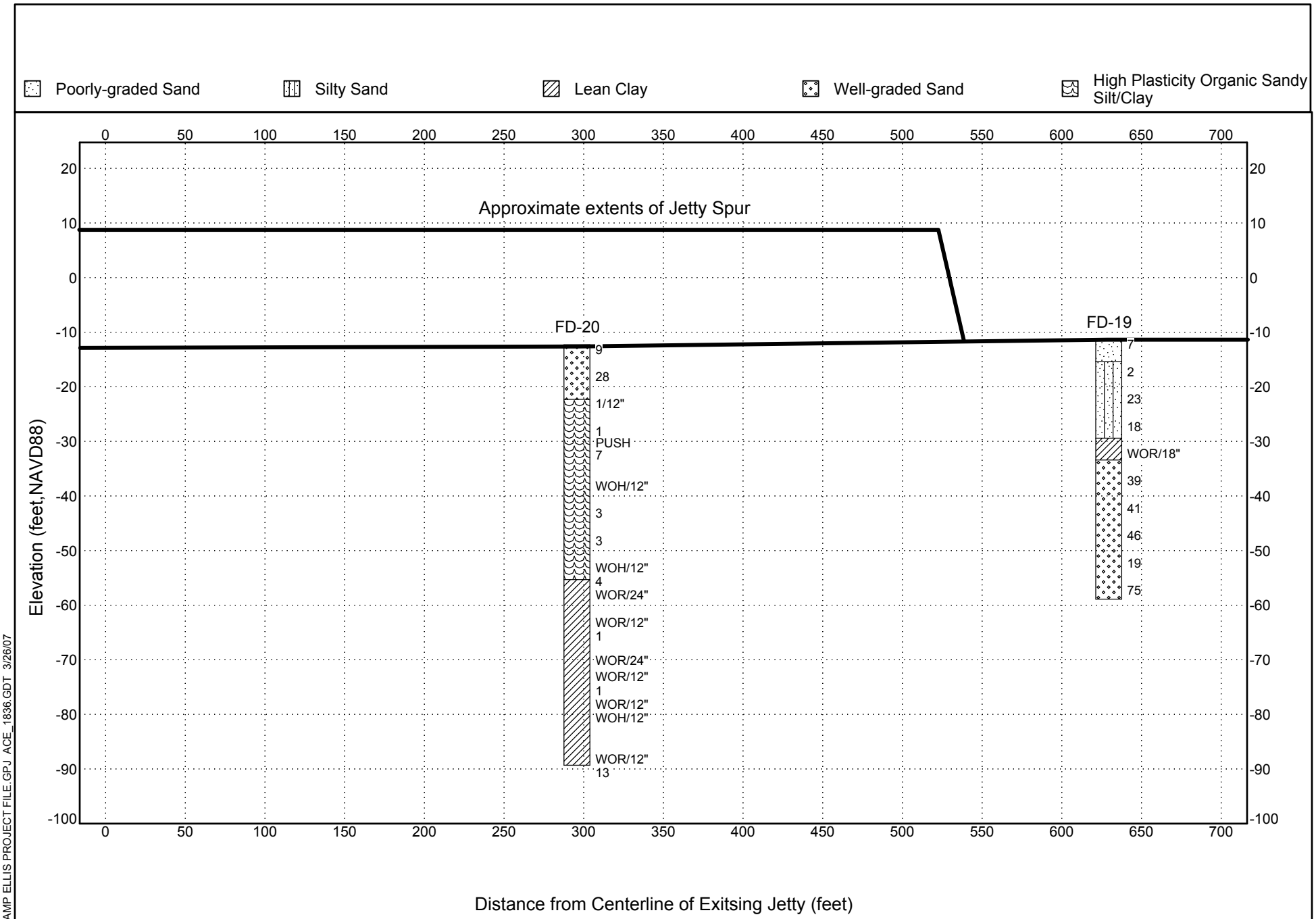


PLATE D-1

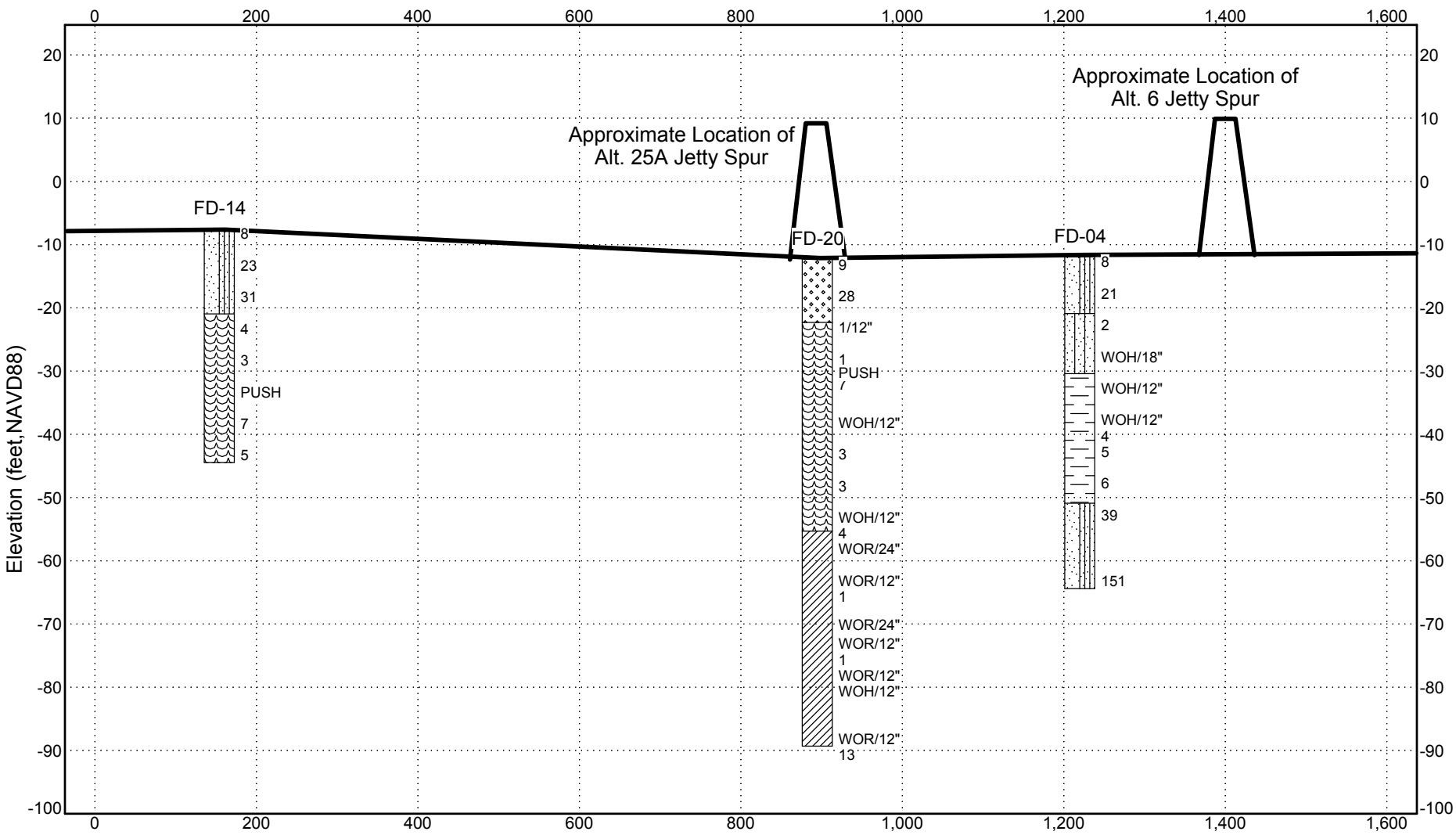


STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 3/26/07

Camp Ellis Beach
Saco, ME
Profile Along Centerline of Alt. 25A Jetty Spur
(Profile A)

PLATE D-2

Poorly-graded Sand with Silt | Silty Sand | Lean Clay | Low Plasticity Organic Sandy Silt/Clay | High Plasticity Organic Sandy Silt/Clay | Well-graded Sand



STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 3/26/07

Camp Ellis Beach
Saco, ME
Profile Across Alt. 25A and Alt. 6
Jetty Spurs (Profile B)

PLATE D-3

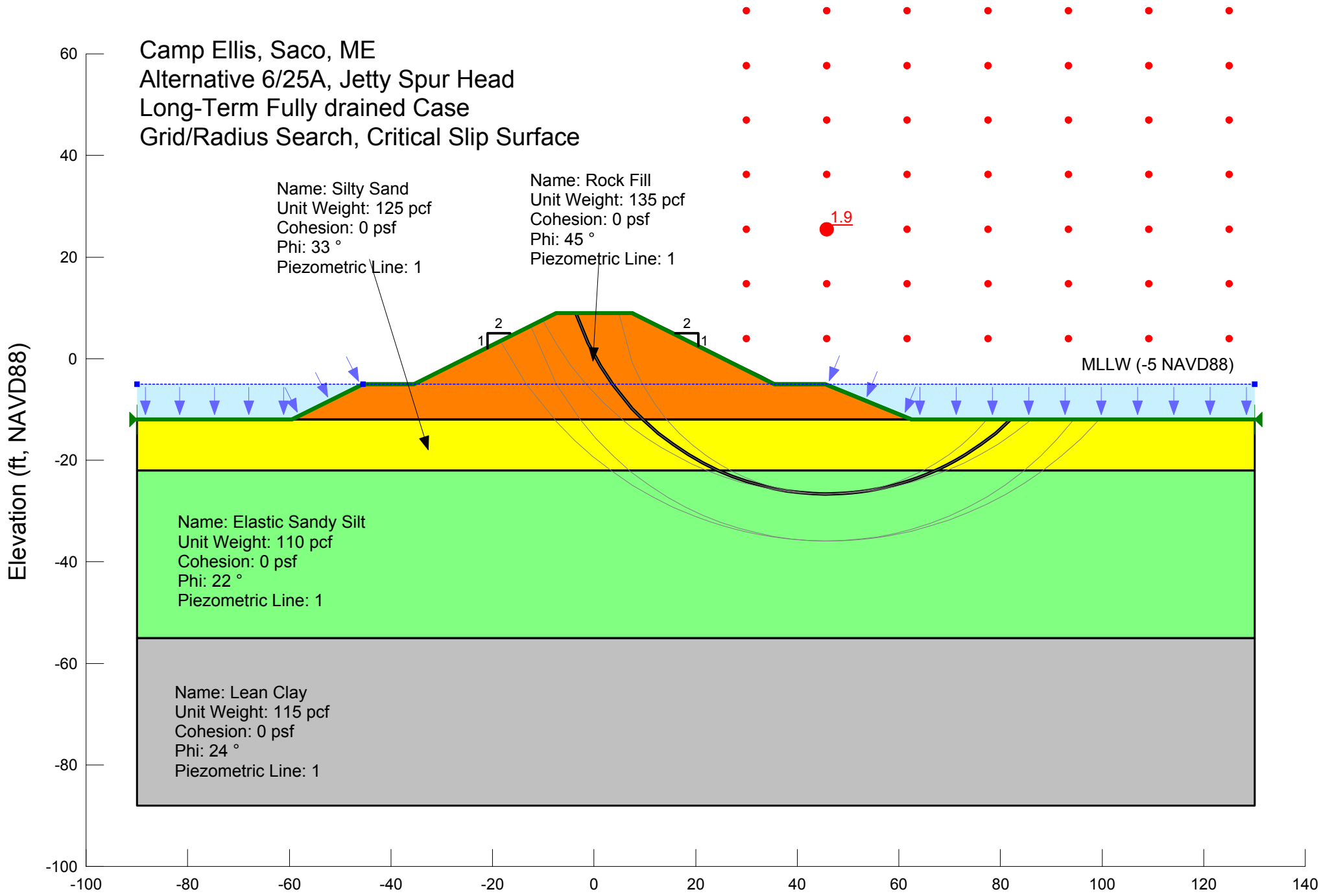
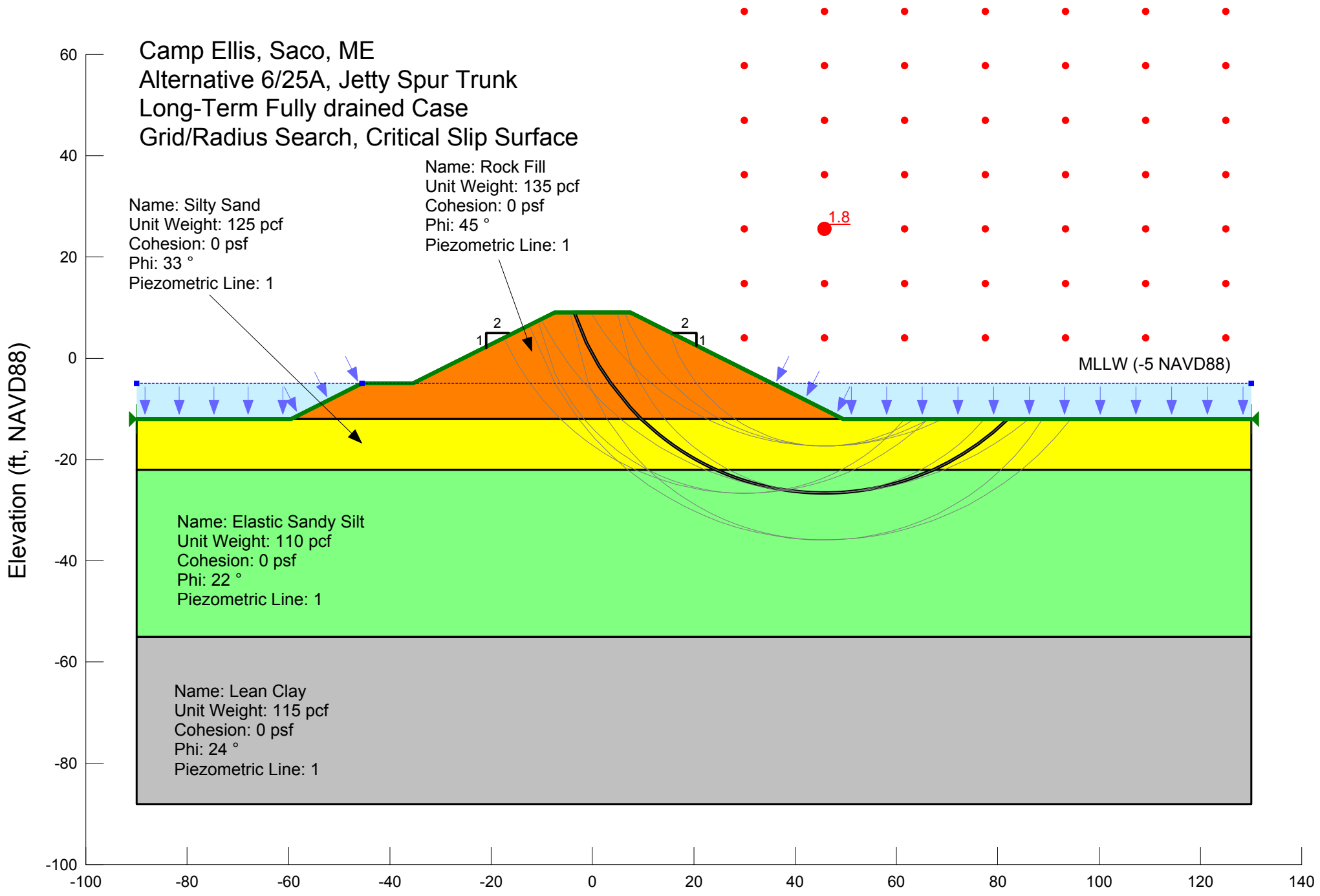

Camp Ellis, Saco, ME
Alternative 6/25A, Jetty Spur Head
Long-Term Fully drained Case
Grid/Radius Search, Critical Slip Surface
Name: Silty Sand
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 33 °
Piezometric Line: 1
Name: Rock Fill
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 45 °
Piezometric Line: 1
1.9
2
1
2
1
MLLW (-5 NAVD88)
Name: Elastic Sandy Silt
Unit Weight: 110 pcf
Cohesion: 0 psf
Phi: 22 °
Piezometric Line: 1
Name: Lean Clay
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 24 °
Piezometric Line: 1
Elevation (ft, NAVD88)
60
40
20
0
-20
-40
-60
-80
-100
-100
-80
-60
-40
-20
0
20
40
60
80
100
120
140

PLATE D-4


Camp Ellis, Saco, ME
Alternative 6/25A, Jetty Spur Trunk
Long-Term Fully drained Case
Grid/Radius Search, Critical Slip Surface
Name: Silty Sand
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 33 °
Piezometric Line: 1
Name: Rock Fill
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 45 °
Piezometric Line: 1
1.8
2
1
2
1
MLLW (-5 NAVD88)
Name: Elastic Sandy Silt
Unit Weight: 110 pcf
Cohesion: 0 psf
Phi: 22 °
Piezometric Line: 1
Name: Lean Clay
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 24 °
Piezometric Line: 1
Elevation (ft, NAVD88)
60
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20
0
-20
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PLATE D-5

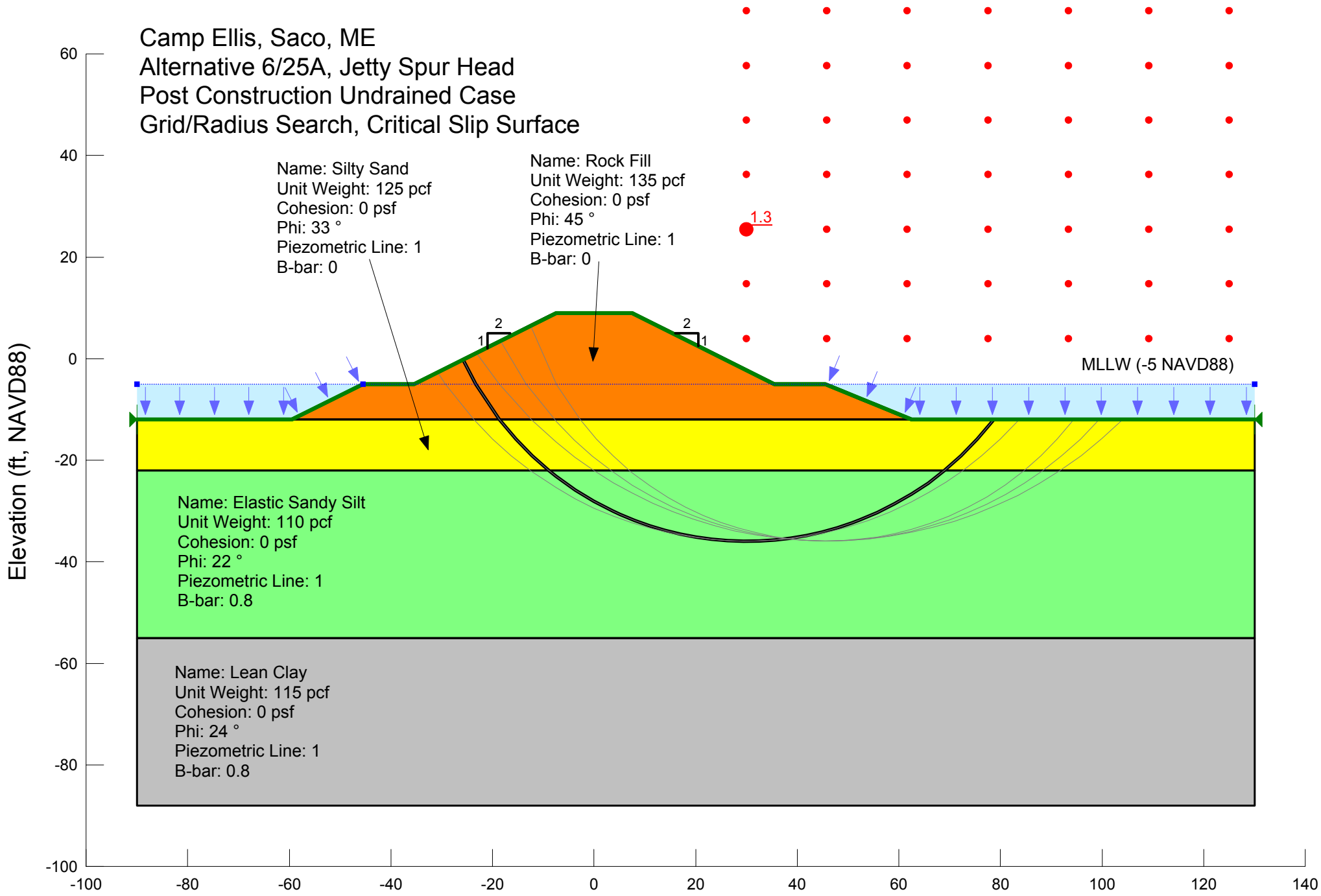
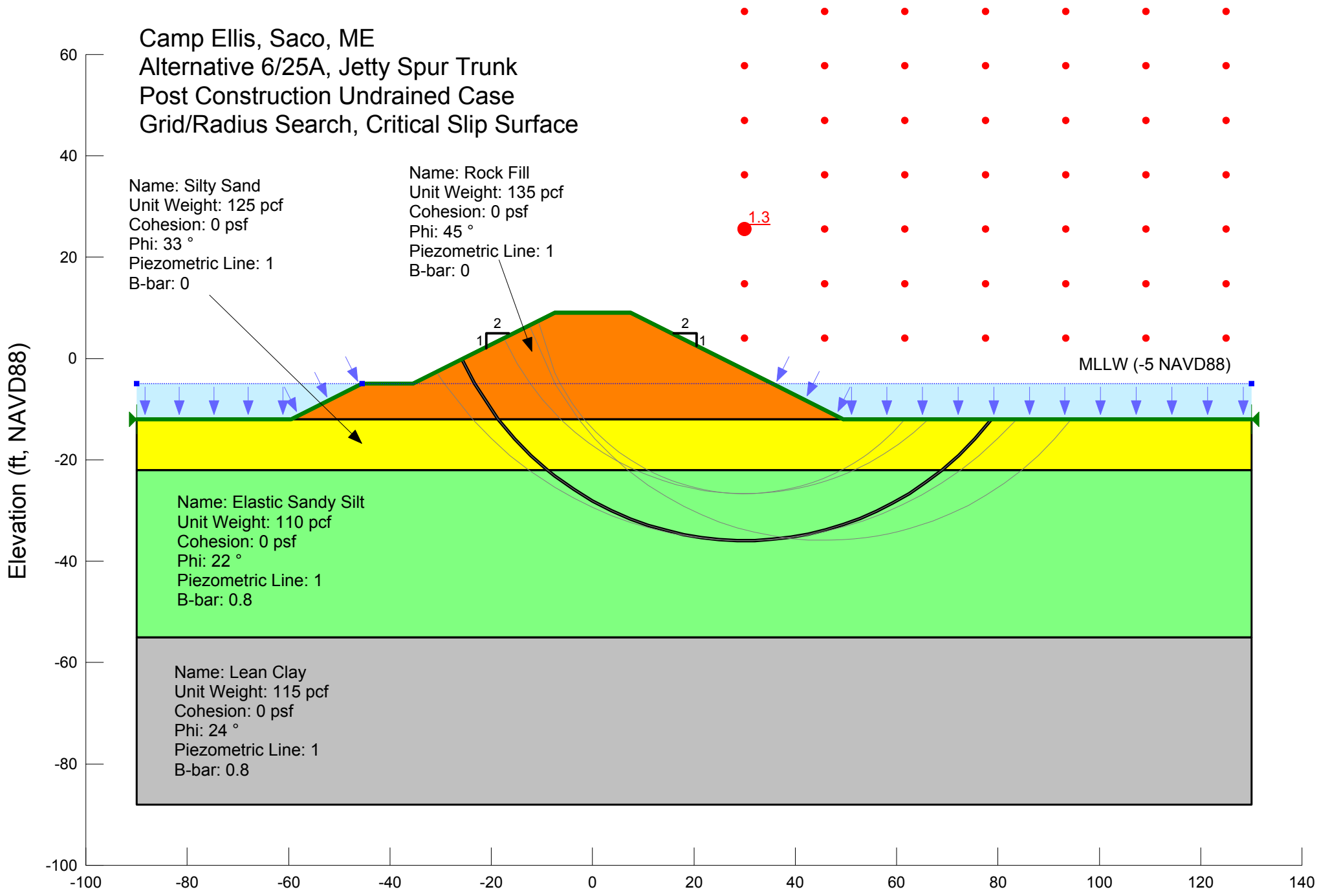

Camp Ellis, Saco, ME
Alternative 6/25A, Jetty Spur Head
Post Construction Undrained Case
Grid/Radius Search, Critical Slip Surface
Name: Silty Sand
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 33 °
Piezometric Line: 1
B-bar: 0
Name: Rock Fill
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 45 °
Piezometric Line: 1
B-bar: 0
1.3
2
1
2
1
MLLW (-5 NAVD88)
Name: Elastic Sandy Silt
Unit Weight: 110 pcf
Cohesion: 0 psf
Phi: 22 °
Piezometric Line: 1
B-bar: 0.8
Name: Lean Clay
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 24 °
Piezometric Line: 1
B-bar: 0.8
Elevation (ft, NAVD88)
60
40
20
0
-20
-40
-60
-80
-100
-100
-80
-60
-40
-20
0
20
40
60
80
100
120
140

PLATE D-6


Camp Ellis, Saco, ME
Alternative 6/25A, Jetty Spur Trunk
Post Construction Undrained Case
Grid/Radius Search, Critical Slip Surface
Name: Silty Sand
Unit Weight: 125 pcf
Cohesion: 0 psf
Phi: 33 °
Piezometric Line: 1
B-bar: 0
Name: Rock Fill
Unit Weight: 135 pcf
Cohesion: 0 psf
Phi: 45 °
Piezometric Line: 1
B-bar: 0
1.3
2
1
2
1
MLLW (-5 NAVD88)
Name: Elastic Sandy Silt
Unit Weight: 110 pcf
Cohesion: 0 psf
Phi: 22 °
Piezometric Line: 1
B-bar: 0.8
Name: Lean Clay
Unit Weight: 115 pcf
Cohesion: 0 psf
Phi: 24 °
Piezometric Line: 1
B-bar: 0.8
Elevation (ft, NAVD88)
60
40
20
0
-20
-40
-60
-80
-100
-100
-80
-60
-40
-20
0
20
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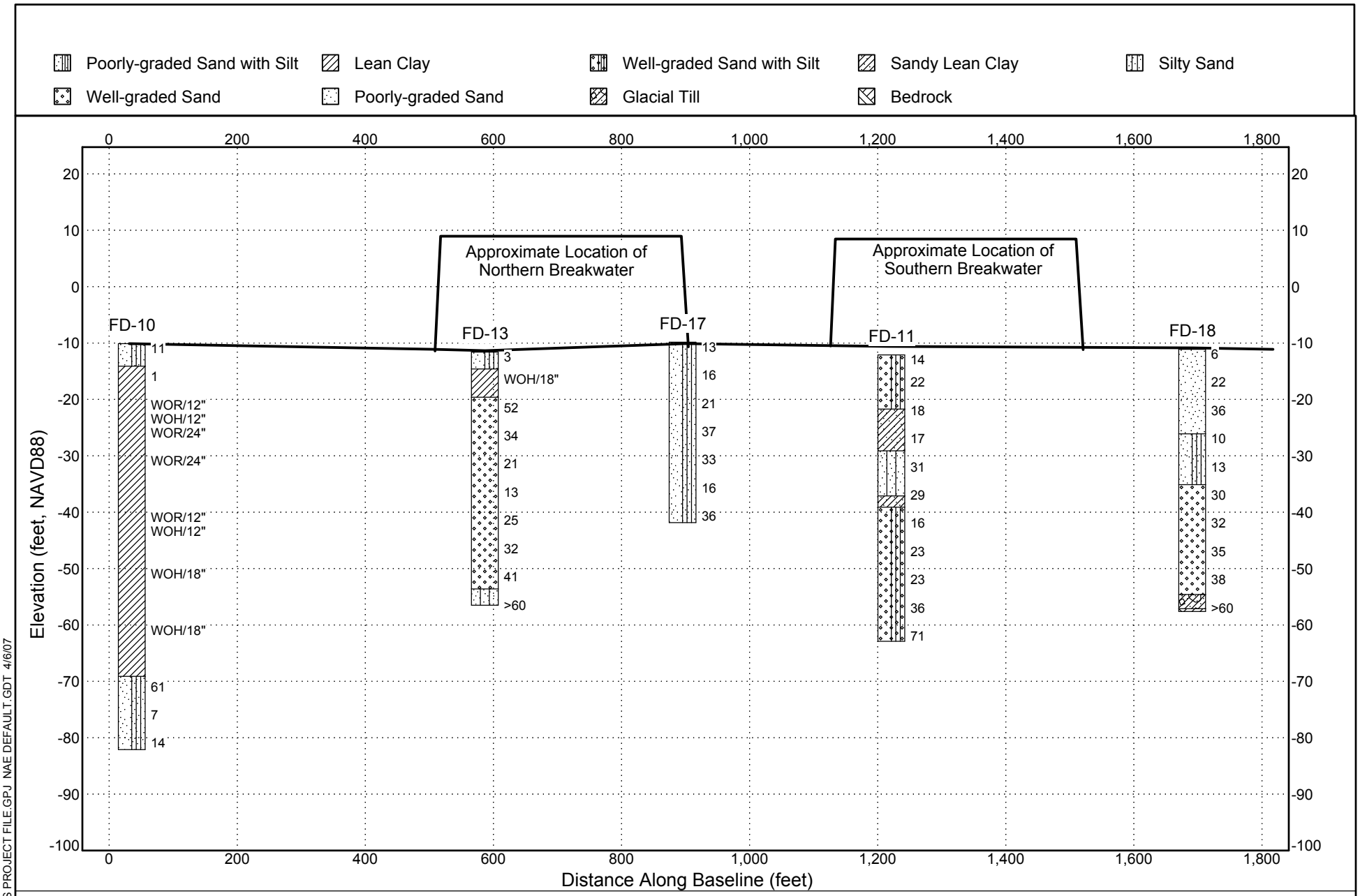
60
80
100
120
140

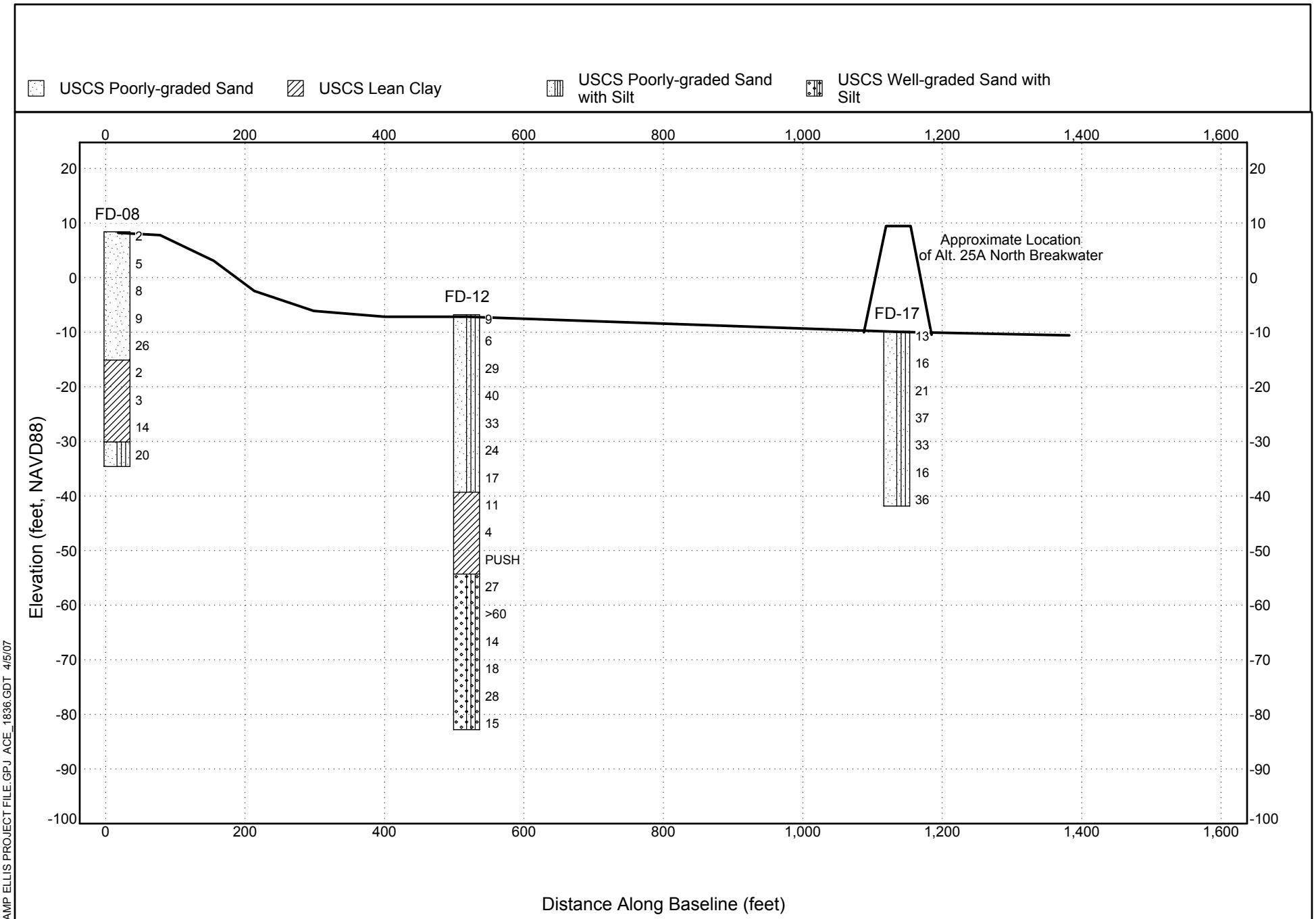
PLATE D-7



STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ NAE DEFAULT.GDT 4/6/07

Camp Ellis Beach
Saco, ME
Profile Along Centerline of
Detached Breakwaters (Profile C)

PLATE D-8



STRATIGRAPHY CAMP ELLIS PROJECT FILE.GPJ ACE_1836.GDT 4/5/07

Camp Ellis Beach
Saco, ME
Profile E
D-75

PLATE D-9

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater North Head Section
Long-Term Fully Drained Case
Grid/Radius Search, Critical Slip Surface

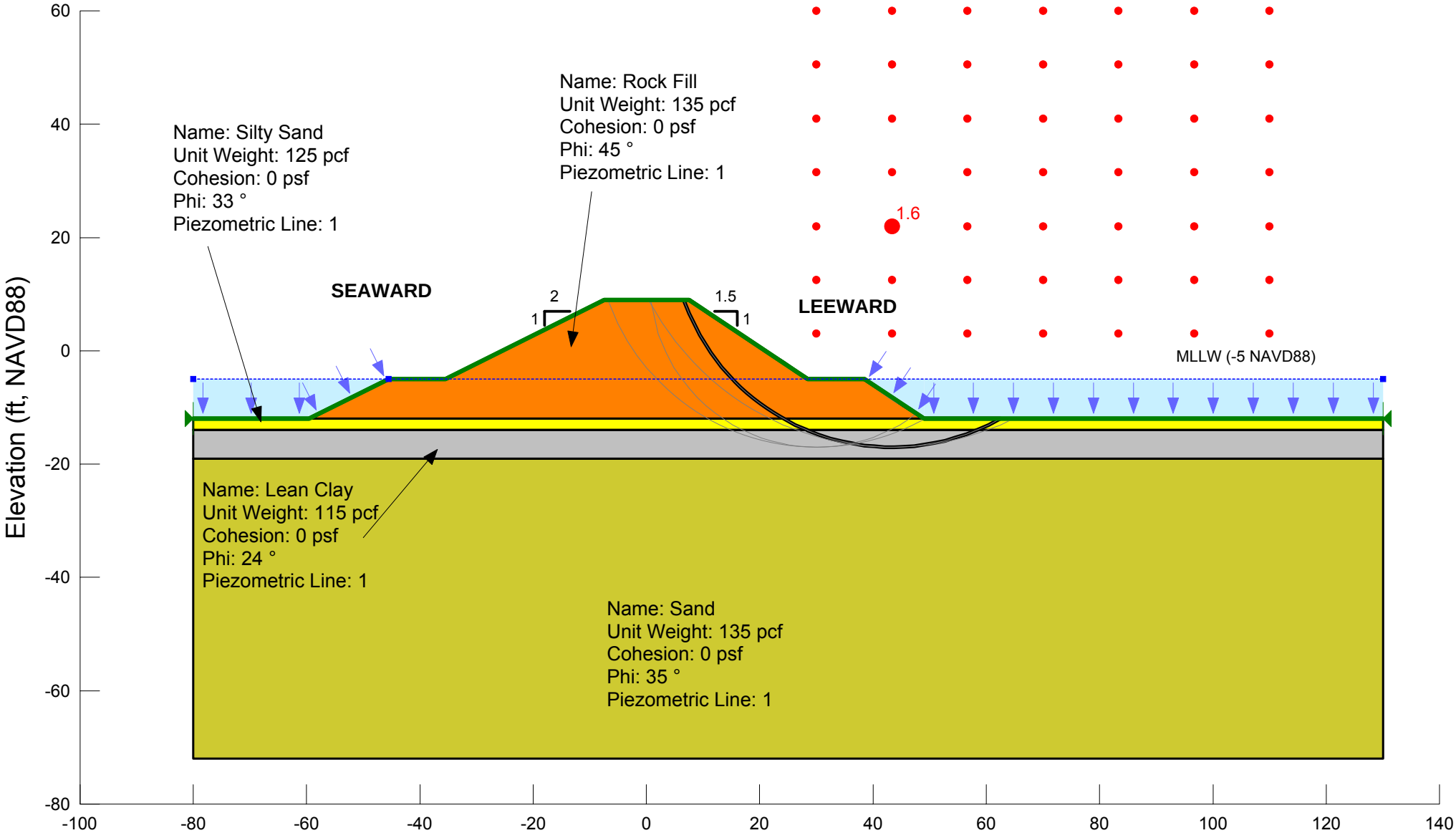


PLATE D-10

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater North Head Section
Post Construction Undrained Case
Grid/Radius Search, Critical Slip Surface

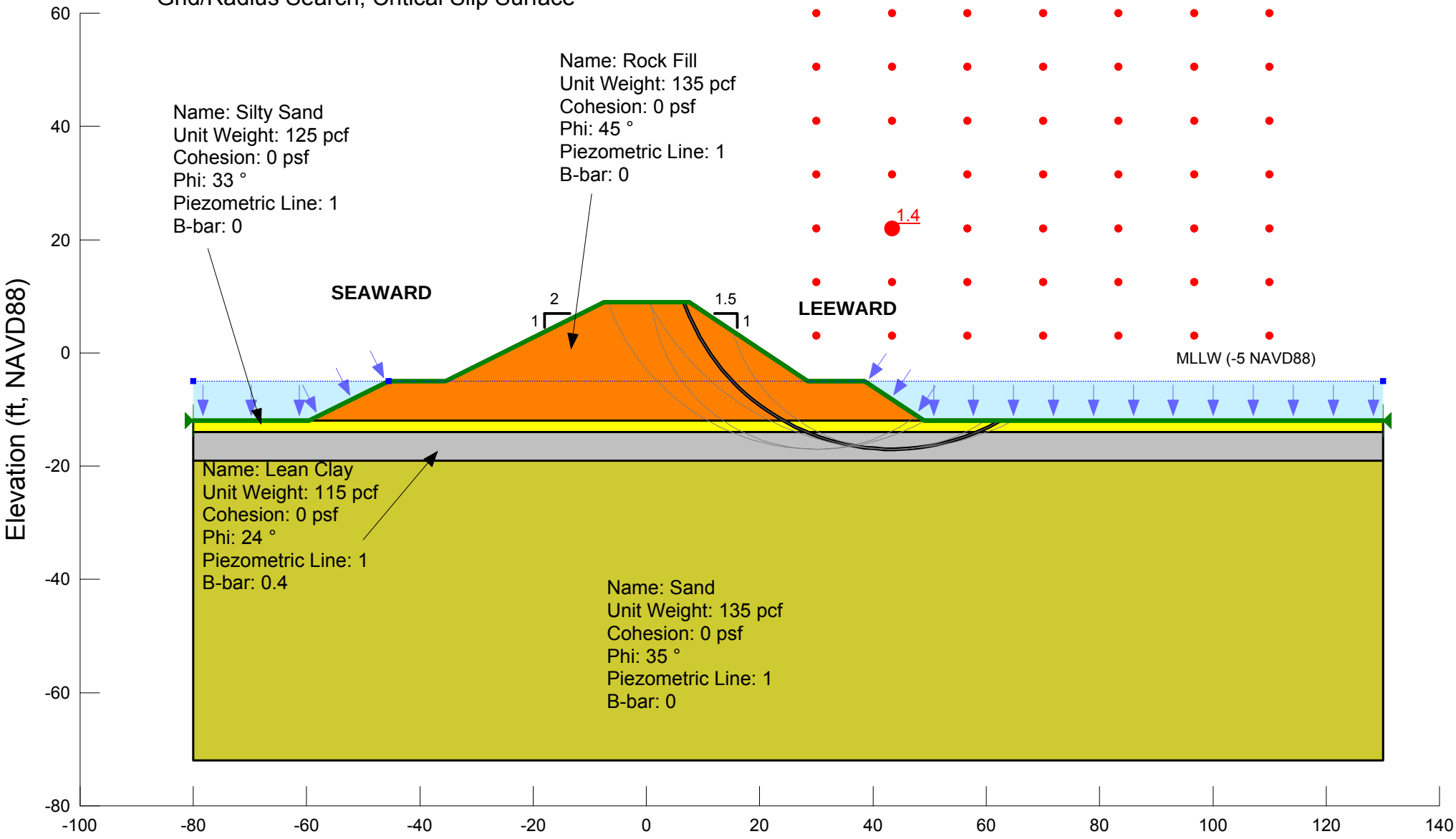


PLATE D-11

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater, Trunk (North end)
Long-Term Fully drained Case
Grid/Radius Search, Critical Slip Surface

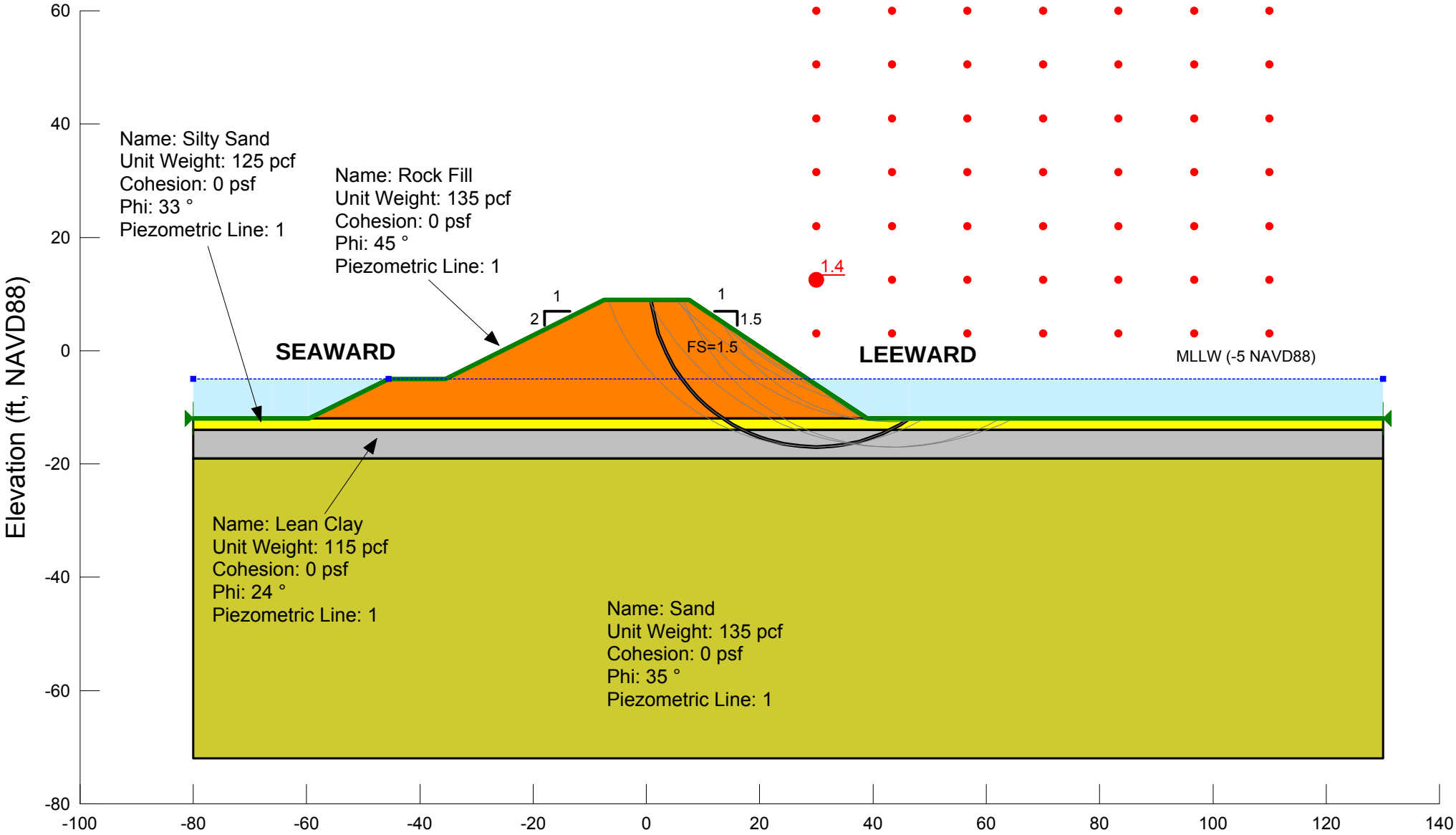


PLATE D-12

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater, Trunk (North end)
Post Construction Undrained Case
Grid/Radius Search, Critical Slip Surface

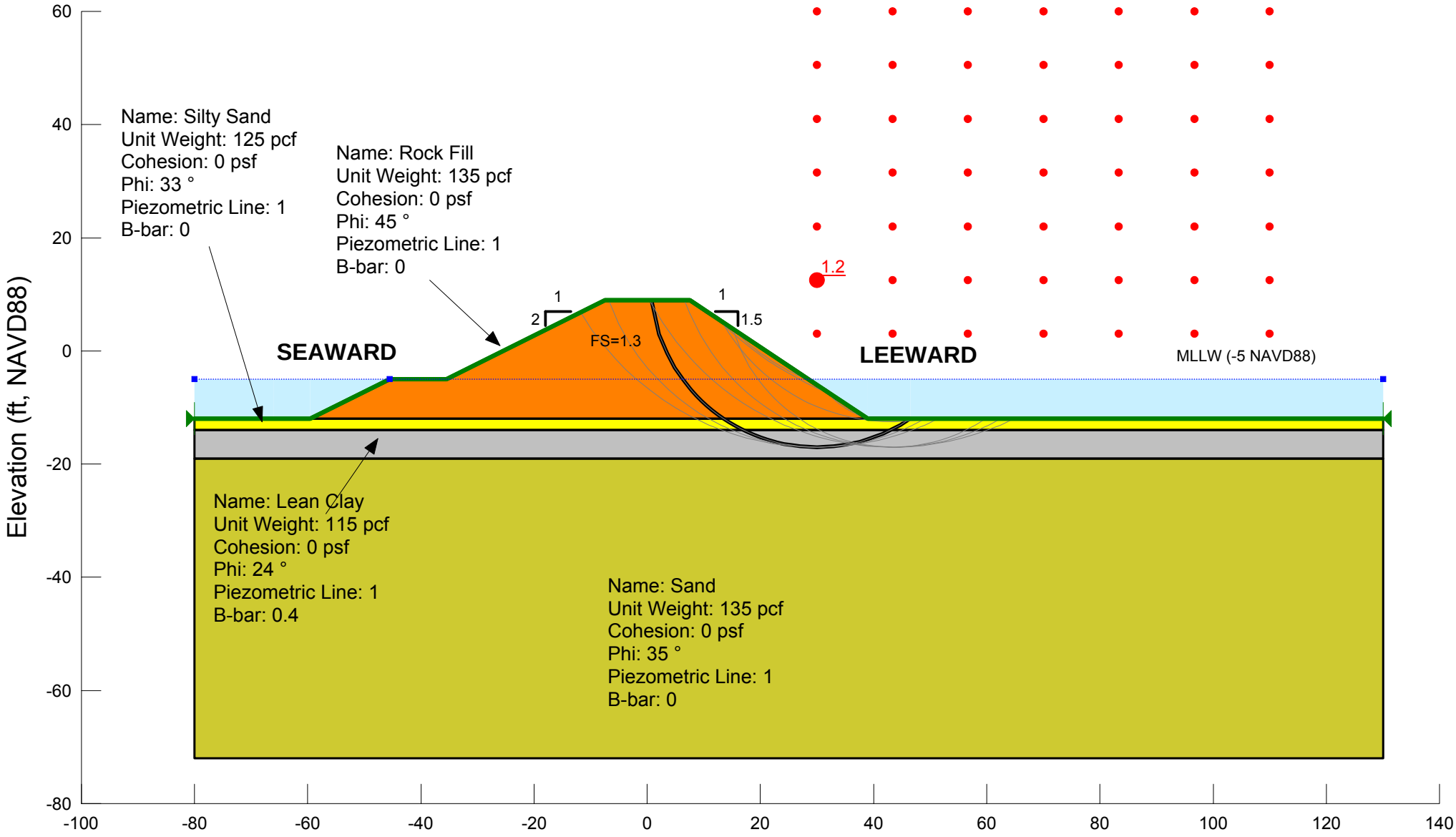


PLATE D-13

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater Trunk (Typical)
Long-Term Fully drained Case
Grid/Radius Search, Critical Slip Surface

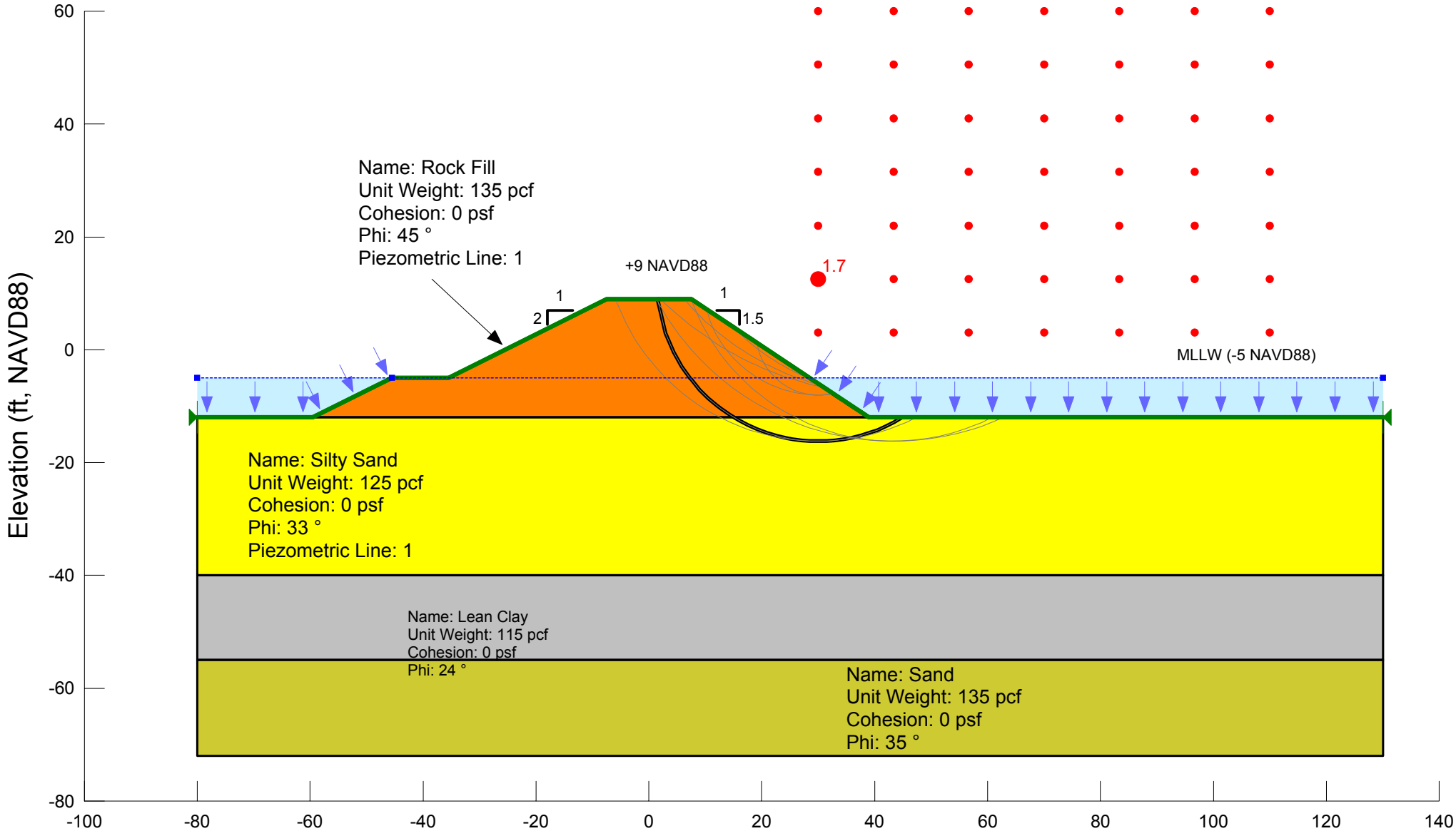


PLATE D-14

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater Trunk (Typical)
Post Construction Undrained Case
Grid/Radius Search, Critical Slip Surface

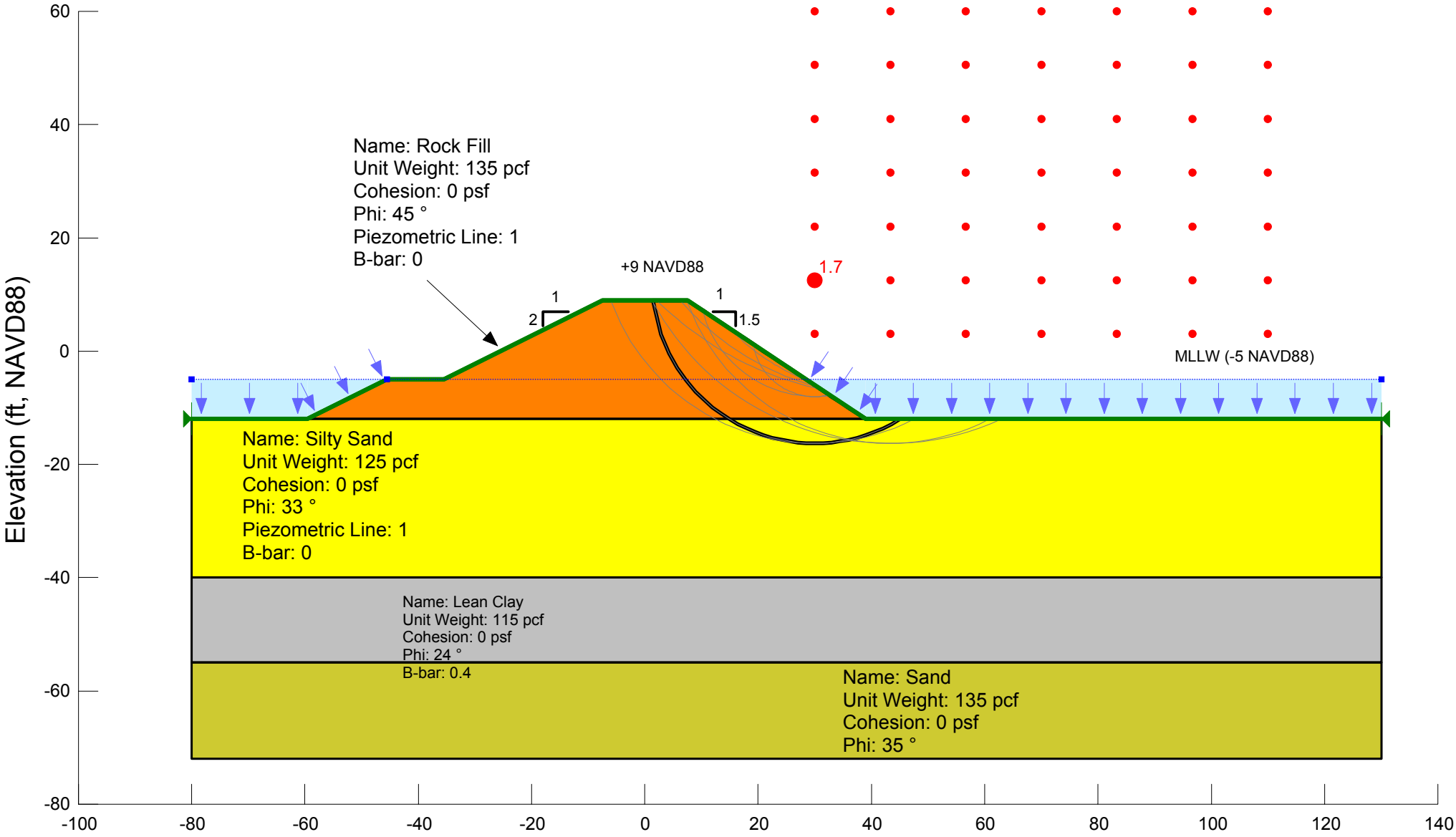


PLATE D-15

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater South Head
Long-Term Fully drained Case
Grid/Radius Search, Critical Slip Surface

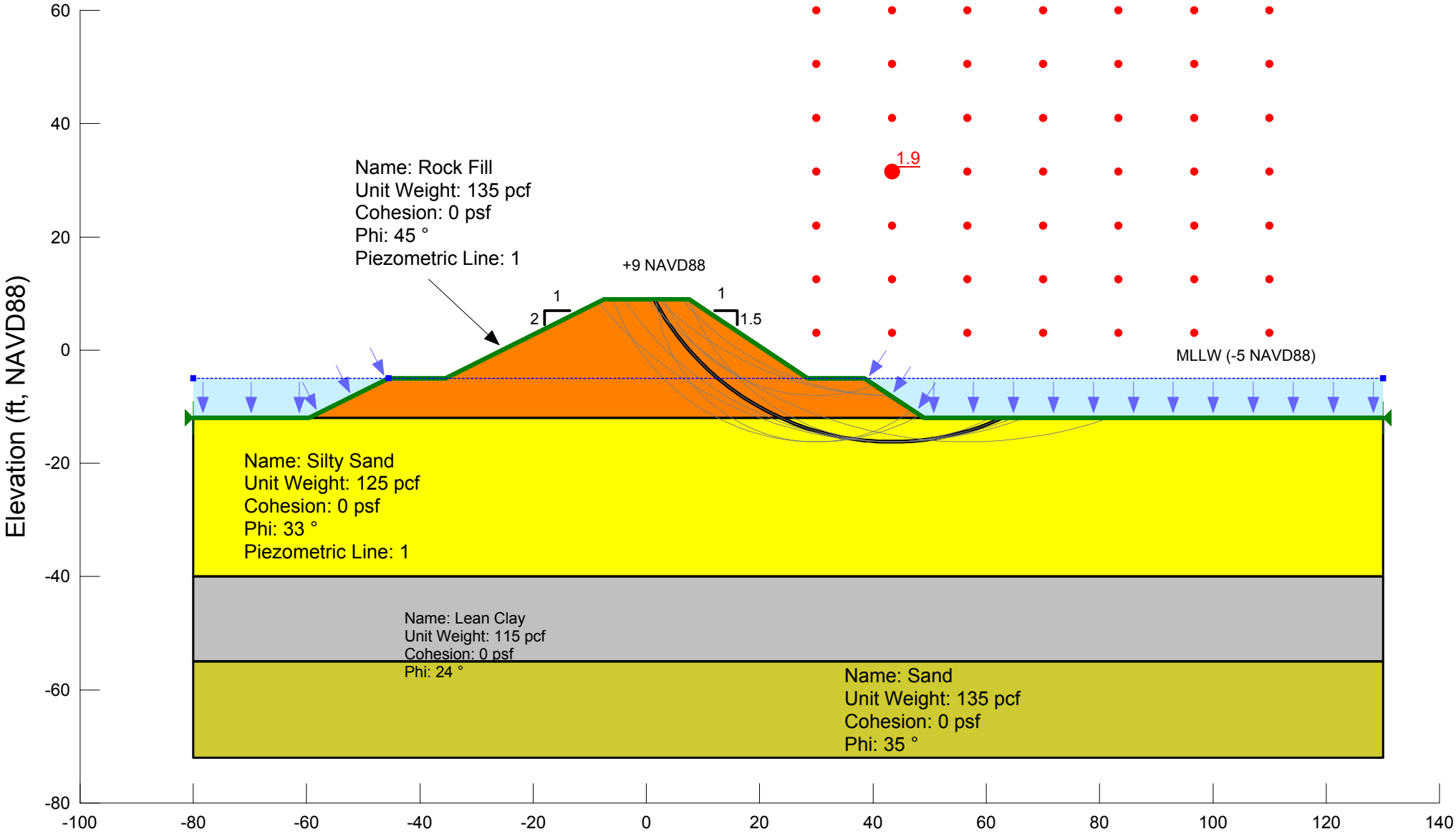


PLATE D-16

Camp Ellis, Saco, ME
Alternative 25A, North Breakwater South Head
Post Construction Undrained Case
Grid/Radius Search, Critical Slip Surface

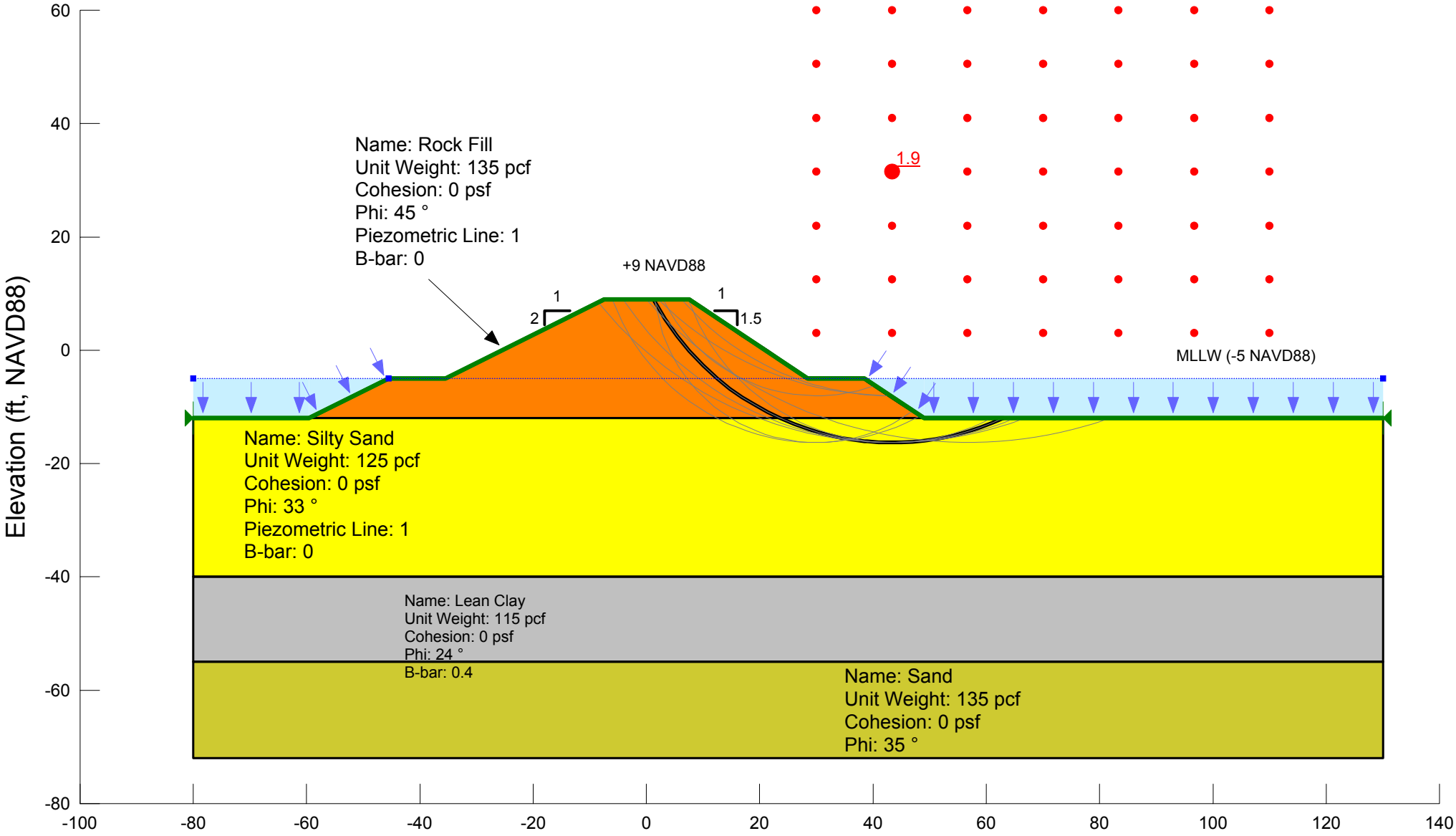


PLATE D-17

Camp Ellis, Saco, ME
Alternative 25A, South Segment Head Section
Fully Drained Case
Grid/Radius Search, Critical Slip Surface

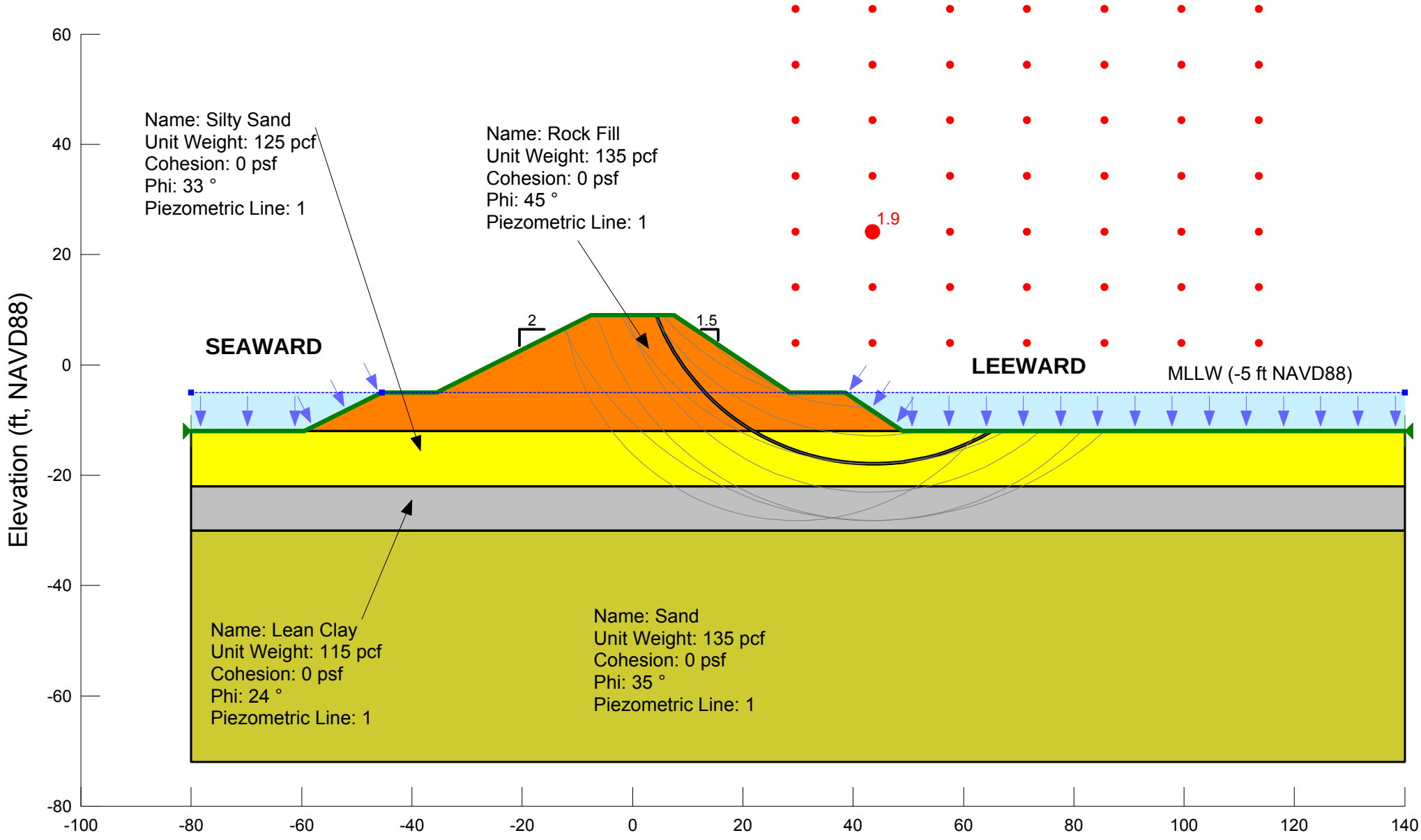


PLATE D-18

Camp Ellis, Saco, ME
Alternative 25A, South Segment Head Section
Post Construction Undrained Case
Grid/Radius Search, Critical Slip Surface

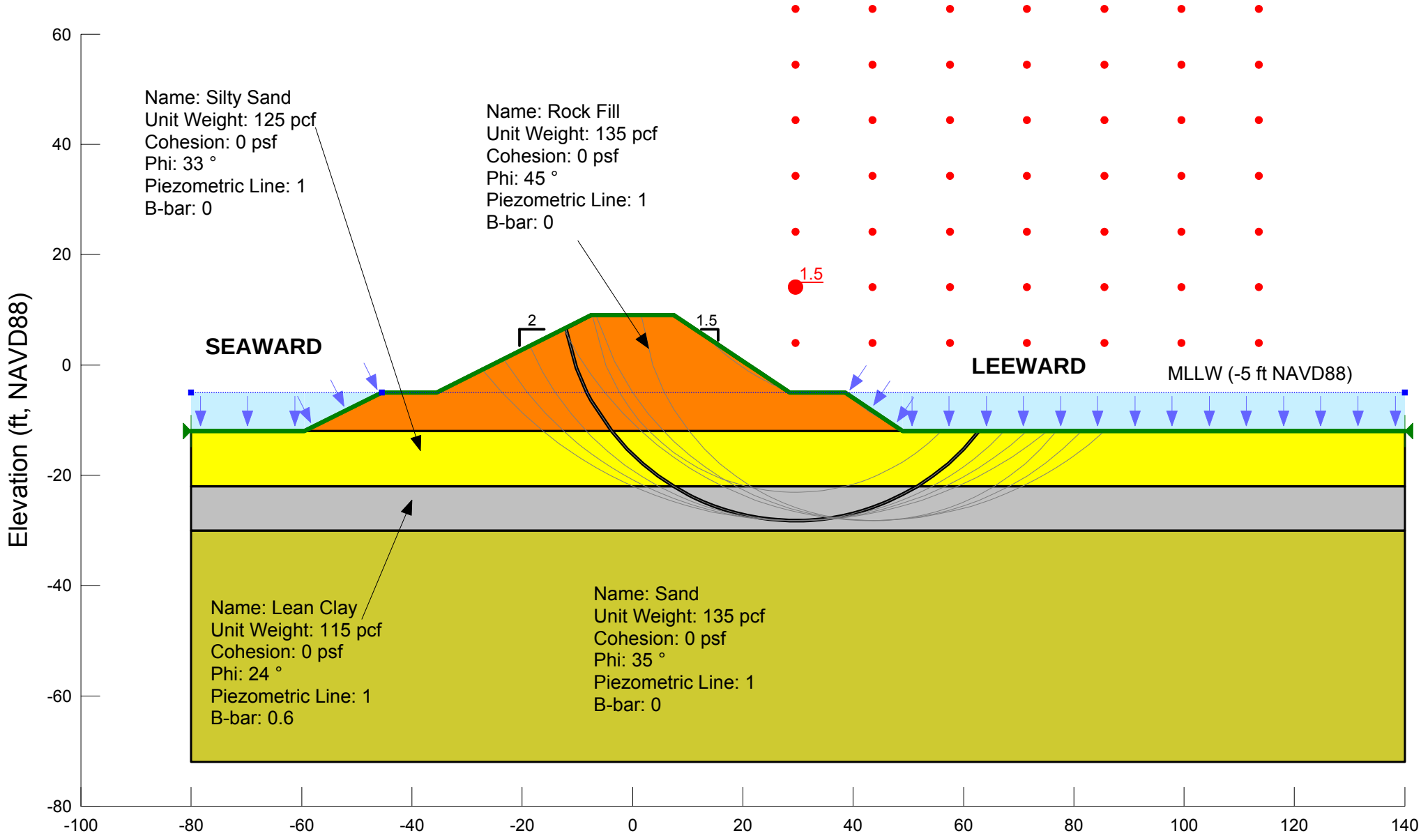


PLATE D-19

Camp Ellis, Saco, ME
Alternative 25A, South Segment Trunk
Fully Drained Case
Grid/Radius Search, Critical Slip Surface

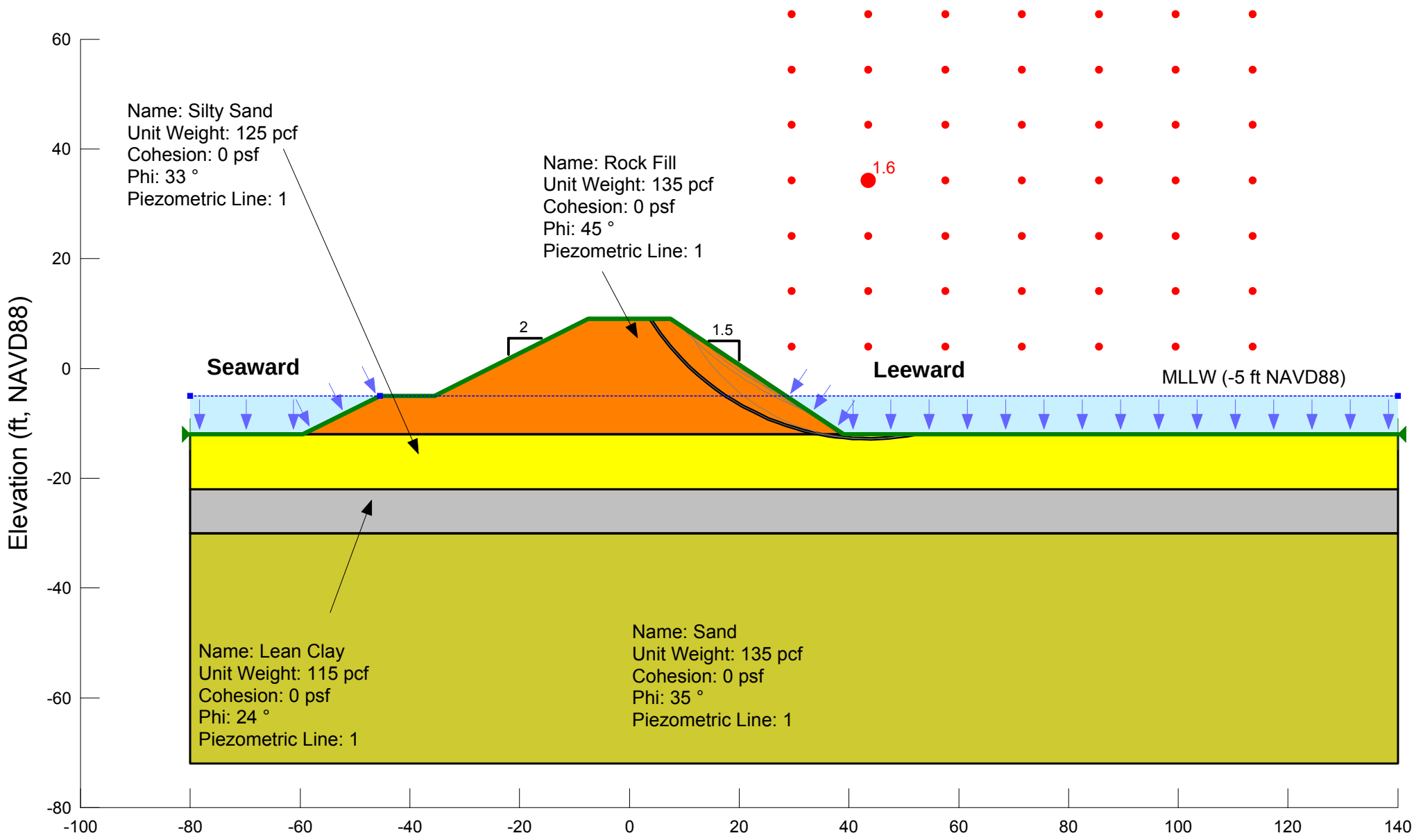


PLATE D-20

Camp Ellis, Saco, ME
Alternative 25A, South Segment Trunk
Post-Construction Undrained Case
Grid/Radius Search, Critical Slip Surface

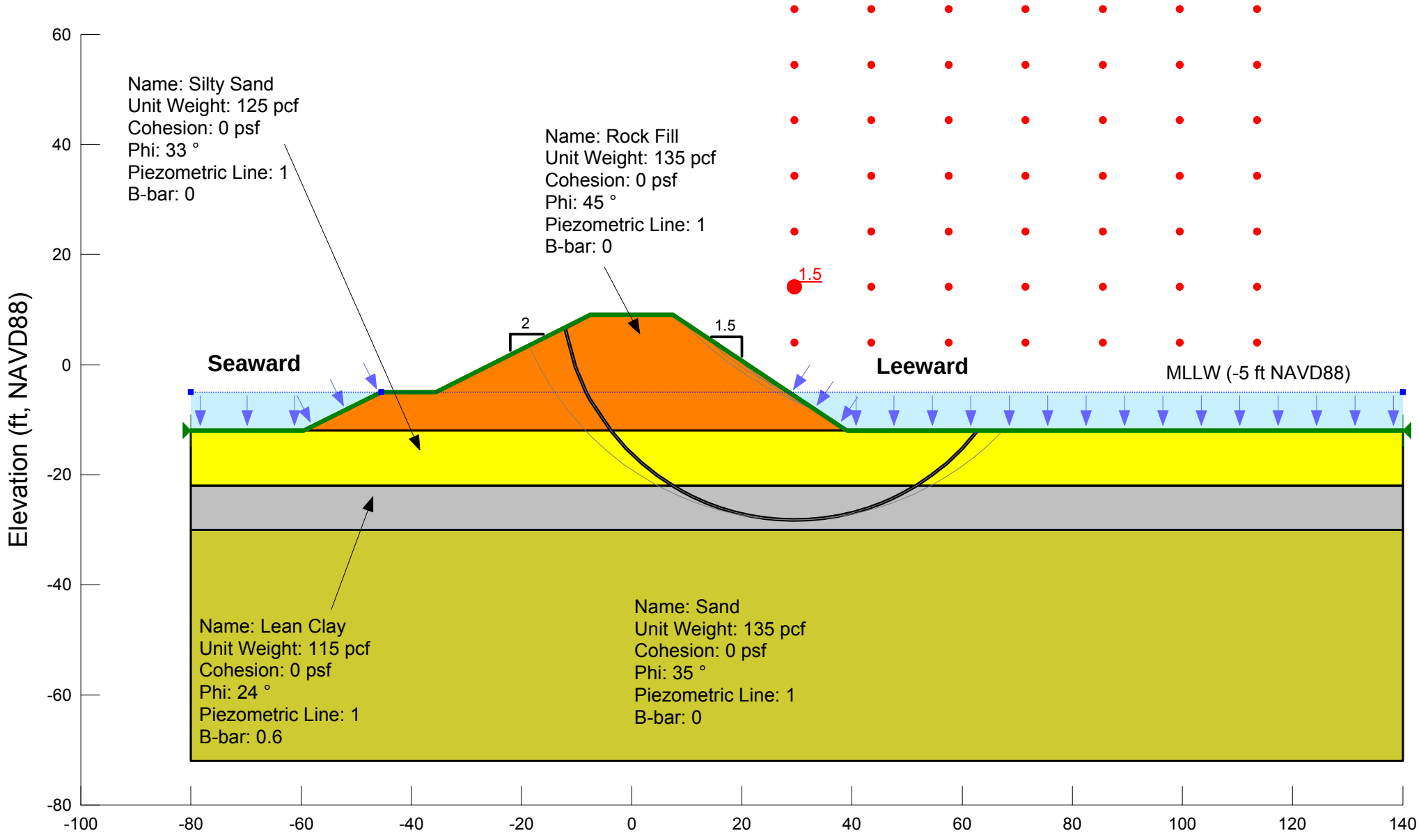


PLATE D-21

CAMP ELLIS, SACO, ME
SECTION 111 SHORE PROTECTION
GEOTECHNICAL DESIGN APPENDIX
ATTACHMENT E
BORING LOGS

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-01

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -10.1
NORTHING: 4813973.06 EASTING: 388779.19
DRILLED BY: New Hampshire Boring Greg Leavitt
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 45.0
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 12/13/04
DATE END: 12/14/04

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	10 16 10 10	24	14				S1: Top 8" - POORLY GRADED SAND WITH SILT (SP-SM); Fine to very fine sand, ~10% non-plastic fines, Gray S1: Bot. 6" - POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% non-plastic fines, shell fragements, Gray.
5	S2	WOR/ 24"	24	12				Top of Clay at 4.5 feet S2: LEAN CLAY (CL); Low to medium plasticity, occasional shell fragment, Lt. Gray.
10	S3	WOR/ 12" WOH/ 12"	24	20				S3: LEAN CLAY (CL); Low to medium plasticity, ~10% very fine sand, Gray.
15	S4	WOR/ 24"	24	24				S4: LEAN CLAY (CL); Similar to S3, with a layer of fine sand about 1/16-inch thick.
20	S5	WOR/ 24"	24	24	.15 .18			S5: LEAN CLAY (CL); Similar to S3
25	S6	WOR/ 24"	24	24	.17 .19			S6: LEAN CLAY (CL); Similar to S3
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, maine GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 2 of 2 **FD-01**

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	WOR/ 24"	24	24	.20 .20			S7: LEAN CLAY (CL); Similar to S3
35	S8	WOR 24"	24	24	.19 .20			S8: LEAN CLAY (CL); Similar to S3
40	S9	27 19 18 22	24	14				S9: Top 2" - LEAN CLAY (CL); Similar to S3 Top of Sand at 41.25 feet S9: Bot. 12" - POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10 % non-plastic fines, Gray. (drill rig chattering at 43.5 feet)
45	S10	25/0"	0	0				Bottom of Boring at 45.0 feet
50								1. Boring advanced using drive and wash technique with 4-inch (HW) casing and N drill rods with a 3-7/8-inch roller bit. The casing was driven to 6 feet with a 300 lb hammer. The Driller was able to advance the casing to 16 feet by pushing the casing with the drive head of the drill rig. Boring was advanced open hole below 16 feet.
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, Maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-02

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -9.5
NORTHING: 4813843.53 EASTING: 388820.69
DRILLED BY: New Hampshire Boring Greg Leavitt
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 30.75
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 12/15/04
DATE END: 12/15/04

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	23 13 15 12	24	14				S1: POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10% non-plastic fines, occasional piece of fine gravel. Gray.
	S2	WOR/ 24"	24	12	0.15			Top of Clay at 2.0 feet S2: LEAN CLAY (CL); Low plasticity, <5% fine sand, Gray.
5								
10	U1	WOR/ 24"	24	24	0.13			U1: LEAN CLAY (CL); Low plasticity, Gray to Dark Gray.
15								
20	S3	WOR/ 24"	24	24	0.13 0.15			S3: LEAN CLAY (CL); Low plasticity, Gray.
25								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, Maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 2

FD-02

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
								(rig chattering at 29.0 feet)
								Top of Sand at 29.0 feet
30	S4	10 17/3" 50/0"	9	9				S4: SILTY SAND (SM); Fine sand,~15% slightly plastic fines, ~20% subrounded to subangular gravel, fractured gravel pieces in the tip of the spoon. Gray.
								Bottom of Boring at 30.75 feet
35								1. Boring advanced using drive and wash technique with 4-inch (HW) casing and and N drill rods with a 3-7/8-inch roller bit. The Driller was able to advance the casing to 10 feet by pushing the casing with the drive head of the drill rig. Boring was advanced open hole below 10 feet.
40								
45								
50								
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, Maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 1

FD-03

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -10.1
NORTHING: 4813703.57 EASTING: 388863.95
DRILLED BY: New Hampshire Boring Greg Leavitt
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 25.0
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 12/16/04
DATE END: 12/16/04

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	22 10 15 20	24	12				S1: Top 6" - POORLY GRADED SAND WITH SILT (SP-SM); Fine to very fine sand, ~10% non-plastic fines, Gray.
	S2	14 19 100/4"	16	9				S1: Bot. 6" - POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~ 10% non-plastic fines, ~15% angular rock pieces, Gray. S2: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); Fine sand, ~10% non-plastic fines, ~10-15% subangular to subrounded fine gravel, Brown.
5	S3	32 27 18 18	24	7				S3: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Fine to coarse sand, ~10% non-plastic fines, ~15% subangular to subrounded gravel, Brown.
10	S4	13 25 21 19	24	7				S4: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Similar to S3.
15	S5	17 66 30 32	24	8				S5: SILTY SAND (SM); Fine to coarse sand, ~15% non-plastic fines, ~25% subangular to subrounded fine to coarse gravel, pieces of fractured cobble wedged in tip of spoon.
20	S6	12 27 17 19	24	24				S6: Recovered 6" of gravel wash. Driller advanced casing to 24 feet before we opened sampler. Casing refusal at 24.0 feet, Roller bit very hard from 24.0 to 25.0 feet. Black rock chips in the wash. Possible bedrock.
25								Bottom of boring at 25.0 feet
30								1. Boring advanced using drive and wash technique with 4-inch (HW) casing and and N drill rods with a 3-7/8-inch roller bit. 2. The Driller drove the HW casing to 24 feet with the 300lb hammer.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, Maine GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 1 of 2 **FD-04**

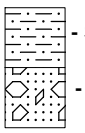
GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

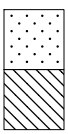
BORING LOCATION: Offshore — TOTAL DEPTH (FT): 52.5
SURFACE ELEVATION (FT): -6.9 — VERT. DATUM: MLLW
NORTHING: 4813193.07 — EASTING: 388817.03 — HOR. DATUM: NAD 83 (m)
DRILLED BY: New Hampshire Boring Greg Leavitt — DATE START: 12/17/04
LOGGED BY: Steve Sarandis — DATE END: 12/17/04

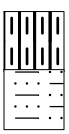
DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	11 3 5 7	24	5				S1: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Fine to coarse sand, ~10 % non-plastic fines, ~15% subangular fine gravel, shell fragments, Brown.
5	S2	33 16 5 6	24	0 (5)				S2: POORLY GRADED SAND WITH SILT (SP-SM); Mostly fine sand, ~10% non-plastic fines, samples has stratified appearance with several 1/4-inch layers of widely graded sand, Gray. (First attempt no recovery, rock wedged in tip of sampler; second attempt with 3-inch OD sampler, recovery = 5")
10	S'3	2 1 1 2	24	12				Top of SAND and SILT at about 9.0 feet. S3: SILTY SAND (SM); Fine sand, ~20% slightly plastic fines, shell fragments, marine-organic odor, Dark Gray.
15	S4	WOH/ 18" 3	24	24				S4: SILTY SAND (SM); Fine sand, ~20-25% slightly plastic fines, occasional layers of sandy silt(ml) 1/4to 3/4 -inch thick, peat fibers, shell fragments, marine-organic odor, Dark Gray.
20	S5	2 WOH/ 12" 2	24	24				Top of SANDY SILT/ ORGANIC SILT at about 18.5 feet. S5: SANDY SILT/ ORGANIC SILT (ML/OL); Low plasticity, ~30% fine sand, layers of silty fine sand with ~30% fines, up to 1-inch thick, pockets of peat, occasional shells, marine-organic odor, Dark Gray.
25	S6	WOH/ 12" 4 4	24	24				S6: SANDY SILT/ORGANIC SILT (ML/OL); Similar to S5.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND


- SILTY SAND
- GRAVEL


- SAND
- CLAY


- ORGANIC SILT
- SILT

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, Maine GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 2 of 2 **FD-04**

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	WOH/6" 2 - 3 4	24	24	0.25 0.30			S7: SANDY SILT/ ORGANIC SILT (ML/OL); Low to medium plasticity, ~15% fine sand, pockets of peat, occasional shells, marine-organic odor, Dark Gray.
35	S8	1 1 5 7	24	24	0.25 0.25			S8: SANDY SILT/ ORGANIC SILT (ML/OL); Low plasticity, ~30% fine sand, peat fibers, occasional shells, lower 12" of sample has numerous layers of silty fine sand up to 1/2-inch thick, marine-organic odor, Gray.
40	S9	12 18 21 23	24	12				Top of SAND at about 39.0 feet. S9: POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10% non-plastic fines, Gray.
45								
50	S10	46 73 78 86	24	10				S10: POORLY GRADED SAND WITH SILT (SP-SM); Similar to S9 with one 2" layer of sandy silt.
55								Bottom of borehole at 52.5 feet. 1. Boring advanced from 0 to 52.5 feet using drive and wash techniques with 4-inch (HW) casing. Driller used N-rods with 3-7/8-inch roller bit to clean out the casing. Casing drivien to a depth of 30 feet. Boring advanced open hole below 30 feet.
60								2. Driller did not have enough casing to advance hole below 40 feet. After sampling at 40 feet the driller ran the drill rods and roller bit down to 50.5 feet to try and encounter rock. Driller did not encounter hard drilling advancing boring to 50.5 feet. Driller attempted to sample at 50.5 feet. The hole collapsed and the sampler and rods would only go down to about 45 feet. The driller was able to push the sampler down to the correct depth with the drill rig. Driller obtained sample from 50.5 feet to 52.5 feet. Sample recovery was about 10-inches. The remainder of the sampler was completly filled with sand that had collapsed into the borehole. The blowcounts for sample S10 are inflated.
65								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- SAND
- ORGANIC SILT
- GRAVEL
- CLAY
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, Maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-05

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -11.5
NORTHING: 4813955.94 EASTING: 388938.67
DRILLED BY: New Hampshire Boring Dave Thompson
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 26.5
VERT. DATUM: MLLW
HOR. DATUM: NAD83 (m)
DATE START: 12/22/04
DATE END: 12/22/04

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	35 13 10 20	24	15				S1: POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10% non-plastic fines, lt. and dk. banding, Gray.
								Top of CLAY at about 3.0 feet.
5	S2	WOR/6" 2 1 1	24	18	0.17 0.20			S2: LEAN CLAY (CL); Low to medium plasticity, <5% fine sand, Olive Gray.
10	U1	WOR/ 12" PUSH/ 12"	24	17	0.20 0.22			U1: LEAN CLAY (CL); Similar to S2.
15								
20	S3	WOR/ 24"	24	15	0.14 0.12			S3: LEAN CLAY (CL); Low to medium plasticity, occasional layer of fine sand ~1/16-inch thick, Gray to Dark Gray.
								Top of GRAVEL at about 23.0 feet.
25	S4	42 53 93/5"	17	2				S4: FRACTURE PIECES OF DARK GRAY ROCK. Sampler bouncing hard at 25"-5". Advance boring from 25'-5" to 26'-6" with roller bit. Drilling very hard and slow. Possible bedrrock.
								Bottom of borehole at 26.5 feet.
30								See Next Page

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- SAND
- ORGANIC SILT
- GRAVEL
- CLAY
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, Maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 2

FD-05

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
35								1. Boring advanced from 0 to 26.5 feet using drive and wash techniques with 4-inch (HW) casing. Driller used N-rods with 3-7/8-inch roller bit to clean out the casing. Casing driven to a depth of 5 feet. Boring advanced open hole below 5 feet.
40								
45								
50								
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, Maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-06A

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -8.4
NORTHING: 4813872.55 EASTING: 388671.67
DRILLED BY: New Hampshire Boring Dave Thompson
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 48.0
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 12/22/04
DATE END: 12/23/04

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	19 8 13 14	24	15				S1: SILTY SAND (SM); Fine sand, ~15% non-plastic fines, Gray.
								Top of CLAY at about 3.5 feet.
5	S2	WOR/ 24"	24	12				S2: LEAN CLAY (CL); Low plasticity, <5% fine sand, Gray.
10	S3	WOR/ 12" WOH/ 12"	24	17	0.20 0.22			S3: LEAN CLAY (CL); Low plasticity, <5% fine sand, Gray.
15	S4	WOR/ 6" WOH/ 18"	24	15				S4: LEAN CLAY (CL); Low plasticity, <5% fine sand, Gray.
20								
25	S5	WOR/ 6" WOH/ 18"	24	18				S5: LEAN CLAY (CL); Similar to S4.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, Maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 2

FD-06A

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
35	S6	WOR/ 24"	24	22	0.19 0.17			S6: LEAN CLAY (CL); Low to medium plasticity, <5% fine sand, Dark Gray. Section of sample have a varved appearance with alternating dark and light layers.
40								
45	S7	7 8 8 33	24	8				Top of SAND at about 43.0 feet. (drill rig starting to chatter at 43 feet) S7: POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10% non-plastic fines, Gray.
50								Bottom of borehole at 48.0 feet. Drill rig bouncing at 47 feet. Advanced boring from 47 to 48 feet with roller bit. Drilling very hard and slow, possible top of bedrock. 1. Boring advanced from 0 to 48.0 feet using drive and wash techniques with 4-inch (HW) casing. Driller used N-rods with 3-7/8-inch roller bit to clean out the casing. Casing driven to a depth of 5 feet. Boring advanced open hole below 5 feet.
55								
60								
65								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 3

FD-07

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Beach, End of Fairhaven Road TOTAL DEPTH (FT): 100
SURFACE ELEVATION (FT): 14.17 VERT. DATUM: MLLW
NORTHING: 4813862.28 EASTING: 388122.17 HOR. DATUM: NAD 83 (m)
DRILLED BY: New Hampshire Boring Steve Garside DATE START: 2/14/05
LOGGED BY: Mary Nodine DATE END: 2/15/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	1 1 1 1	24	17				S1(0-13"): POORLY GRADED SAND (SP); Mostly medium sand, some coarse and; black, white, tan, purple S1(13"-17"): POORLY GRADED SAND (SP); Medium to coarse sand, tan-orange
5	S2	2 3 5 5	24	16				S2: POORLY GRADED SAND (SP); Moslty medium to coarse sand, ~10% fine sand; tan-orange
10	S3	1 2 2 4	24	10				S3(0"-5"): POORLY GRADED SAND (SP); Mostly medium sand, ~20% coarse and fine sand; gray S3(5"-10"): PEAT (PT); Wood fibers, moderate organic odor, tan
15	S4	4 11 13 9	24	15				S4: POORLY GRADED SAND (SP); Mostly fine to medium sand, trace of wood fibers, gray
20	S5	WOH/ 24"	24	24				Top of CLAY at about 18' S5: LEAN CLAY (CL); Low-placticity, homogeneous, gray
25	U1	PUSH	24	0				U1: No recovery
	S6	WOH/ 24"	24	24				S6: LEAN CLAY (CL); Similar to S5, except contains several layers of fine sand
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

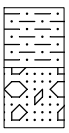
STRATIGRAPHIC LEGEND

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, ME GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 2 of 3 **FD-07**

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	U2	PUSH	25	25	0.20			U2: LEAN CLAY (CL); Medium-plasticity, seams of fine sand observed in bottom of sample, gray
35	S7	WOH/ 24"	24	24				S7: LEAN CLAY (CL); Low-plasticity, homogeneous, gray with streaks of black, mild organic odor, high dry strength
40	S8	WOH/ 18" 2	24	24				S8: LEAN CLAY (CL); Similar to S7
45	S9	WOH/ 18" 2	24	24				S9: LEAN CLAY (CL); Similar to S7, except dark gray, with streaks of black in top ~7". Clay appears stiffer toward bottom of sample
50	S10	WOH/ 12" 3 4	24	24				S10: LEAN CLAY (CL); Medium-plasticity, ~5% fine sand, homogeneous, trace shell fragments, dark gray
55	S11	WOH/ 12" 2 4	24	24				S11: LEAN CLAY (CL); Similar to S10, except no shell fragments
60	S12	WOH/ 12" 2 2	24	24				S12: LEAN CLAY (CL); Medium-plasticity, ~5% fine sand, homogeneous; gray
65	S13	1 7 7 4	24	24				S13: Interbedded LEAN CLAY (CL~60%) and CLAYEY SAND (SC ~40%); Clay portion is medium plasticity, Sand portion is fine to medium sand with ~20% low plastic fines. Sand layers occur at 5-8", 10-13", and 18-20".

