

APPENDIX B MONITORING WELL DIAGRAMS

Appendix B

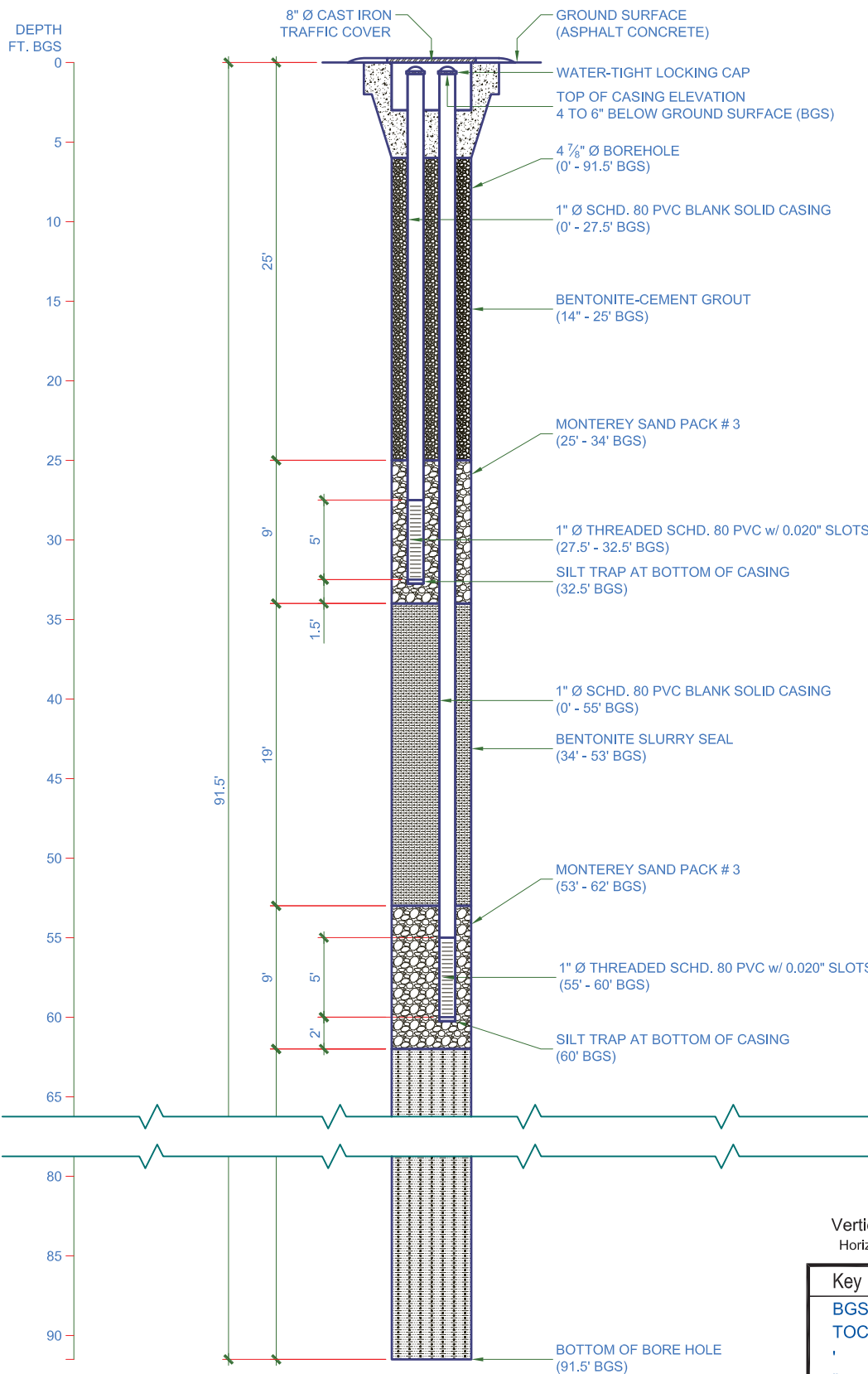
Figure B-1: Gas/Groundwater Monitoring Well Diagrams (ACE Phase)

Figure B-2: Gas/Groundwater Monitoring Well Diagrams (PE Phase)

Figure B-3: Gas/Groundwater Monitoring Well Diagrams (Adv. PE Phase)

BORING G-11 MONITORING WELL DETAIL

GROUNDWATER



Vertical Scale: 1" = 10'-0"
 Horizontal Scale Exaggerated



AMEC Environment & Infrastructure
 5628 E. Slauson Avenue, Los Angeles, California 90040
 Phone (323) 889-5300 Fax (323) 889-5398

WELL NO.:	G-11	DRAWN:	L. Morley
INSTALLED:	06/15/2009	CHKD:	Jag
SCALE:	1" = 10' Vertical	DATE:	December 2, 2011
DRILL CO.:	C&L Pacific	TECHNIQUE:	Rotary-Wash
FIELD PERSONNEL:	A. Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	Wilshire and Beverly, Los Angeles, CA		

MTA WESTSIDE SUBWAY EXTENSION
 Parsons Brinckerhoff

WELL CONSTRUCTION
 DETAIL
 Groundwater Monitoring Well

FIGURE NO.

B-1.1

PROJECT NO.
 4953-11-1421

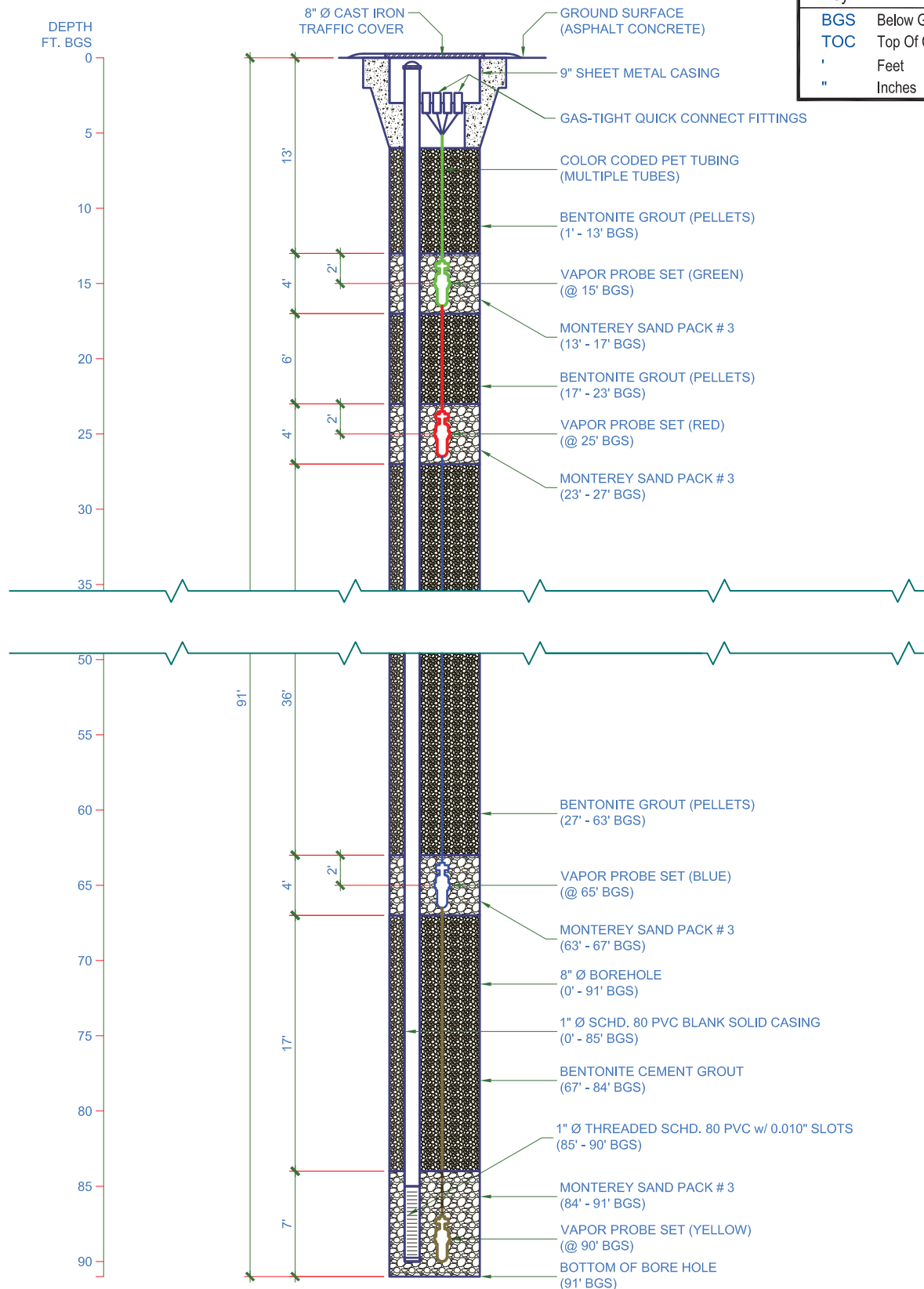
BORING M-17 MONITORING WELL DETAIL

METHANE

Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key

BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches



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WELL NO.:	M-17	DRAWN:	L. Morley
INSTALLED:	06/28/2009	CHKD:	Jag
SCALE:	1" = 10' Vertical	DATE:	December 2, 2011
DRILL CO.:	Cascade Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Paul Kane		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	Wilshire & South Stanley, Los Angeles, CA		

MTA WESTSIDE SUBWAY EXTENSION
Parsons Brinckerhoff

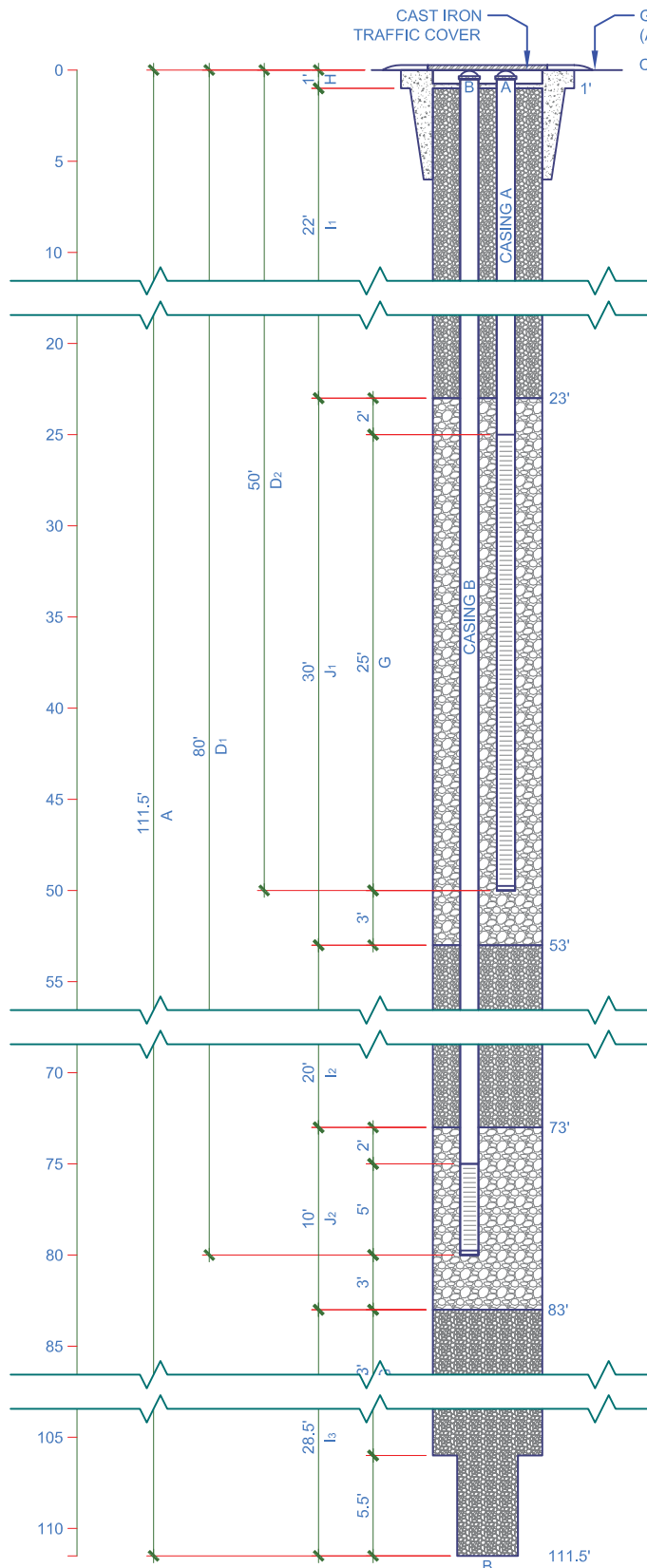
WELL CONSTRUCTION
DETAIL
Methane Gas Monitoring Well

FIGURE NO.

B-1.2

PROJECT NO.
4953-11-1421

GROUNDWATER OBSERVATION WELL G-139



- A. TOTAL DEPTH OF BORING: 111.5' BGS
- B. DIAMETER OF BORING: 8"Ø, 4 7/8"Ø AT BOTTOM 5.5'
DRILLING METHOD: ROTARY-WASH
- C. TOP OF BOX ELEVATION: NA
- D. CASING LENGTH: 50' (A), 80' (B)
MATERIAL: PVC
- E. CASING DIAMETER: 2"Ø (EACH)
- F. DEPTH TO TOP OF SCREEN: 25' (A) & 75' (B)
- G. PERFORATION LENGTH: 25' (A), 5' (B)
PERFORATION SIZE: 0.020" SLOTS
- H. SUBSURFACE SEAL: 1' CONCRETE, 6" GROUT
- I. SEAL:
MATERIAL: HYDRATED BENTONITE (CHIPS)
 - I1. 1'-23': BENTONITE CEMENT GROUT OVER 1' OF BENTONITE CHIPS HYDRATED
 - I2. 53'-73': BENTONITE CHIPS HYDRATED
 - I3. 83'-111.5' BENTONITE CHIPS HYDRATED
- J. SAND PACK: 23'-53', 73'-83' (BGS)
MATERIAL: # 3 SAND PACK
w/ TRANSITION SAND AT TOP AND FILTER FABRIC SOCK PLACED OVER SCREEN
 - J1. 23'-53'
 - J2. 73'-83'
- K. WATER LEVELS ON 07/29/2011 WERE AS FOLLOWS:
 - A. 36.3 FEET BELOW TOC
 - B. 42.2 FEET BELOW TOC

Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches

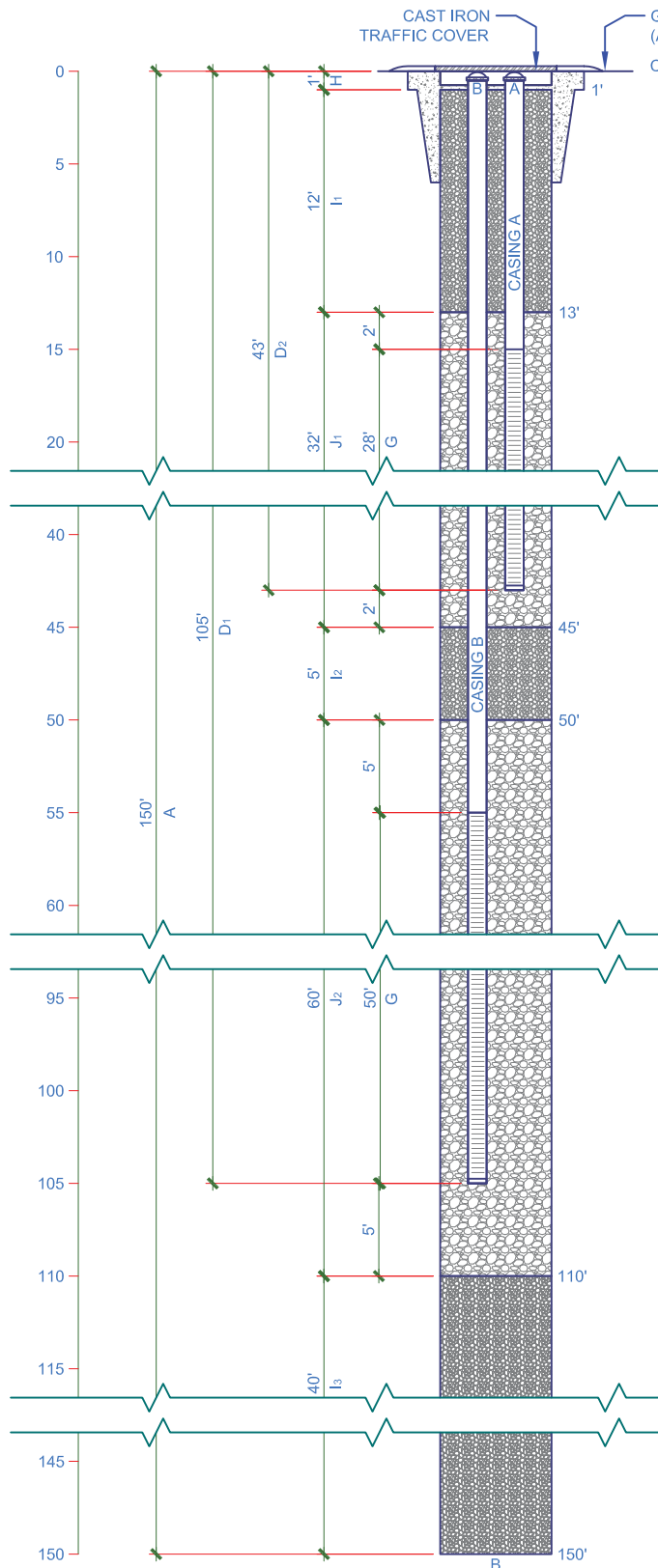


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Phone (323) 889-5300 Fax (323) 889-5398

WELL NO.:	G-139	DRAWN:	L. Morley
INSTALLED:	05/20/2011	CHKD:	Jag
SCALE:	1" = 10' Vertical	DATE:	December 2, 2011
DRILL CO.:	C & L Drilling	TECHNIQUE:	Rotary-Wash
FIELD PERSONNEL:	Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	Wilshire west of Altmont, Century City, CA		

MTA WESTSIDE SUBWAY EXTENSION	
Parsons Brinckerhoff	
WELL CONSTRUCTION DETAIL Groundwater Observation Well	FIGURE NO. B-2.1
	PROJECT NO. 4953-11-1421

GROUNDWATER OBSERVATION WELL G-165



- A. TOTAL DEPTH OF BORING: 150' BGS
- B. DIAMETER OF BORING: 8"Ø
DRILLING METHOD: ROTARY WASH
- C. TOP OF BOX ELEVATION: NA
- D. CASING LENGTH: 43' (A), 105' (B)
MATERIAL: PVC
- E. CASING DIAMETER: 2"Ø (EACH)
- F. DEPTH TO TOP OF SCREEN: 15' (A) & 55' (B)
- G. PERFORATION LENGTH: 28' (A), 50' (B)
PERFORATION SIZE: 0.010" SLOTS
- H. SUBSURFACE SEAL: 1' CONCRETE, 6' GROUT
- I. SEAL: 1'-13', 45'-50', 110'-150' (BGS)
MATERIAL: HYDRATED BENTONITE (CHIPS)
 - I₁: 1'-13': 8' OF BENTONITE CEMENT GROUT
OVER 4' OF BENTONITE CHIPS HYDRATED
 - I₂: 45'-50': BENTONITE CHIPS HYDRATED
 - I₃: 110'-150': BENTONITE CHIPS HYDRATED
- J. SAND PACK: 13'-45', 50'-110' (BGS)
MATERIAL: # 3 SAND PACK
 - J₁: 13'-45'
 - J₂: 50'-110'
- K. WATER LEVELS ON 04/22/2011 WERE AS FOLLOWS:
 - A. 26.0 FEET BELOW TOC
 - B. 64.5 FEET BELOW TOC

Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key

BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches



AMEC Environment & Infrastructure
5628 E. Slauson Avenue, Los Angeles, California 90040
Phone (323) 889-5300 Fax (323) 889-5398

WELL NO.:	G-165	DRAWN:	L. Morley
INSTALLED:	03/19/2011	CHKD:	H.P. / Jag
SCALE:	1" = 10' Vertical	DATE:	December 2, 2011
DRILL CO.:	C & L Drilling	TECHNIQUE:	Rotary-Wash
FIELD PERSONNEL:	Daniel Wader		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	Beverly Hills High School, Beverly Hills, CA		

MTA WESTSIDE SUBWAY EXTENSION
Parsons Brinckerhoff

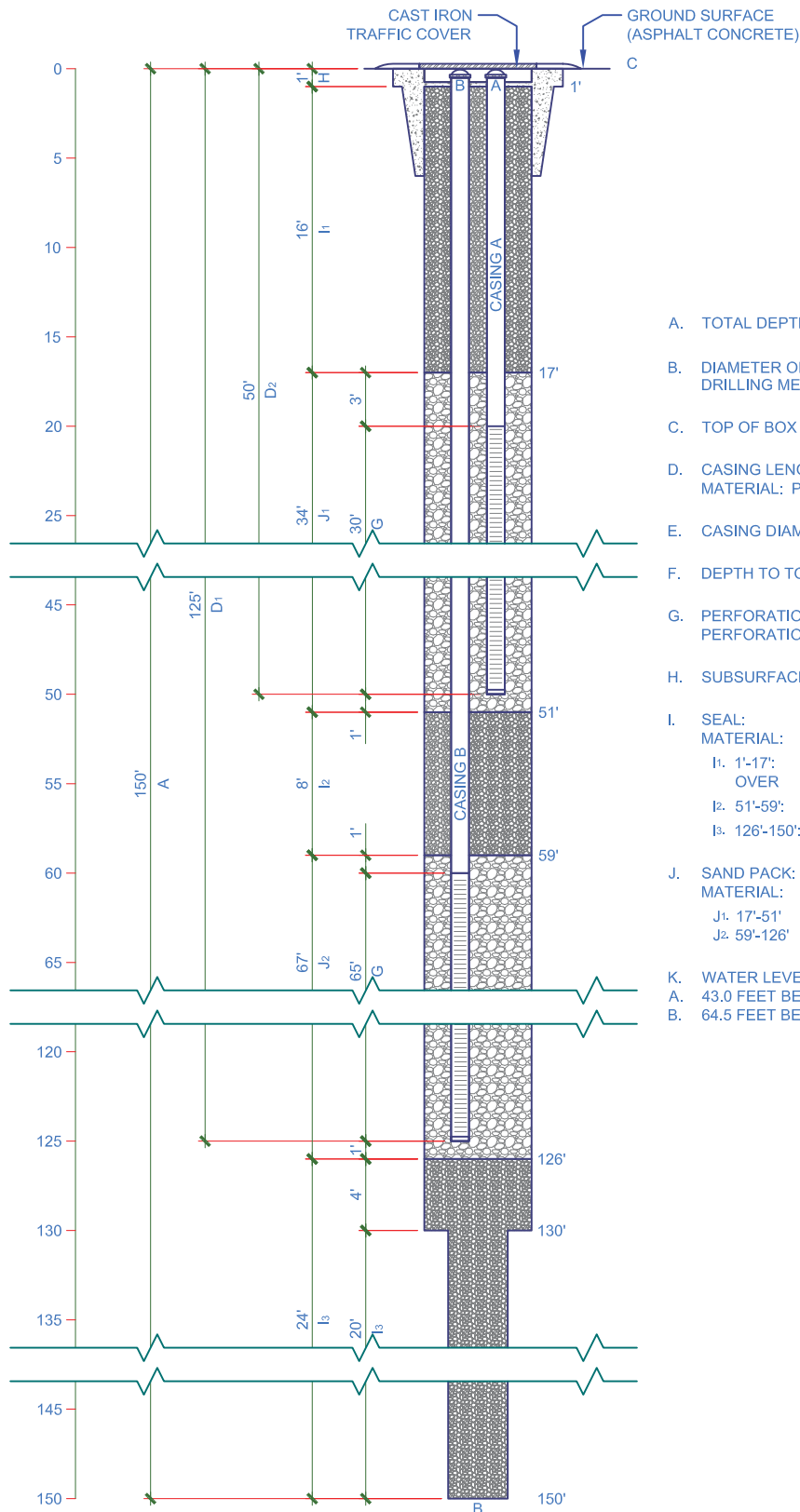
WELL CONSTRUCTION
DETAIL
Groundwater Observation Well

FIGURE NO.