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND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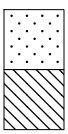
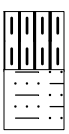
- GRAVEL


- SAND

- CLAY


- ORGANIC SILT

- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 3 of 3

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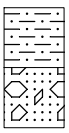
DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
70	S14	WOH/ 24"	24	24				S14(0"-8"); LEAN CLAY (CL); Similar to S12 S14(8"-14"); CLAYEY SAND (SC); Mostly fine sand, ~40% low plastic fines, dark gray S14(14"-24"); LEAN CLAY (CL); Similar to S12
75						Interbedded CLAY and Fine SAND		
80								Advanced hole without sampling in an attempt to establish extent of clay (due to time constraints).
85								
90						Interbedded CLAY and Fine SAND		
95								
100								BOTTOM OF BOREHOLE 100' FEET/EL. -85.8 FEET

Boring terminated at 100'. Wash water and roller bit resistance indicated that soil was soft clay to 100'.

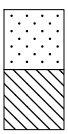
Boring advanced using drive and wash technique with 4-inch (HW) casing and N drill rods with a 3-7/8-inch roller bit. Boring was advancedopen hole from 20' to 40'. Driller drove casing to 40', then advanced the boring open hole to 100'.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

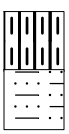
STRATIGRAPHIC LEGEND


- SILTY SAND

- GRAVEL


- SAND

- CLAY


- ORGANIC SILT

- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-08

GROUNDWATER INFORMATION

DATE	TIME	DEPTH (FT) WATER	CASING	HOLE

BORING LOCATION: Beach, North Ave. & Riverside TOTAL DEPTH (FT): 44'
SURFACE ELEVATION (FT): 13.32 VERT. DATUM: MLLW
NORTHING: 4813407.42 EASTING: 388265.70 HOR. DATUM: NAD 83 (m)
DRILLED BY: New Hampshire Boring Steve Garside DATE START: 2/16/05
LOGGED BY: Mary Nodine DATE END: 2/16/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	1 1 1 2	24	10				S1: POORLY GRADED SAND (SP); Mostly medium to coarse sand, tan
5	S2	2 2 3 3	24	10				S2: POORLY GRADED SAND (SP); Mostly medium sand, tan-orange
10	S3	2 3 5 7	24	12				S3: WELL-GRADED SAND (SW); Fine to coarse sand, tan
15	S4	4 4 5 12	24	12				S4: WELL-GRADED SAND (SW); Mostly medium to coarse sand, ~20% fine sand, ~10% subrounded-subangular gravel, max 3/4", tan-orange with black and white gravel
20	S5	9 13 13 12	24	16				S5: POORLY GRADED SAND WITH SILT (SP-SM); Mostly fine to medium sand, ~5-10% non plastic fines; gray; wood fragments in top 5"
25	S6	1 1 1 1	24	9		Interbedded CLAY and Fine SAND		Top of CLAY at about 23.5' S6: SANDY LEAN CLAY (CL); Mostly low plastic fines, ~30% fine sand, trace wood fibers, trace shell fragments, mild organic odor, dark gray
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, ME GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 2 of 2 **FD-08**

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	2 1 2 2	24	8		Interbedded CLAY and Fine SAND		S7: LEAN CLAY (CL); Mostly low plastic fines, ~10% fine sand; mild organic odor, dark gray
35	S8	3 7 7 9	24	17				S8(0"-5"): SANDY LEAN CLAY (CL); Mostly low plasticity fines, ~40% fine sand, ~10% angular-subangular gravel, max size 1", dark gray S8(6"-17"): LEAN CLAY WITH SAND (CL); Mostly low plastic fines, ~20% fine sand, dark gray
40	S9	6 8 12 13	24	16		Fine Sand		Top of SAND at about 38.5' S9: POORLY GRADED SAND WITH SILT (SP-SM); Mostly fine-medium sand;~10% nonplastic fines, seams of brown organic material, mild organic odor, gray
45								Driller indicated roller bit hit bedrock at 43'. Drilled 1' into rock with roller bit. Fine black shards observed in wash water. BOTTOM OF BOREHOLE AT 44.0'/EL.-30.7 FEET Boring advaced using drive and wash technique with 4-inch (HW) casing and N drill rods wtih a 3-7/8-inch roller bit. Boring was advanced open hole from 20' to 40'. Driller drove casing to 40' before taking final sample.
50								
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 1

FD-09

GROUNDWATER INFORMATION

DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Beach, North Ave. & Riverside TOTAL DEPTH (FT): 27'
SURFACE ELEVATION (FT): 2.33 VERT. DATUM: MLLW
NORTHING: 4813255.54 EASTING: 388360.67 HOR. DATUM: NAD 83 (m)
DRILLED BY: New Hampshire Boring Steve Garside DATE START: 2/17/05
LOGGED BY: Mary Nodine DATE END: 2/17/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	WOH/ 12" 1 2	24	10		encountered resistance from~4-8 feet this may have been caused by gravel, cobbles or boulders		S1: WELL-GRADED SAND (SW); Fine to coarse sand; tan-gray
5	S2	WOR/ 12" 6 14	24	5				S2: POORLY GRADED SAND WITH GRAVEL (SP); Mostly fine to medium sand, ~20% subangular gravel, (1 piece, 1.5" diam.); tan with black gravel
10	S3	10 6 6 7	24	6				S3: WELL-GRADED SAND WITH GRAVEL (SW); Mostly fine to medium sand, ~15% subrounded - subangular gravel, max size 1";~5% nonplastic fines; gray with black gravel. Gravel possibly broken off adjacent cobble or boulder.
15	S4	3 5 7 5	24	13				S4: WELL-GRADED SAND (SW); Mostly fine to medium sand, <5% nonplastic fines; gray. Wood fragments in tip of spoon
20	S5	WOH/ 18" 2	24	24				Top of Clay at about 18.5' S5: SANDY LEAN CLAY (CL); Mostly low plastic fines, ~40% sand, mostly fine sand; trace wood fragments; moderate organic odor; dark gray
25	S6	3	24	17				S6: LEAN CLAY (CL); Mostly low plastic fines, ~10% fine sand; trace shell fragments; moderate organic odor; dark gray
30								BOTTOM OF BOREHOLE AT 27.0'/EL.-24.7 FEET Boring terminated at 27' due to incoming tide. Boring advaced using drive and wash technique with 4-inch (HW) casing and N drill rods wtih a 3-7/8-inch roller bit. Boring was advanced open hole beyond 20'

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 3

FD-10

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -5.1
NORTHING: 4813864.85 EASTING: 388461.04
DRILLED BY: New Hampshire Boring D. Thompson
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 72
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 4/18/05
DATE END: 4/19/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	9 6 5 8	24	8				S1: POORLY GRADED SAND WITH SILT (SP-SM); Predominantly fine to very fine sand, ~10% non-plastic fines, Gray
								Top of CLAY at about 4'
5	S2	WOH/ 9" 1/3" 1-1	24	24	.15 .15			S2: LEAN CLAY (CL); Low to medium plasticity, ~5-10% fine sand, Gray
10	S3	WOR/ 12" WOH/ 12"	24	24	.15 .20			S3: LEAN CLAY (CL); Similar to S2
15	S4	WOR/ 24"	24	24	.15 .15			S4: LEAN CLAY (CL); Similar to S2
20	S5	WOR/ 24"	24	24	.15 .15			S5: LEAN CLAY (CL); Similar to S2
25								
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
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- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 3

FD-10

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S6	WOR/ 12" WOH/ 12"	24	24	.10 .20			S6: LEAN CLAY (CL); Low to medium plasticity, ~5% fine sand; occasional piece of medium to coarse sand, gray-blue
35								
40	S7	WOR/ 6" WOH/ 18"	24	18	.20 .20			S7: LEAN CLAY (CL); Similar to S6
45								
50	S8	WOR/ 18" WOH/ 6"	24	24	.15 .20			S8: LEAN CLAY (CL) Medium plasticity, ~5% fine sand, Gray
55								
60	S9	14 18 43 28	24	9				Top of SAND at about 59' S9: POORLY GRADED SAND WITH SILT (SP-SM); Predominantly fine sand, ~5% medium to coarse sand, ~10% non-plastic fines, gray
65	S10	3 4 3 12	24	11				S10: POORLY GRADED SAND WITH SILT (SP-SM); Similar to S9 with several layers of sandy silt ~ 1/2" thick, gray

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, ME GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 3 of 3 **FD-10**

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
70	S11	4 5 9 17	24	10				S11: POORLY GRADED SAND WITH SILT (SP-SM); Similar to S9 with ~5-10% medium to coarse sand, gray
								Bottom of Borehole @ 72' 1. Advanced borehole to 19' using drive and wash technique with 4" casing and a 3-7/8" roller bit 2. Advanced boring open hole below 19'.
75								
80								
85								
90								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
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- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-11

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -7.1
NORTHING: 4813522.59 EASTING: 388578.71
DRILLED BY: New Hampshire Boring D. Thompson
LOGGED BY: Steve Sarandis/Justin deWolfe

TOTAL DEPTH (FT): 50.8'
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 4/19/05
DATE END: 4/20/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	9 6 8 8	24	4				S1: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); Predominantly fine sand, ~10% non-plastic fines, ~20% subangular coarse gravel, gray
5	S2	23 13 9 11	24	10				S2: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Mostly fine to medium sand, ~10% coarse sand; ~10% non-plastic fines; ~10% fine subangular gravel; brown
10	S3	13 13 5 9	24	10				Top of CLAY at 9.0' S3: Top 7" Similar to S2 Bottom 3" LEAN CLAY (CL); Low plasticity varved appearance, Brown
15	S4	2 8 9 13	24	20				S4: LEAN CLAY (CL); Low to medium plasticity; two ~1" layers of fine to medium sand, varved appearance, Brown
20	S5	16 15 16 19	24	10				Top of SAND at about 17.0' S5: WELL-GRADED SAND WITH SILT (SW-SM); Fine to coarse sand, ~10-15% non-plastic fines; 5-10% subangular fine gravel, Brown
25	S6	31 17 12 11	24	11	.3			S6: Top 8" SILTY SAND (SM); Fine to coarse sand, ~15% low plastic fines, 5% fine subangular gravel, occasional pockets of clay, brown Bottom 3" LEAN CLAY (CL); Low to medium plasticity, 5% fine sand,

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

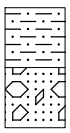
PAGE 2 of 2

FD-11

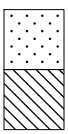
DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
								Brown
30	S7	10 8 8 12	24	12				S7: WELL-GRADED SAND WITH SILT (SW-SM); Fine to coarse sand, ~10% low plastic fines, Brown
35	S8	11 13 10 11	24	12				S8: POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% low plastic fines, Brown
40	S9	7 8 15 10	24	10				S9: WELL-GRADED SAND WITH SILT (SW-SM); Fine to coarse sand, ~10% low plastic fines, Brown
45	S10	12 16 20 37	24	14				S10: WELL-GRADED SAND WITH SILT (SW-SM); Fine to coarse sand, ~10% low plastic fines, ~5% fine subrounded gravel, brown
50	S11	33 18 53 100/4"	20	4				S11: POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% low plastic fines, ~3% fine subrounded gravel, Brown
55								Bottom of borehole @ 50.8'
60								1. Boring was advanced using drive and wash technique with 4" (HW) casing and a 3-7/8" roller bit.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

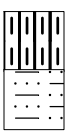
STRATIGRAPHIC LEGEND


- SILTY SAND

- GRAVEL


- SAND

- CLAY


- ORGANIC SILT

- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 3
FD-12

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -1.8
NORTHING: 4813520.59 EASTING: 388371.83
DRILLED BY: New Hampshire Boring D. Thompson
LOGGED BY: Steve Sarandis/Justin deWolfe

TOTAL DEPTH (FT): 76'
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 4/20/05
DATE END: 4/22/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	4 5 4 6	24	15				S1: POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% low plastic fines, brown
5	S2	10 4 2 3	24	0 (10)		2nd Attempt = 10"		S2: SANDY CLAY (CL); Low to medium plasticity, ~15-20% fine to medium sand, gray
						Cobble @ 8'		
10	S3	11 19 10 19	24	1 (7)		1st attempt coarse piece of gravel wedged in tip of spoon		S3: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Fine to coarse sand, ~10% non-plastic fines, ~10-15% subangular fine gravel, brown
15	S4	5 25 15 17	24	12				S4: Similar to S3
20	S5	12 17 16 13	24	12				S5: POORLY GRADED SAND WITH SILT (SP-SM); Mostly fine sand; trace of medium to coarse sand, ~10% non-plastic fines, brown
25	S6	17 13 11 11	24	0		wash water changed to gray @ 27'		S6: No recovery

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 3

FD-12

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
30	S7	10 8 9 8	24	13				S7: Top 10" SILTY SAND (SM); Mostly fine sand, ~15% slightly plastic fines, gray Bottom 3" CLAYEY SAND (SC); Mostly fine sand, ~40% low plastic fines, gray
35	S8	3 6 5 5	24	24				Top of CLAY at about 32.5' S8: LEAN CLAY (CL); Low to medium plasticity, several layers of fine sand up to ~3" thick, gray
40	S9	3 2 2 2	24	18	.25 .30			S9: LEAN CLAY (CL); Low to medium plasticity, trace of fine sand, gray
45	U1	PUSH	24	24	.55 .50 .50			U1: LEAN CLAY (CL); Similar to S9
50	S10	7 13 14 18	24	2				Top of SAND at about 47.5' S10: CLAYEY SAND (SC); Mostly fine sand, ~15-20% low plasticity fines, gray
55	S11	22 28 56 43/3"	21	15		Blow counts inflated casing going down with sampler last 4"		S11: Top 3" SILTY SAND (SM); Fine to coarse angular sand, ~20% low plastic fines, gray Bottom 12" WELL-GRADED SAND WITH GRAVEL (SW); Fine to coarse subrounded sand, ~15% subrounded fine gravel, gray
60	S12	12 9 5 6	24	7				S12: WELL-GRADED SAND WITH SILT (SW-SM); Fine to coarse sand, ~10% non-plastic fines, ~5-10% fine subrounded gravel, gray

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
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- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

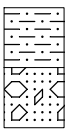
BORING LOG

FD-12

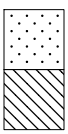
DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
65	S13	16 10 8 15	24	6				S13: Similar to S12
70	S14	20 15 13 16	24	0				S14: No recovery
75	S15	10 7 8 10	24	8				S15: WELL-GRADED SAND WITH SILT (SW-SM); Similar to S12
80								Bottom of borehole @ 76' 1. Boring was advanced using drive and wash technique with 4" (HW) casing and a 3-7/8" roller bit.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

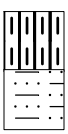
STRATIGRAPHIC LEGEND


- SILTY SAND

- GRAVEL


- SAND

- CLAY


- ORGANIC SILT

- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 2

FD-13

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -6.6
NORTHING: 4813702.65 EASTING: 388507.88
DRILLED BY: New Hampshire Boring D. Thompson
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 44.9'
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 4/25/05
DATE END: 4/22/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	1 1 2 3	24	15		Rig Jumping @ 8-9'		S1: POORLY GRADED SAND WITH SILT (SP-SM); Mostly fine sand, trace of medium sand, ~10% non-plastic fines, gray
								Top of CLAY at about 3'
5	S2	WOH/ 18" 2	24	18				S2: LEAN CLAY (CL); Low to medium plasticity, gray
								Top of SAND at about 8'
10	S3	18 27 25 20	24	18				S3: WELL-GRADED SAND WITH GRAVEL (SW); Fine to coarse sand, ~40% subrounded fine to coarse gravel, ~5% fines, brown
15	S4	15 17 17 19	24	2				S4: WELL-GRADED SAND WITH GRAVEL (SW); Similar to S3
20	S5	11 12 9 8	24	2				S5: WELL-GRADED SAND WITH GRAVEL (SW); Similar to S3
25	S6	10 8 5-5/4" 23/0"	22	7				S6: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Fine to coarse sand, ~20% subrounded fine gravel, ~10% non-plastic fines, gray

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 2

FD-13

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
30	S7	25 14 11 16	24	8				S7: POORLY GRADED SAND WITH SILT (SP-SM); Mostly fine sand, ~10% non-plastic fines, several pieces of fractured gravel at top of sample, gray
35	S8	15 16 16 16	24	5				S8: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Fine to coarse sand, ~20% subangular fine gravel (some pieces fractured by sampler), ~10% non-plastic fines, gray
40	S9	32 24 17 29	24	1				S9: Piece of coarse gravel wedged in tip of sampler
45	S10	27 100/4"	10	2		Casing driving hard @ 42'		S10: SILTY SAND (SM); Mostly fine to medium sand, ~15% slightly plastic fines, ~10% subangular fine gravel, one piece of coarse gravel in tip of spoon, gray
50								Bottom of borehole at 44.9' 1. Boring was advanced using drive and wash technique with 4" (HW) casing and a 3-7/8" roller bit.
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 2

FD-14

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -2.5
NORTHING: 4813267.53 EASTING: 388500.66
DRILLED BY: New Hampshire Boring D. Thompson
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 37'
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 4/26/05
DATE END:

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	8 4 4 6	24	7		Rig Bouncing @ ~9-10'		S1: SILTY SAND (SM); Fine to very fine sand, ~15% non-plastic fines, gray
5	S2	8 11 12 14	24	7				S2: POORLY GRADED SAND WITH SILT (SP-SM); Mostly fine to medium sand, ~10% non-plastic fines, trace of coarse sand and fine gravel, brown
10	S3	29 17 14 20	24	12				S3: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Mostly fine to medium sand, ~15% subrounded and subangular fine gravel, one piece of coarse subangular gravel at top of sample, ~10% non-plastic fines, gray
13.5								Top of SANDY SILT at 13.5'
15	S4	2 2 2 11	24	12				S4: SANDY SILT (ML-OL); Low plasticity, ~40% fine sand, occasional peat fiber, organic odor, olive gray
20	S5	1 2 1 2	24	15				S5: SANDY SILT (ML-OL); Medium plasticity, ~25-30% fine sand, occasional piece of subrounded fine gravel, peat fiber, shell fragment; organic odor, dark olive gray
25	U1	PUSH	27	27	0.65 0.55			U1: Similar to S5; except low plasticity (ML-OL)
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, ME
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 2

FD-14

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
35	S6	4 4 3 6	24	24				S6: SANDY SILT (ML-OL); Low plasticity, ~35% fine sand, peat fiber, shell fragments, organic odor, dark olive gray
	S7	2 1 4 5	24	24				S7: Similar to S6; lower 12" of sample has several layers of fine to medium sand up to 1" thick
40								Bottom of boring at 37'
								Boring terminated prematuraly due to unanticipated marine conditions
45								
50								
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-15

GROUNDWATER INFORMATION

DATE	TIME	DEPTH (FT) WATER	CASING	HOLE
			FD-15	

BORING LOCATION: FD-15 TOTAL DEPTH (FT): 62.0'
SURFACE ELEVATION (FT): -3.4 VERT. DATUM: MLLW
NORTHING: 4813910.24 EASTING: 388278.32 HOR. DATUM: NAD 83 (m)
DRILLED BY: New Hampshire Boring B. Thompson DATE START: 10/20/05
LOGGED BY: Steve Sarandis DATE END: 10/20/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	9 6 5 5	24	14				S1: Top 2"; POORLY GRADED SAND WITH SILT (SP-SM); Very fine sand, ~10% non plastic fines, Gray. S1: Bot. 12" POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% non plastic fines, Gray.
5	S2	3 3 4 5	24	24	0.60 0.60			S2: LEAN CLAY (CL); Low to medium plasticity, trace fine sand, Olive Gray.
10	S3	WOR/12" 1 2	24	24	0.20 0.20			S3: LEAN CLAY (CL); Low to medium plasticity, occasional layer of fine sand, ~1/8" max size, Gray, with layers of black.
15	S4	1 1/12" 1	24	24	0.25 0.20 0.25			S4: LEAN CLAY (CL); Simialr to S3.
20	S5	WOR/24"	24	24				S5: LEAN CLAY (CL); Simialr to S3.
25	S6	WOR/24"	24	24	0.15 0.15			S6: LEAN CLAY (CL); Low to medium plasticity, occasional layers and lamina of fine sand, ~1/16" max size, Dark Gray to Black.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, maine GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 2 of 2 **FD-15**

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	WOR/12" 3 3	24	24	0.30 0.30			S7: LEAN CLAY (CL-CH); Medium plasticity, Dark Gray.
35	S8	WOR 4 4 5	24	24	0.45 0.50 0.55			S8: LEAN CLAY (CL); Low to medium plasticity, trace fine sand, Dark Gray.
40	S9	WOR/12" 3 4	24	24	0.35 0.35 0.35			S9: LEAN CLAY (CL); Similar to S8.
45	S10	3 4 5 6	24	12	0.40 0.40			S10: LEAN CLAY (CL); Low to medium plasticity, Dark Gray.
50	S11	WOR 1 2 3	24	24				S11: LEAN CLAY (CL); Low to medium plasticity, frequent layers and lamina of fine sand, Gray.
55	S12	WOR	24	24				S12: LEAN CLAY (CL); Low plasticity, ~20% fine sand, layers of fine sand ~1/2" thick, Gray.
60	S13	14 14 14 18	24	18				Top of CLAYEY SAND at about 58.5' S13: CLAYEY SAND (SC); Fine sand, ~20% low plasticity fines, Gray.
65								Bottom of Boring at 62.0'

1. Boring advanced from 0-15' using drive and wash techniques with 4" (HW) casing.
2. Boring advanced open hole below 15'.
3. Advanced an adjacent hole to 15' to take an undisturbed sample. Shelby tube sample was taken from 15' to 17'. Coordinates for the undisturbed sample are 4813907.55 N , 388279.65 E. Boring designated FD-15A.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 1

FD-15A

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE
			FD-15A	

BORING LOCATION: FD-15A
SURFACE ELEVATION (FT): NM
NORTHING: 4813907.55 EASTING: 388279.65
DRILLED BY: New Hampshire Boring B. Thompson
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 17.0'
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 9/11/05
DATE END: 9/11/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0								
5								
10								
15	U1		24	24				U1: LEAN CLAY (CL); Medium plasticity, <5% fine sand, Olive-gray
20								Bottom of Boring at 17.0'
25								1. This hole was advanced adjacent to FD-15 to a depth of 15' to take an undisturbed sample. Shelby tube sample was taken from 15' to 17'.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

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PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 3
FD-16

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -4.0
NORTHING: 4813802.11 EASTING: 388312.85
DRILLED BY: New Hampshire Boring Greg Leavitt
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 70.0'
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 11/02/05
DATE END: 11/02/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	7 6 8 8	24	13				S1: POORLY GRADED SAND WITH SILT (SP-SM); Fine to very fine sand sand, ~10% non plastic fines, Gray.
5	S2	1 1 2 1	24	24	0.25 0.25			Top of CLAY at about 4.5' S2: LEAN CLAY (CL); Low to medium plasticity, ~5% fine sand, lamina of silty fine sand, Light Gray.
10	S3	WOR/12" WOH/12"	24	24	0.25 0.30			S3: LEAN CLAY (CL); Medium plasticity, ~5% fine sand, Gray with layers and zones of black, medium dry strength.
15	U1	PUSH/24"	24	24	0.25 0.30 0.25			U1: LEAN CLAY (CL); Simialr to S3.
20	S4	WOR/24"	24	24				S4: LEAN CLAY (CL); Simialr to S3.
25	S5	WOR/24"	24	24	0.20 0.20			S5: LEAN CLAY (CL); Simialr to S3.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

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Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 2 of 3
FD-16

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S6	WOR/24"	24	24	0.20 0.25			S6: LEAN CLAY (CL); Medium plasticity, ~5% fine sand, Dark Gray with Black.
35	S7	WOR/24"	24	24	0.20 0.20			S7: LEAN CLAY (CL); Medium plasticity, ~5-10% fine sand, Olive Gray.
40	S8	WOR/24"	24	24	0.30 0.30 0.30			S8: LEAN CLAY (CL); Similar to S7.
45	S9	WOR/24"	24	24	0.35 0.35 0.35			S9: LEAN CLAY (CL); Similar to S7.
50	S10	WOR/12" 3 4	24	24	0.35 0.40			S10: LEAN CLAY (CL); Similar to S7.
55	S11	WOR 4 7 6	24	24				S11: Top 6"; LEAN CLAY (CL); Similar to S7.
								Top of SILTY SAND at 55.5'
								S11: Bot. 18" SILTY SAND (SM); Fine sand, ~20% slightly plastic fines, fragmented layers of Sandy Silt (ML), up to 1" thick, Dark Gray.
60	S12	2 1 1 7	24	24				S12: SILTY SAND (SM); Fine sand, ~15% slightly plastic fines, bottom 6" has numerous layers of sandy silt, Gray.
65	S13	5 9 10 14	24	24				S13: POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10% non-plastic fines, Gray.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

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PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

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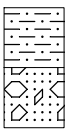
FD-16

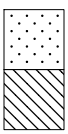
DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
70								Bottom of Boring at 70.0'
75								Advanced boring to 70' with roller bit, attempted to sample; hole would not stay open. Drilling and wash indicated sand at 70'.
80								1. Advanced boring from 0 to 10' using drive and wash technique with 4" (HW) casing.
85								2. Advanced boring open hole below 10'.
90								3. Advanced boring to 70' with roller bit, attempted to sample but hole would not stay open. Drilling and wash water indicate we are still in sand. Did not have sufficient time to advance the casing to 70' to continue boring.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

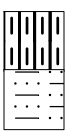
STRATIGRAPHIC LEGEND


- SILTY SAND

- GRAVEL


- SAND

- CLAY


- ORGANIC SILT

- SILT

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PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 2
FD-17

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

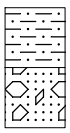
BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -4.9
NORTHING: 4813613.17 EASTING: 388537.53
DRILLED BY: New Hampshire Boring B. Thompson
LOGGED BY: Steve Sarandis

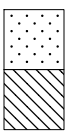
TOTAL DEPTH (FT): 32.0'
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 11/03/05
DATE END: 11/03/05

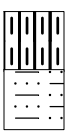
DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	7 6 7 8	24	14				S1: POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10% non plastic fines, top 8" light brown, bottom 6" gray.
5	S2	10 10 6 7	24	8				S2: Top 4" - Similar to the bottom 6" of S1. S2: Bot. 4" - SILTY SAND WITH GRAVEL (SM); Fine to coarse sand, ~15% slightly plastic fines, ~20% subangular fine gravel, Tan, Brown Mottlen. Difficulty washing out casing from 5-13'. Large amount of gravel in wash/rollerbit binding up inside casing.
10	S3	6 9 12 13	24	3				S3: SILTY GRAVEL WITH SAND (GM); Fine to coarse subangular gravel, ~15% slightly plastic fines, ~25% fine to coarse sand, Tan.
15	S4	15 20 17 13	24	5				S4: SILTY GRAVELWITH SAND (GM); Fine to coarse subangular gravel, ~15% slightly plastic fines, ~30% fine to coarse sand, Tan.
20	S5	15 24 9 11	24	9				S5: Top 3" - WELL-GRADED GRAVEL WITH SAND (GW); Fine to coarse subrounded gravel, ~25% fine to medium sand,~5% fines, Gray. S5: Bot. 6" - POORLY GRADED SAND WITH SILT (SP-SM); Fine sand, ~10% non plastic fines, Light Brown.
25	S6	14 8 8 9	24	13				S6: WELL-GRADED SAND WITH SILT (SW-SM); Fine to medium sand, ~10% non plastic fines, ~5% coarse sand, ~5% fine subrounded gravel, Light Brown. Hard Drilling at 27'.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND


- SILTY SAND
- GRAVEL


- SAND
- CLAY


- ORGANIC SILT
- SILT

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PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

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FD-17

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	20 15 21 18	24	0				S7: Three pieces of coarse gravel in tip sample.
35								Bottom of Boring at 32'. 1. Advanced boring from 0-32' using drive and wash technique with 4" (HW) casing. 2. Stopped boring at 32' and returned drilling barge to dock due to deteriorating weather conditions.
40								
45								
50								
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

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PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 1 of 2

FD-18

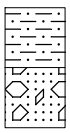
GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE
			FD-18	

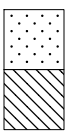
BORING LOCATION: FD-18 TOTAL DEPTH (FT): 46.5'
SURFACE ELEVATION (FT): -2.3 VERT. DATUM: MLLW
NORTHING: 4813388.88 EASTING: 388629.94 HOR. DATUM: NAD 83 (m)
DRILLED BY: New Hampshire Boring B. Thompson DATE START: 11/8/05
LOGGED BY: Kevin Duffy DATE END: 11/8/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	2 2 4 6	24	10				S1: POORLY GRADED SAND (SP); Fine to medium sand, ~5% fines, Tan-Gray.
5	S2	12 11 11 13	24	10				S2: Top 3" - POORLY GRADDED SAND (SP); Similar to S1 with ~10% coarse subrounded gravel. S2: Bot. 7" - SILTY SAND WITH GRAVEL (SM); Fine to coarse sand, ~25% fine to coarse gravel, ~15% slightly plastic fines, Tan-Gray.
10	S3	35 22 14 5	24	9				S3: POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% non plastic fines, 50% subrounded coarse gravel, bottom 1" is clayey sand, ~40% low plastic sand, Tan.
15	S4	19 7 3 6	24	24				S4: CLAYEY SAND (SC); Mostly fine sand, ~35% low plasticity fines, layers of sandy clay and silty fine sand, layers ranging 1/2" -2" thick, one piece angular gravel @ top of sample, gravel fractured during sampling, Tan.
20	S5	8 6 7 7	24	17				S5: POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% silt, clay layers throughout sample, 1/2" in length, ~1.5" area of liquefaction, no silt in area, Brown-Tan.
25	S6	12 13 17 22	24					S6: WELL-GRADED SAND (SW); Mostly fine to coarse sand, ~15% fine subangular gravel, <5% fines, Tan.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND


- SILTY SAND
- GRAVEL


- SAND
- CLAY


- ORGANIC SILT
- SILT

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PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

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FD-18

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	14 13 19 22	24	16				S7: WELL-GRADED SAND (SW); Similar to S6.
								Hard drilling at 33.0'
35	S8	18 17 18 16	24	16				S8: WELL-GRADED SAND WITH GRAVEL (SW); Mostly fine to coarse sand, ~20% fine to coarse gravel, ~5% non plastic fines, Tan.
40	S9	13 17 21 13	24	13				S9: WELL-GRADED SAND WITH GRAVEL (SW); Similar to S8.
								Top of SILTY SAND at about 43.5'
45	S10	65 85 100	18	3				S10: Interface of glacial till and weathered rock. One piece fractured rock, less weathered.
								Bottom of Boring at 46.5'
50								1. Boring advanced from 0-46' using drive and wash technique with 4" (HW) casing
55								
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

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CITY/STATE: Saco, maine
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BORING LOG

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FD-19

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE
				FD-19

BORING LOCATION: FD-19 TOTAL DEPTH (FT): 47.5'
SURFACE ELEVATION (FT): -0.6 VERT. DATUM: MLLW
NORTHING: 4813312.79 EASTING: 388726.89 HOR. DATUM: NAD 83 (m)
DRILLED BY: New Hampshire Boring B. Thompson DATE START: 11/09/05
LOGGED BY: Steve Sarandis DATE END: 11/09/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	2 3 4 4	24	14				S1: POORLY GRADED SAND (SP); Fine to medium sand, ~25% coarse sand, ~5% non plastic fines, Gray.
5	S2	3 1 1 2	24	18				Top of SILTY SAND at about 4' S2: SILTY SAND (SM); Fine sand, ~20% slightly plastic fines, occasional shell, Dark Gray, one-3" layer sandy silt (ML-MH), medium plasticity, possibly organic
10	S3	14 10 13 17	24	11				S3: SILTY SAND (SM); Fine sand, ~10% medium to coarse sand, ~20% slightly plastic fines, ~10% subangular to subrounded fine gravel (black), Gray.
15	S4	7 8 10 6	24	4				Wash color change at 14' S4: CLAYEY SAND (SC); Fine sand, ~35% low plasticity fines, Tan.
20	S5	WOR/18" 3	24	24	0.25 0.30 0.60 0.65			Top of CLAY at about 18' S5: LEAN CLAY (CL); Low plasticity, ~5% fine sand, Top 12" Gray with black layers, Bottom 12" Olive Gray.
25	S6	13 16 23 26	24	15				Top of SAND at about 22' Wash color changes every 6"-12" from 20'-25' (tan/gray) S6: POORLY GRADED SAND WITH SILT (SP-SM); Fine to medium sand, ~10% non plastic fines, ~5% coarse sand, Tan.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- SAND
- ORGANIC SILT
- GRAVEL
- CLAY
- SILT

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Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 2 of 2

FD-19

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	30 23 18 18	24	14				S7: WELL-GRADED SAND WITH GRAVEL (SW); Fine to coarse sand, ~20% subrounded fine gravel, ~5% non plastic fines, Brown.
35	S8	21 20 26 23	24	17				S8: WELL-GRADED SAND WITH GRAVEL (SW); Fine to coarse sand, ~30% subrounded fine gravel, ~5% non plastic fines, Dark Gray.
40	S9	10 8 11 11	24	8				S9: WELL-GRADED SAND WITH GRAVEL (SW); Similar to S8.
45	S10	26 25 50 55	24	15				S10: WELL-GRADED SAND WITH GRAVEL (SW); Fine to coarse sand, ~35% subrounded fine to coarse gravel (some gravel pieces fractured during sampling), ~5% non plastic fines, Dark Brown.
50								Bottom of Boring at 47.5'
55								1. Boring advanced using drive and wash technique with 4" (HW) casing from 0-47.5'. 2. Unable to drive casing past 47.5'.
60								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
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- CLAY
- ORGANIC SILT
- SILT

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1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG
PAGE 1 of 3
FD-20

GROUNDWATER INFORMATION				
DATE	TIME	DEPTH (FT)		
		WATER	CASING	HOLE

BORING LOCATION: Offshore
SURFACE ELEVATION (FT): -7.3
NORTHING: 4813211.08 EASTING: 388719.56
DRILLED BY: New Hampshire Boring Greg Leavitt
LOGGED BY: Steve Sarandis

TOTAL DEPTH (FT): 77.0
VERT. DATUM: MLLW
HOR. DATUM: NAD 83 (m)
DATE START: 11/11/05
DATE END: 11/11/05

DEPTH FT.	SAMPLE INFORMATION TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
0	S1	5 4 5 6	24	12				S1: WELL-GRADED SAND WITH GRAVEL (SW); Fine to medium sand, ~10% coarse sand, ~15% subrounded fine gravel, ~5% fines, Gray.
5	S2	2 9 19 14	24	16				S2: Top 6" - Similar to S1. S2: Bot. 6" - SILTY SAND WITH GRAVEL (SM); Well-graded sand, ~15% subrounded fine gravel, ~15% slightly plastic fines, Gray. Rig chattering at 8'.
10	S3	1 1/12" 2	24	24	0.15 0.20			Top of SILT at 10'. S3: Top 12" - SANDY SILT (ML-OL); Low plasticity, ~30% fine sand, shells, peat fibers, organic odor, Gray. S3: Bot. 12" - SILTY SAND (SM); Fine sand, ~30% slightly plastic fines, Gray.
15	S4	WOR 1 1/12"	24	24				S4: SANDY ELASTIC SILT (MH-OH); High plasticity, ~35% fine sand, shells, pieces of wood, organic odor. Gray.
	U1							U1: SANDY ELASTIC SILT (MH-OH); High Plasticity, ~40% fine sand, Gray.
20	S5	1 2 5 3	24	24				S5: SANDY ELASTIC SILT (MH-OH); High plasticity, ~35% fine sand, numerous zones of peat, Gray.
25	S6	WOH/12" 2 2	24	24	0.35 0.40			S6: SANDY ELASTIC SILT (MH-OH); High plasticity, ~20% fine sand, peat fibers, shells, occasional layer of fine sand.
30								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc. 1021 Main Street Winchester, MA 01890	PROJECT NAME: Camp Ellis Beach CITY/STATE: Saco, maine GEI PROJECT NUMBER: 04376-0	BORING LOG PAGE 2 of 3 **FD-20**

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
	S7	WOH 1 2 2	24	24	0.40 0.40			S7: SANDY ELASTIC SILT (MH-OH); Similar to S6.
35	S8	2 2 1 2	24	24	0.45			S8: SANDY ELASTIC SILT (MH-OH); Similar to S6; with ~25% fine sand, and frequent layers of fine sand up to 1" thick.
40	S9	WOH/12" 4 8	24	24				S9: SANDY ELASTIC SILT (MH-OH); Similar to S6; Bottom 12" of sample appears drier and more stiff.
								Drilled through something hard from 42.5-43.0'
								Top of CLAY at about 43'.
45	S10	WOR/24"	24	24	0.20 0.20			S10: LEAN CLAY (CL); Low plasticity, ~5% fine sand, Gray.
								Hard drilling at 48'
50	S11	WOR/12" 1 2	24	24	0.25 0.30			S11: LEAN CLAY (CL); Low plasticity, ~5% fine sand, Gray.
55	S12	WOR/12"	24	10				S12: LEAN CLAY (CL); Similar to S11.
60	S13	WOR/12" 1 2	24	24	0.20 0.15			S13: LEAN CLAY (CL); Low plasticity, ~5% fine sand, Gray.
65	S14	WOR/12" WOH/12"	24	16	0.20 0.15			S14: LEAN CLAY (CL); Similar to S13.

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

GEI Consultants, Inc.
1021 Main Street
Winchester, MA 01890

PROJECT NAME: Camp Ellis Beach
CITY/STATE: Saco, maine
GEI PROJECT NUMBER: 04376-0

BORING LOG

PAGE 3 of 3

FD-20

DEPTH FT.	SAMPLE INFORMATION: TYPE and NO.	BLOWS PER 6 IN.	PEN IN.	REC IN.	Sv (tsf)	REMARKS	STRATA	SOIL / BEDROCK DESCRIPTION
70								
75	S15	WOR/12" 13 16	24	8				S15: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Fine to medium sand, ~10% coarse sand, ~10% non plastic fines, ~15% subrounded fine gravel. Gray.
80								Bottom of Boring @ 77'
85								1. Boring advanced to 15' using drive and wash technique with (HW) casing. 2. Boring advanced open hole below 15'.
90								

BLOWS PER 6 inch - 140lb. hammer falling 30 inches
PEN - Penetration length of sampler or core barrel
REC - Recovery length of sample
U - 3 inch Shelby tube sample
QD - Pocket penetrometer
Sv - Shear strength from torvane
S - 2 inch O.D Split spoon sample
TSF - Tons per square foot
S' - 3 inch O.D Split spoon sample

STRATIGRAPHIC LEGEND

- SILTY SAND
- GRAVEL
- SAND
- CLAY
- ORGANIC SILT
- SILT

CAMP ELLIS, SACO, ME
SECTION 111 SHORE PROTECTION
GEOTECHNICAL DESIGN APPENDIX
ATTACHMENT F
LABORATORY DATA

GeoTesting express

1145 Massachusetts Avenue
Boxborough, MA 01719
978 635 0424 Tel
978 635 0266 Fax

Geotechnical Test Report

June 28, 2005

Camp Ellis Project

Saco, Maine

Prepared for:

US Army Corp of Engineers

GeoTesting EXPRESS

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	---	Sample Type:	---	Tested By:	pcs
Sample ID:	---	Test Date:	05/22/05	Checked By:	jdt
Depth :	---	Test Id:	70873		

USCS Classification - ASTM D 2487

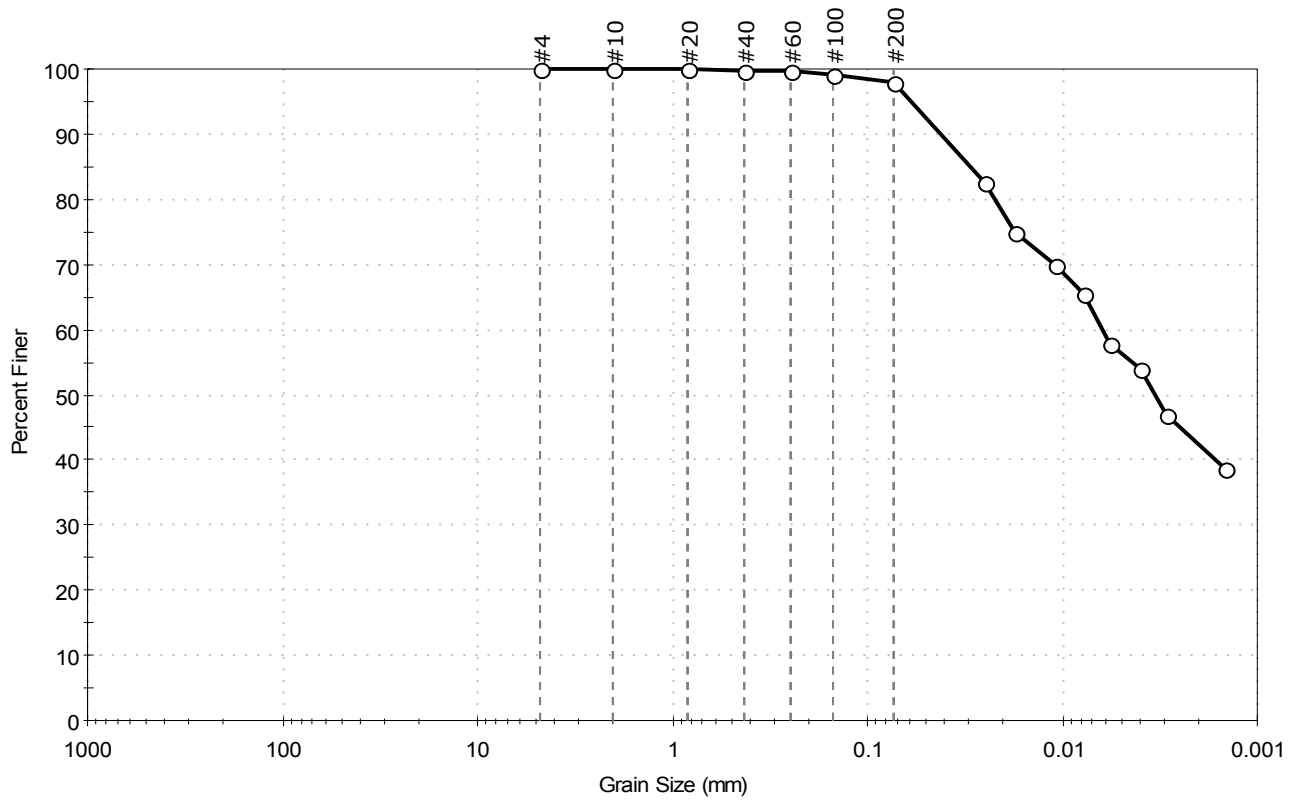
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
FD-02	U1	10-12 ft.	lean clay	CL	0.0	2.2	97.8
FD-05	U1	10-12 ft.	lean clay	CL	0.0	2.3	97.7
FD-07	U2	30-32 ft.	lean clay	CL	0.0	1.5	98.5
FD-12	U1	44-46 ft.	lean clay	CL	0.0	0.3	99.7
FD-14	U1	25-27 ft.	fat clay	CH	0.0	8.5	91.5

Remarks: Grain Size analysis performed by ASTM D422, results enclosed
Atterbeg Limits performed by ASTM 4318, results enclosed

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-02	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	05/22/05	Checked By:	jdt
Depth :	10-12 ft.	Test Id:	70859		
Test Comment:	---				
Sample Description:	Moist, dark gray clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	2.2	97.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.84	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	99		
#200	0.074	98		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0252	83		
---	0.0176	75		
---	0.0108	70		
---	0.0077	66		
---	0.0056	58		
---	0.0040	54		
---	0.0029	47		
---	0.0015	39		

Coefficients

D_{85} = 0.0299 mm D_{30} = N/A
D_{60} = 0.0062 mm D_{15} = N/A
D_{50} = 0.0033 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM lean clay (CL)

AASHTO Clayey Soils (A-6 (21))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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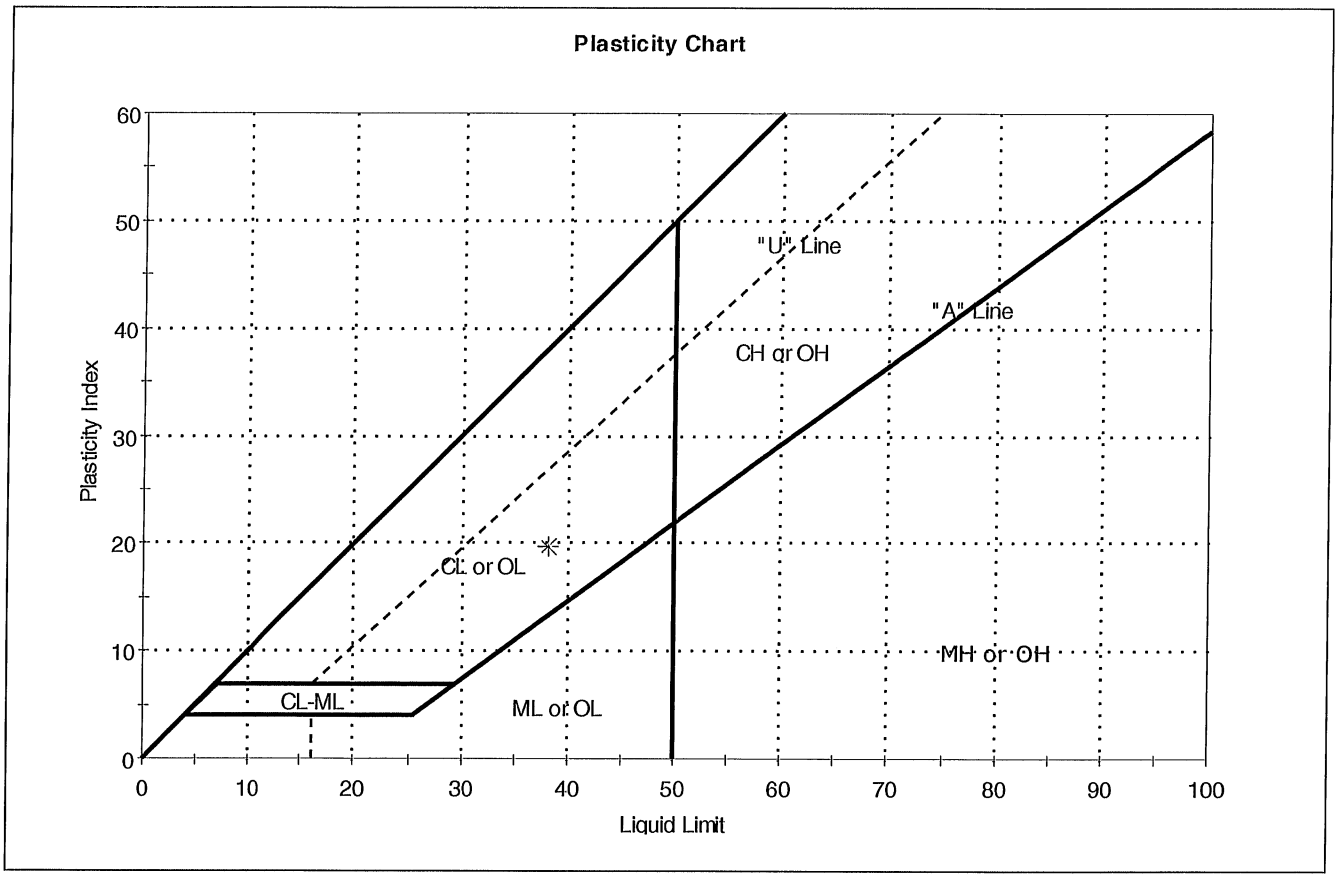
GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-02	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	06/22/05	Checked By:	jdt
Depth :	10-12 ft.	Test Id:	70864		
Test Comment:	---				
Sample Description:	Moist, dark gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U1	FD-02	10-12 ft.	32	38	18	20	1	lean clay (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilentancy: SLOW
Toughness: LOW

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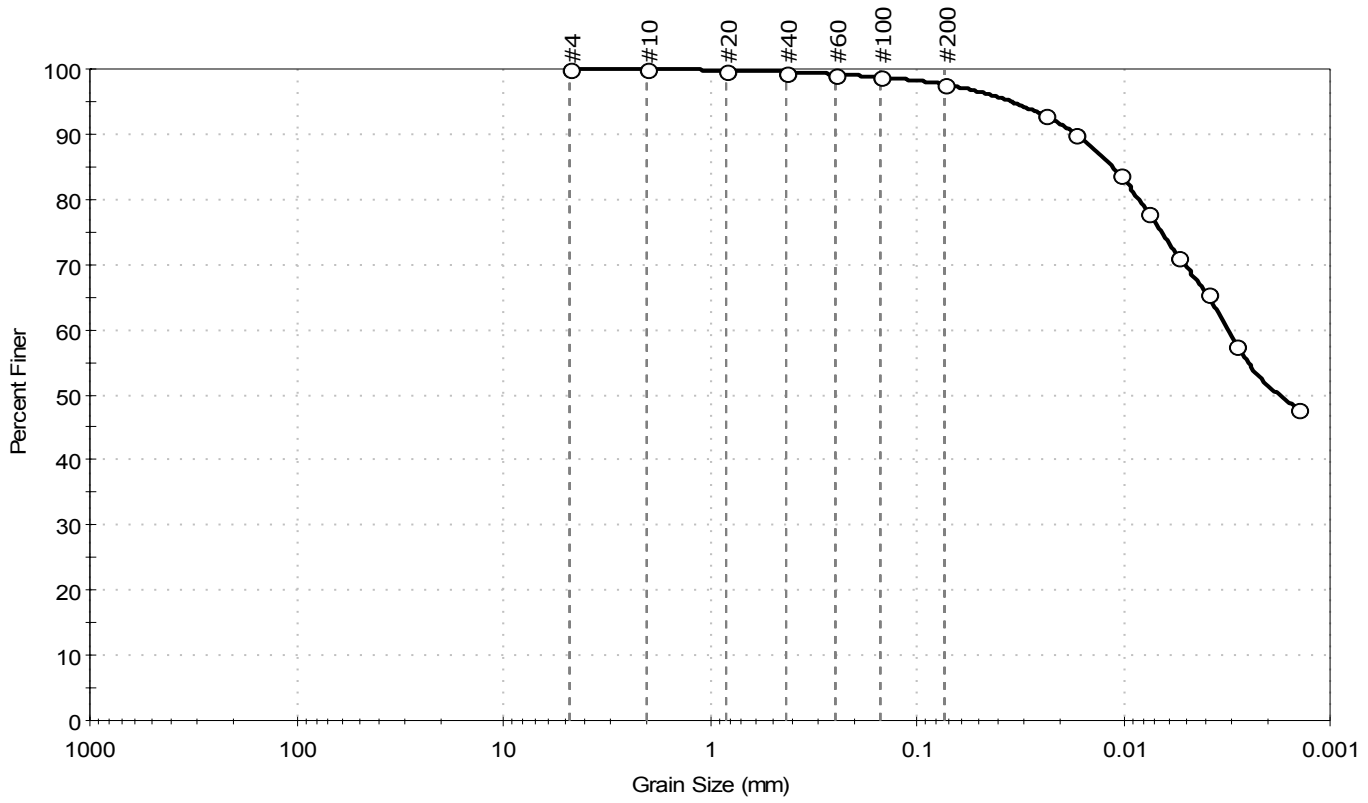
GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-05	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	05/22/05	Checked By:	jdt
Depth :	10-12 ft.	Test Id:	70860		
Test Comment:	---				
Sample Description:	Moist, dark gray clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	2.3	97.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.84	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	99		
#200	0.074	98		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0241	93		
---	0.0171	90		
---	0.0104	84		
---	0.0076	78		
---	0.0054	71		
---	0.0039	65		
---	0.0028	58		
---	0.0014	48		

Coefficients

D_{85} = 0.0115 mm D_{30} = N/A
D_{60} = 0.0031 mm D_{15} = N/A
D_{50} = 0.0017 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM lean clay (CL)

AASHTO Clayey Soils (A-7-6 (33))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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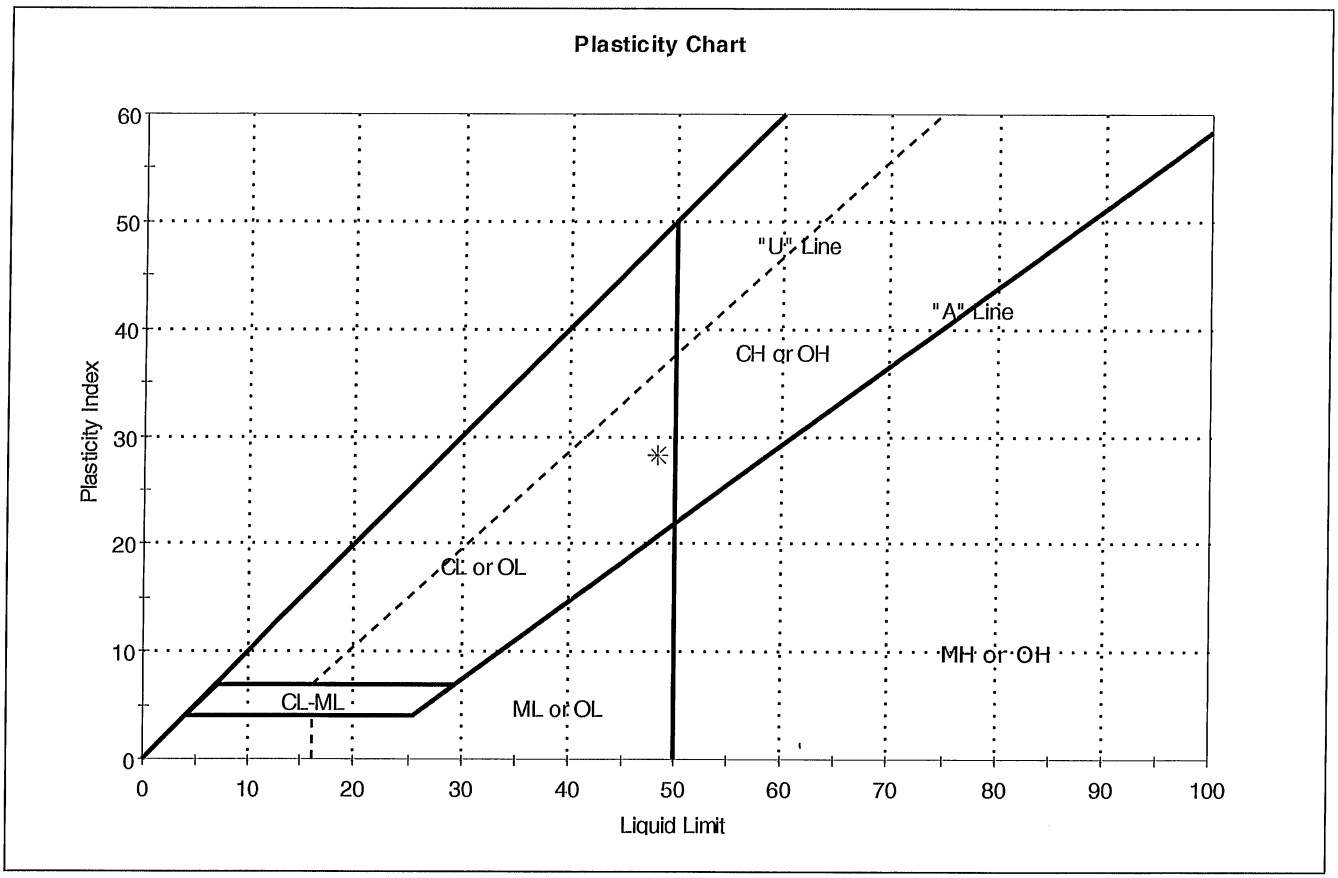
GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-05	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	06/20/05	Checked By:	jdt
Depth :	10-12 ft.	Test Id:	70865		
Test Comment:	---				
Sample Description:	Moist, dark gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U1	FD-05	10-12 ft.	42	48	20	28	1	lean clay (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: HIGH
Dilentancy: SLOW
Toughness: MEDIUM

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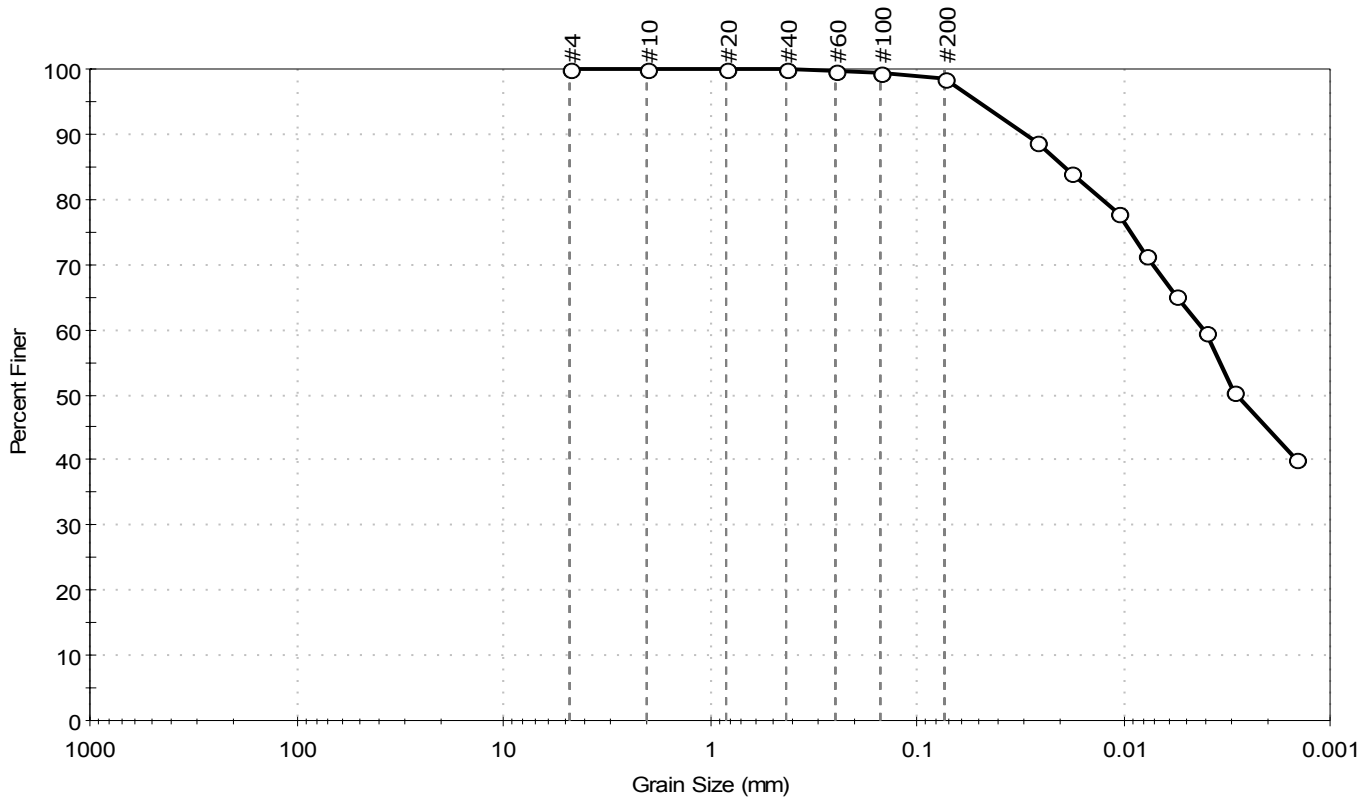
GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-07	Sample Type:	tube	Tested By:	pcs
Sample ID:	U2	Test Date:	05/22/05	Checked By:	jdt
Depth :	30-32 ft.	Test Id:	70861		
Test Comment:	---				
Sample Description:	Moist, olive gray clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	1.5	98.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.84	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	100		
#200	0.074	99		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0260	89		
---	0.0181	84		
---	0.0107	78		
---	0.0077	72		
---	0.0055	65		
---	0.0040	60		
---	0.0029	50		
---	0.0015	40		

Coefficients

D_{85} = 0.0194 mm D_{30} = N/A
D_{60} = 0.0041 mm D_{15} = N/A
D_{50} = 0.0028 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM lean clay (CL)

AASHTO Clayey Soils (A-7-6 (26))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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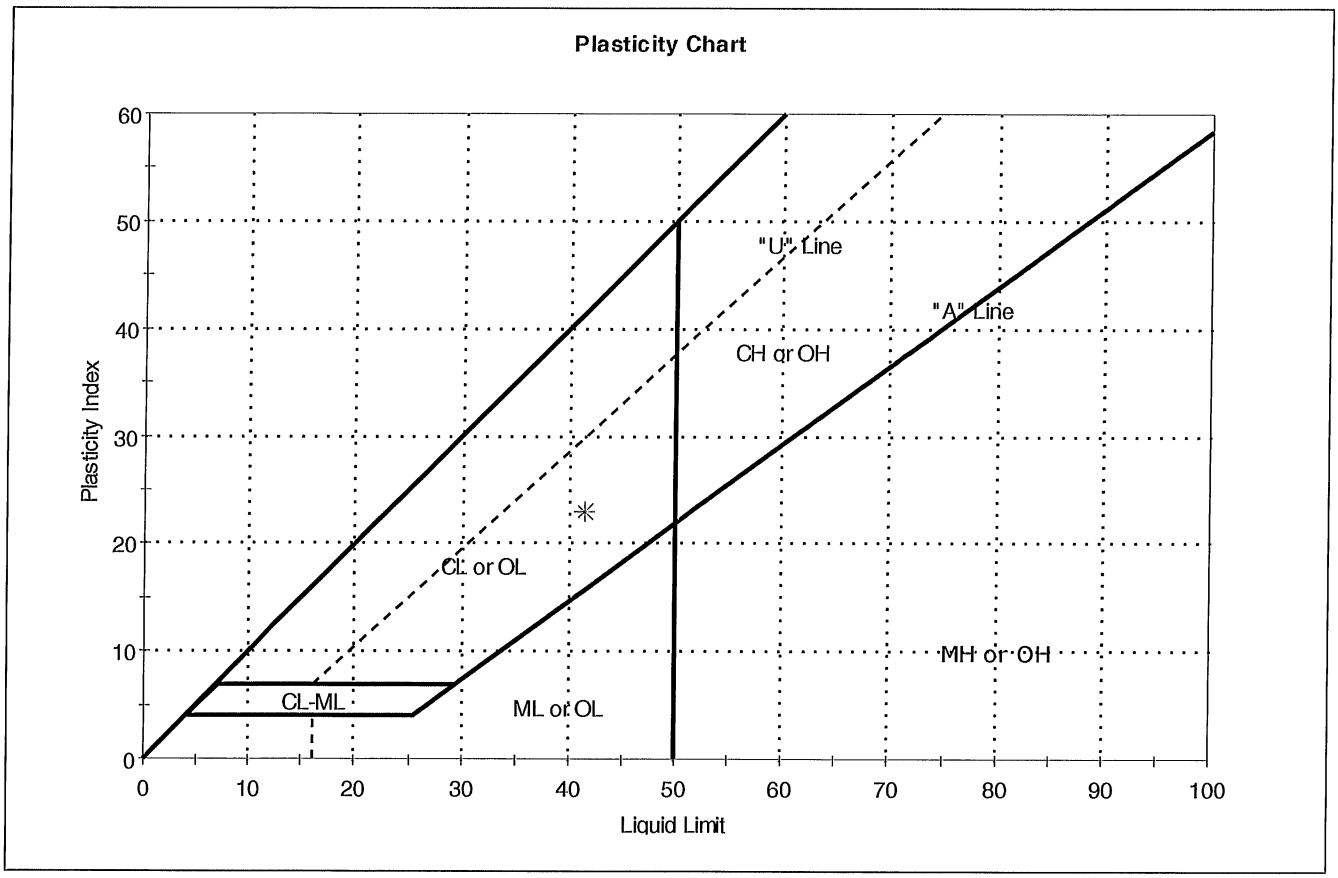
GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-07	Sample Type:	tube	Tested By:	pcs
Sample ID:	U2	Test Date:	06/21/05	Checked By:	jdt
Depth :	30-32 ft.	Test Id:	70866		
Test Comment:	---				
Sample Description:	Moist, olive gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318



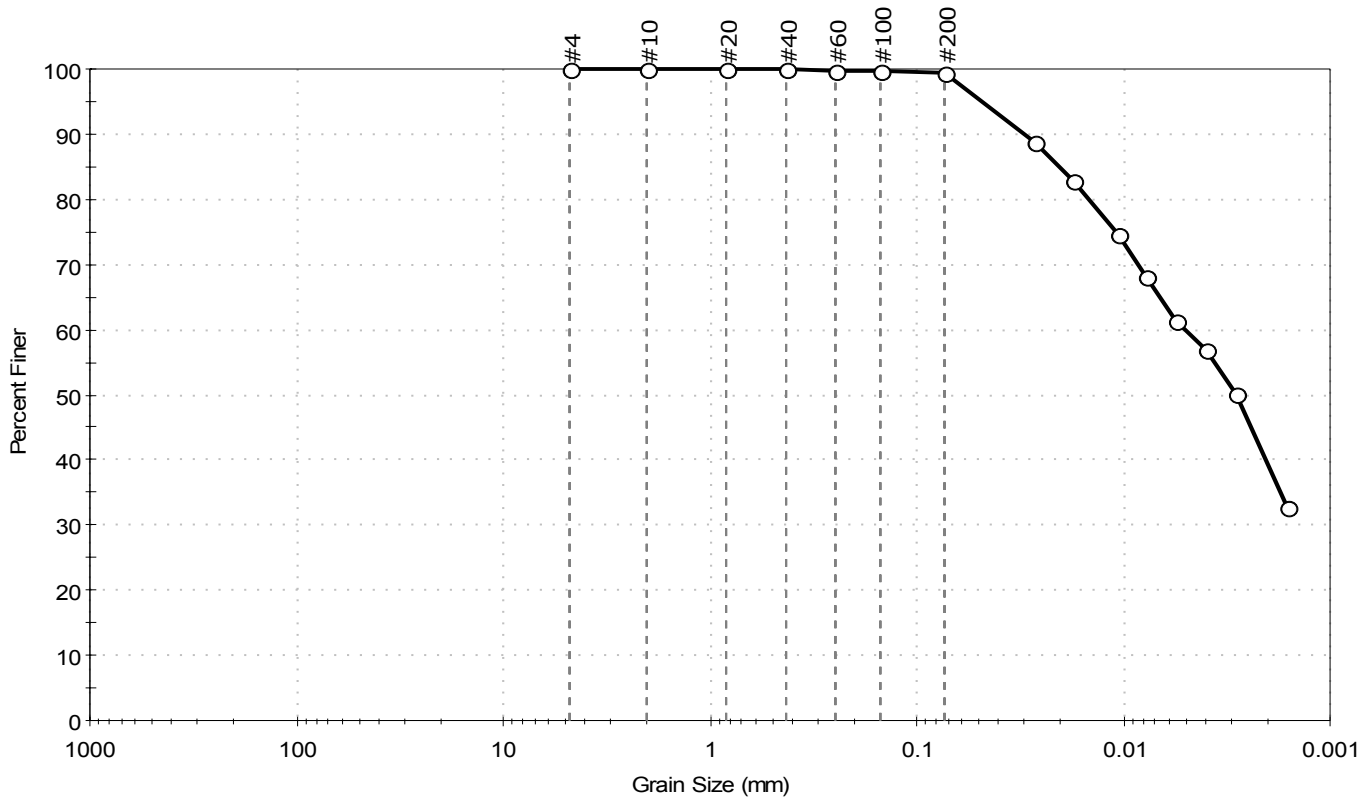
Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U2	FD-07	30-32 ft.	38	41	18	23	1	lean clay (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: HIGH
Dilentancy: SLOW
Toughness: LOW

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-12	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	07/05/05	Checked By:	jdt
Depth :	44-46 ft.	Test Id:	72040		
Test Comment:	---				
Sample Description:	Moist, gray clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	0.6	99.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.84	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	100		
#200	0.074	99		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0272	89		
---	0.0177	83		
---	0.0106	75		
---	0.0077	68		
---	0.0056	61		
---	0.0040	57		
---	0.0029	50		
---	0.0016	33		

Coefficients

D_{85} = 0.0207 mm D_{30} = N/A
D_{60} = 0.0050 mm D_{15} = N/A
D_{50} = 0.0029 mm D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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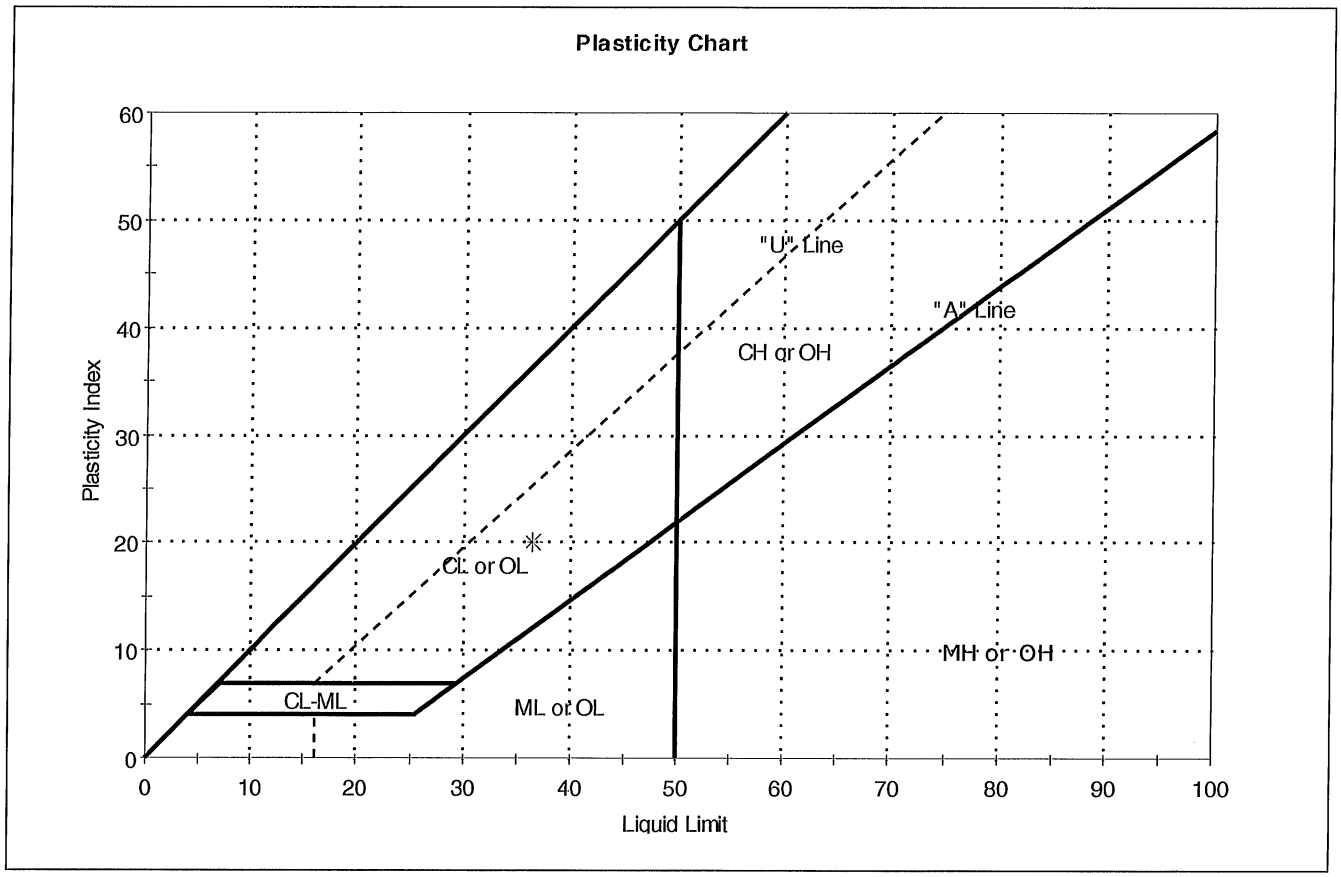
GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-12	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	06/21/05	Checked By:	jdt
Depth :	44-46 ft.	Test Id:	70867		
Test Comment:	---				
Sample Description:	Moist, gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318

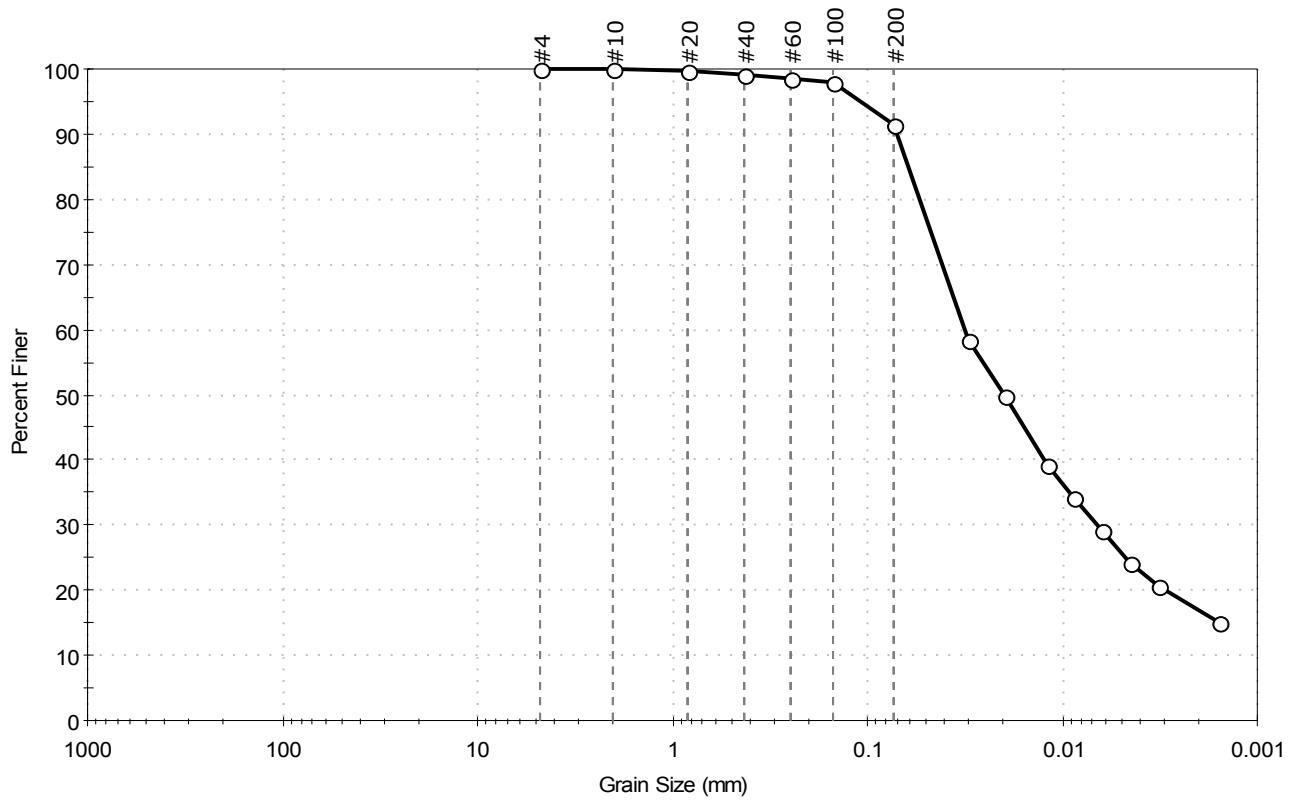


Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U1	FD-12	44-46 ft.	34	36	16	20	1	lean clay (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: HIGH
Dilentancy: SLOW
Toughness: LOW