B-2.2

PROJECT NO.
4953-11-1421

GROUNDWATER OBSERVATION WELL G-166



- A. TOTAL DEPTH OF BORING: 150' BGS
- B. DIAMETER OF BORING: 8"Ø, 4 7/8"Ø BOTTOM 20' DRILLING METHOD: ROTARY WASH
- C. TOP OF BOX ELEVATION: NA
- D. CASING LENGTH: 50' (A), 125' (B) MATERIAL: PVC
- E. CASING DIAMETER: 2"Ø (EACH)
- F. DEPTH TO TOP OF SCREEN: 20' (A) & 60' (B)
- G. PERFORATION LENGTH: 30' (A), 65' (B) PERFORATION SIZE: 0.010" SLOTS
- H. SUBSURFACE SEAL: 1' CONCRETE, 6' GROUT
- I. SEAL: 1'-17', 51'-59', 126'-150' (BGS) MATERIAL: HYDRATED BENTONITE (CHIPS)
 - I1. 1'-17': 12' OF BENTONITE CEMENT GROUT OVER 4' OF BENTONITE CHIPS HYDRATED
 - I2. 51'-59': BENTONITE CHIPS HYDRATED
 - I3. 126'-150': BENTONITE CHIPS HYDRATED
- J. SAND PACK: 17'-51', 59'-126' (BGS) MATERIAL: # 3 SAND PACK
 - J1. 17'-51'
 - J2. 59'-126'
- K. WATER LEVELS ON 04/22/2011 WERE AS FOLLOWS:
 - A. 43.0 FEET BELOW TOC
 - B. 64.5 FEET BELOW TOC

Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches

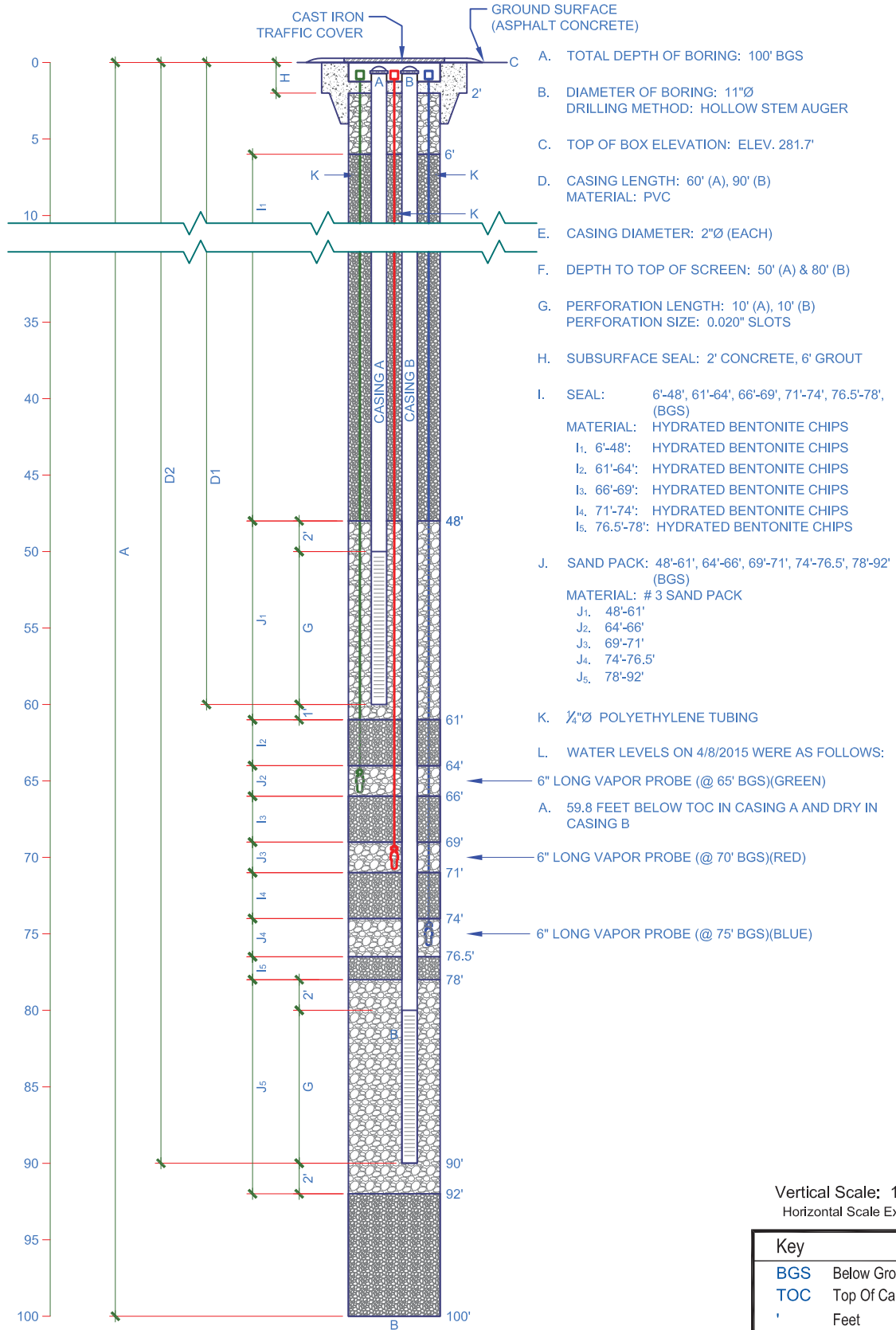


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WELL NO.:	G-166	DRAWN:	L. Morley
INSTALLED:	04/20/2011	CHKD:	H.P. / Jag
SCALE:	1" = 10' Vertical	DATE:	December 2, 2011
DRILL CO.:	C & L Drilling	TECHNIQUE:	Rotary-Wash
FIELD PERSONNEL:	Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	Beverly Hills High School, Beverly Hills, CA		

MTA WESTSIDE SUBWAY EXTENSION	
Parsons Brinckerhoff	
WELL CONSTRUCTION DETAIL Groundwater Observation Well	FIGURE NO. B-2.3
	PROJECT NO. 4953-11-1421

SOIL GAS/GROUND WATER MONITORING WELL M-407



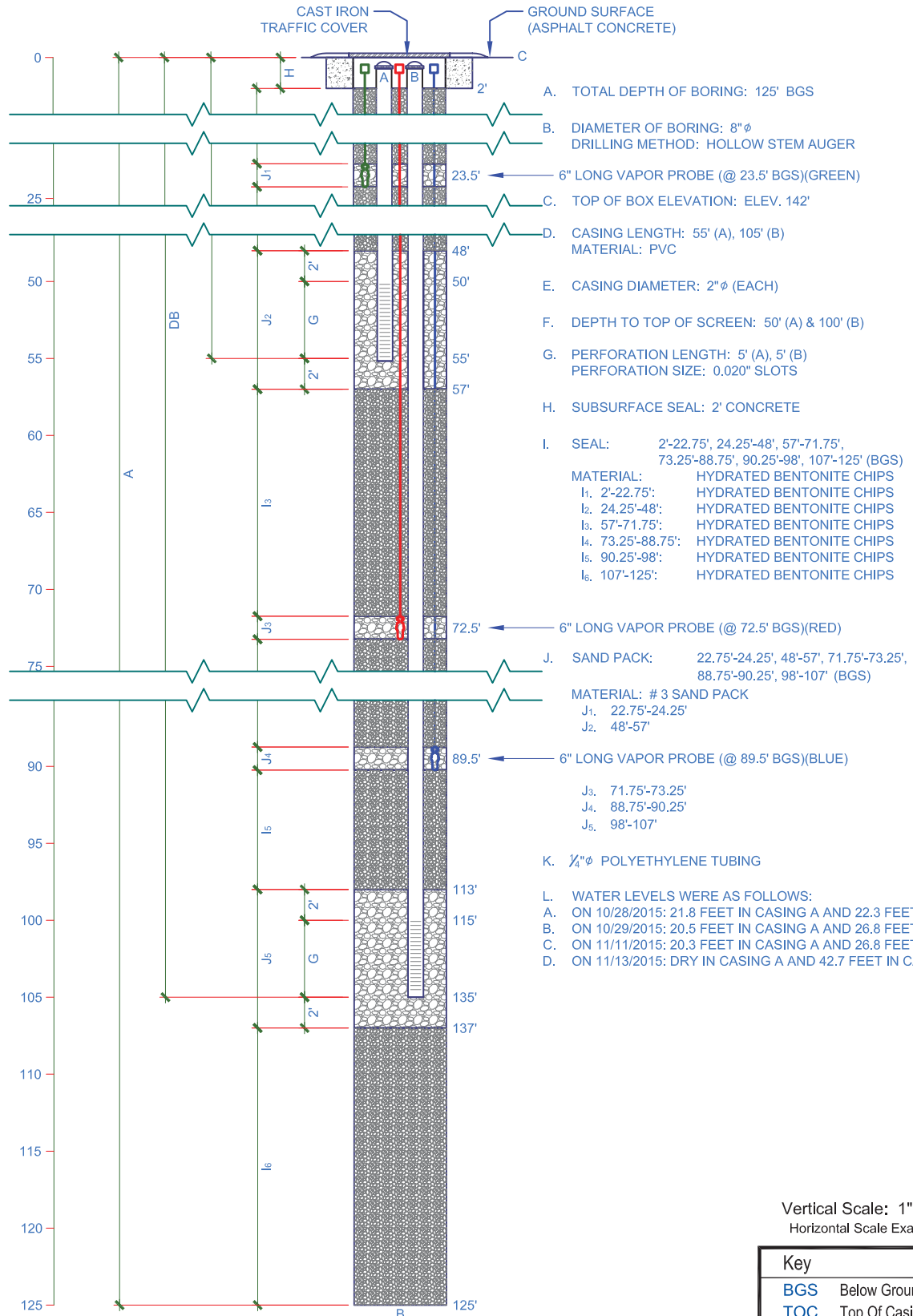
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 Date: May 07, 2015 - 1:12pm By: ogoultier



WELL NO.:	M-407	PREPARED BY:	KO/KC
INSTALLED:	03/11/2015	CHKD:	F. WANG
SCALE:	1" = 10' vertical	DATE:	May 6, 2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Ron Lopez/Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	Constellation Blvd and Century Park East		

MTA WESTSIDE EXTENSION Parsons Brinckerhoff	
WELL CONSTRUCTION DETAIL Soil Gas/Ground Water Monitoring Well	B-3.1 PROJECT NO. 4953-11-1423

SOIL GAS/GROUND WATER MONITORING WELL M-402



Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches

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Date: December 07, 2015 - 8:19pm By: ogutierrez



WELL NO.:	E-126A	PREPARED BY:	KO/KC
INSTALLED:	10/26/2015	CHKD:	F. WANG
SCALE:	1" = 10' Vertical	DATE:	October 26, 2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Ron Lopez/Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	West of intersection of Wilshire Boulevard and S. Carson Road		

MTA WESTSIDE EXTENSION
Parsons Brinckerhoff

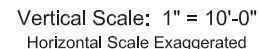
**WELL CONSTRUCTION
DETAIL**

Soil Gas/Ground Water Monitoring Well

B-3.2

PROJECT NO.
4953-11-1423

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Date: December 07, 2015 - 7:42pm By: ogouthier



Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches



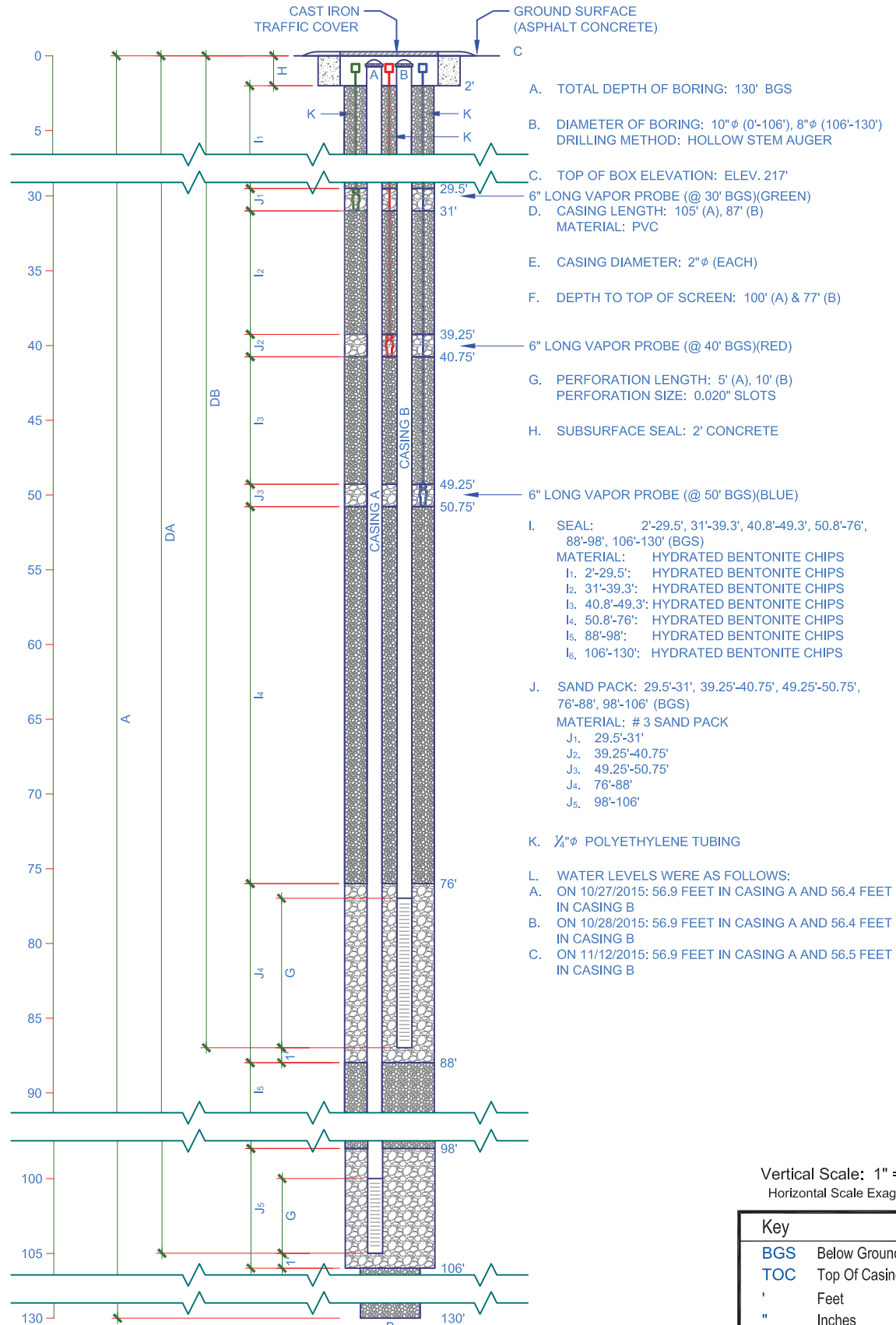
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INSTALLED:	10/26/2015	CHKD:	F. WANG
SCALE:	1" = 10' Vertical	DATE:	October 26, 2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Ron Lopez/Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	West of intersection of Wilshire Boulevard and S. La Peer Drive		

WELL CONSTRUCTION
DETAIL
Soil Gas/Ground Water Monitoring Well

B-3.3

PROJECT NO.
4953-11-1423

SOIL GAS/GROUND WATER MONITORING WELL E-126A/M-404



Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches

Path: S:\ACAD\2015-105 WSE Purple Line\Well Diagram\4953-11-1423_PEWells(2015,12.05).dwg [E-126A]
Date: December 07, 2015 - 7:42pm By: oguntier



Amec Foster Wheeler
Environment & Infrastructure, Inc.
6001 Rickover Road
Los Angeles, CA 90040
Phone (323) 889-4300
Fax (323) 721-6700

WELL NO.:	E-126A	PREPARED BY:	KO/KC
INSTALLED:	10/26/2015	CHKD:	F. WANG
SCALE:	1" = 10' Vertical	DATE:	October 26, 2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Ron Lopez/Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	West of intersection of Wilshire Boulevard and S. Crescent Drive		

MTA WESTSIDE EXTENSION
Parsons Brinckerhoff

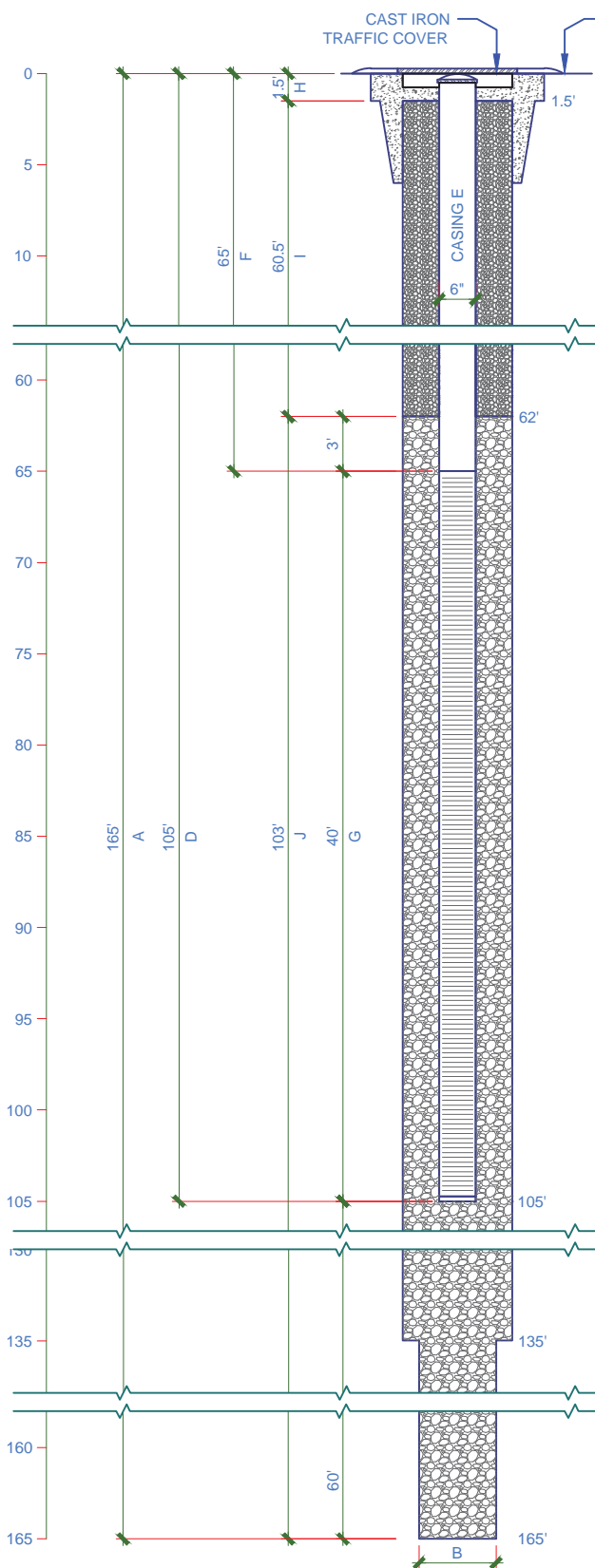
**WELL CONSTRUCTION
DETAIL**

Soil Gas/Ground Water Monitoring Well

B-3.4

PROJECT NO.
4953-11-1423

GROUNDWATER PUMPING TEST WELL G-408/P-306



- A. TOTAL DEPTH OF BORING: 165' BGS
- B. DIAMETER OF BORING: 12" ϕ , 4 $\frac{1}{8}$ " ϕ AT BOTTOM 30"
DRILLING METHOD: ROTARY WASH/HOLLOW STEM AUGER
- C. TOP OF BOX ELEVATION: NA
- D. CASING LENGTH: 105'
MATERIAL: PVC
- E. CASING DIAMETER: 6" ϕ
- F. DEPTH TO TOP OF SCREEN: 65'
- G. PERFORATION LENGTH: 40'
PERFORATION SIZE: 0.04" SLOTS
- H. SUBSURFACE SEAL: 1.5' CONCRETE
- I. SEAL: 1.5'-62' (BGS)
MATERIAL: MEDIUM HYDRATED BENTONITE (CHIPS)
- J. SAND PACK: 62'-165' (BGS)
MATERIAL: # AQUARIUM SAND PACK
w/ TRANSITION SAND AT TOP
- K. WATER LEVELS WERE AS FOLLOWS:
A. ON 9/29/2015: 56 FEET
B. ON 9/30/2015: 61.5 FEET

Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches



WELL NO.:	G-408/P-306	PREPARED BY:	VMN
INSTALLED:	9/24/15 and 9/25/15	CHKD:	LT
SCALE:	1" = 10' vertical	DATE:	10/21/2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	RW / HS
FIELD PERSONNEL:			LH
PROJECT NAME:	MTA Westside Purple Line Extension		
WELL LOCATION:	Wilshire Blvd at Reeves Dr., Beverly Hills, CA		

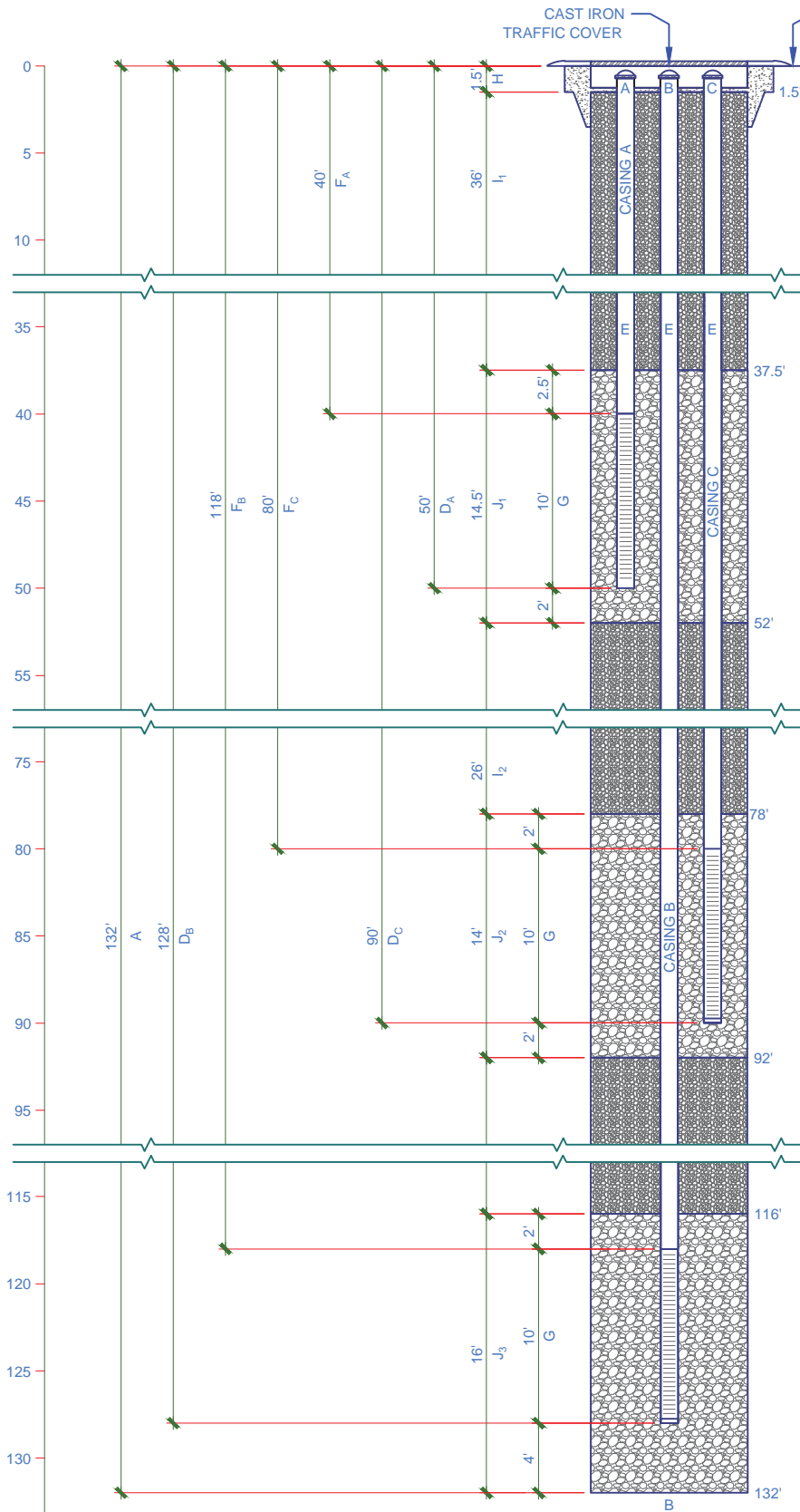
MTA WESTSIDE PURPLE LINE EXTENSION
Parsons Brinckerhoff

WELL CONSTRUCTION DETAIL

B-3.5

PROJECT NO.
4953-11-1423

GROUNDWATER MONITORING WELL OB-307



- A. TOTAL DEPTH OF BORING: 132' BGS
- B. DIAMETER OF BORING: 8"Ø
DRILLING METHOD: HOLLOW-STEM AUGER
- C. TOP OF BOX ELEVATION: NA
- D. CASING LENGTH: 50' (A), 128' (B) & 90' (C)
MATERIAL: PVC
- E. CASING DIAMETER: 2"Ø (EACH)
- F. DEPTH TO TOP OF SCREEN: 40' (A), 118' (B) & 80' (C)
- G. PERFORATION LENGTH: 10' (A), 10' (B) & 10' (C)
PERFORATION SIZE: 0.02" SLOTS
- H. SUBSURFACE SEAL: 1.5' CONCRETE
- I. SEAL: 1.5'-37.5', 52'-78', 92'-116' (BGS)
MATERIAL: HYDRATED BENTONITE (CHIPS)
 - I1. 1.5'-37.5': BENTONITE CHIPS HYDRATED
 - I2. 52'-78': BENTONITE CHIPS HYDRATED
 - I3. 92'-116': BENTONITE CHIPS HYDRATED
- J. GRAVEL PACK: 37.5'-52', 78'-92', 116'-132' (BGS)
MATERIAL: # 3 SAND PACK
w/ TRANSITION SAND AT TOP AND FILTER FABRIC SOCK PLACED OVER SCREEN
 - J1. 37.5'-52'
 - J2. 78'-92'
 - J3. 116'-132'
- K. WATER LEVELS WERE AS FOLLOWS:
 - A. ON 9/22/2015: DRY IN CASING A, 64.2 FEET IN CASING B AND 62.1 FEET IN CASING C
 - B. ON 9/29/2015: DRY IN CASING A, 64.1 FEET IN CASING B AND 62.6 FEET IN CASING C
 - C. ON 9/30/2015: 63.8 FEET IN CASING B AND 62.8 FEET IN CASING C
 - D. ON 11/1/2015: DRY IN CASING A, 63.8 FEET IN CASING B AND 62.5 FEET IN CASING C
 - E. ON 11/14/2015: 63.9 FEET IN CASING B AND 62.6 FEET IN CASING C

Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches



WELL NO.:	OB-307	PREPARED BY:	VMN
INSTALLED:	9/13/2015	CHKD:	LT
SCALE:	1" = 10' vertical	DATE:	10/21/2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	RW / HS
FIELD PERSONNEL:			LH
PROJECT NAME:	MTA Westside Purple Line Extension		
WELL LOCATION:	Wilshire Blvd / Reeves Dr., Beverly Hills, CA		

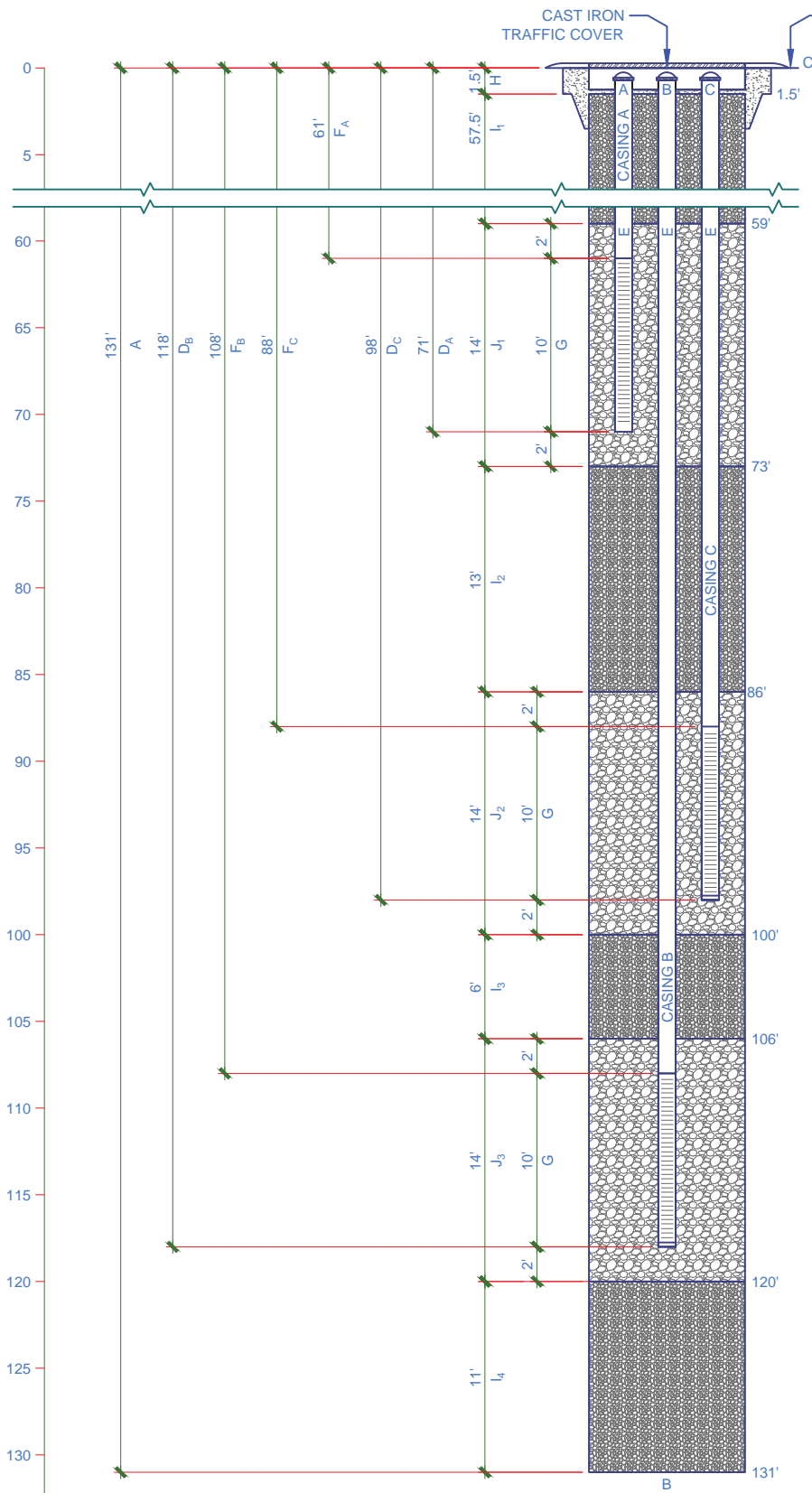
MTA WESTSIDE PURPLE LINE EXTENSION
Parsons Brinckerhoff

WELL CONSTRUCTION DETAIL

B-3.6

PROJECT NO.
4953-11-1423

GROUNDWATER MONITORING WELL OB-308



- A. TOTAL DEPTH OF BORING: 131' BGS
- B. DIAMETER OF BORING: 8"Ø
DRILLING METHOD: HOLLOW-STEM-AUGER
- C. TOP OF BOX ELEVATION: NA
- D. CASING LENGTH: 71' (A), 118' (B) & 98' (C)
MATERIAL: PVC
- E. CASING DIAMETER: 2"Ø (EACH)
- F. DEPTH TO TOP OF SCREEN: 61' (A), 108' (B) & 88' (C)
- G. PERFORATION LENGTH: 10' (A), 10' (B) & 10' (C)
PERFORATION SIZE: 0.02" SLOTS
- H. SUBSURFACE SEAL: 1.5' CONCRETE
- I. SEAL:
MATERIAL: 1.5'-59', 73'-86', 100'-106', 120'-131' (BGS)
HYDRATED BENTONITE (CHIPS)
 - I1. 1.5'-59': BENTONITE CHIPS HYDRATED
 - I2. 73'-86': BENTONITE CHIPS HYDRATED
 - I3. 100'-106': BENTONITE CHIPS HYDRATED
 - I4. 120'-131': BENTONITE CHIPS HYDRATED
- J. GRAVEL PACK: 59'-73', 86'-100', 106'-120' (BGS)
MATERIAL: # 3 SAND PACK
w/ TRANSITION SAND AT TOP AND FILTER FABRIC SOCK
PLACED OVER SCREEN
 - J1. 59'-73'
 - J2. 86'-100'
 - J3. 106'-120'
- K. WATER LEVELS WERE AS FOLLOWS:
 - A. ON 9/22/2015: 58.8 FEET IN CASING A, 62.4 FEET IN CASING B AND 63.3 FEET IN CASING C
 - B. ON 9/29/2015: 58.3 FEET IN CASING A, 61.1 FEET IN CASING B AND 64.3 FEET IN CASING C
 - C. ON 11/1/2015: 58 FEET IN CASING A, 61.1 FEET IN CASING B AND 63.1 FEET IN CASING C
 - D. ON 11/14/2015: 62.4 FEET IN CASING B AND 63.2 FEET IN CASING C

Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches



WELL NO.:	OB-308	PREPARED BY:	VMN
INSTALLED:	9/18/2015	CHKD:	LT
SCALE:	1" = 10' vertical	DATE:	10/21/2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	RW / HS
FIELD PERSONNEL:			LH
PROJECT NAME:	MTA Westside Purple Line Extension		
WELL LOCATION:	Wilshire Blvd. / Reeves Dr., Beverly Hills, CA		

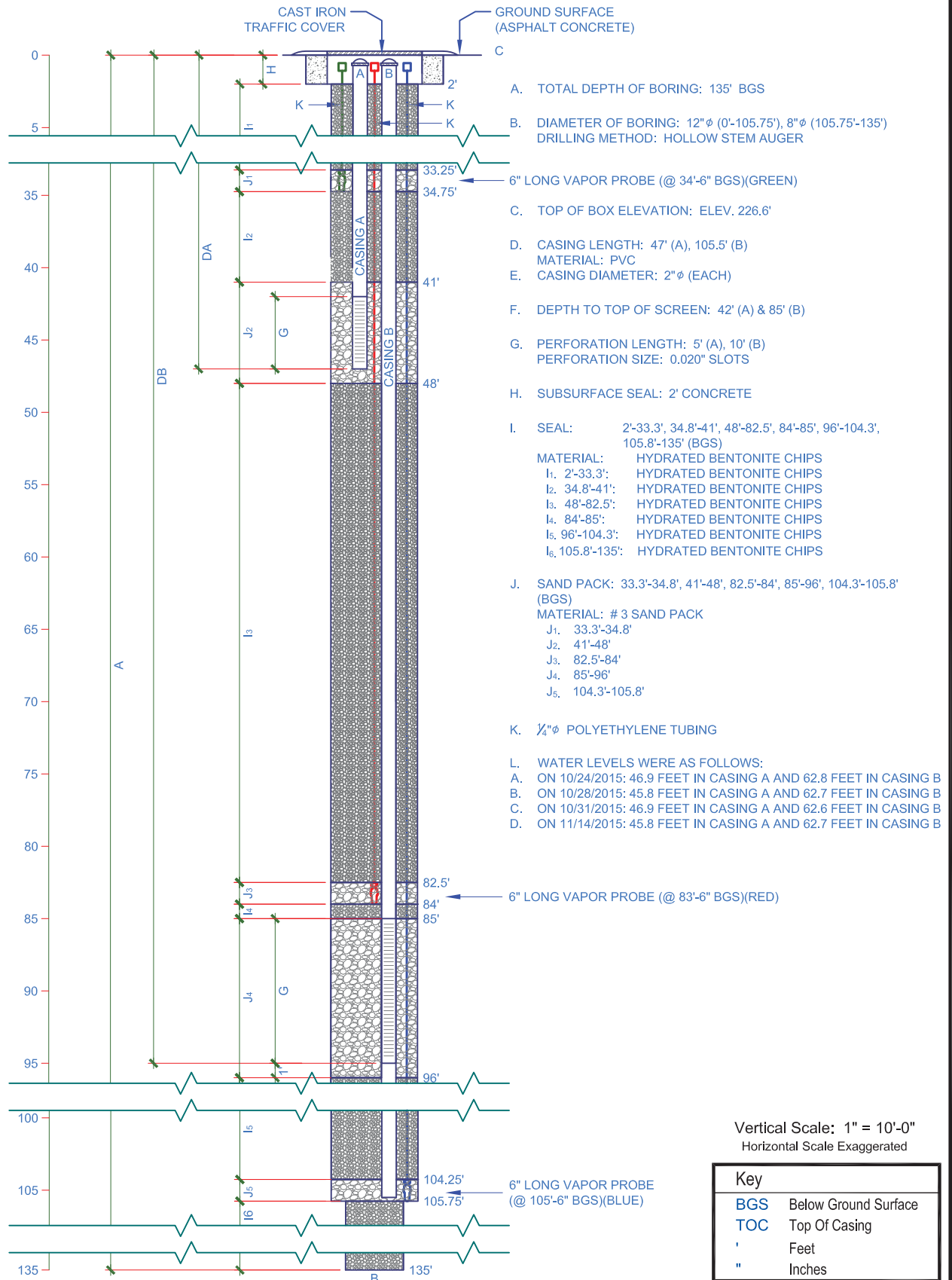
MTA WESTSIDE PURPLE LINE EXTENSION
Parsons Brinckerhoff

WELL CONSTRUCTION DETAIL

B-3.7

PROJECT NO.
4953-11-1423

SOIL GAS/GROUND WATER MONITORING WELL E-126B/M-405



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Date: December 07, 2015 7:43pm By: oguntier



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Environment & Infrastructure, Inc.
6001 Rickover Road
Los Angeles, CA 90040
Phone (323) 889-4300
Fax (323) 721-6700

WELL NO.:	E-126B	PREPARED BY:	KO/KC
INSTALLED:	10/26/2015	CHKD:	F. WANG
SCALE:	1" = 10' Vertical	DATE:	October 26, 2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Ron Lopez/Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	East of intersection of Wilshire Boulevard and S. Beverly Drive		

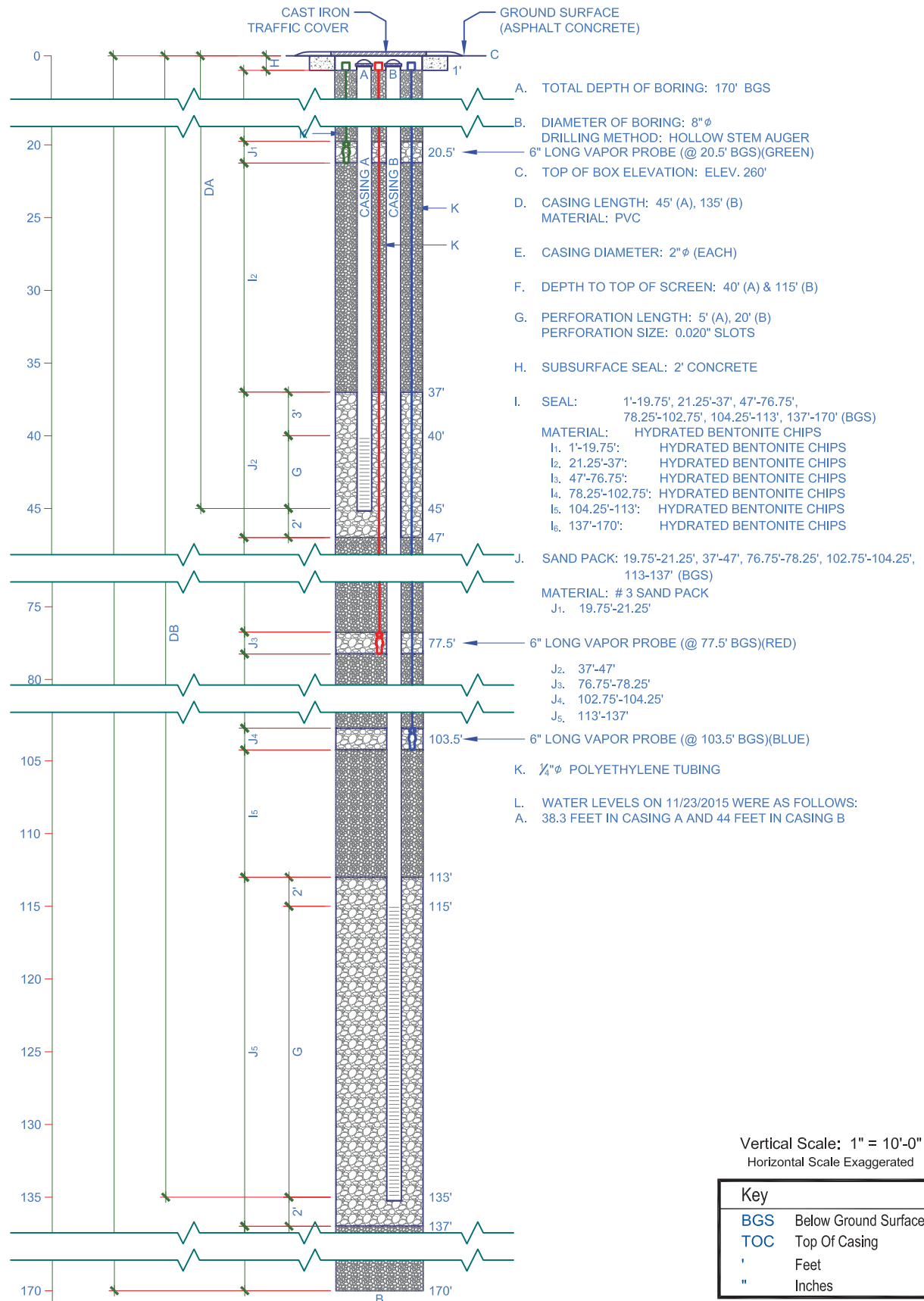
MTA WESTSIDE EXTENSION
Parsons Brinckerhoff

**WELL CONSTRUCTION
DETAIL**
Soil Gas/Ground Water Monitoring Well

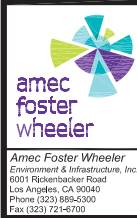
B-3.8

PROJECT NO.
4953-11-1423

SOIL GAS/GROUND WATER MONITORING WELL G-410/M-406



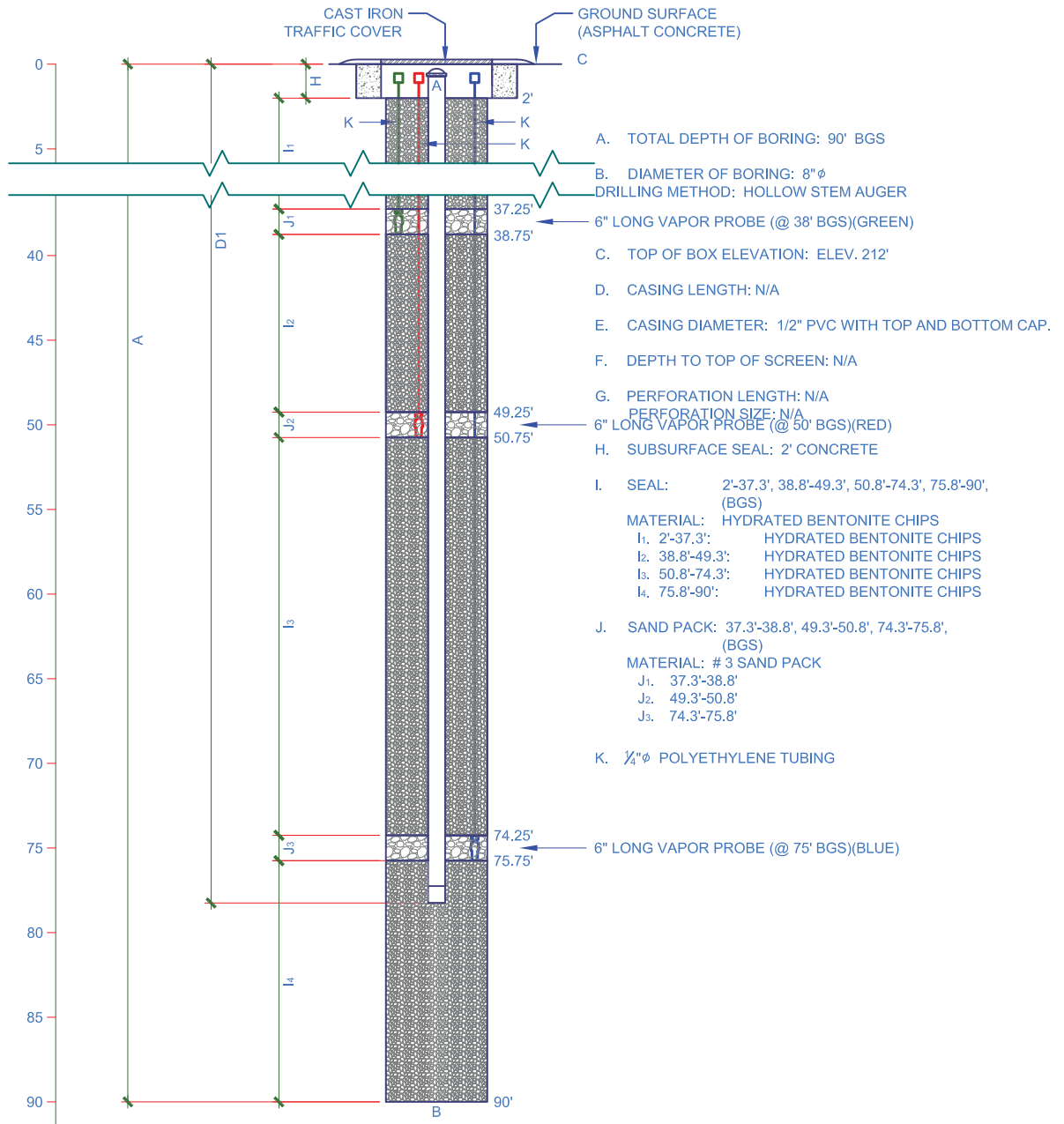
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Date: December 07, 2015 - 8:19pm By: oguntier



WELL NO.:	E-126A	PREPARED BY:	KO/KC
INSTALLED:	10/26/2015	CHKD:	F. WANG
SCALE:	1" = 10' Vertical	DATE:	October 26, 2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Ron Lopez/Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	South of intersection of Wilshire Boulevard and S. Spalding Drive		

MTA WESTSIDE EXTENSION Parsons Brinckerhoff	
WELL CONSTRUCTION DETAIL Soil Gas/Ground Water Monitoring Well	B-3.9
	PROJECT NO. 4953-11-1423

SOIL GAS/GROUND WATER MONITORING WELL G-407



Vertical Scale: 1" = 10'-0"
Horizontal Scale Exaggerated

Key	
BGS	Below Ground Surface
TOC	Top Of Casing
'	Feet
"	Inches



Amec Foster Wheeler
Environment & Infrastructure, Inc.
6001 Rickover Road
Los Angeles, CA 90040
Phone (323) 889-4300
Fax (323) 721-6700

WELL NO.:	G-407	PREPARED BY:	KO/KC
INSTALLED:	10/26/2015	CHKD:	F. WANG
SCALE:	1" = 10' Vertical	DATE:	October 26, 2015
DRILL CO.:	Martini Drilling	TECHNIQUE:	Hollow Stem
FIELD PERSONNEL:	Ron Lopez/Angel Recio		
PROJECT NAME:	MTA Westside Subway Extension		
WELL LOCATION:	West of intersection of Wilshire Boulevard and S. Rexford Drive		

MTA WESTSIDE EXTENSION
Parsons Brinckerhoff

**WELL CONSTRUCTION
DETAIL**
Soil Gas/Ground Water Monitoring Well

B-3.10

PROJECT NO.
4953-11-1423

APPENDIX C CONE PENETRATION TEST RESULTS

Appendix C

Figure C-1: Cone Penetration Test Results (PE Phase)

Figure C-2: Suspension Logging Test Results (Adv. PE Phase)