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-14	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	05/22/05	Checked By:	jdt
Depth :	25-27 ft.	Test Id:	70863		
Test Comment:	---				
Sample Description:	Moist, dark olive gray clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	8.5	91.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.84	100		
#40	0.42	99		
#60	0.25	98		
#100	0.15	98		
#200	0.074	92		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0303	58		
---	0.0198	50		
---	0.0121	39		
---	0.0087	34		
---	0.0062	29		
---	0.0045	24		
---	0.0032	21		
---	0.0016	15		

Coefficients

D_{85} =0.0620 mm	D_{30} =0.0066 mm
D_{60} =0.0316 mm	D_{15} =0.0016 mm
D_{50} =0.0200 mm	D_{10} =0.0008 mm
C_u =39.500	C_c =1.723

Classification

ASTM fat clay (CH)

AASHTO Clayey Soils (A-7-5 (39))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

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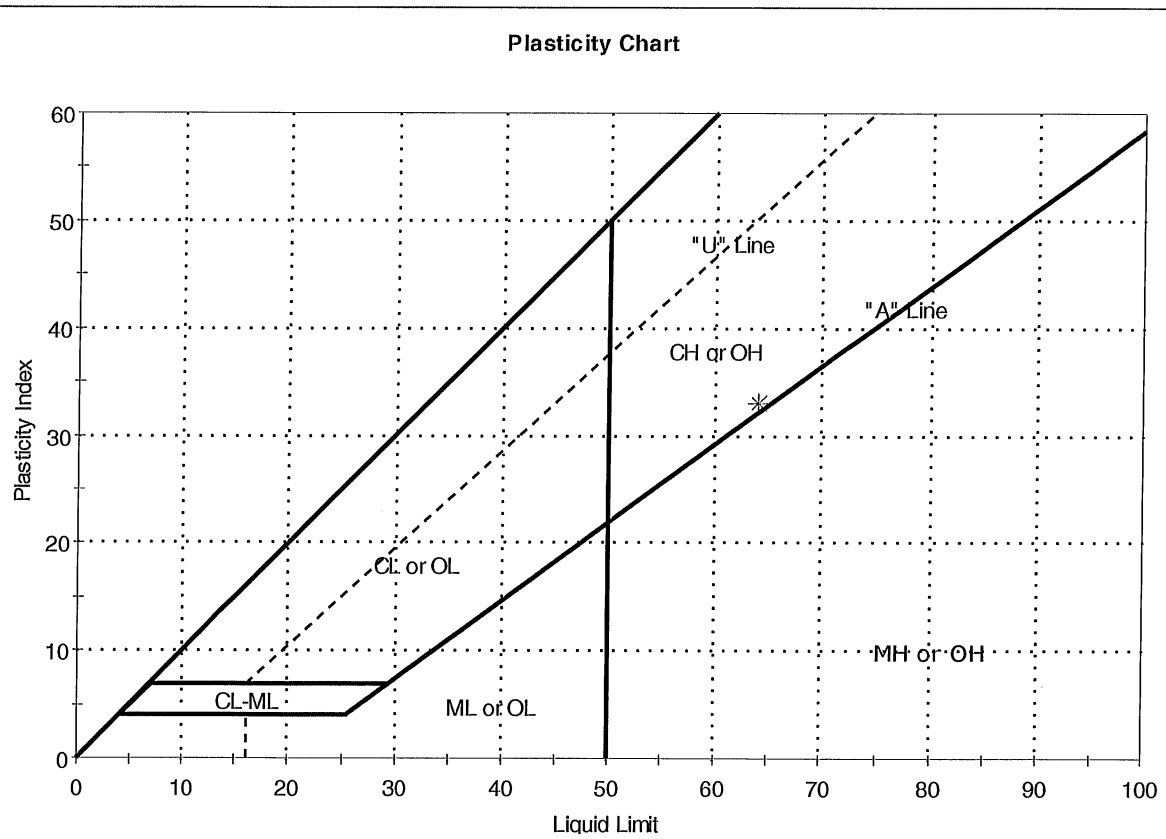
GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-14	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	06/21/05	Checked By:	jdt
Depth :	25-27 ft.	Test Id:	70868		
Test Comment:	---				
Sample Description:	Moist, dark olive gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U1	FD-14	25-27 ft.	53	64	31	33	1	fat clay (CH)

Sample Prepared using the WET method
1% Retained on #40 Sieve
Dry Strength: HIGH
Dilentancy: SLOW
Toughness: LOW

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GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	---	Sample Type:	---	Tested By:	pcs
Sample ID:	---	Test Date:	01/12/06	Checked By:	jdt
Depth :	---	Test Id:	83560		

USCS Classification - ASTM D 2487

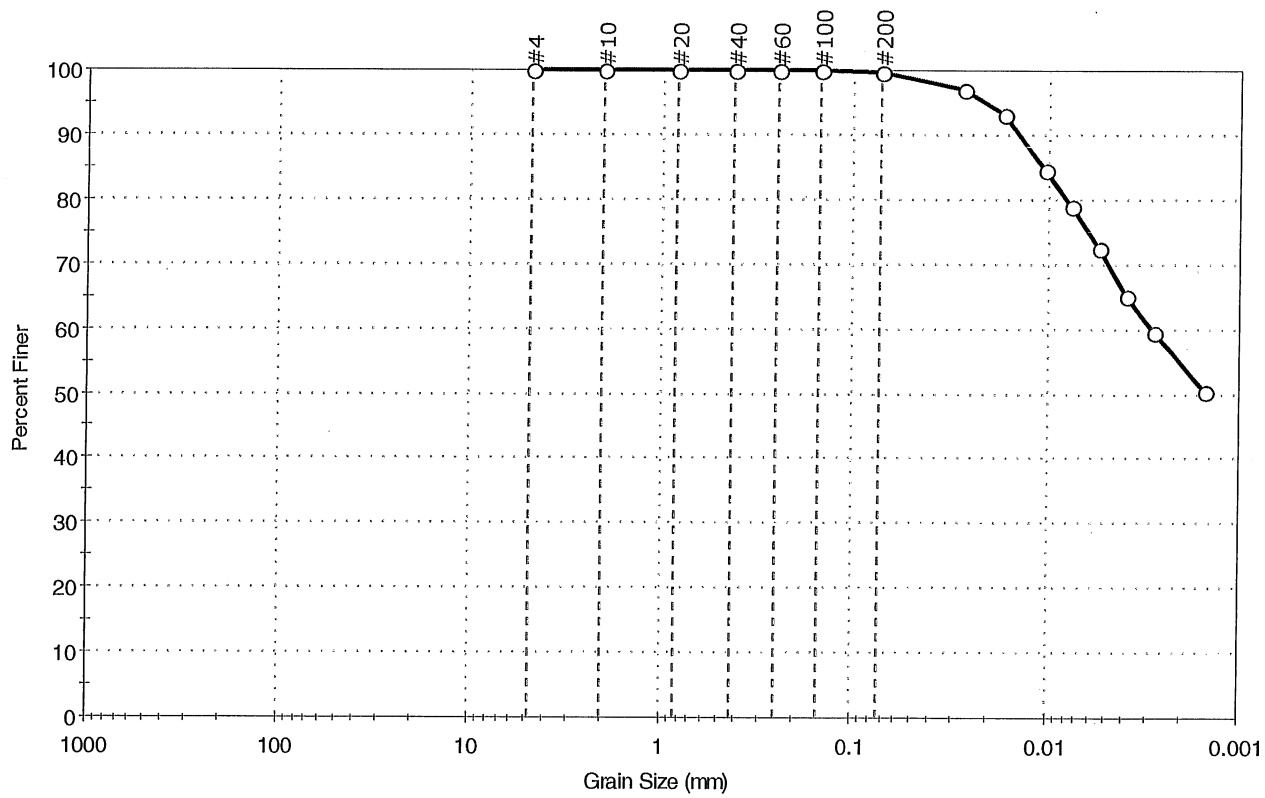
Boring ID	Sample ID	Depth	Group Name	Group Symbol	Gravel, %	Sand, %	Fines, %
FD-15A	U1	10-12 ft.	lean clay	CL	0.0	0.3	99.7
FD-16	U1	15-17 ft.	lean clay	CL	0.1	4.8	95.1
FD-20	U1	17-19 ft.	Sandy elastic silt	MH	0.1	39.2	60.7

Remarks: Grain Size analysis performed by ASTM D422, results enclosed
Atterbeg Limits performed by ASTM 4318, results enclosed

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-15A	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	01/11/06	Checked By:	jdt
Depth :	10-12 ft.	Test Id:	83552		
Test Comment:	---				
Sample Description:	Moist, olive brown clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	0.3	99.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.84	100		
#40	0.42	100		
#60	0.25	100		
#100	0.15	100		
#200	0.074	100		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0275	97		
---	0.0173	93		
---	0.0104	85		
---	0.0075	79		
---	0.0055	73		
---	0.0039	65		
---	0.0028	60		
---	0.0015	50		

Coefficients

D_{85} = 0.0105 mm	D_{30} = N/A
D_{60} = 0.0029 mm	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM lean clay (CL)

AASHTO Clayey Soils (A-7-6 (27))

Sample/Test Description

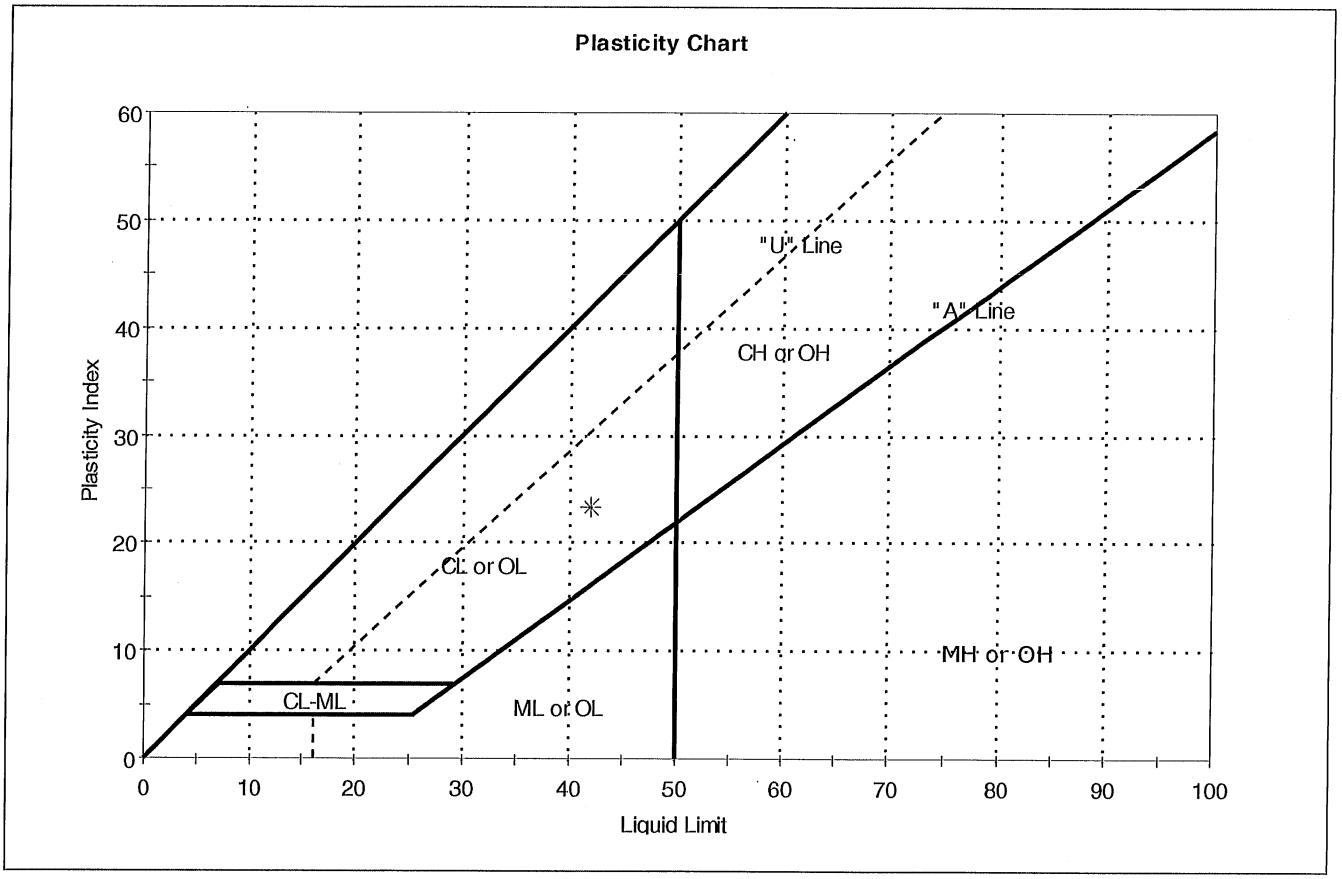
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-15A	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	01/03/06	Checked By:	jdt
Depth :	10-12 ft.	Test Id:	83555		
Test Comment:	---				
Sample Description:	Moist, olive brown clay				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318



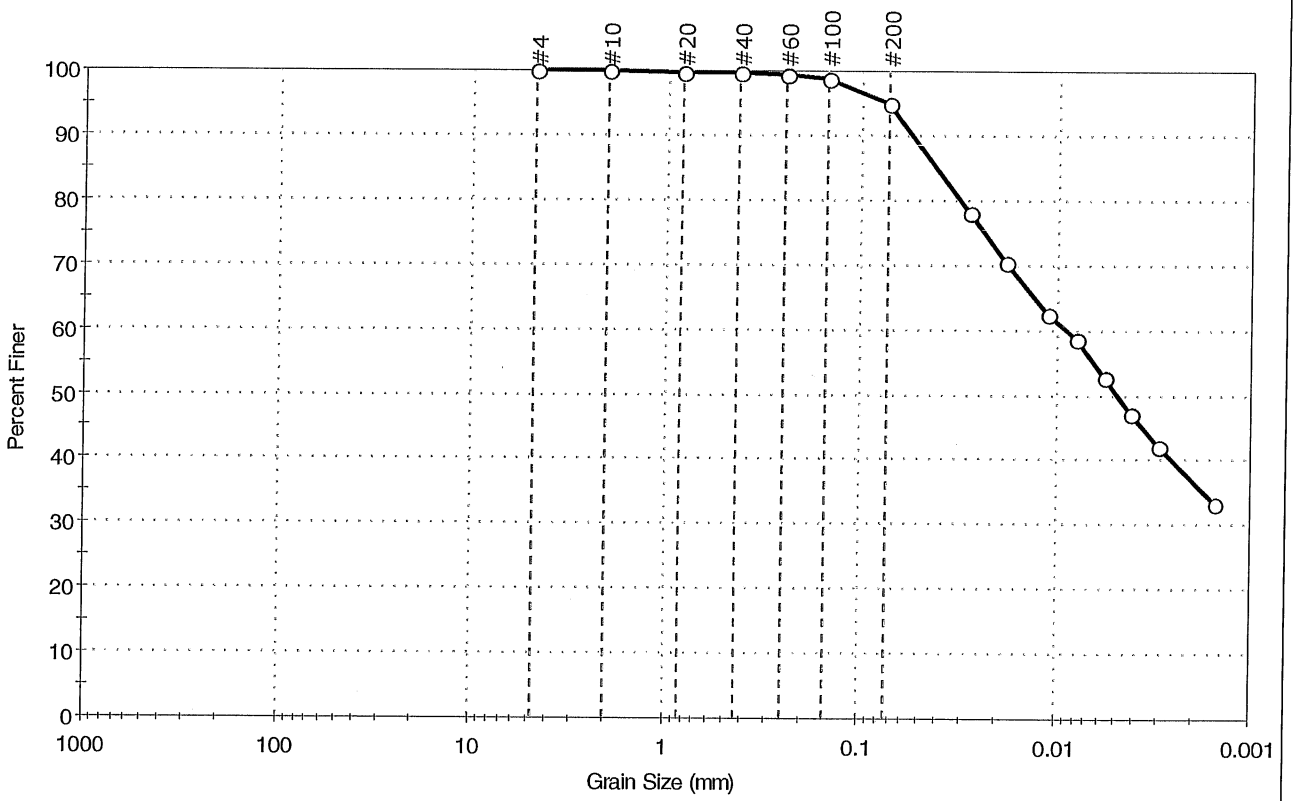
Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U1	FD-15A	10-12 ft.	39	42	19	23	1	lean clay (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilentancy: NONE
Toughness: MEDIUM

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-16	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	01/11/06	Checked By:	jdt
Depth :	15-17 ft.	Test Id:	83553		
Test Comment:	---				
Sample Description:	Moist, olive gray clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.1	4.8	95.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.84	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	99		
#200	0.074	95		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0282	78		
---	0.0185	70		
---	0.0111	63		
---	0.0079	59		
---	0.0057	53		
---	0.0042	47		
---	0.0030	42		
---	0.0016	33		

Coefficients

D_{85} = 0.0416 mm	D_{30} = N/A
D_{60} = 0.0088 mm	D_{15} = N/A
D_{50} = 0.0049 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM lean clay (CL)

AASHTO Clayey Soils (A-6 (14))

Sample/Test Description

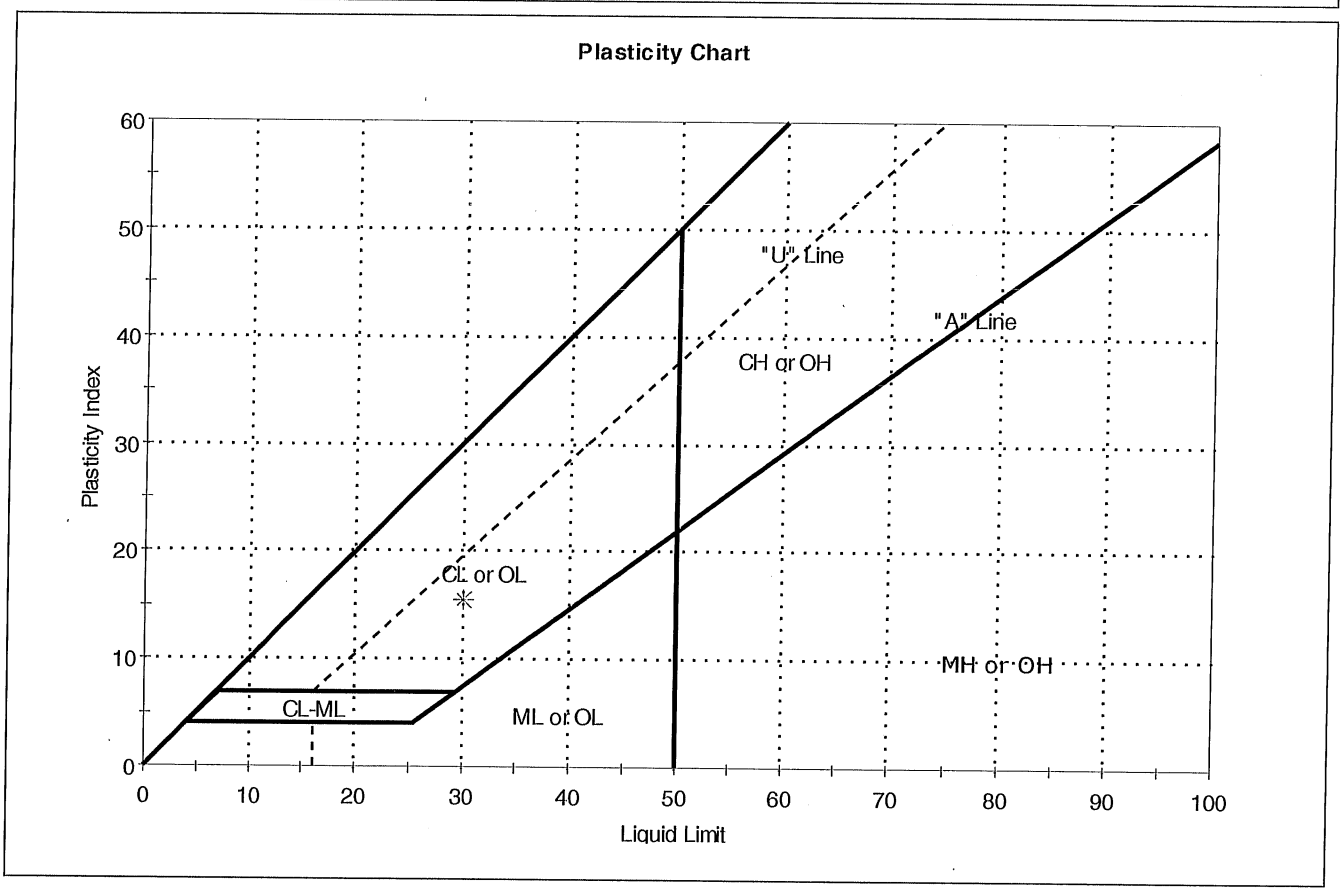
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-16	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	01/12/06	Checked By:	jdt
Depth :	15-17 ft.	Test Id:	83556		
Test Comment:	---				
Sample Description:	Moist, olive gray clay				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318



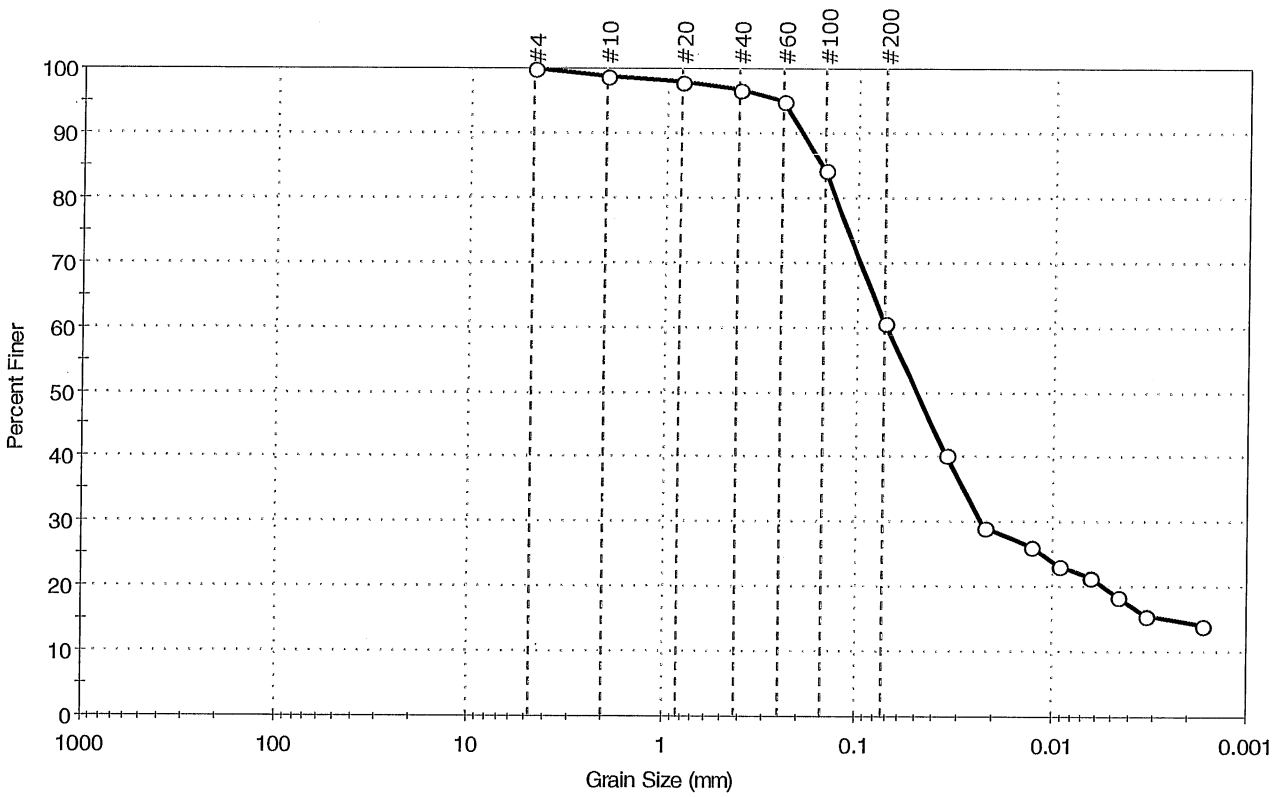
Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U1	FD-16	15-17 ft.	28	30	14	16	1	lean clay (CL)

Sample Prepared using the WET method
0% Retained on #40 Sieve
Dry Strength: VERY HIGH
Dilentancy: NONE
Toughness: LOW

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-20	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	01/10/06	Checked By:	jdt
Depth :	17-19 ft.	Test Id:	83554		
Test Comment:	---				
Sample Description:	Moist, dark olive gray sandy silt				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.1	39.2	60.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.84	98		
#40	0.42	97		
#60	0.25	95		
#100	0.15	84		
#200	0.074	61		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0350	40		
---	0.0221	29		
---	0.0128	26		
---	0.0091	23		
---	0.0064	21		
---	0.0046	18		
---	0.0033	16		
---	0.0017	14		

Coefficients

D_{85} = 0.1543 mm	D_{30} = 0.0228 mm
D_{60} = 0.0722 mm	D_{15} = 0.0025 mm
D_{50} = 0.0499 mm	D_{10} = 0.0003 mm
C_u = 240.667	C_c = 24.000

Classification

ASTM Sandy elastic silt (MH)

AASHTO Clayey Soils (A-7-5 (16))

Sample/Test Description

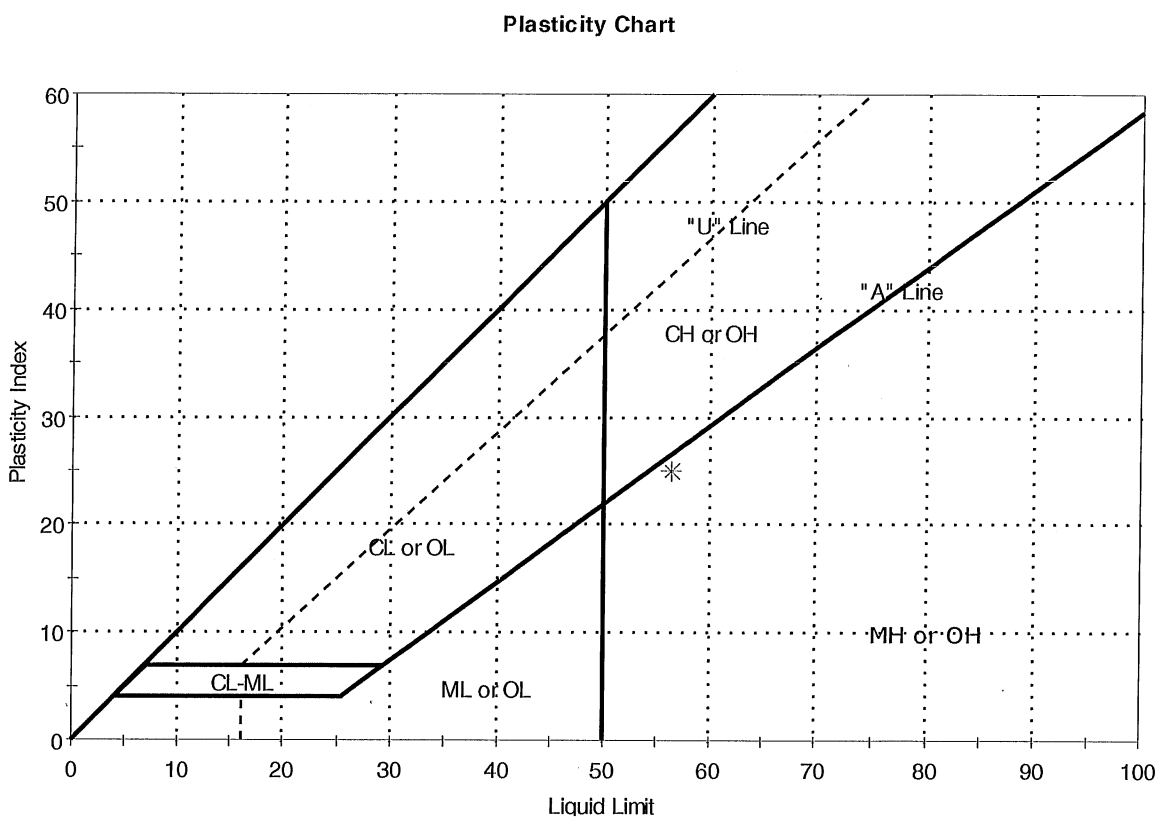
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting express

Client:	US Army Corp of Engineers				
Project:	Camp Ellis				
Location:	Saco, ME			Project No:	GTX-5947
Boring ID:	FD-20	Sample Type:	tube	Tested By:	pcs
Sample ID:	U1	Test Date:	01/12/06	Checked By:	jdt
Depth :	17-19 ft.	Test Id:	83557		
Test Comment:	---				
Sample Description:	Moist, dark olive gray sandy silt				
Sample Comment:	---				

Atterberg Limits - ASTM D 4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
*	U1	FD-20	17-19 ft.	53	56	31	25	1	Sandy elastic silt (MH)

Sample Prepared using the WET method
3% Retained on #40 Sieve
Dry Strength: MEDIUM
Dilentancy: SLOW
Toughness: LOW

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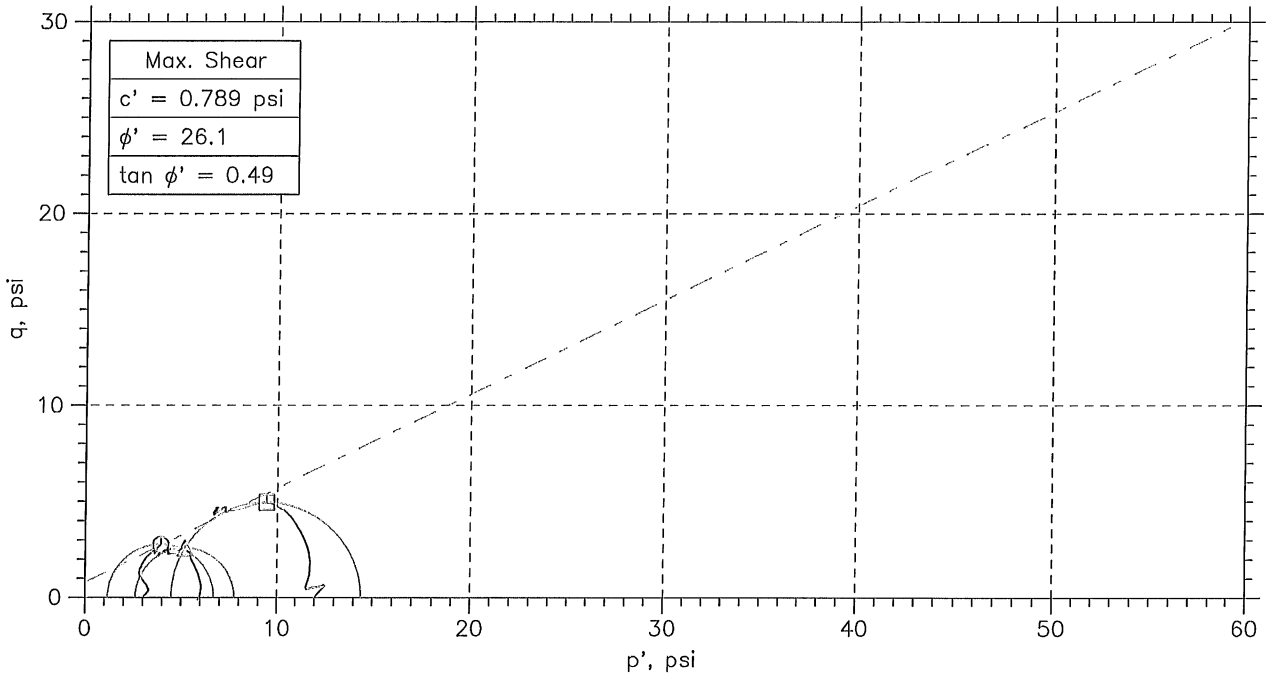
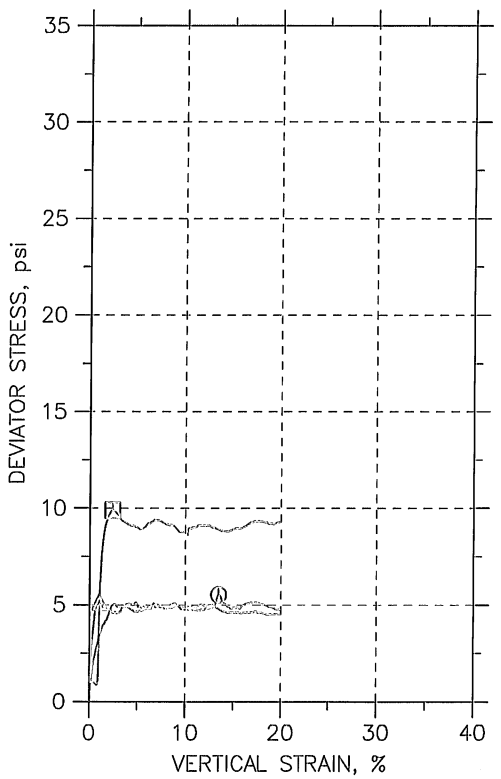
CONSOLIDATED UNDRAINED TRIAXIAL TESTS

CONSOLIDATED UNDRAINED TRIAXIAL TEST





Symbol		⏲	△	⊡	
Sample No.		U-1	U-1	U-1	
Test No.		CU4	CU5	CU6	
Depth		10-12 ft	10-12 ft	10-12 ft.	
Initial	Diameter, in	2.01	2.87	2.01	
	Height, in	4.1	6	3.9	
	Water Content, %	32.7	37.2	31.8	
	Dry Density, pcf	89.41	81.41	90.63	
	Saturation, %	99.6	93.8	99.9	
	Void Ratio	0.885	1.07	0.86	
Before Shear	Water Content, %	32.5	36.2	30.6	
	Dry Density, pcf	89.75	85.25	92.24	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.878	0.977	0.827	
	Back Press., psi	100.	28.01	99.99	
Ver. Eff. Cons. Stress, psi		3.001	5.996	12.01	
Shear Strength, psi		2.766	2.577	4.953	
Strain at Failure, %		13.5	1.03	2.4	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value					
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		38	38	38	
Plastic Limit		18	18	18	

GeoTesting express

Project: Camp Ellis

Location: Saco, ME

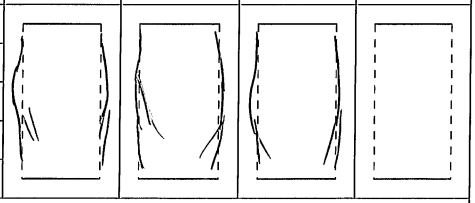
Project No.: GTX-5947

Boring No.: FD-02

Sample Type: Tube

Description: Moist, dark gray clay

Remarks: ---

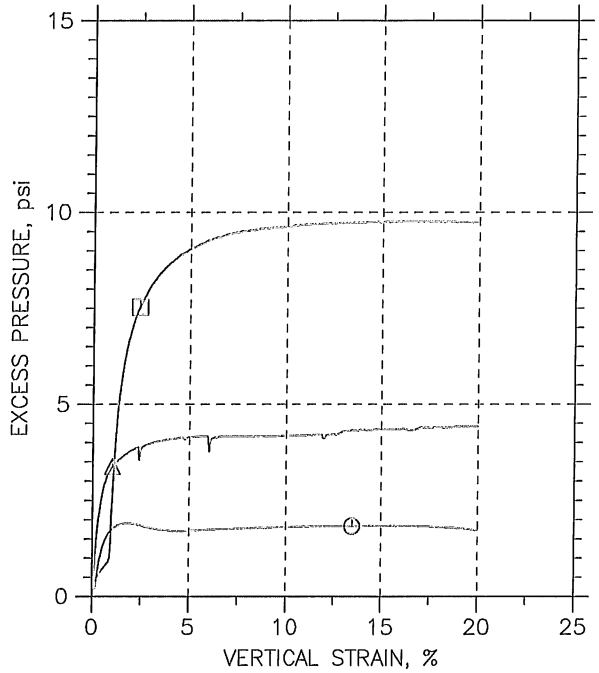


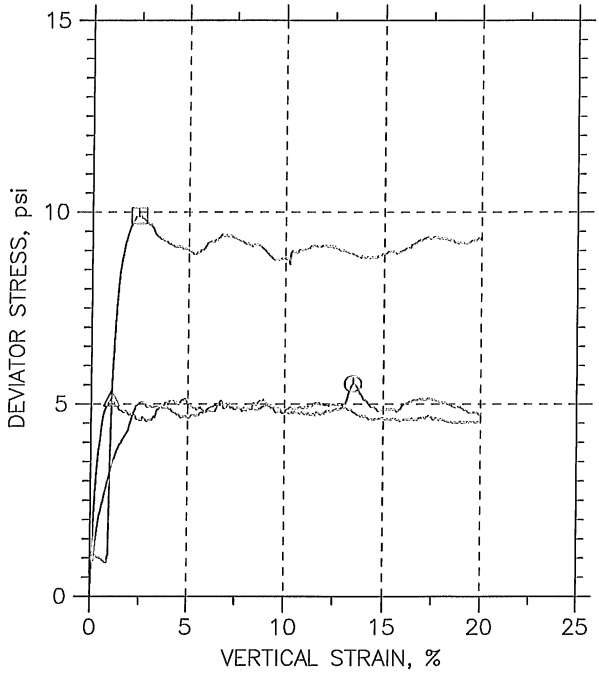
Phase calculations based on start and end of test.

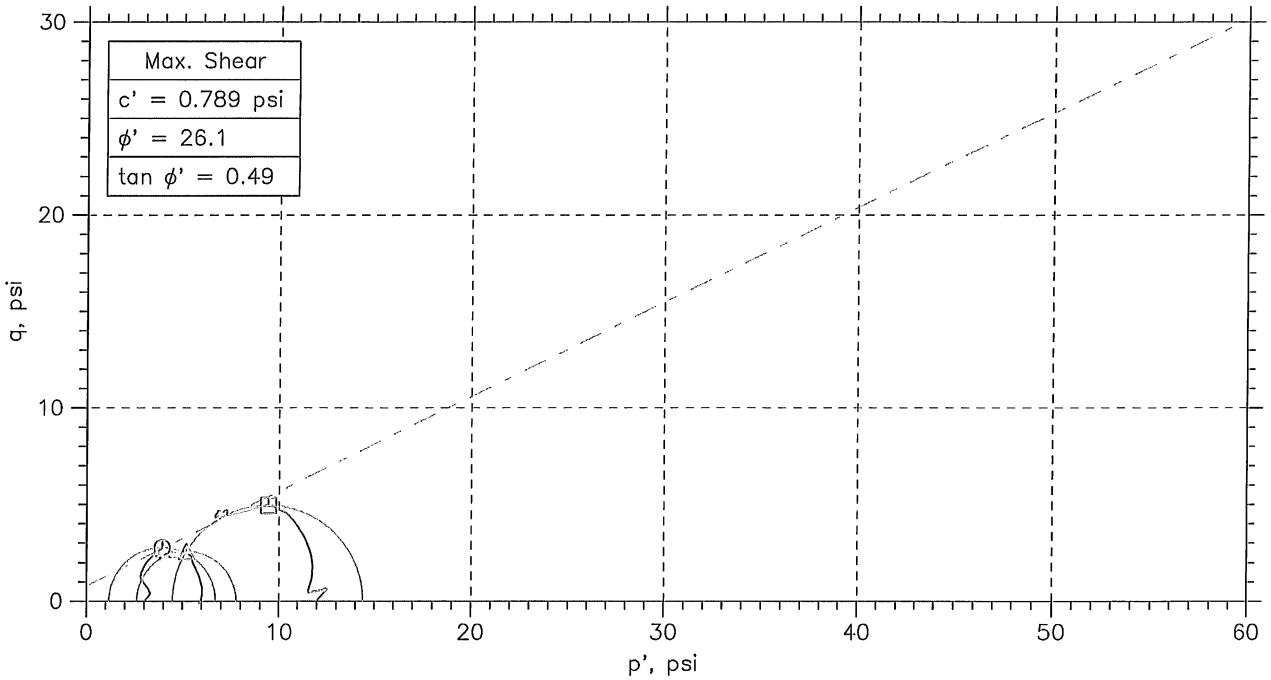
* Saturation is set to 100% for phase calculations.

Tue, 28-JUN-2005 08:06:17

CONSOLIDATED UNDRAINED TRIAXIAL TEST







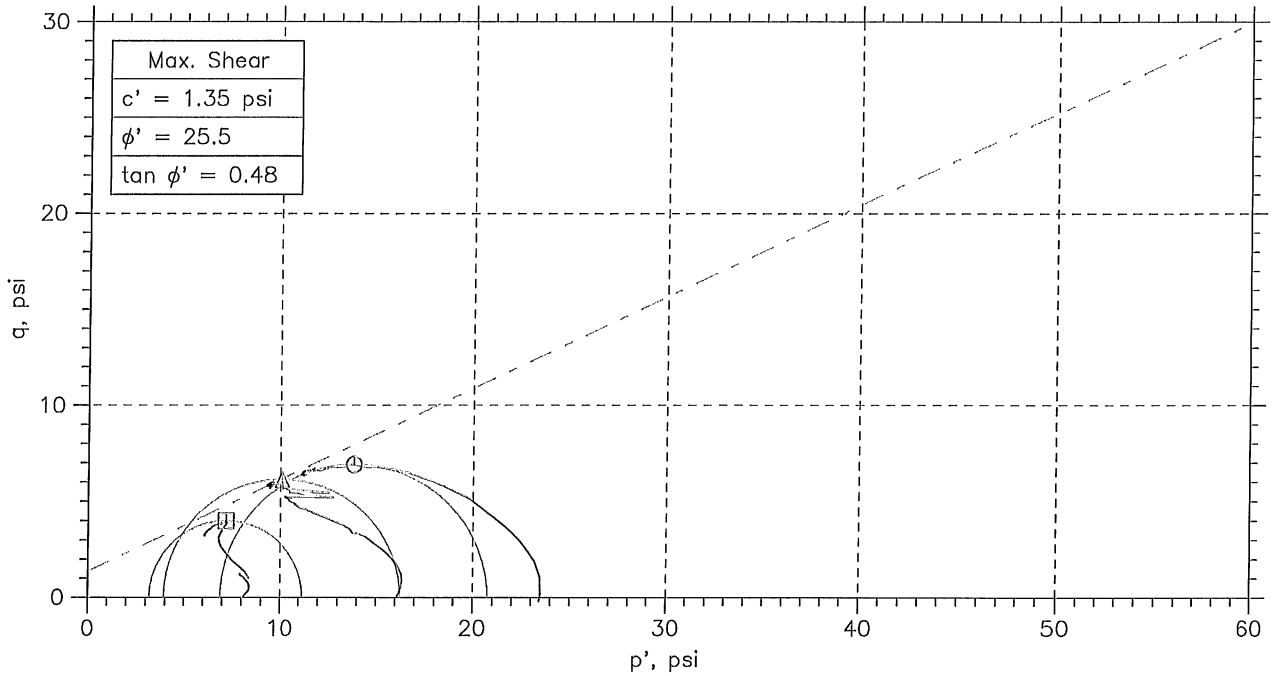
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	U-1	CU4	10-12 ft	njh	06/15/05	jdt		5947-cu4.dat
△	U-1	CU5	10-12 ft	njh	06/15/05	jdt		5947-cu5.dat
□	U-1	CU6	10-12 ft.	njh	06/15/05	jdt		5947-CU6.dat

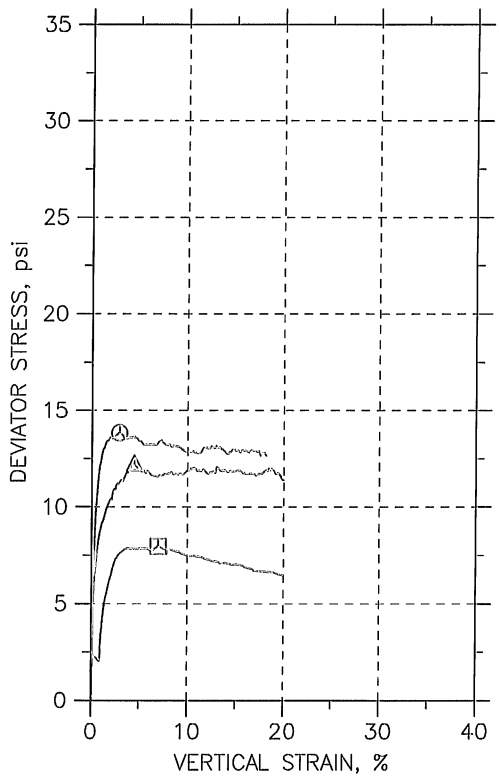
Geotesting express

Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
Boring No.: FD-02	Sample Type: Tube	
Description: Moist, dark gray clay		
Remarks: ---		

Tue, 28-JUN-2005 08:08:20

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

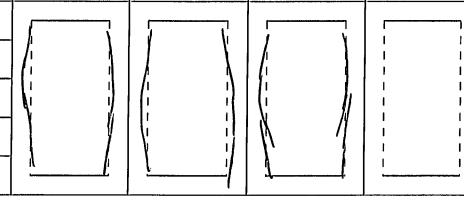




Symbol		⏀	△	⊡	
Sample No.		U-2	U-2	U-2	
Test No.		CU10	CU11	CU12	
Depth		30-32 ft.	30-32 ft	30-32 ft	
Initial	Diameter, in	2.01	2.01	2.01	
	Height, in	4	3.89	3.9	
	Water Content, %	38.0	37.3	36.8	
	Dry Density, pcf	83.11	83.82	84.36	
	Saturation, %	99.7	99.7	99.7	
	Void Ratio	1.03	1.01	0.998	
Before Shear	Water Content, %	34.3	35.1	35.9	
	Dry Density, pcf	87.57	86.49	85.57	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.925	0.949	0.97	
	Back Press., psi	94.	28.	99.99	
Ver. Eff. Cons. Stress, psi		25	16	8.007	
Shear Strength, psi		6.922	6.142	3.988	
Strain at Failure, %		2.91	4.46	6.96	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value					
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		41	41	41	
Plastic Limit		18	18	18	

GeoTesting express

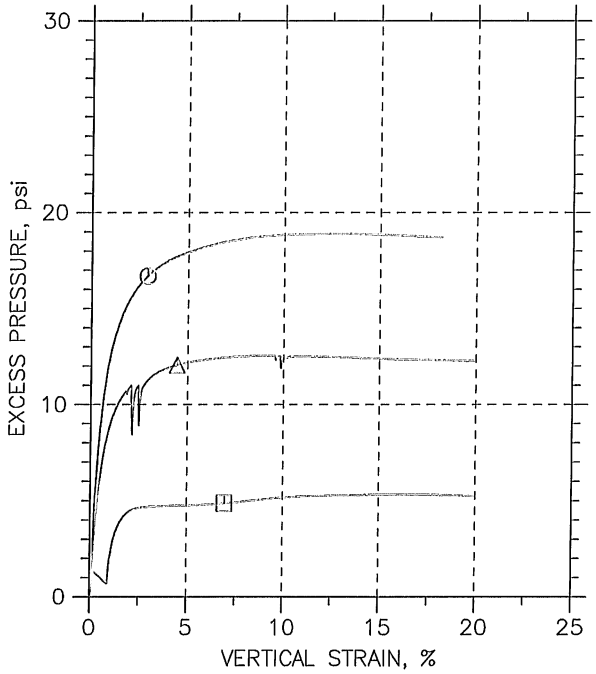
Project: Camp Ellis
Location: Saco, ME
Project No.: GTX-5947
Boring No.: FD-07
Sample Type: Tube
Description: Moist, olive gray clay
Remarks: ---

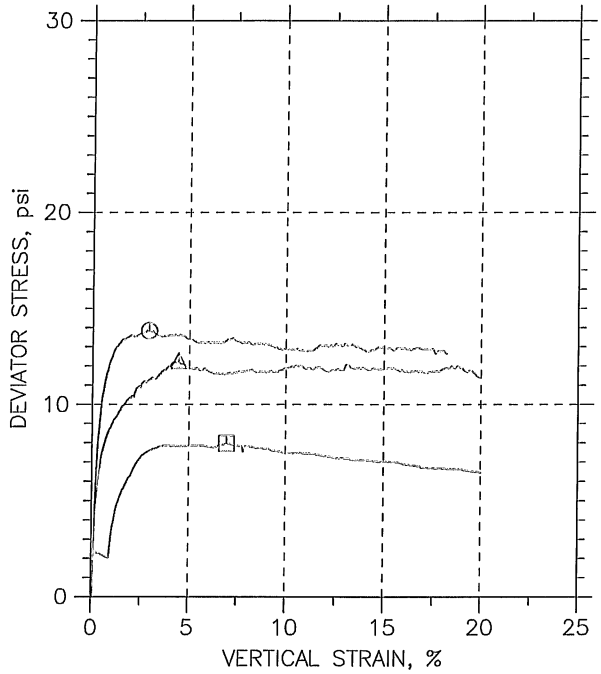


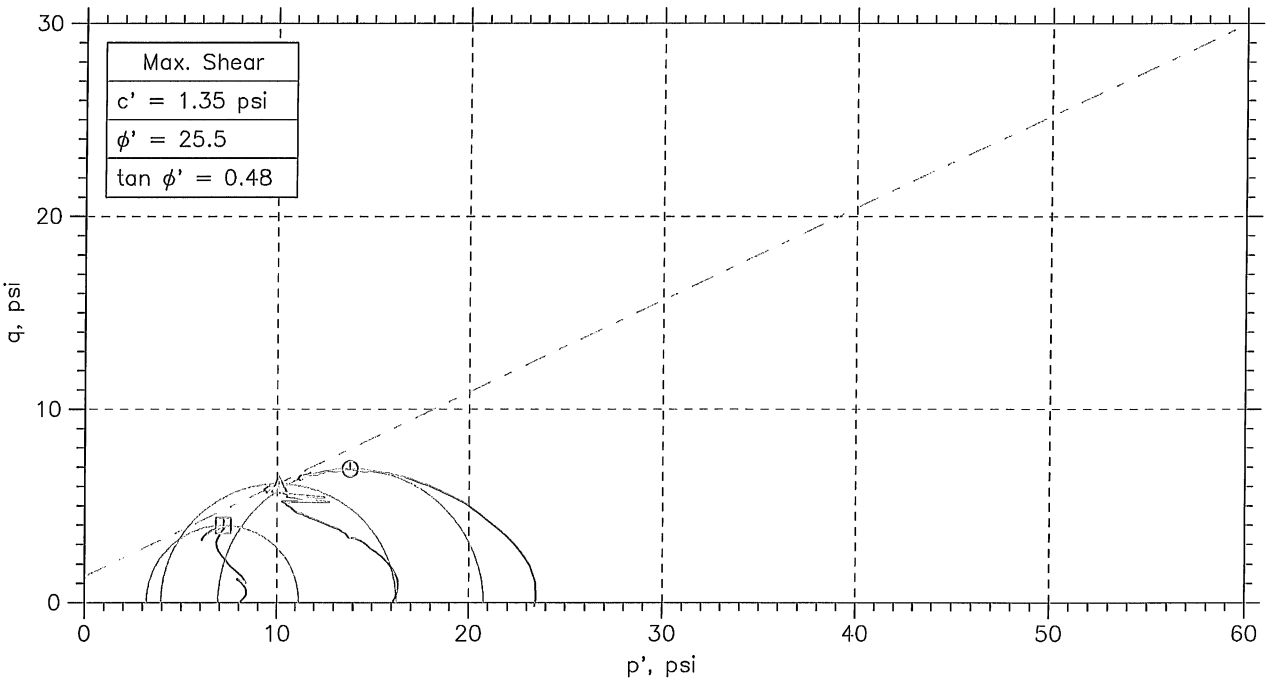
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Tue, 28-JUN-2005 08:32:34

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⏲	U-2	CU10	30-32 ft.	njh	06/20/05	jdt		5947-CU10a.dat
△	U-2	CU11	30-32 ft	njh	06/20/05	jdt		5947-cu11.dat
⊡	U-2	CU12	30-32 ft	njh	06/20/05	jdt		5947-cu12a.dat

Geotesting express

Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
Boring No.: FD-07	Sample Type: Tube	
Description: Moist, olive gray clay		
Remarks: ---		

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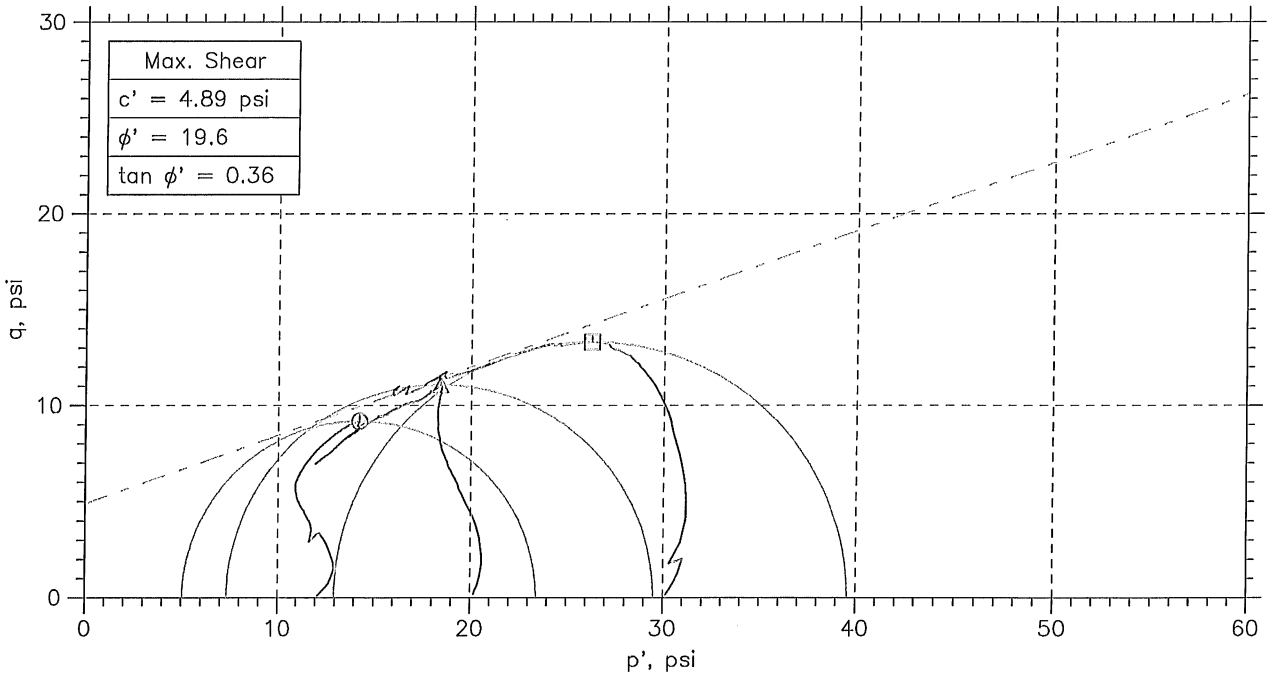
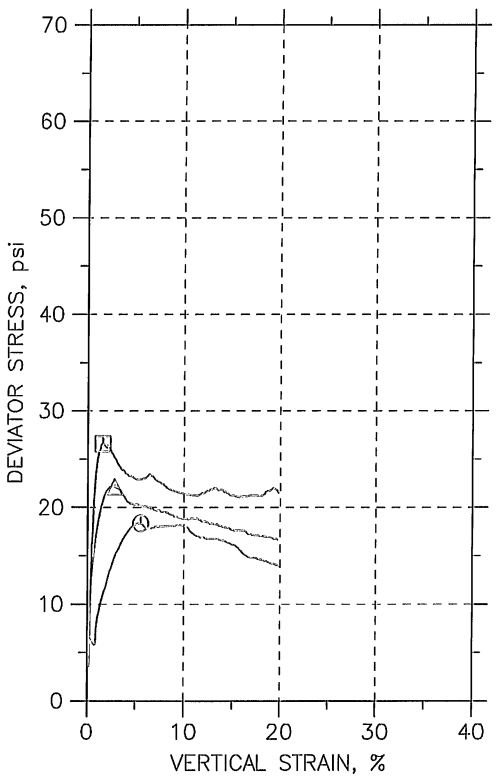
CONSOLIDATED UNDRAINED TRIAXIAL TEST

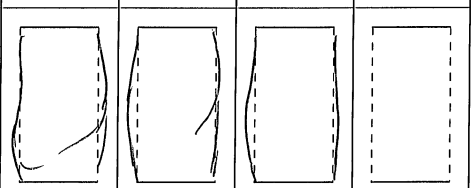




Symbol		⊙	△	⊡	
Sample No.		U-1	U-1	U-1	
Test No.		CU7	CU8	CU9	
Depth		44-46 ft	44-46 ft.	44-46 ft	
Initial	Diameter, in	2.01	2.01	2.01	
	Height, in	4	4	4	
	Water Content, %	36.7	38.2	34.2	
	Dry Density, pcf	84.09	82.99	87.22	
	Saturation, %	98.7	99.9	99.0	
	Void Ratio	1	1.03	0.932	
Before Shear	Water Content, %	36.3	35.1	32.5	
	Dry Density, pcf	85.11	86.58	89.71	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.98	0.947	0.879	
	Back Press., psi	100.	100.	79.	
Ver. Eff. Cons. Stress, psi		12	19.99	30	
Shear Strength, psi		9.183	11.07	13.31	
Strain at Failure, %		5.52	2.81	1.56	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value					
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		36	36	36	
Plastic Limit		16	16	16	

GeoTesting express

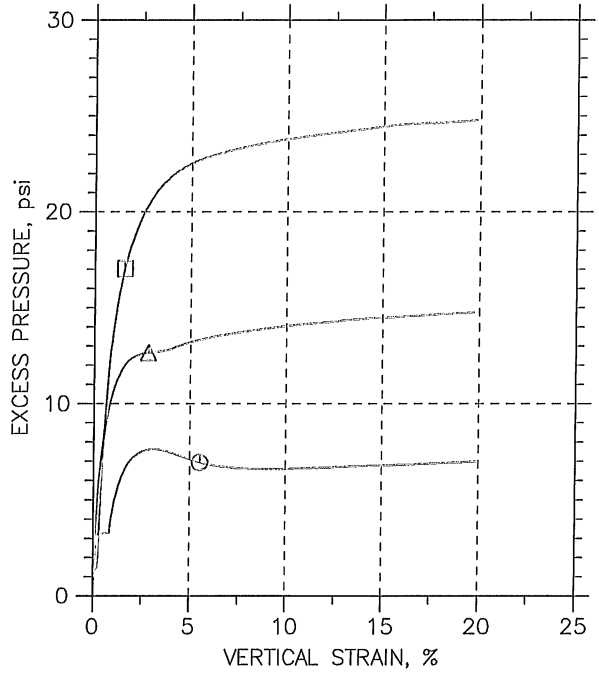
Project: Camp Ellis
Location: Saco, ME
Project No.: GTX-5947
Boring No.: FD-12
Sample Type: Tube
Description: Moist, gray clay
Remarks: ---

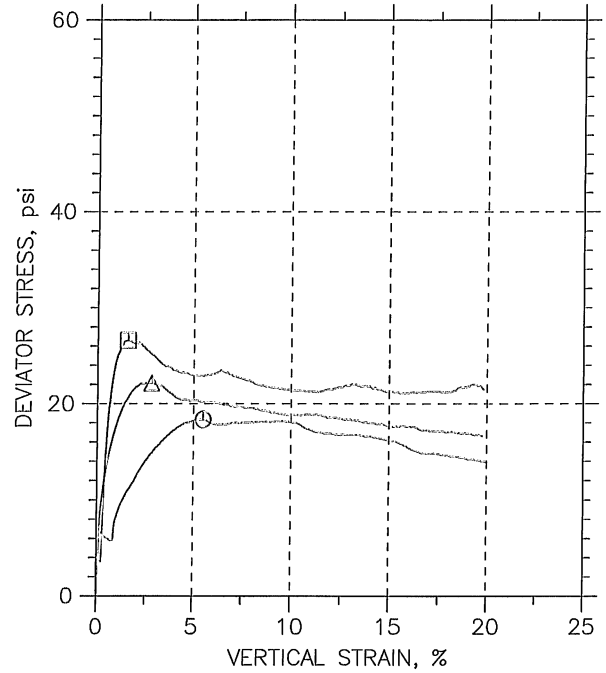


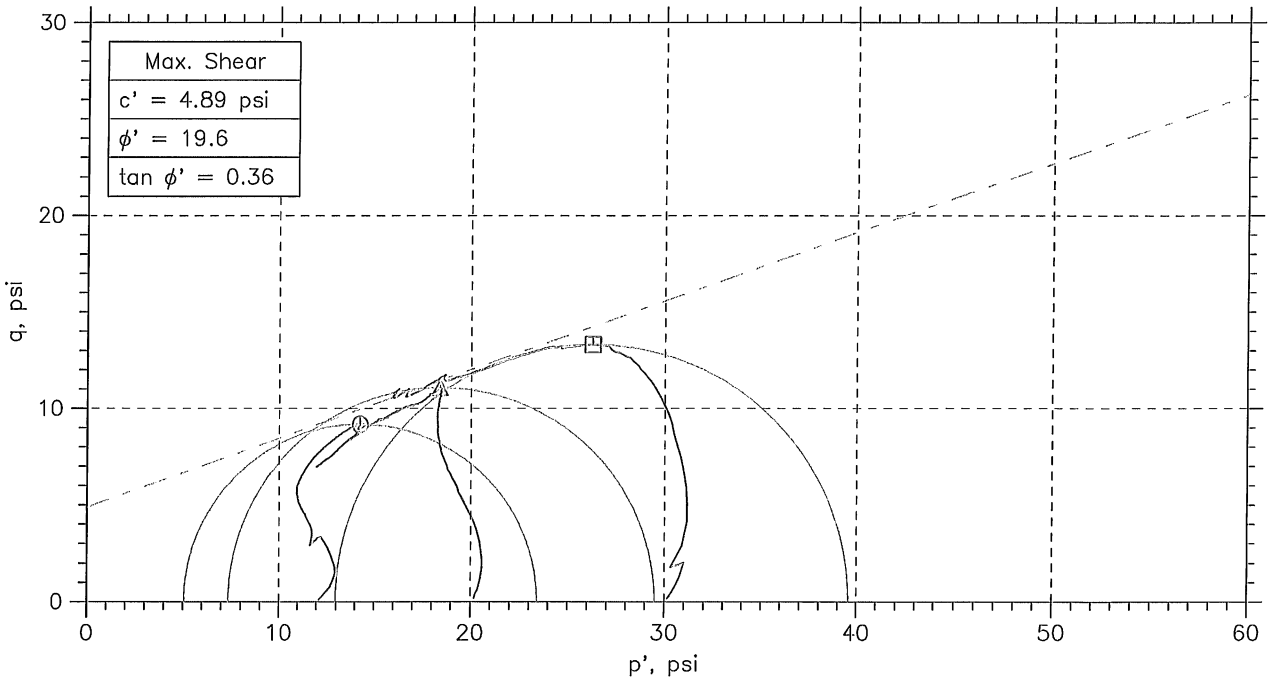
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Tue, 28-JUN-2005 08:30:22

CONSOLIDATED UNDRAINED TRIAXIAL TEST







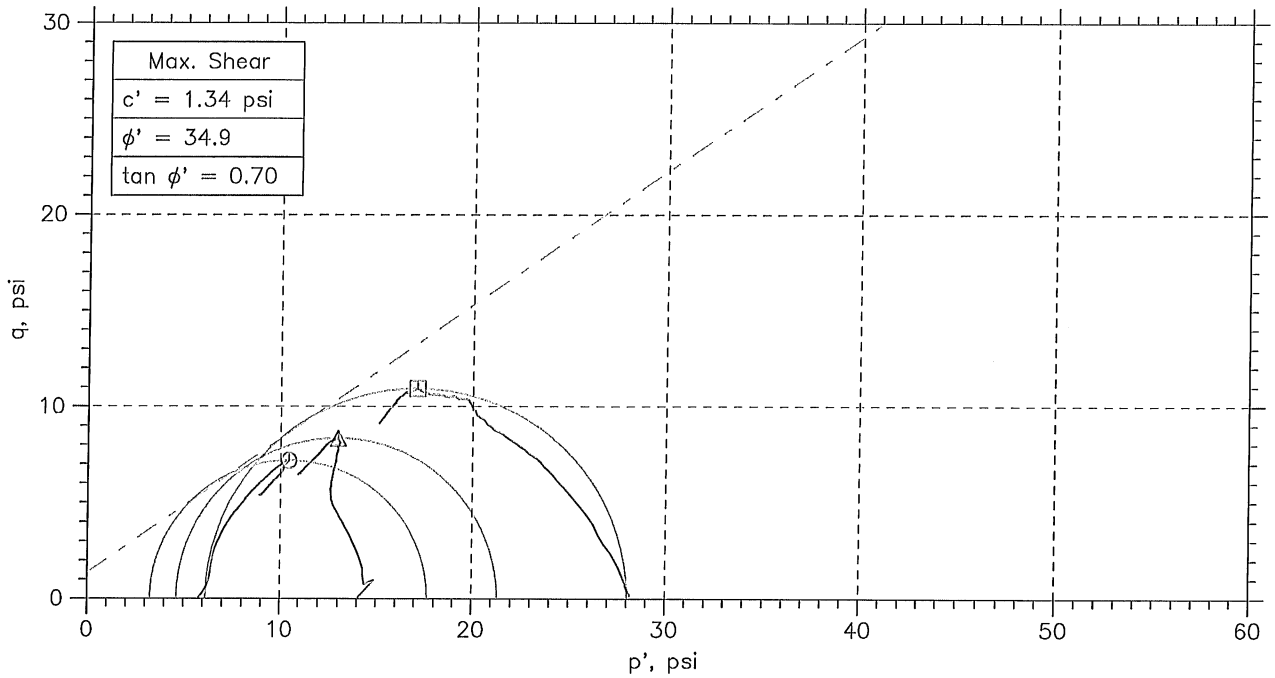
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⏲	U-1	CU7	44-46 ft	njh	06/17/05	jdt		5947-cu7a.dat
△	U-1	CU8	44-46 ft.	njh	06/17/05	jdt		5947-CU8.dat
⊡	U-1	CU9	44-46 ft	njh	06/17/05	jdt		5947-cu9a.dat

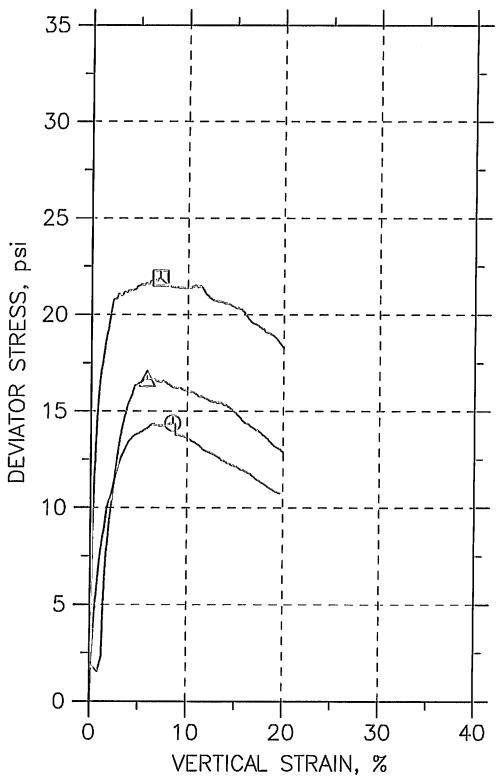
GeoTesting express

Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
Boring No.: FD-12	Sample Type: Tube	
Description: Moist, gray clay		
Remarks: ---		

Tue, 28-JUN-2005 08:30:40

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

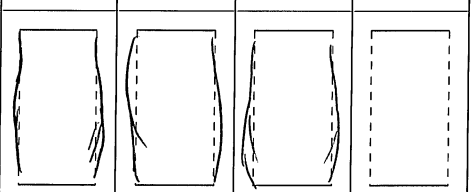




Symbol		⊙	△	⊡	
Sample No.		U-1	U-1	U-1	
Test No.		CU1	CU2	CU3	
Depth		25-27 ft.	25-27 ft	25-27 ft	
Initial	Diameter, in	2.87	2.87	2.87	
	Height, in	6	6	6	
	Water Content, %	60.6	56.6	52.1	
	Dry Density, pcf	63.93	64.38	67.54	
	Saturation, %	100.0	94.4	94.1	
	Void Ratio	1.64	1.62	1.5	
Before Shear	Water Content, %	52.5	51.0	46.3	
	Dry Density, pcf	69.76	70.92	74.95	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.42	1.38	1.25	
	Back Press., psi	19.01	100.	85.02	
Ver. Eff. Cons. Stress, psi		6.977	13.98	27.97	
Shear Strength, psi		7.191	8.349	10.94	
Strain at Failure, %		8.5	5.81	7.14	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value					
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		64	64	64	
Plastic Limit		31	31	31	

GeoTesting express

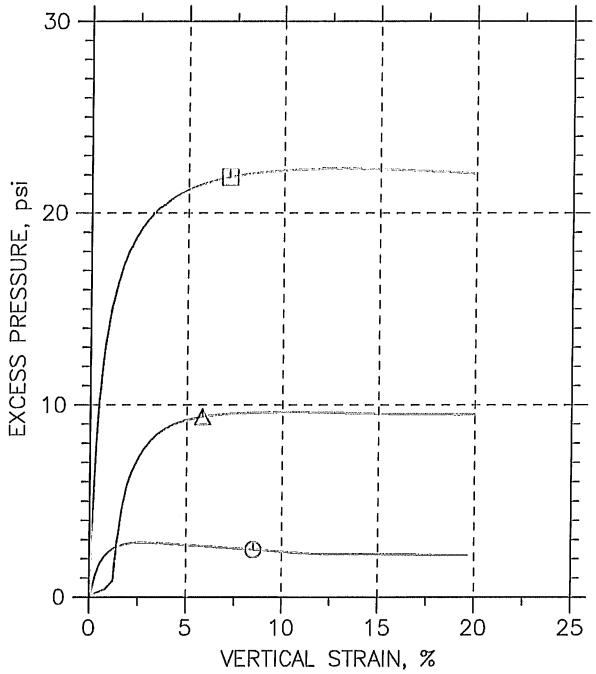
Project: Camp Ellis
Location: Saco, ME
Project No.: GTX-5947
Boring No.: FD-14
Sample Type: Tube
Description: Moist, dark olive gray clay
Remarks: ---

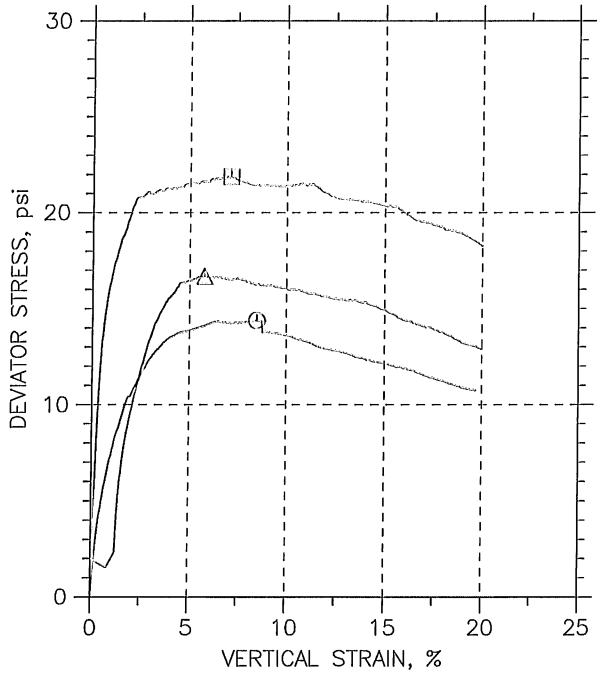


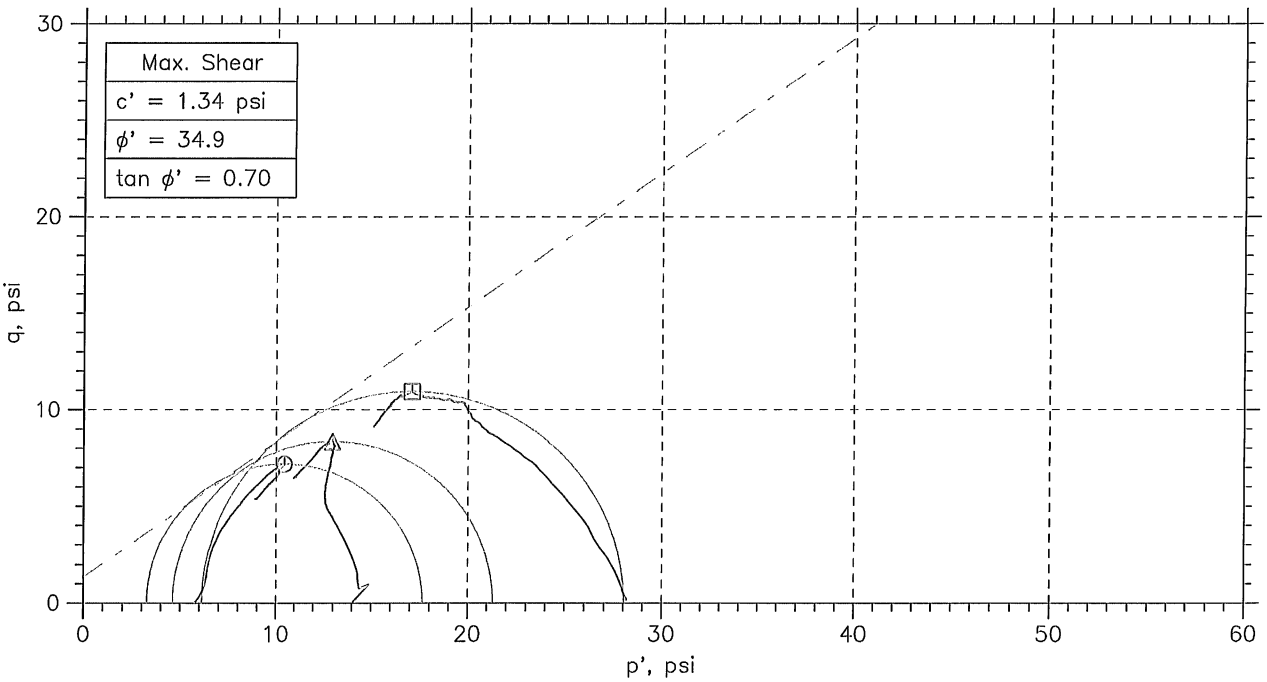
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Tue, 28-JUN-2005 08:12:16

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





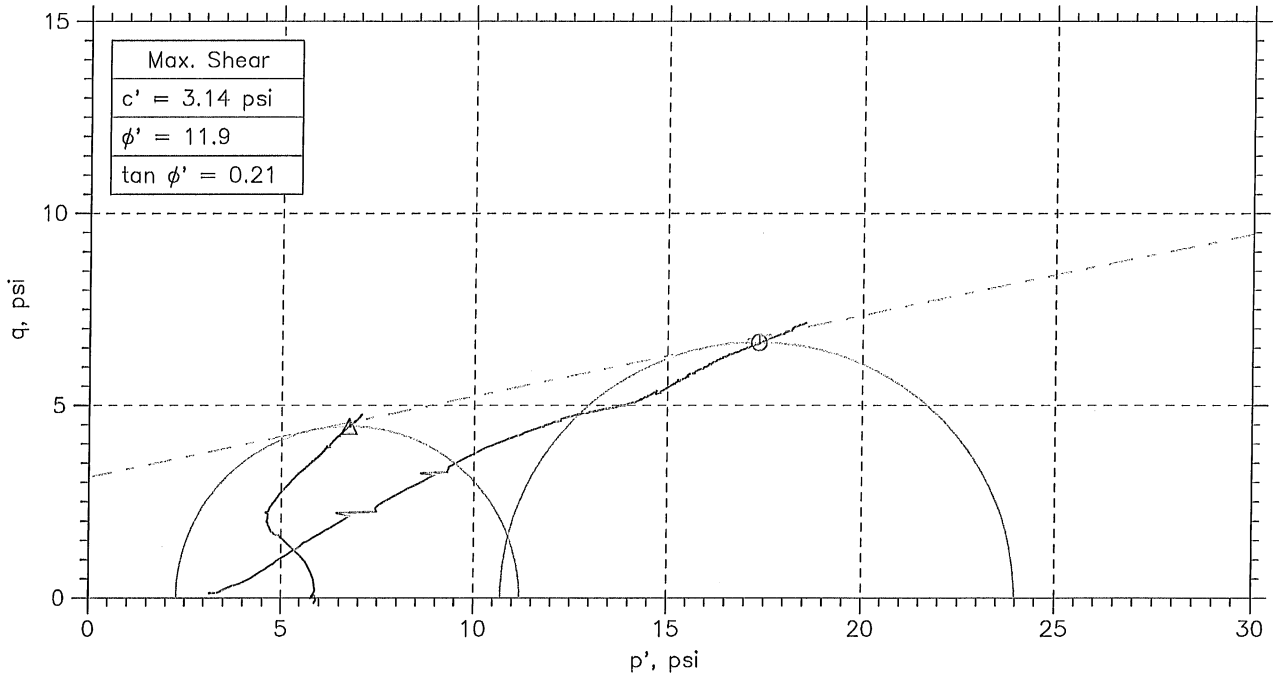


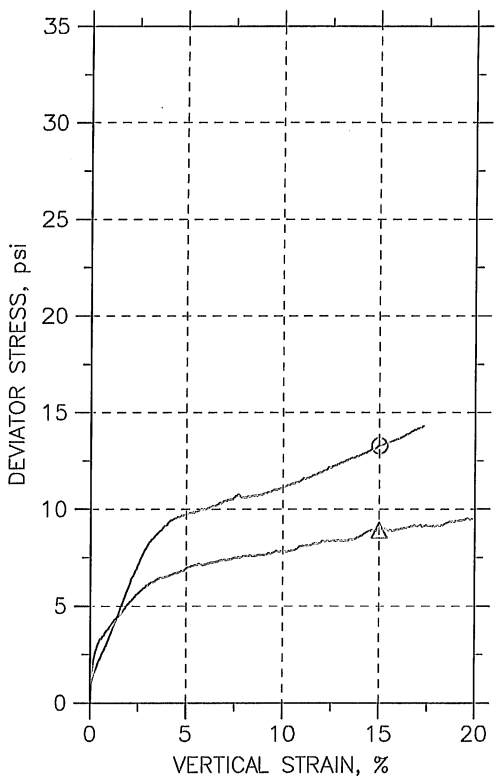
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	U-1	CU1	25-27 ft.	njh	06/13/05	jdt		5947-cu1a.dat
△	U-1	CU2	25-27 ft	njh	06/13/05	jdt		5947-cu2a.dat
□	U-1	CU3	25-27 ft	njh	06/13/05	jdt		5947-cu3.dat

GeoTesting express

Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
Boring No.: FD-14	Sample Type: Tube	
Description: Moist, dark olive gray clay		
Remarks: ---		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		⏀	△		
Sample No.		U-1	U-1		
Test No.		CU15	CU14		
Depth		10-12 ft.	10-12 ft		
Initial	Diameter, in	2.01	2.02		
	Height, in	3.95	4.35		
	Water Content, %	11.7	40.6		
	Dry Density, pcf	101.7	79.25		
	Saturation, %	47.9	97.3		
	Void Ratio	0.658	1.13		
Before Shear	Water Content, %	31.1	39.7		
	Dry Density, pcf	91.66	81.39		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.839	1.07		
	Back Press., psi	109.	100.		
Ver. Eff. Cons. Stress, psi		3.006	6		
Shear Strength, psi		6.637	4.457		
Strain at Failure, %		15	15		
Strain Rate, %/min		0.025	0.025		
B-Value		0.20	0.92		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		42	42		
Plastic Limit		19	19		

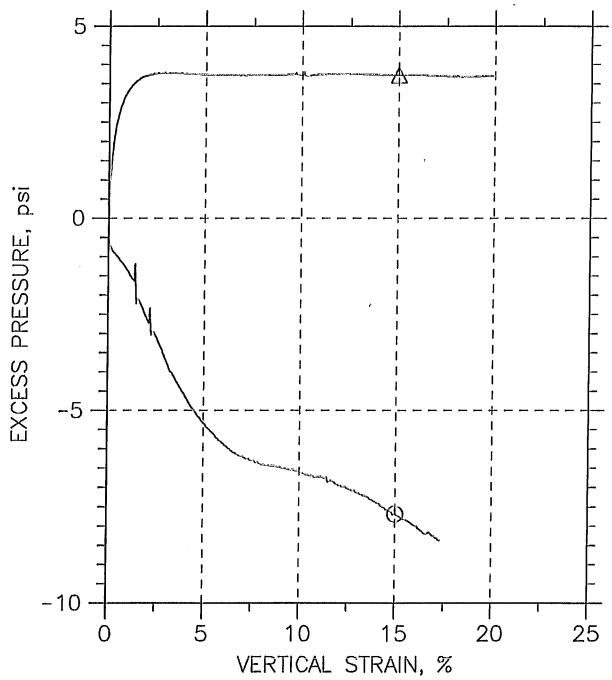
GeoTesting express

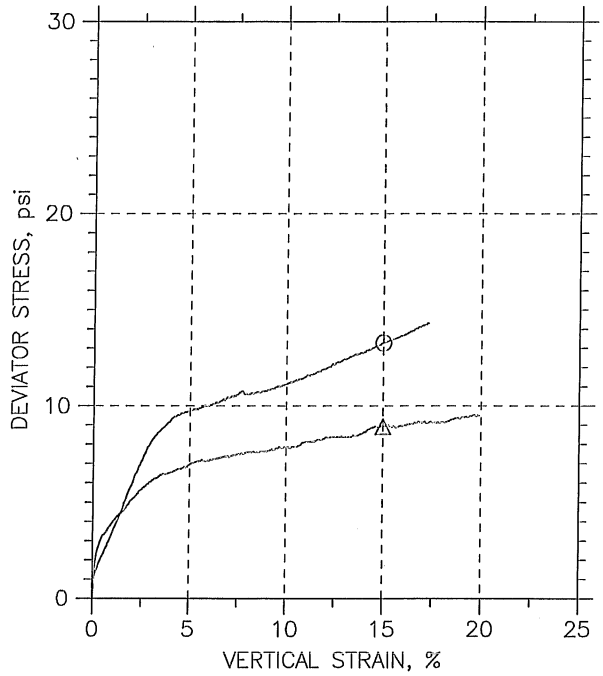
Project: Camp Ellis
Location: Saco, ME
Project No.: GTX-5947
Boring No.: FD 15A
Sample Type: Tube
Description: Moist, olive brown clay
Remarks: ---

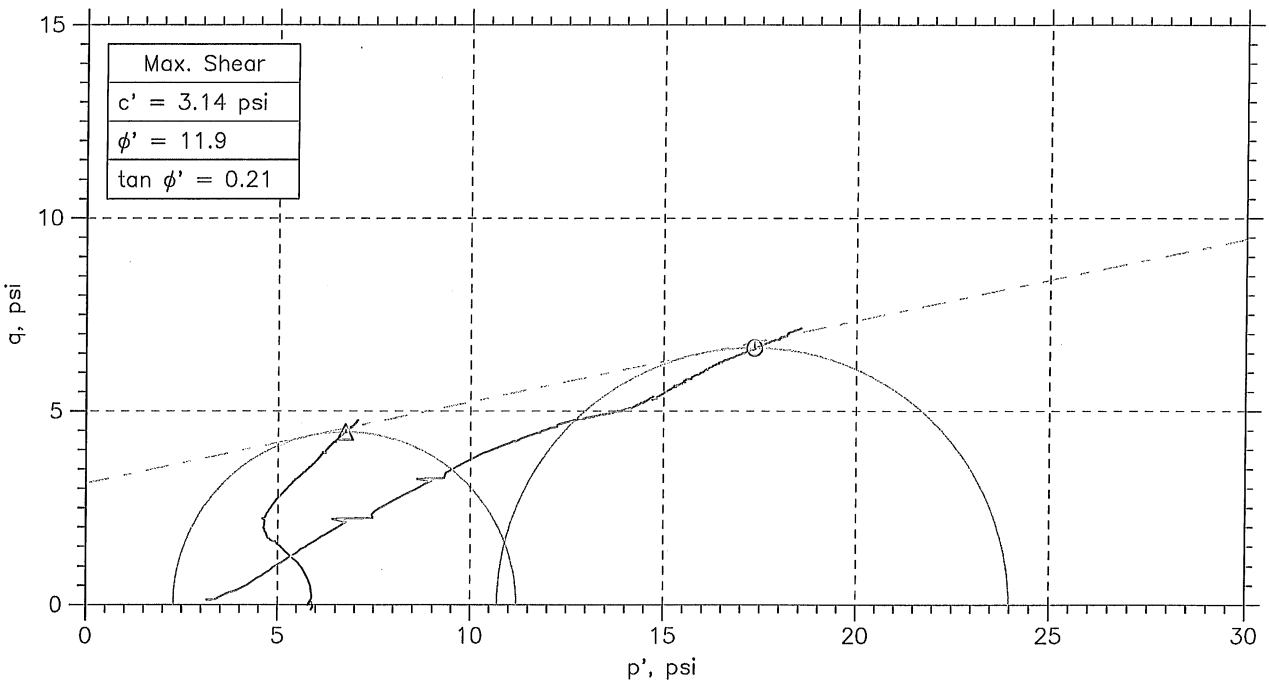
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Tue, 24-JAN-2006 13:29:09

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





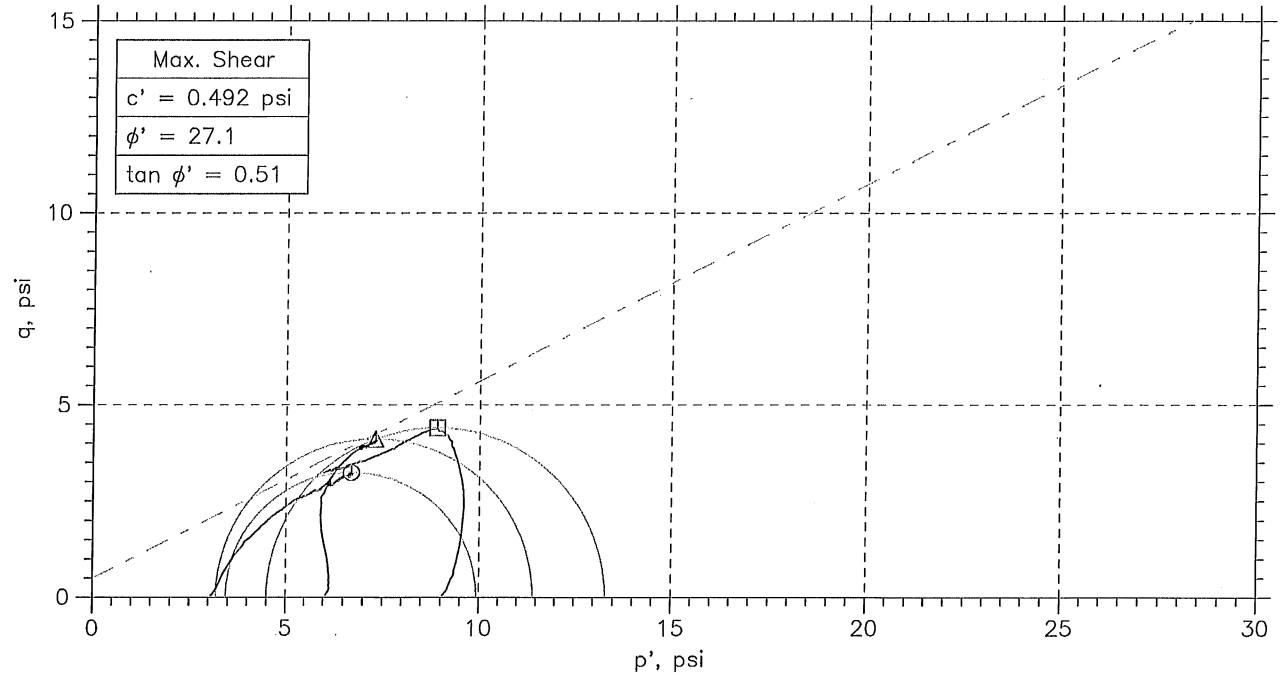


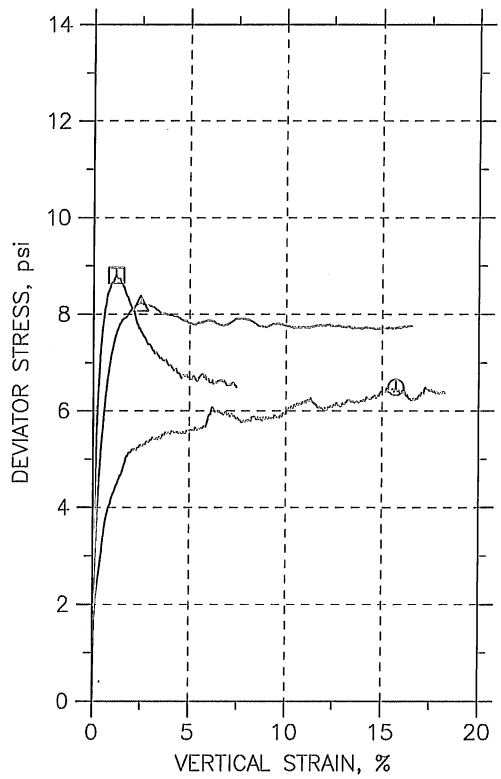
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	U-1	CU15	10-12 ft.	njh	01/05/06	jdt		5947-cu15a.dat
△	U-1	CU14	10-12 ft	njh	01/04/06	jdt		5947-cu14.dat

GeoTesting express

Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
Boring No.: FD 15A	Sample Type: Tube	
Description: Moist, olive brown clay		
Remarks: ---		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		⏲	△	⏍	
Sample No.		FD-16	FD-16	FD16	
Test No.		CU19	CU20	CU21	
Depth		15-17 ft	15-17 ft	15-17 ft.	
Initial	Diameter, in	2.01	2.01	2.01	
	Height, in	4.51	4.44	4.6	
	Water Content, %	28.4	23.8	28.6	
	Dry Density, pcf	95.4	102.6	95.1	
	Saturation, %	100.0	99.9	100.0	
	Void Ratio	0.767	0.643	0.772	
Before Shear	Water Content, %	29.3	26.4	32.5	
	Dry Density, pcf	94.08	98.42	89.73	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.792	0.713	0.879	
	Back Press., psi	109.	99.99	99.99	
Ver. Eff. Cons. Stress, psi		3.006	6	8.999	
Shear Strength, psi		3.244	4.113	4.402	
Strain at Failure, %		15.7	2.46	1.18	
Strain Rate, %/min		0.025	0.025	0.025	
B-Value		0.85	0.91	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		30	30	30	
Plastic Limit		14	14	14	

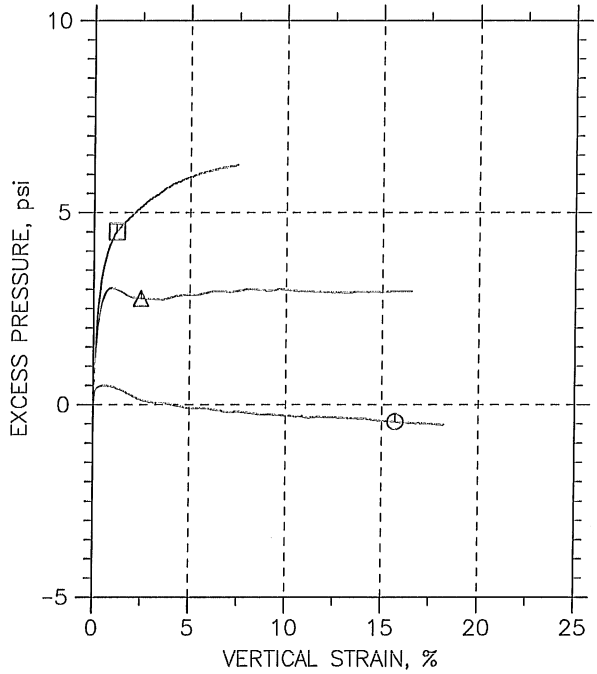
GeoTesting express

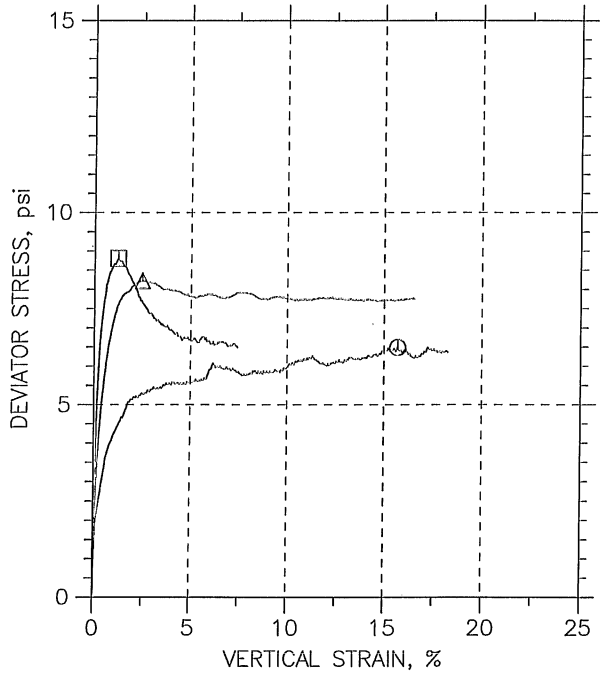
Project: Camp Ellis
Location: Saco, ME
Project No.: GTX-5947
Boring No.: U-1
Sample Type: Tube
Description: Moist, olive gray clay
Remarks: ---

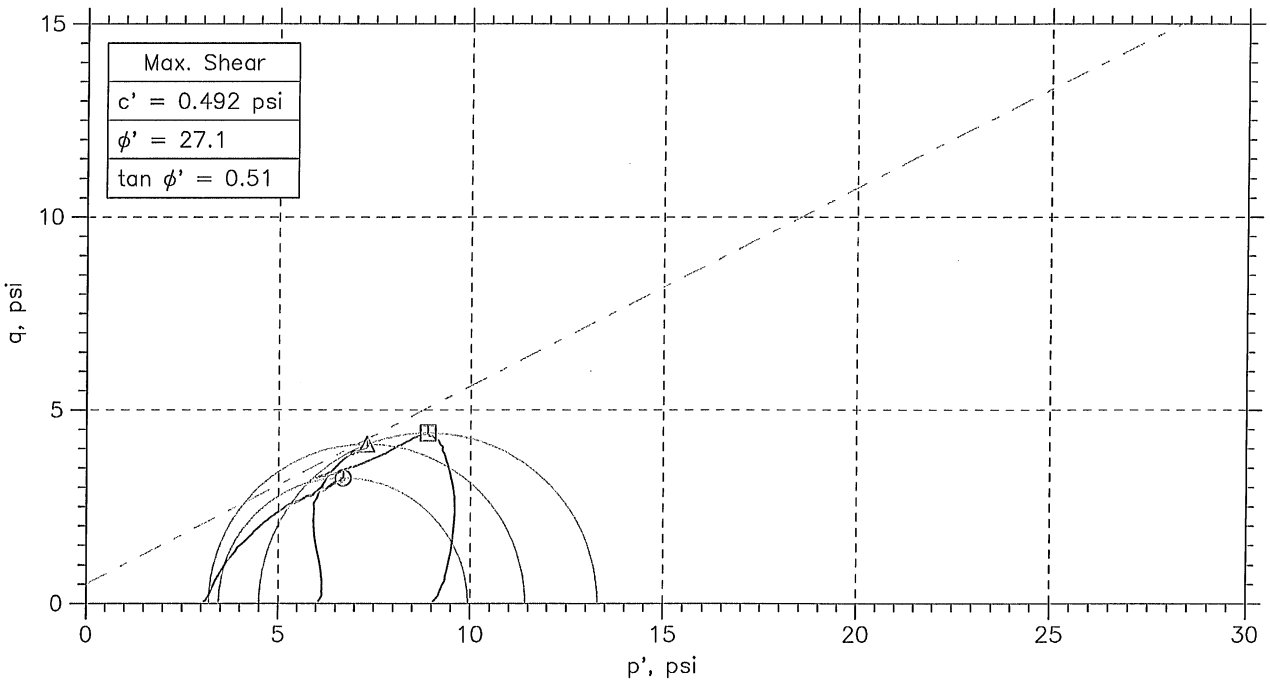
Phase calculations based on start and end of test.
* Saturation is set to 100% for phase calculations.