CPT Data

Job Number 04.0911-0016

CPT Number C-113A

Loca W. Subway Ext. Los Angeles-CA

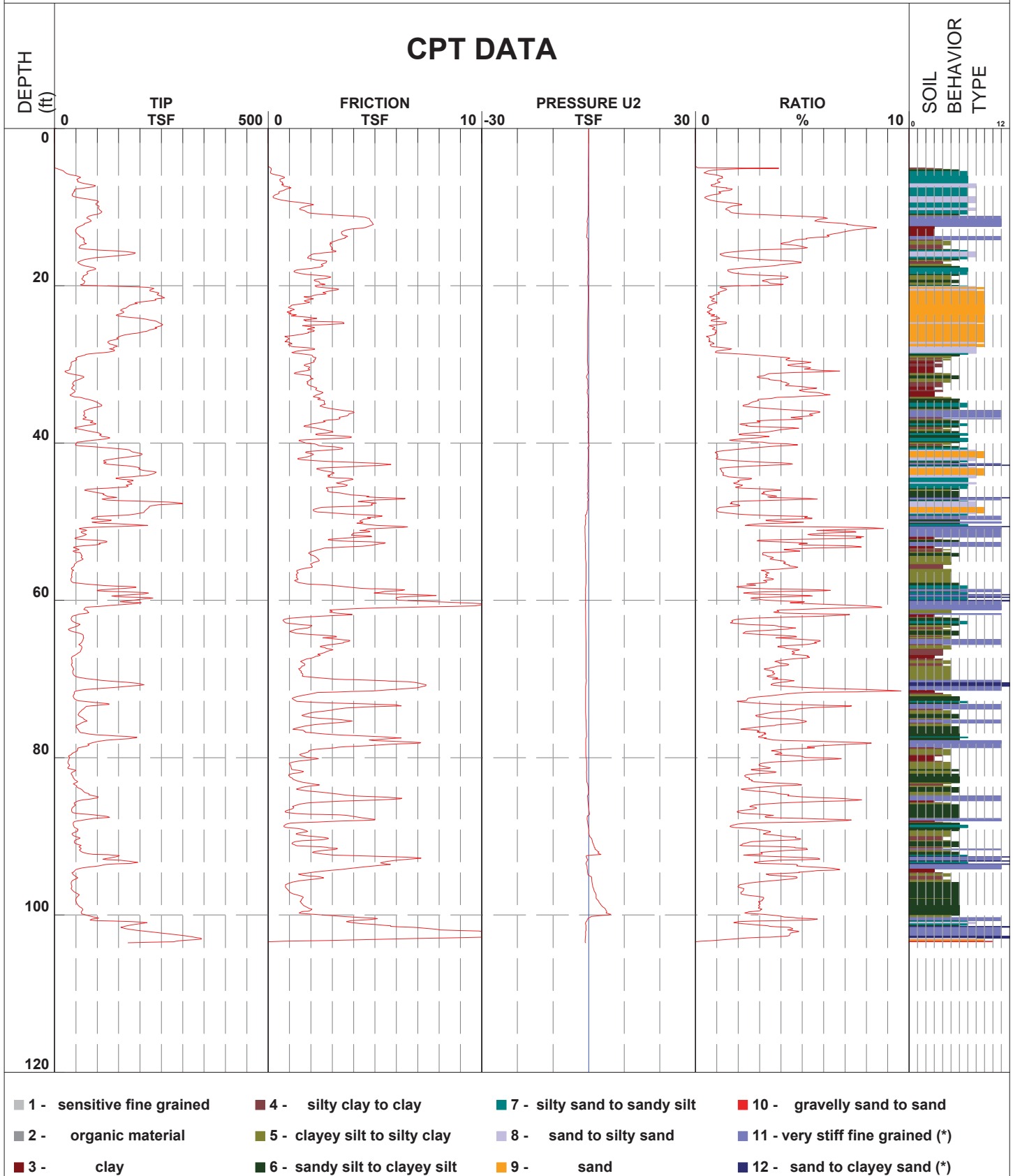
Operator Daniel Garza

Date and Tin 24-Jun-2011 09:55:03

Cone Number F7.5CKE2HA3S1645

Client MACTEC

Hand augered 5'





CPT Data

Job Number 04.0911-0016

CPT Number C-114

Location W. Subway Ext. Los Angeles-CA

Operator Daniel Garza

Date and Time 31-May-2011 12:04:57

Cone Number F7.5CKE2HA3S1645

Client

MACTEC

Hand augered 6'

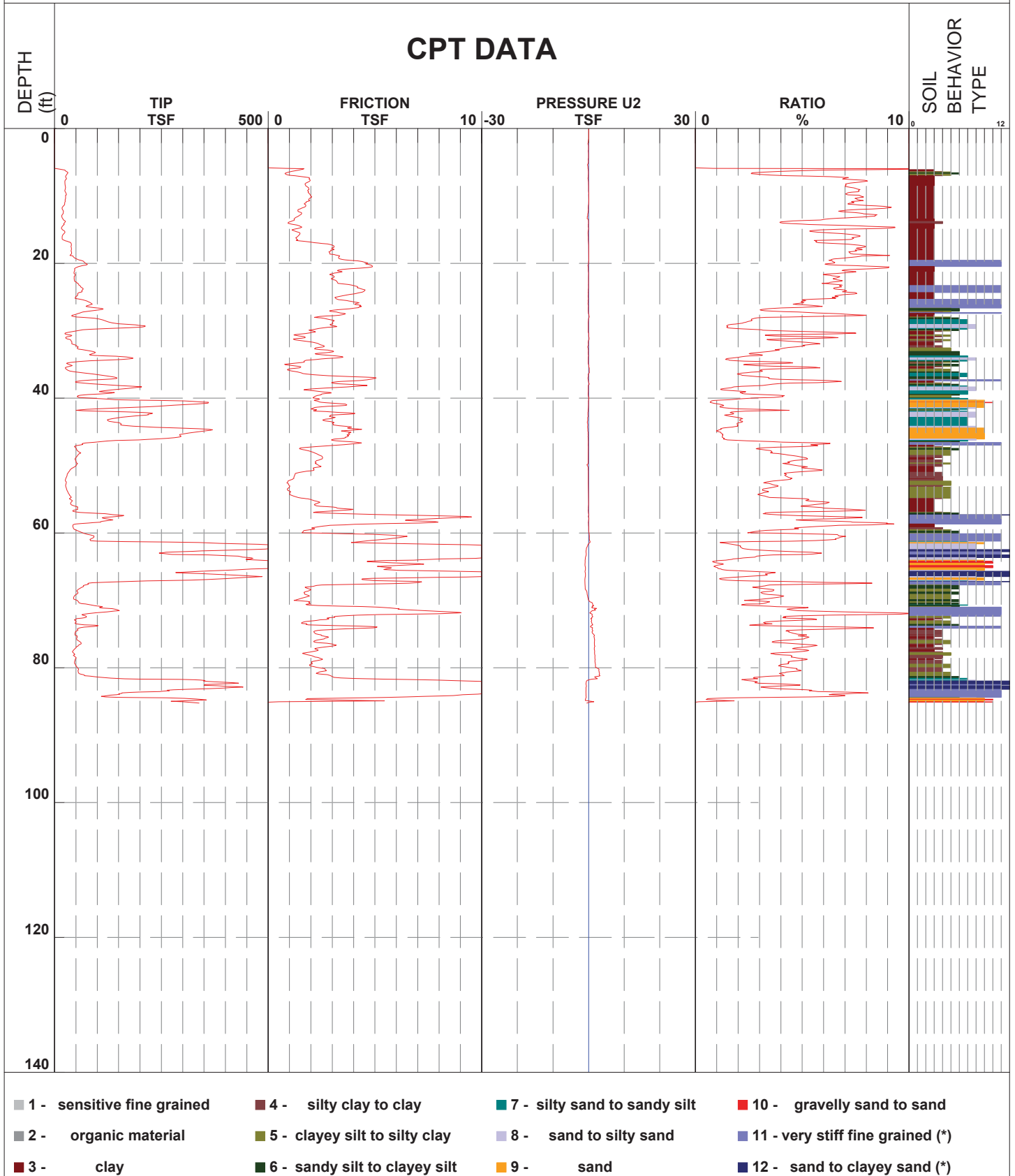
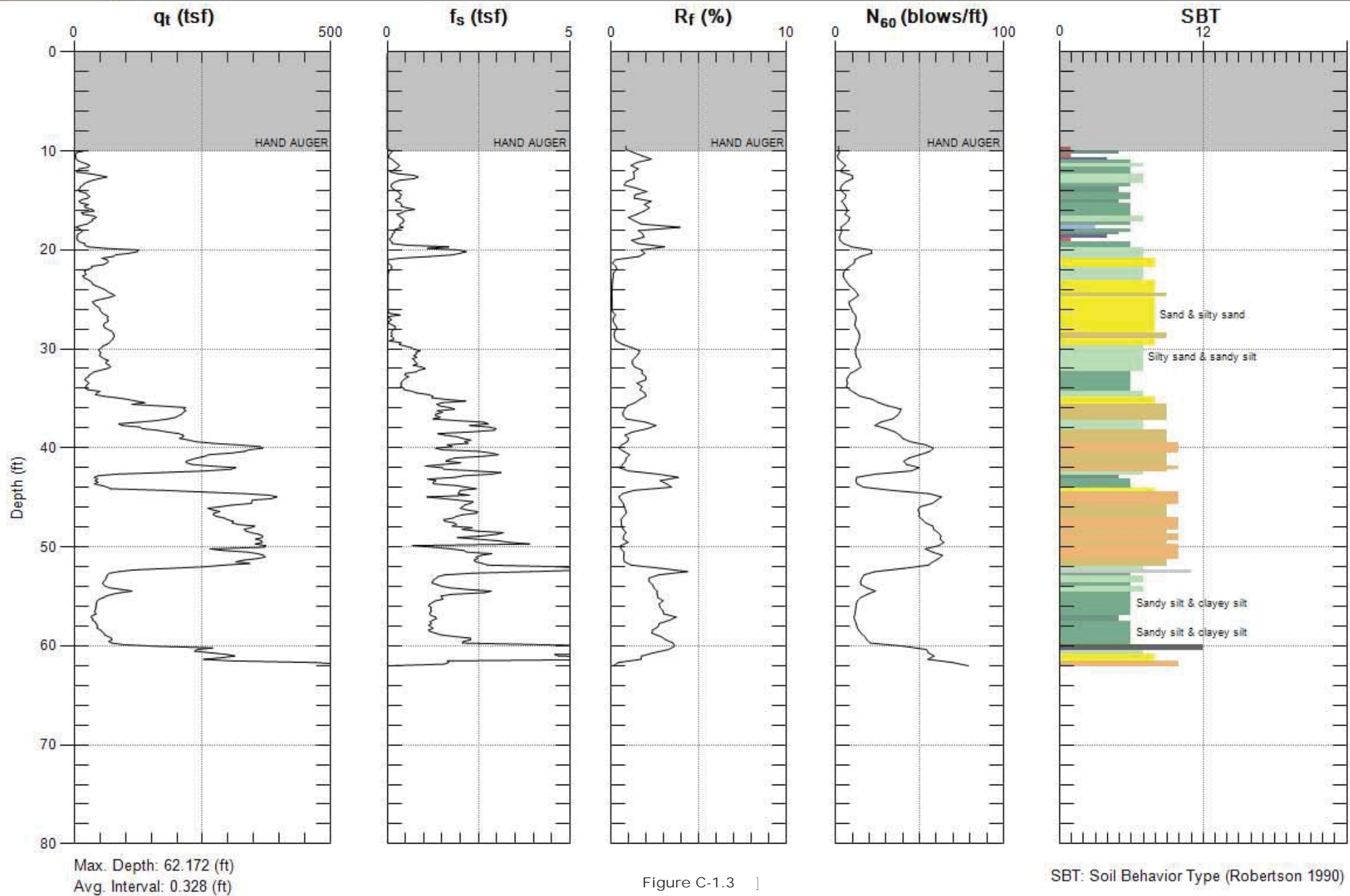
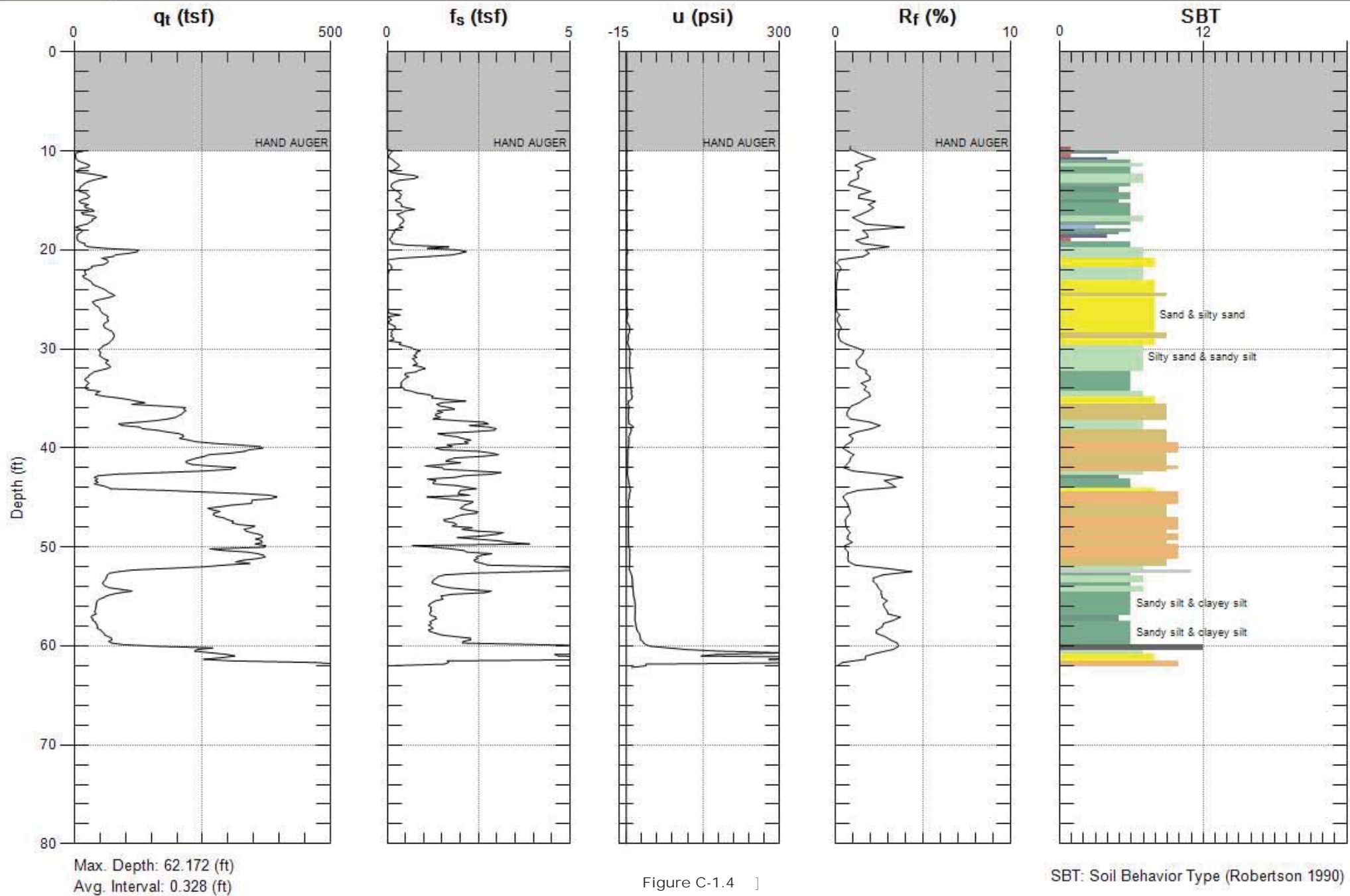



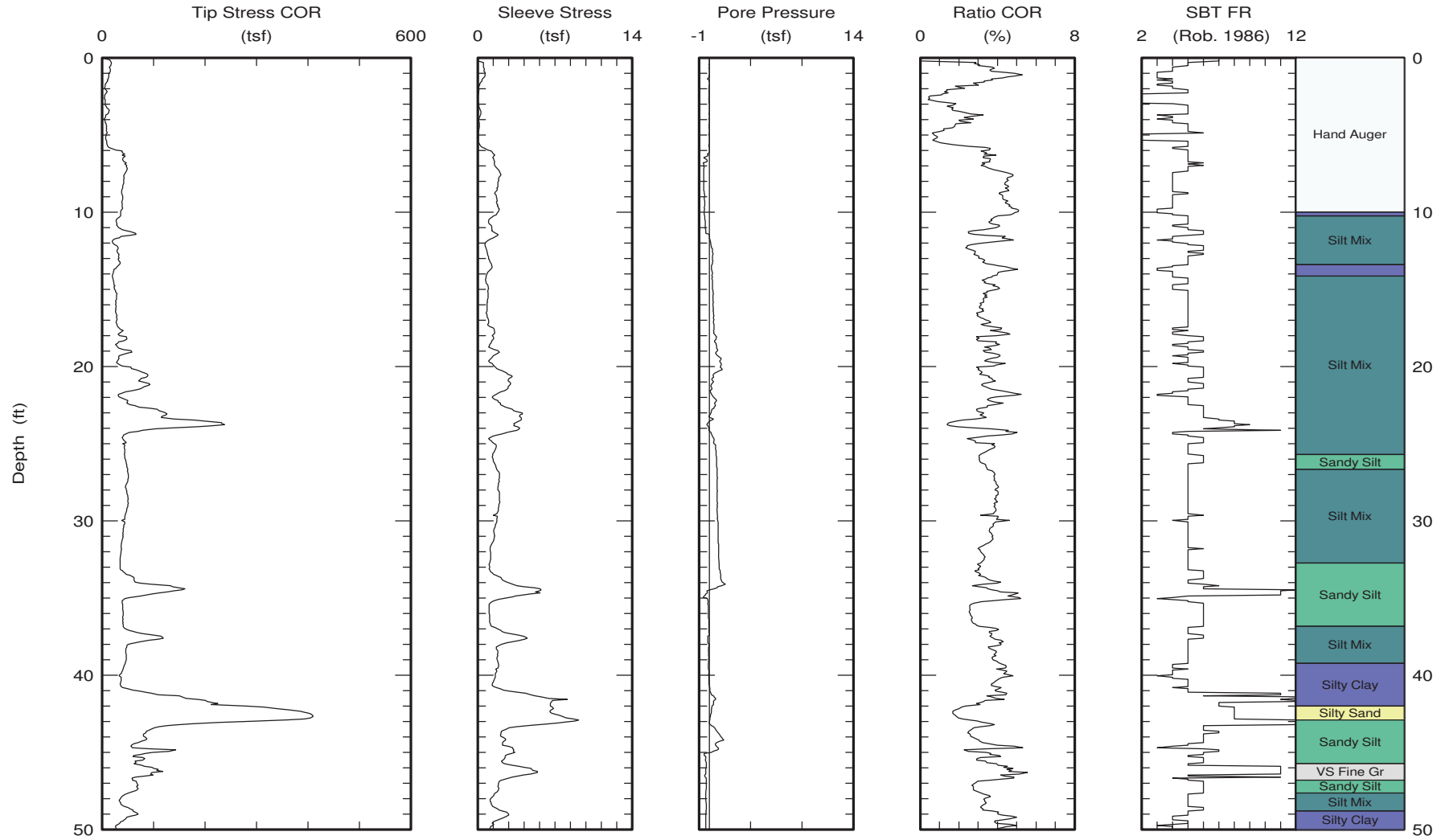
Figure C-1.2

Robertson et al. 1986 * Overconsolidated or Cemented






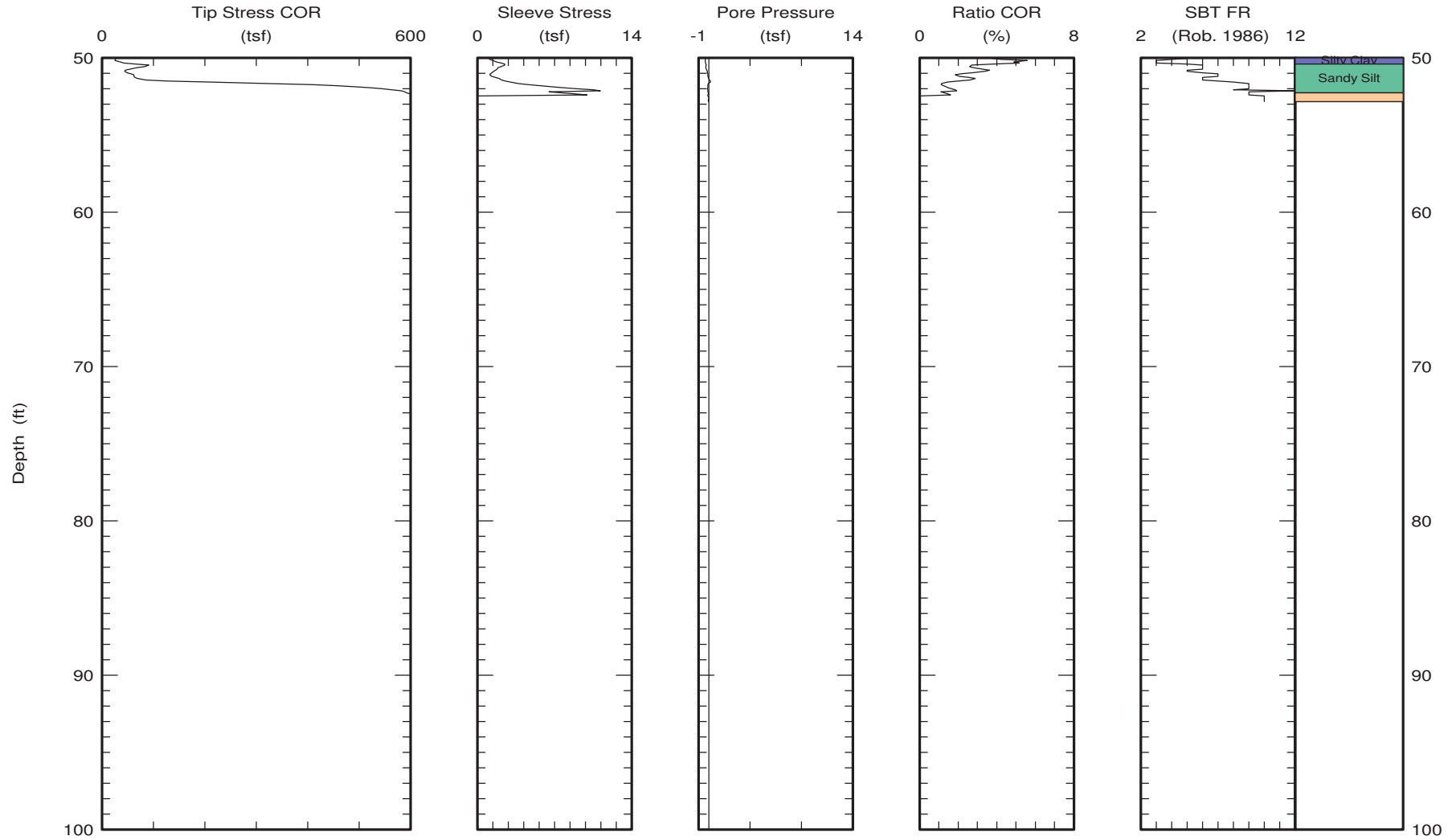
	Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 05/Mar/2011 Test ID: C-117 Project: LosAngeles
		Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 52.84 (ft)
Page 1 of 2


Figure C-1.5

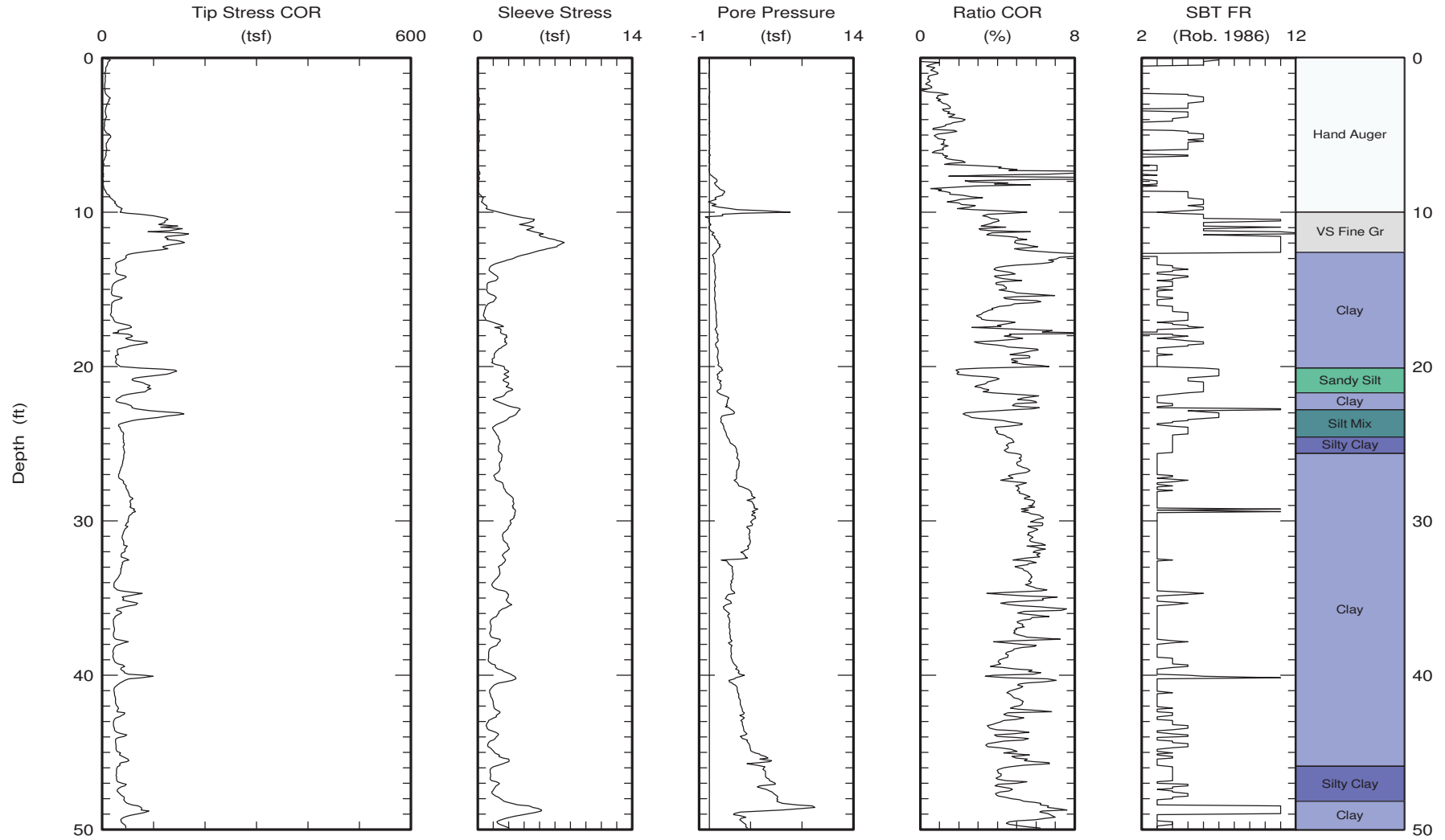
 <p> Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com </p>	CPT Data 30 ton rig	Date: 05/Mar/2011 Test ID: C-117 Project: Los Angeles
	Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 52.84 (ft)
Page 2 of 2