Tue, 24-JAN-2006 13:17:07

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







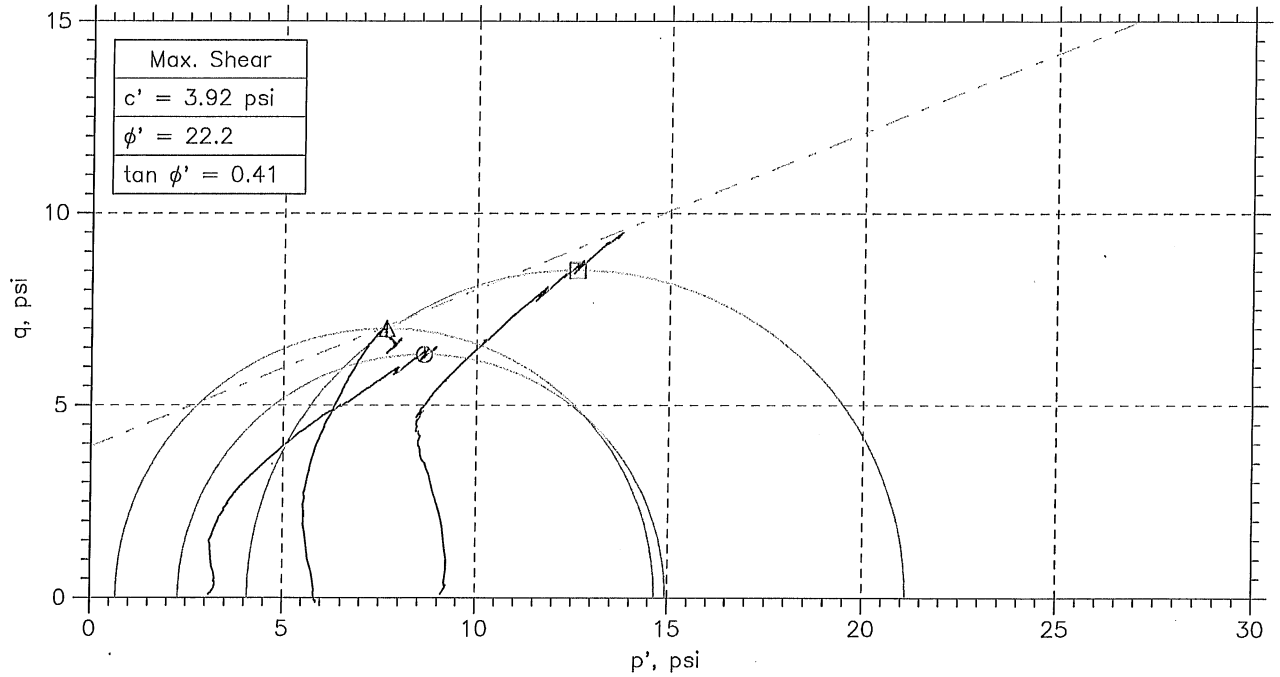
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⏲	FD-16	CU19	15-17 ft	jdt	01/12/06	jdt		5947-cu19.dat
△	FD-16	CU20	15-17 ft	njh	01/11/06	jdt		5947-cu20.dat
⏍	FD16	CU21	15-17 ft.	njh	01/10/06	jdt		5947-cu21a.dat

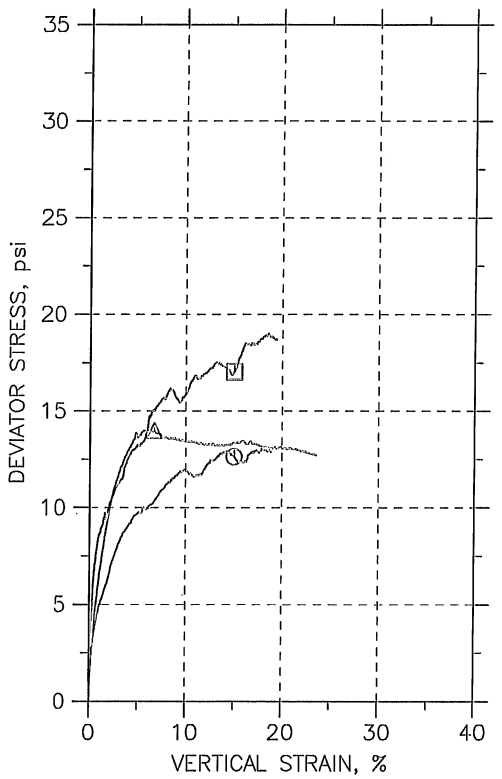
Geotesting express

Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
Boring No.: U-1	Sample Type: Tube	
Description: Moist, olive gray clay		
Remarks: ---		

Tue, 24-JAN-2006 13:17:26

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		⊙	△	⊡	
Sample No.		FD-20	FD-20	FD-20	
Test No.		CU16	CU17	CU18	
Depth		17-19 ft.	17-19 ft	17-19 ft	
Initial	Diameter, in	2.01	2.024	2.1	
	Height, in	4.4	4.6	4.45	
	Water Content, %	42.1	43.5	41.5	
	Dry Density, pcf	77.4	71.87	71.9	
	Saturation, %	98.0	88.5	84.4	
	Void Ratio	1.14	1.3	1.3	
Before Shear	Water Content, %	44.1	64.3	39.5	
	Dry Density, pcf	76.26	61.19	80.86	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	1.17	1.7	1.05	
	Back Press., psi	106.	94.	106.	
Ver. Eff. Cons. Stress, psi		3.006	6.001	8.997	
Shear Strength, psi		6.321	6.995	8.514	
Strain at Failure, %		15	6.68	15	
Strain Rate, %/min		0.025	0.025	0.025	
B-Value		0.95	0.95	0.90	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		56	56	56	
Plastic Limit		31	31	31	

GeoTesting express

Project: Camp Ellis

Location: Saco, ME

Project No.: GTX-5947

Boring No.: U-1

Sample Type: Tube

Description: Moist, dark olive gray sandy silt

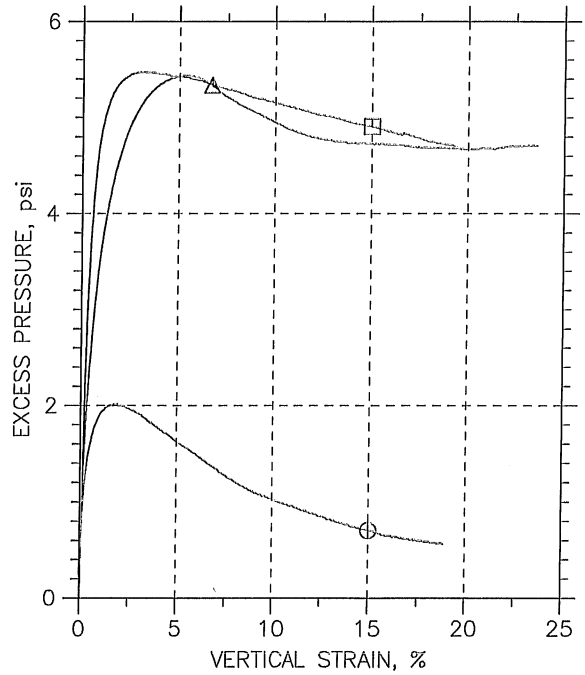
Remarks: ---

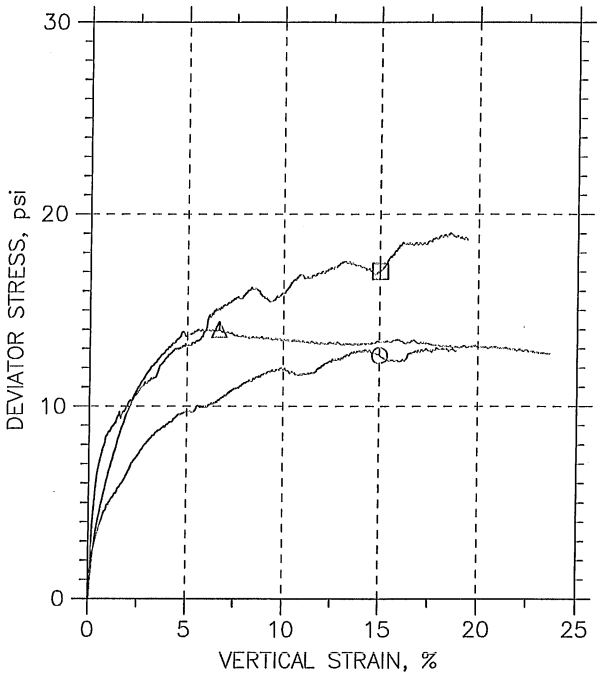
Phase calculations based on start and end of test.

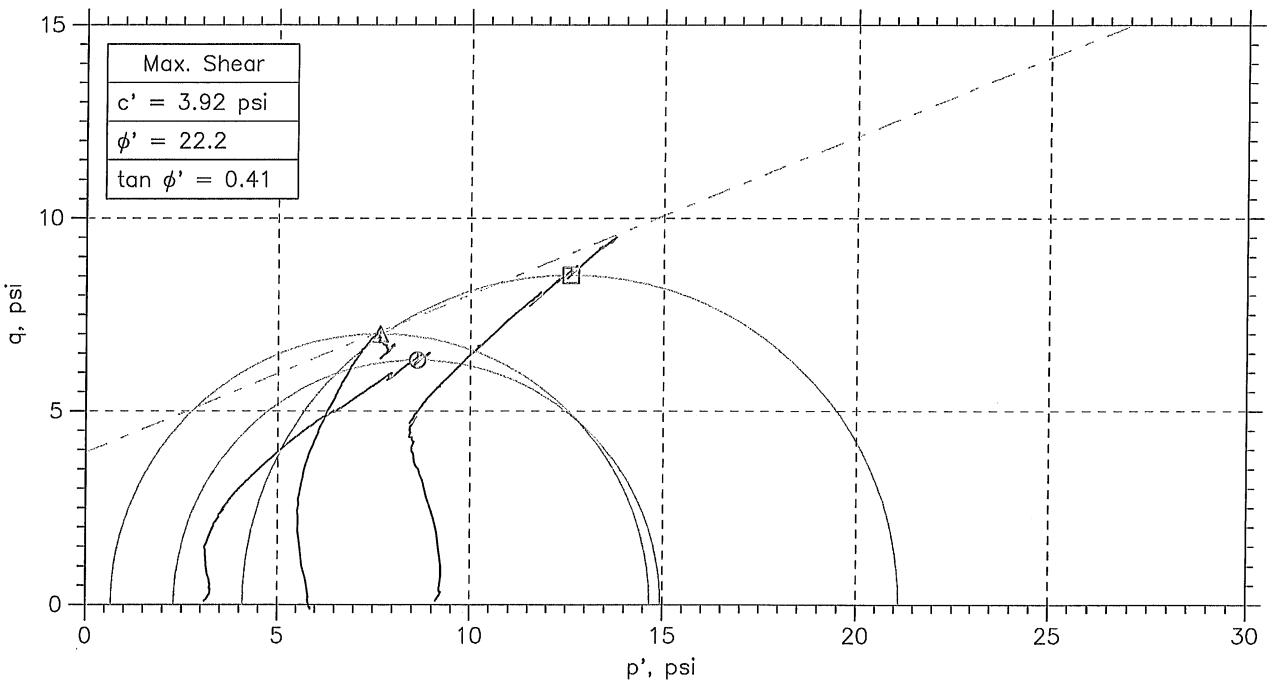
* Saturation is set to 100% for phase calculations.

Tue, 24-JAN-2006 13:48:14

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	FD-20	CU16	17-19 ft.	njh	01/09/06	jdt		5947-cu16.dat
△	FD-20	CU17	17-19 ft	njh	01/09/06	jdt		5947-cu17.dat
□	FD-20	CU18	17-19 ft	njh	01/10/06	jdt		5947-cu18b.dat

GeoTesting express

Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
Boring No.: U-1	Sample Type: Tube	
Description: Moist, dark olive gray sandy silt		
Remarks: ---		

GeoTesting EXPRESS

Client:	US Army Corps of Engineers
Project Name:	Camp Ellis
Project Location:	Saco, Maine
GTX #:	5947
Date:	06/20/05
Tested by:	md
Checked by:	jdt

Laboratory Vane Shear by ASTM D 4648

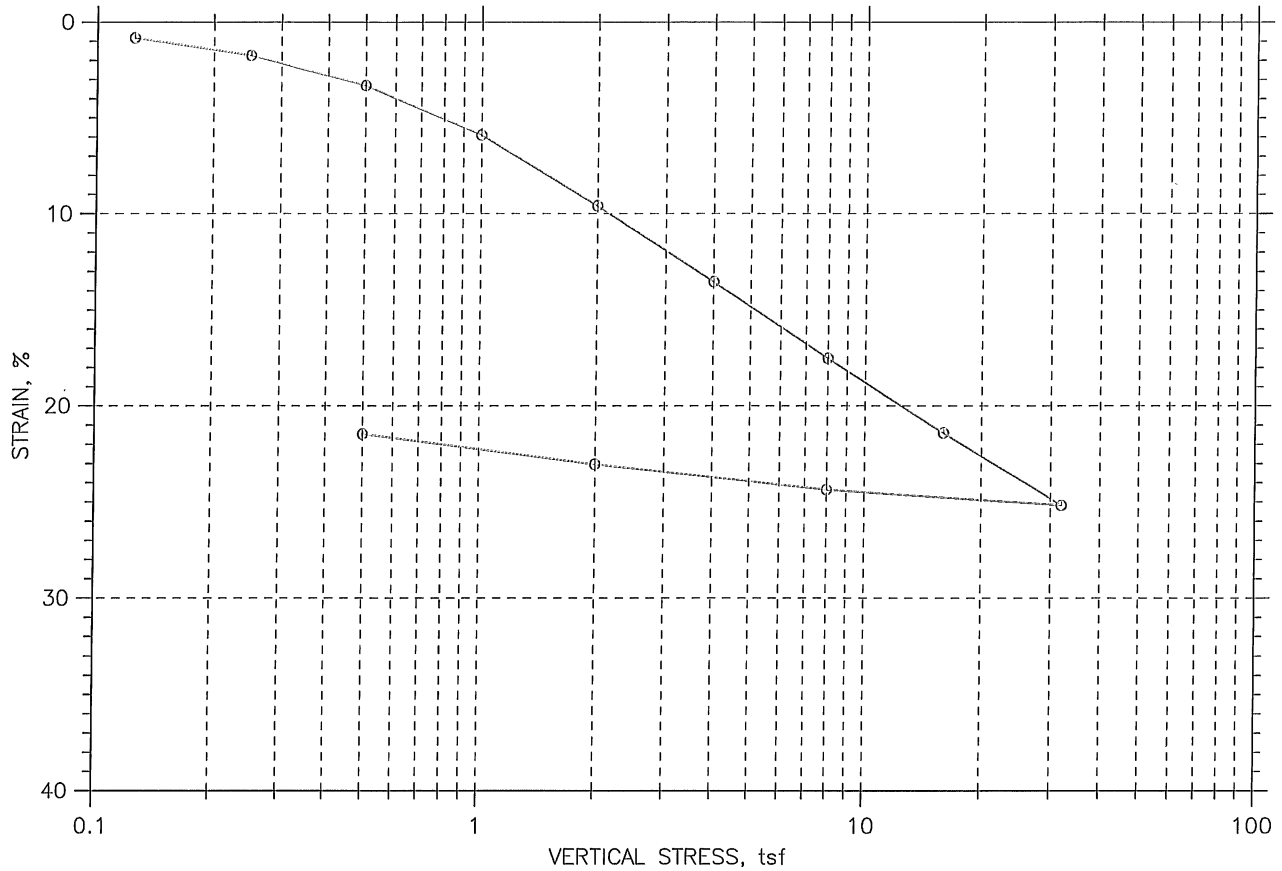
Boring ID	Sample ID	Depth, ft	Visual Description	Vane Shear Strength, kN/m^2	Vane Shear Strength, tsf
FD-02	U-1	10-12	Wet, gray silty clay	29.2	0.30
				30.6	0.32
				29.6	0.31
			Average	29.8	0.31
FD-05	U-1	10-12	Wet, gray silty clay	40.8	0.43
				33.1	0.35
				35.0	0.37
			Average	36.3	0.38
FD-07	U-2	30-32	Wet, gray silty clay	33.1	0.35
				28.2	0.29
				26.6	0.28
			Average	29.3	0.31
FD-12	U-1	44-46	Wet, gray silty clay	25.9	0.27
				25.0	0.26
				23.3	0.24
			Average	24.7	0.26

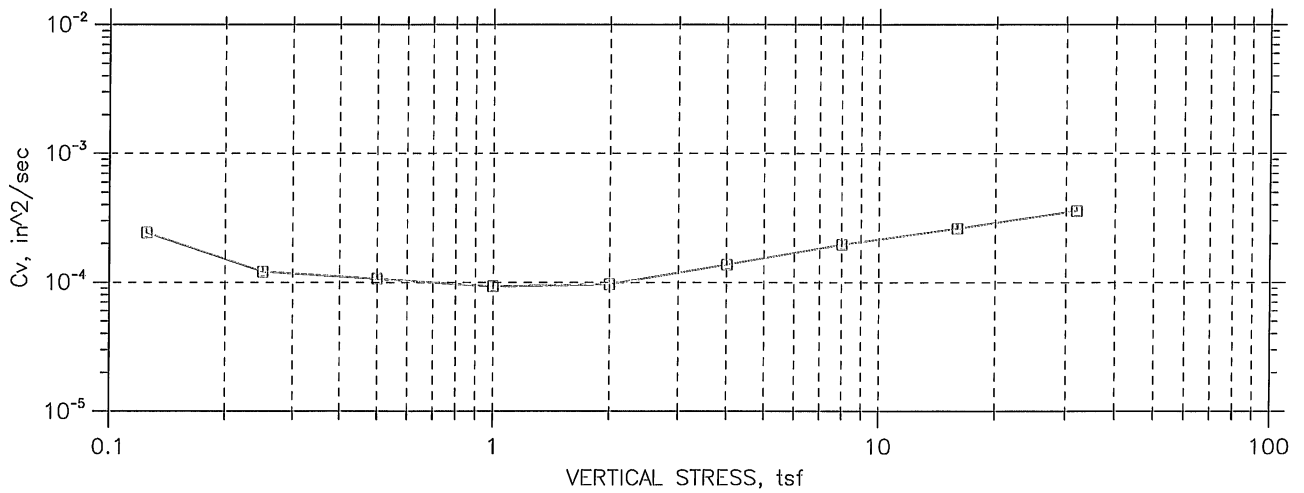
Comments:

CONSOLIDATION TESTS

CONSOLIDATION TEST DATA

SUMMARY REPORT

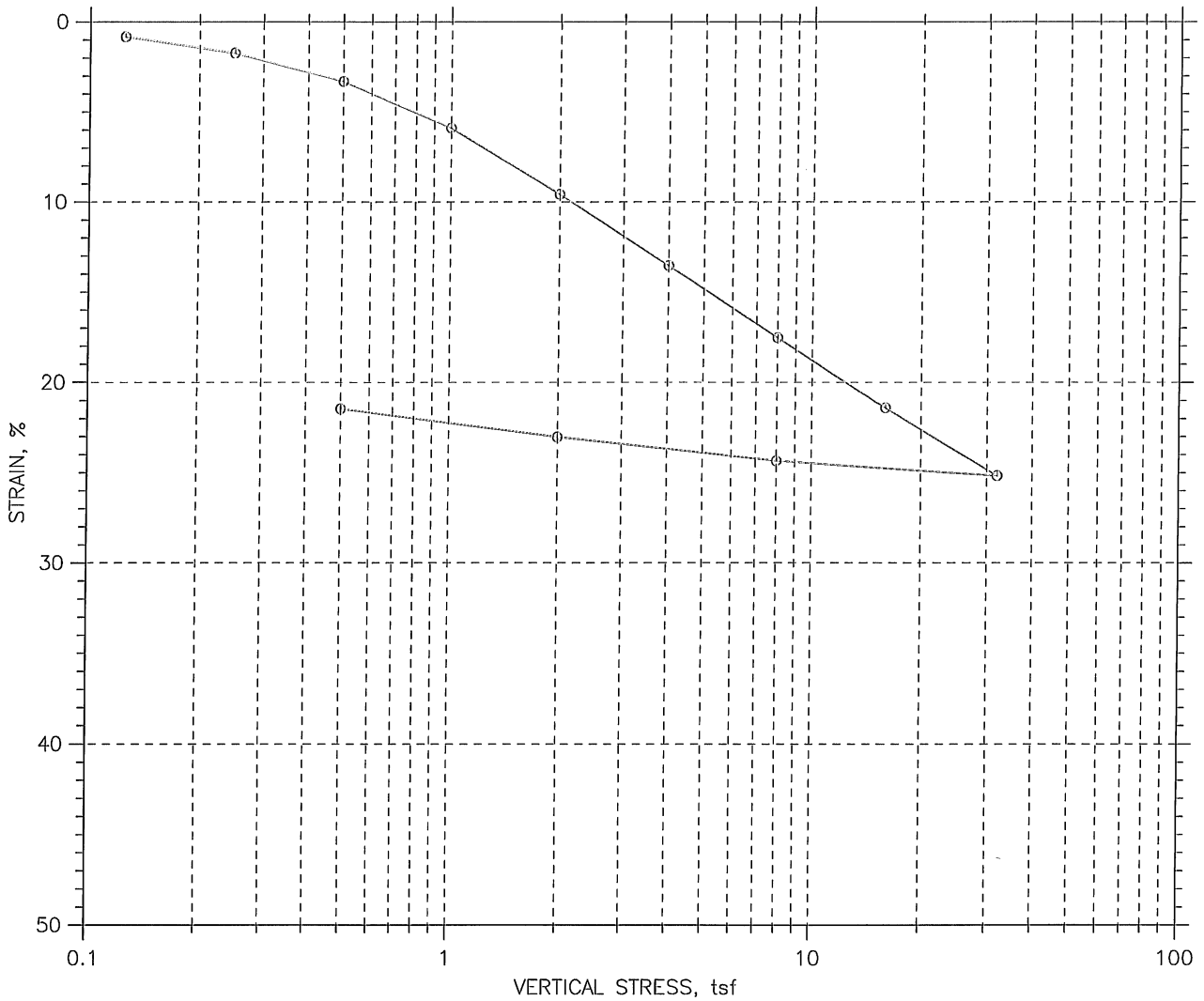




GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure: ---				Water Content, %	40.80	24.22
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	80.29	102.2
Compression Index: ---				Saturation, %	99.75	100.00
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.11	0.66
LL: 48	PL: 20	PI: 28	GS: 2.71			

GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

GeoTesting EXPRESS

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-05
Sample No.: U-1
Test No.: C-2

Location: Saco, ME
Tested By: md
Test Date: 06/16/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 10-12 ft
Elevation: ---

Soil Description: Moist, dark gray clay
Remarks: ---

Estimated Specific Gravity: 2.71
Initial Void Ratio: 1.11
Final Void Ratio: 0.66

Liquid Limit: 48
Plastic Limit: 20
Plasticity Index: 28

Initial Height: 1.00 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	Twice	RING		47
Wt. Container + Wet Soil, gm	134.38	360.41	343.25	136.53
Wt. Container + Dry Soil, gm	97.26	318.2	318.2	111.54
Wt. Container, gm	8.08	214.74	214.74	8.34
Wt. Dry Soil, gm	89.18	103.46	103.46	103.2
Water Content, %	41.62	40.80	24.22	24.22
Void Ratio	---	1.11	0.66	---
Degree of Saturation, %	---	99.75	100.00	---
Dry Unit Weight, pcf	---	80.292	102.23	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

GeoTesting EXPRESS

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-05
Sample No.: U-1
Test No.: C-2

Location: Saco, ME
Tested By: md
Test Date: 06/16/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 10-12 ft
Elevation: ---

Soil Description: Moist, dark gray clay
Remarks: ---

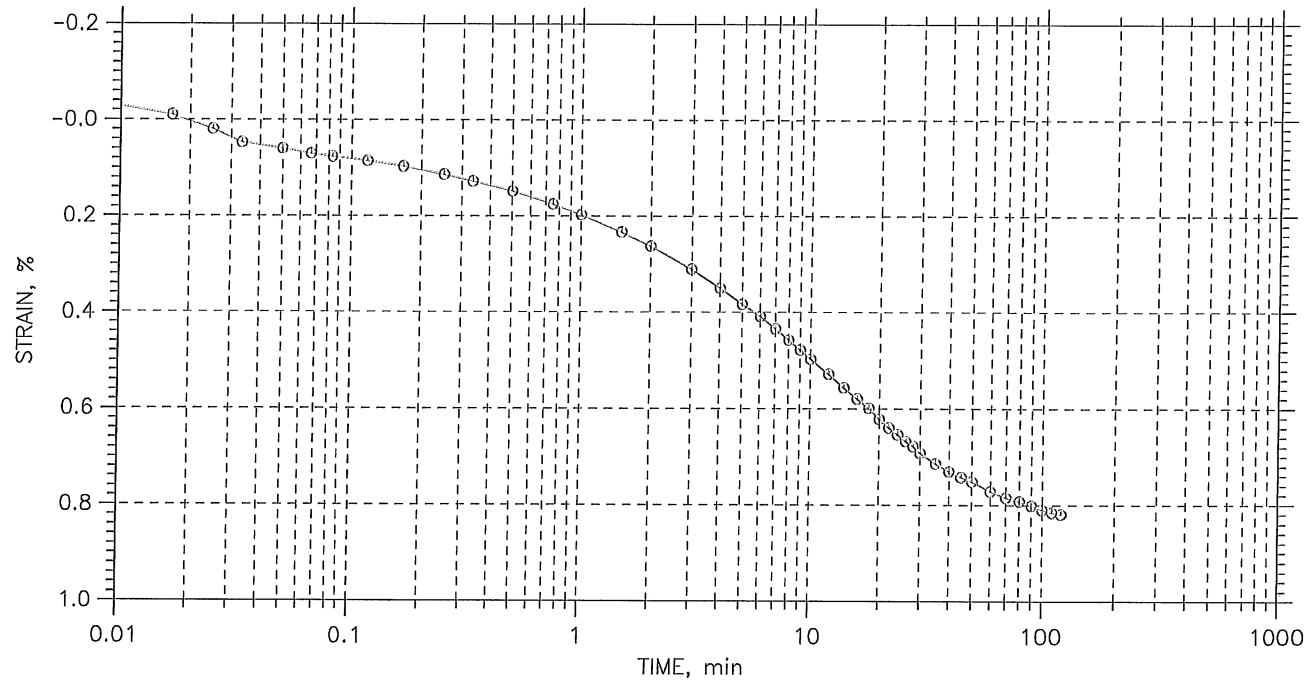
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.125	0.008185	1.093	0.82	3.3	0.0	2.44e-004	0.00e+000	2.44e-004
2	0.25	0.01735	1.073	1.73	5.6	7.7	1.43e-004	1.05e-004	1.21e-004
3	0.5	0.03305	1.040	3.31	6.6	8.0	1.19e-004	9.71e-005	1.07e-004
4	1	0.05887	0.986	5.89	7.0	9.1	1.07e-004	8.25e-005	9.31e-005
5	2	0.09573	0.908	9.57	6.9	7.6	1.01e-004	9.26e-005	9.66e-005
6	4	0.1353	0.825	13.53	4.6	4.8	1.41e-004	1.34e-004	1.37e-004
7	8	0.1752	0.740	17.52	2.7	3.2	2.14e-004	1.82e-004	1.97e-004
8	16	0.214	0.658	21.40	1.6	2.4	3.27e-004	2.19e-004	2.62e-004
9	32	0.2517	0.579	25.17	1.2	1.5	4.15e-004	3.16e-004	3.59e-004
10	8	0.2435	0.596	24.35	0.2	0.0	2.41e-003	0.00e+000	2.41e-003
11	2	0.2303	0.624	23.03	1.4	2.2	3.38e-004	2.22e-004	2.68e-004
12	0.5	0.2146	0.657	21.46	6.6	7.8	7.53e-005	6.34e-005	6.88e-005

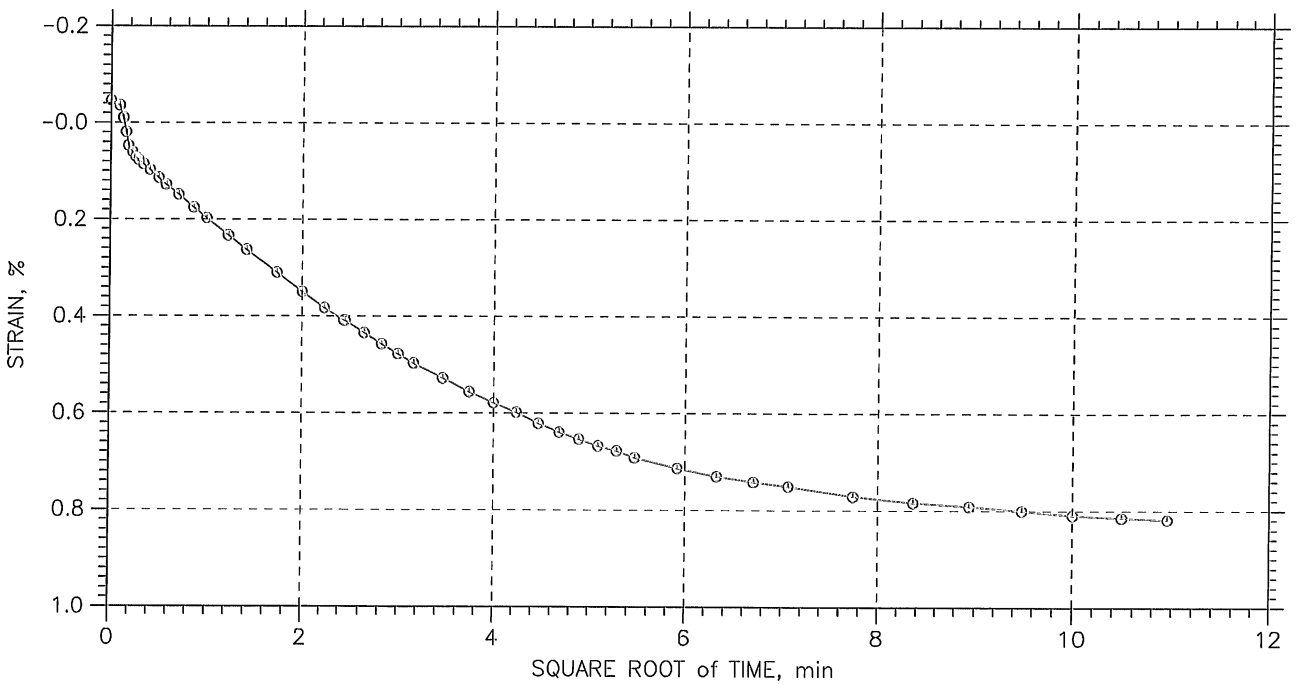
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 12

Stress: 0.125 tsf





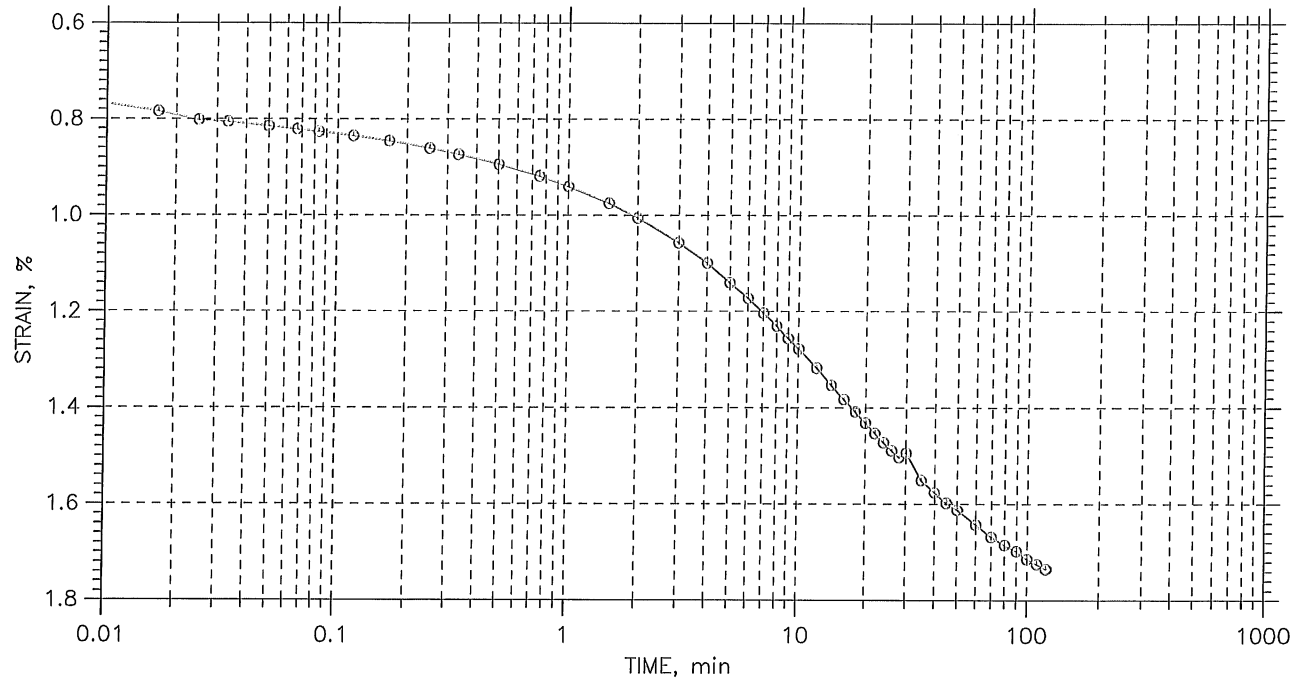
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

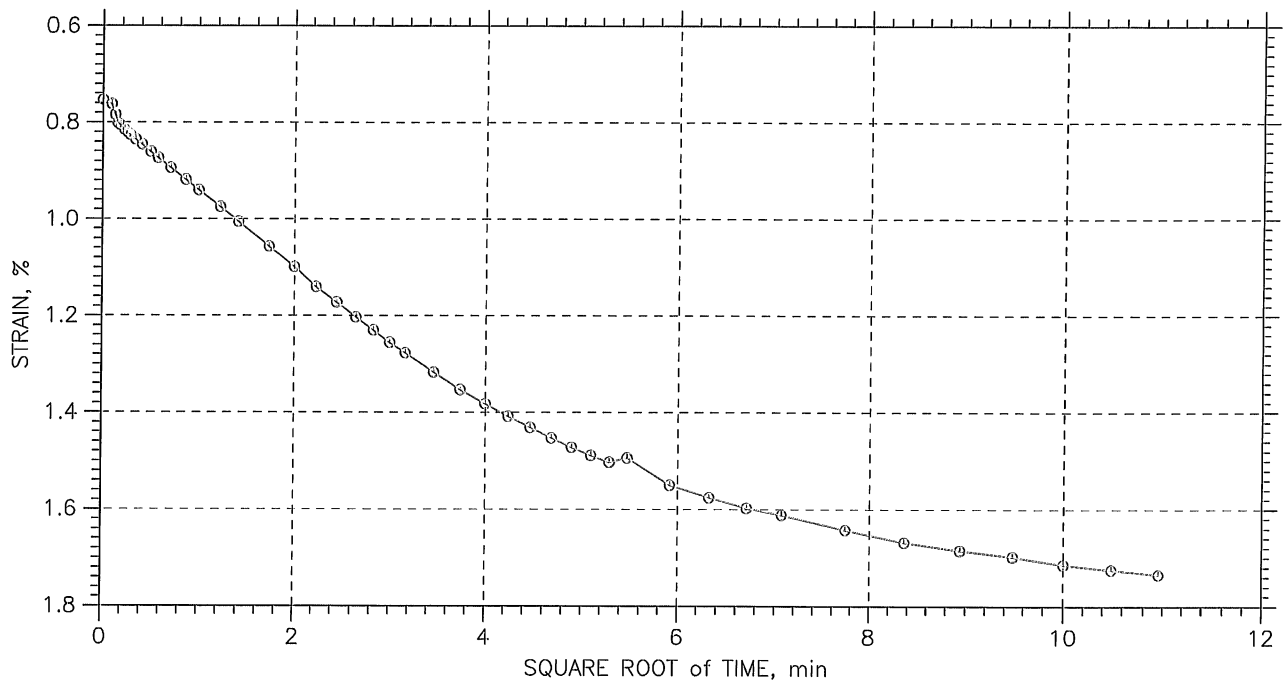
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 12

Stress: 0.25 tsf





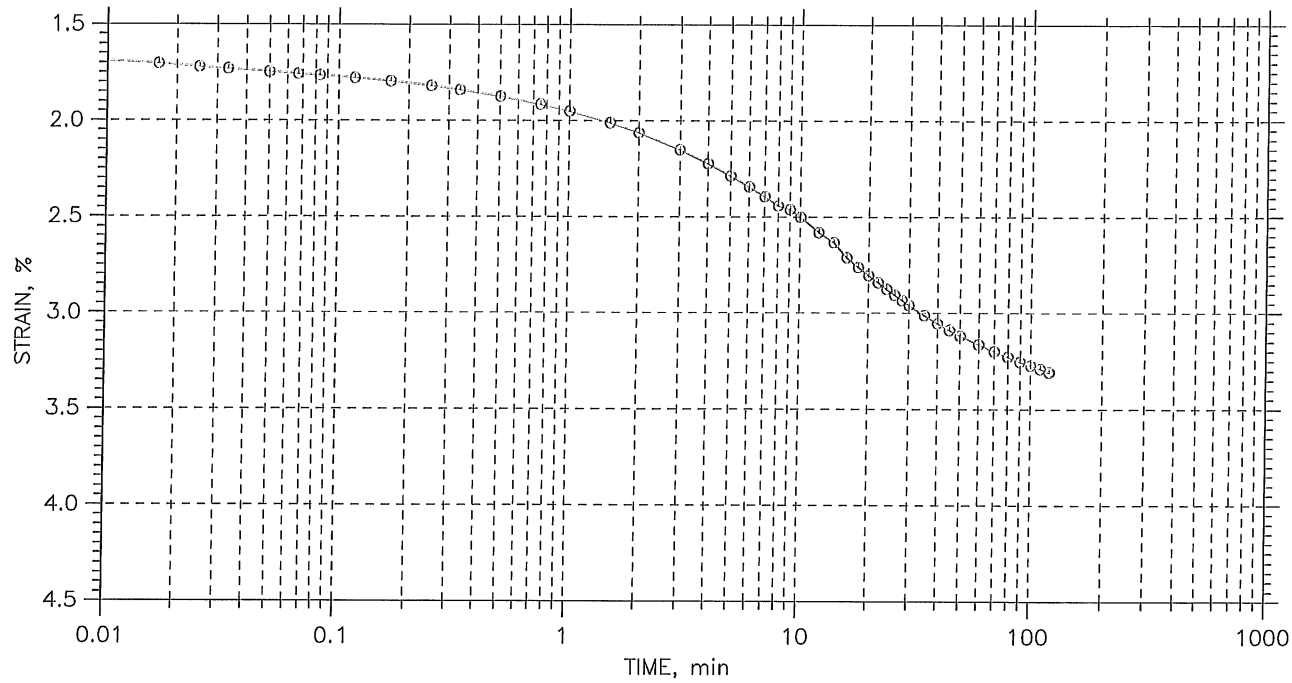
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

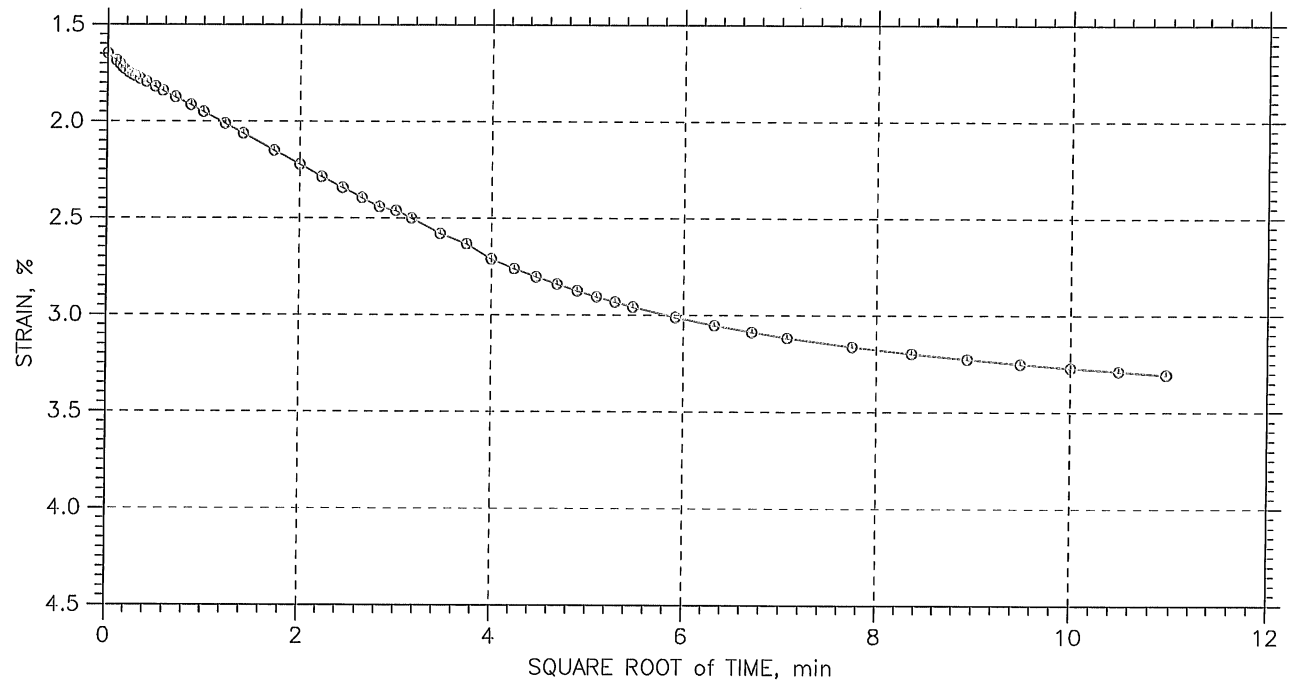
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 12

Stress: 0.5 tsf





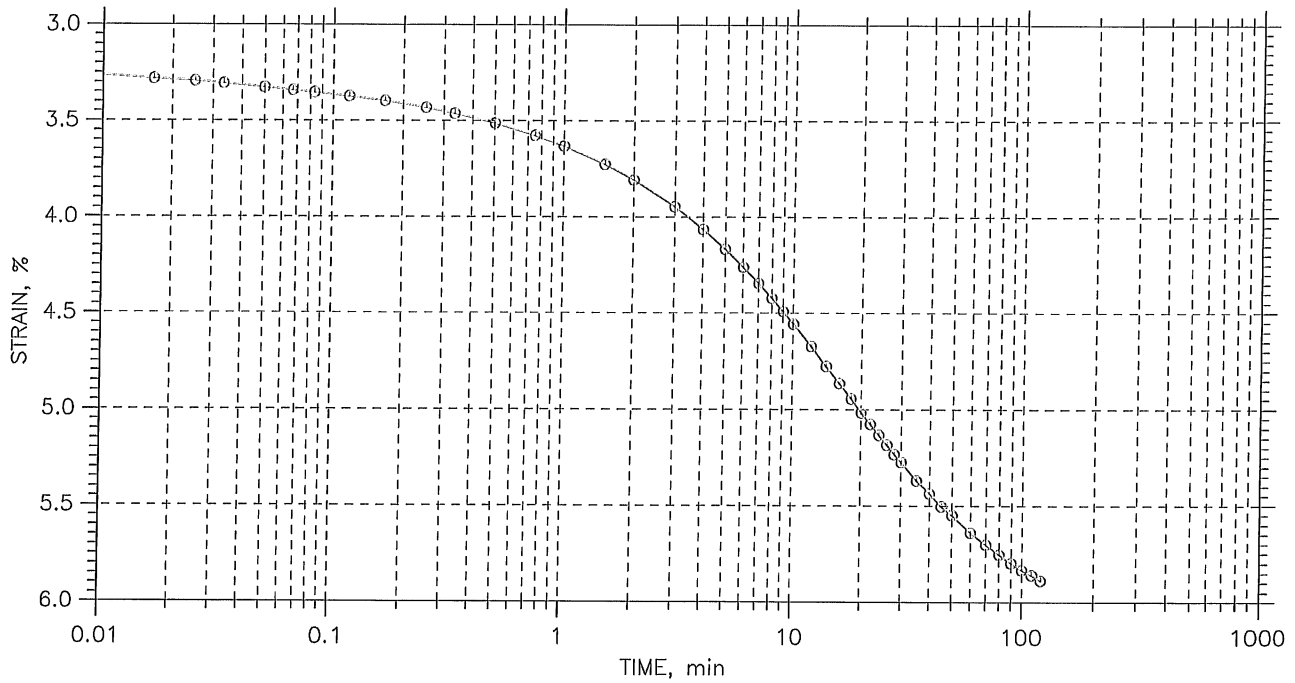
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

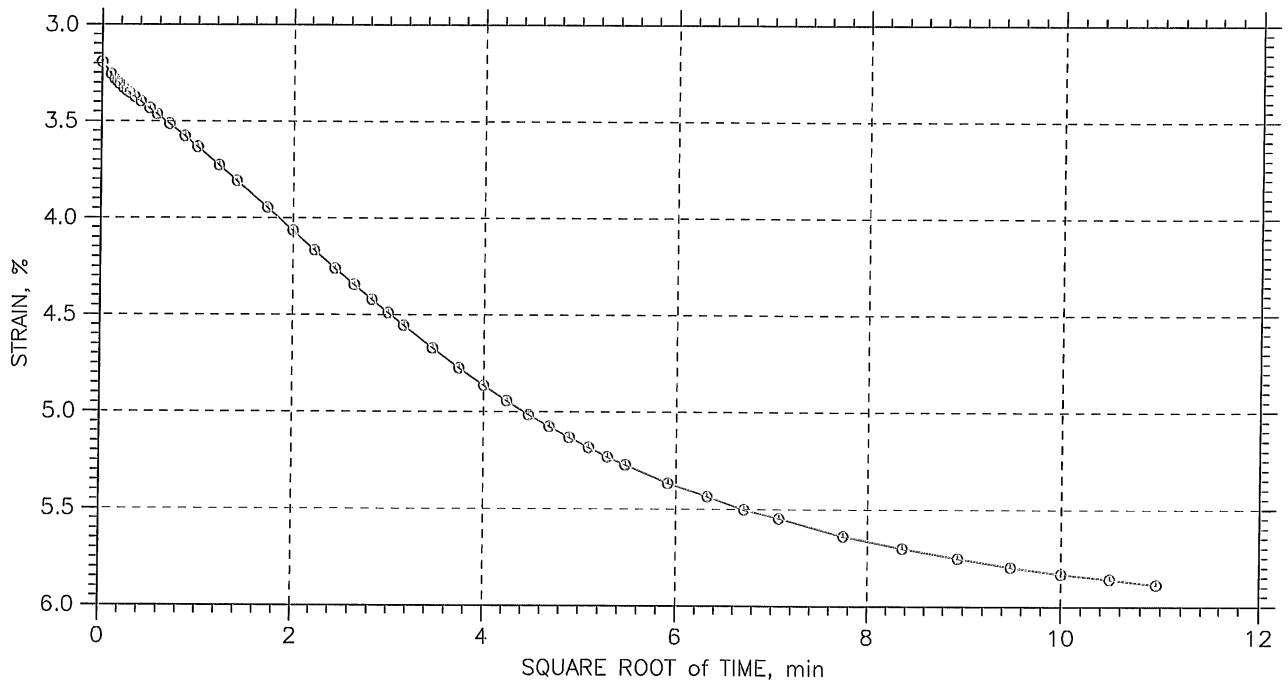
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 12

Stress: 1. tsf





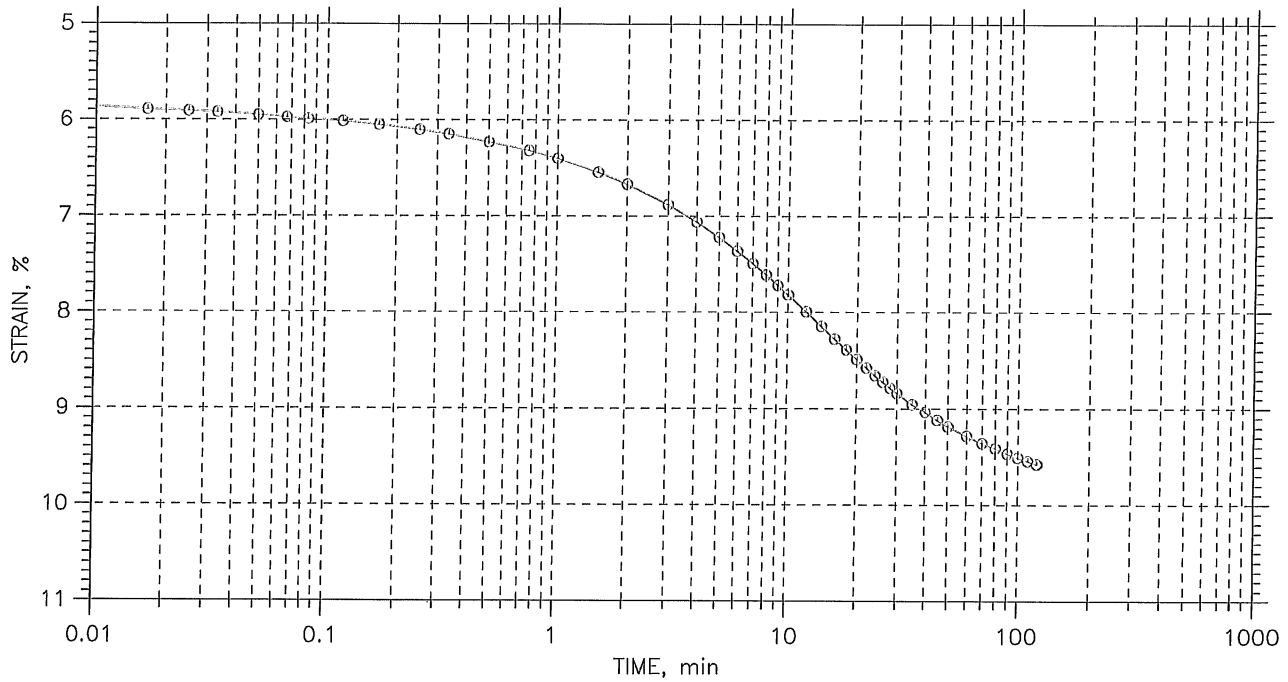
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

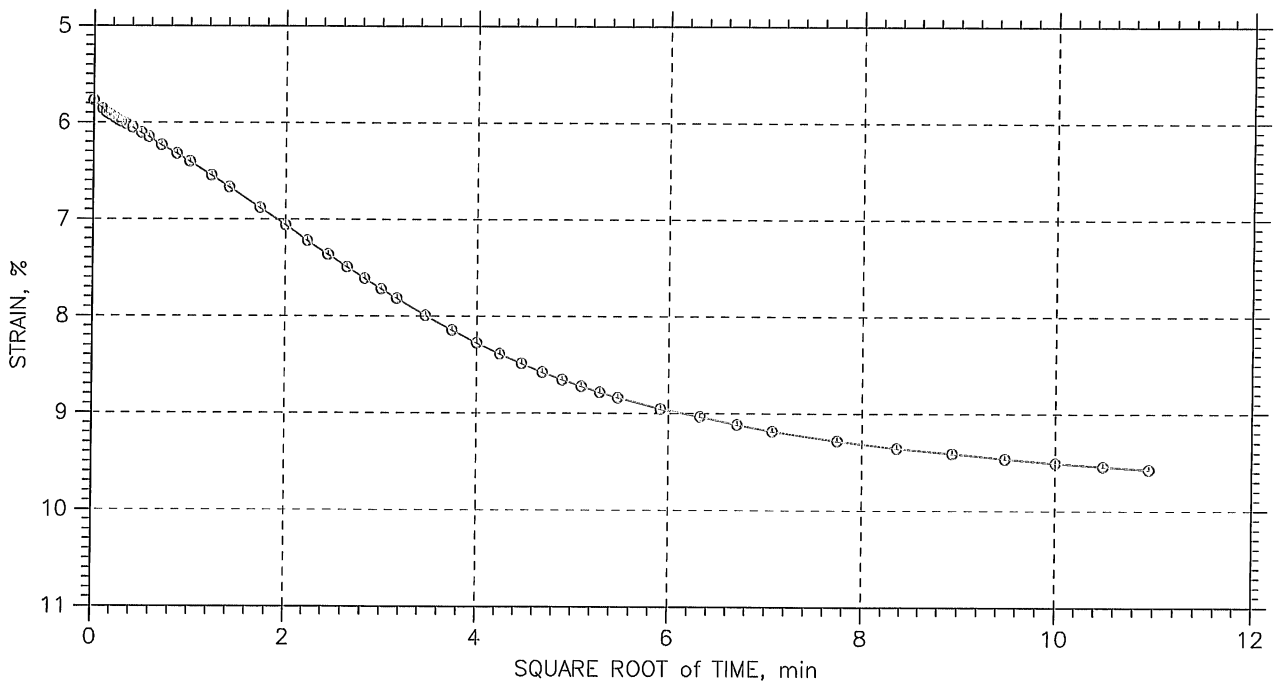
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 12

Stress: 2. tsf





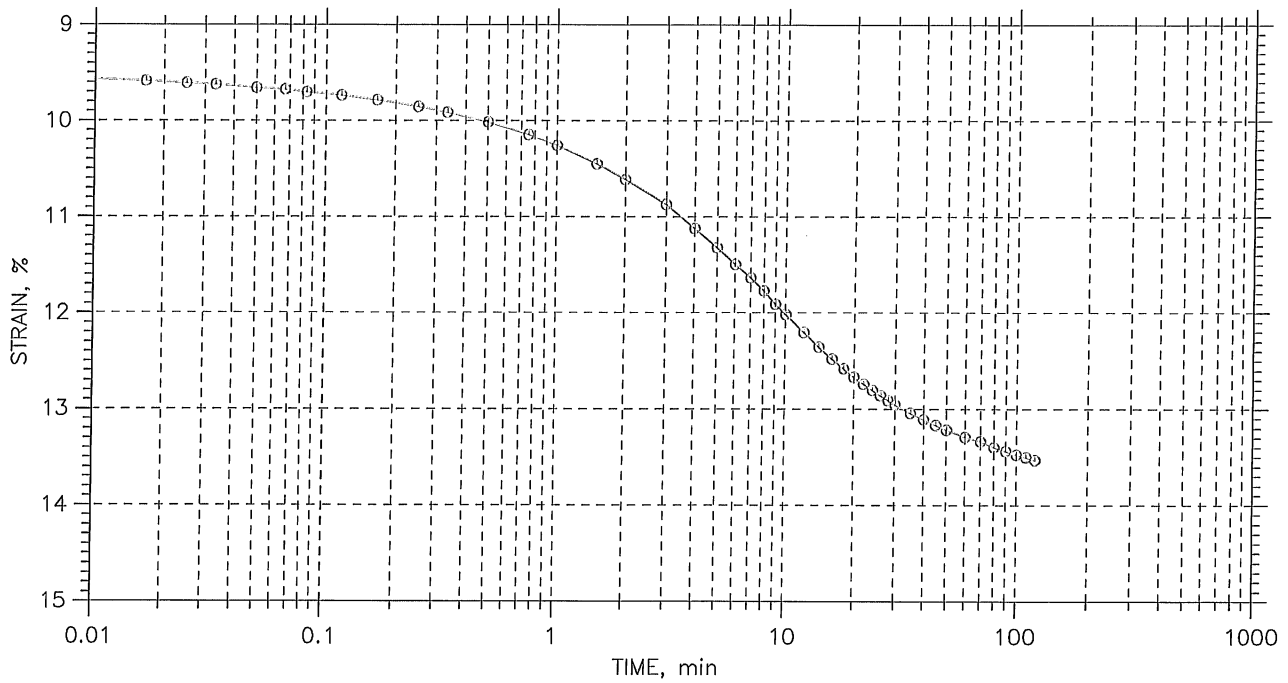
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

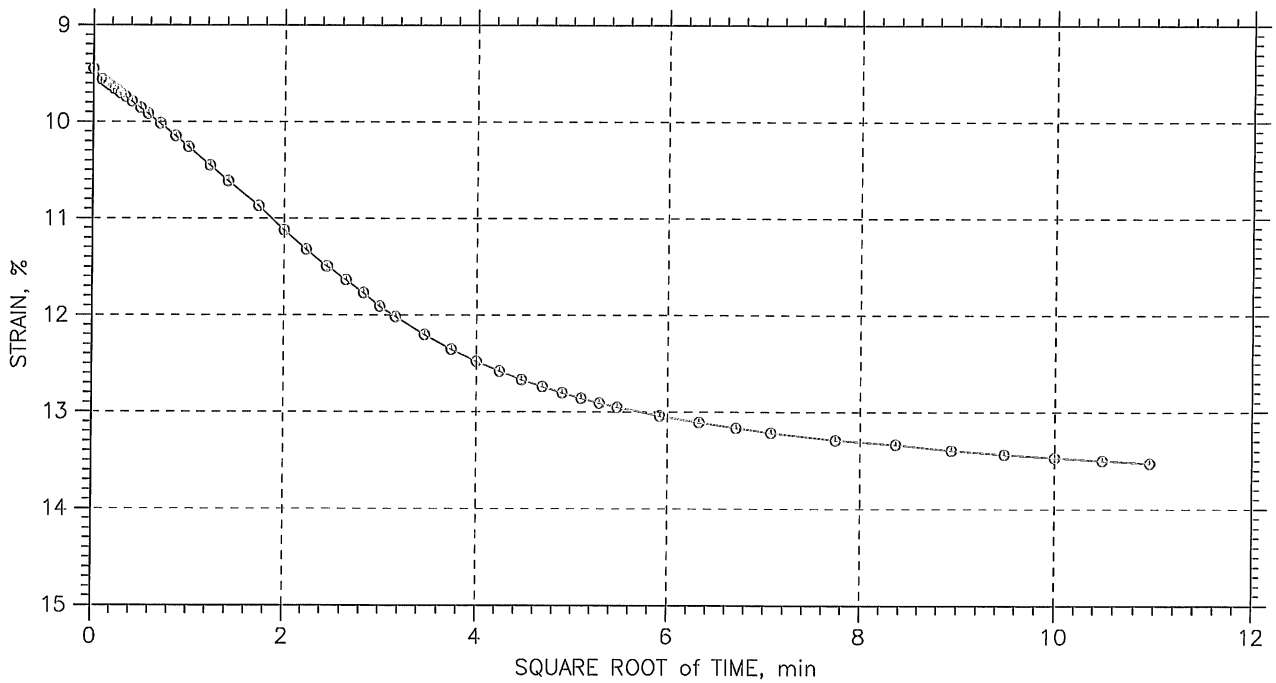
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 12

Stress: 4. tsf





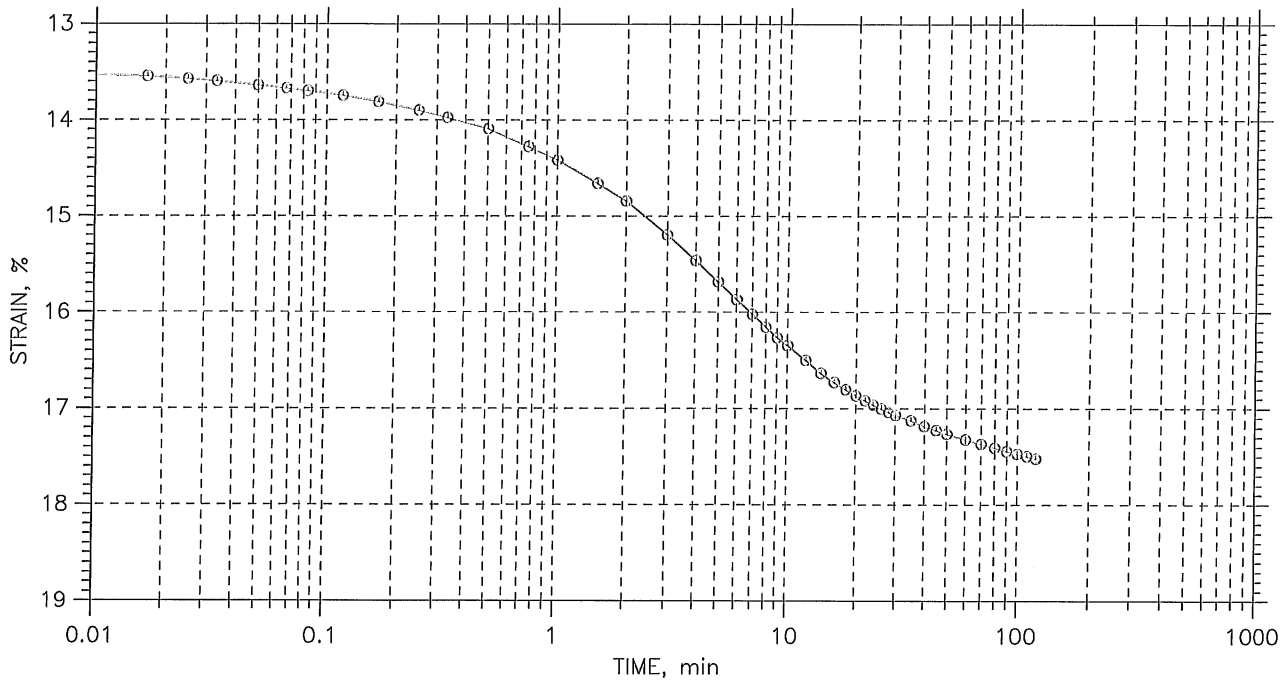
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

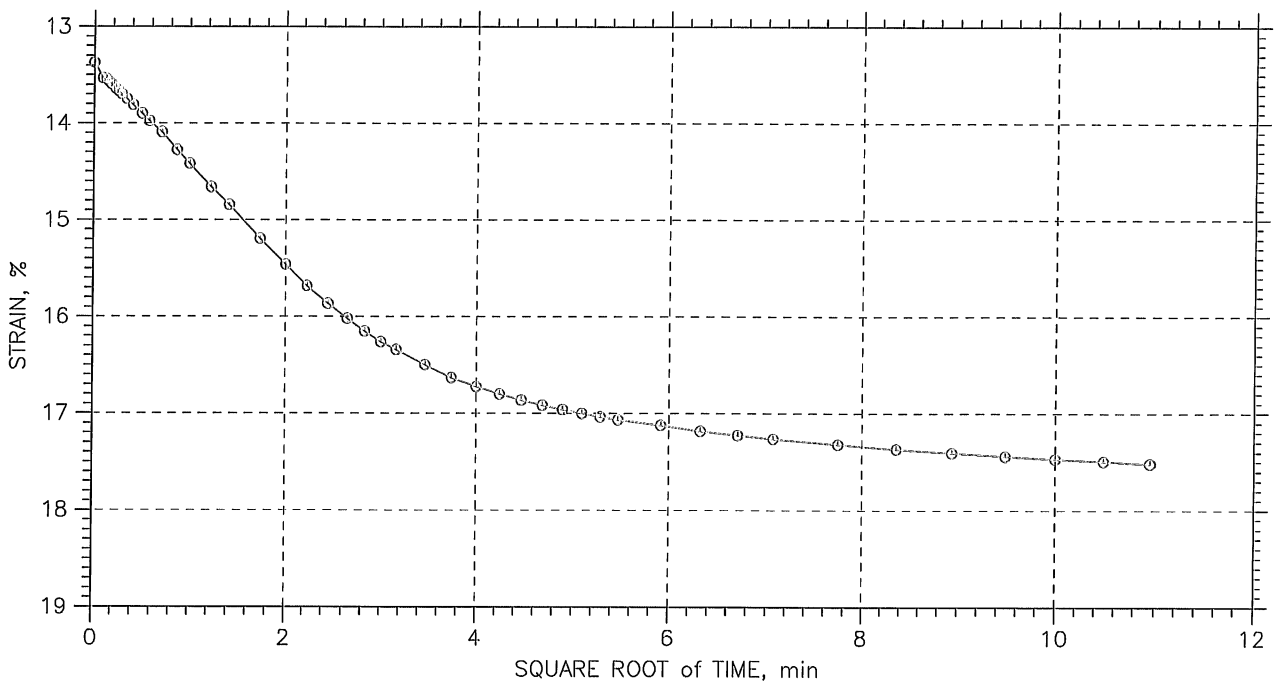
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 12

Stress: 8. tsf





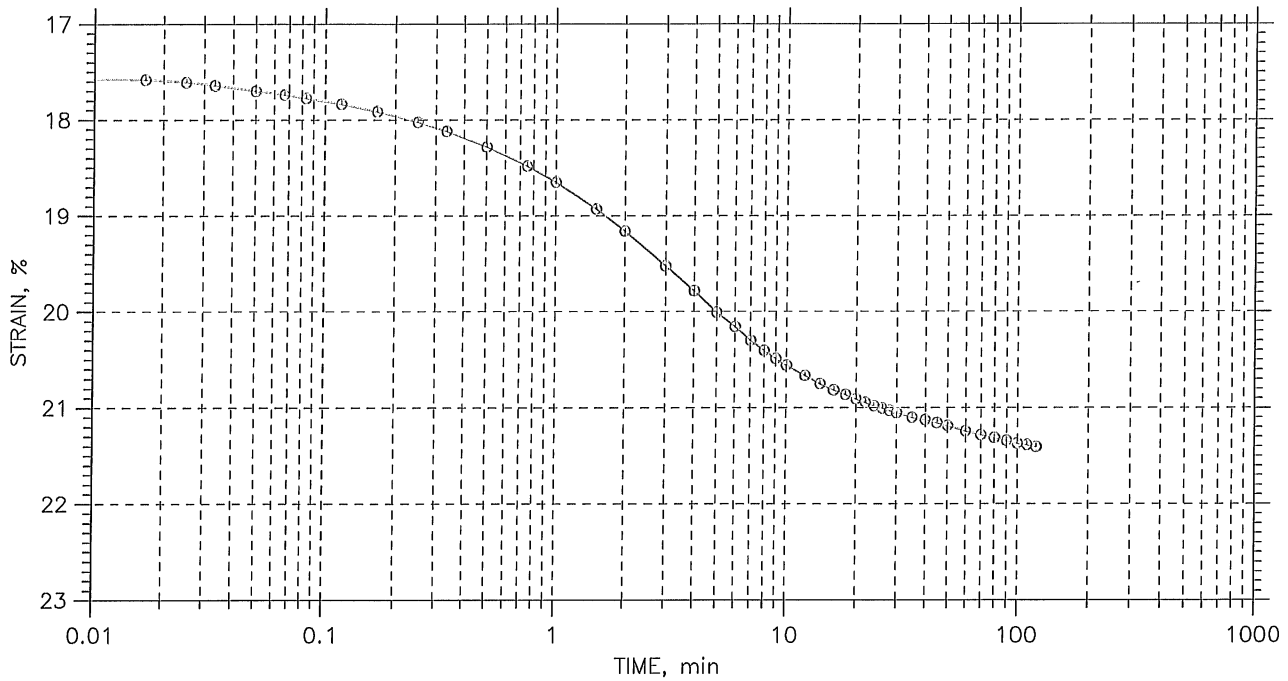
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

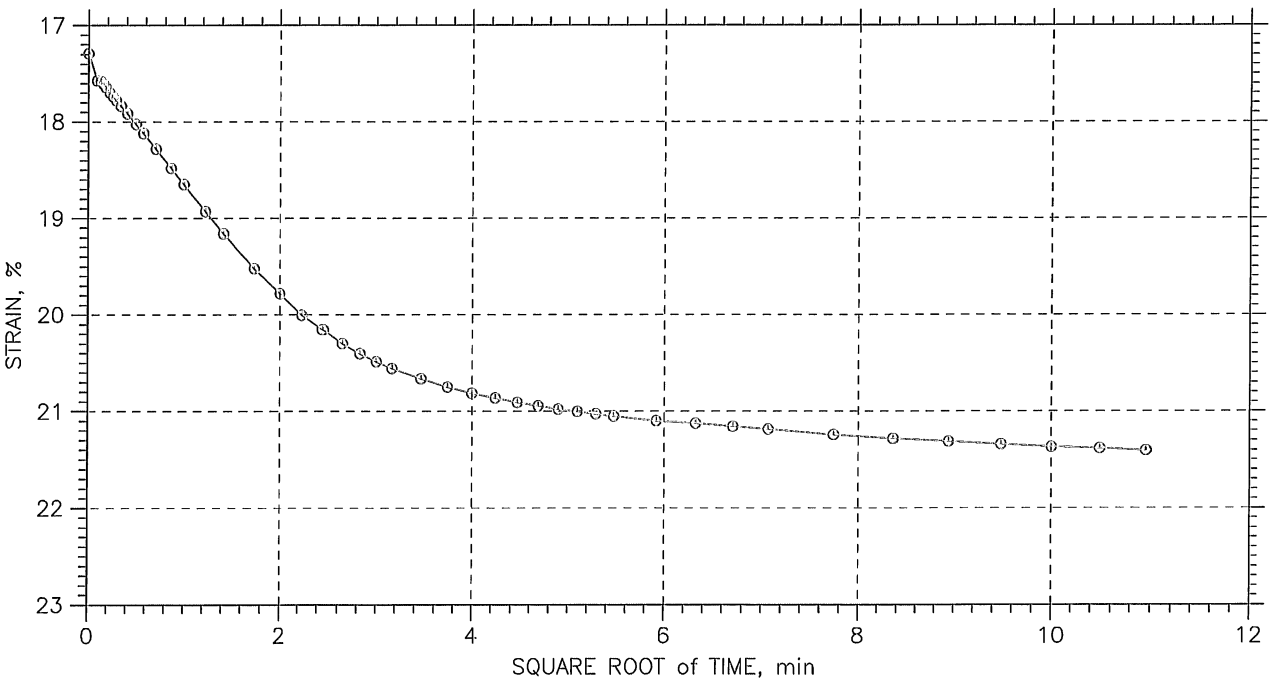
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 12

Stress: 16. tsf





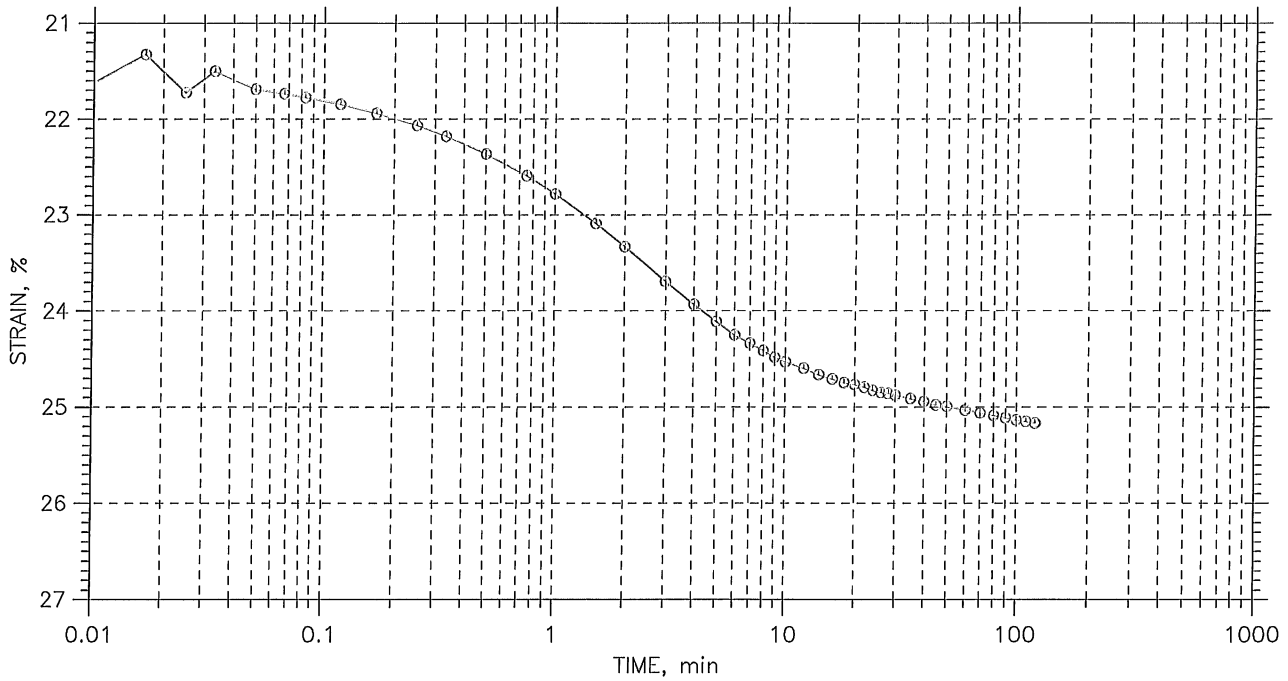
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

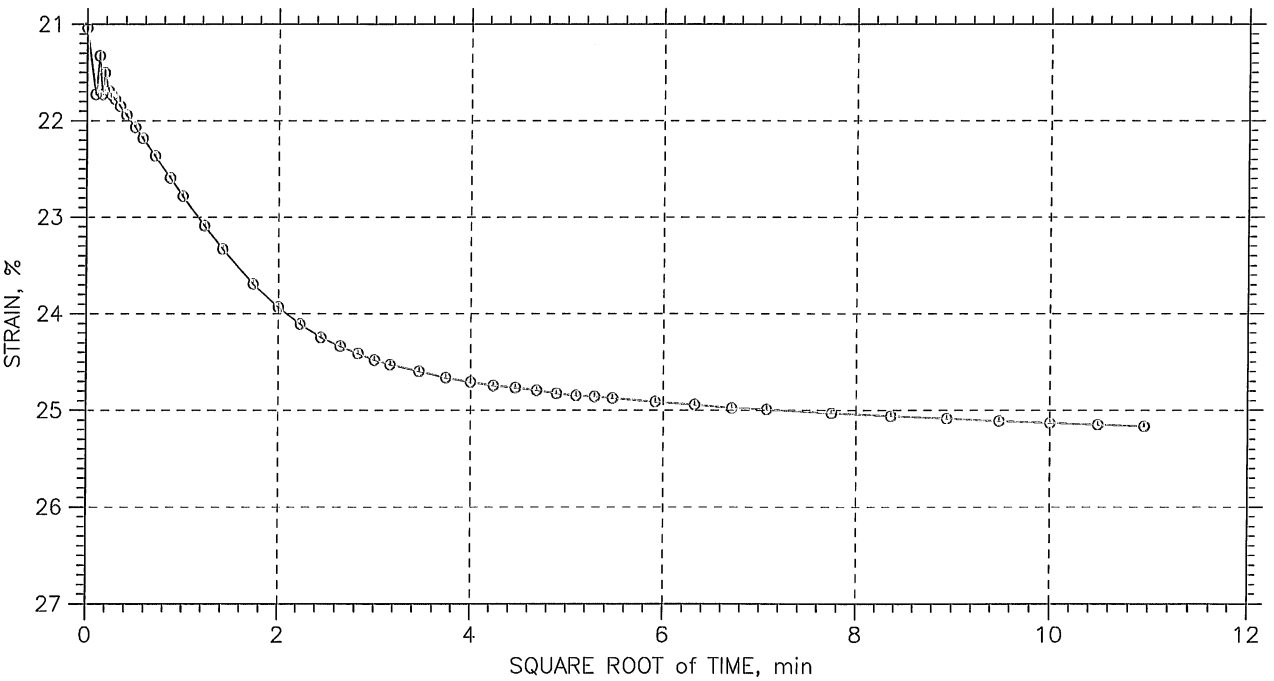
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 12

Stress: 32. tsf





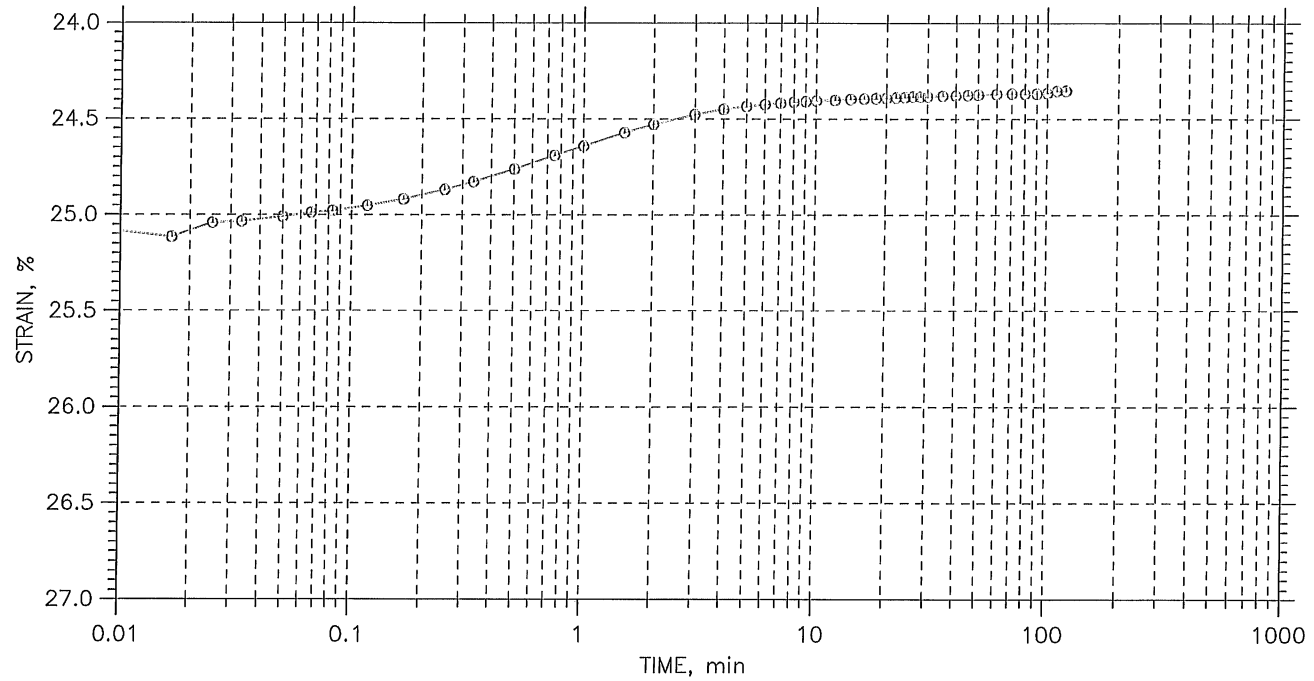
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

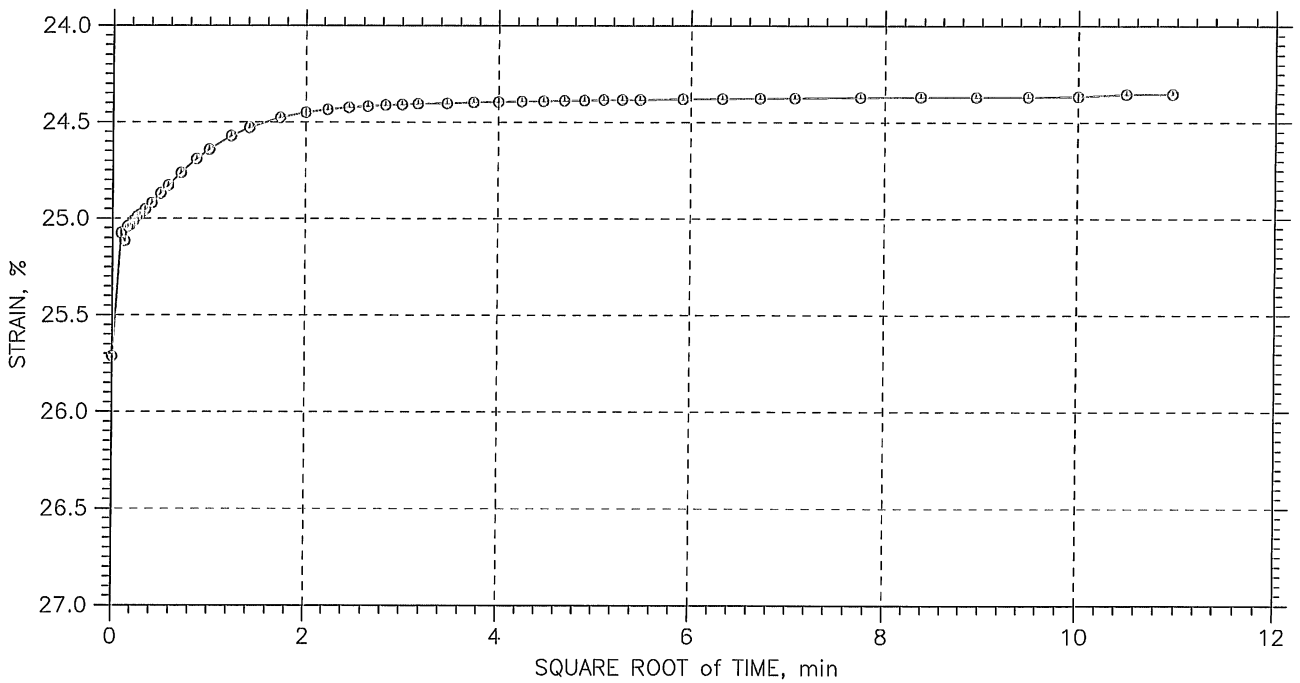
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 12

Stress: 8. tsf





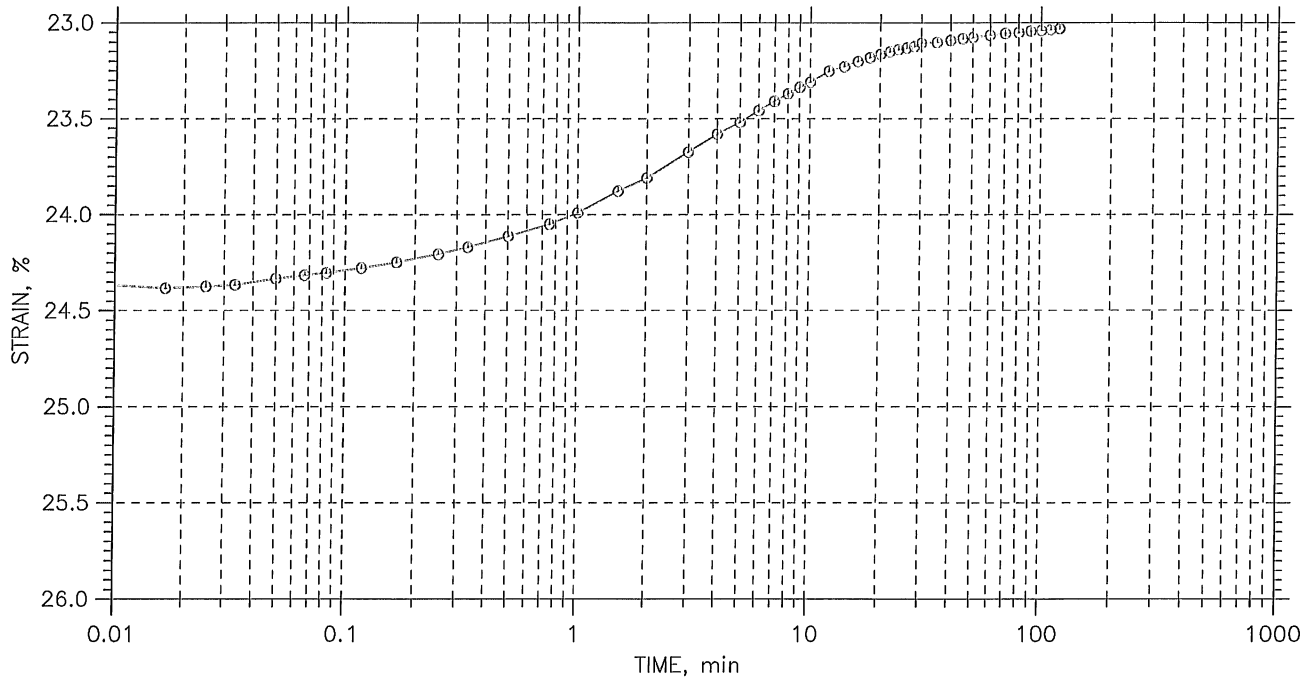
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

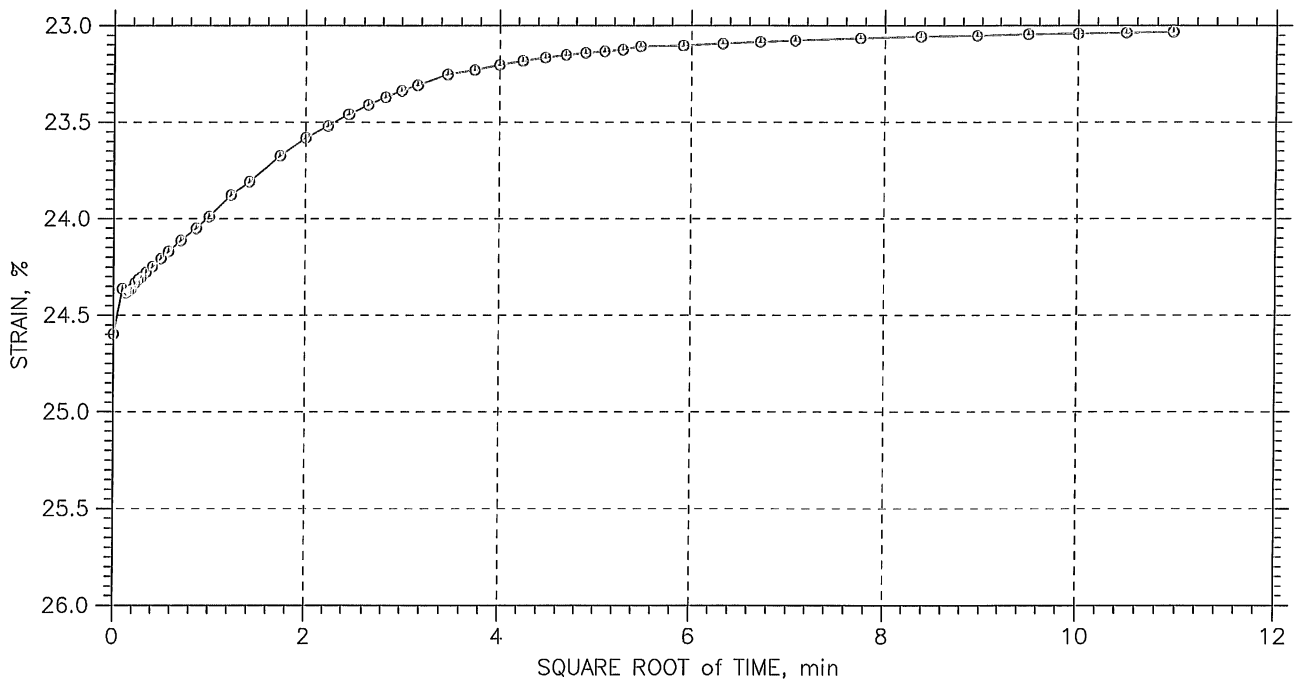
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 12

Stress: 2. tsf





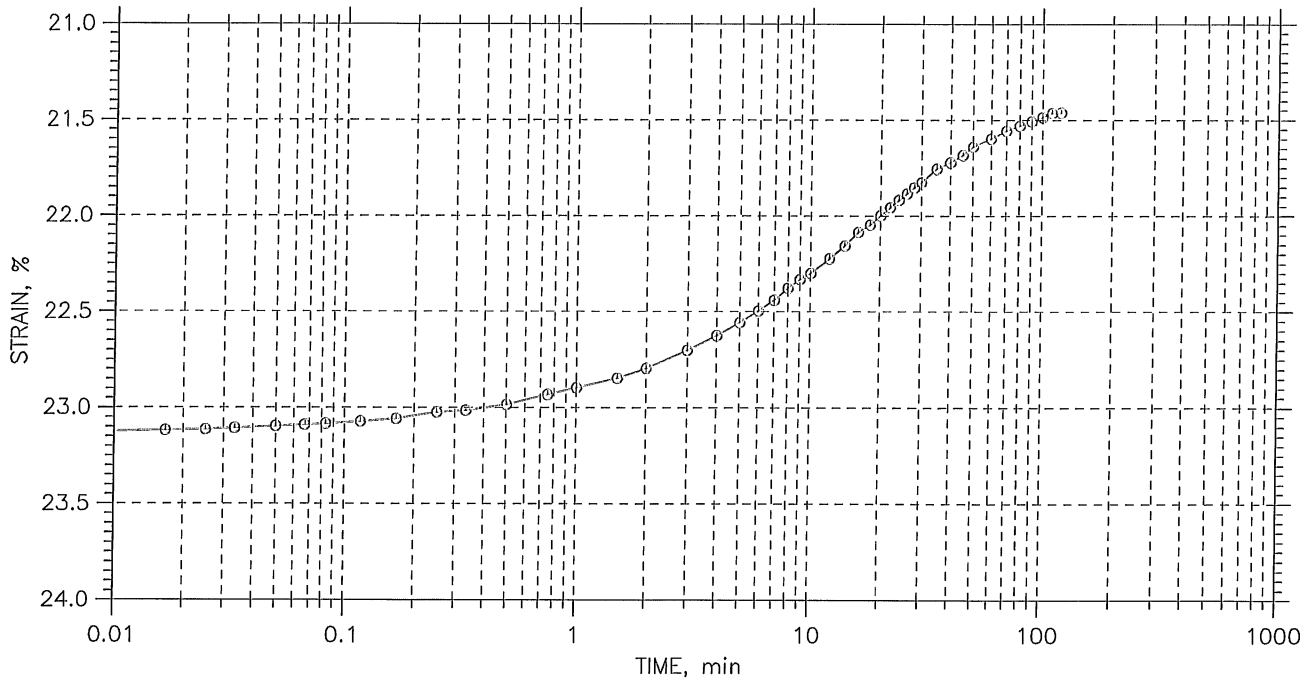
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

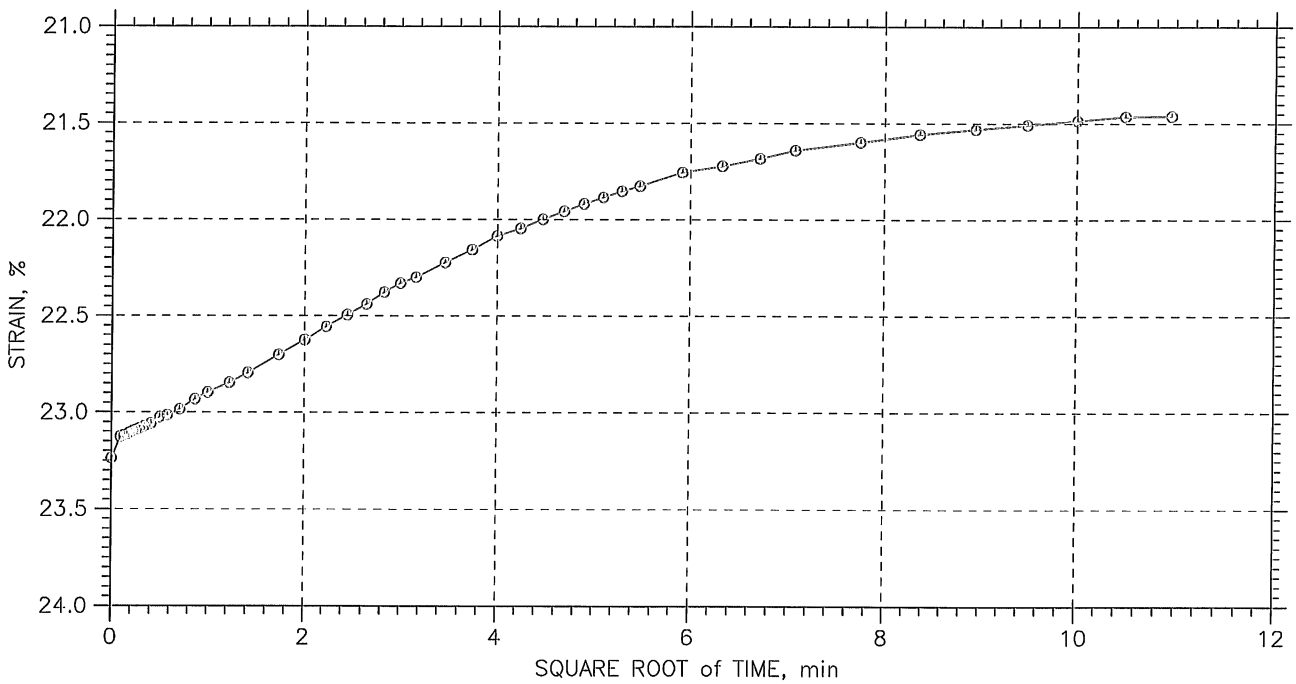
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 12

Stress: 0.5 tsf

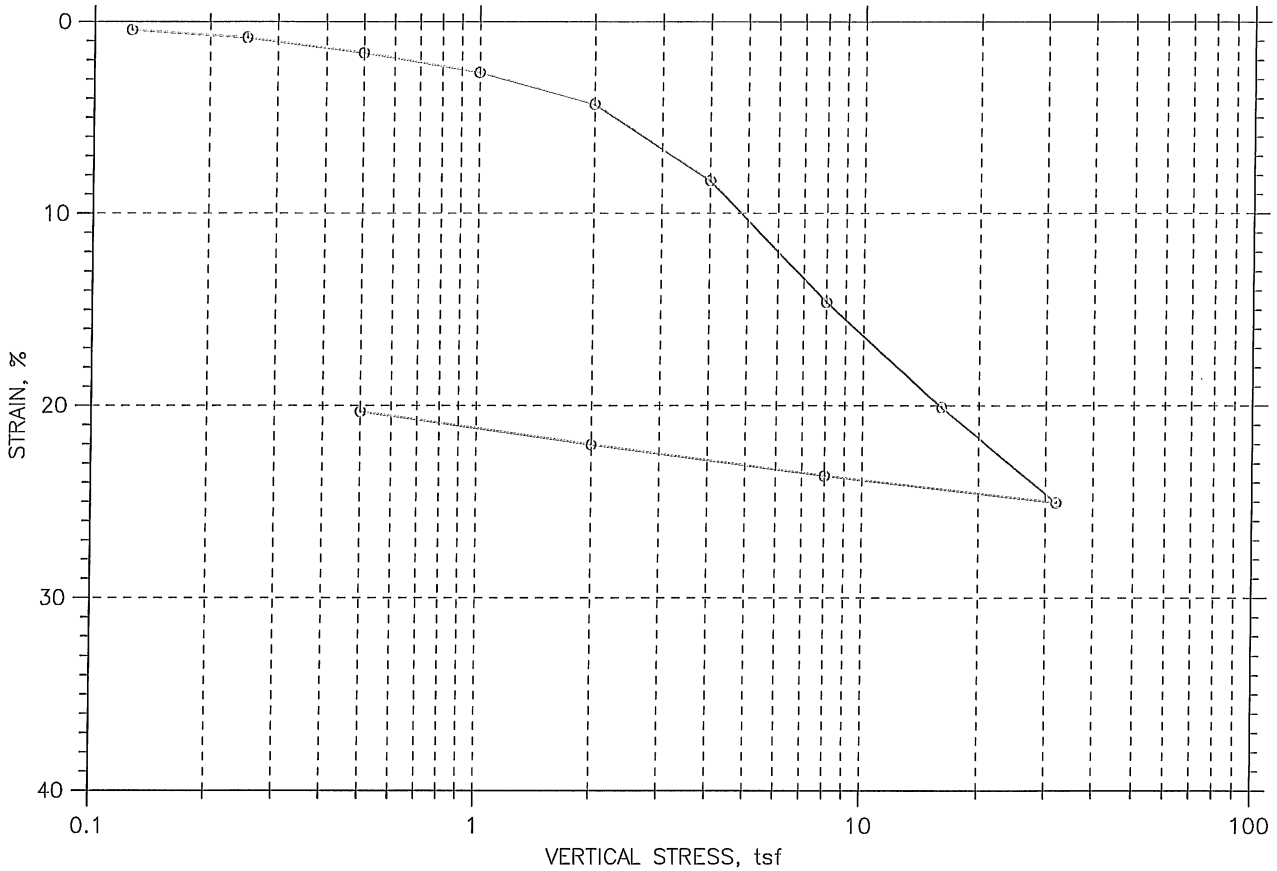


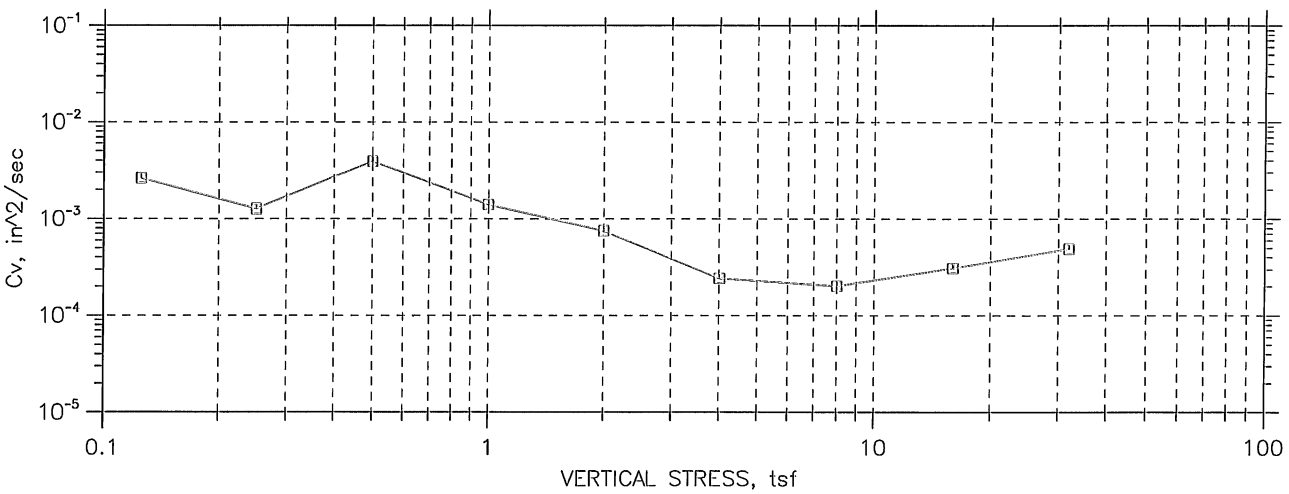


GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-05	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 10-12 ft
	Test No.: C-2	Sample Type: Tube	Elevation: ---
	Description: Moist, dark gray clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

SUMMARY REPORT

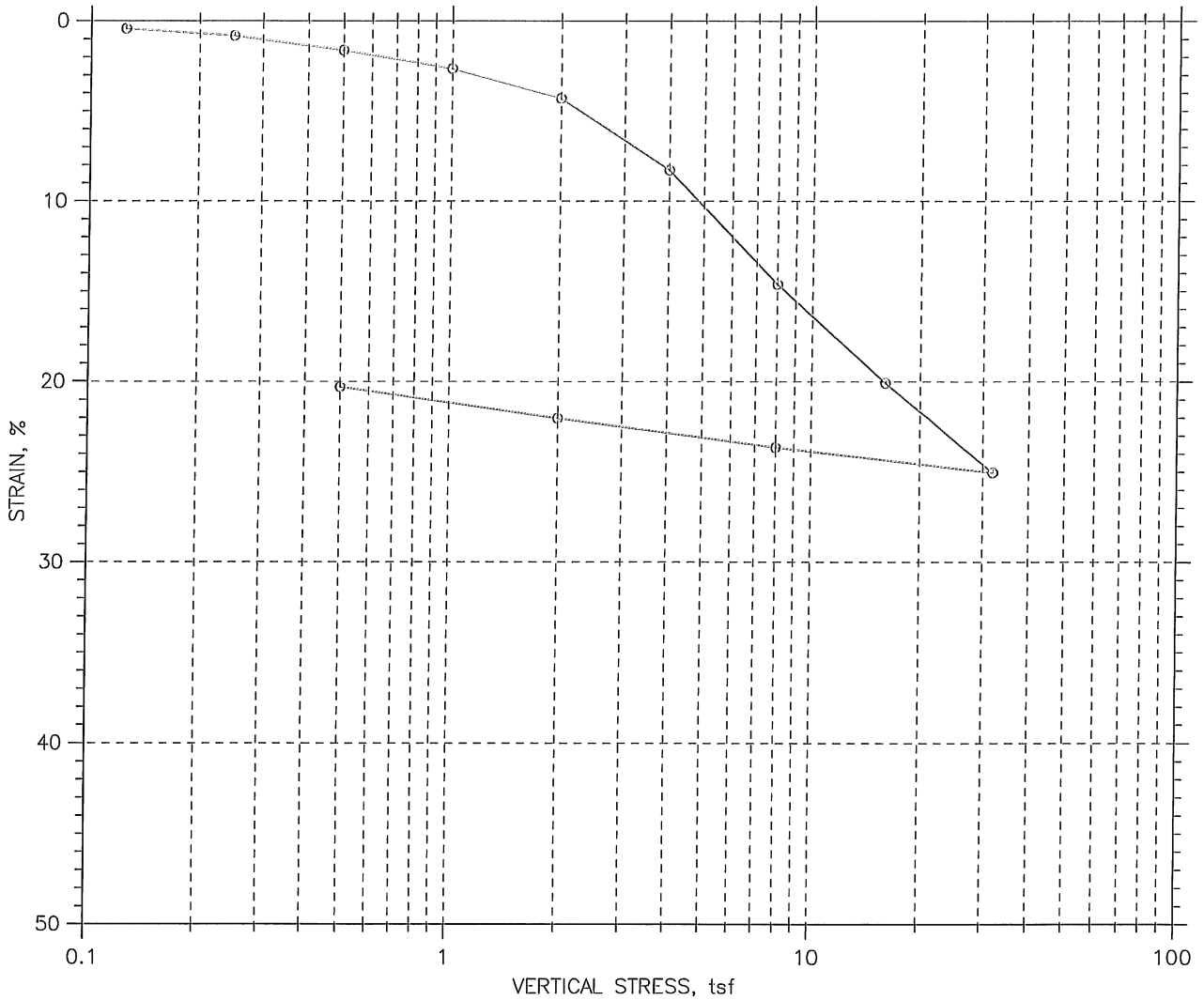




GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure: ---				Water Content, %	35.40	22.06
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	84.2	105.6
Compression Index: ---				Saturation, %	95.41	100.00
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.00	0.60
LL: 36	PL: 16	PI: 20	GS: 2.70			

GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

GeoTesting EXPRESS

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-12
Sample No.: U-1
Test No.: C-1

Location: Saco, ME
Tested By: md
Test Date: 06/16/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 44-46 ft
Elevation: ---

Soil Description: Moist, gray clay
Remarks: ---

Estimated Specific Gravity: 2.70
Initial Void Ratio: 1.00
Final Void Ratio: 0.60

Liquid Limit: 36
Plastic Limit: 16
Plasticity Index: 20

Initial Height: 1.00 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	3 CHY	RING		w
Wt. Container + Wet Soil, gm	144.2	363.5	349.02	140.09
Wt. Container + Dry Soil, gm	108.21	325.09	325.09	116.19
Wt. Container, gm	8.09	216.59	216.59	7.83
Wt. Dry Soil, gm	100.12	108.5	108.5	108.36
Water Content, %	35.95	35.40	22.06	22.06
Void Ratio	---	1.00	0.60	---
Degree of Saturation, %	---	95.41	100.00	---
Dry Unit Weight, pcf	---	84.204	105.65	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

GeoTesting EXPRESS

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-12
Sample No.: U-1
Test No.: C-1

Location: Saco, ME
Tested By: md
Test Date: 06/16/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 44-46 ft
Elevation: ---

Soil Description: Moist, gray clay
Remarks: ---

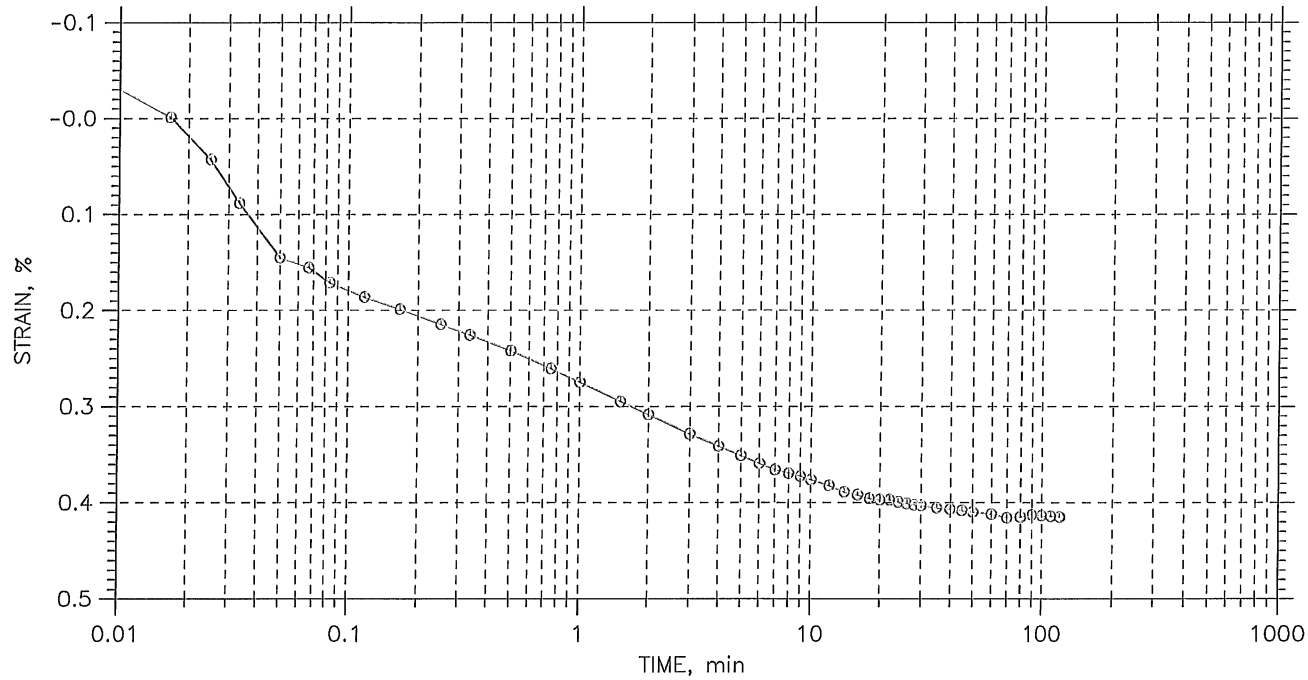
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.125	0.004148	0.994	0.41	0.3	0.0	2.64e-003	0.00e+000	2.64e-003
2	0.25	0.008224	0.985	0.82	0.7	0.6	1.24e-003	1.30e-003	1.27e-003
3	0.5	0.01625	0.969	1.63	0.3	0.1	2.63e-003	7.70e-003	3.92e-003
4	1	0.02646	0.949	2.65	0.6	0.5	1.25e-003	1.61e-003	1.40e-003
5	2	0.04292	0.916	4.29	1.1	1.0	7.10e-004	8.01e-004	7.53e-004
6	4	0.08272	0.836	8.27	3.1	2.8	2.32e-004	2.54e-004	2.42e-004
7	8	0.146	0.710	14.60	2.8	3.6	2.32e-004	1.79e-004	2.02e-004
8	16	0.2008	0.600	20.08	1.6	2.0	3.45e-004	2.81e-004	3.10e-004
9	32	0.2504	0.501	25.04	0.9	1.1	5.30e-004	4.55e-004	4.90e-004
10	8	0.2365	0.528	23.65	0.0	0.0	3.35e-002	0.00e+000	3.35e-002
11	2	0.2203	0.561	22.03	1.0	0.0	5.10e-004	0.00e+000	5.10e-004
12	0.5	0.203	0.596	20.30	6.1	6.8	8.42e-005	7.47e-005	7.92e-005

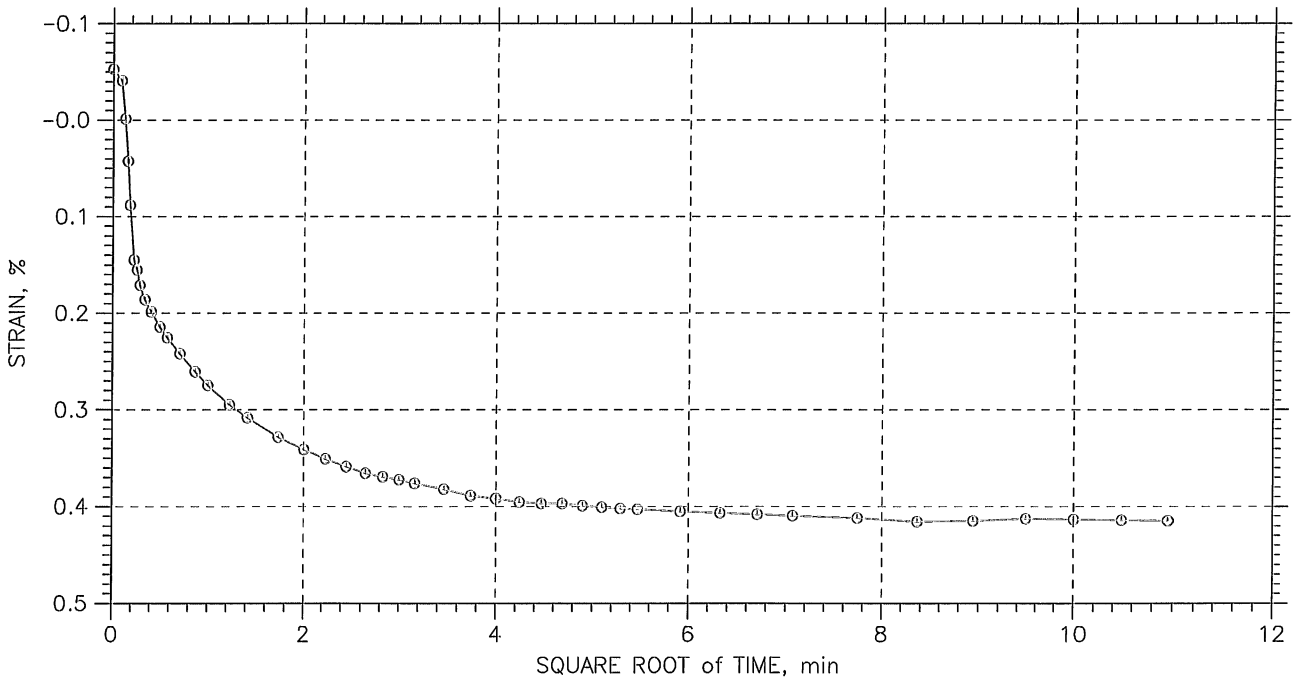
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 12

Stress: 0.125 tsf





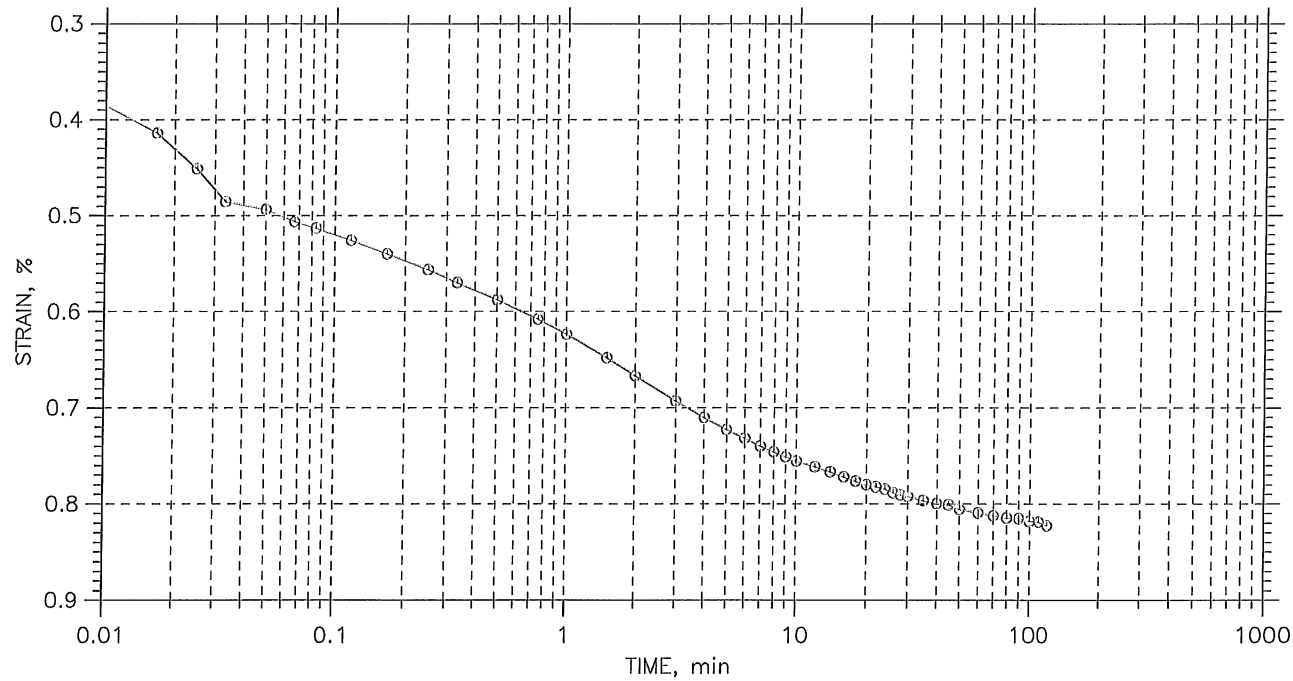
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

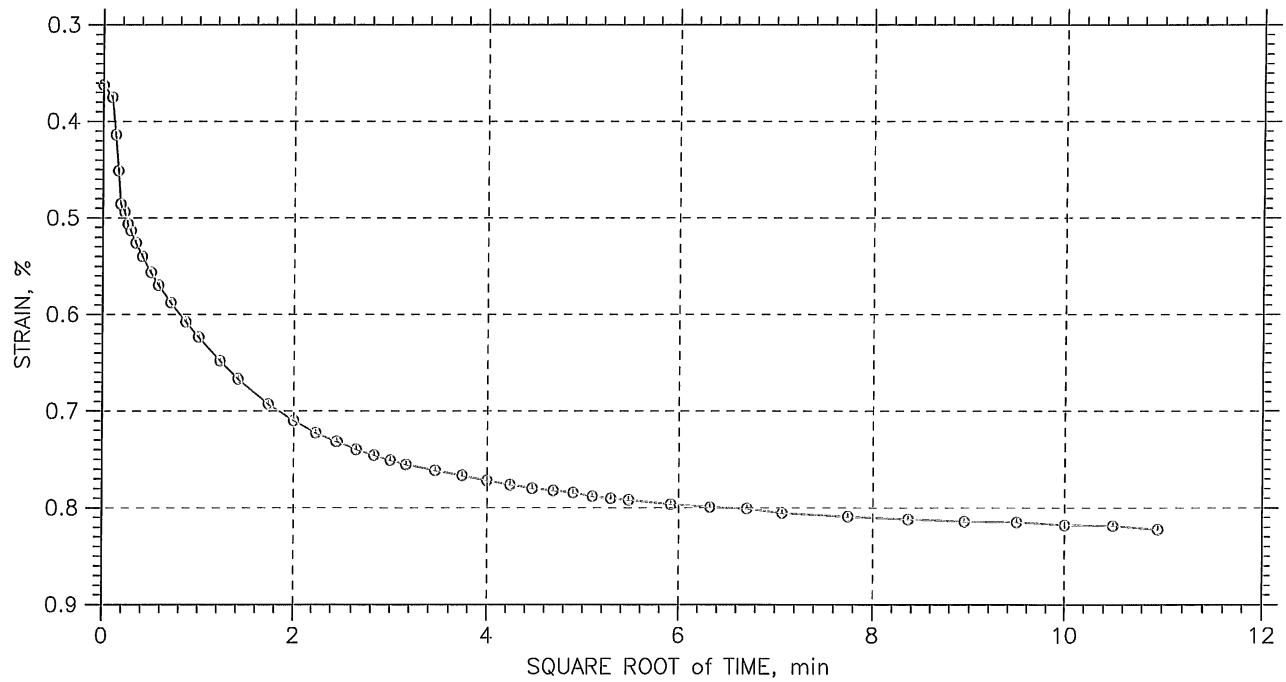
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 12

Stress: 0.25 tsf





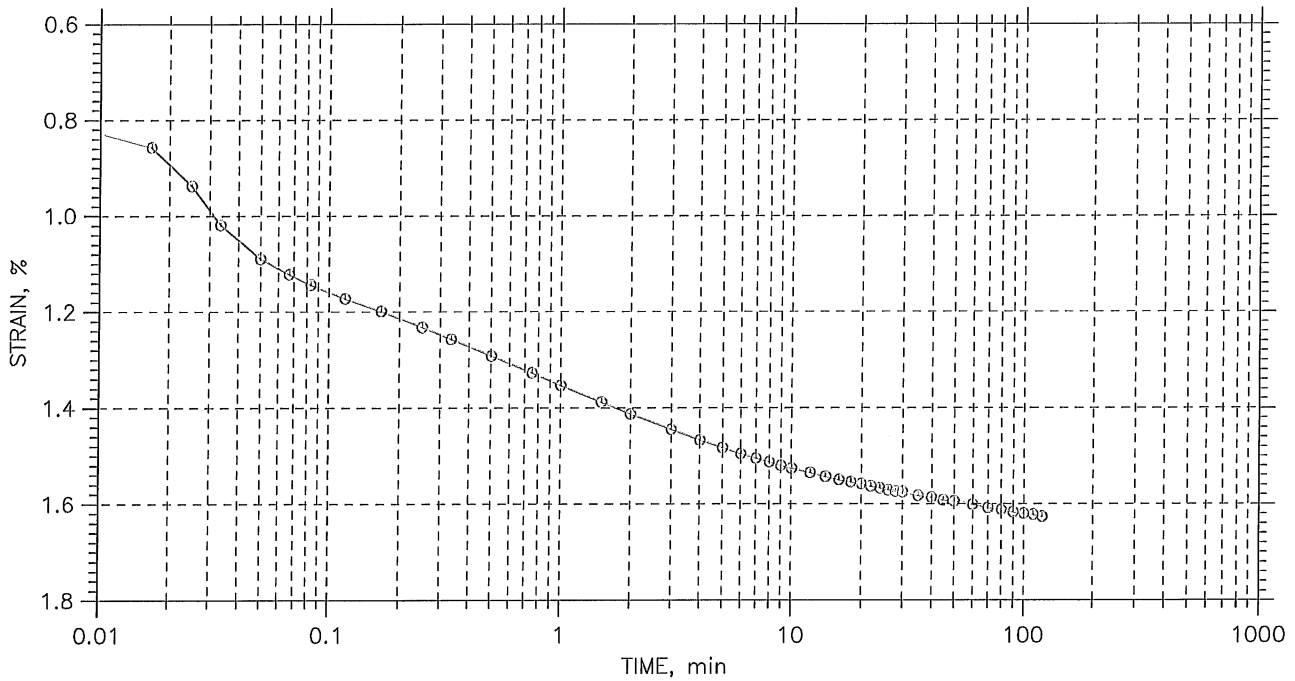
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

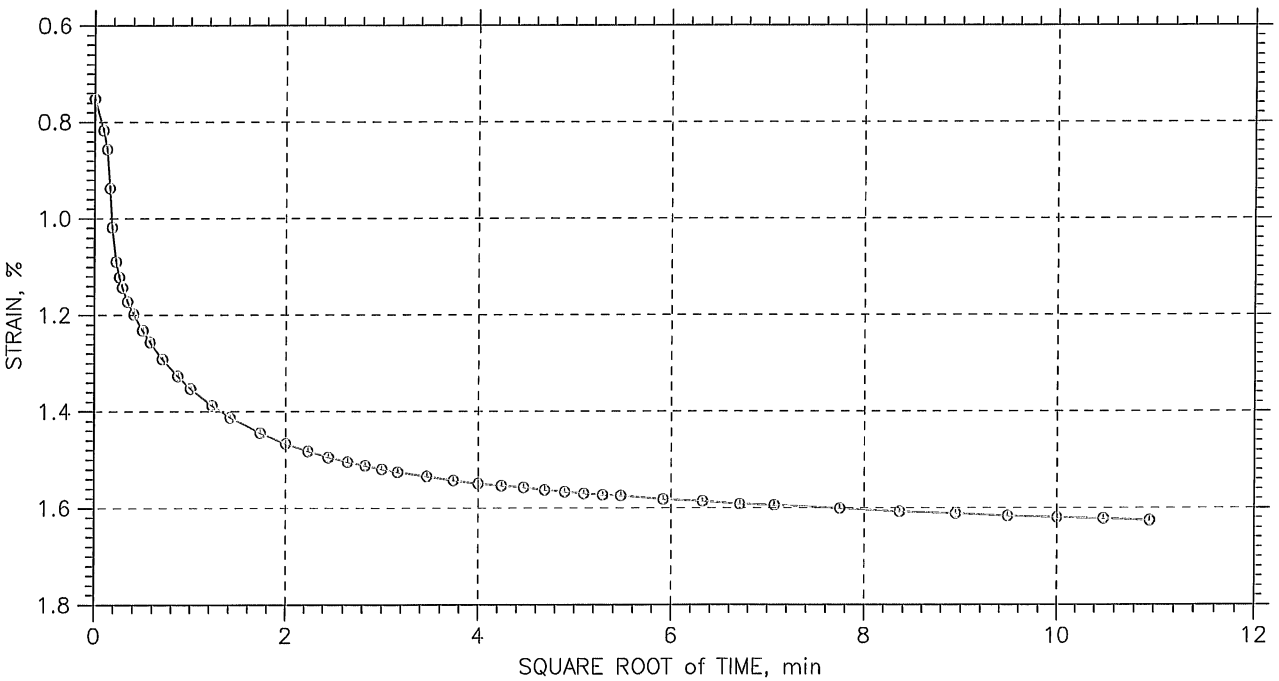
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 12

Stress: 0.5 tsf





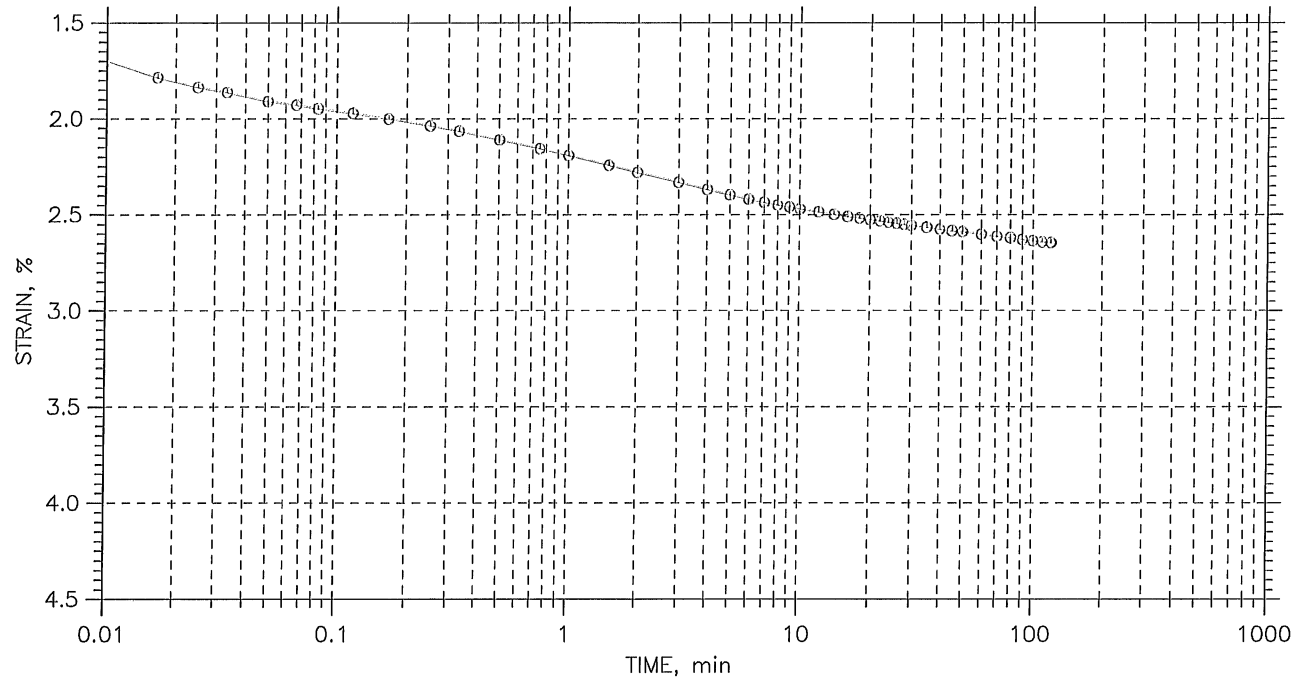
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

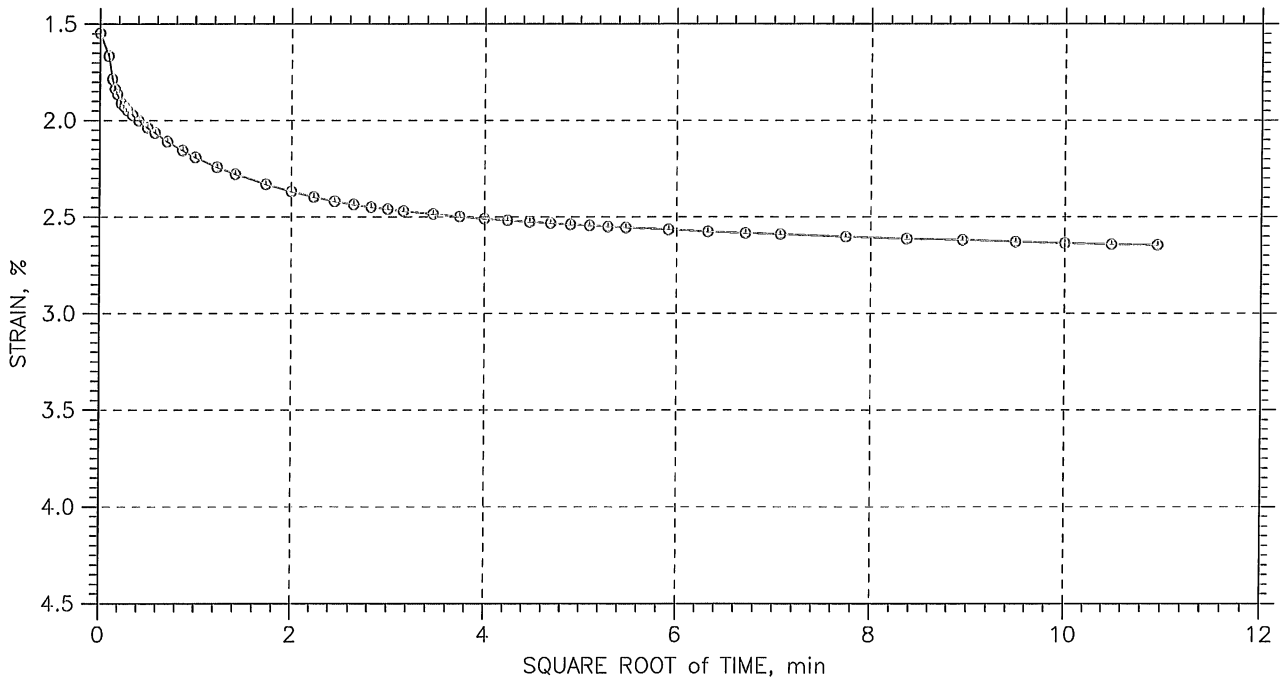
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 12

Stress: 1. tsf





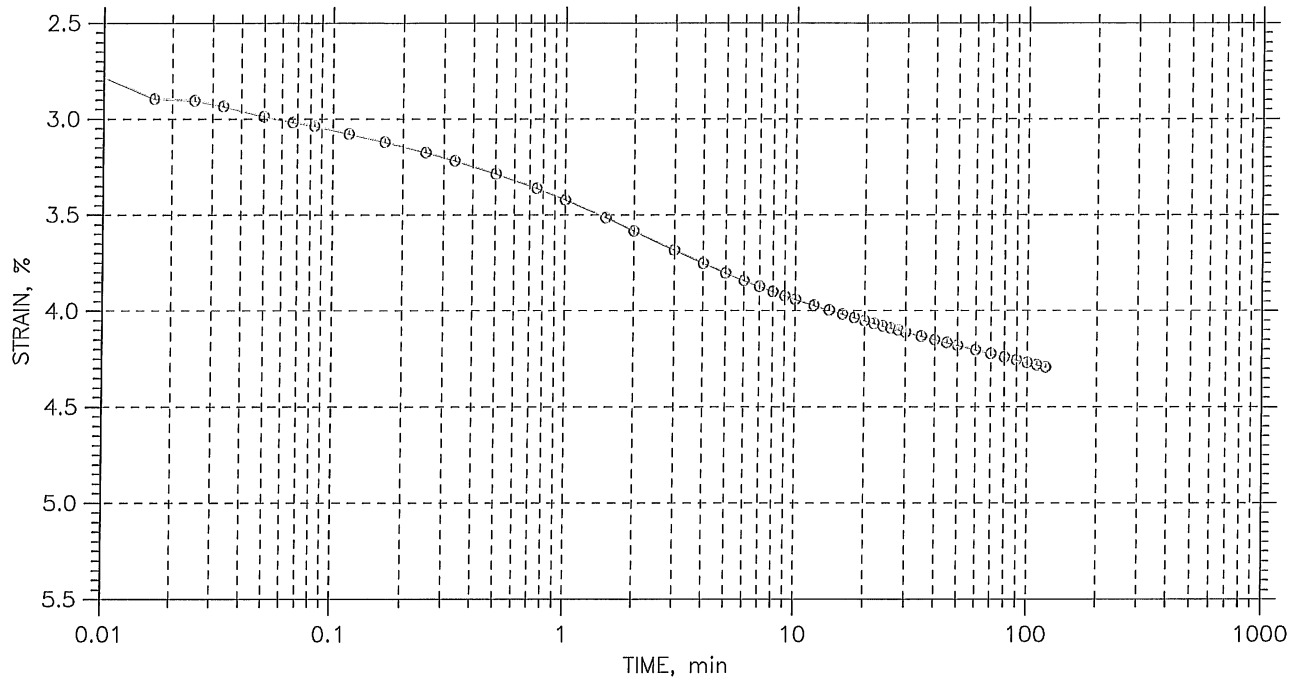
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

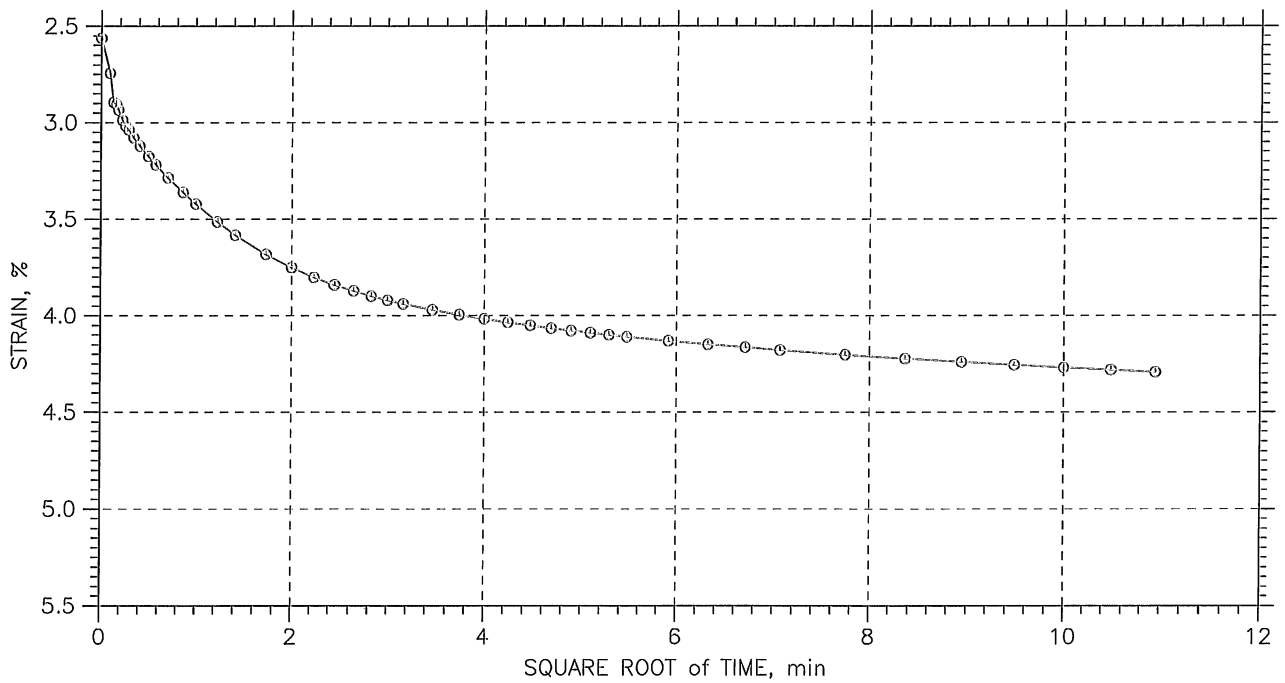
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 12

Stress: 2. tsf





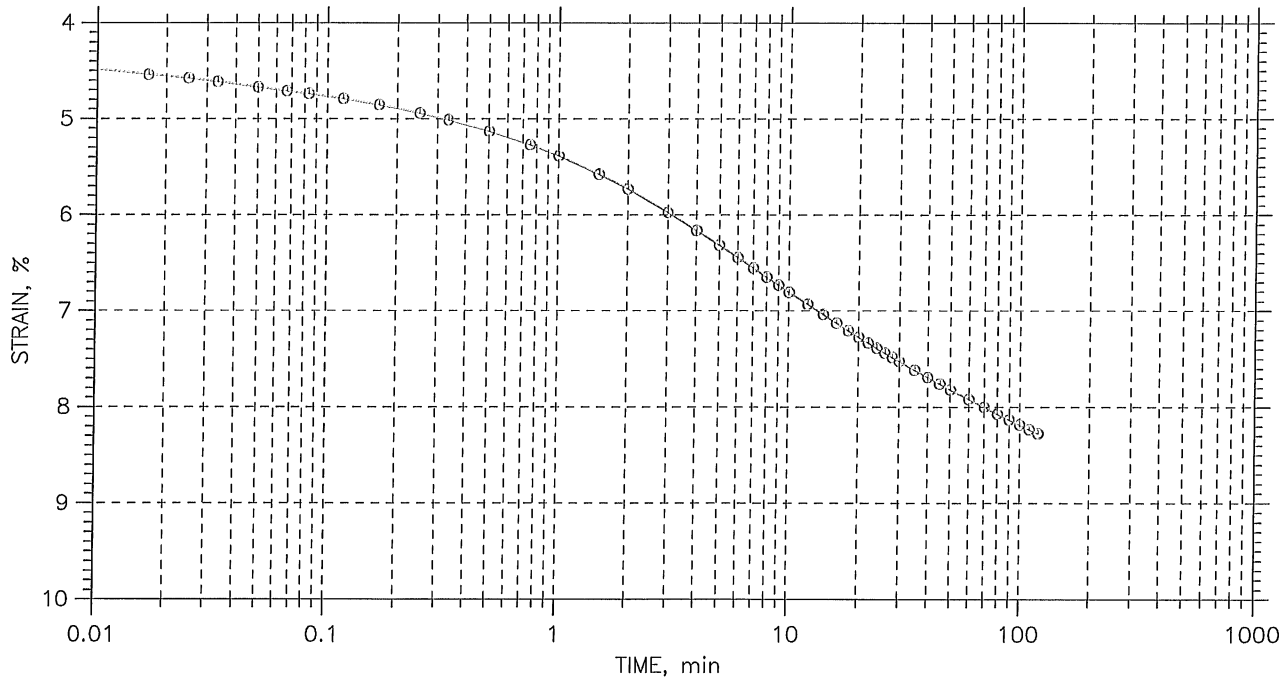
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

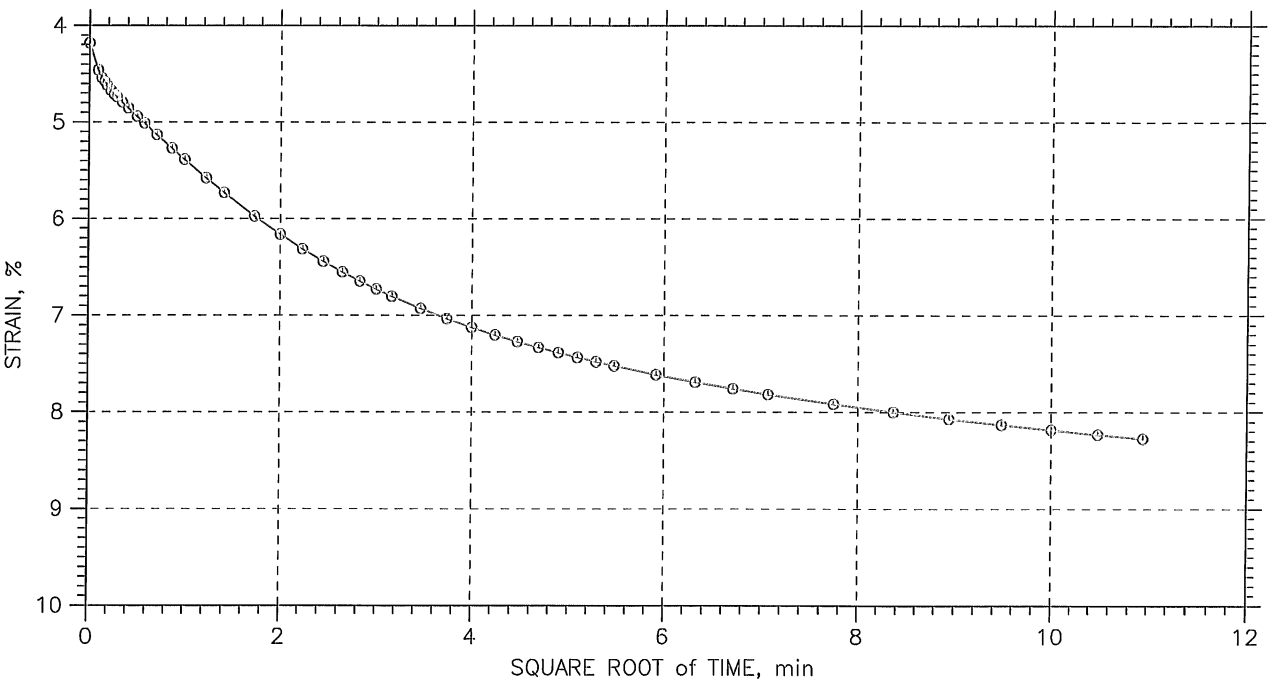
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 12

Stress: 4. tsf





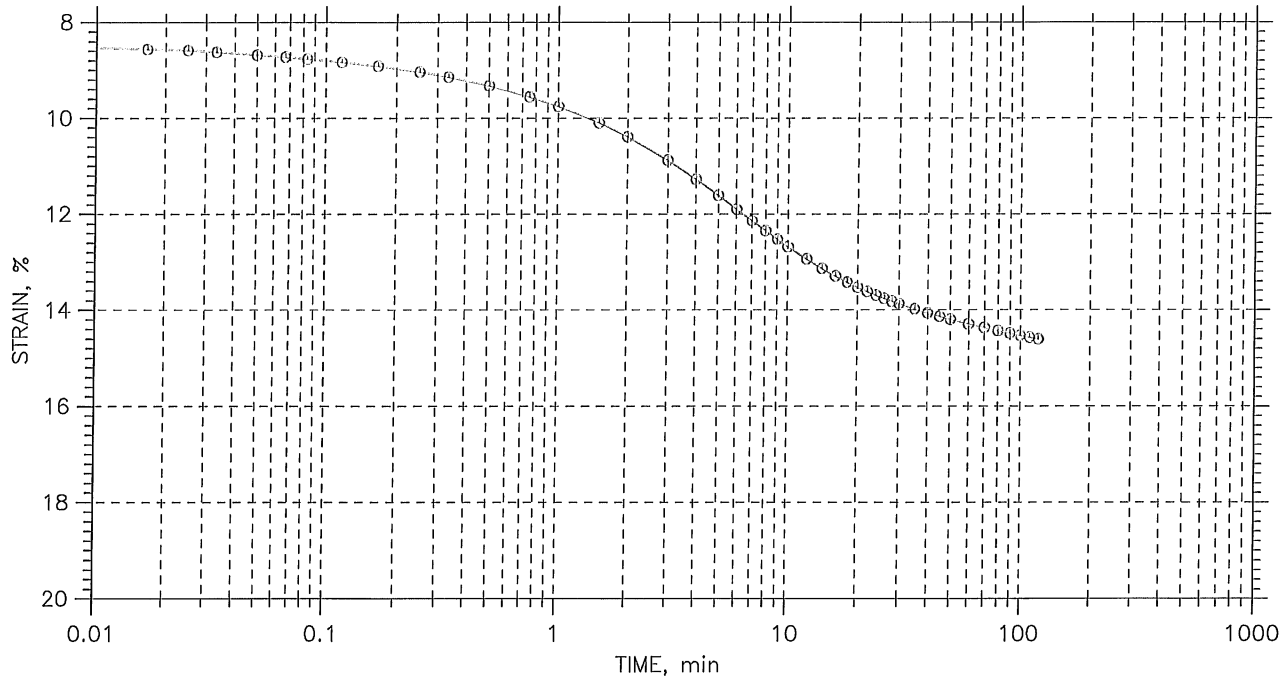
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

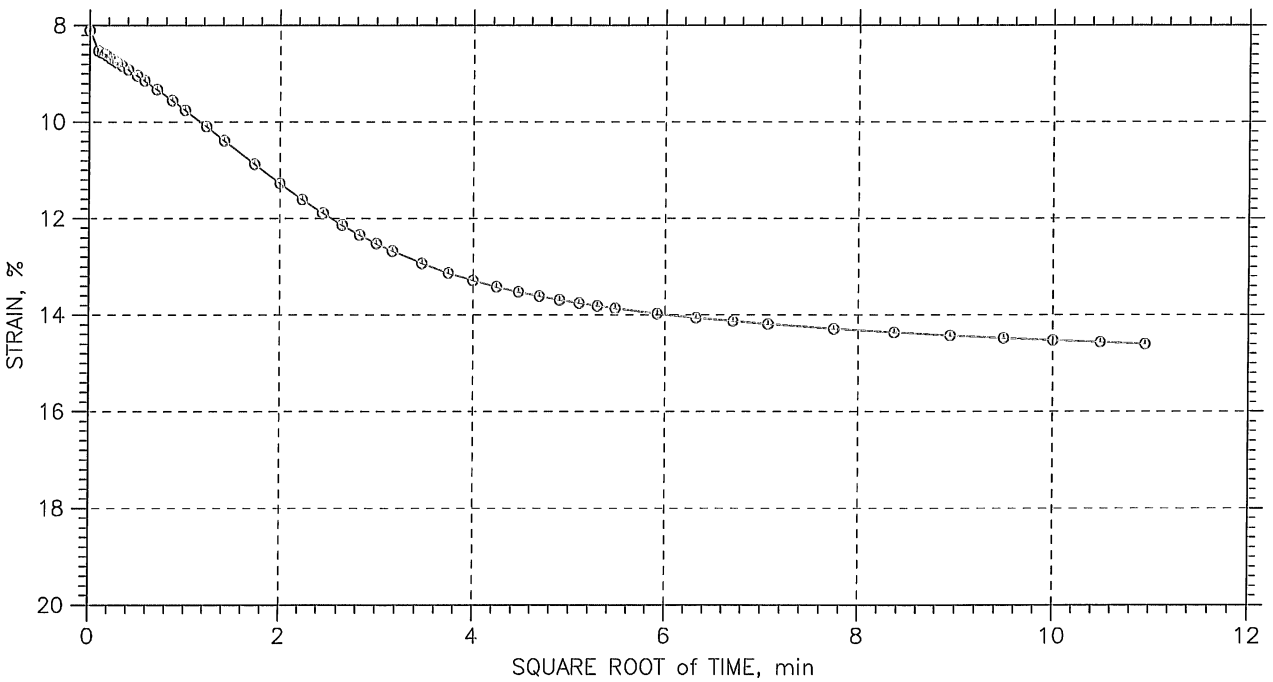
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 12

Stress: 8. tsf





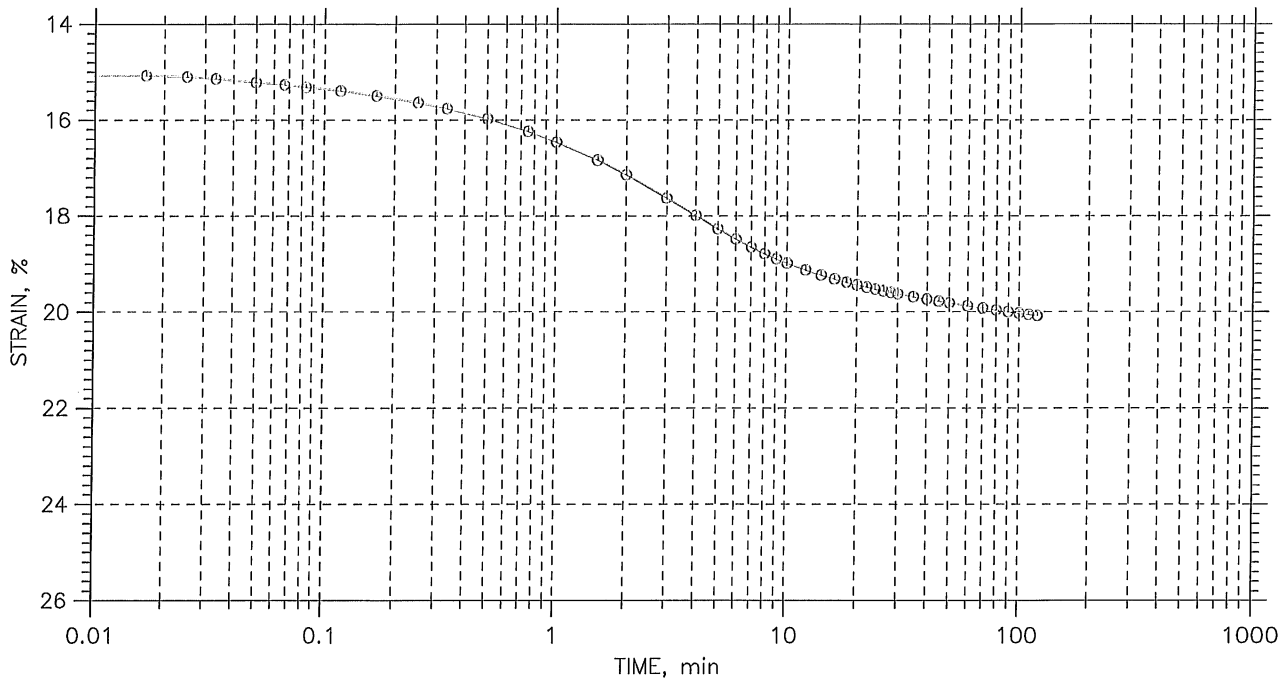
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

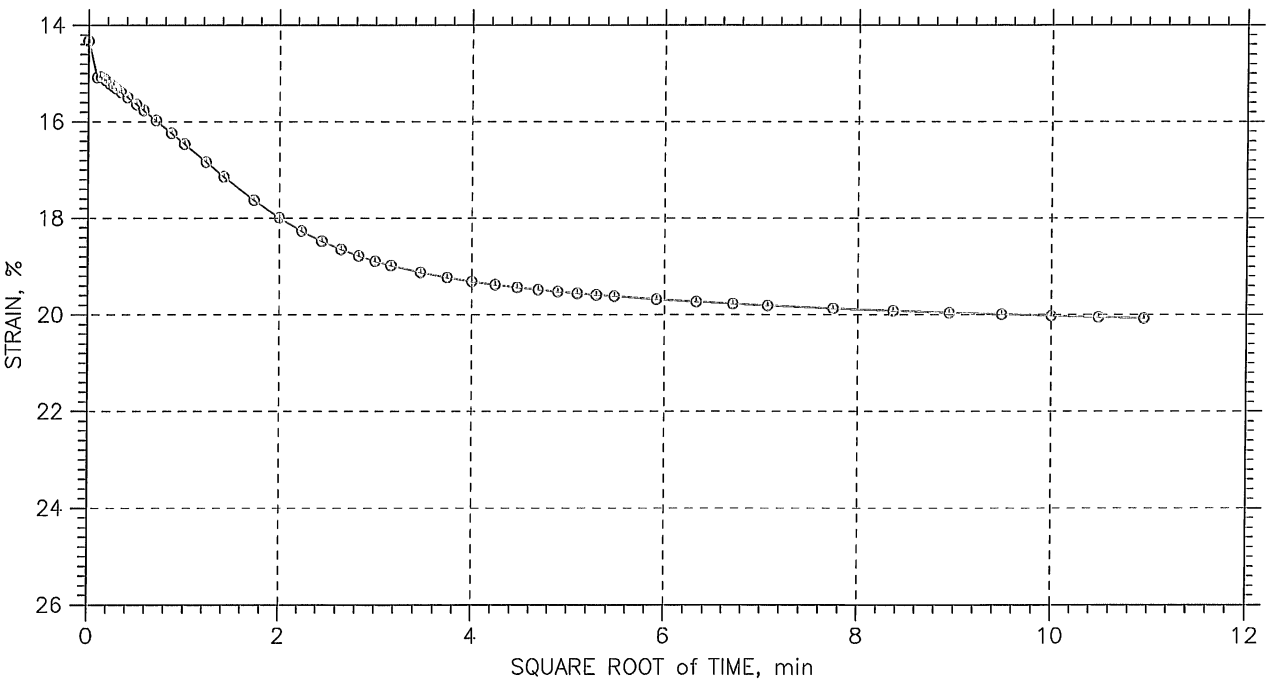
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 12

Stress: 16. tsf





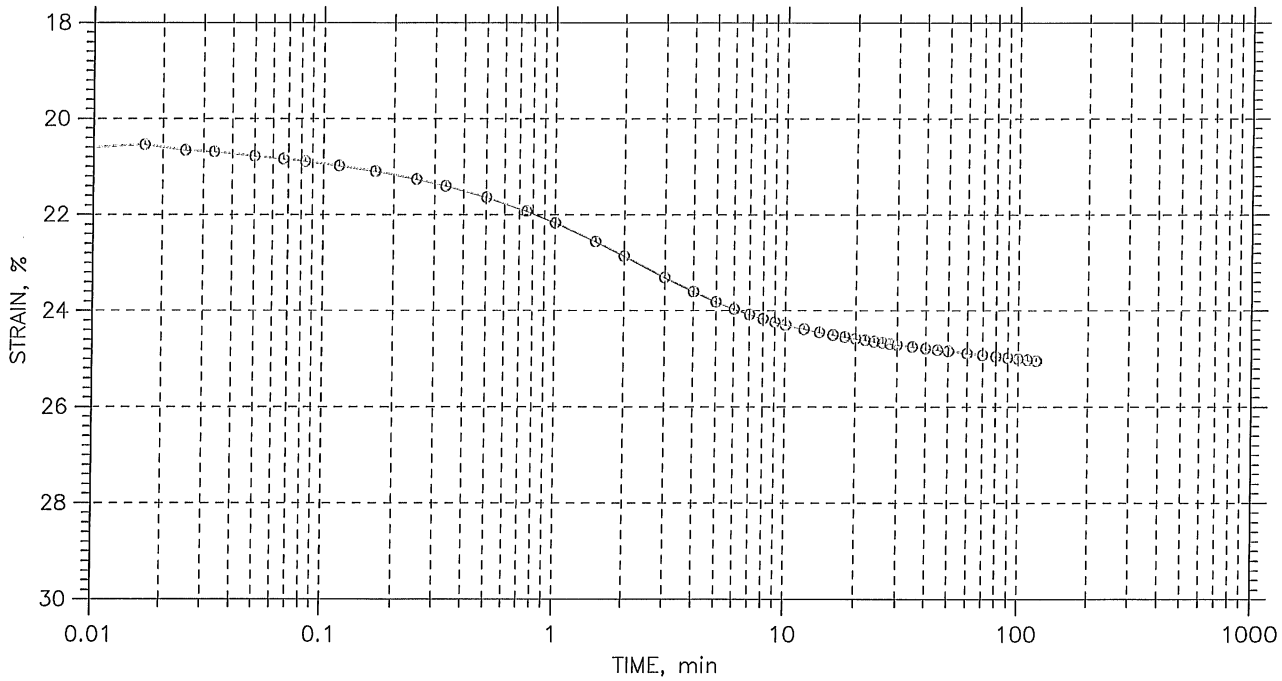
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

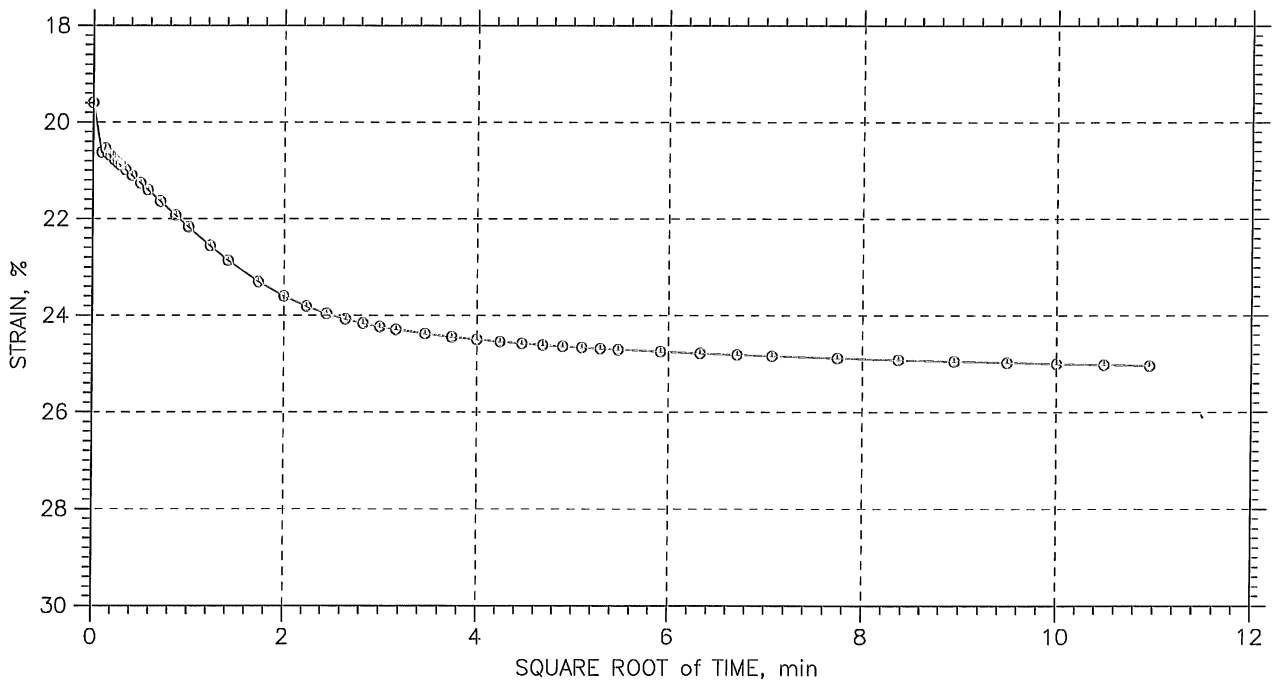
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 12

Stress: 32. tsf





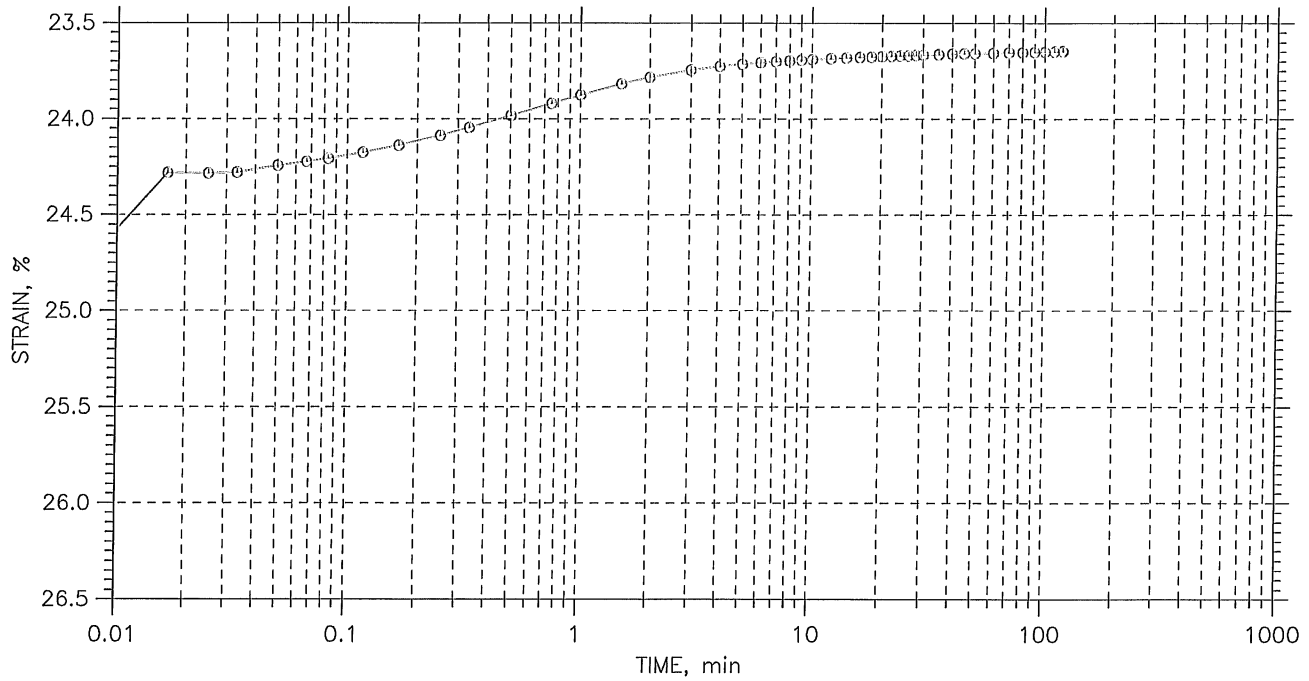
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