Figure C-1.6

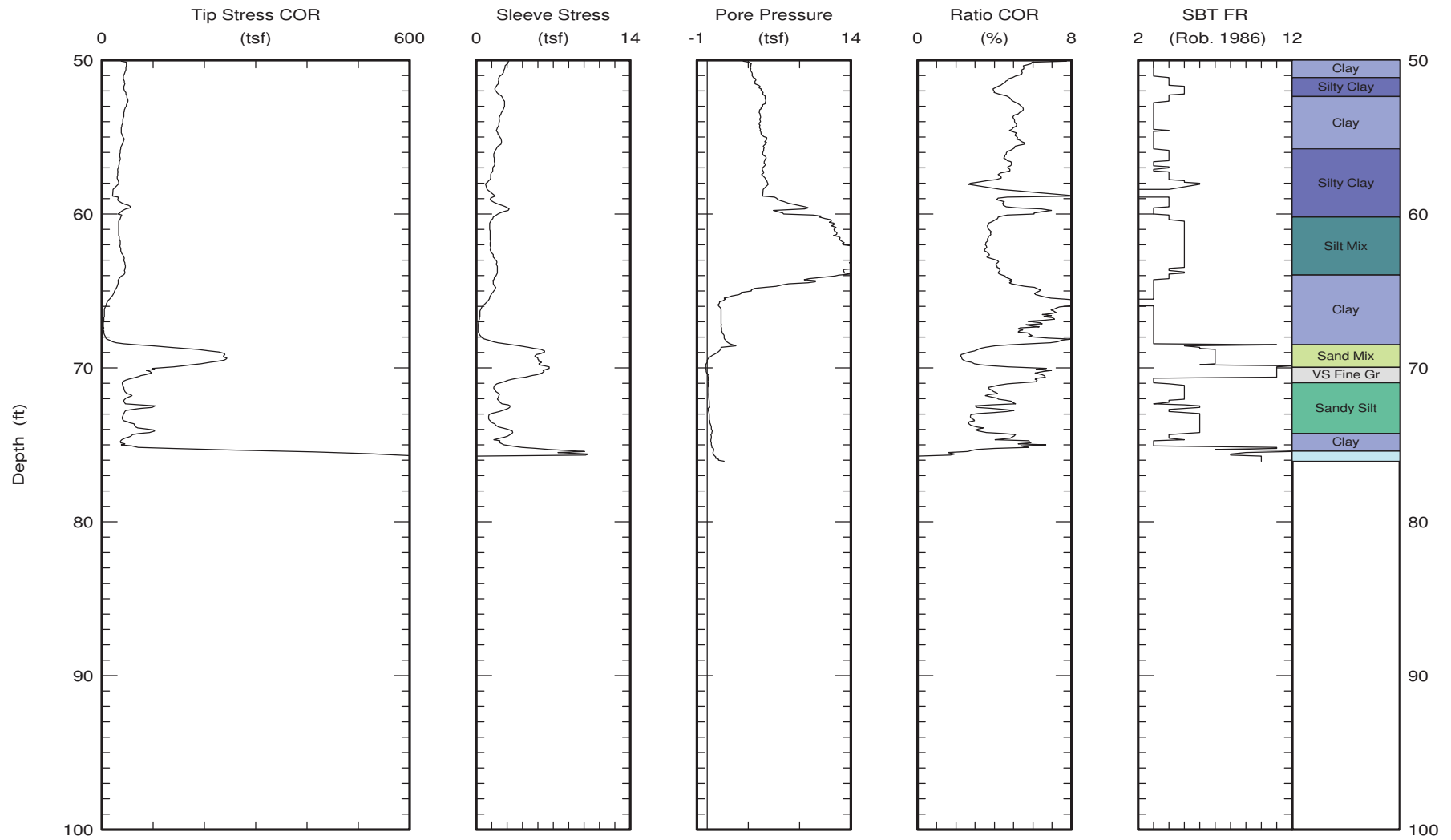
 Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 26/Feb/2011 Test ID: C-118 Project: LosAngeles
	Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 76.08 (ft)
Page 1 of 2


Figure C-1.7

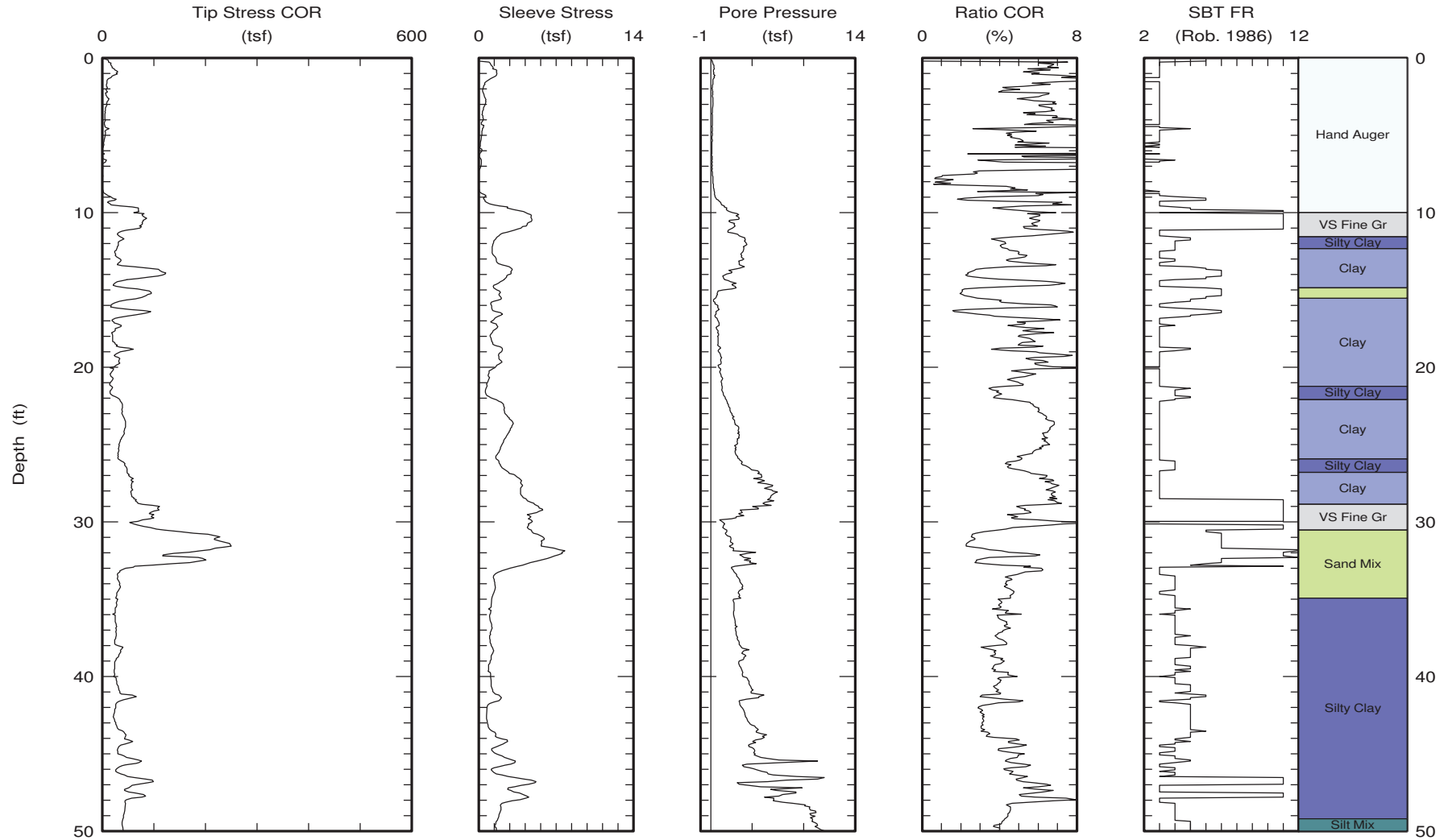
 Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 26/Feb/2011 Test ID: C-118 Project: Los Angeles
	Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 76.08 (ft)
Page 2 of 2


Figure C-1.8

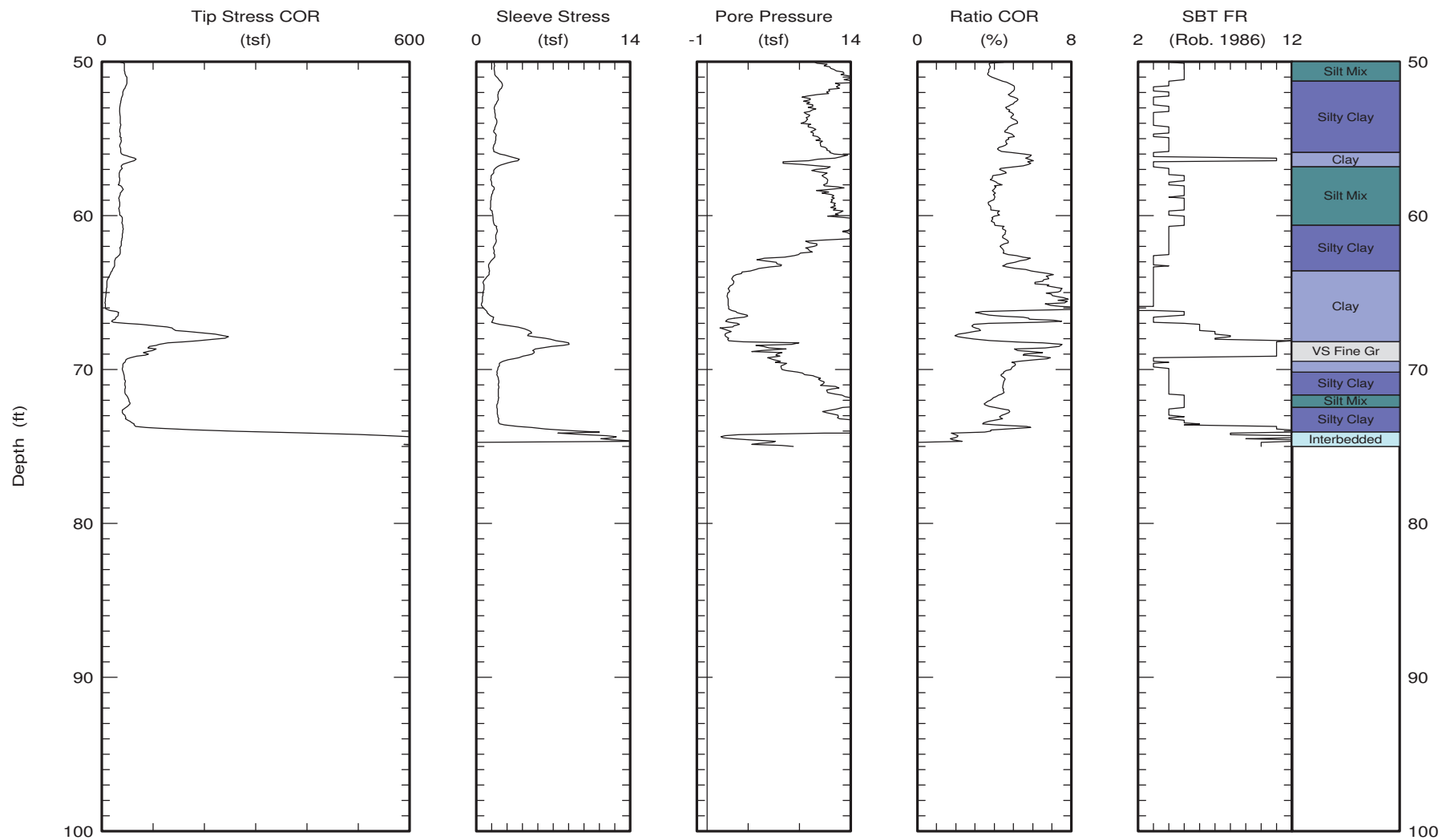
 Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 26/Feb/2011 Test ID: C-119A Project: LosAngeles
	Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 75.03 (ft)
 Page 1 of 2


Figure C-1.9

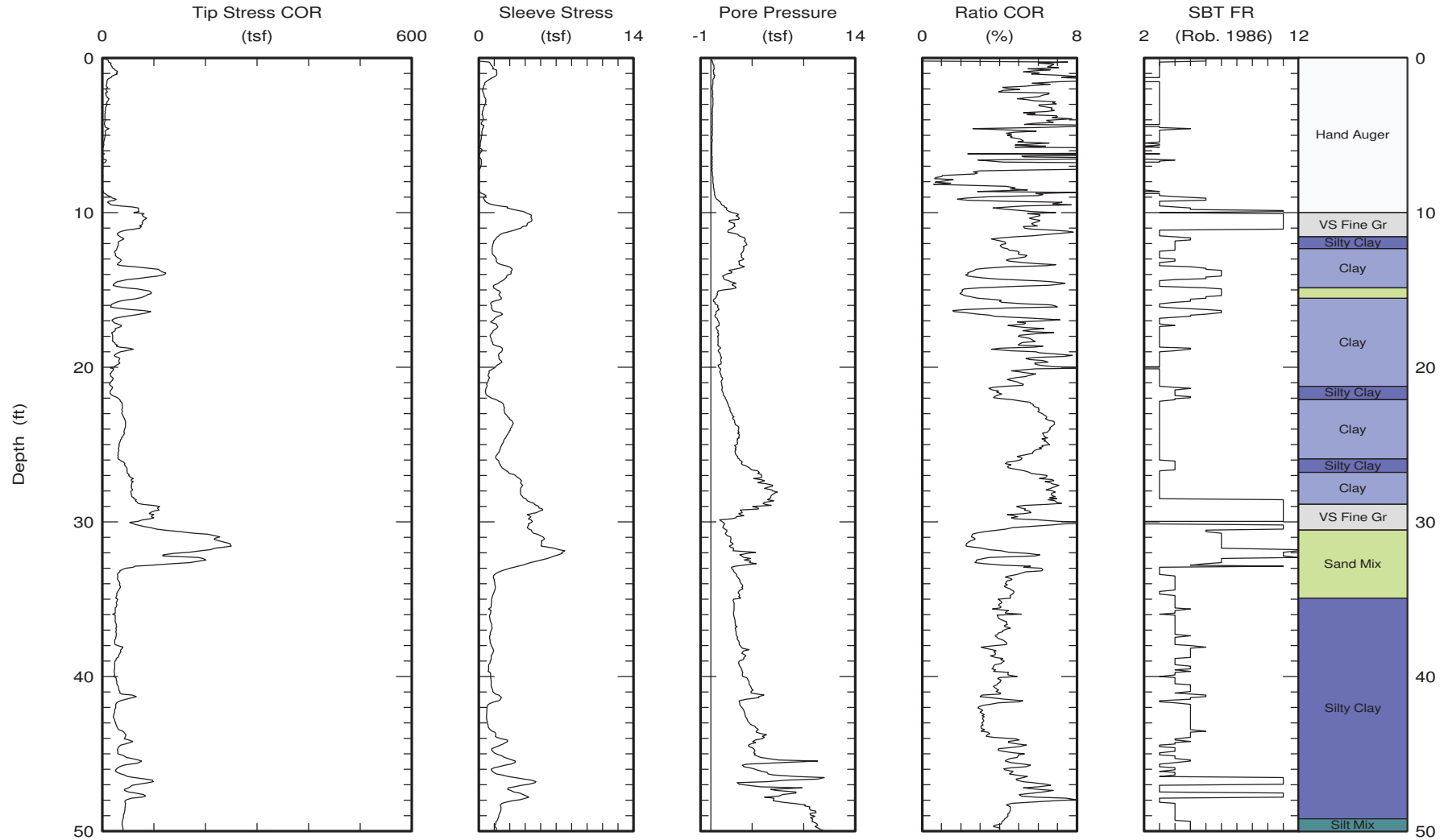
	Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 26/Feb/2011 Test ID: C-119A Project: LosAngeles
		Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 75.03 (ft)
Page 2 of 2


Figure C-1.10

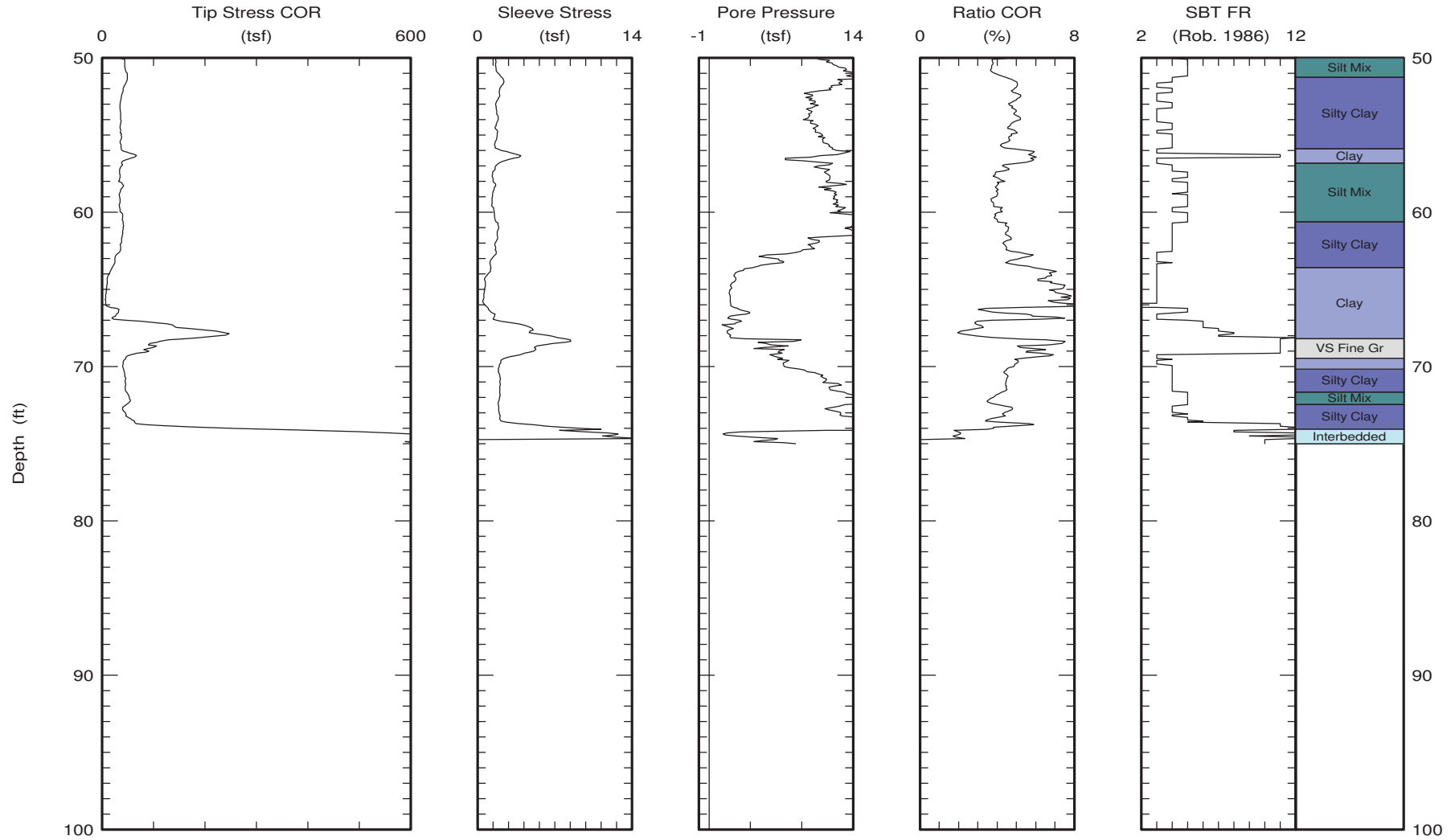
	Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 26/Feb/2011 Test ID: C-119B Project: Los Angeles
		Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 75.03 (ft)
Page 1 of 2

Figure C-1.11

 Kehoe Testing & Engineering Office: (714) 901-7270 Fax: (714) 901-7289 rich@kehoetesting.com www.kehoetesting.com	CPT Data 30 ton rig	Date: 26/Feb/2011 Test ID: C-119B Project: LosAngeles
	Customer: MACTEC Job Site: Beverly Hills High School	



Maximum depth: 75.03 (ft)
 Page 2 of 2

Figure C-1.12

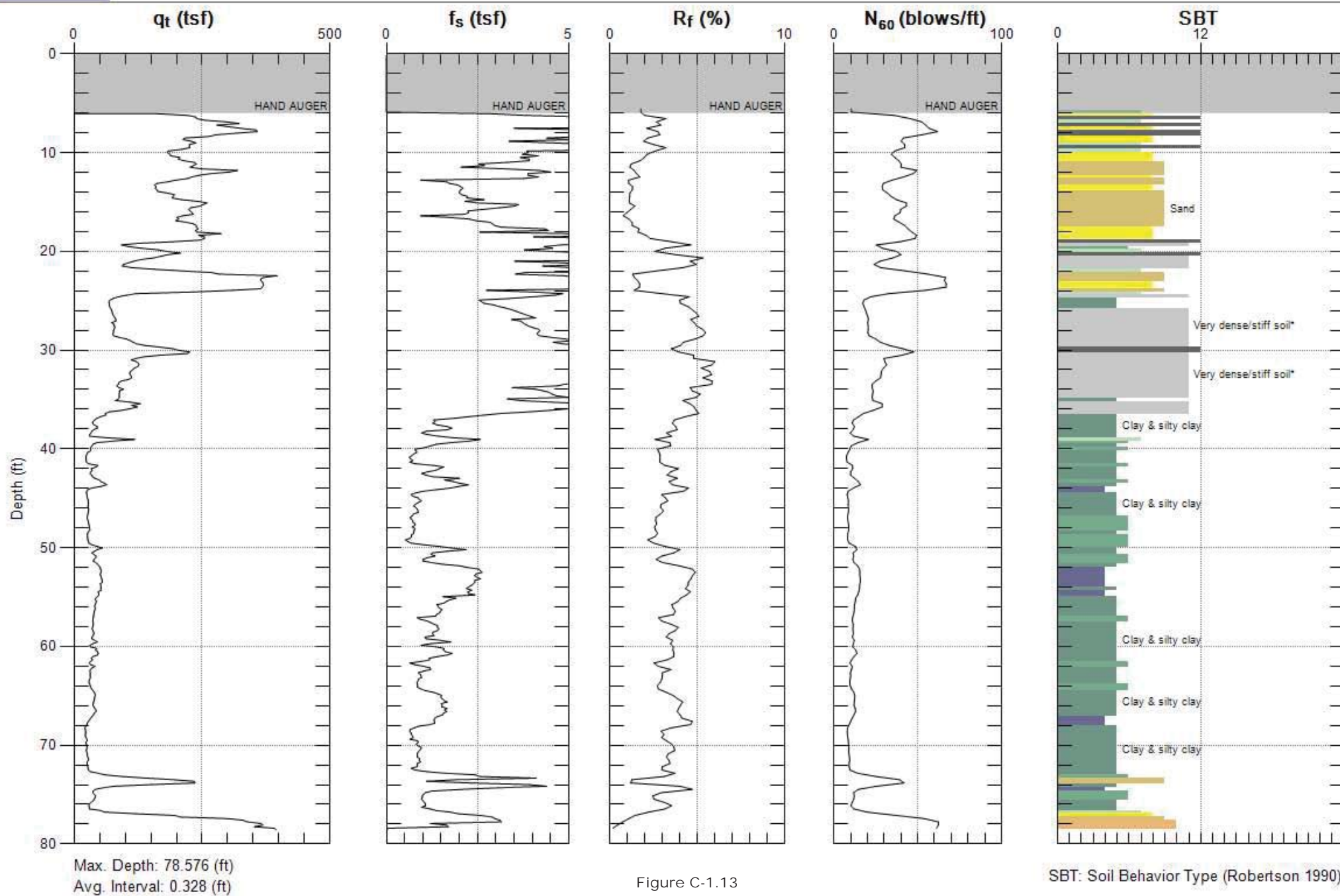
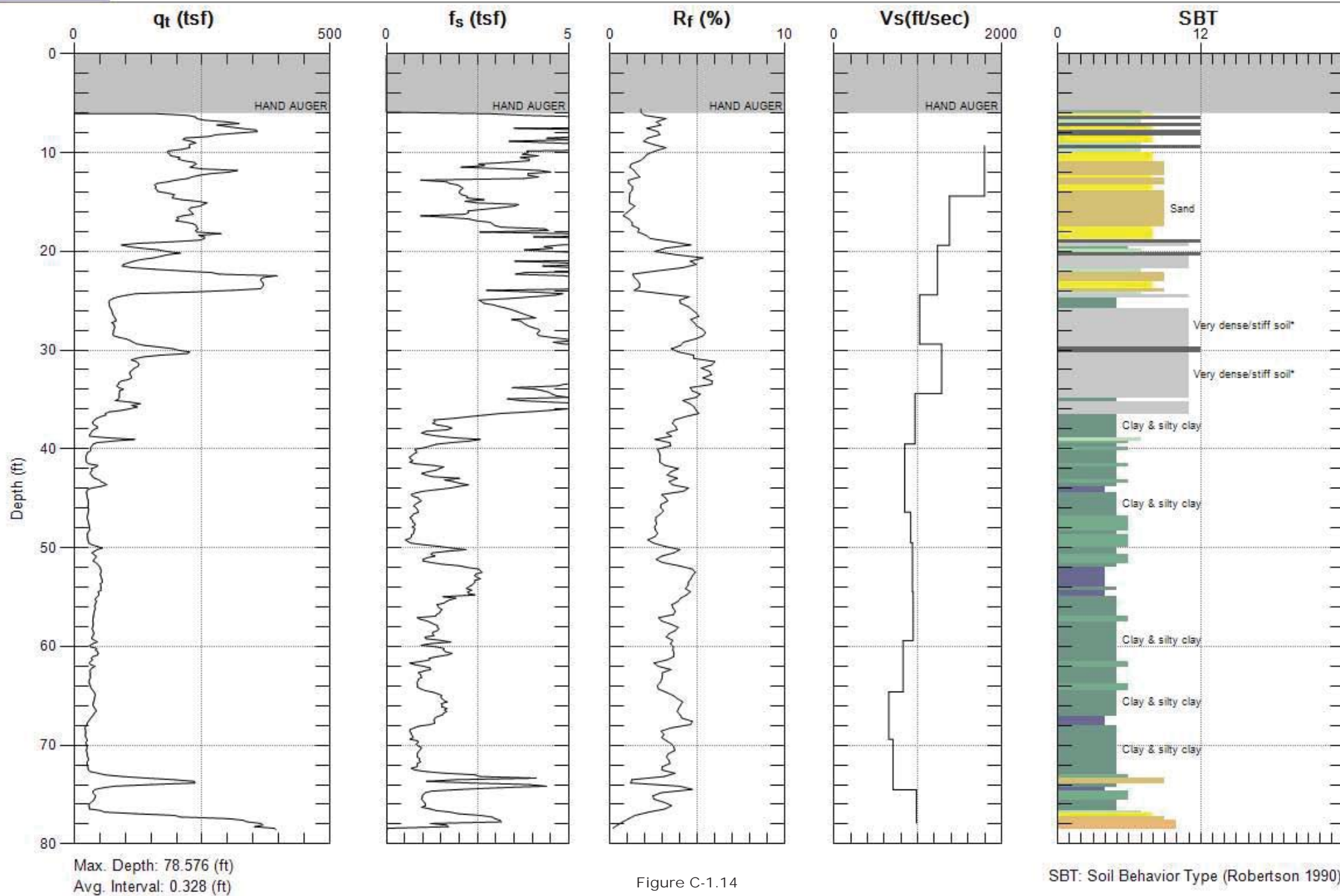
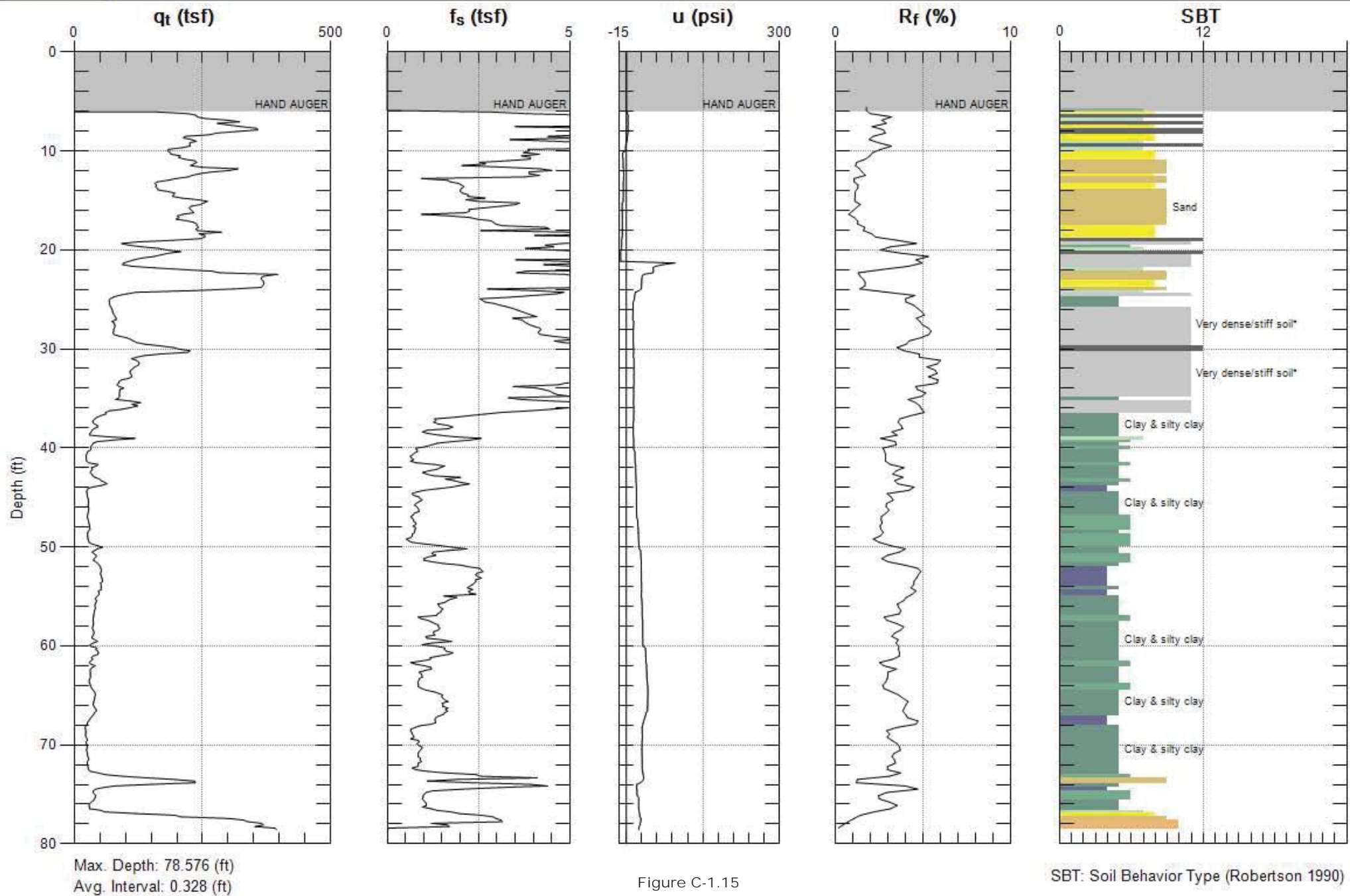


Figure C-1.13





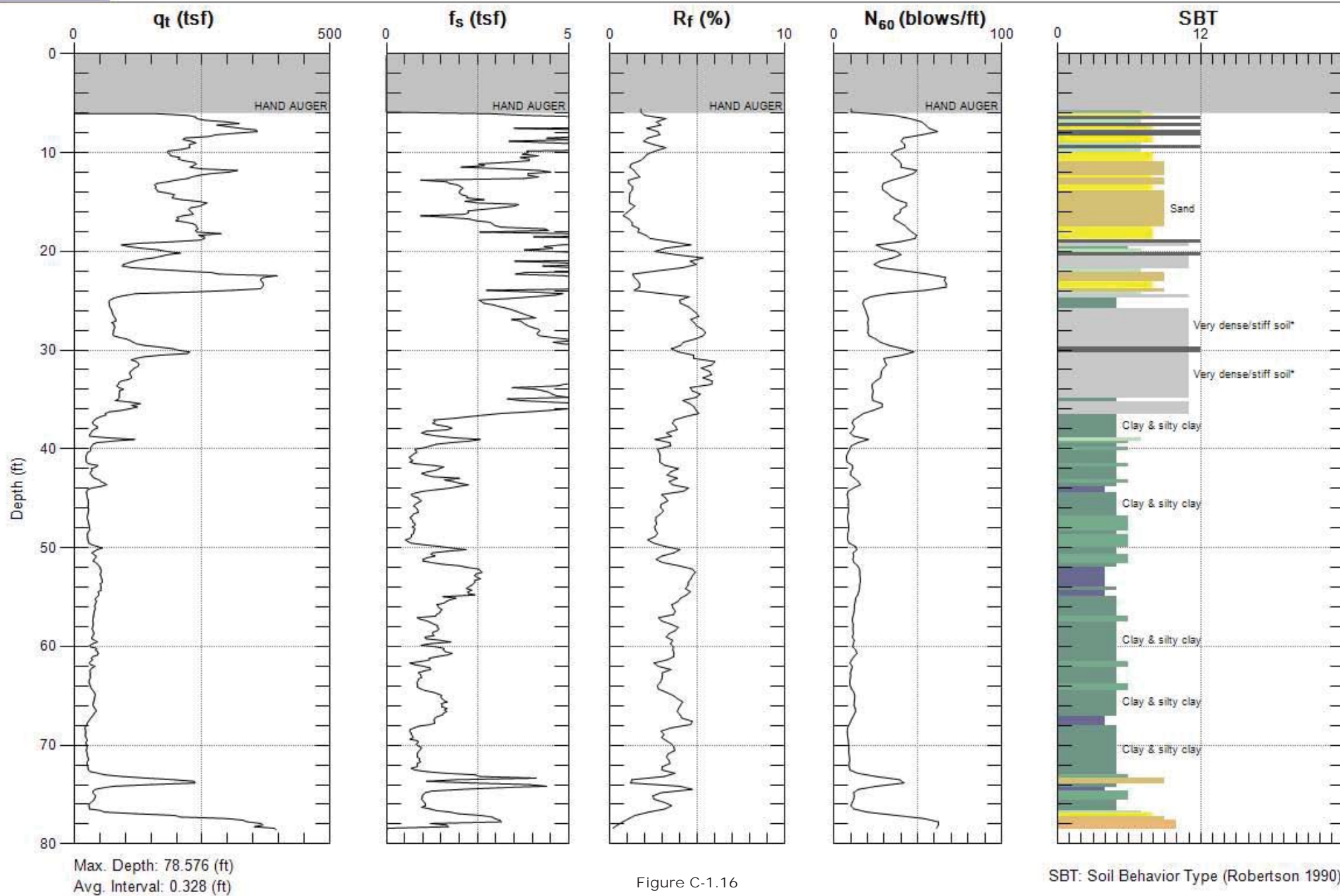


Figure C-1.16

SBT: Soil Behavior Type (Robertson 1990)

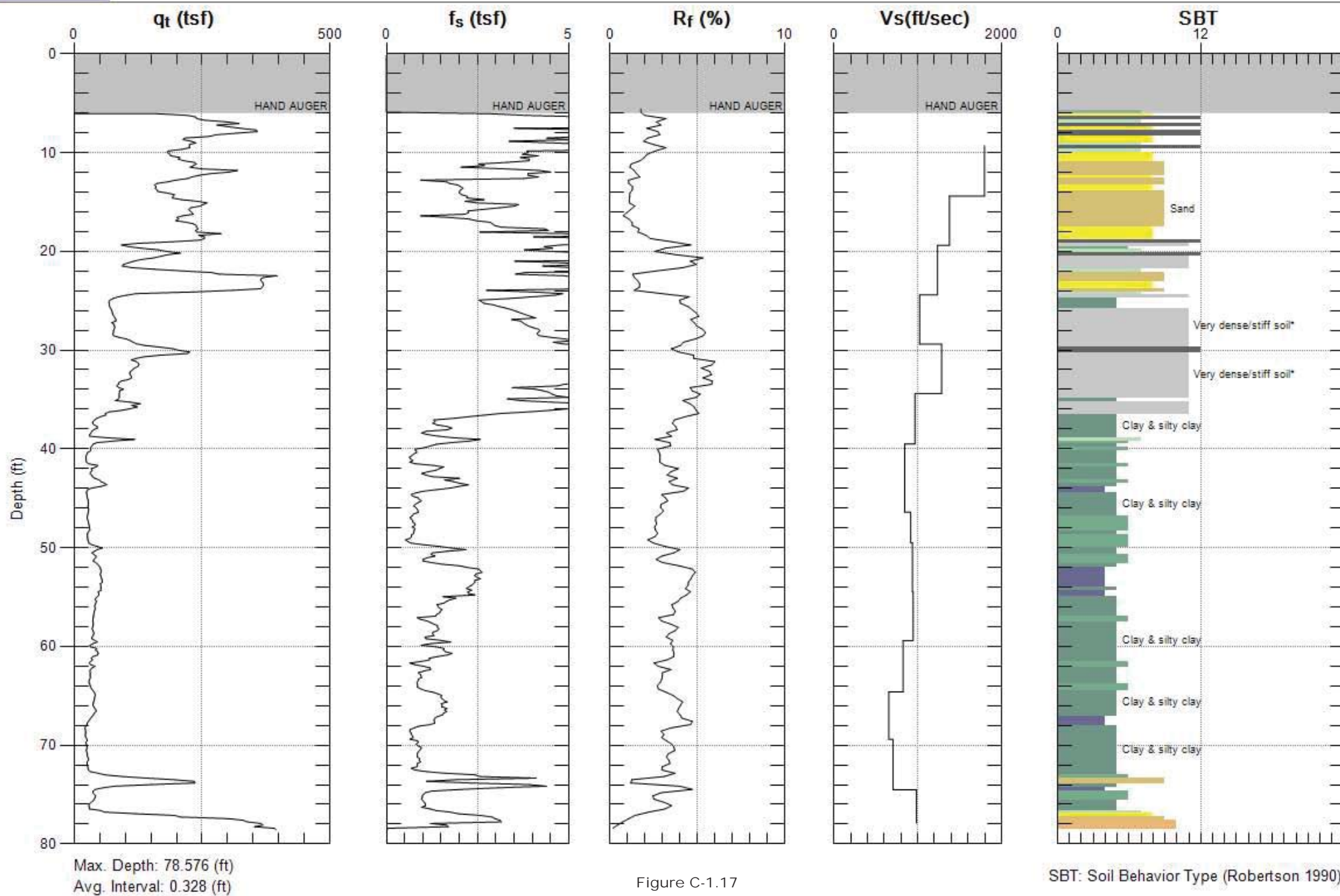
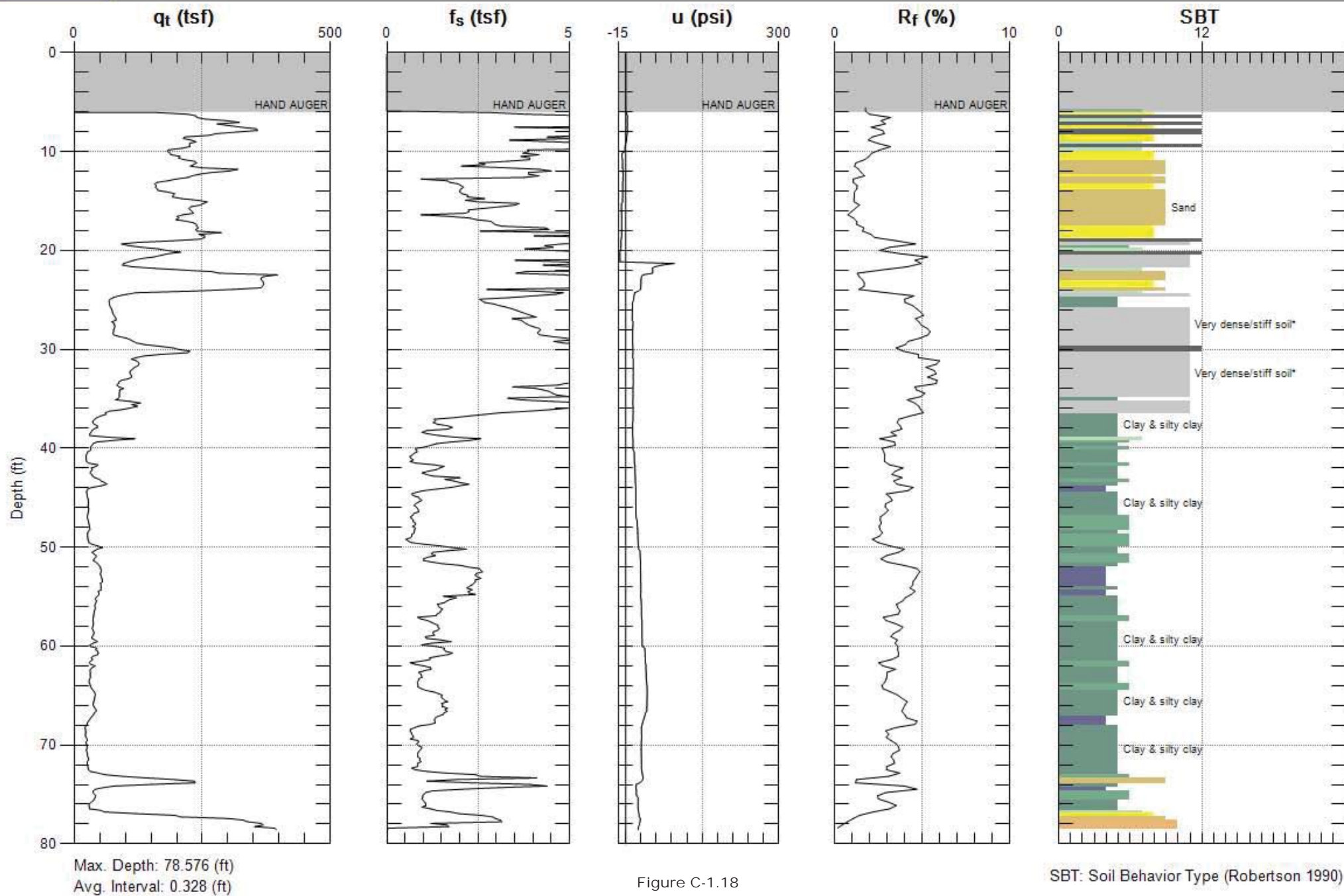
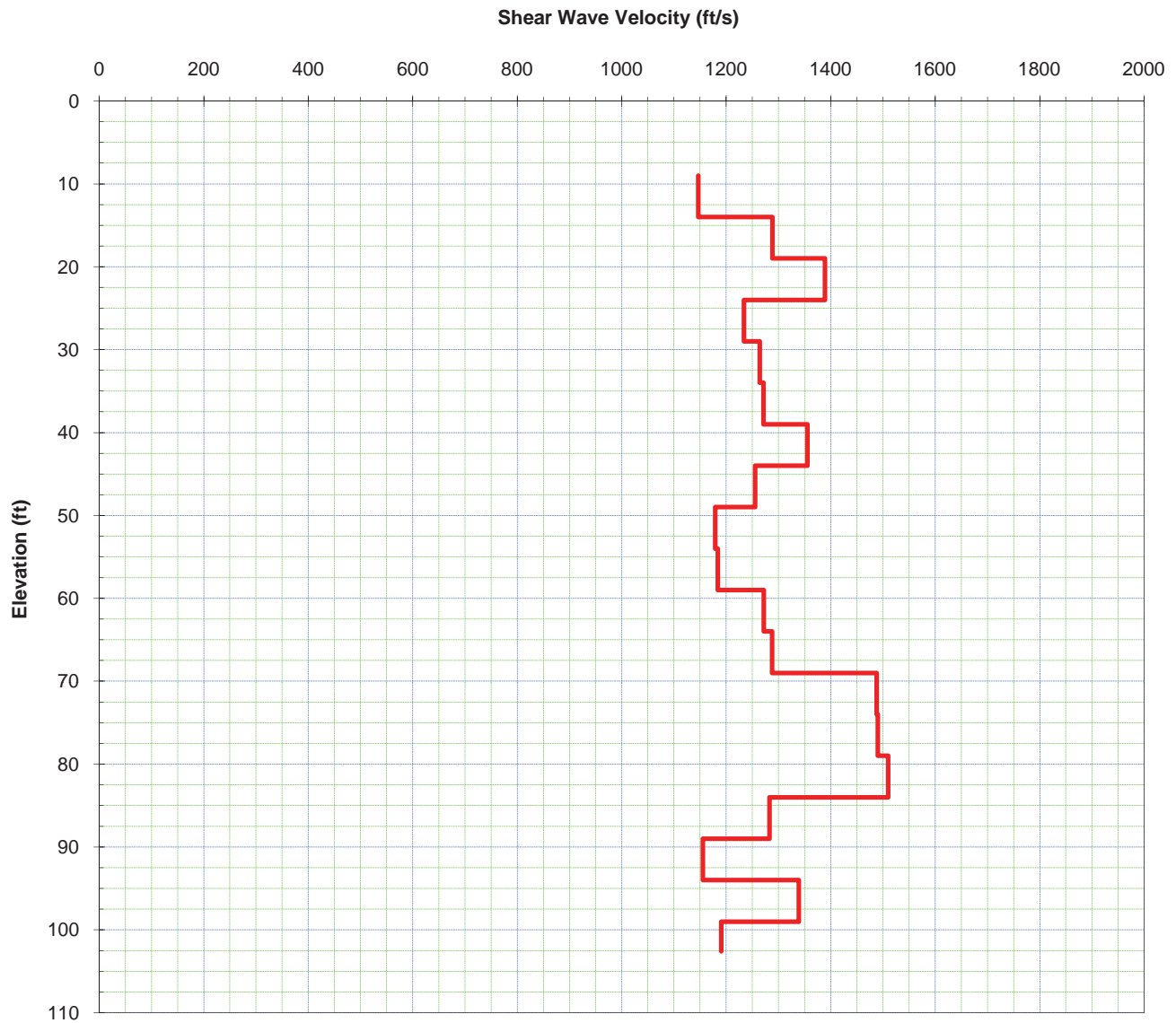
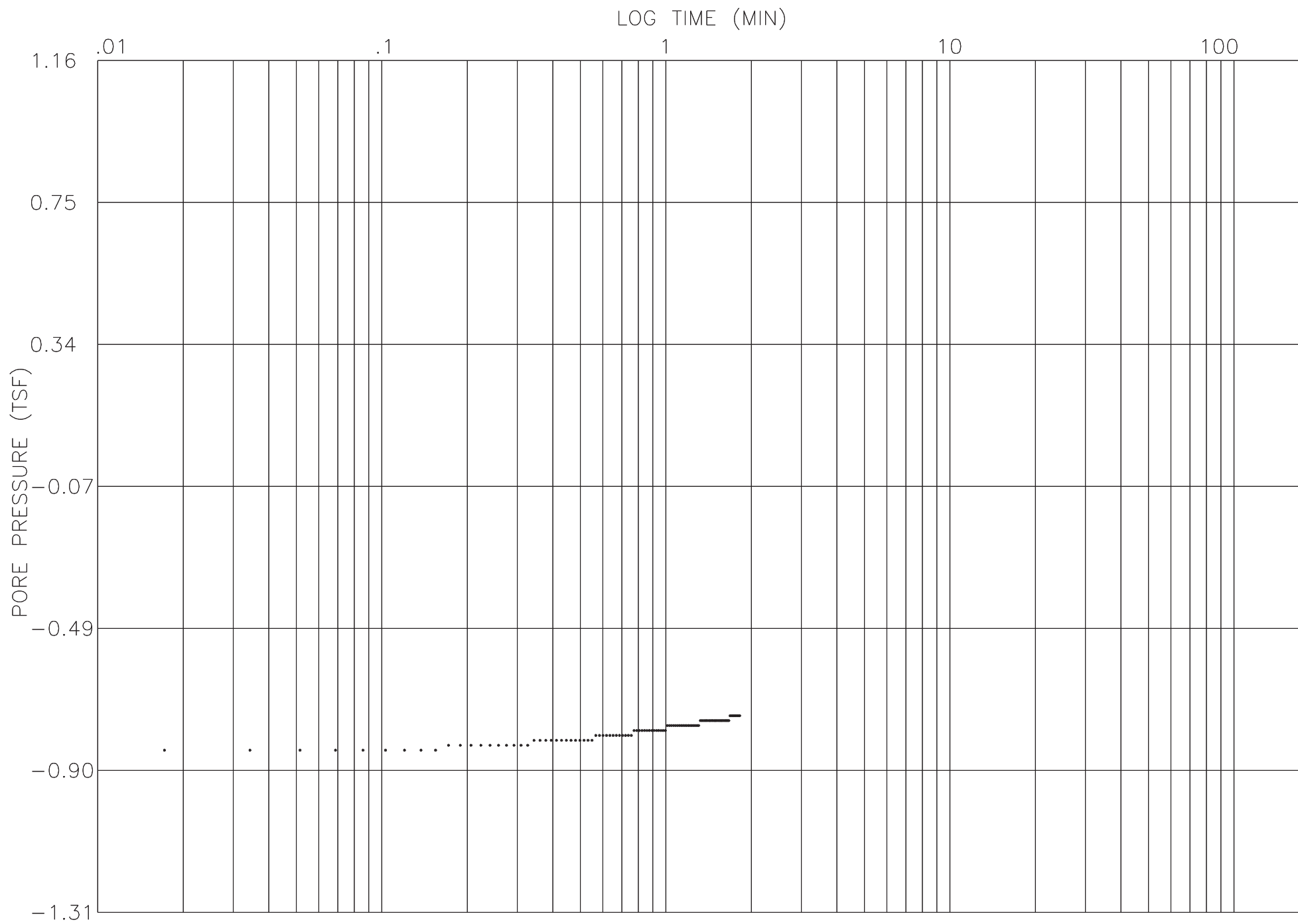