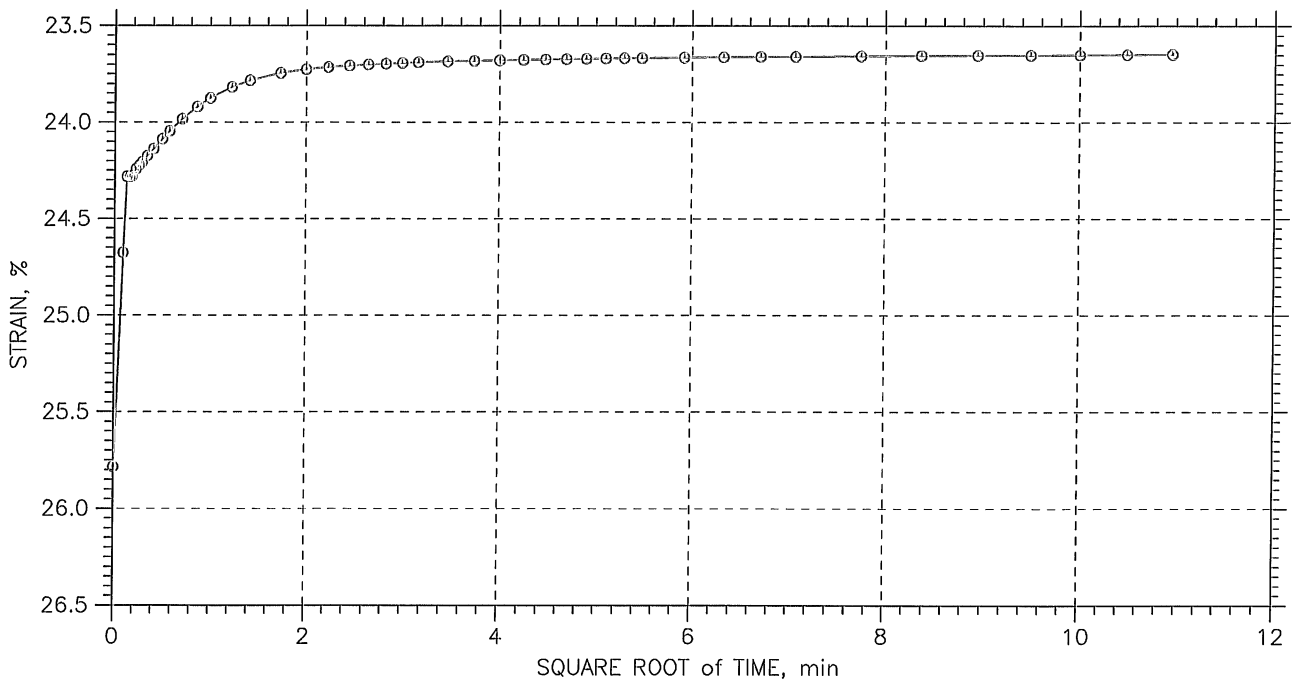
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 12

Stress: 8. tsf





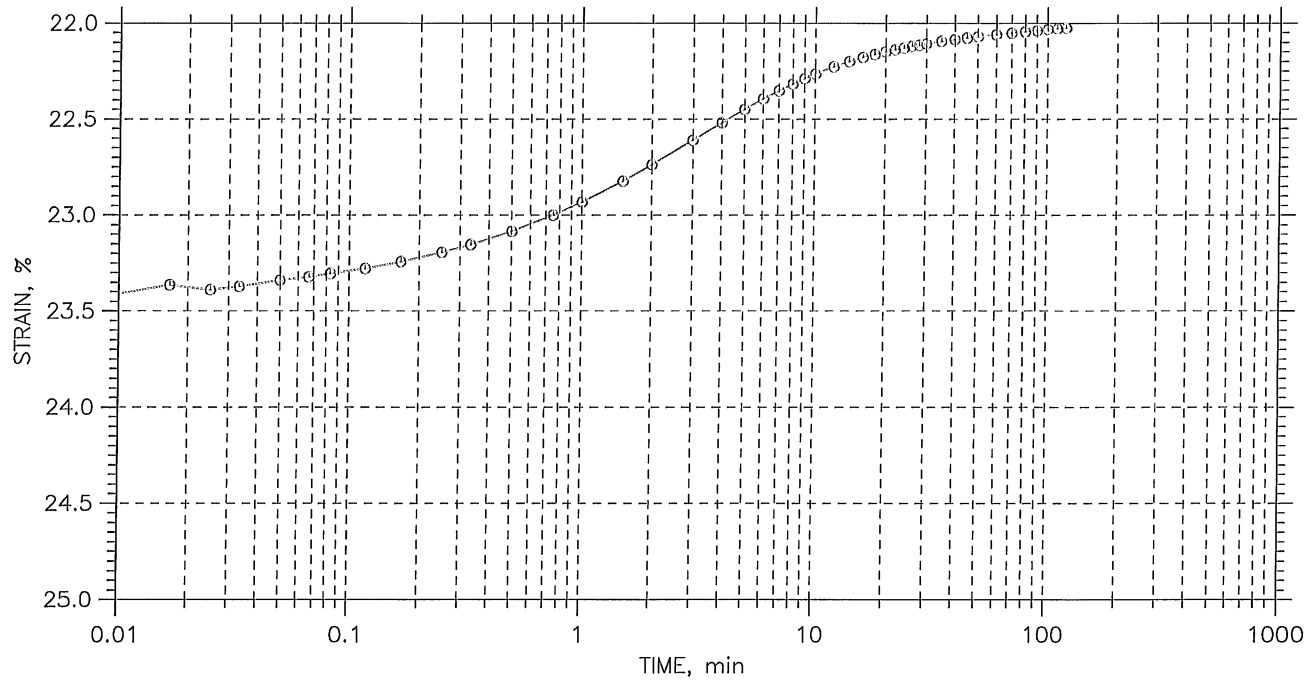
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

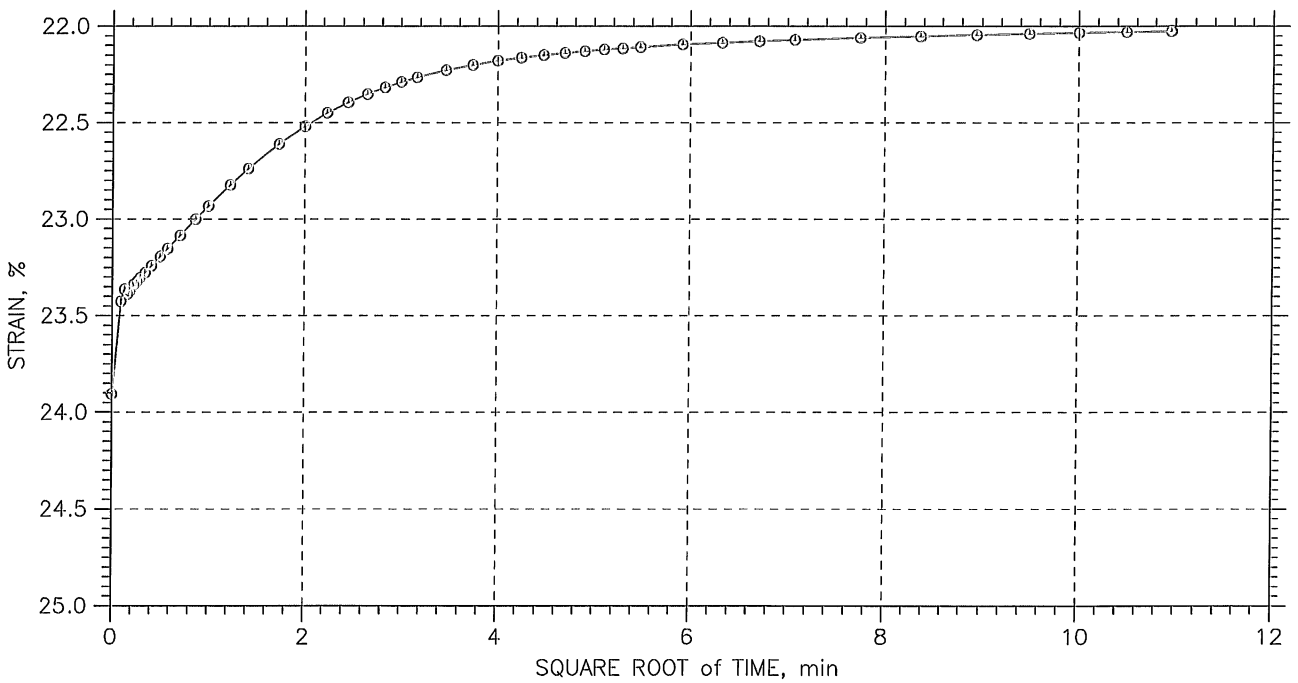
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 12

Stress: 2. tsf





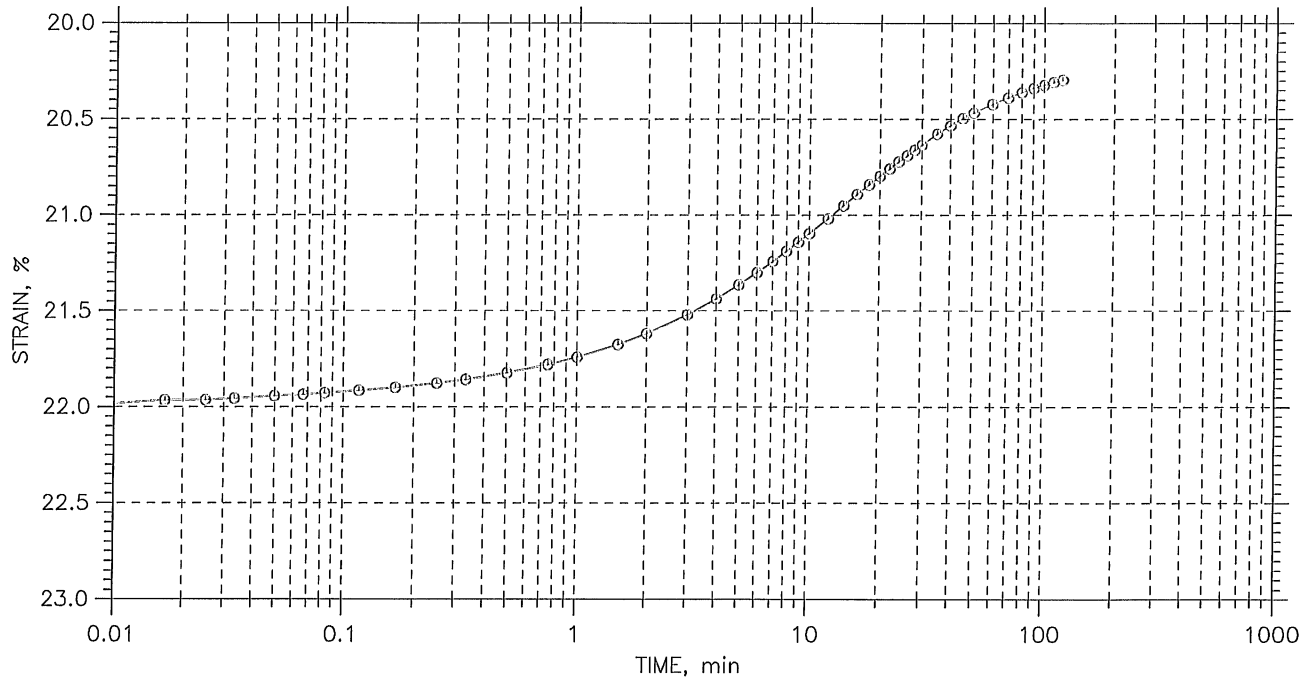
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

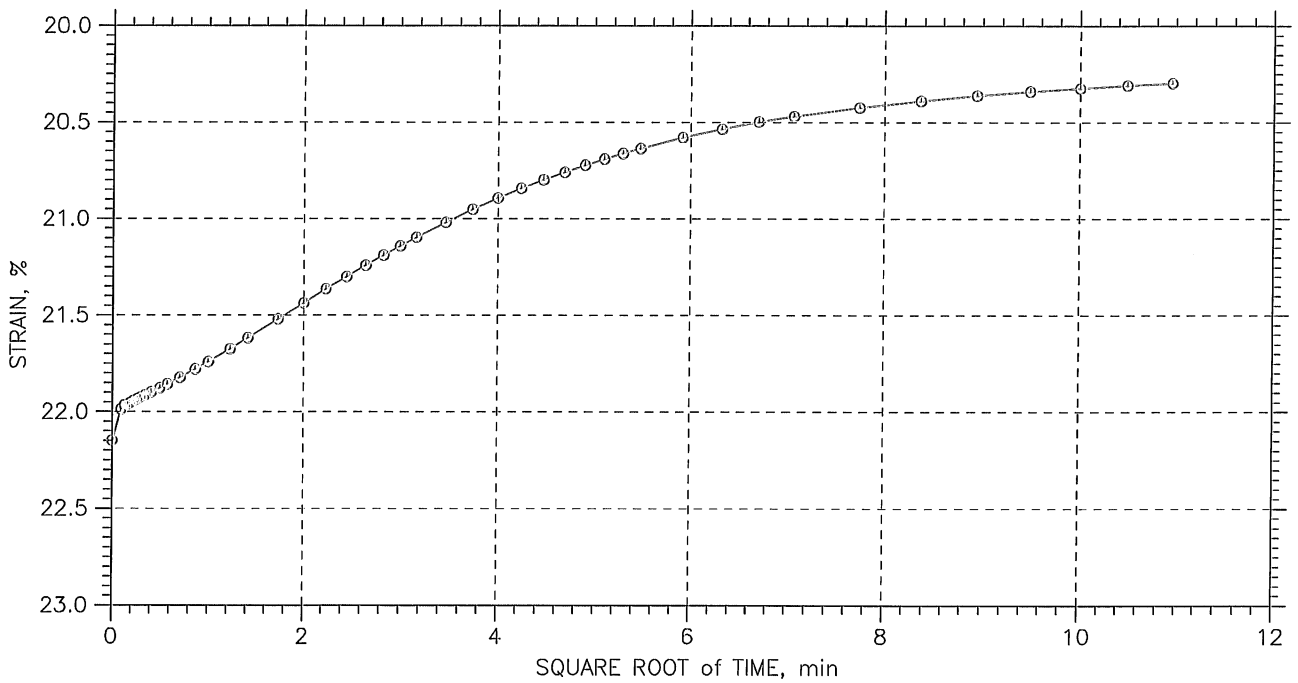
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 12

Stress: 0.5 tsf

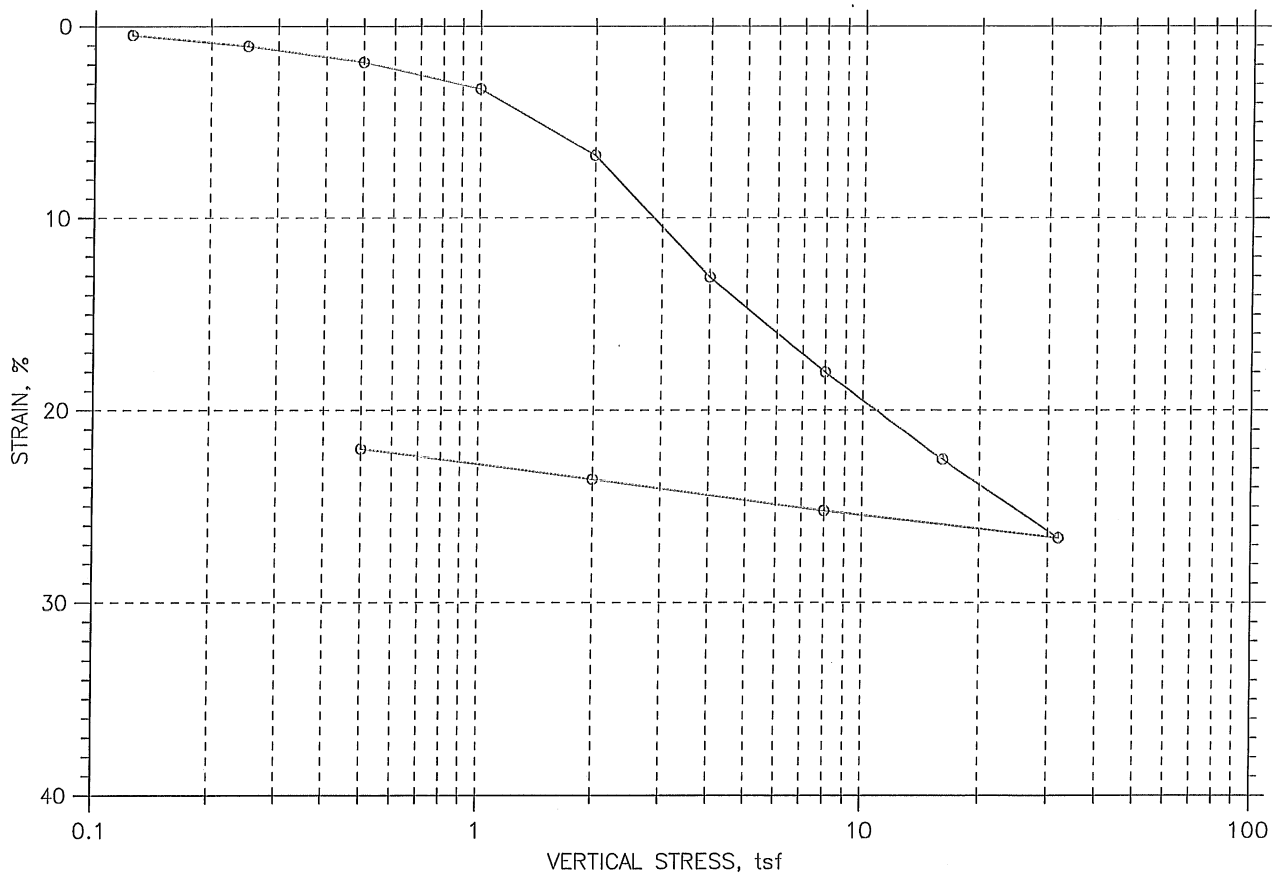


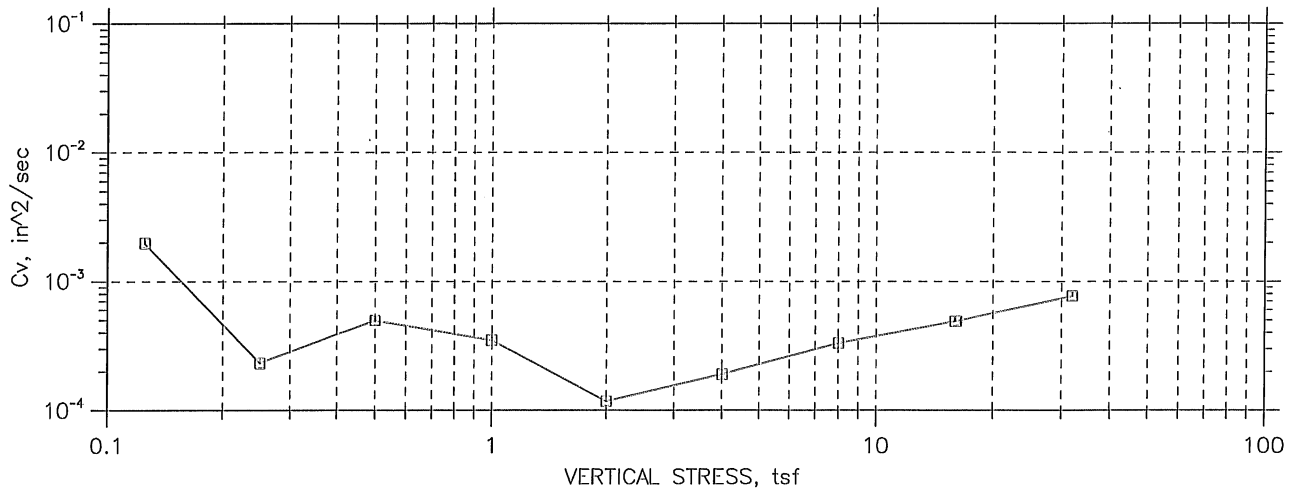


Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-12	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 06/16/05	Depth: 44-46 ft
	Test No.: C-1	Sample Type: Tube	Elevation: ---
	Description: Moist, gray clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

SUMMARY REPORT

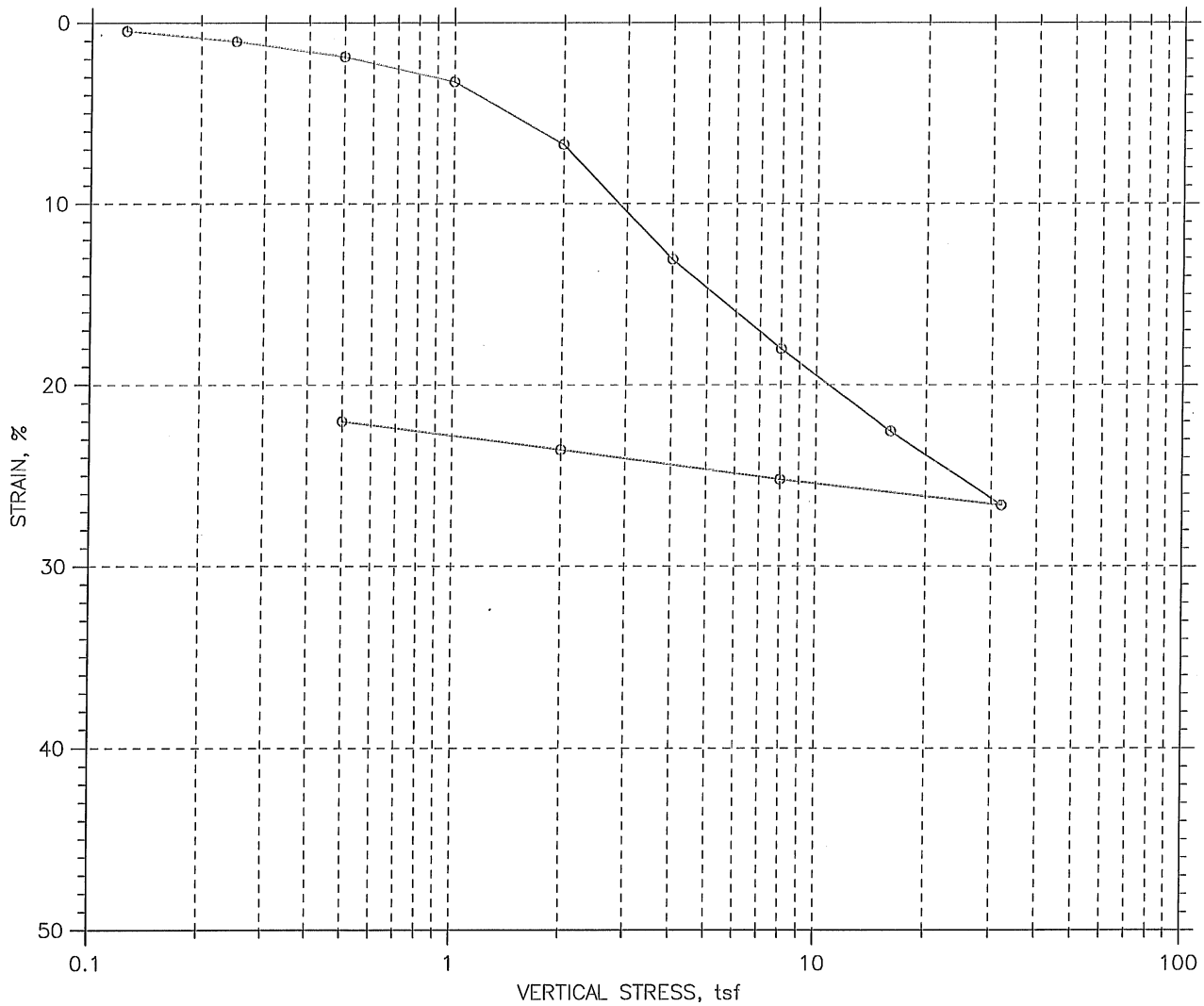




GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure: ---				Water Content, %	43.12	26.37
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	76.79	98.45
Compression Index: ---				Saturation, %	97.43	100.00
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.19	0.71
LL: 42	PL: 19	PI: 23	GS: 2.70			

GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-15A
Sample No.: U-1
Test No.: C-5

Location: Saco, ME
Tested By: md
Test Date: 12/27/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 10-12 ft
Elevation: ---

Soil Description: Moist, olive brown clay
Remarks: ---

Estimated Specific Gravity: 2.70
Initial Void Ratio: 1.19
Final Void Ratio: 0.71

Liquid Limit: 42
Plastic Limit: 19
Plasticity Index: 23

Initial Height: 1.00 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	1393	RING		2859C
Wt. Container + Wet Soil, gm	146.72	350.67	334.1	132.75
Wt. Container + Dry Soil, gm	106.07	308.01	308.01	106.7
Wt. Container, gm	8.53	209.06	209.06	7.91
Wt. Dry Soil, gm	97.54	98.948	98.948	98.79
Water Content, %	41.68	43.12	26.37	26.37
Void Ratio	---	1.19	0.71	---
Degree of Saturation, %	---	97.43	100.00	---
Dry Unit Weight, pcf	---	76.792	98.453	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-15A
Sample No.: U-1
Test No.: C-5

Location: Saco, ME
Tested By: md
Test Date: 12/27/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 10-12 ft
Elevation: ---

Soil Description: Moist, olive brown clay
Remarks: ---

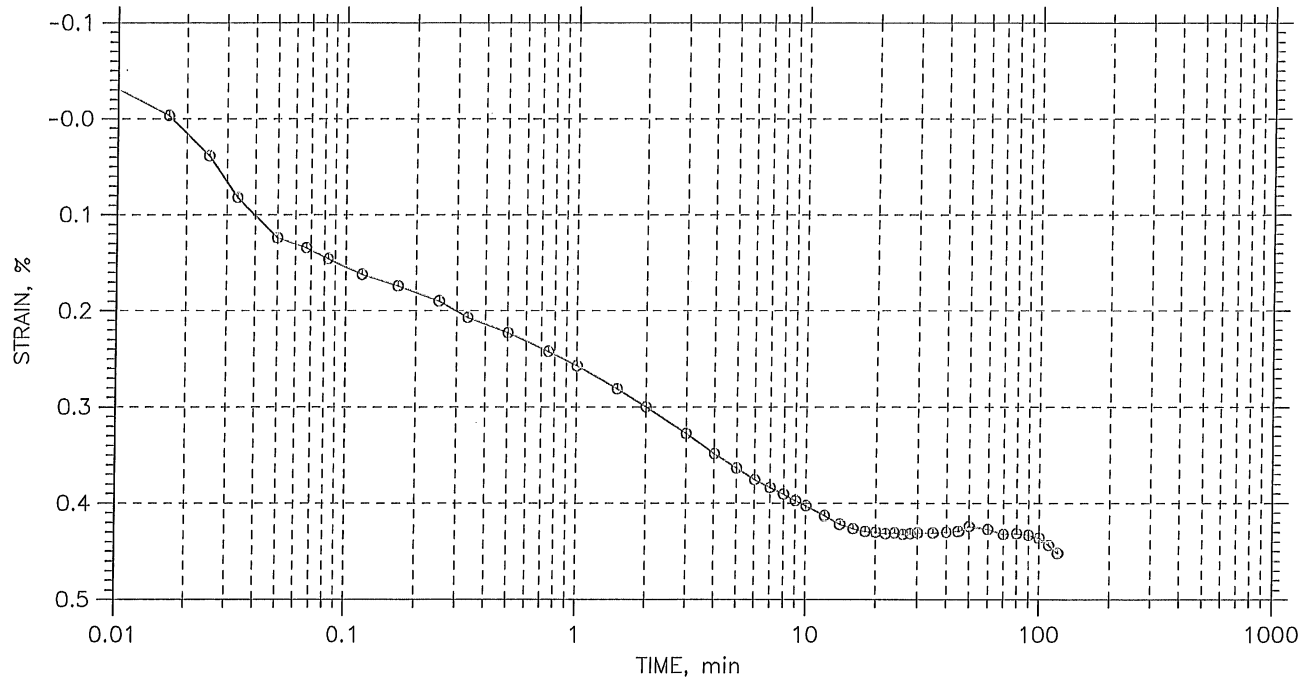
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.125	0.004516	1.185	0.45	0.4	0.0	1.98e-003	0.00e+000	1.98e-003
2	0.25	0.01031	1.172	1.03	3.5	0.0	2.33e-004	0.00e+000	2.33e-004
3	0.5	0.01875	1.154	1.88	2.1	1.1	3.75e-004	7.40e-004	4.98e-004
4	1	0.03261	1.123	3.26	2.7	1.8	2.93e-004	4.36e-004	3.51e-004
5	2	0.0672	1.047	6.72	6.3	0.0	1.18e-004	0.00e+000	1.18e-004
6	4	0.1306	0.908	13.06	3.2	3.8	2.09e-004	1.75e-004	1.91e-004
7	8	0.1801	0.799	18.01	1.4	2.1	4.21e-004	2.74e-004	3.32e-004
8	16	0.2255	0.700	22.55	0.9	1.2	5.61e-004	4.37e-004	4.91e-004
9	32	0.2663	0.610	26.63	0.5	0.7	9.28e-004	6.56e-004	7.69e-004
10	8	0.2521	0.641	25.21	0.0	0.0	4.65e-002	4.49e-002	4.57e-002
11	2	0.2358	0.677	23.58	0.7	0.0	6.55e-004	0.00e+000	6.55e-004
12	0.5	0.22	0.712	22.00	3.2	3.8	1.51e-004	1.28e-004	1.39e-004

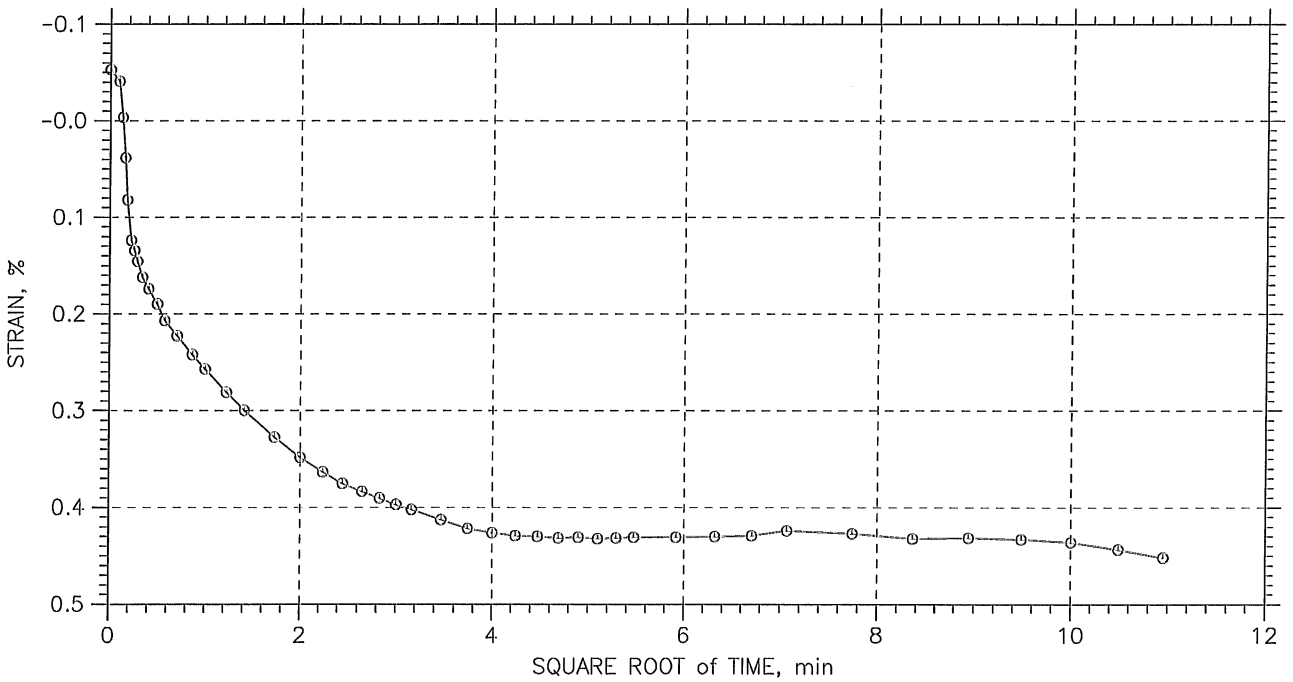
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 12

Stress: 0.125 tsf





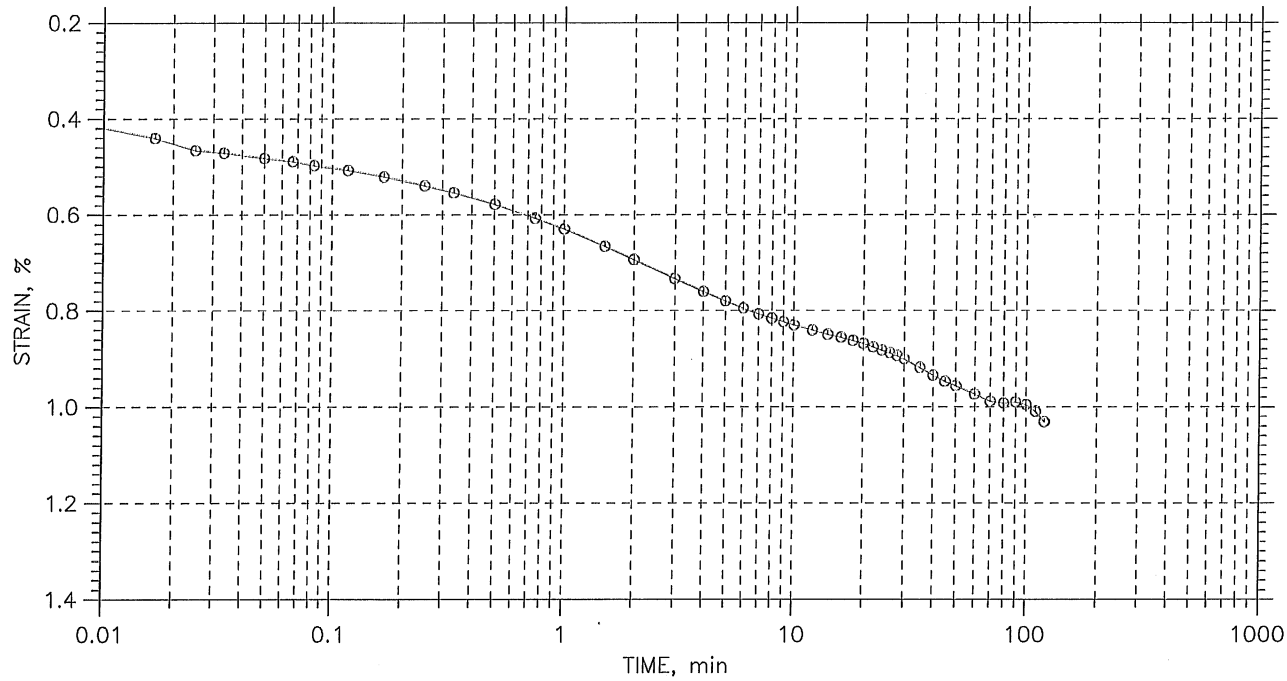
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

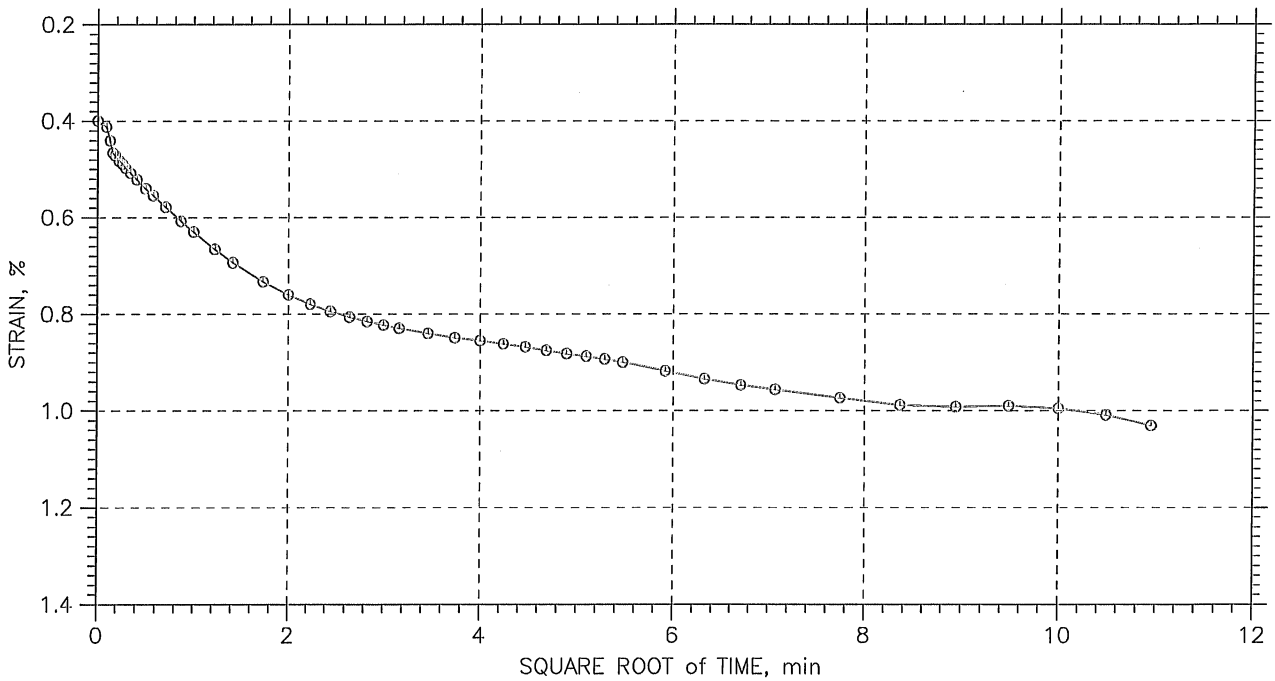
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 12

Stress: 0.25 tsf





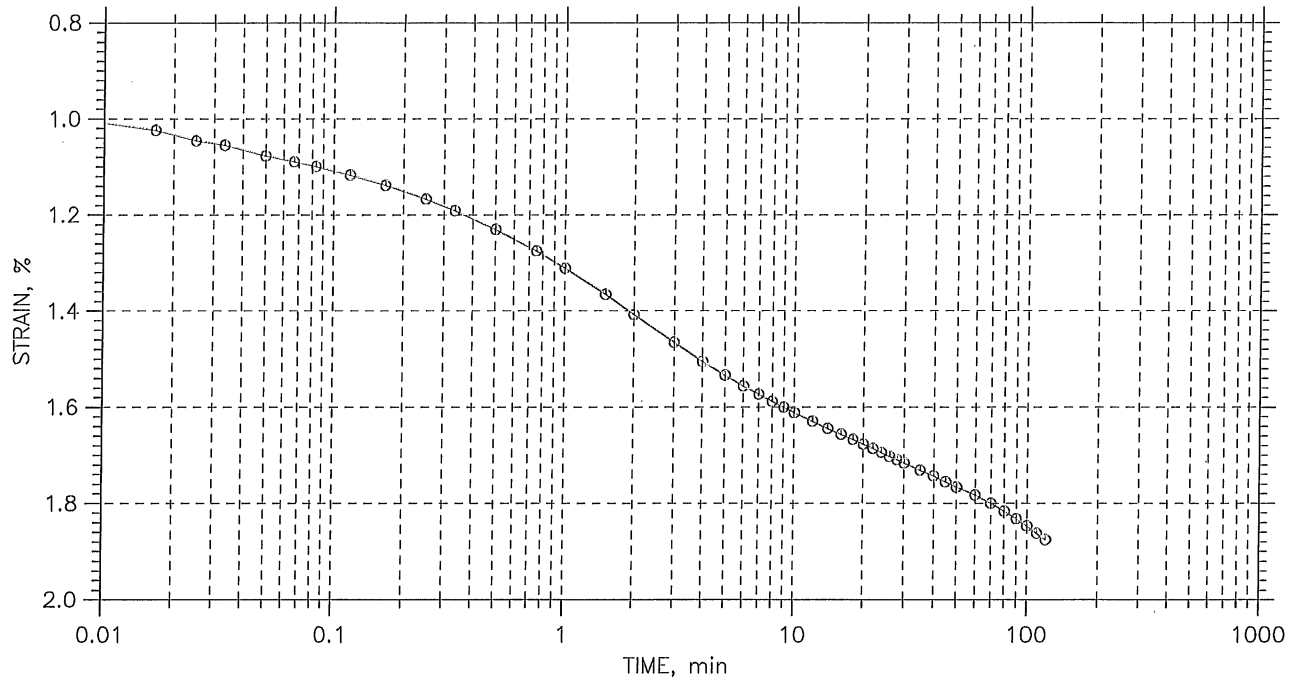
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

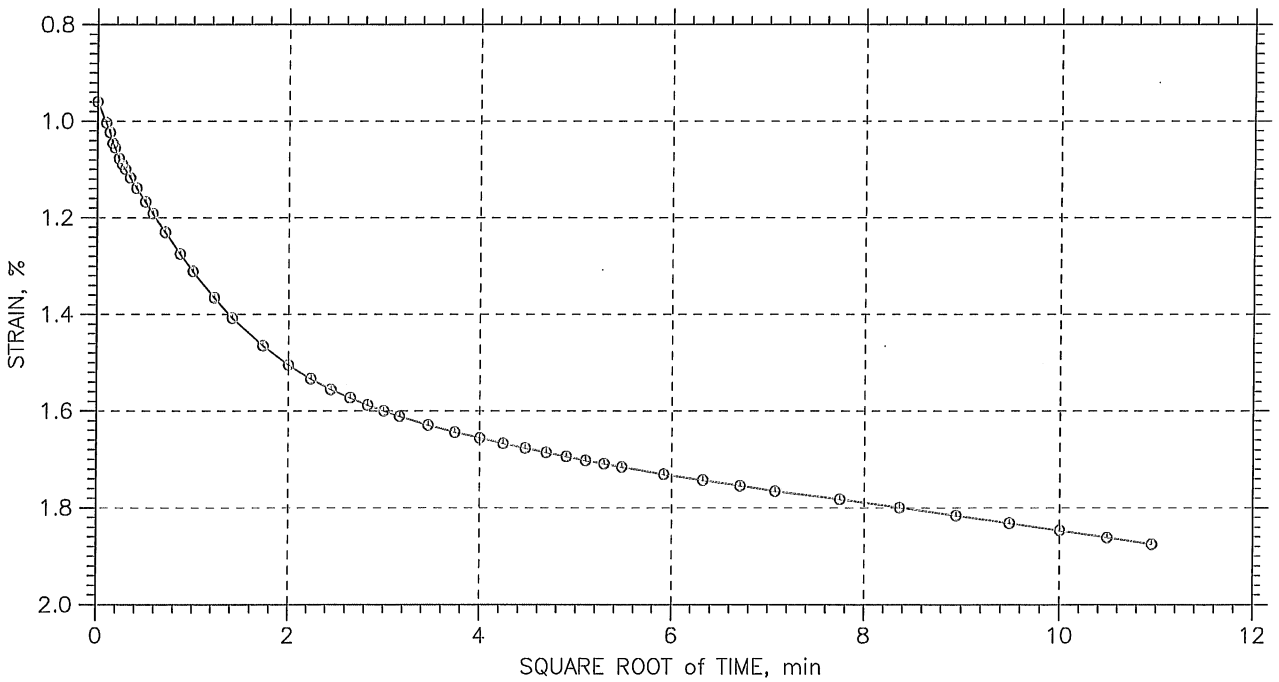
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 12

Stress: 0.5 tsf





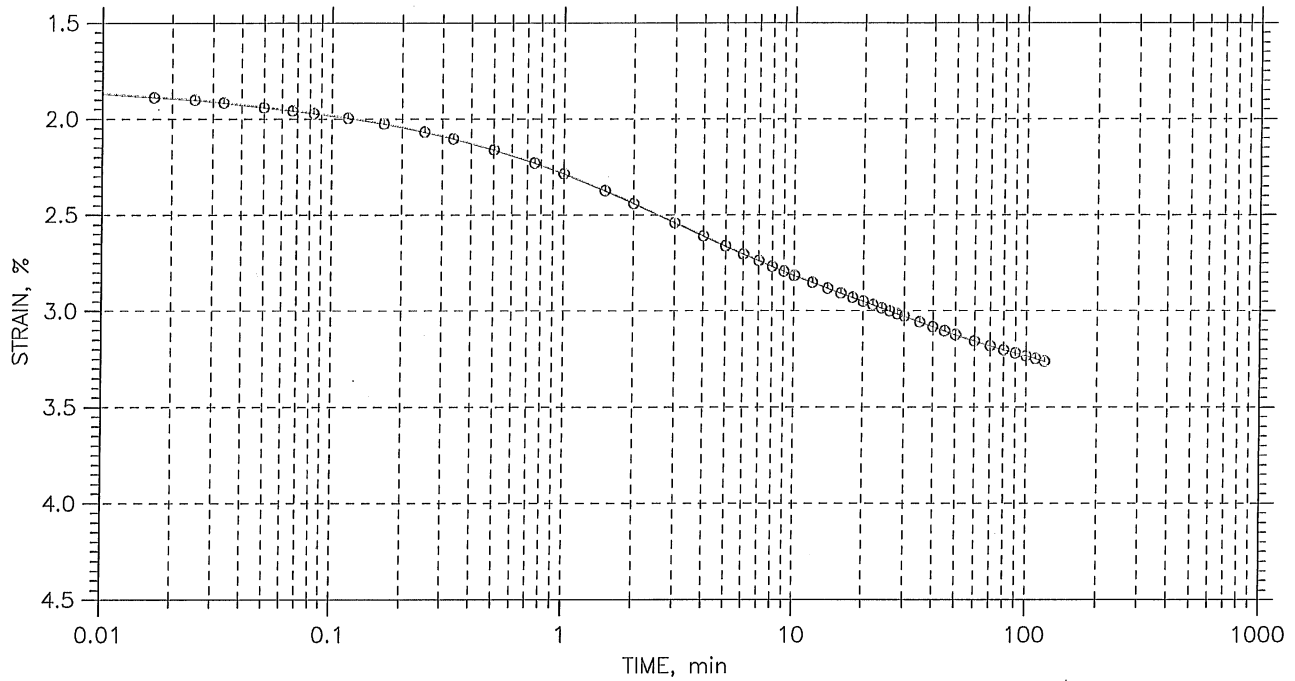
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

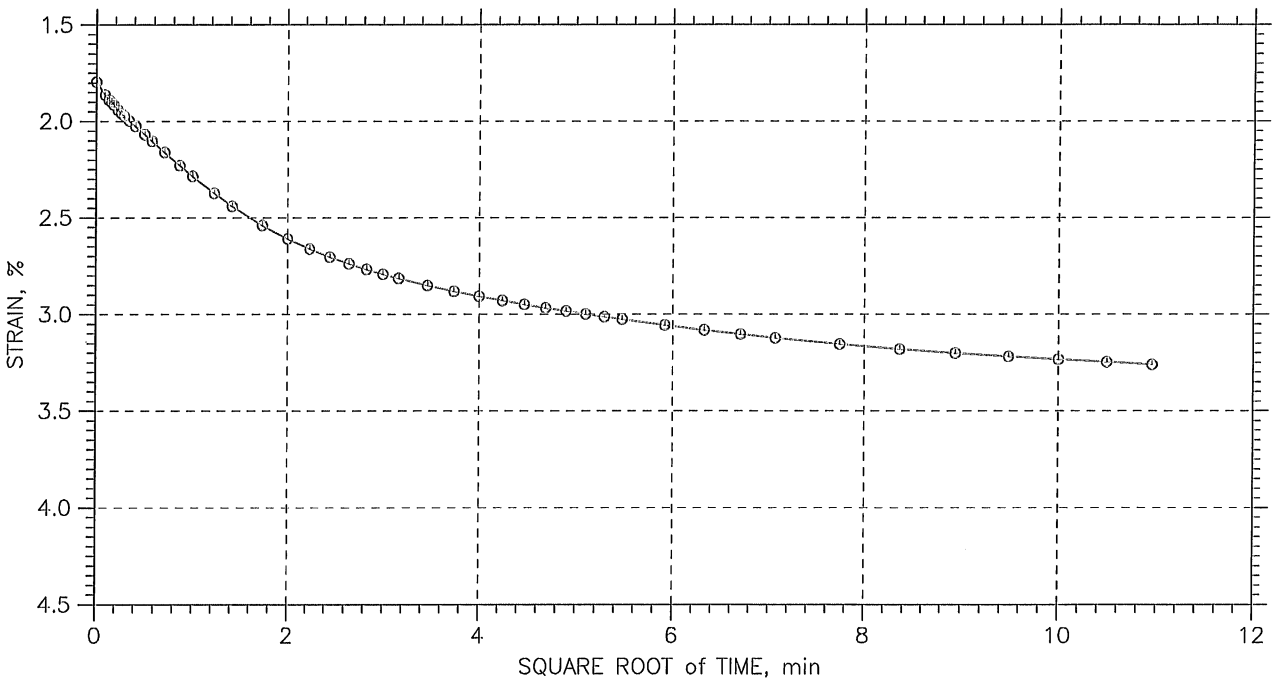
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 12

Stress: 1. tsf





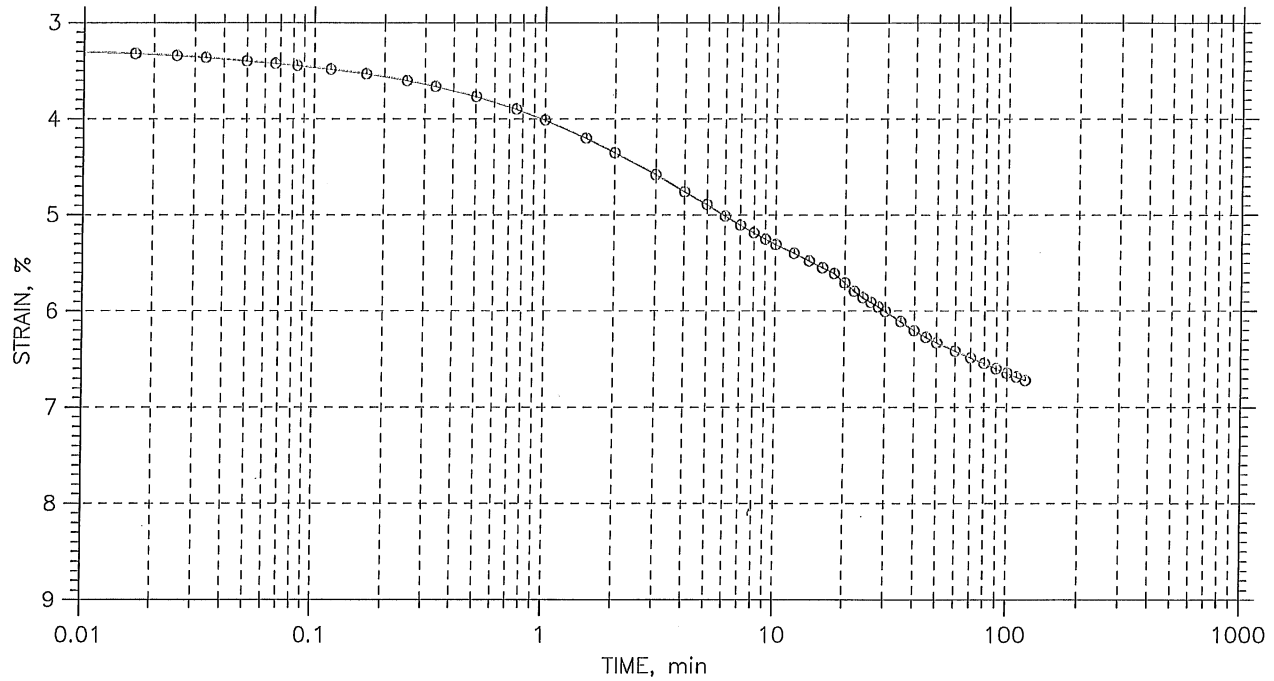
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

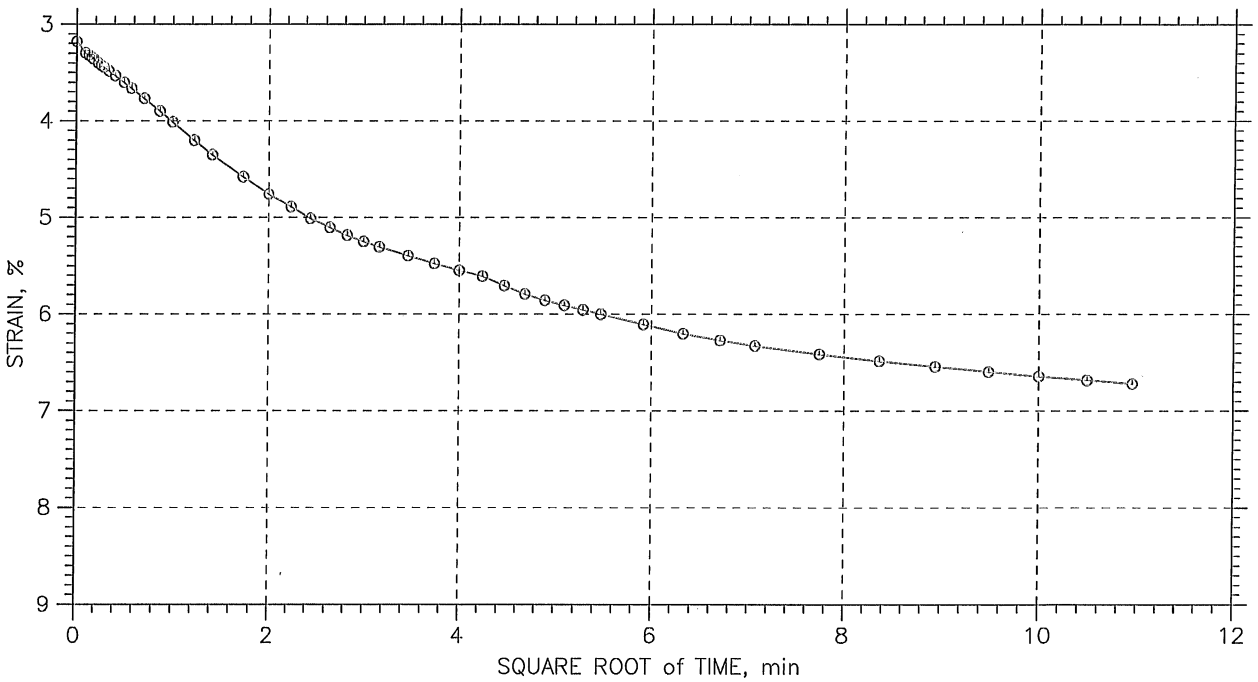
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 12

Stress: 2. tsf





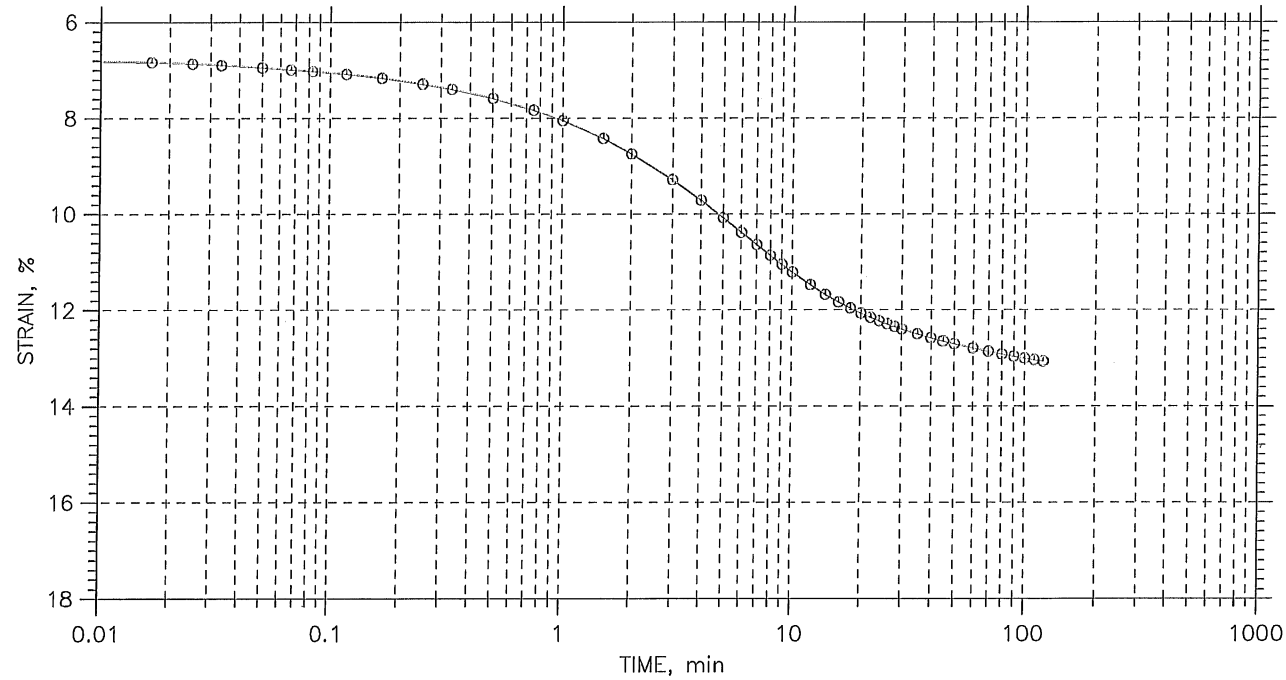
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

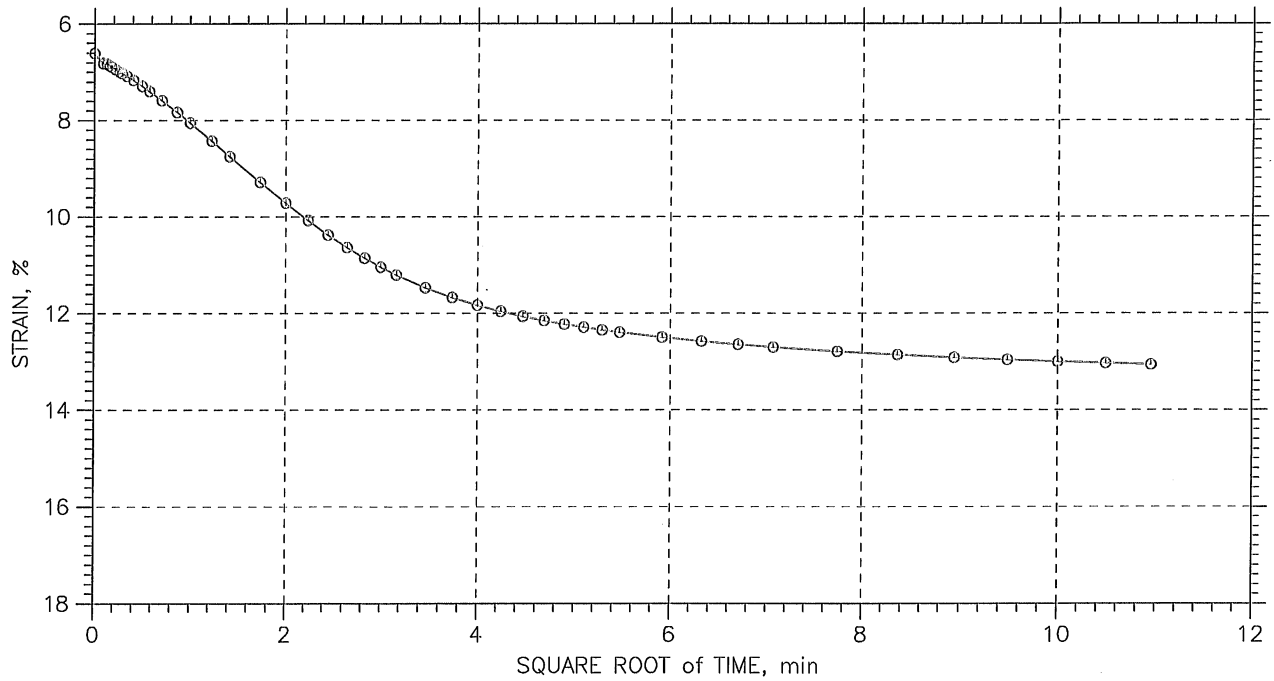
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 12

Stress: 4. tsf





GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

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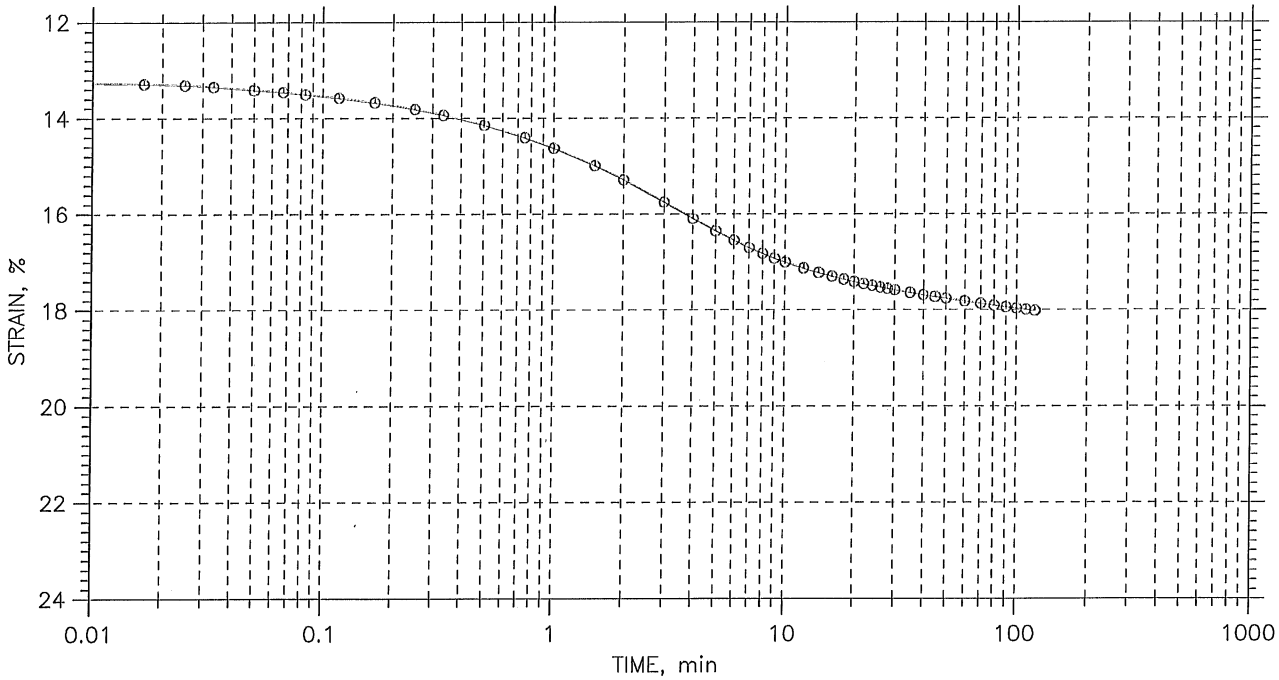
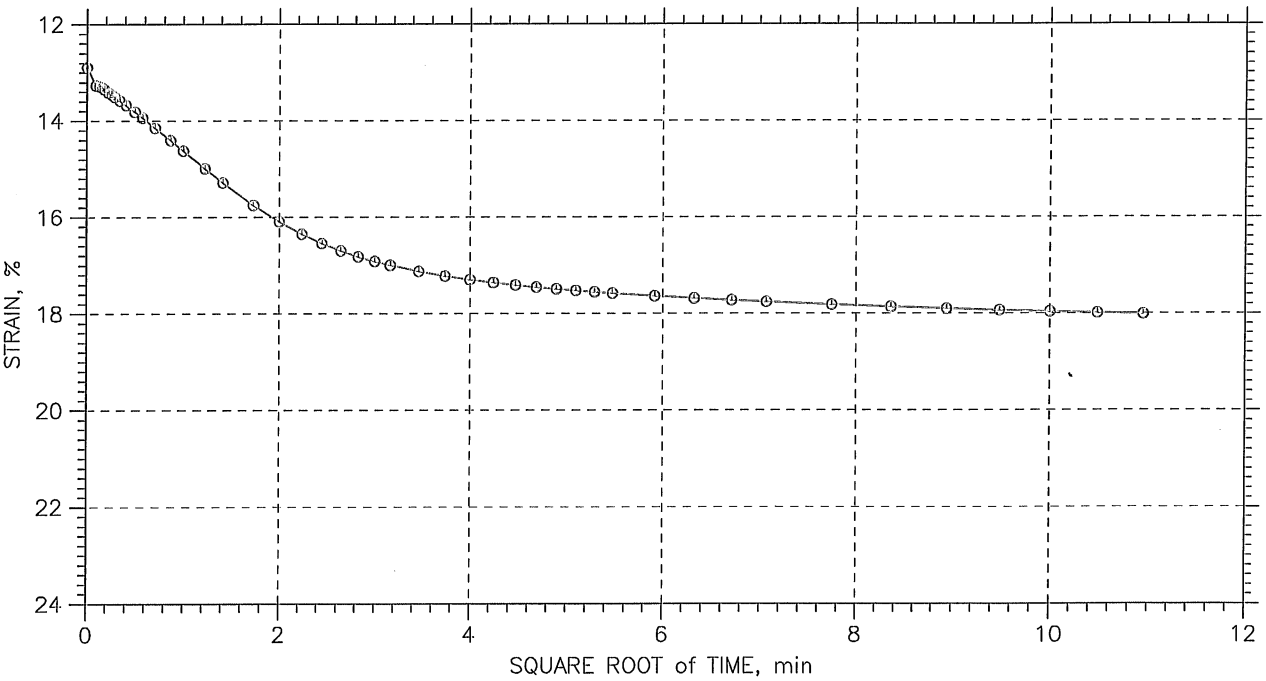
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 12

Stress: 8. tsf





Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

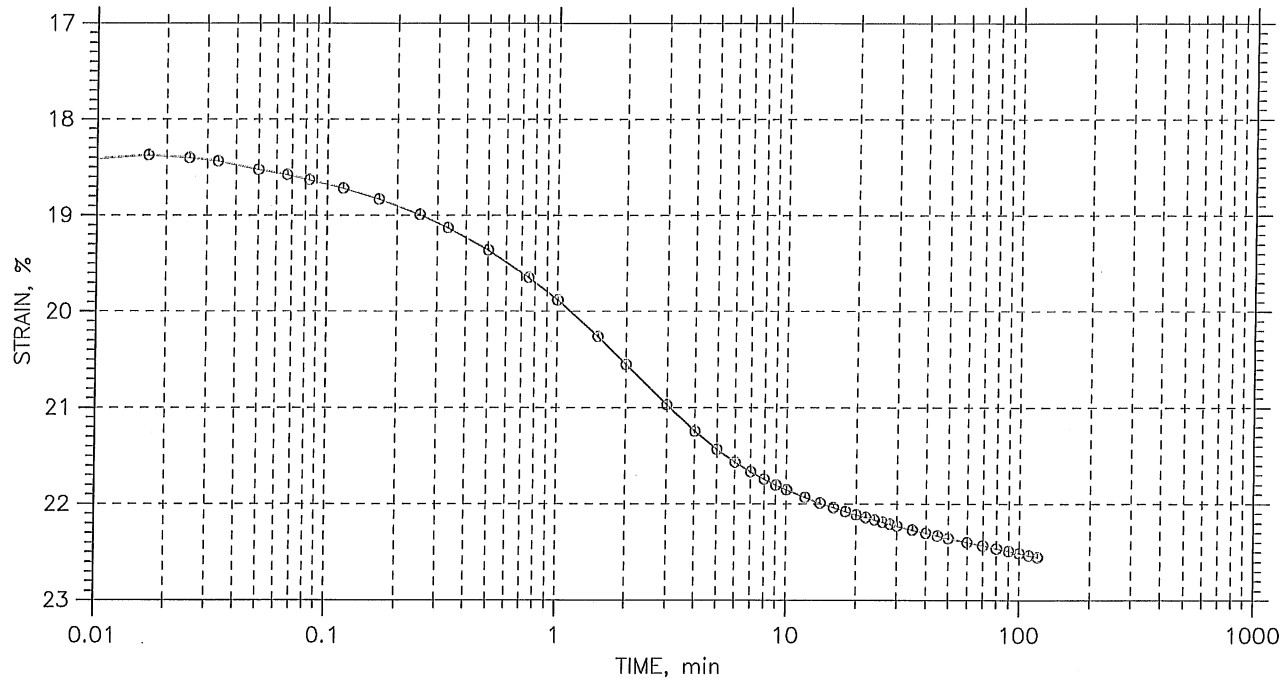
Mon, 23-JAN-2006 13:18:22

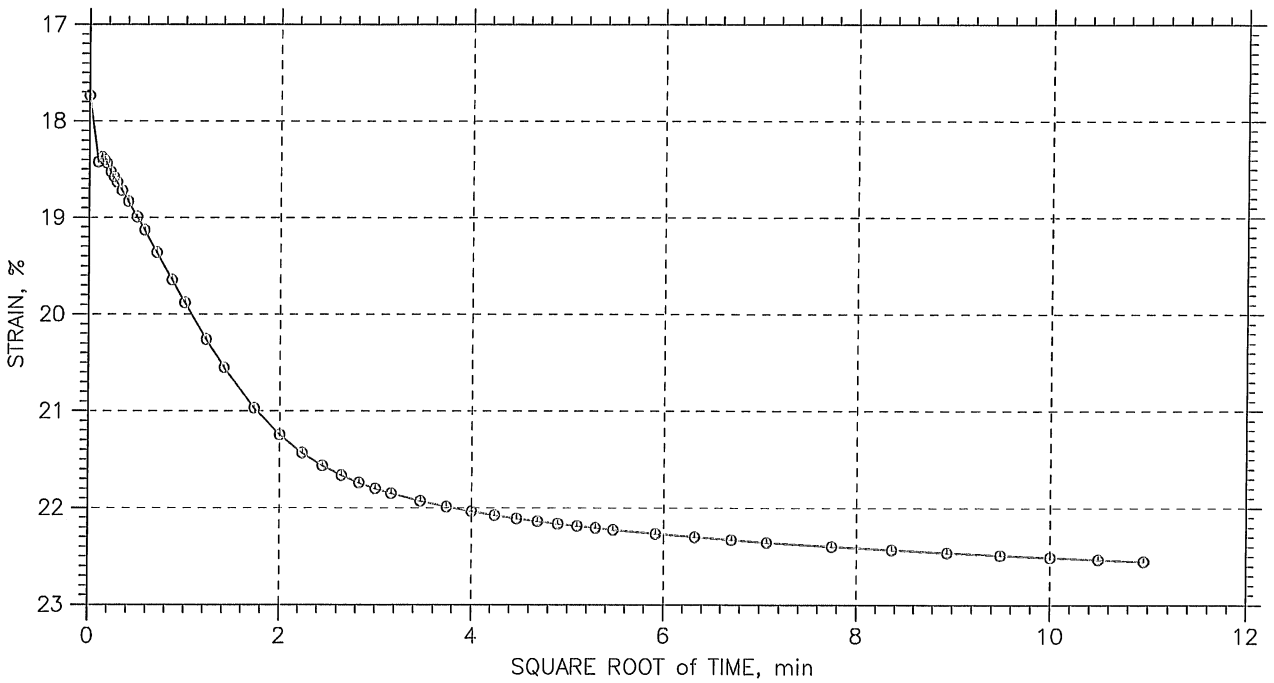
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 12

Stress: 16. tsf





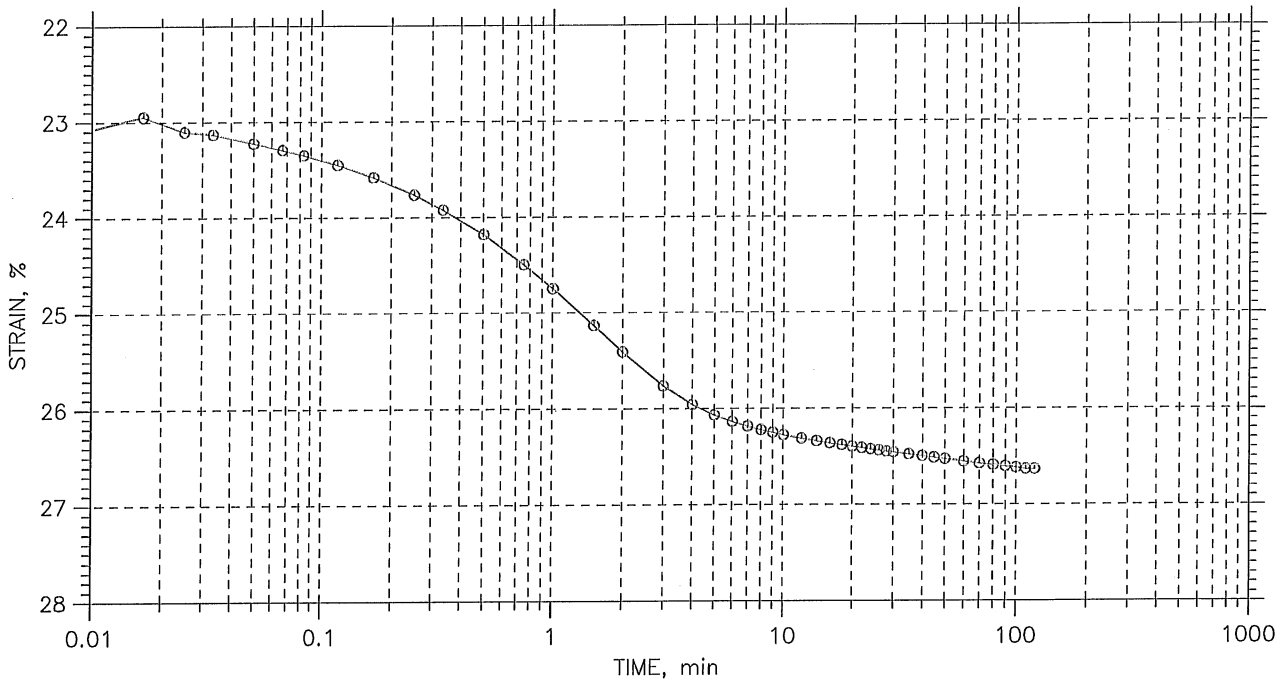
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

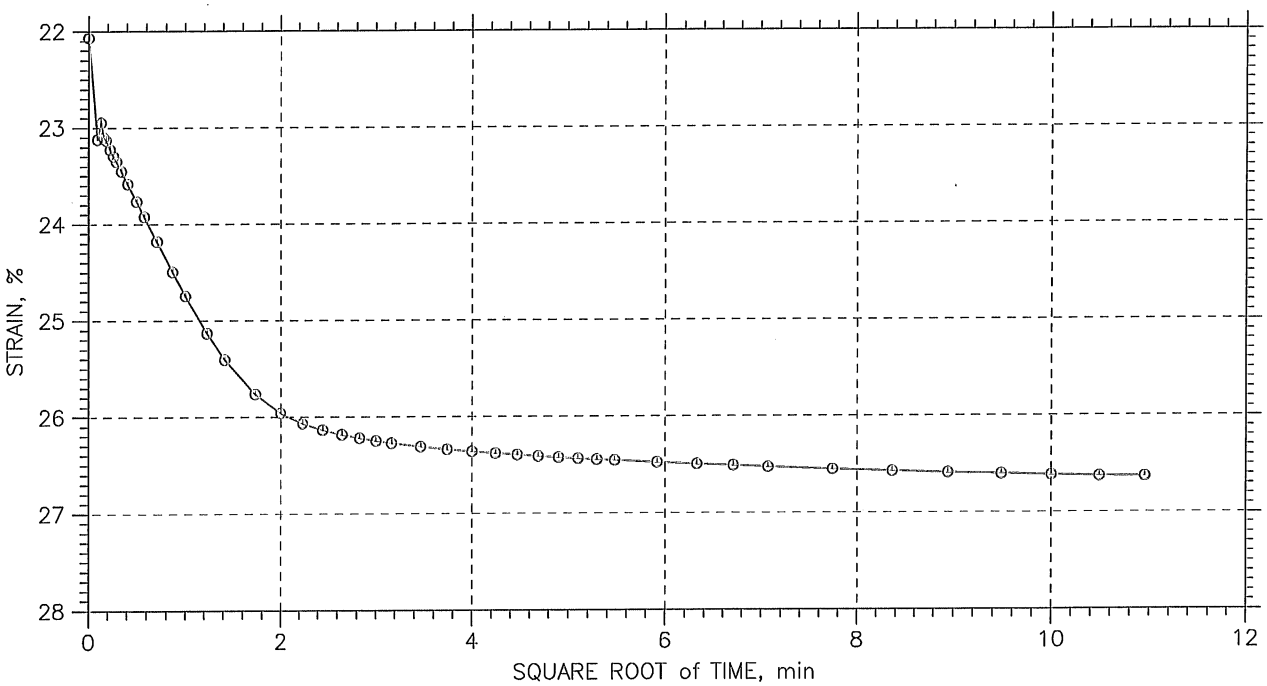
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 12

Stress: 32. tsf





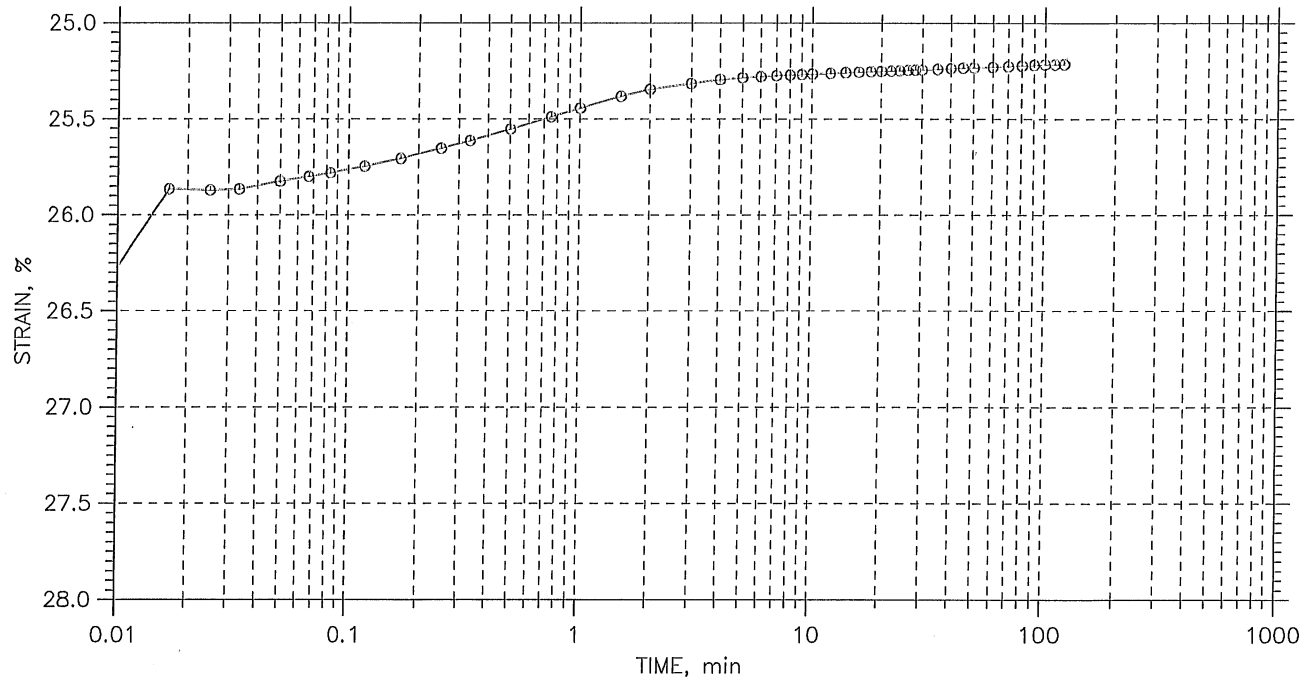
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

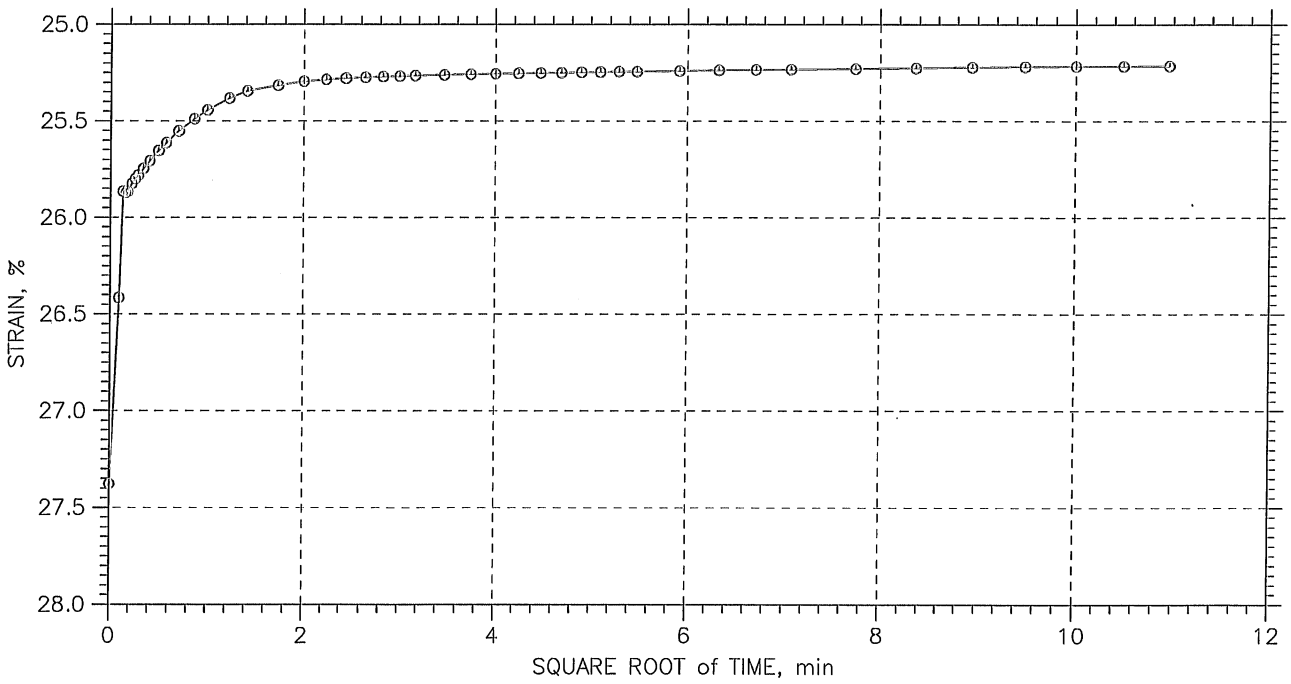
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 12

Stress: 8. tsf





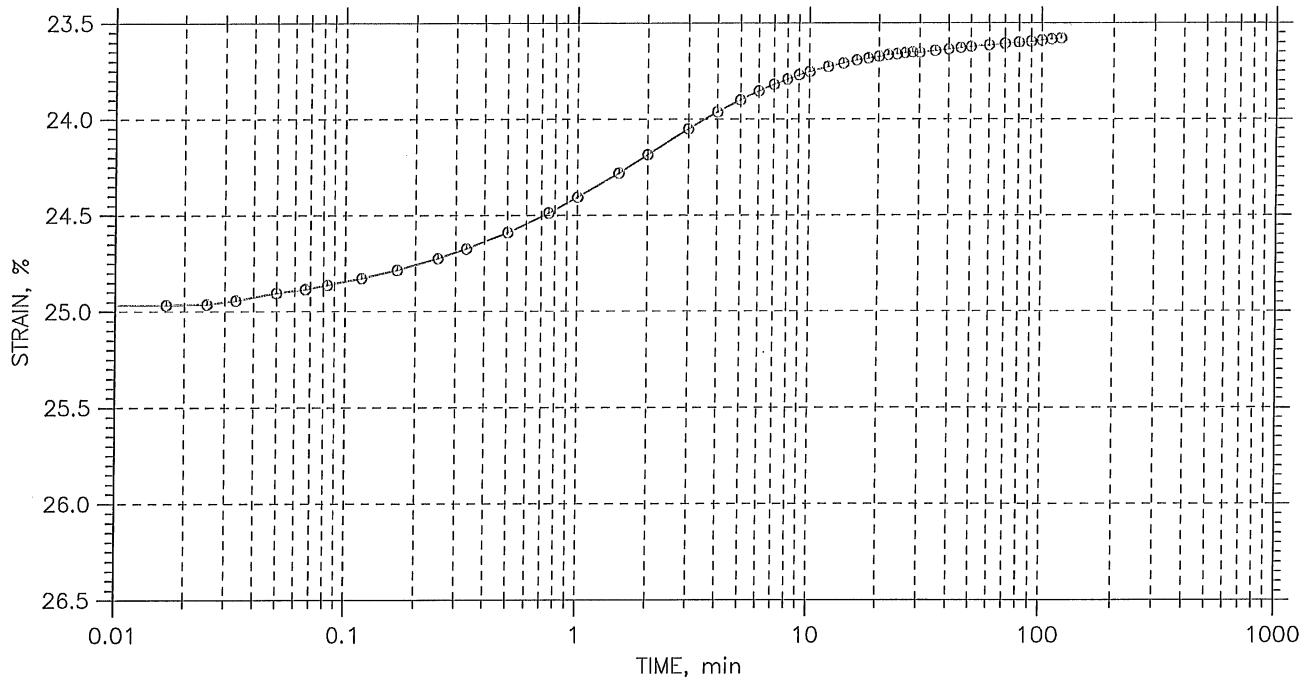
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