Figure C-1.17





SEISMIC CONE PENETRATION TEST RESULTS - C-113A
Wilshire Blvd.
MACTEC

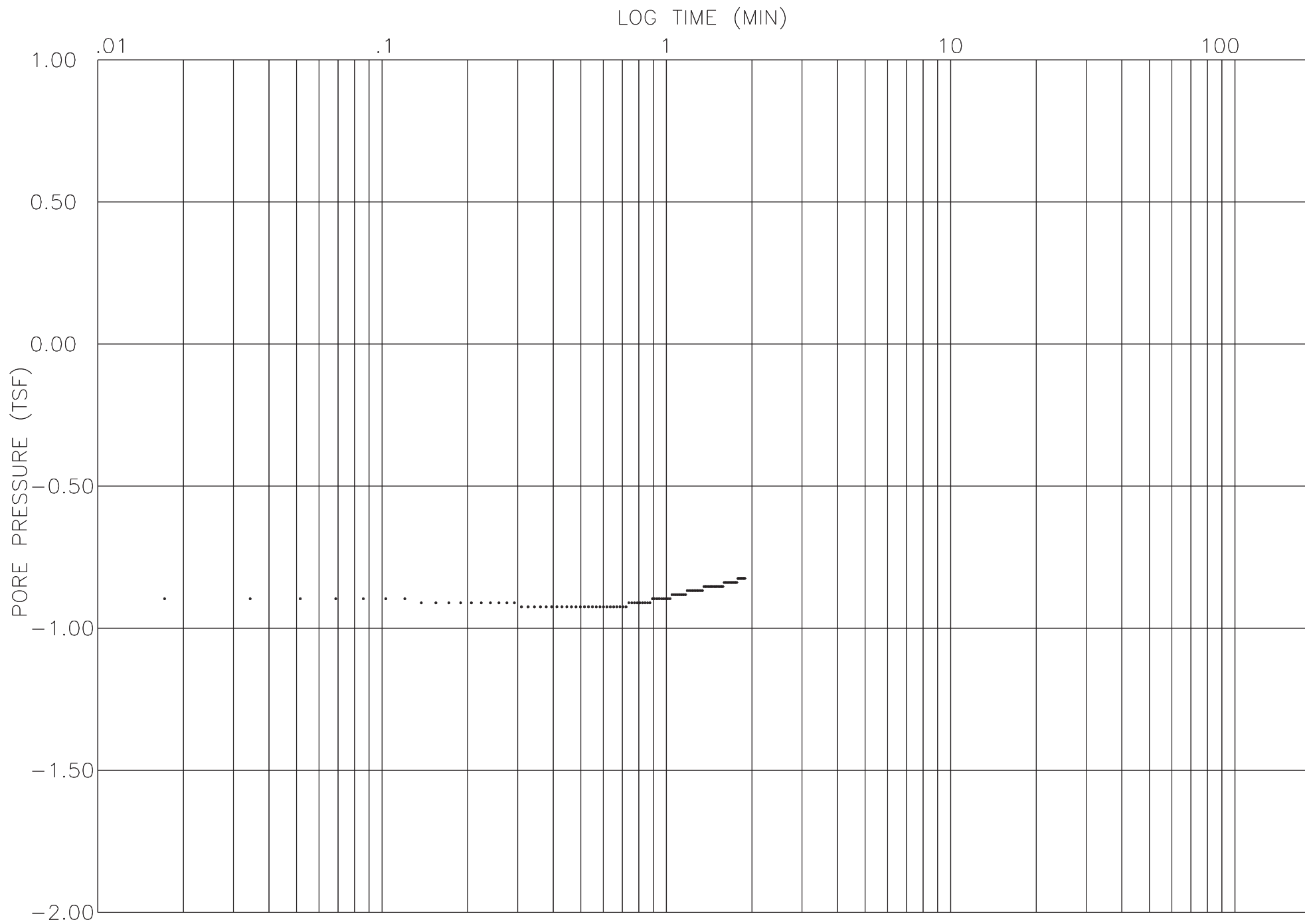


CPT NUMBER: C-113A
JOB NUMBER: 04.0911-0016

DISSIPATION TEST

DEPTH: 54.99 Feet
DATE: 24-Jun-2011

Figure C-1.20

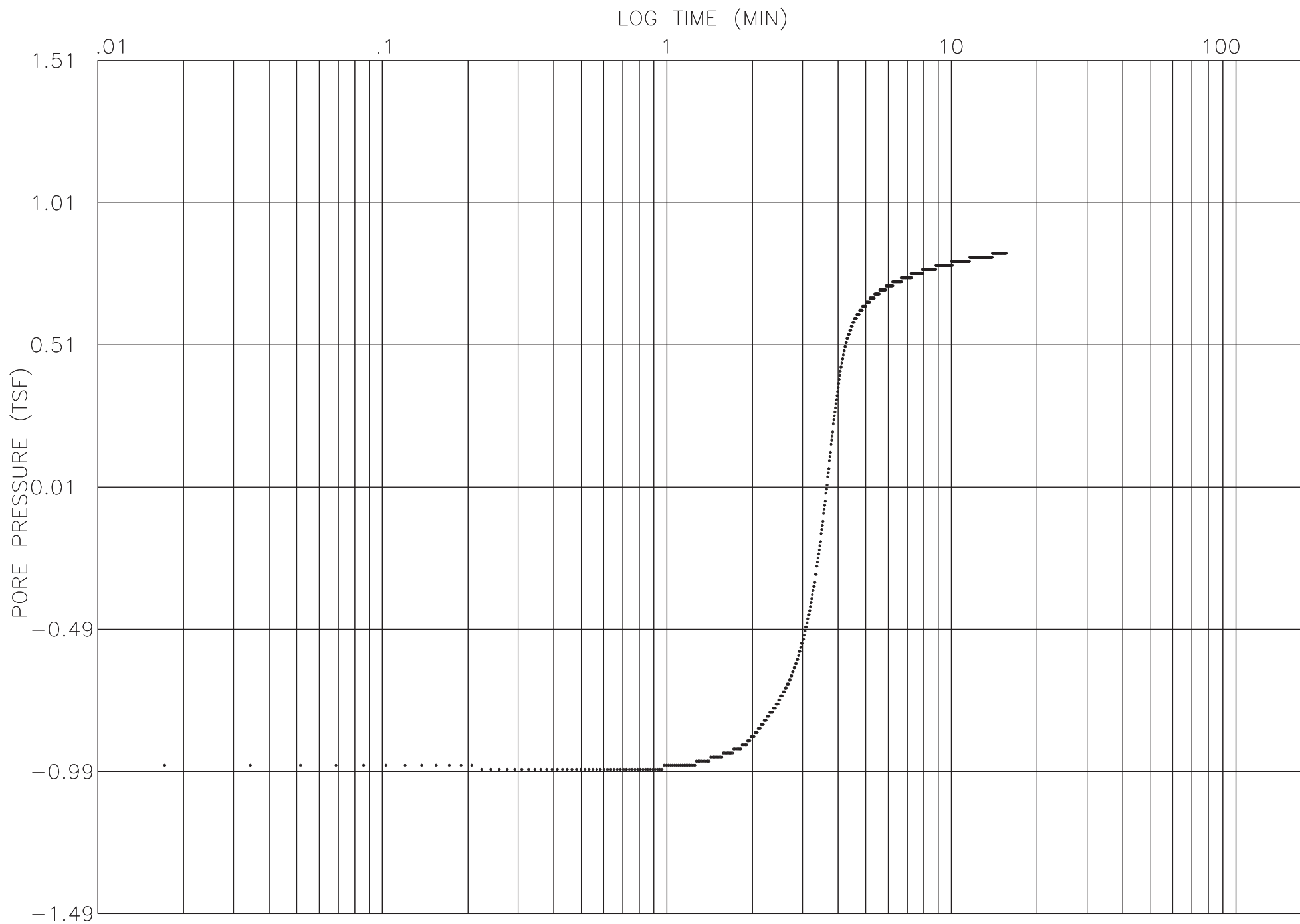


CPT NUMBER: C-113A
JOB NUMBER: 04.0911-0016

DISSIPATION TEST

DEPTH: 60.07 Feet
DATE: 24-Jun-2011

Figure C-1.21



CPT NUMBER: C-114
JOB NUMBER: 04.0911-0016

DISSIPATION TEST

DEPTH: 84.94 Feet
DATE: 31-May-2011

Figure C-1.22

Westside Purple Line Extension
Locations of Reach 5 CPTs

Job No. 4953-11-1423

Name	POINT_X	POINT_Y	Longitude	Latitude	Total Depth (ft.)
T9C1	6437496.878	1845185.184	-118.4099689	34.0619637	69.81
T9C2	6437496.88	1845208.158	-118.4099692	34.06202683	61.59
T9C4	6437500.685	1845281.272	-118.4099576	34.06222777	63.65
T9C5	6437500.09	1845351.776	-118.4099605	34.0624215	68.41
T9C6	6437501.488	1845425.799	-118.4099569	34.06262492	76.67
T9C7	6437503.293	1845476.452	-118.4099516	34.06276413	68.54
T9C8	6437502.918	1845506.723	-118.4099532	34.0628473	73.59
T9C9	6437502.999	1845568.617	-118.4099538	34.06301738	74.85
T9C10	6437503.167	1845599.392	-118.4099537	34.06310195	78.06
T9C11	6437504.468	1845645.82	-118.40995	34.06322954	80.39
T9C12	6437503.43	1845672.58	-118.4099538	34.06330306	80.22
T9C13	6437505.533	1845734.533	-118.4099477	34.06347332	80.37
T9C14	6437501.01	1845802.197	-118.4099635	34.0636592	80.51
T9C15	6437502.021	1845846.845	-118.4099608	34.06378189	80.32
T9C16	6437502.911	1845876.827	-118.4099583	34.06386429	80.27
T9C17	6437503.746	1845941.171	-118.4099564	34.06404111	80.15
T9C18	6437500.771	1845962.851	-118.4099665	34.06410064	80.75
T9C19	6437507.567	1846027.754	-118.4099449	34.06427907	98.31
T9C20	6437504.324	1846058.581	-118.409956	34.06436373	114.55
T9C21	6437503.756	1846118.436	-118.4099587	34.0645282	49.44
T9C22	6437505.684	1846150.612	-118.4099528	34.06461664	110.5
T9C23	6437506.126	1846208.563	-118.4099521	34.06477588	102.93
T9C24	6437502.562	1846241.686	-118.4099643	34.06486686	91.89
T9C25	6437559.376	1846307.8	-118.4097776	34.06504917	94.51
T9C26	6437582.677	1846304.772	-118.4097006	34.06504111	96.14
T9C27	6437838.236	1846339.94	-118.4088573	34.0651406	117.31
T9C28	6437839.669	1846444.174	-118.408854	34.06542703	112.09
T9C29	6437840.482	1846493.025	-118.408852	34.06556128	96.98
T9C30	6437839.968	1846585.199	-118.4088549	34.06581455	95.63
T9C31	6437840.504	1846635.098	-118.4088538	34.06595167	97.74
T9C32	6437833.883	1846730.852	-118.4088769	34.06621472	98.62
T9C33	6437833.883	1846760.7	-118.4088774	34.06629674	100.21

Explanation:

T9BX - Continuous Core Boring

T9CX - CPT

Figure C-2.1



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C1

Total depth: 69.81 ft, Date: 10/13/2015

Cone Type: Vertek

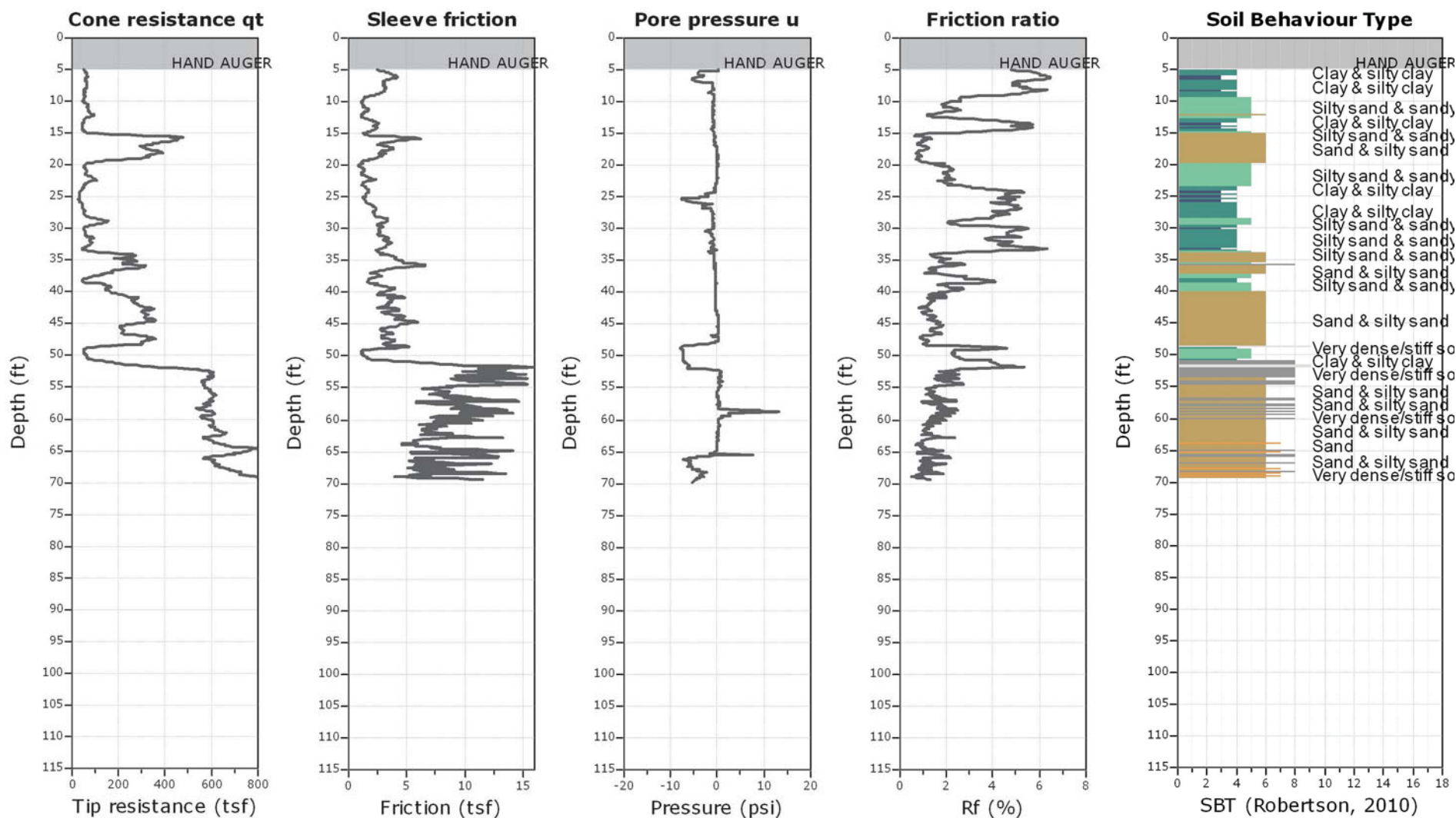


Figure C-2.2



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C2

Total depth: 61.59 ft, Date: 10/13/2015

Cone Type: Vertek

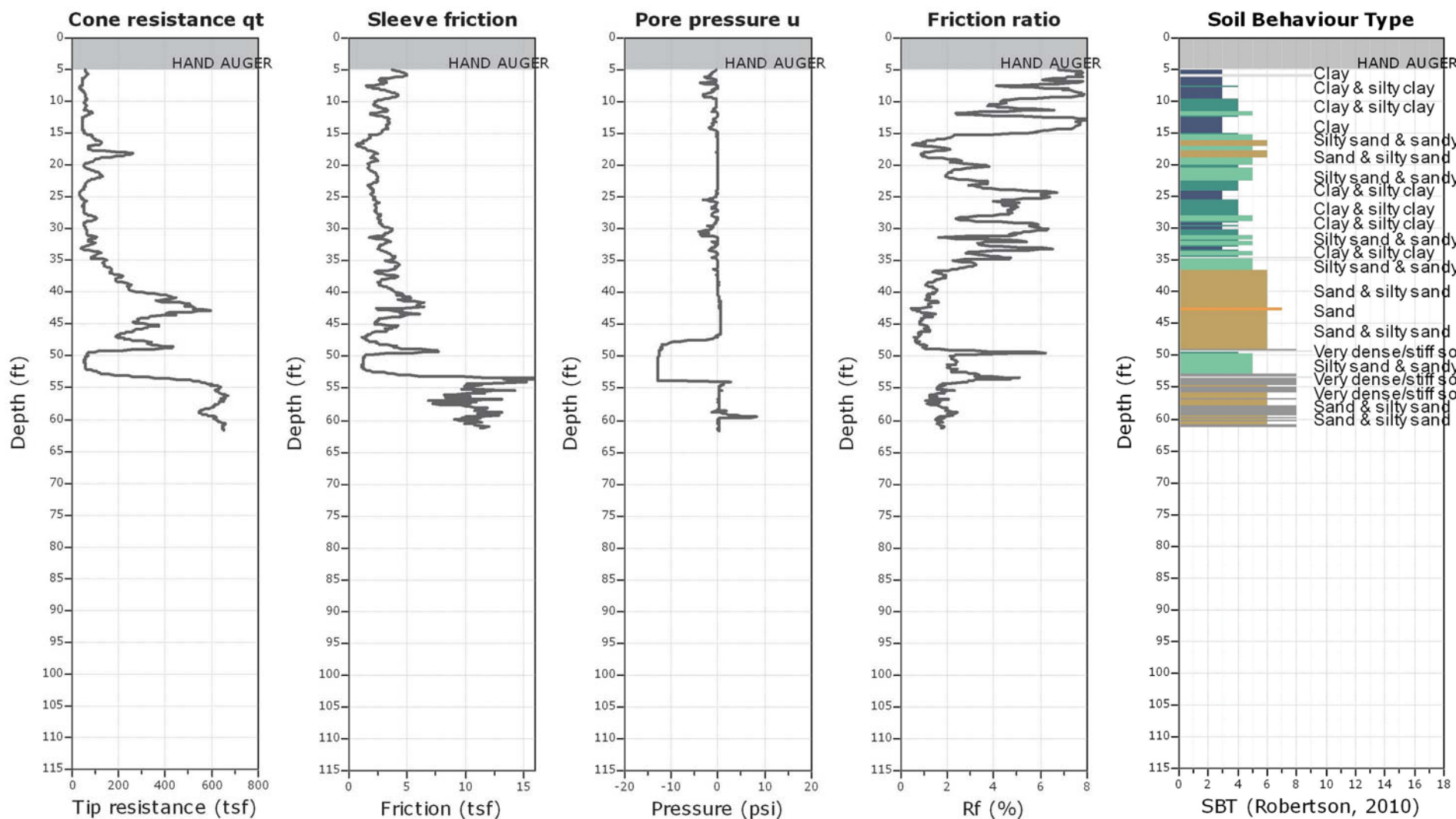


Figure C-2.3



AMEC FOSTER WHEELER

Site: S.LASKY DR.

Sounding: T9-C4

Engineer: M.ESPINOZA

Date: 10/8/2015 12:31

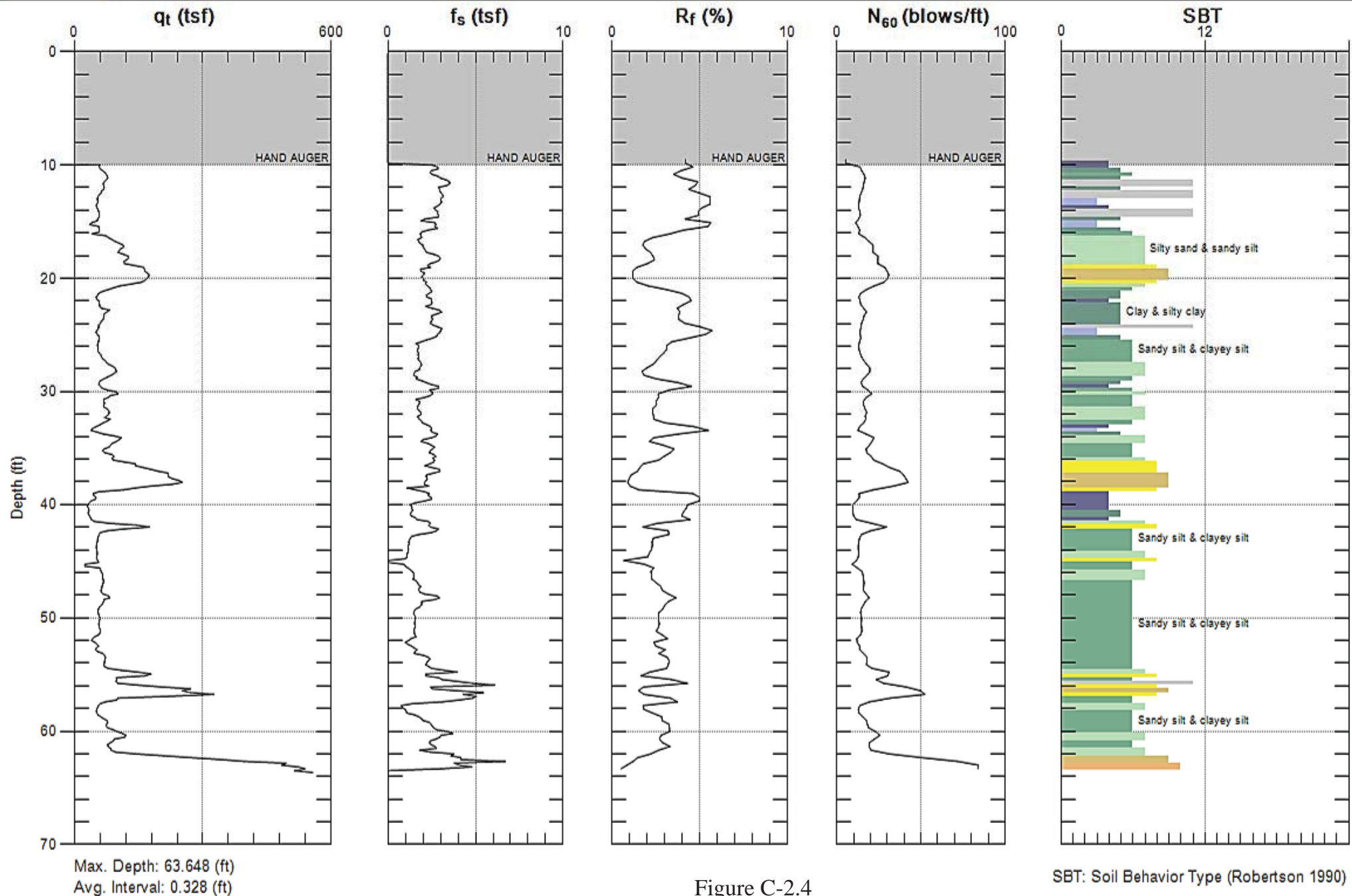


Figure C-2.4



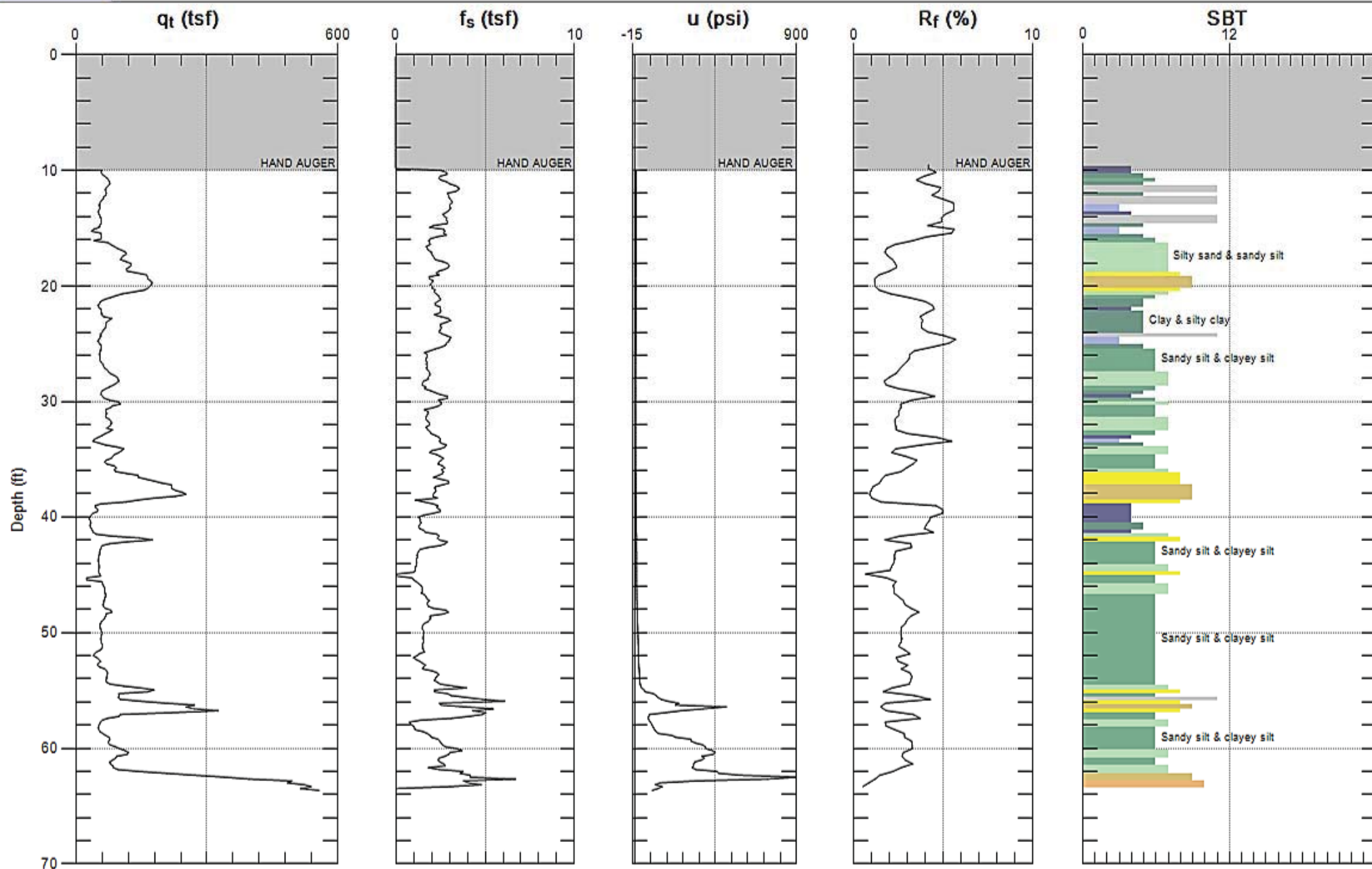
AMEC FOSTER WHEELER

Site: S.LASKY DR.

Sounding: T9-C4

Engineer: M.ESPINOZA

Date: 10/8/2015 12:31



Max. Depth: 63.648 (ft)
Avg. Interval: 0.328 (ft)

Figure C-2.5

SBT: Soil Behavior Type (Robertson 1990)



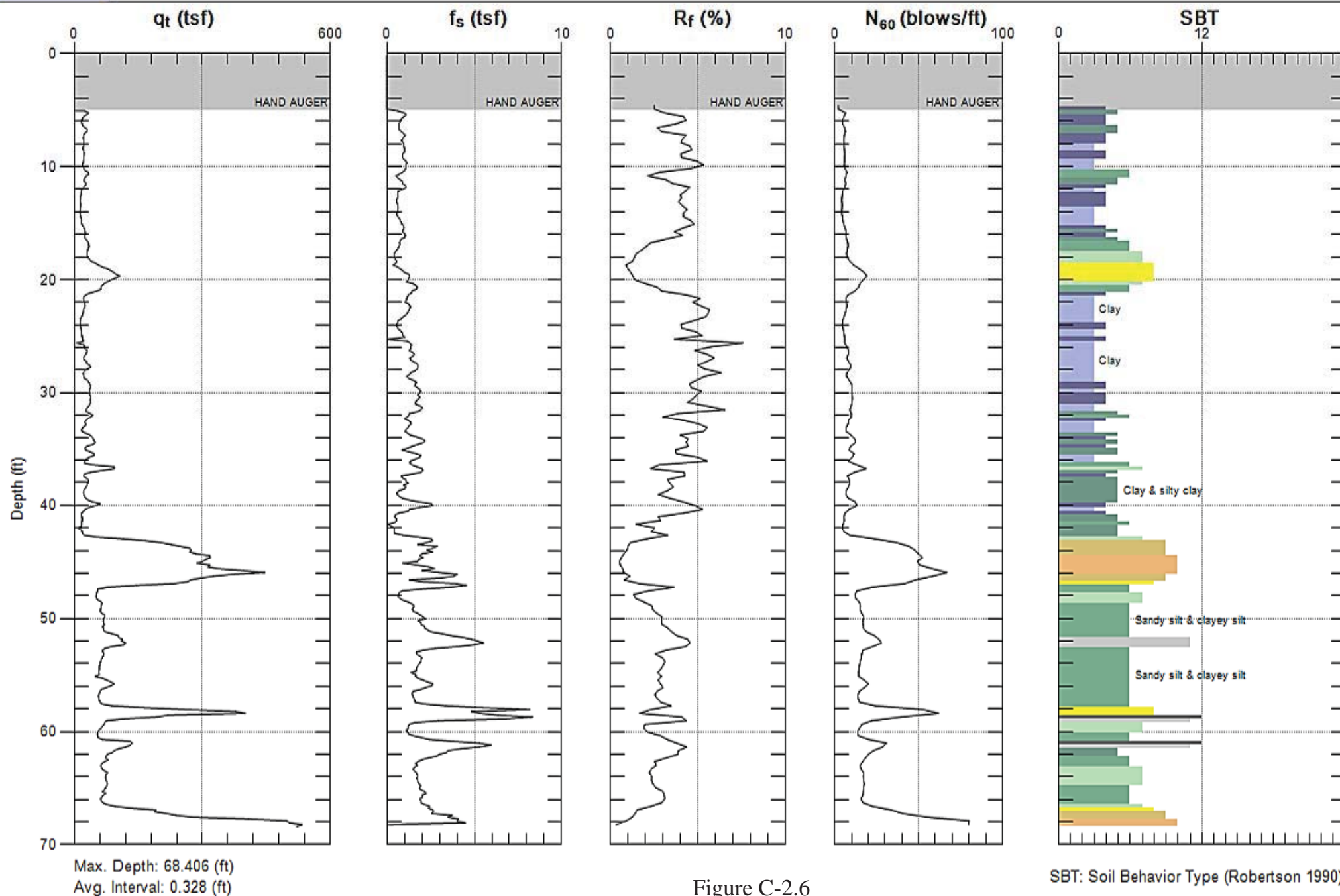
AMEC FOSTER WHEELER

Site: S.LASKY DR.

Sounding: T9-C5

Engineer: M.ESPINOZA

Date: 10/8/2015 10:30





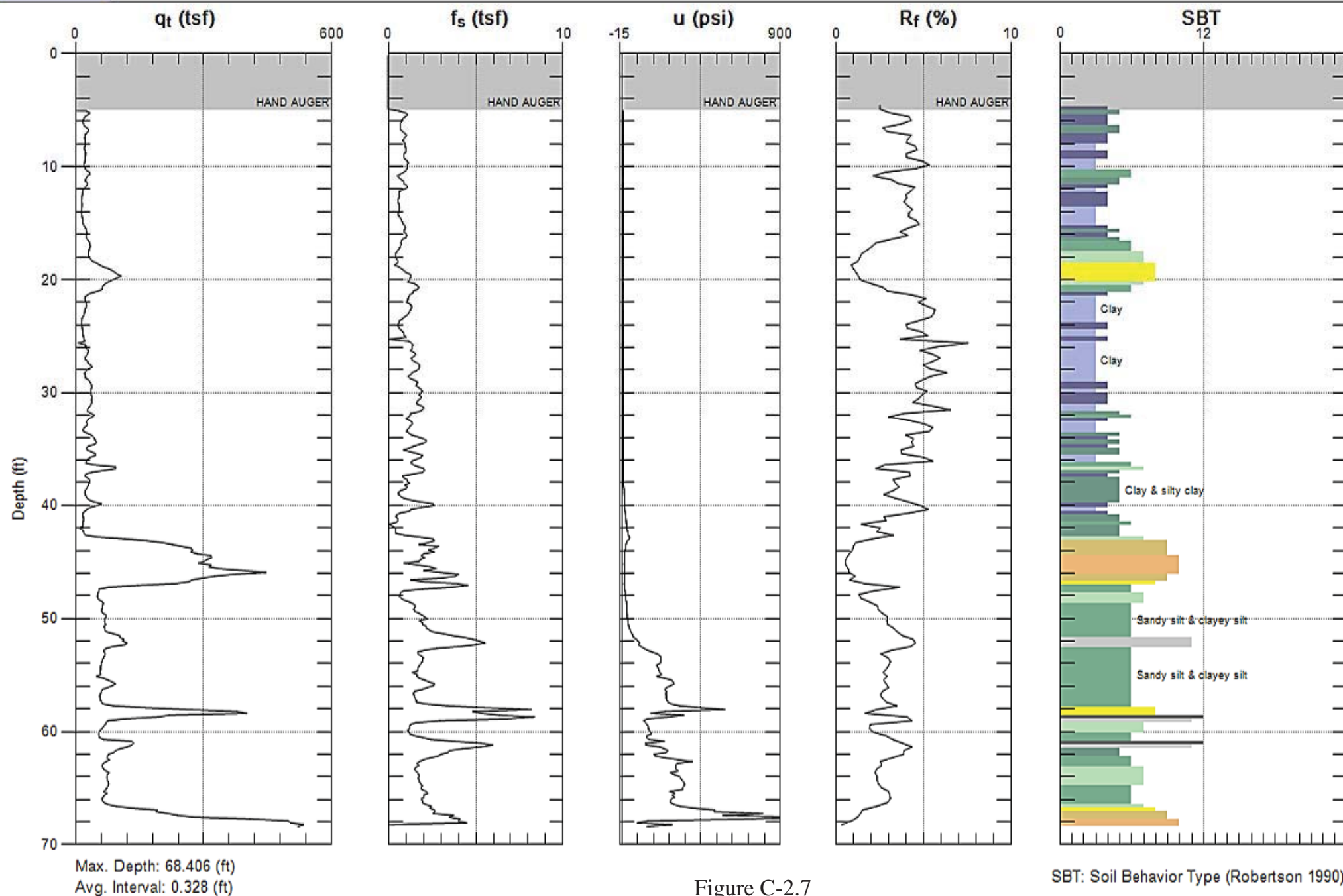
AMEC FOSTER WHEELER

Site: S.LASKY DR.

Sounding: T9-C5

Engineer: M.ESPINOZA

Date: 10/8/2015 10:30





Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C6

Total depth: 76.67 ft, Date: 10/2/2015
 Cone Type: Vertek

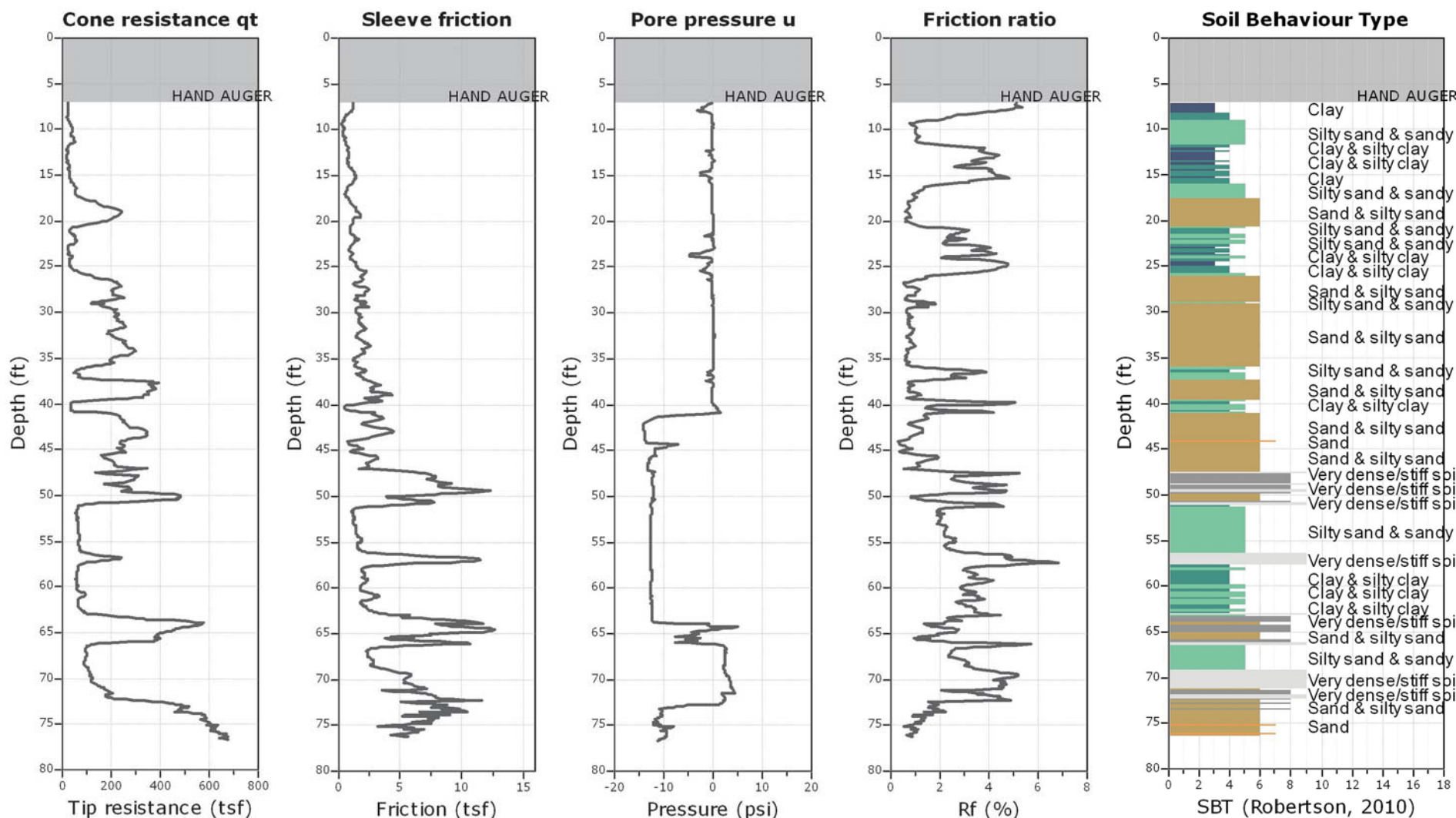


Figure C-2.8



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C7

Total depth: 68.54 ft, Date: 10/2/2015

Cone Type: Vertek

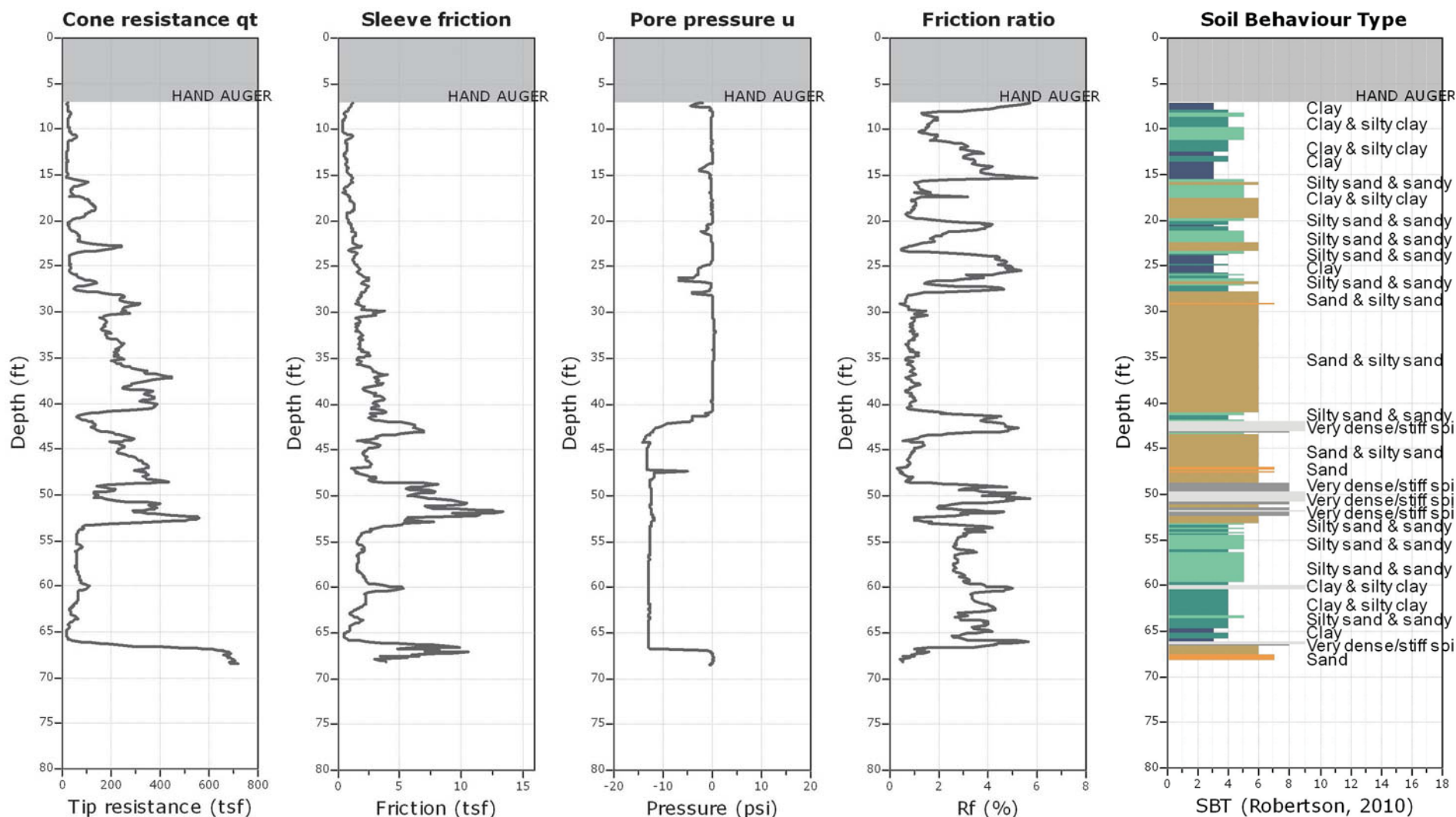


Figure C-2.9



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C8

Total depth: 73.59 ft, Date: 10/1/2015
 Cone Type: Vertek

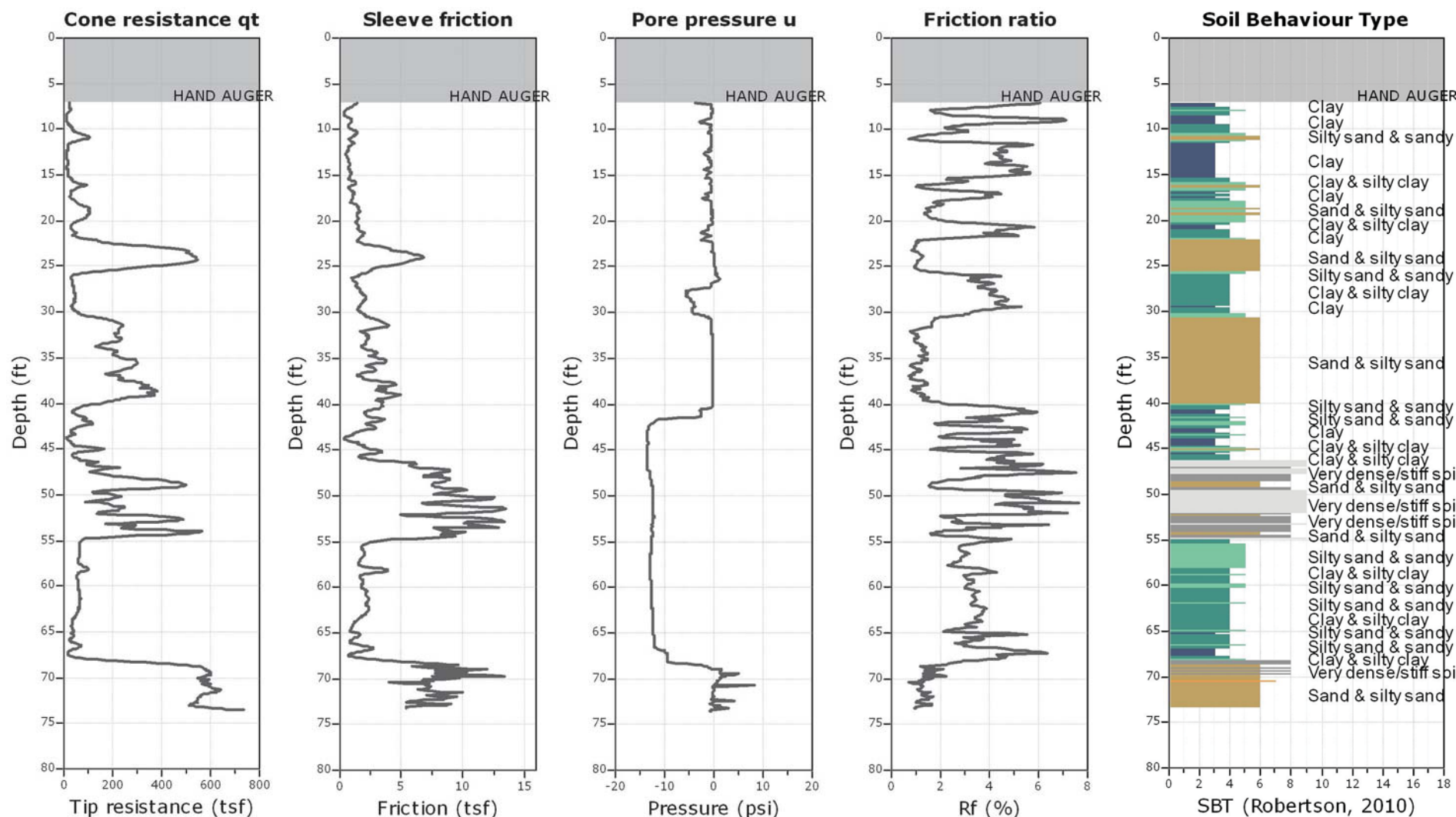


Figure C-2.10



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C9

Total depth: 74.85 ft, Date: 10/2/2015

Cone Type: Vertek