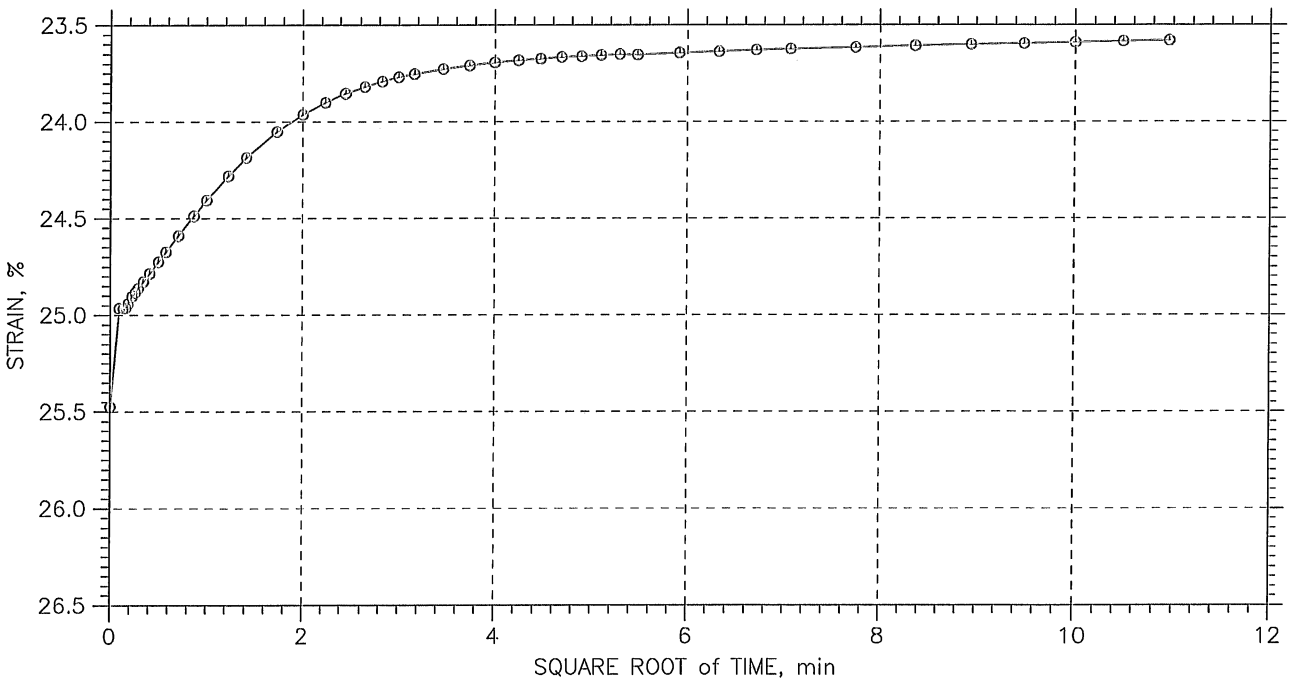
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 12

Stress: 2. tsf





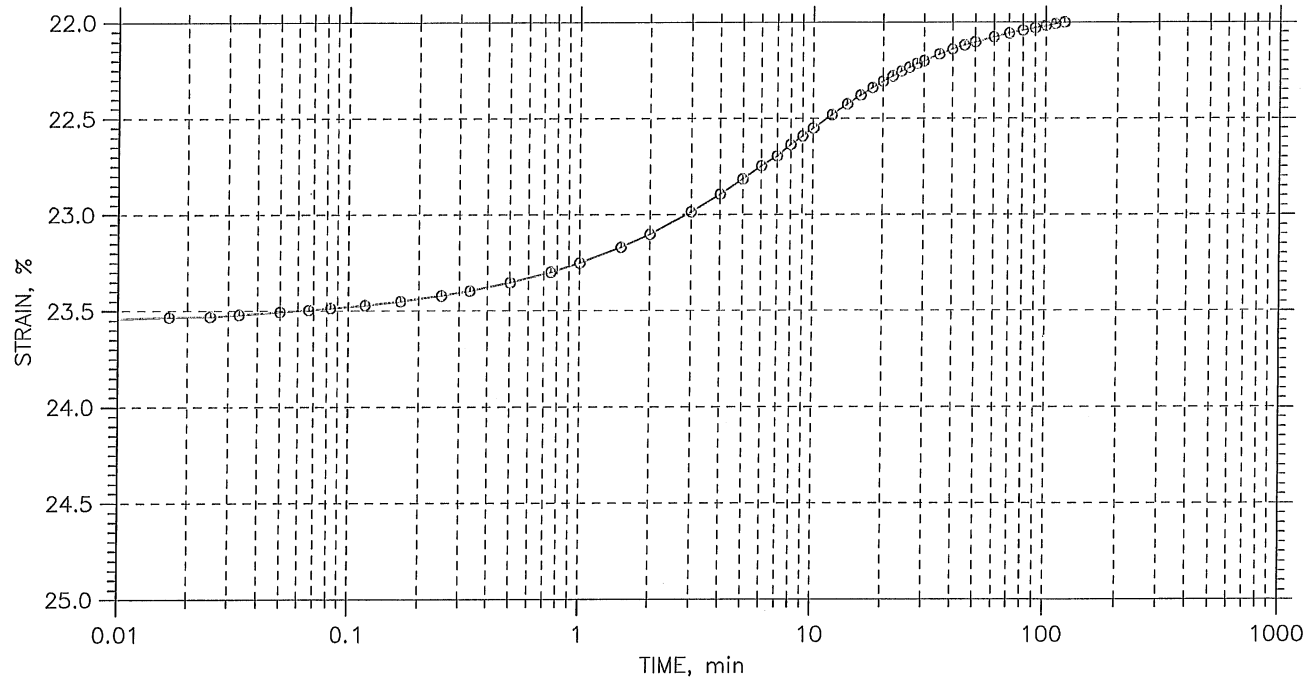
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

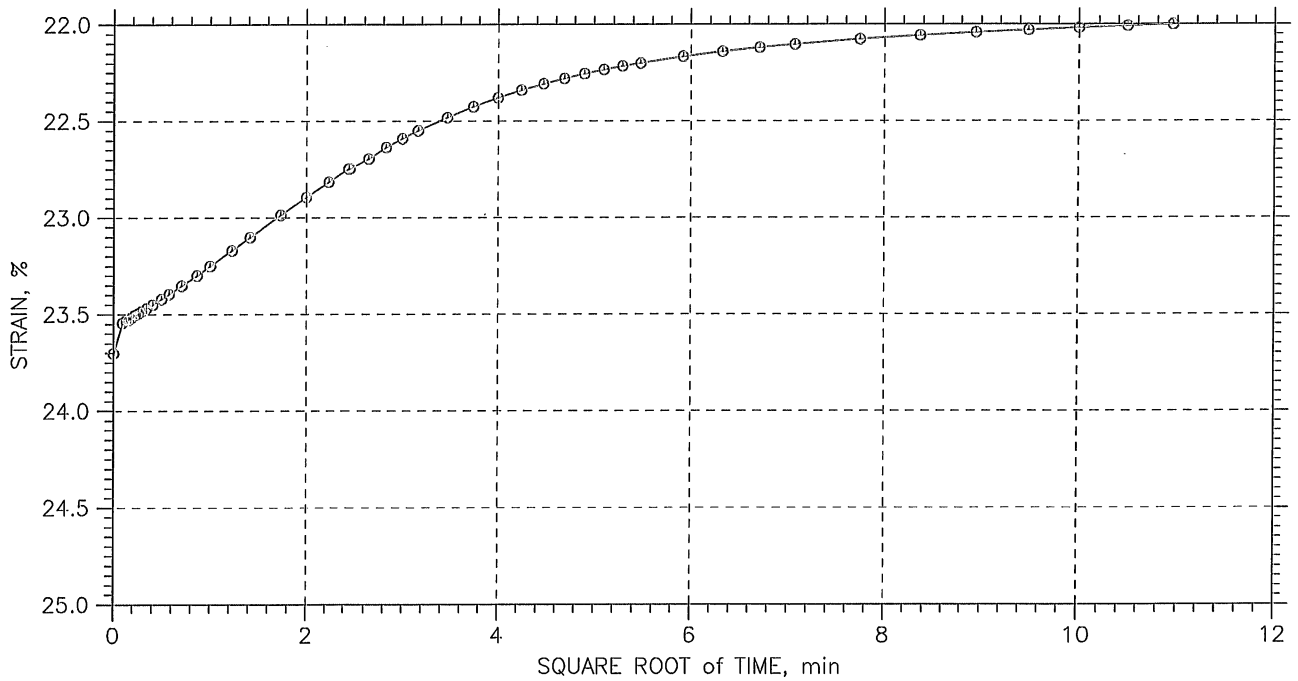
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 12

Stress: 0.5 tsf





Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-15A	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/27/05	Depth: 10-12 ft
	Test No.: C-5	Sample Type: Tube	Elevation: ---
	Description: Moist, olive brown clay		
	Remarks: ---		

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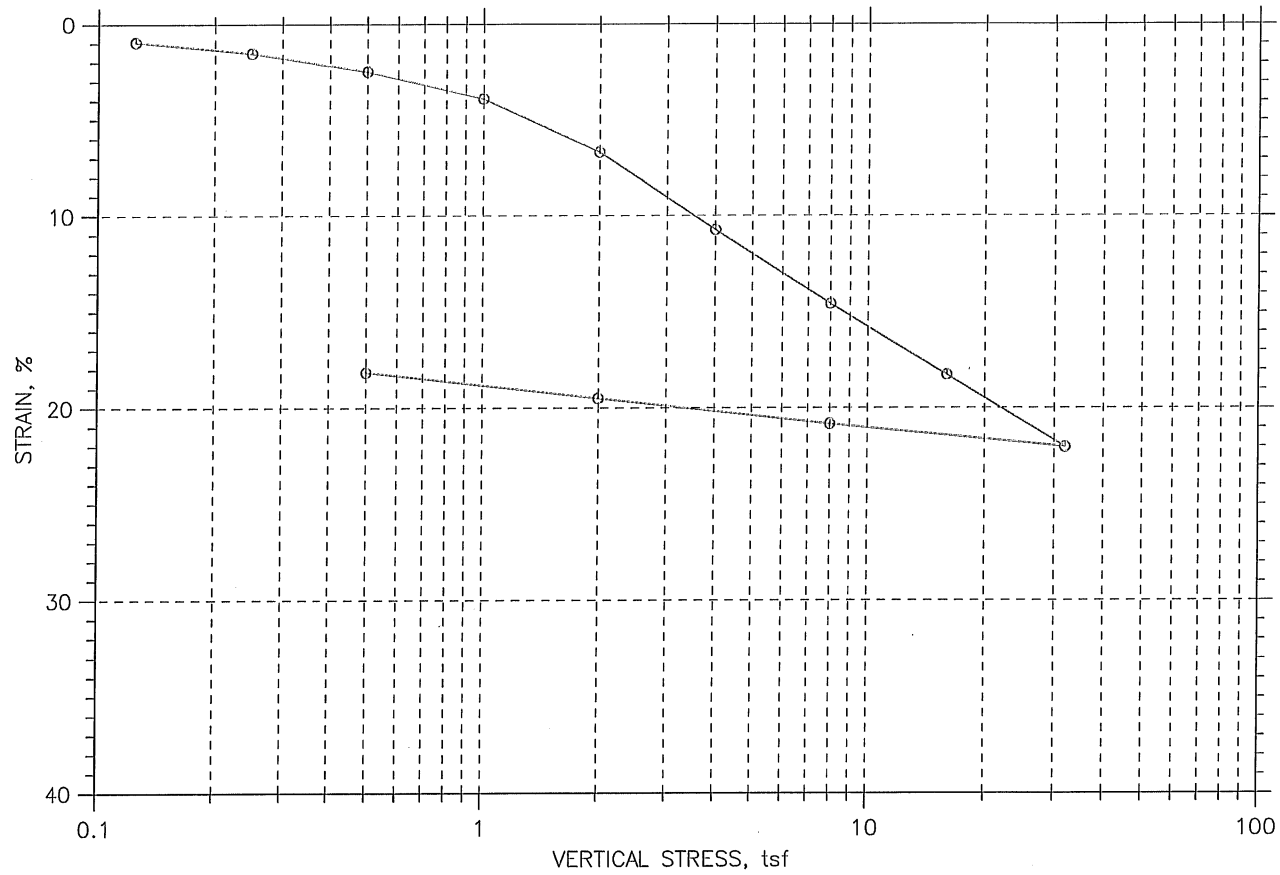
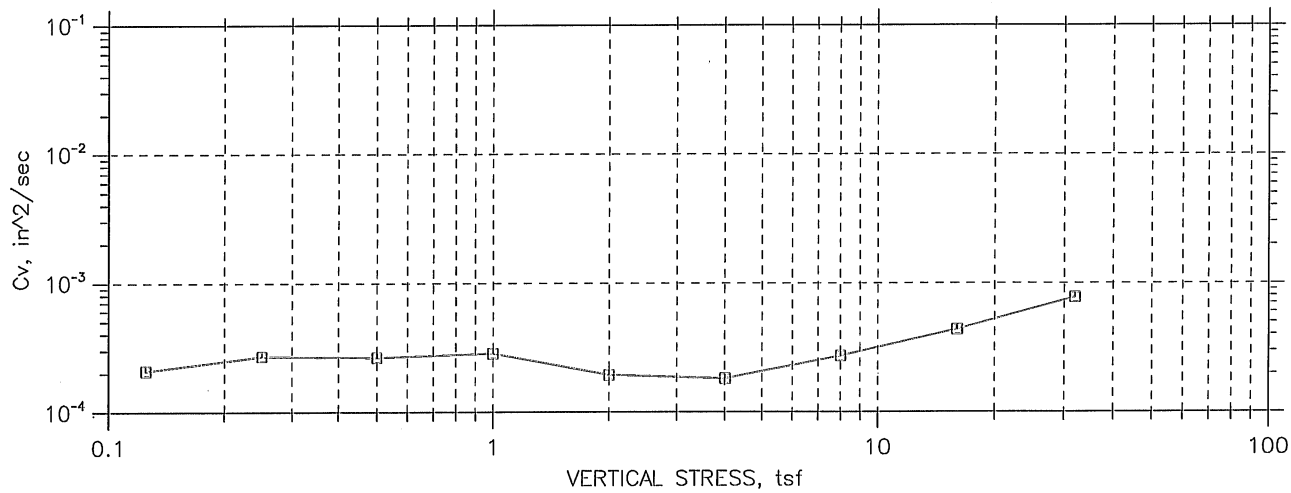
CONSOLIDATION TEST DATA

SUMMARY REPORT

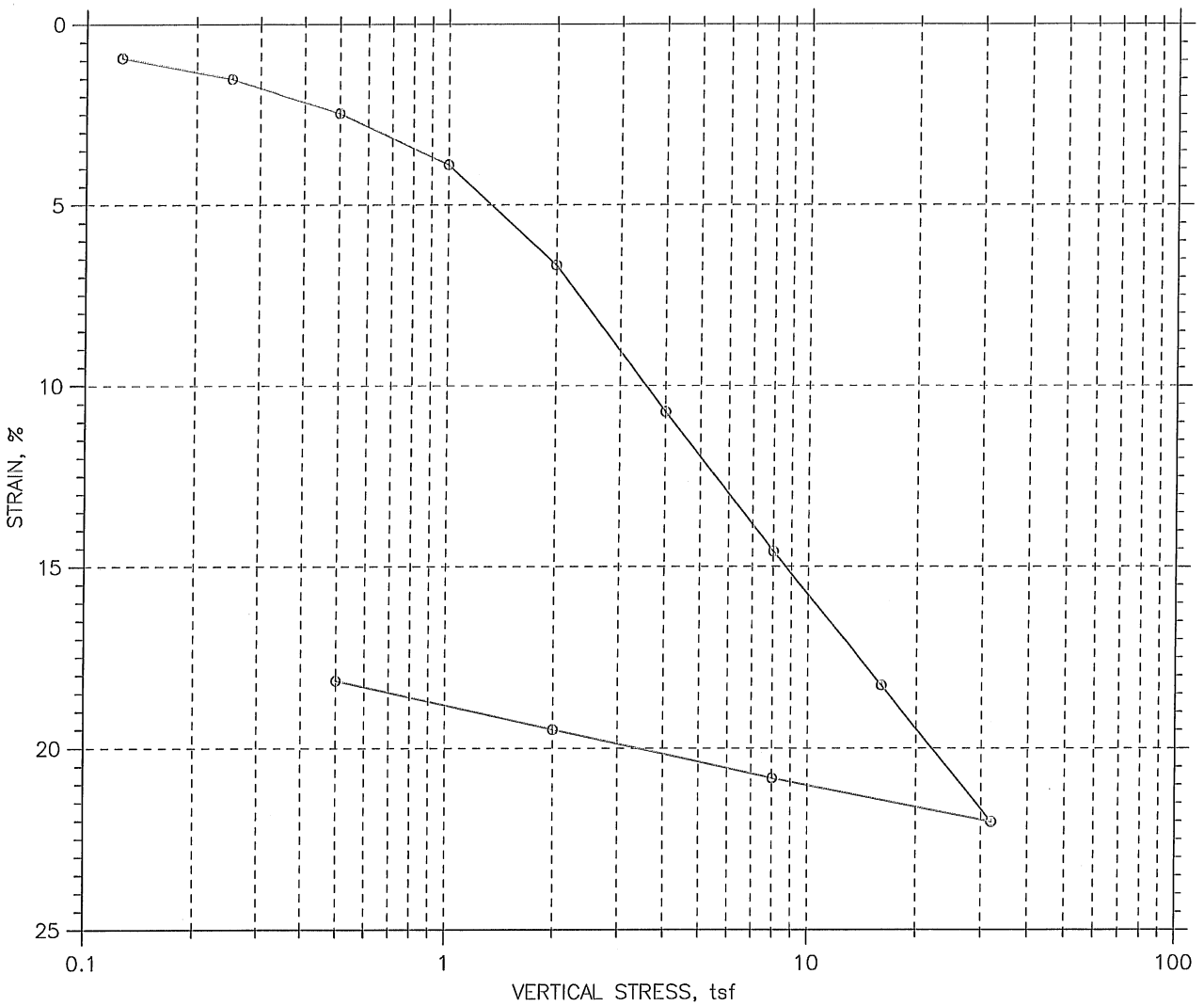




GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure: ---				Water Content, %	33.83	21.19
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	87.77	107.2
Compression Index: ---				Saturation, %	99.24	100.00
Diameter: 2.5 in		Height: 1 in		Void Ratio	0.92	0.57
LL: 30	PL: 14	PI: 16	GS: 2.70			

Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-16
Sample No.: U-1
Test No.: C-3

Location: Saco, ME
Tested By: md
Test Date: 12/20/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 15-17 ft
Elevation: ---

Soil Description: Moist, olive gray clay
Remarks: ---

Estimated Specific Gravity: 2.70
Initial Void Ratio: 0.92
Final Void Ratio: 0.57

Liquid Limit: 30
Plastic Limit: 14
Plasticity Index: 16

Initial Height: 1.00 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	Watson	RING		Kazza
Wt. Container + Wet Soil, gm	77.73	366.86	352.56	144.87
Wt. Container + Dry Soil, gm	60.11	328.6	328.6	120.96
Wt. Container, gm	7.98	215.51	215.51	8.1
Wt. Dry Soil, gm	52.13	113.09	113.09	112.86
Water Content, %	33.80	33.83	21.19	21.19
Void Ratio	---	0.92	0.57	---
Degree of Saturation, %	---	99.24	100.00	---
Dry Unit Weight, pcf	---	87.768	107.22	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-16
Sample No.: U-1
Test No.: C-3

Location: Saco, ME
Tested By: md
Test Date: 12/20/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 15-17 ft
Elevation: ---

Soil Description: Moist, olive gray clay
Remarks: ---

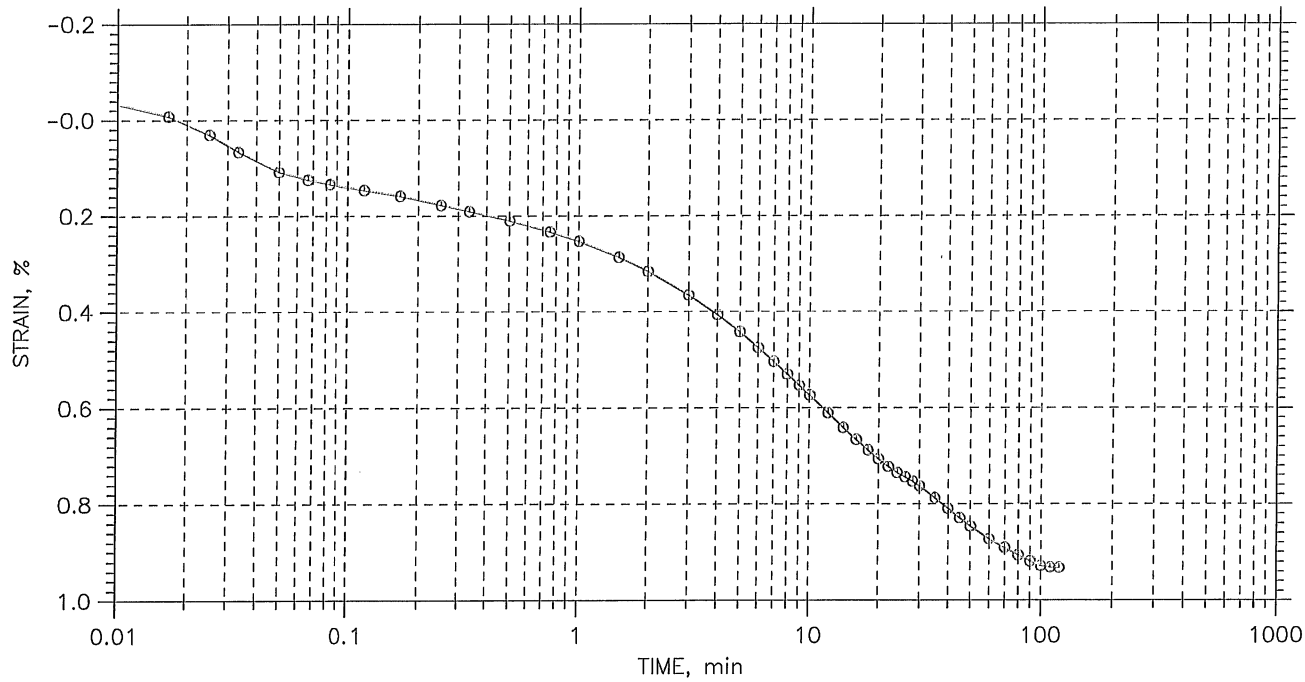
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.125	0.009322	0.902	0.93	4.1	3.7	1.99e-004	2.21e-004	2.10e-004
2	0.25	0.01513	0.891	1.51	2.7	3.2	2.93e-004	2.53e-004	2.71e-004
3	0.5	0.02464	0.873	2.46	2.9	3.1	2.74e-004	2.58e-004	2.66e-004
4	1	0.03884	0.846	3.88	2.3	3.1	3.39e-004	2.46e-004	2.85e-004
5	2	0.06662	0.792	6.66	3.7	3.9	1.97e-004	1.91e-004	1.94e-004
6	4	0.1072	0.715	10.72	3.7	3.8	1.84e-004	1.80e-004	1.82e-004
7	8	0.1457	0.641	14.57	2.1	2.5	3.00e-004	2.50e-004	2.72e-004
8	16	0.1827	0.570	18.27	1.2	1.5	4.95e-004	3.91e-004	4.37e-004
9	32	0.2203	0.497	22.03	0.7	0.7	7.50e-004	7.98e-004	7.73e-004
10	8	0.2082	0.521	20.82	0.0	0.0	5.61e-002	0.00e+000	5.61e-002
11	2	0.1949	0.546	19.49	0.7	0.0	7.17e-004	0.00e+000	7.17e-004
12	0.5	0.1814	0.572	18.14	4.2	4.2	1.30e-004	1.29e-004	1.29e-004

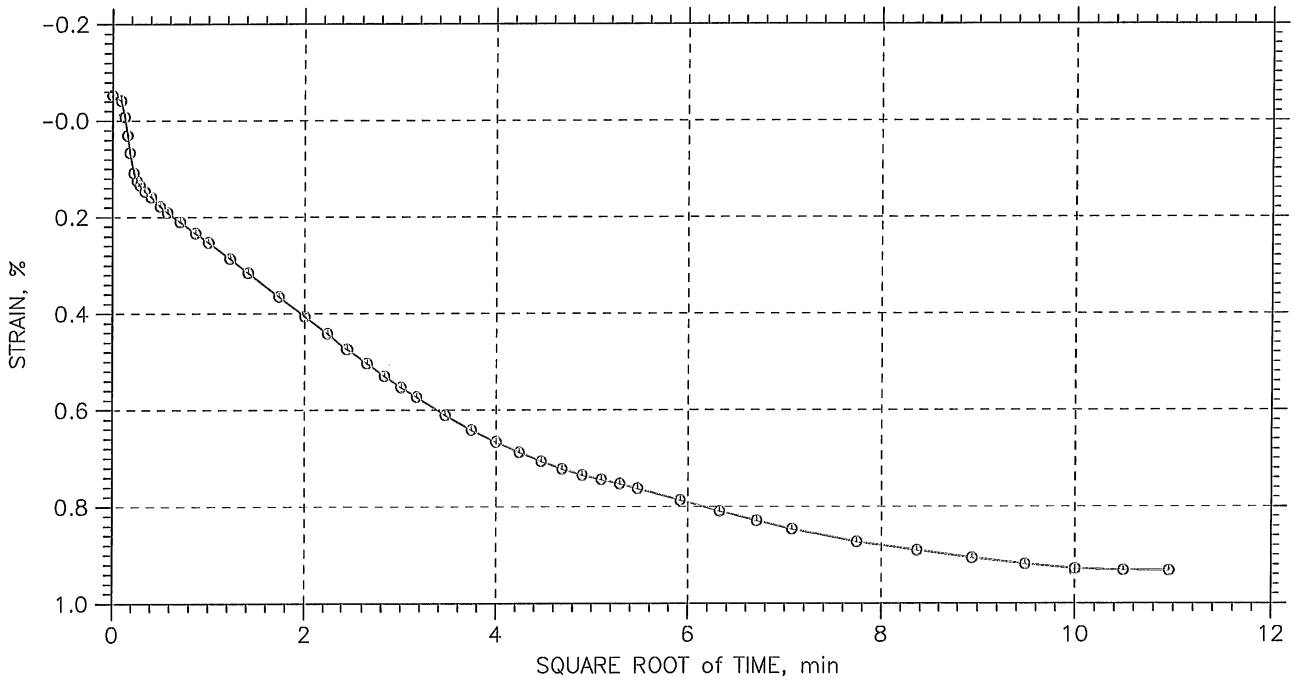
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 12

Stress: 0.125 tsf





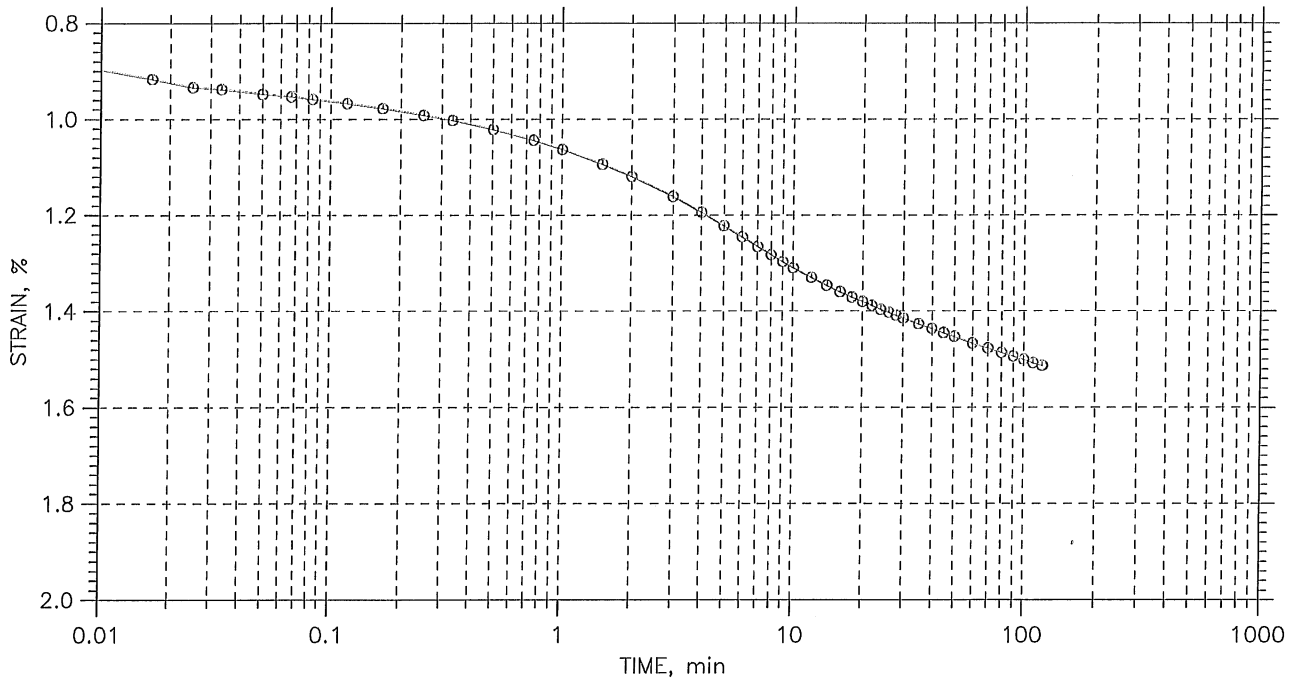
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

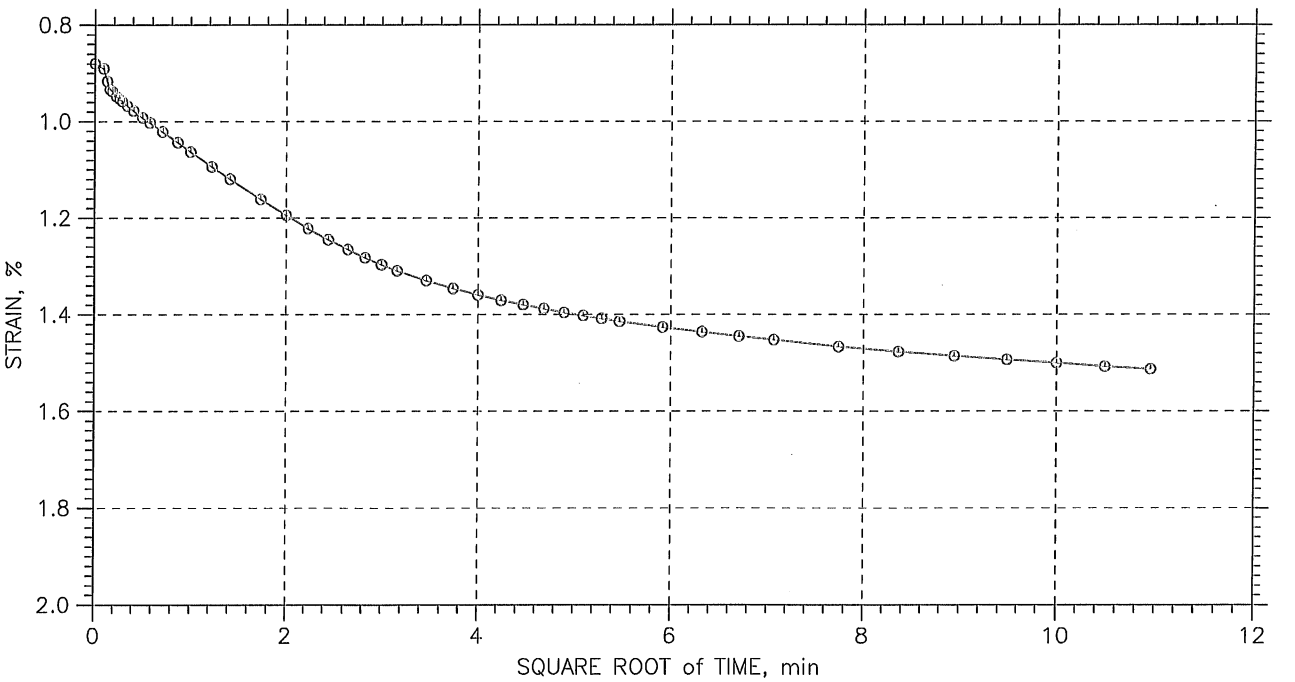
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 12

Stress: 0.25 tsf





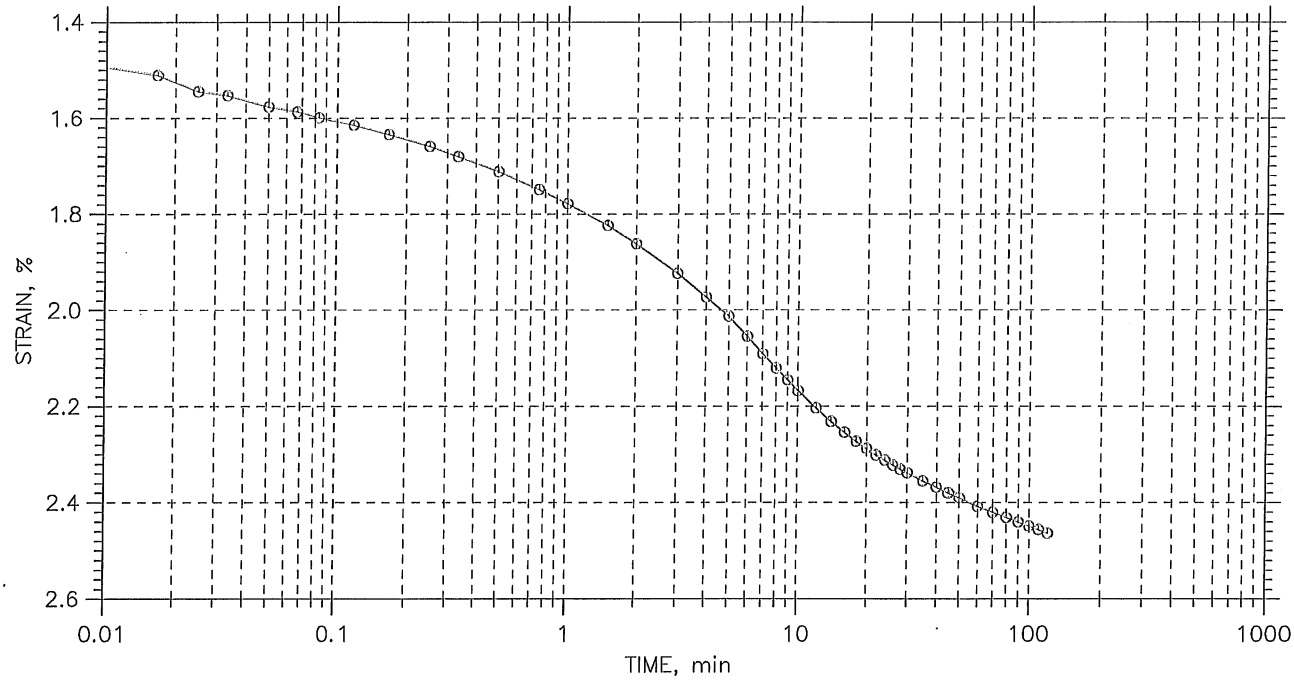
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

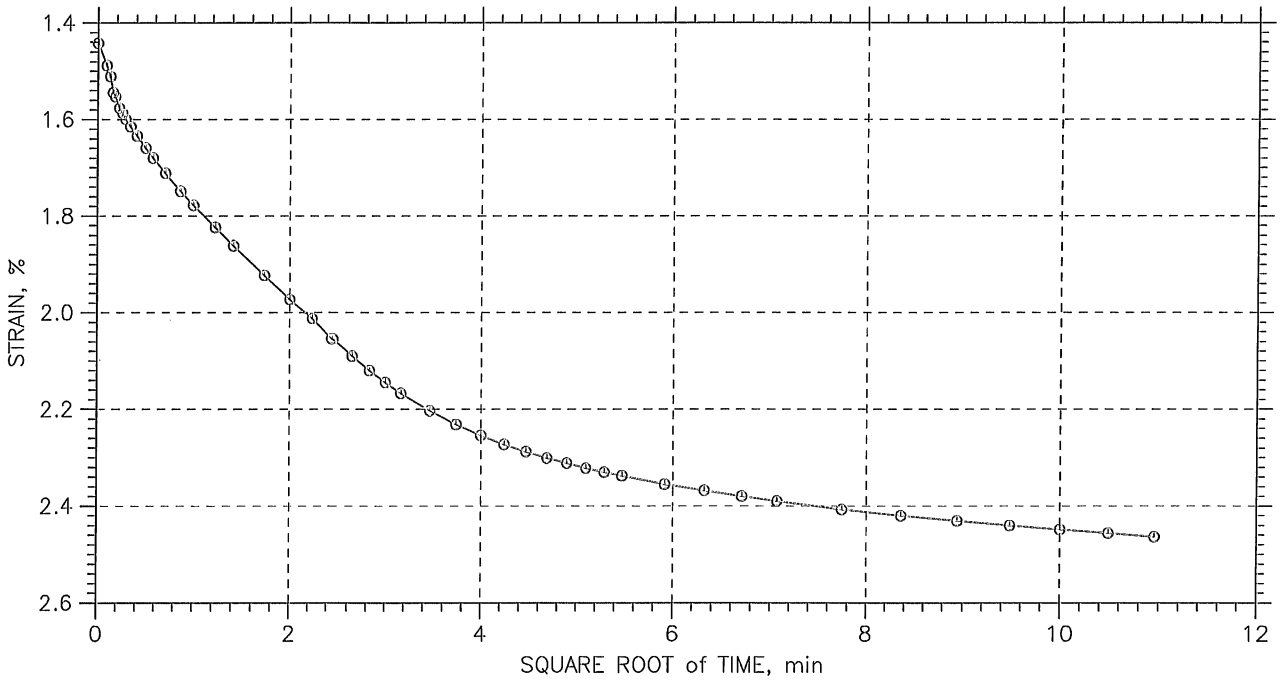
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 12

Stress: 0.5 tsf





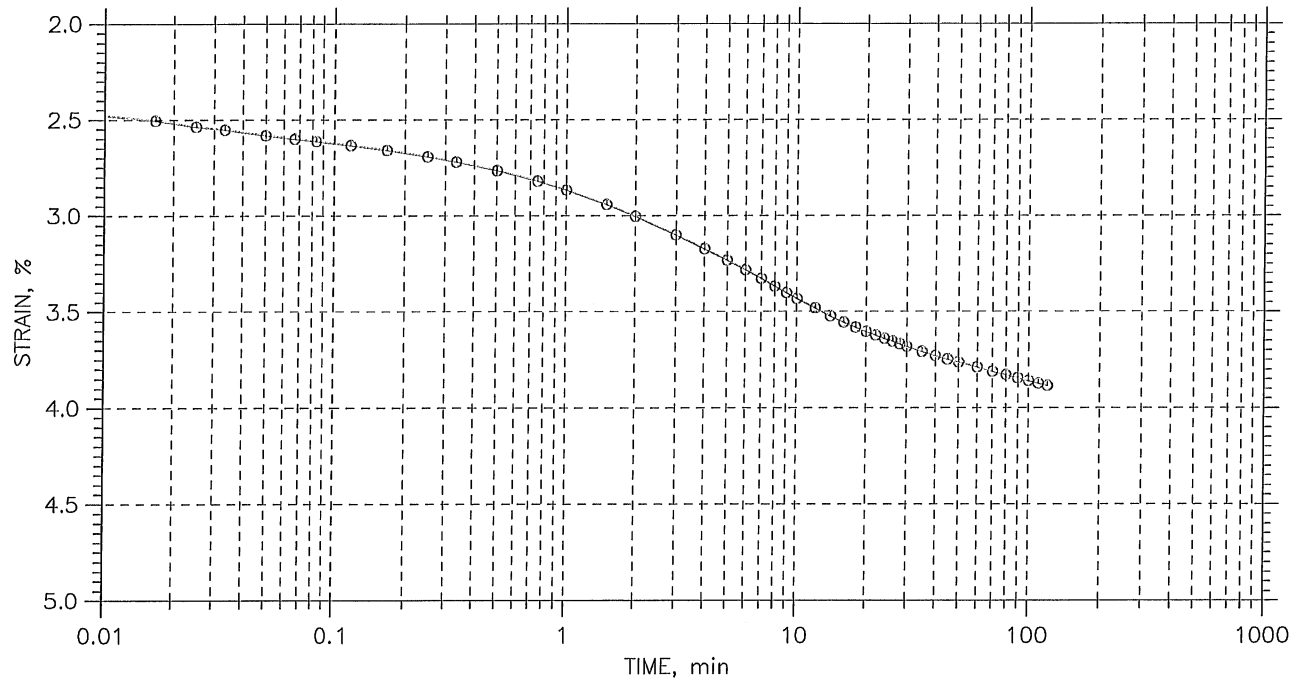
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

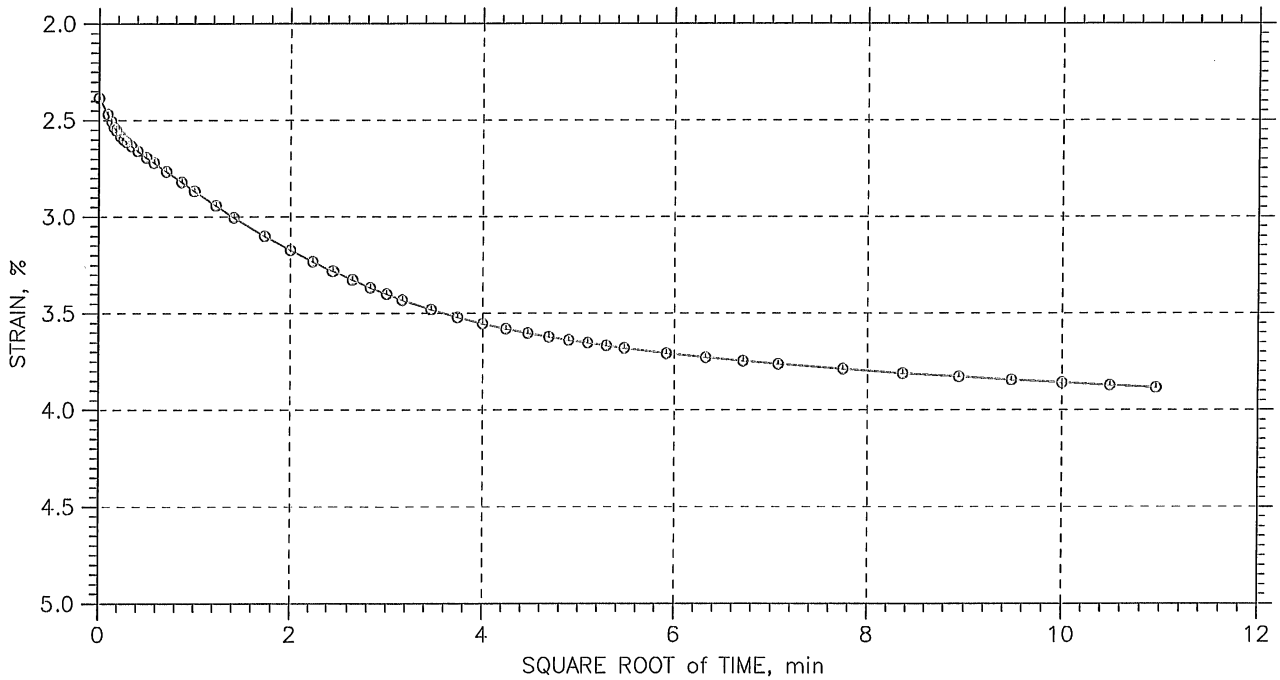
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 12

Stress: 1. tsf





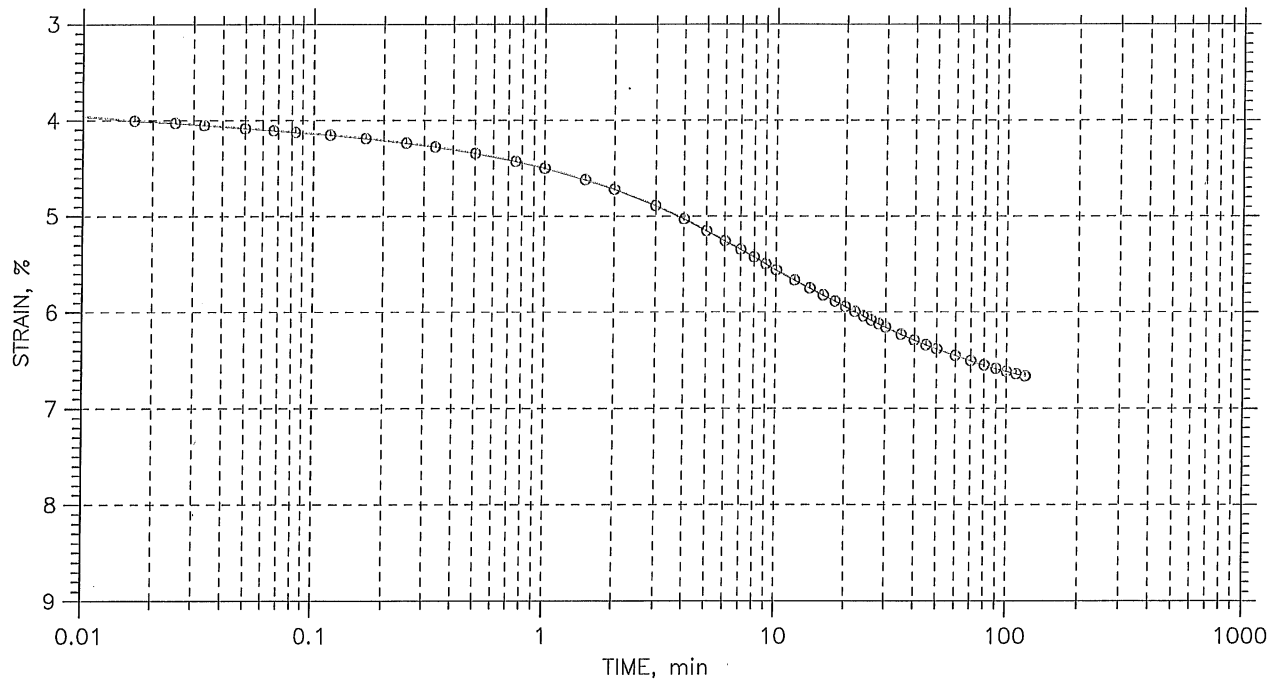
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

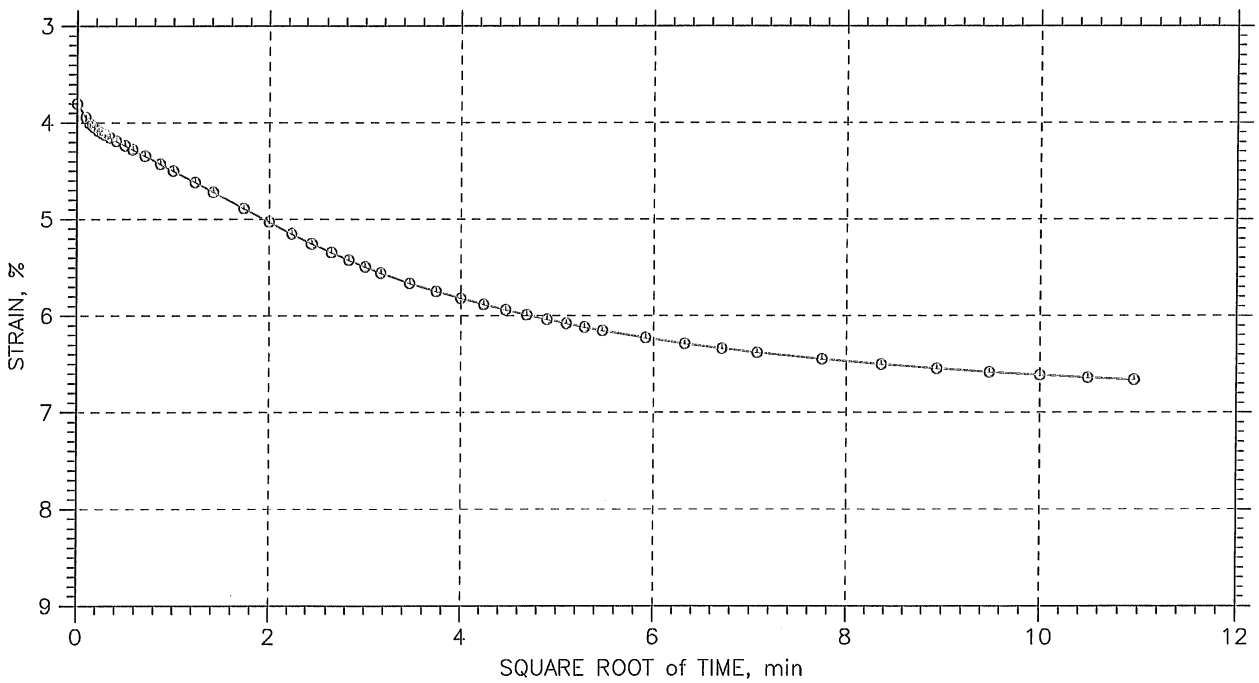
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 12

Stress: 2. tsf





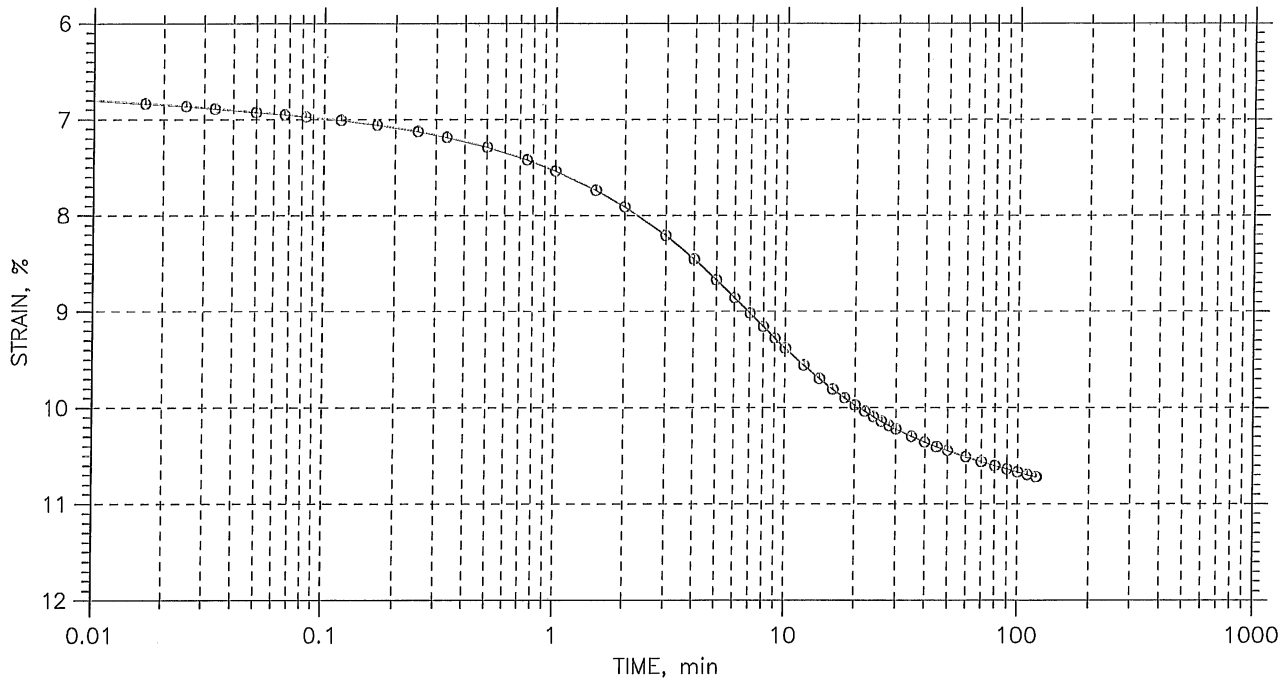
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

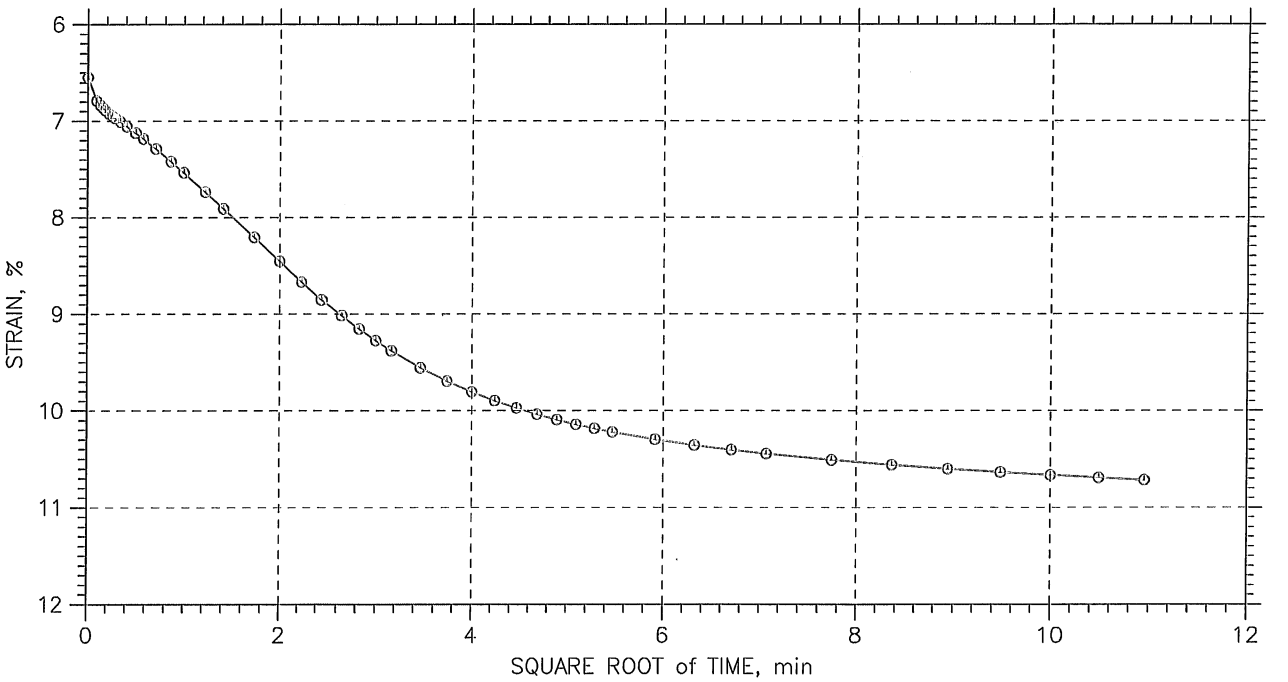
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 12

Stress: 4. tsf





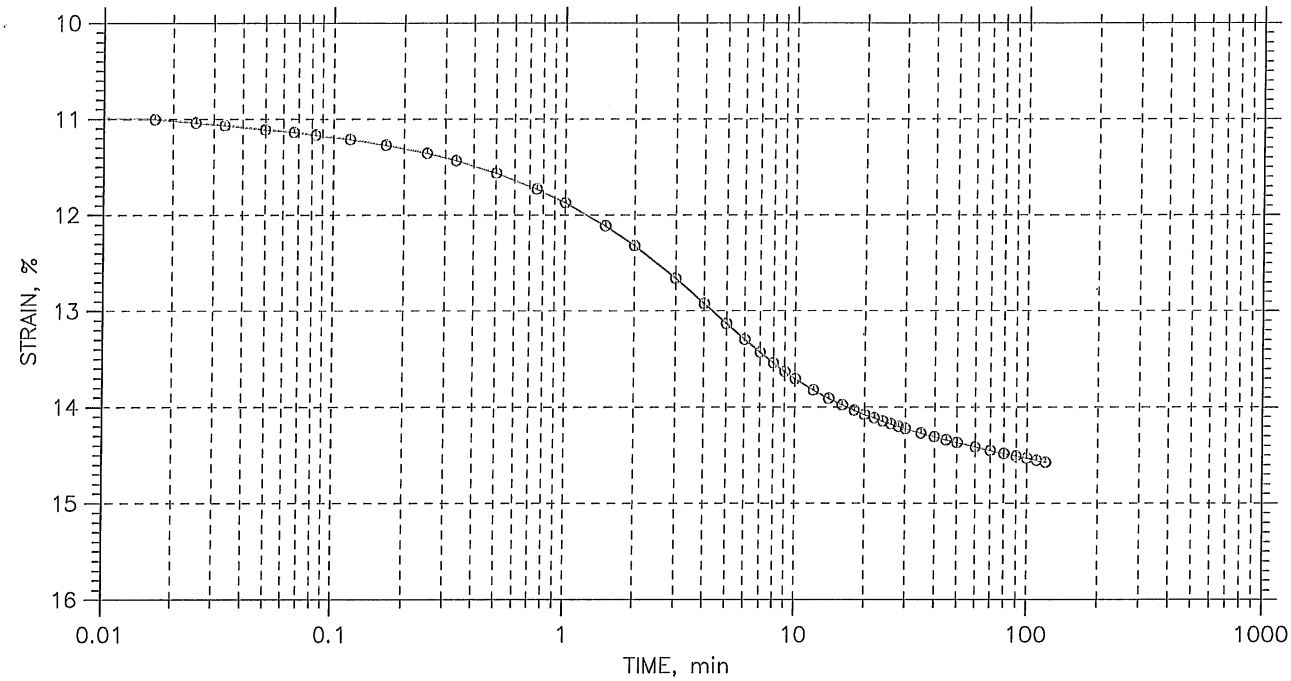
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

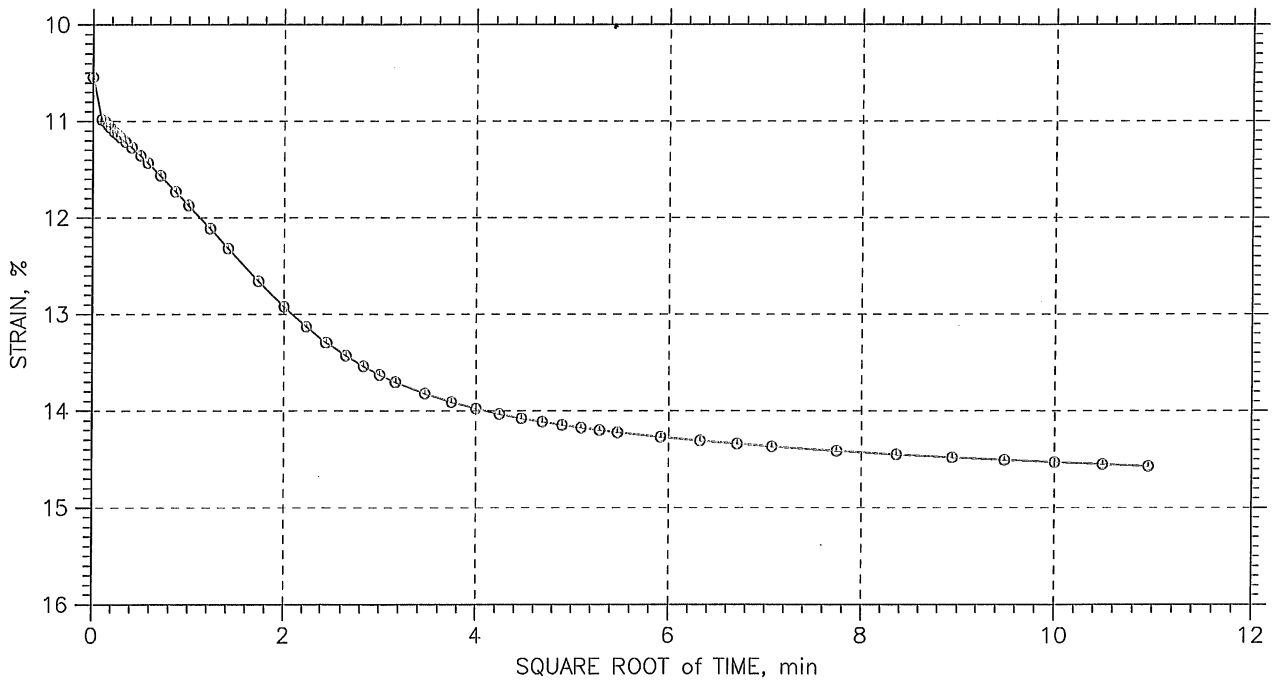
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 12

Stress: 8. tsf





GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

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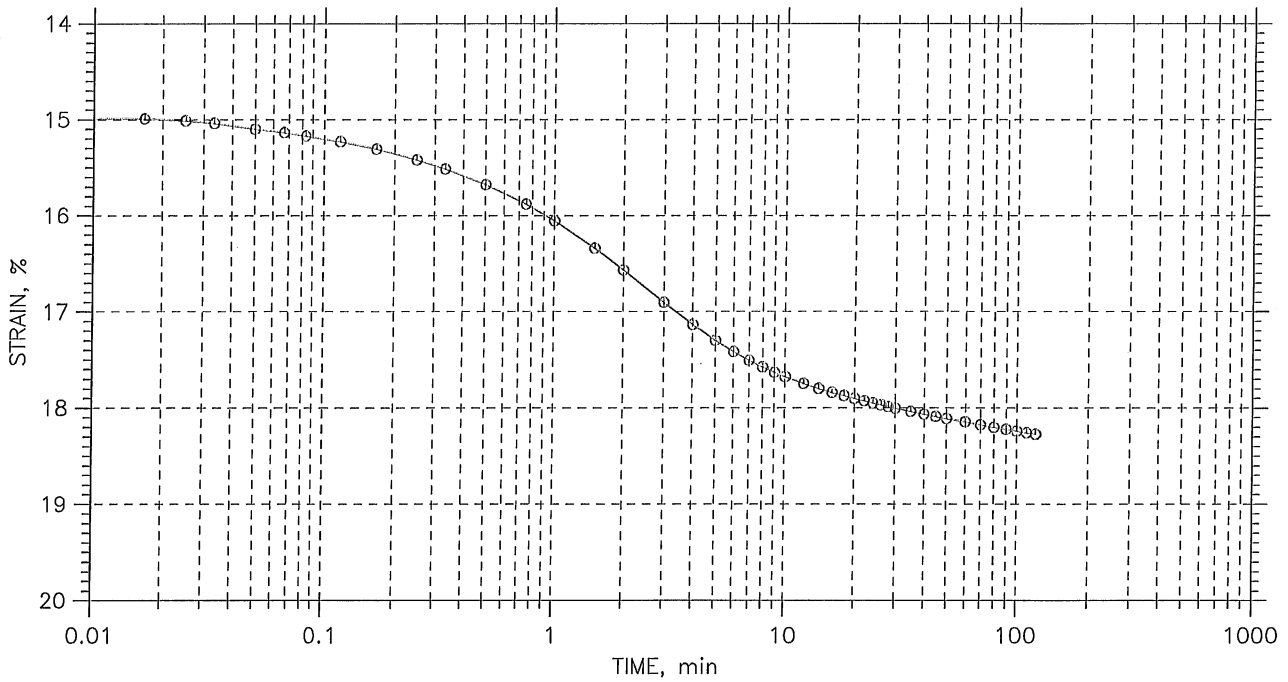
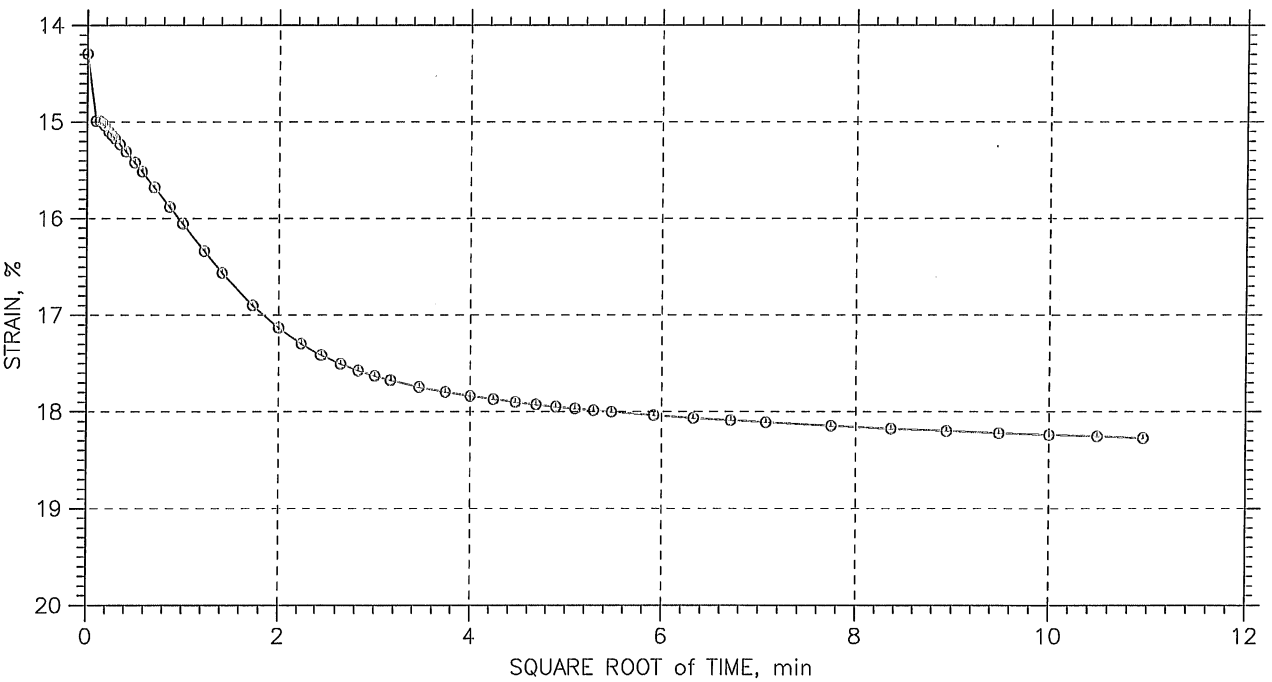
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 12

Stress: 16. tsf





Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

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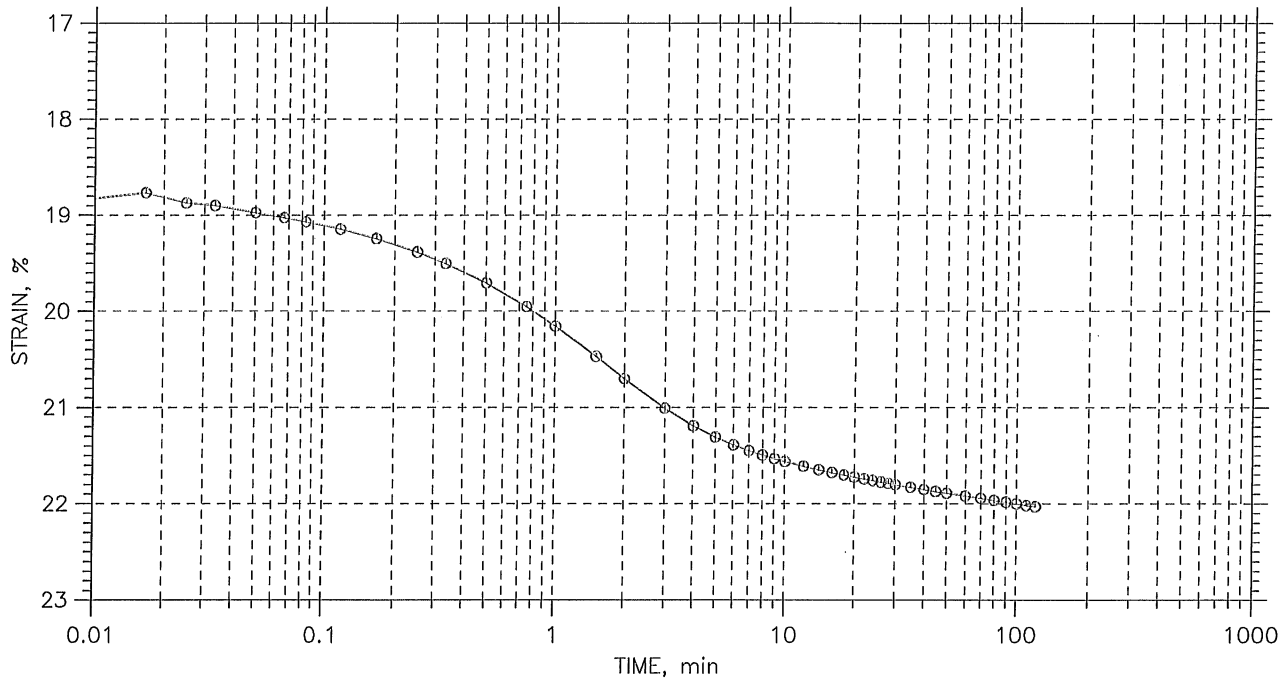
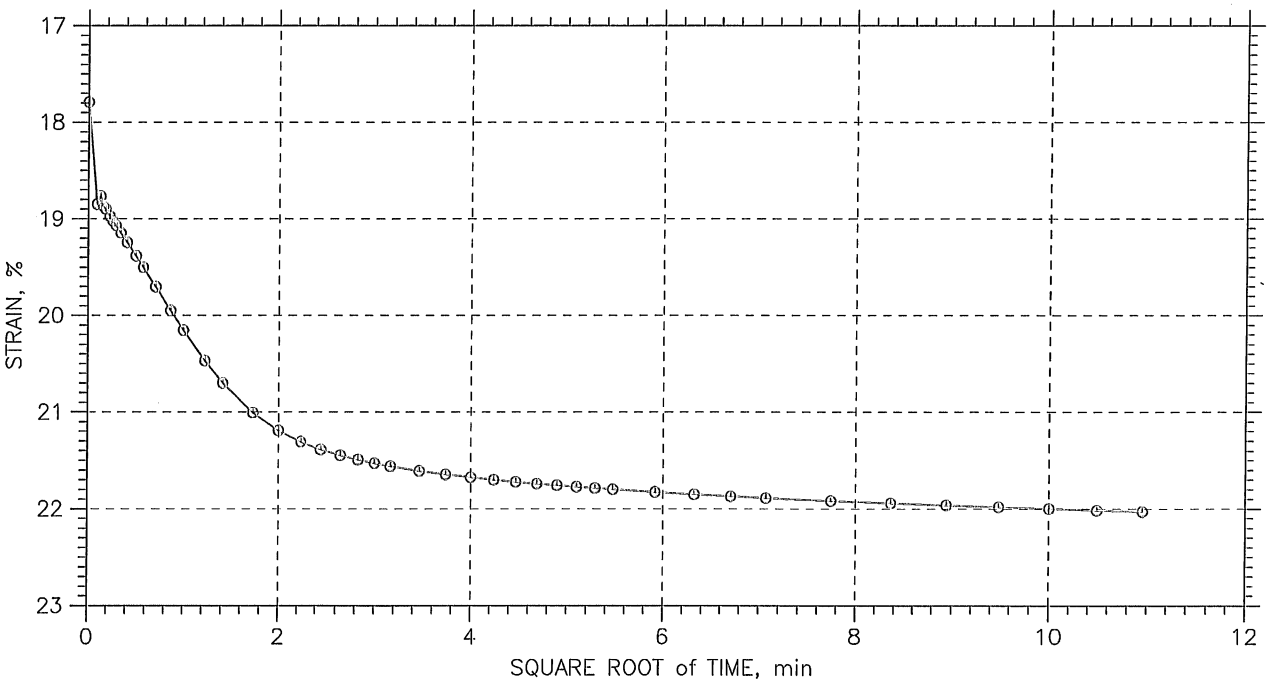
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 12

Stress: 32. tsf





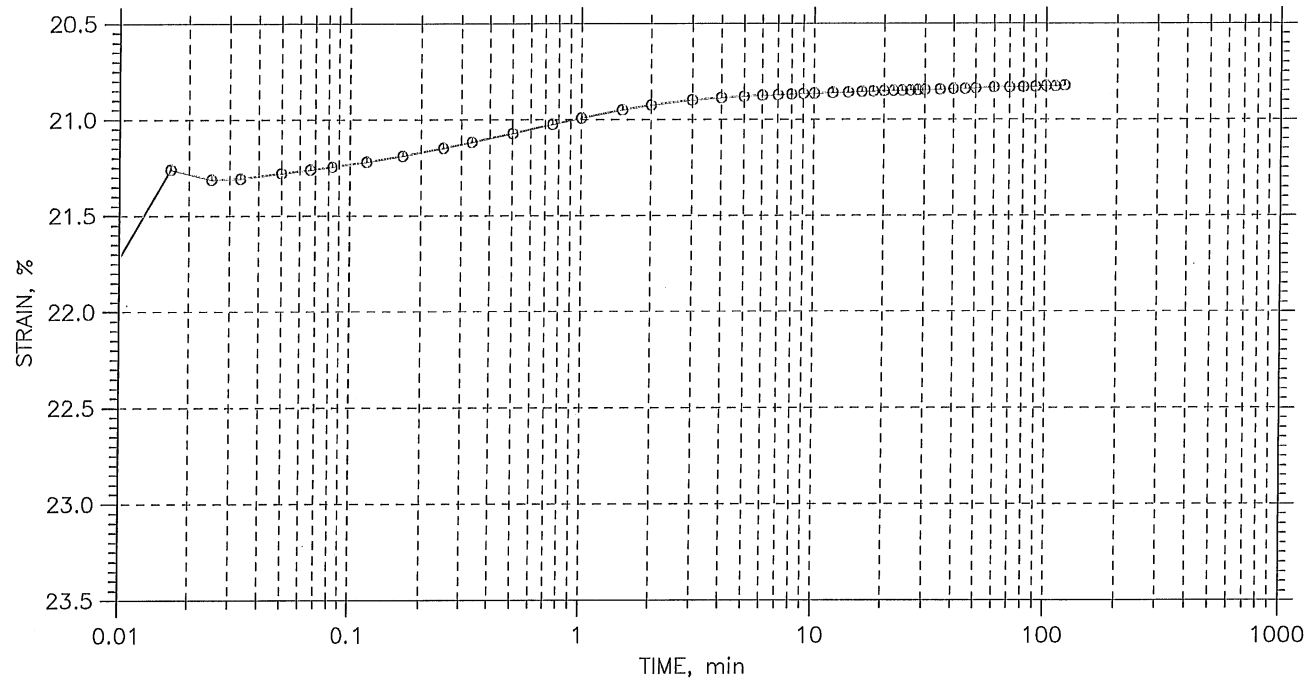
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

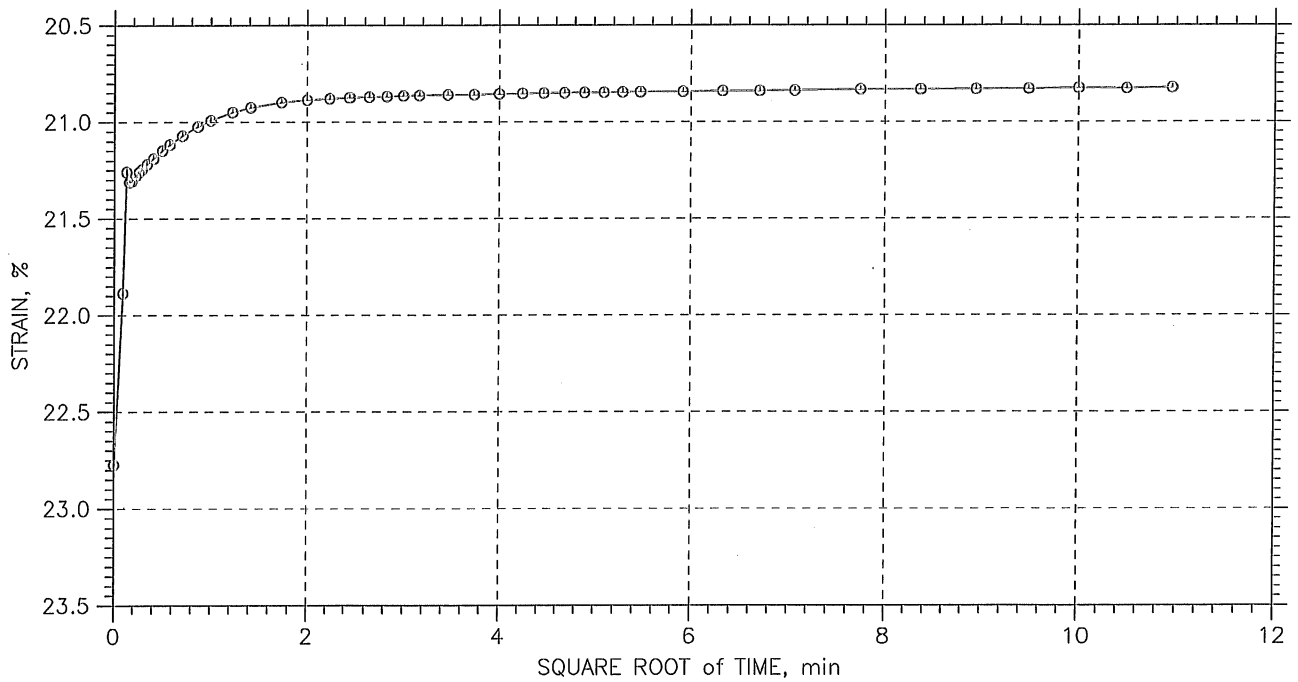
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 12

Stress: 8. tsf





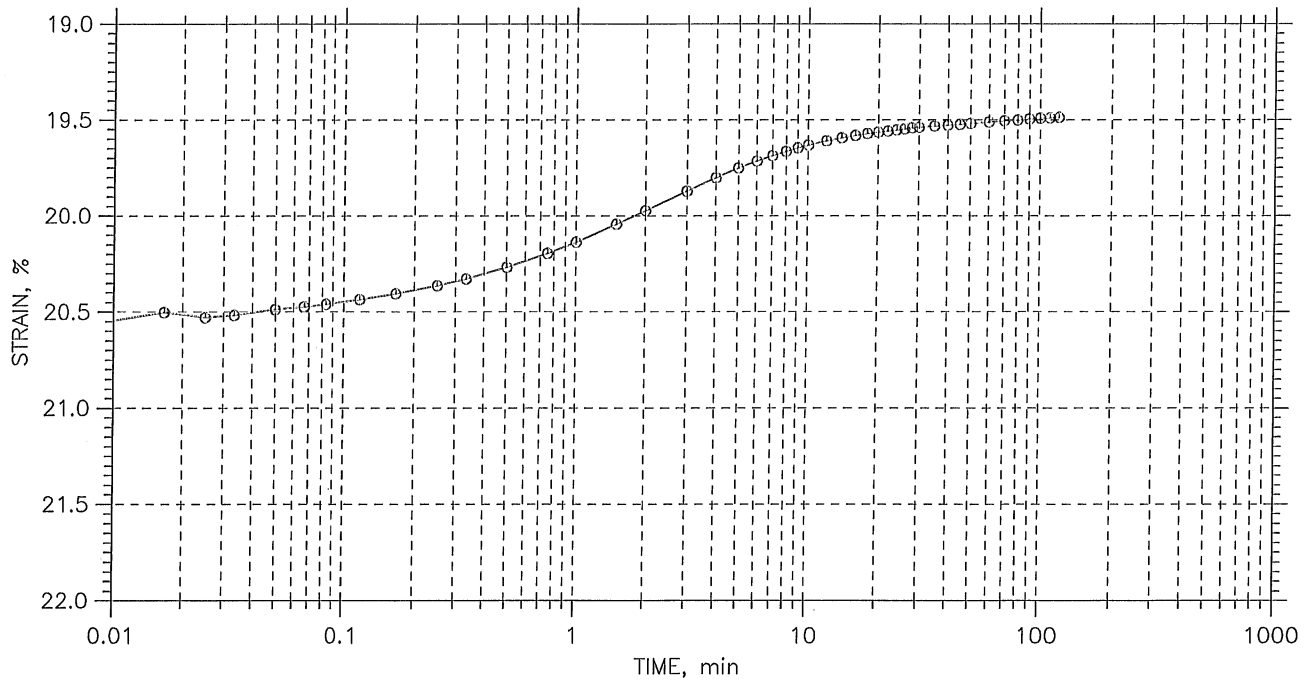
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

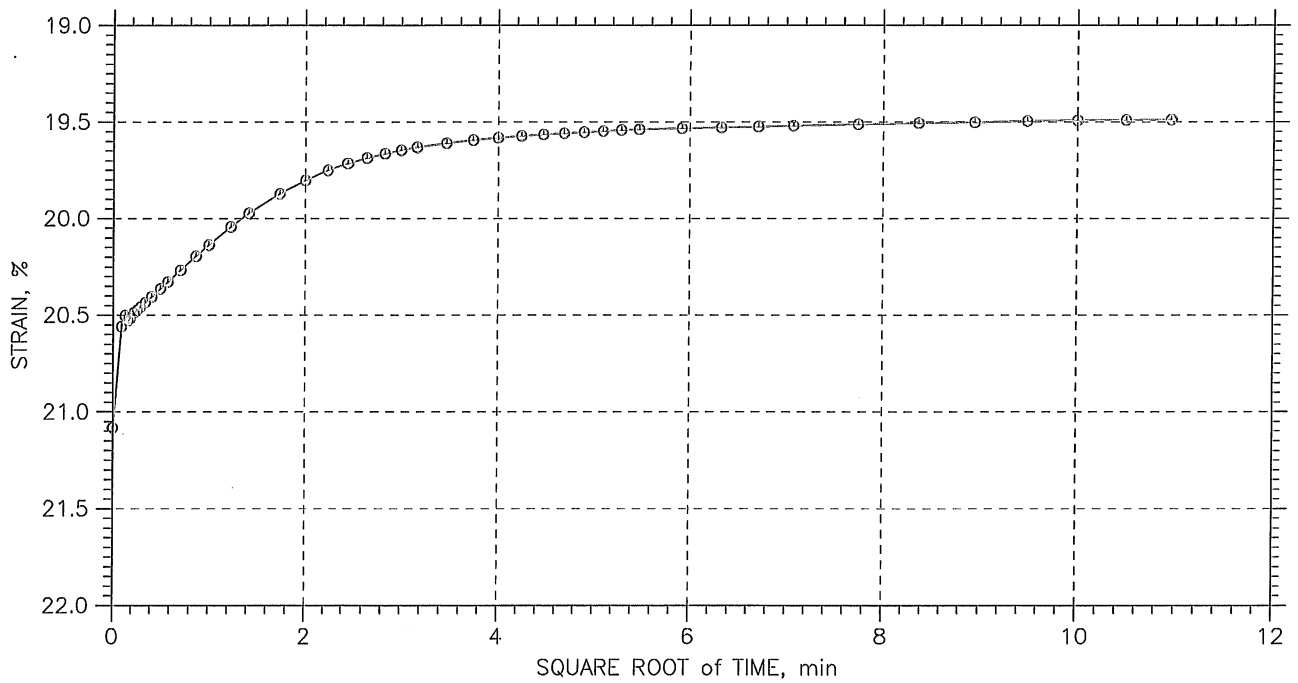
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 12

Stress: 2. tsf





GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

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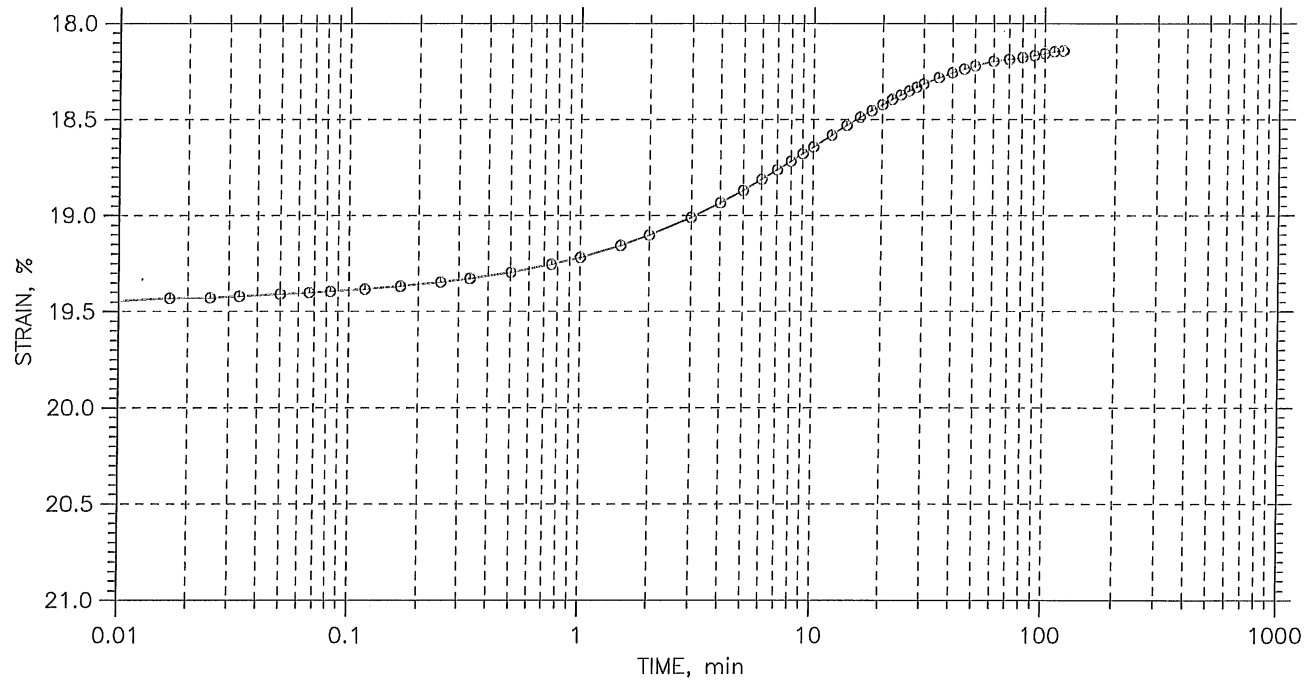
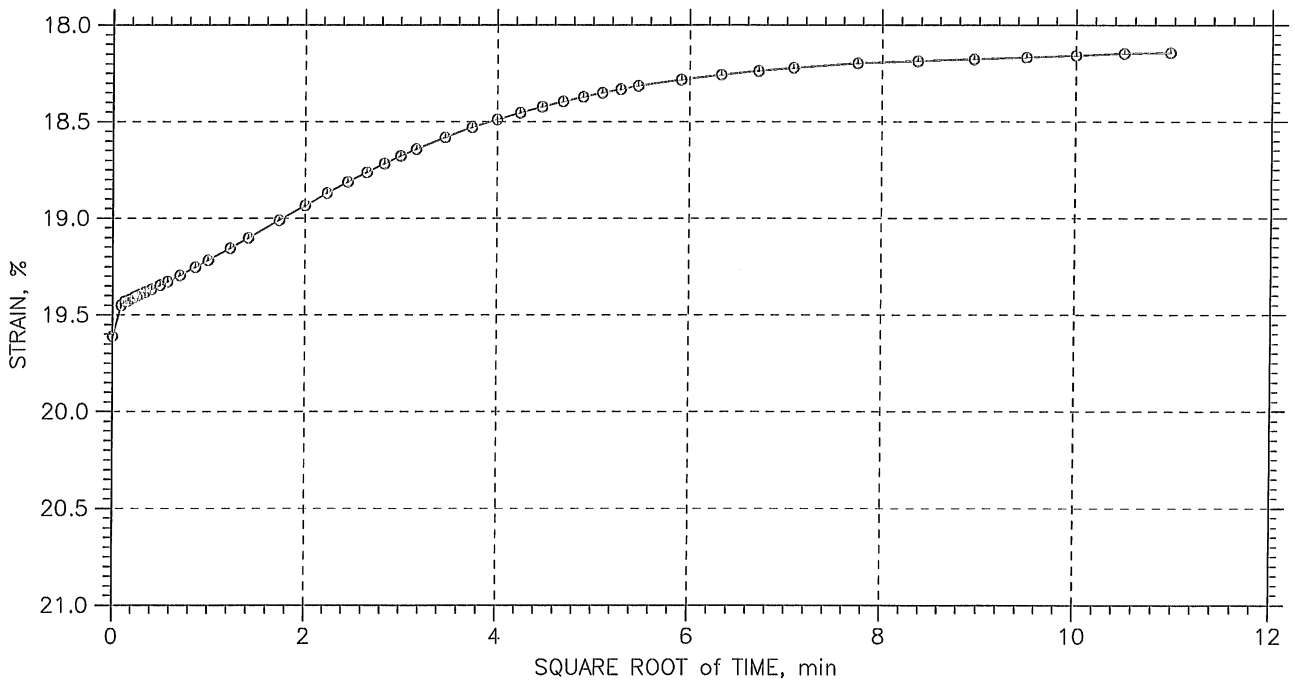
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 12

Stress: 0.5 tsf

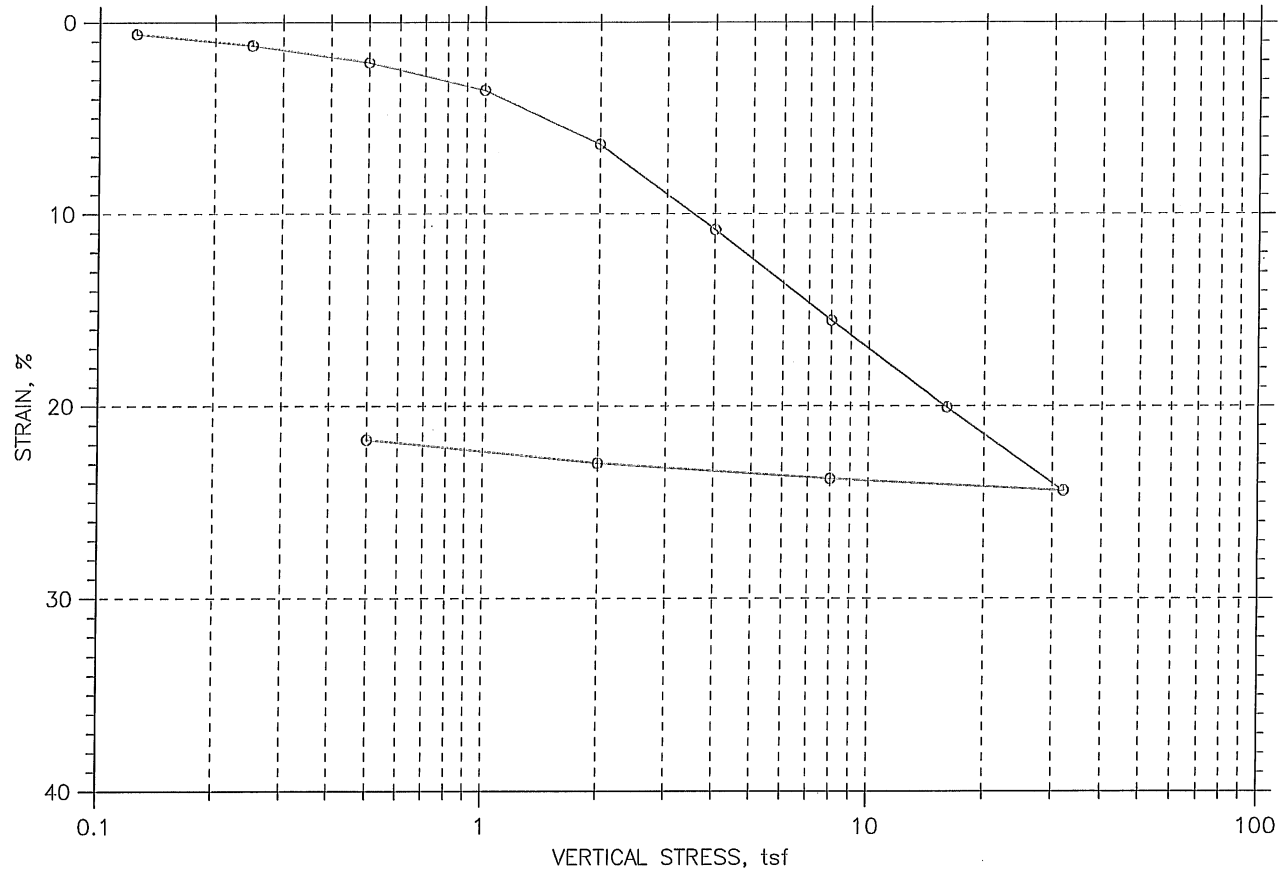


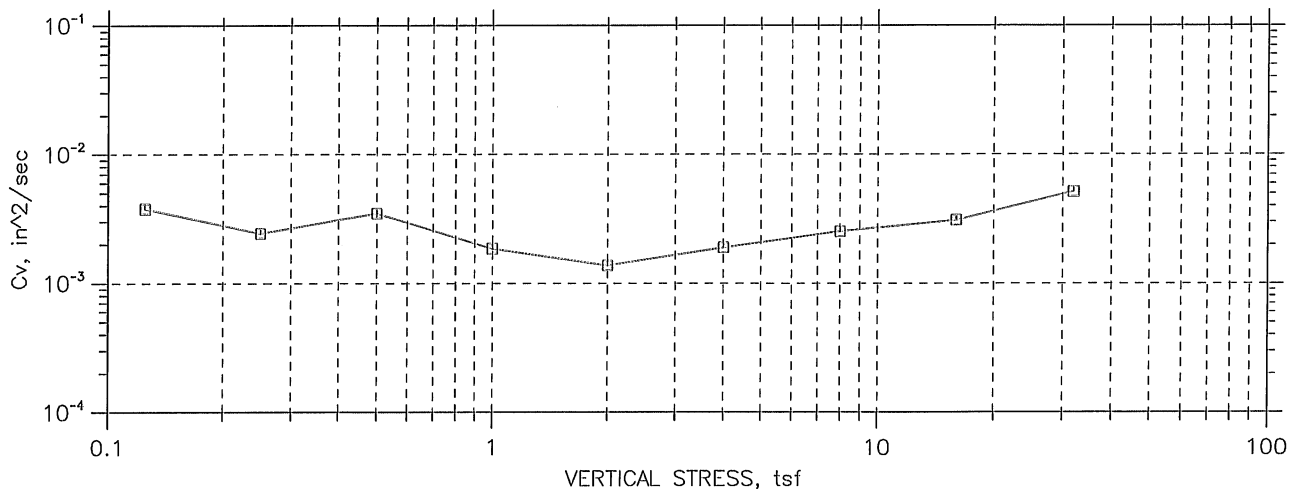


GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-16	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 15-17 ft
	Test No.: C-3	Sample Type: Tube	Elevation: ---
	Description: Moist, olive gray clay		
	Remarks: ---		

CONSOLIDATION TEST DATA

SUMMARY REPORT





Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

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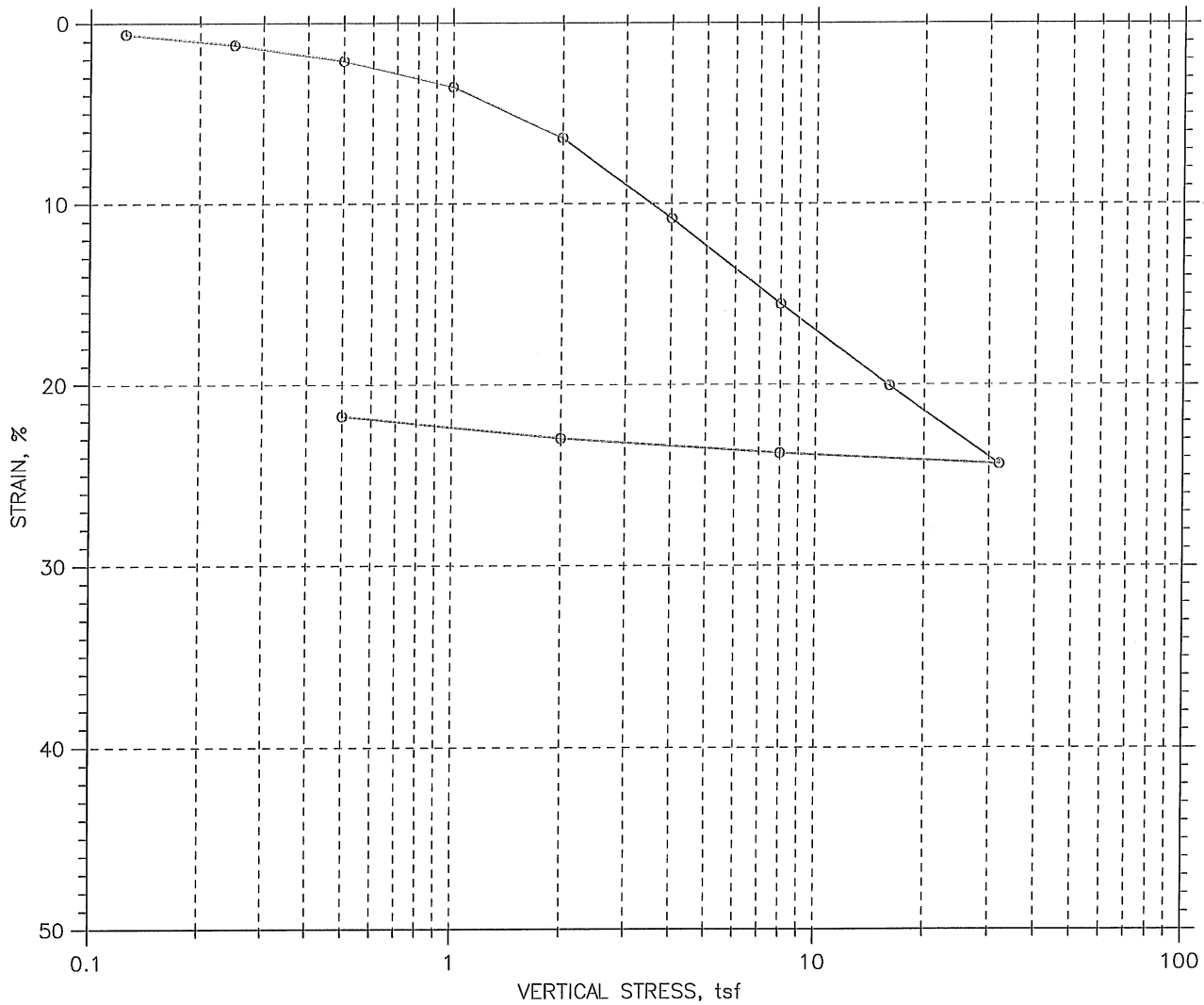
CONSOLIDATION TEST DATA

SUMMARY REPORT



					Before Test	After Test
Overburden Pressure: ---				Water Content, %	40.94	27.93
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	74.4	95.07
Compression Index: ---				Saturation, %	88.66	100.00
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.22	0.74
LL: 56	PL: 31	PI: 25	GS: 2.65			

GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-20
Sample No.: U-1
Test No.: C-4

Location: Saco, ME
Tested By: md
Test Date: 12/20/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 17-19 ft
Elevation: ---

Soil Description: Moist dark olive gray sandy silt
Remarks: ---

Estimated Specific Gravity: 2.65
Initial Void Ratio: 1.22
Final Void Ratio: 0.74

Liquid Limit: 56
Plastic Limit: 31
Plasticity Index: 25

Initial Height: 1.00 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	Bag B 3015	RING		Lemmiwinks
Wt. Container + Wet Soil, gm	122.4	352.04	339.57	130.45
Wt. Container + Dry Soil, gm	86.38	312.8	312.8	103.73
Wt. Container, gm	8.46	216.93	216.93	8.06
Wt. Dry Soil, gm	77.92	95.865	95.865	95.67
Water Content, %	46.23	40.94	27.93	27.93
Void Ratio	---	1.22	0.74	---
Degree of Saturation, %	---	88.66	100.00	---
Dry Unit Weight, pcf	---	74.4	95.07	---

Note: Specific Gravity and Void Ratios are calculated assuming the degree of saturation equals 100% at the end of the test. Therefore, values may not represent actual values for the specimen.

CONSOLIDATION TEST DATA

Project: Camp Ellis
Boring No.: FD-20
Sample No.: U-1
Test No.: C-4

Location: Saco, ME
Tested By: md
Test Date: 12/20/05
Sample Type: Tube

Project No.: GTX-5947
Checked By: jdt
Depth: 17-19 ft
Elevation: ---

Soil Description: Moist dark olive gray sandy silt
Remarks: ---

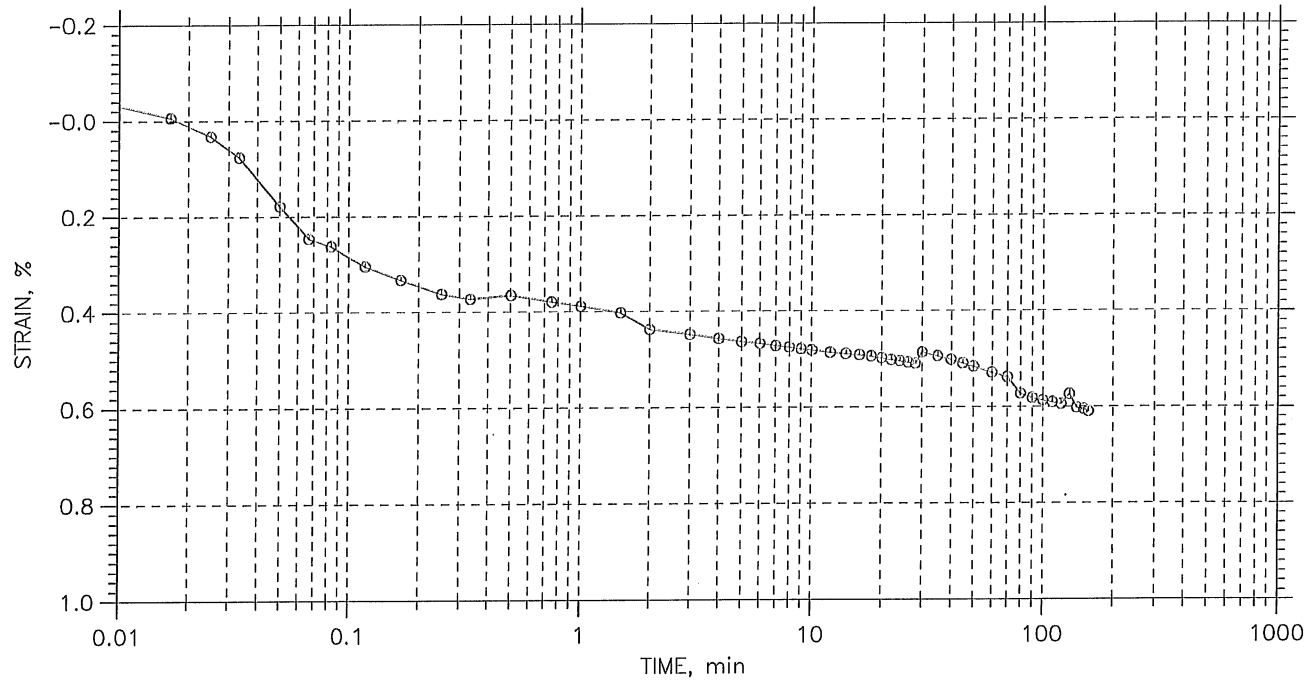
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. in^2/sec	Coefficient of Consolidation Log in^2/sec	Coefficient of Consolidation Ave. in^2/sec
1	0.125	0.006097	1.210	0.61	0.2	0.0	3.78e-003	0.00e+000	3.78e-003
2	0.25	0.01209	1.197	1.21	0.6	0.1	1.39e-003	9.49e-003	2.43e-003
3	0.5	0.02099	1.177	2.10	0.4	0.1	2.07e-003	1.10e-002	3.49e-003
4	1	0.03538	1.145	3.54	0.8	0.1	1.03e-003	9.60e-003	1.86e-003
5	2	0.0636	1.082	6.36	1.0	0.1	7.66e-004	6.50e-003	1.37e-003
6	4	0.1081	0.983	10.81	0.6	0.1	1.16e-003	5.13e-003	1.89e-003
7	8	0.1554	0.878	15.54	0.4	0.1	1.59e-003	6.15e-003	2.52e-003
8	16	0.2006	0.777	20.06	0.3	0.1	1.94e-003	7.63e-003	3.09e-003
9	32	0.2439	0.681	24.39	0.1	0.0	3.40e-003	1.06e-002	5.14e-003
10	8	0.2378	0.695	23.78	0.0	0.0	7.35e-002	0.00e+000	7.35e-002
11	2	0.2296	0.713	22.96	0.2	0.0	2.35e-003	0.00e+000	2.35e-003
12	0.5	0.2174	0.740	21.74	1.6	0.0	3.07e-004	0.00e+000	3.07e-004

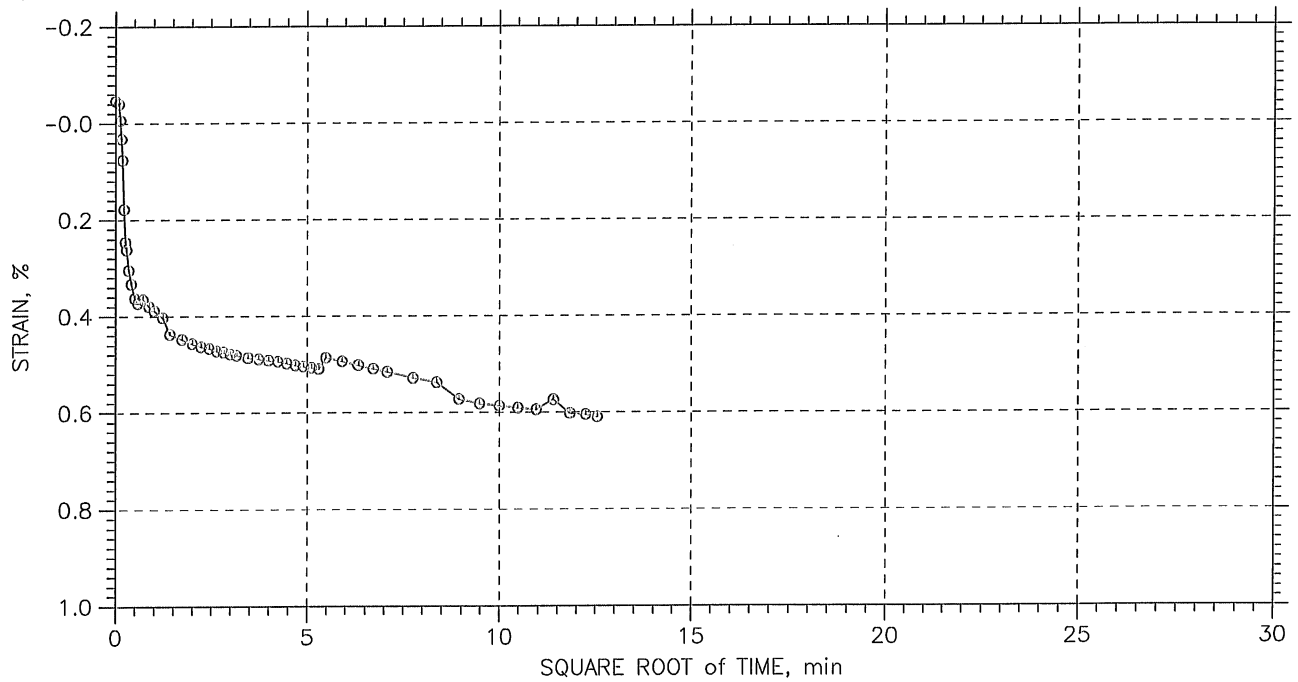
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 12

Stress: 0.125 tsf





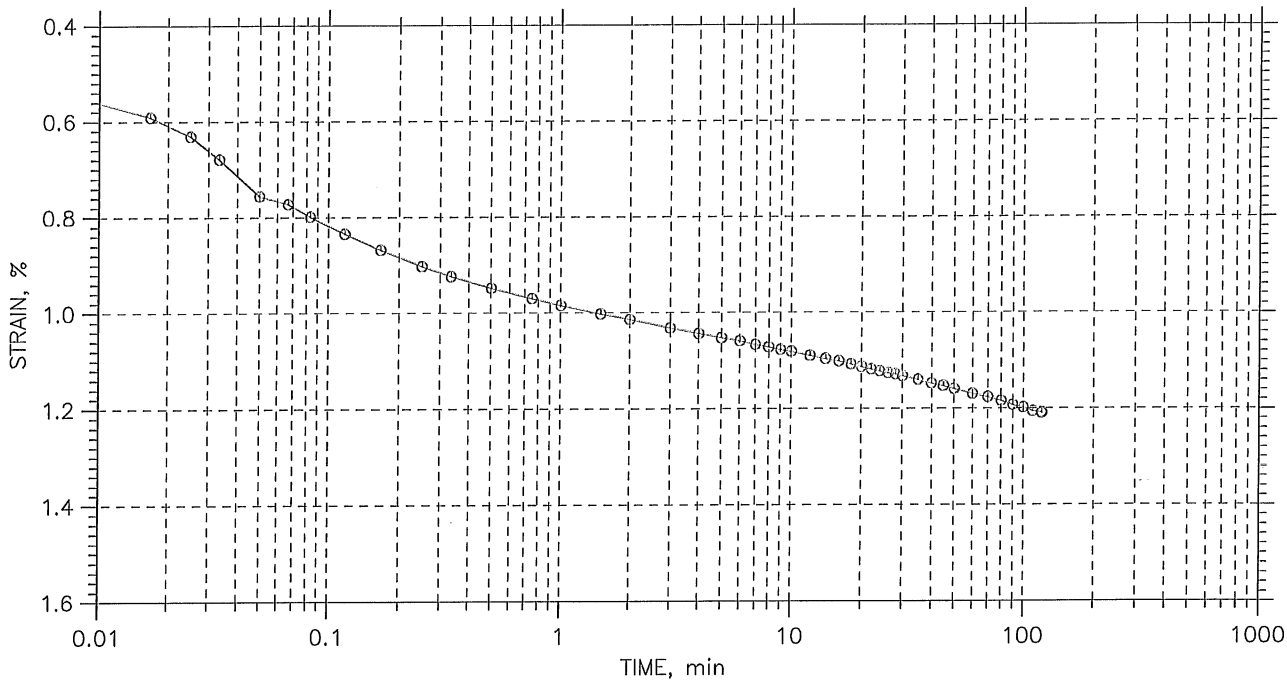
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

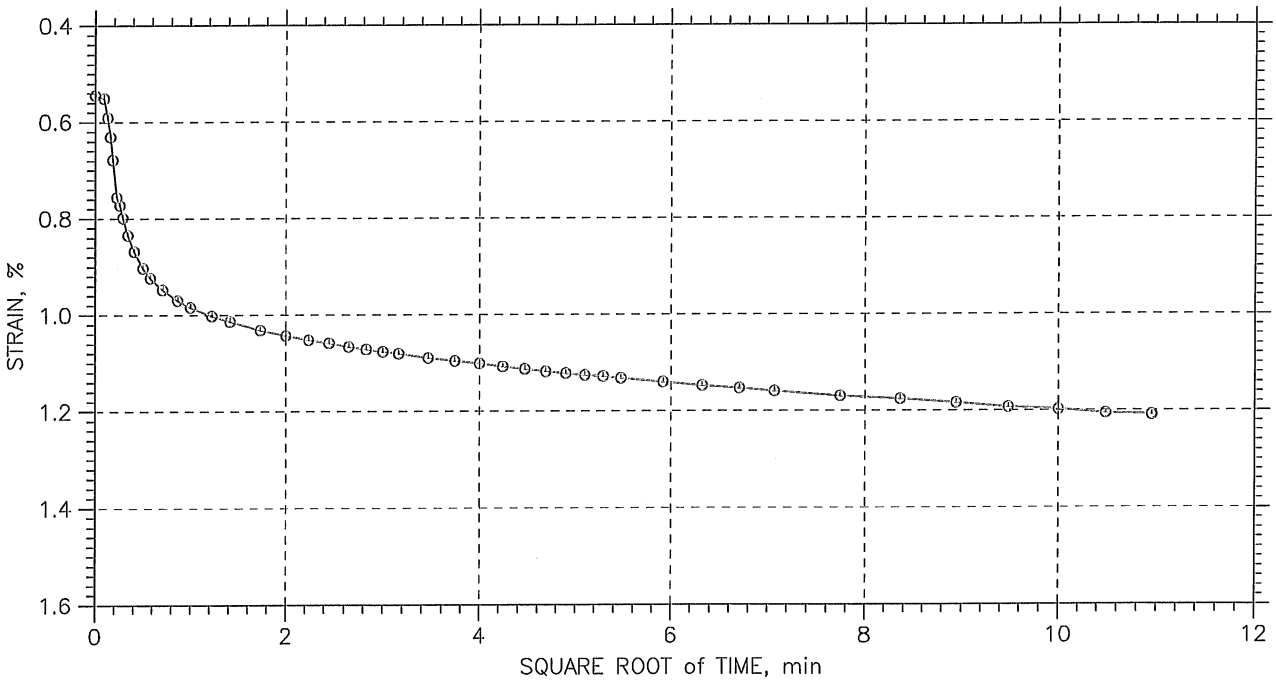
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 12

Stress: 0.25 tsf





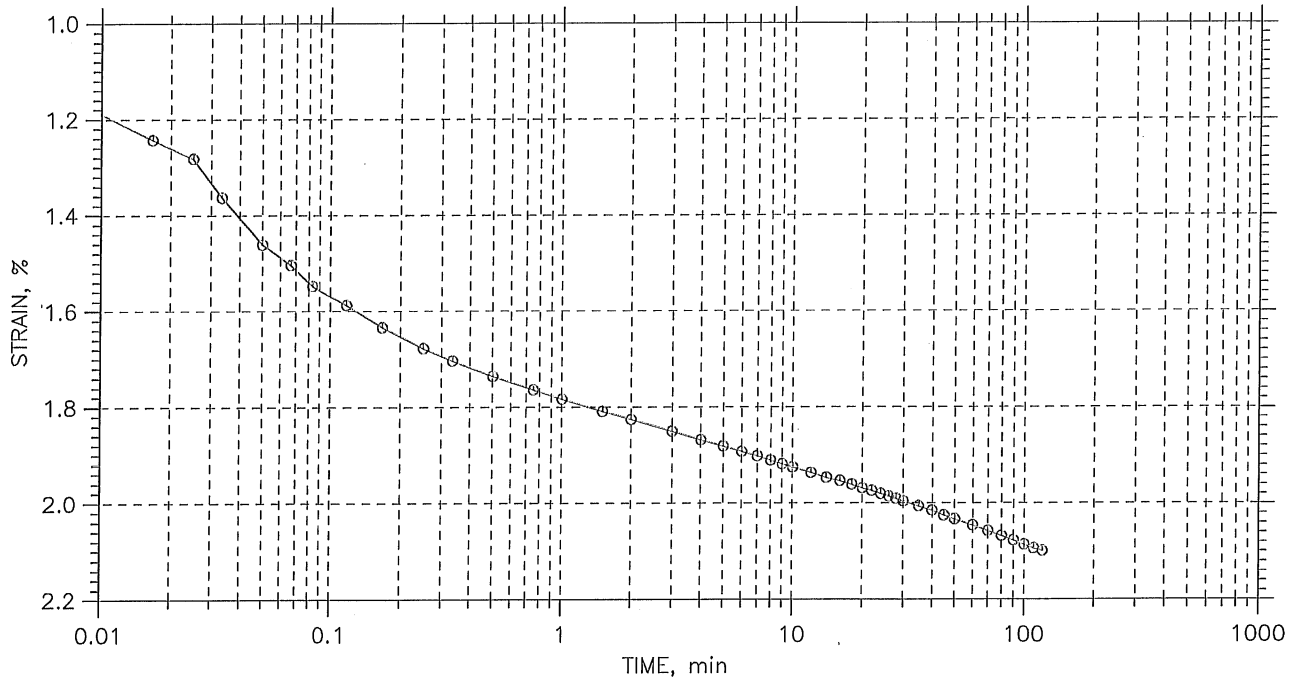
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

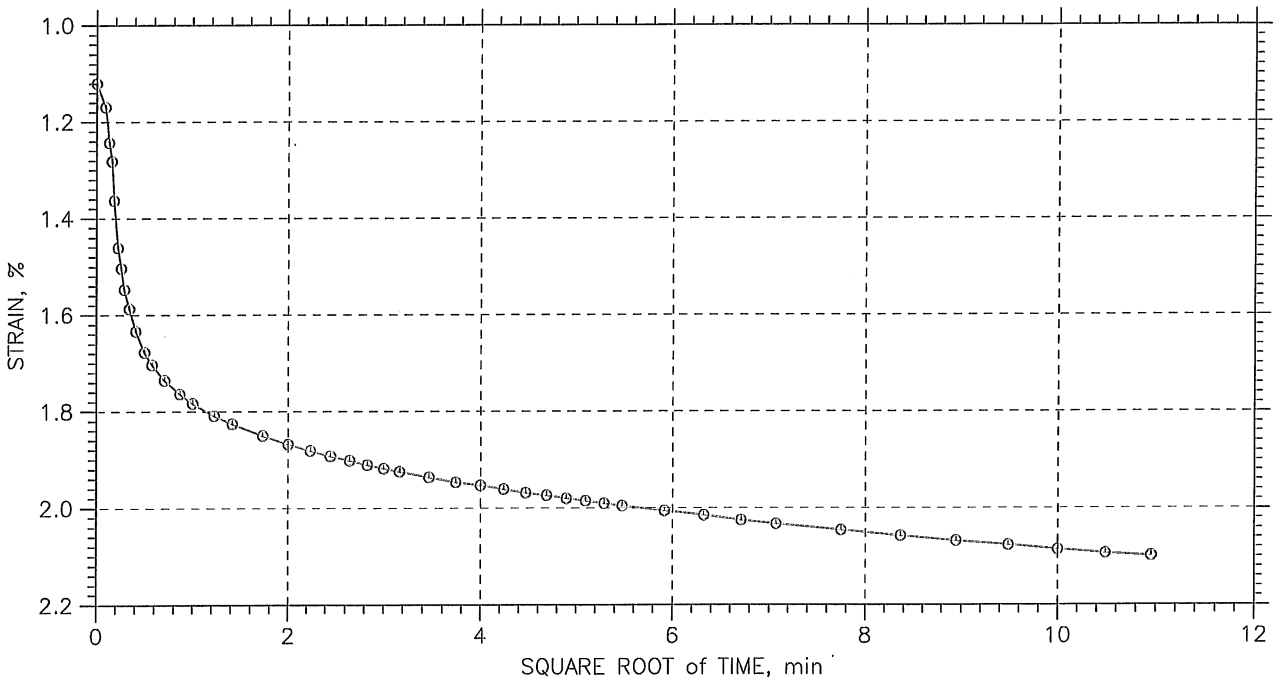
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 12

Stress: 0.5 tsf





GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

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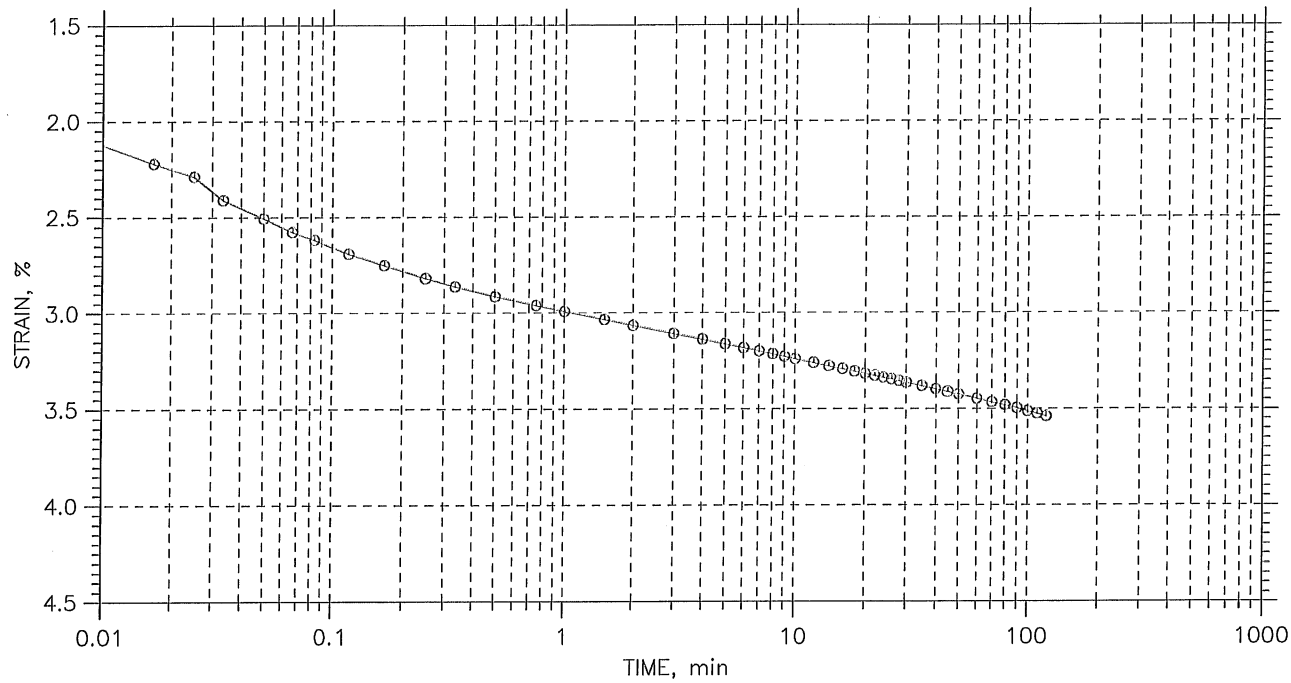
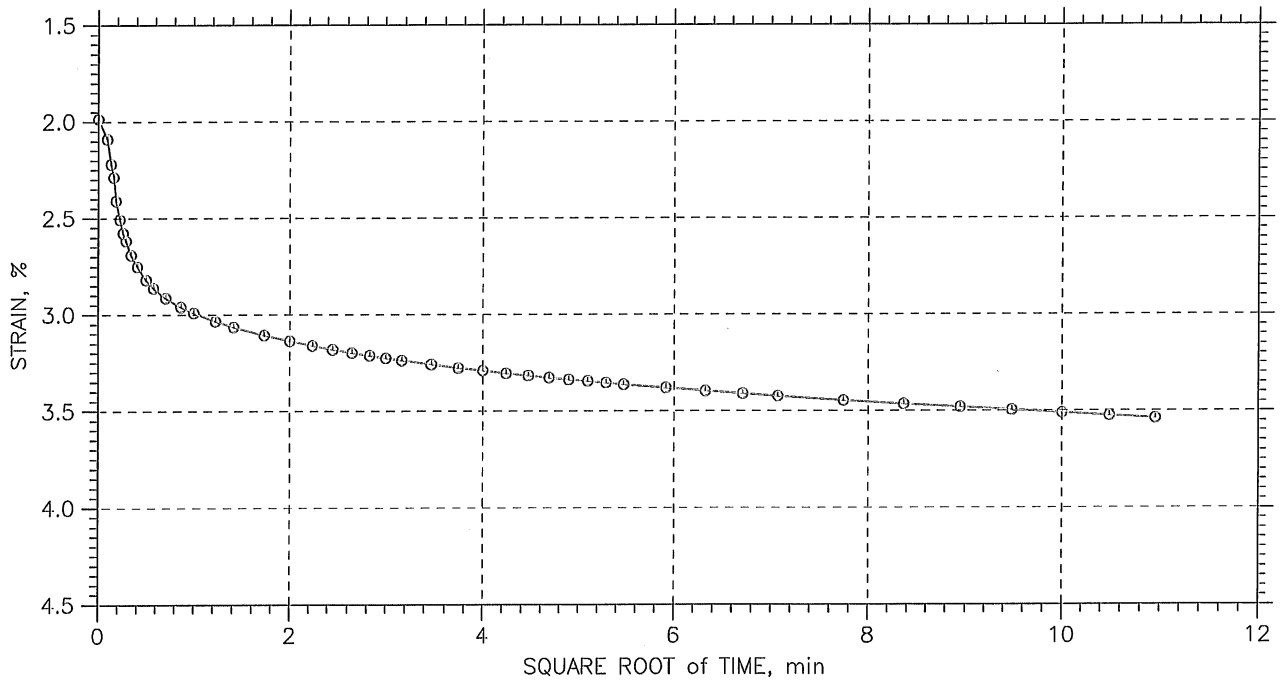
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 12

Stress: 1. tsf





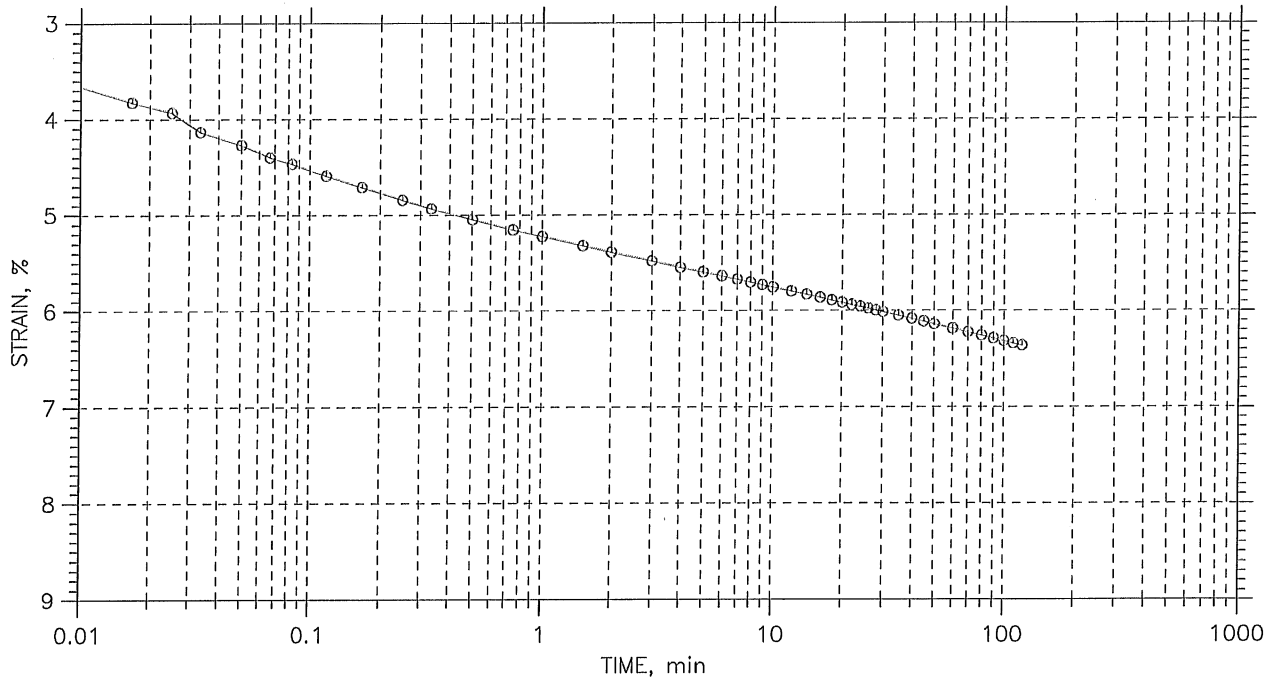
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

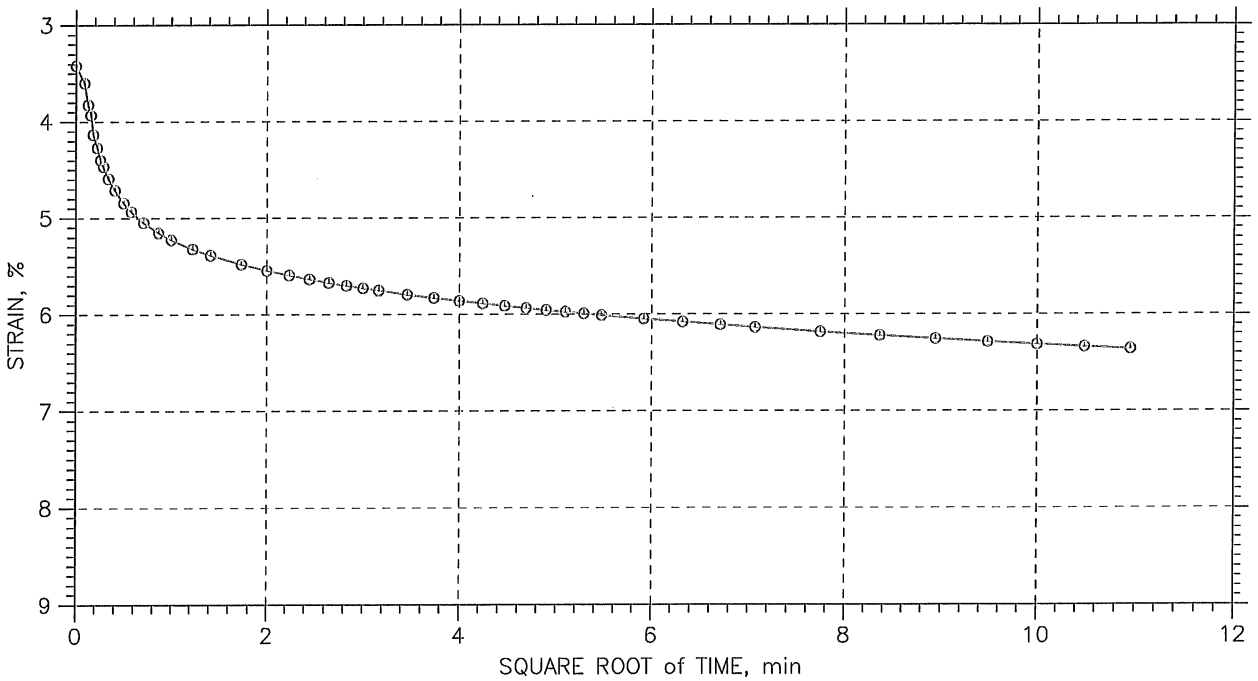
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 12

Stress: 2. tsf





GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

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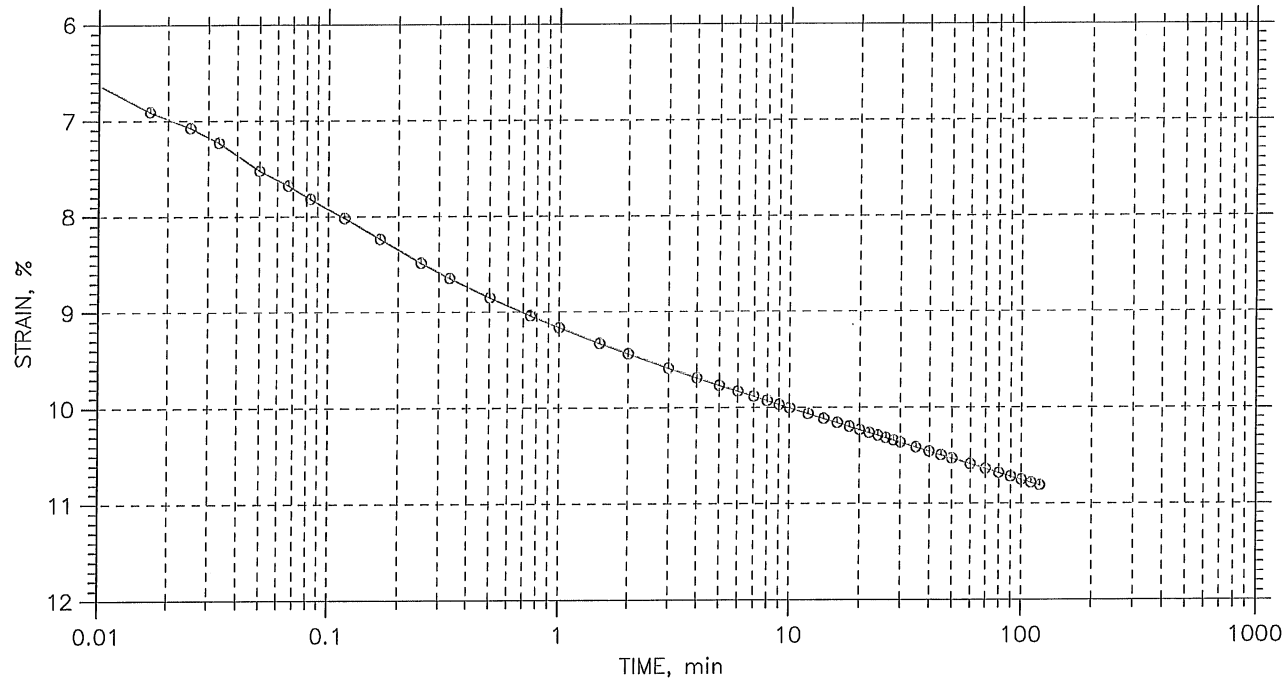
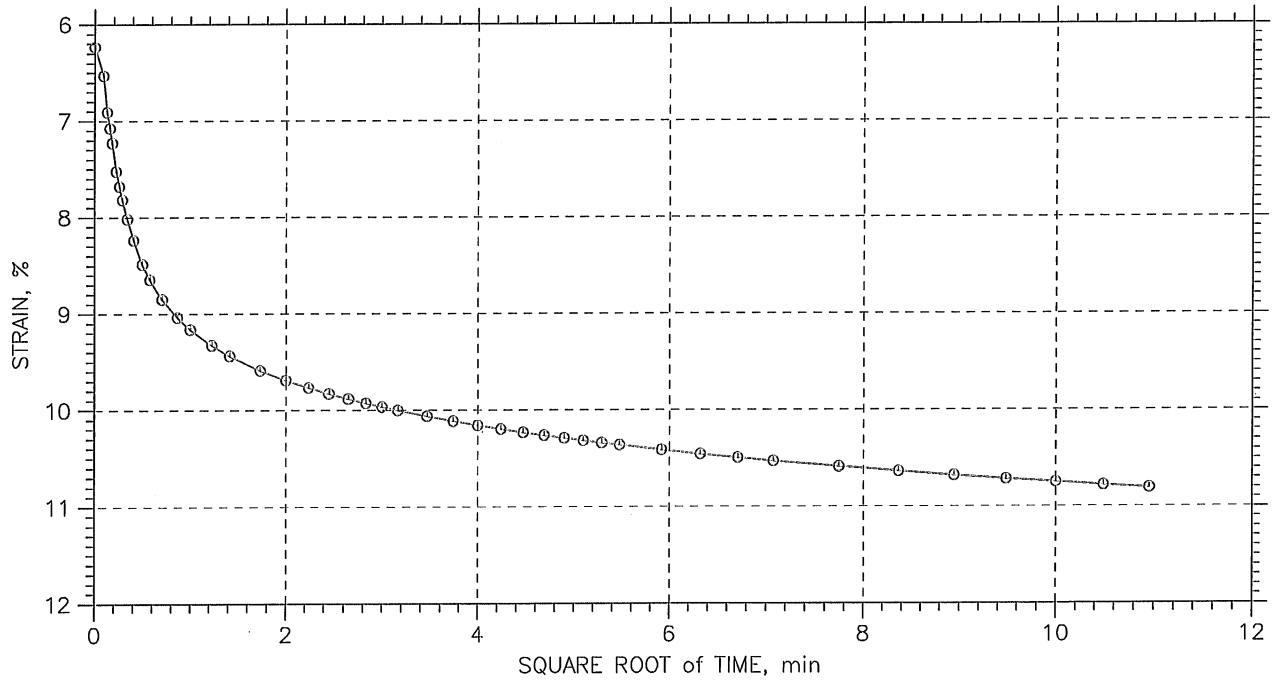
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 12

Stress: 4. tsf





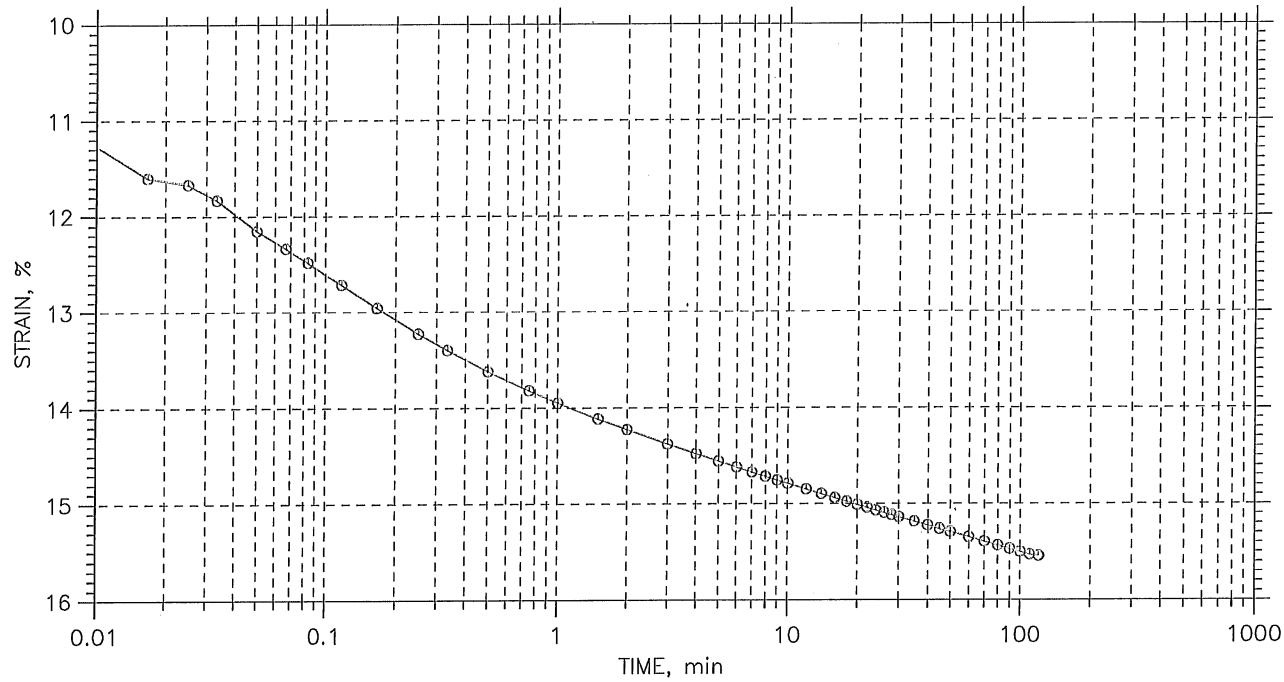
Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

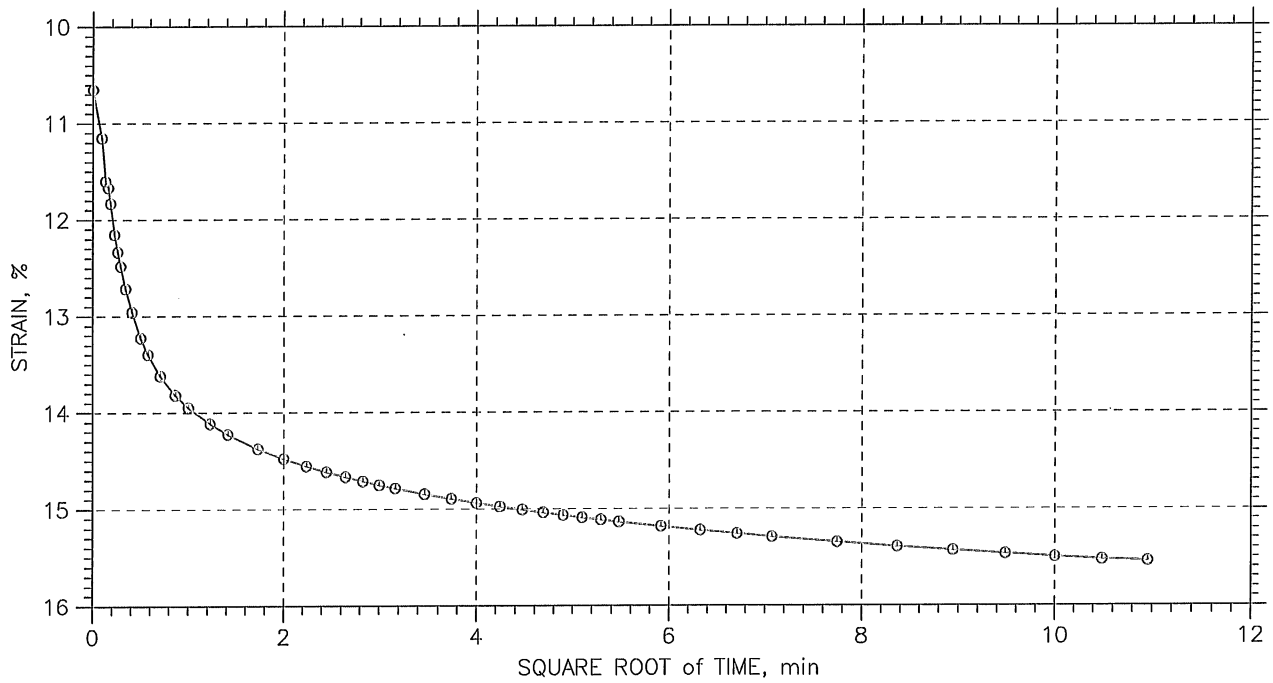
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 12

Stress: 8. tsf





Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

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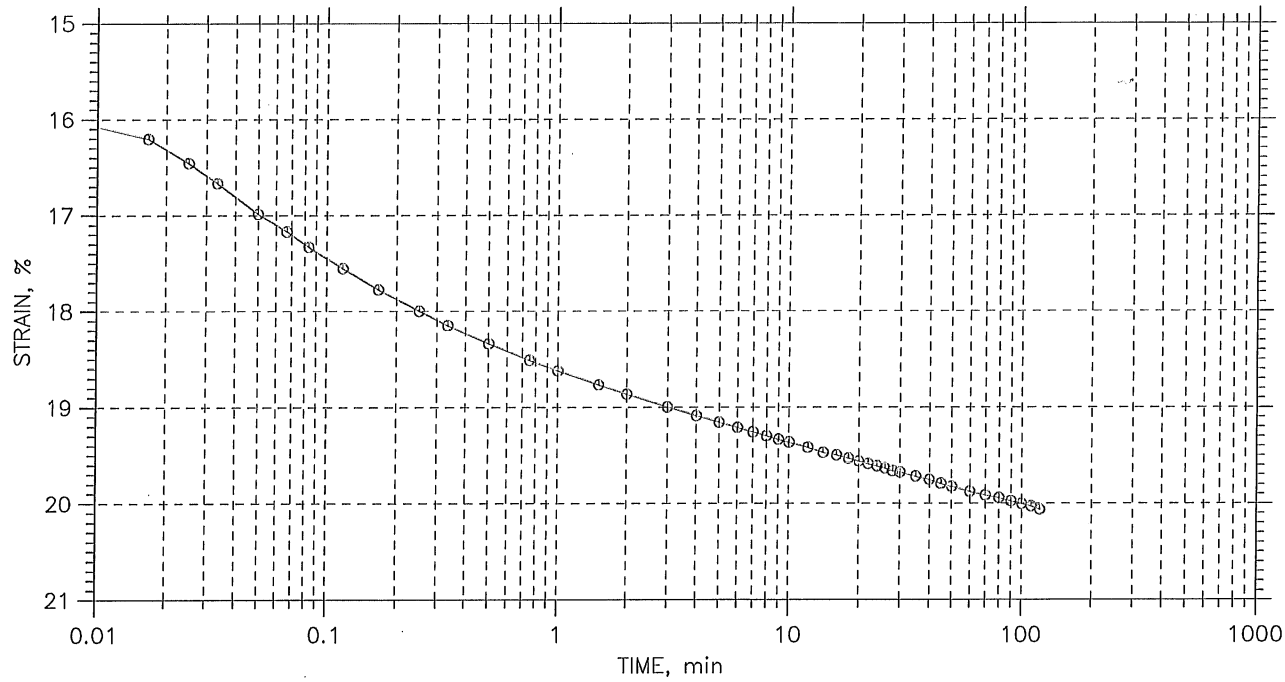
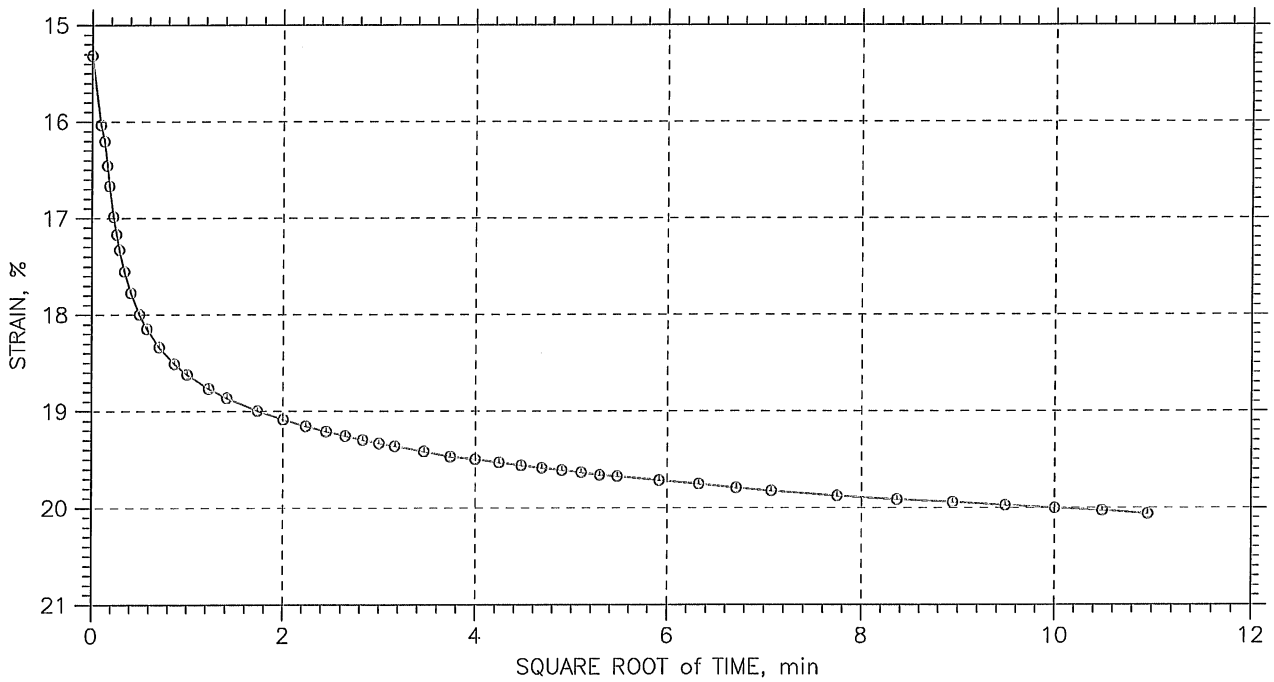
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 12

Stress: 16. tsf





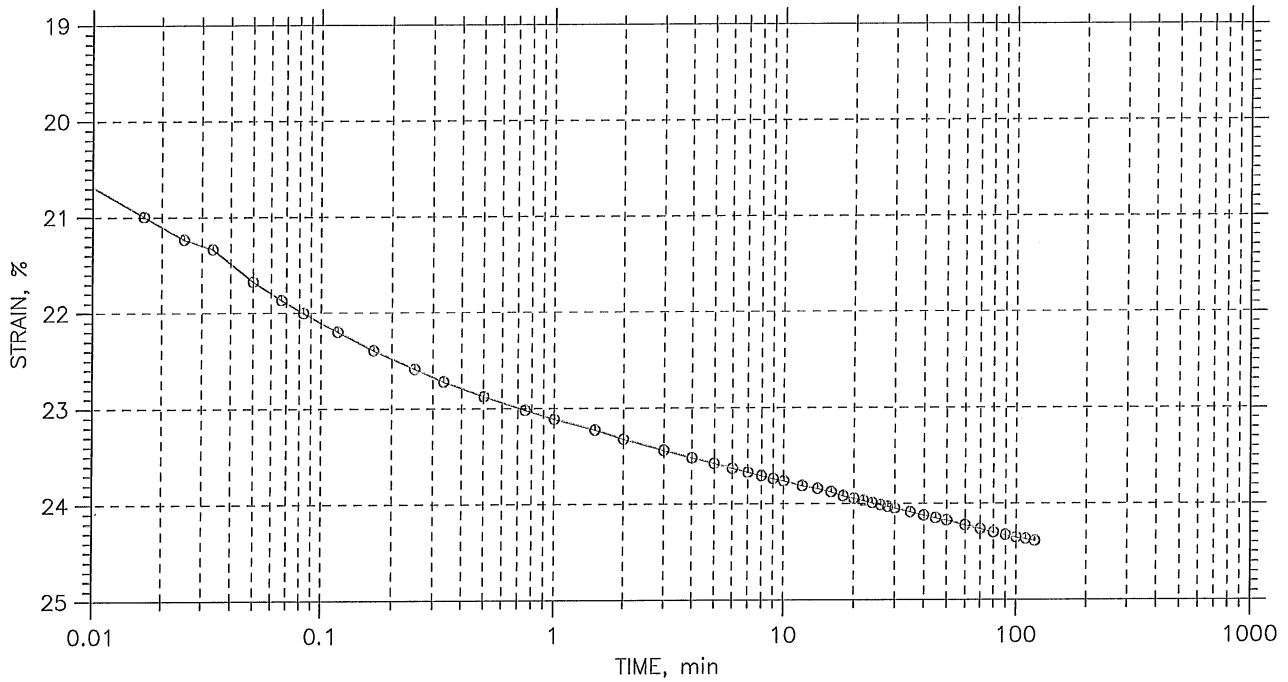
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

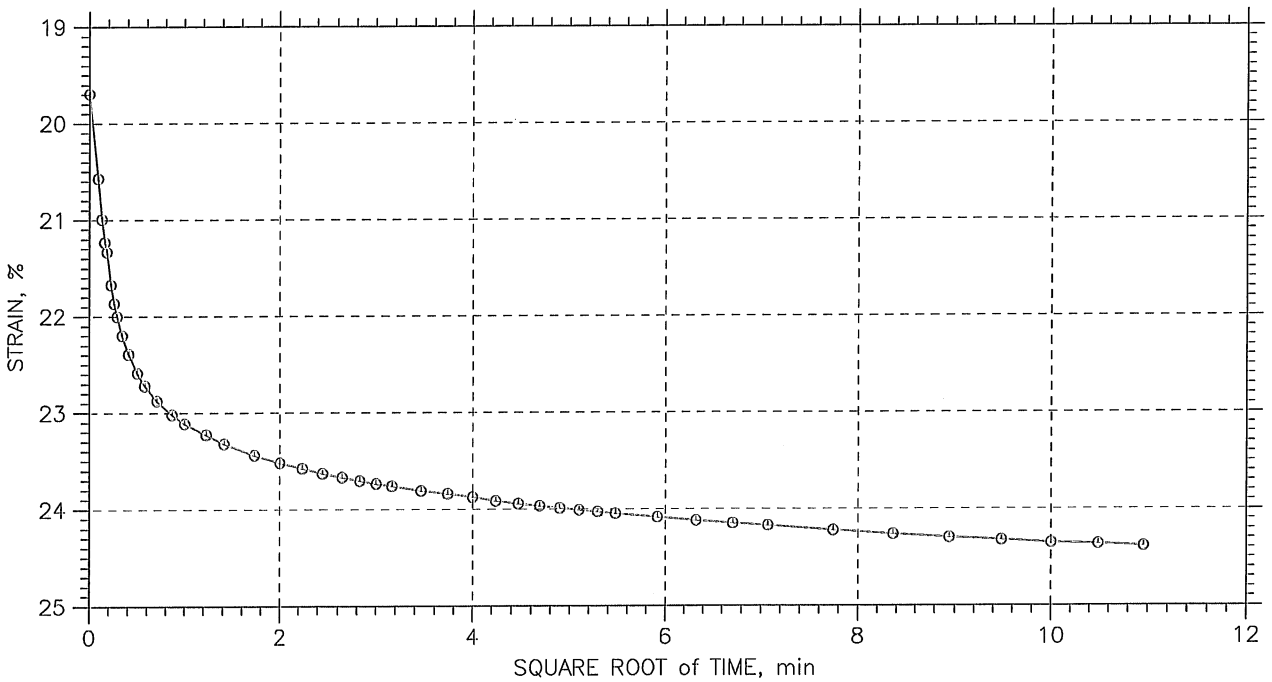
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 12

Stress: 32. tsf





Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

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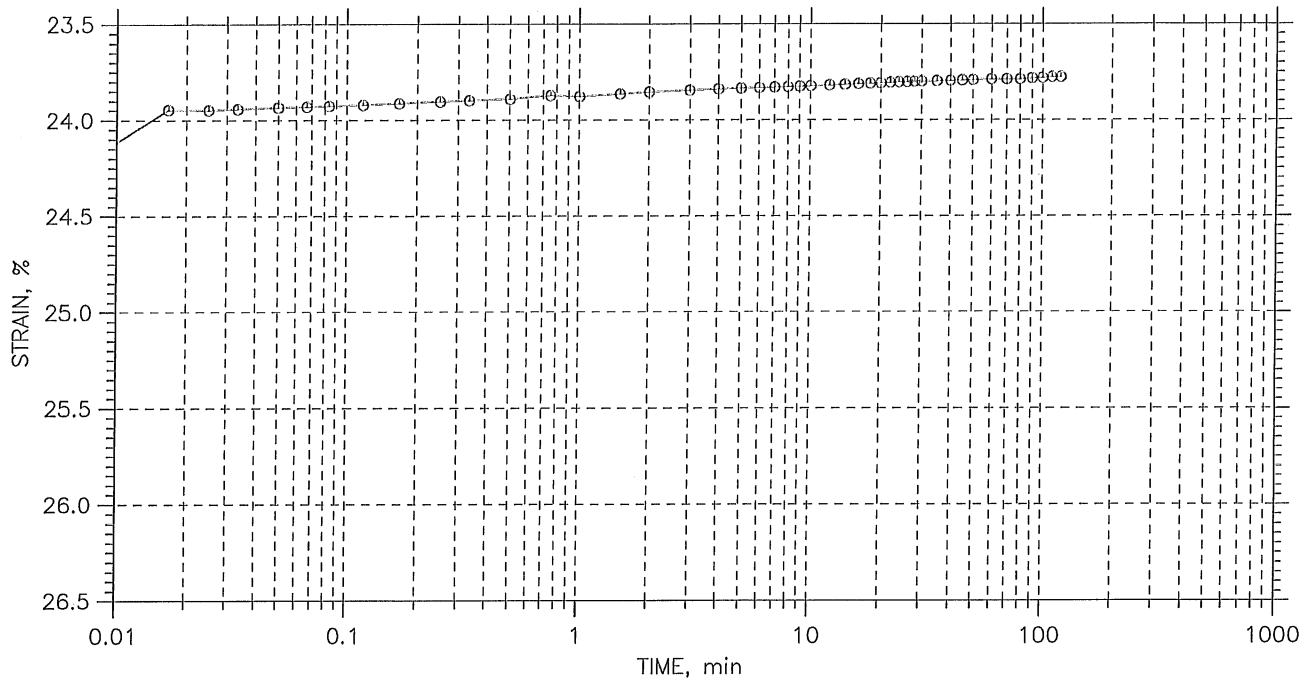
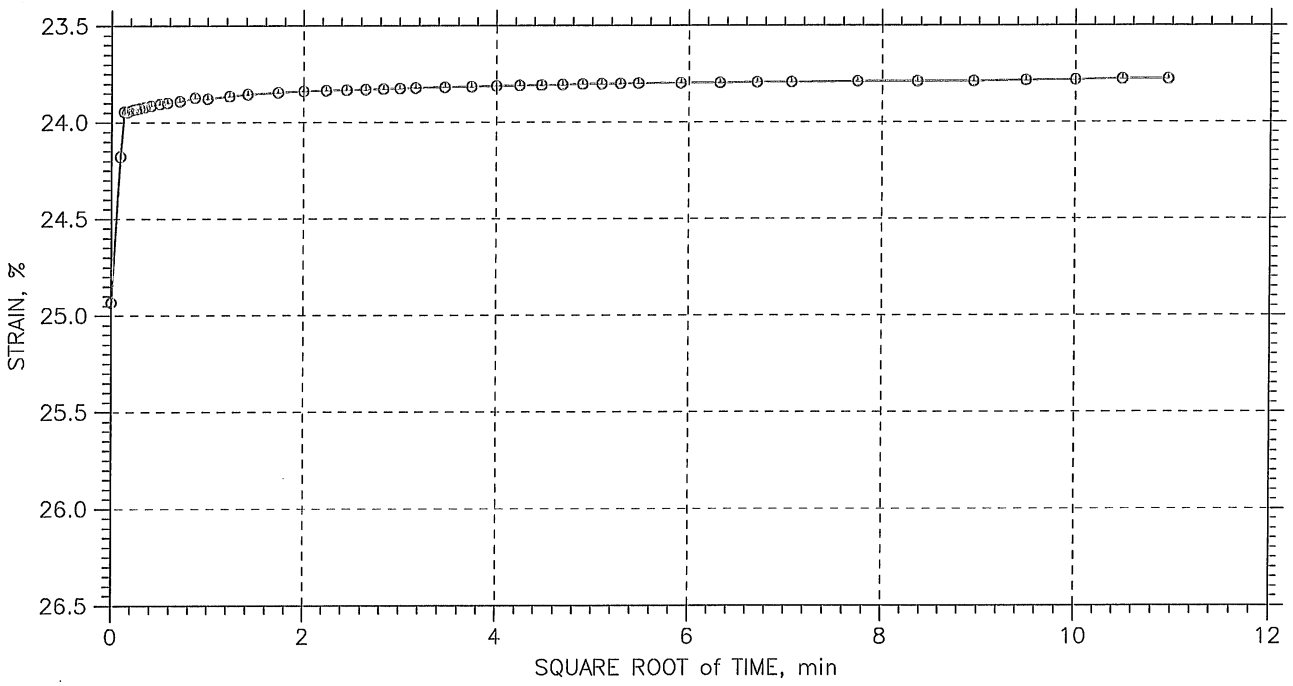
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 12

Stress: 8. tsf





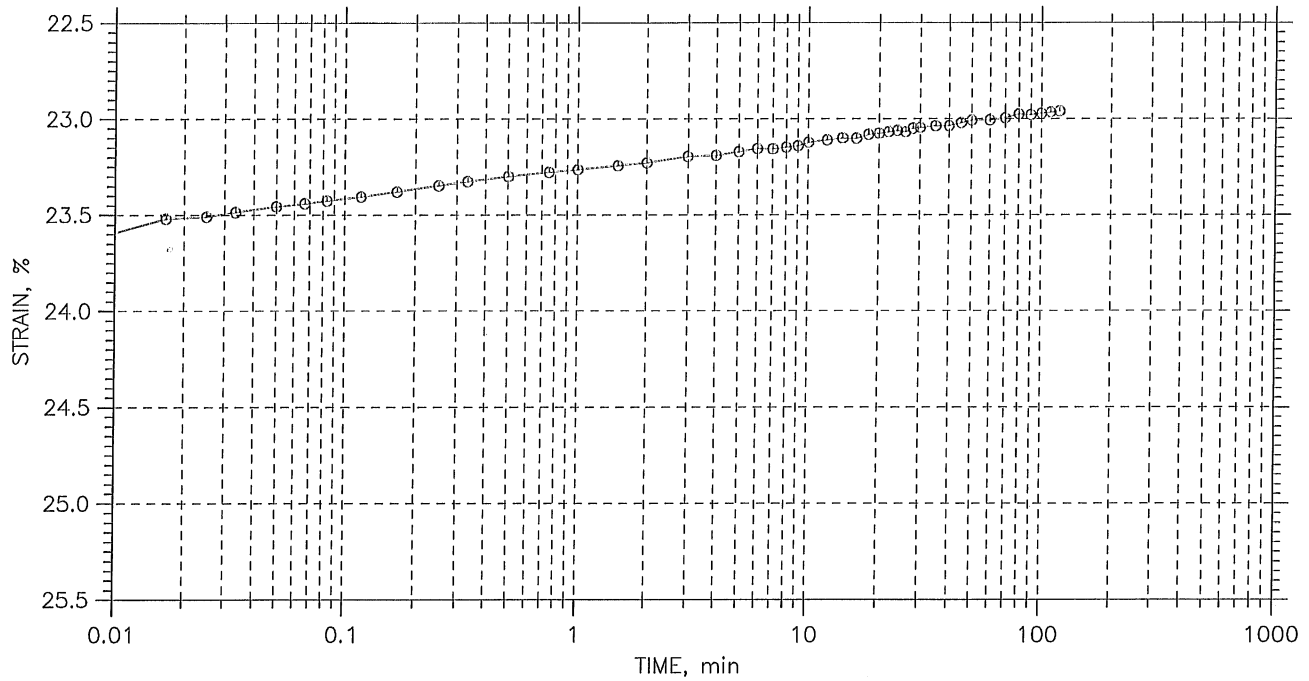
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

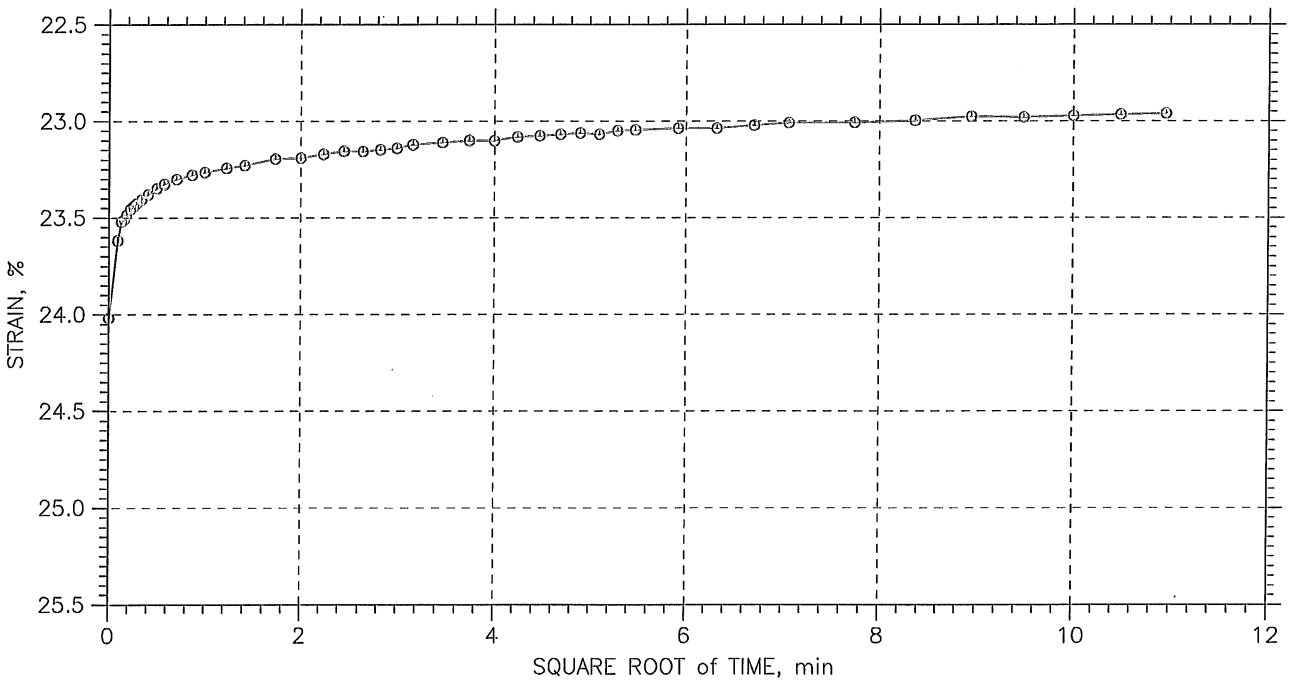
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 12

Stress: 2. tsf





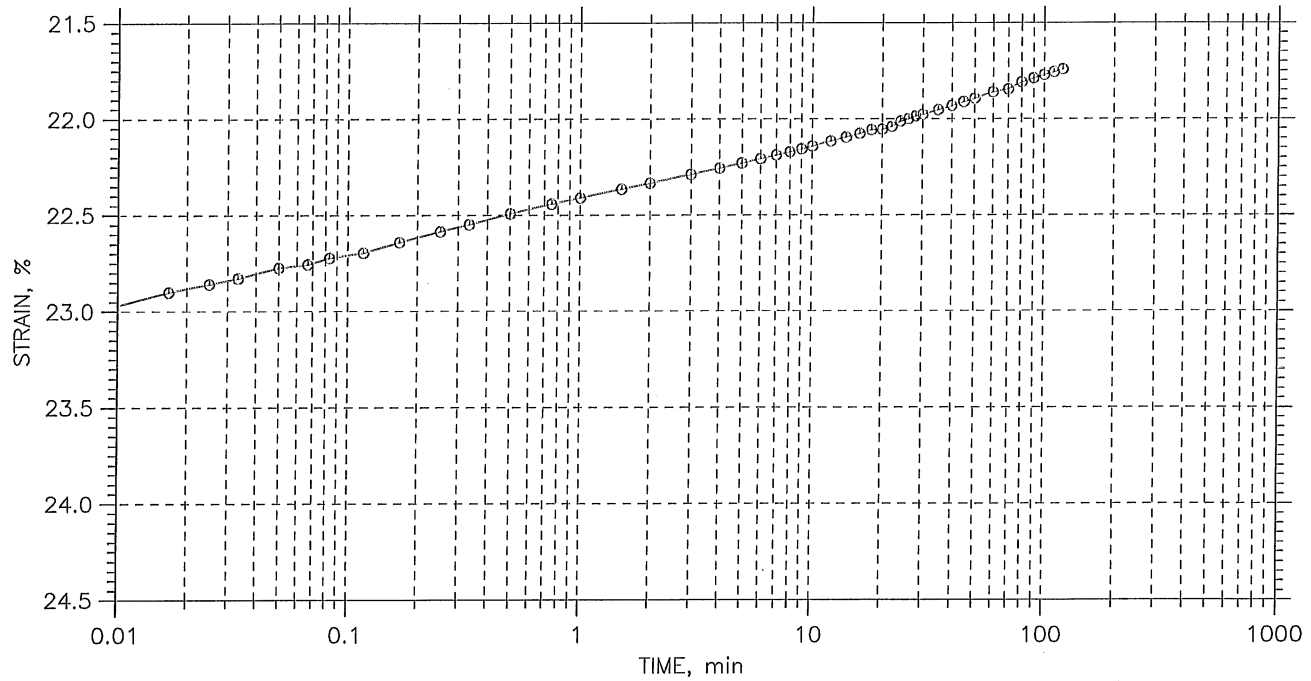
GeoTesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

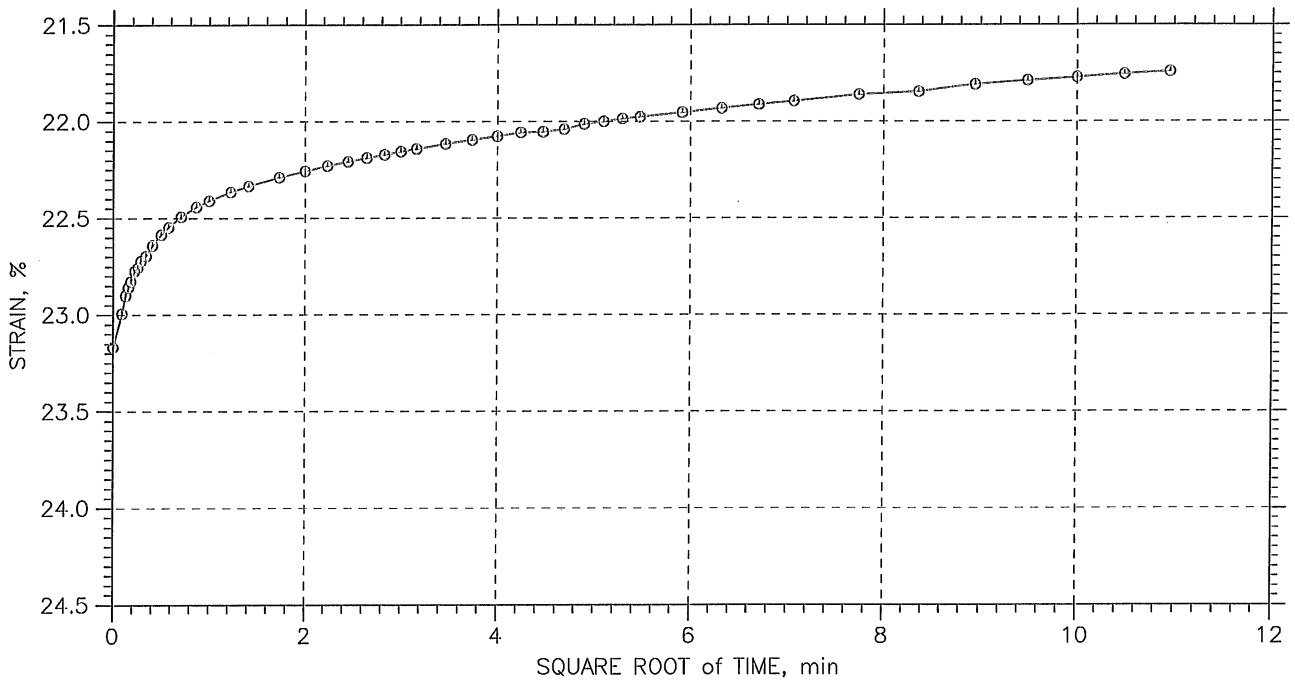
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 12

Stress: 0.5 tsf





Geotesting express	Project: Camp Ellis	Location: Saco, ME	Project No.: GTX-5947
	Boring No.: FD-20	Tested By: md	Checked By: jdt
	Sample No.: U-1	Test Date: 12/20/05	Depth: 17-19 ft
	Test No.: C-4	Sample Type: Tube	Elevation: ---
	Description: Moist dark olive gray sandy silt		
	Remarks: ---		

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WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

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Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
PI	plasticity index
i	gradient
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S	degree of saturation
SL	shrinkage limit
s_u	undrained shear strength
T	time factor for consolidation
T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength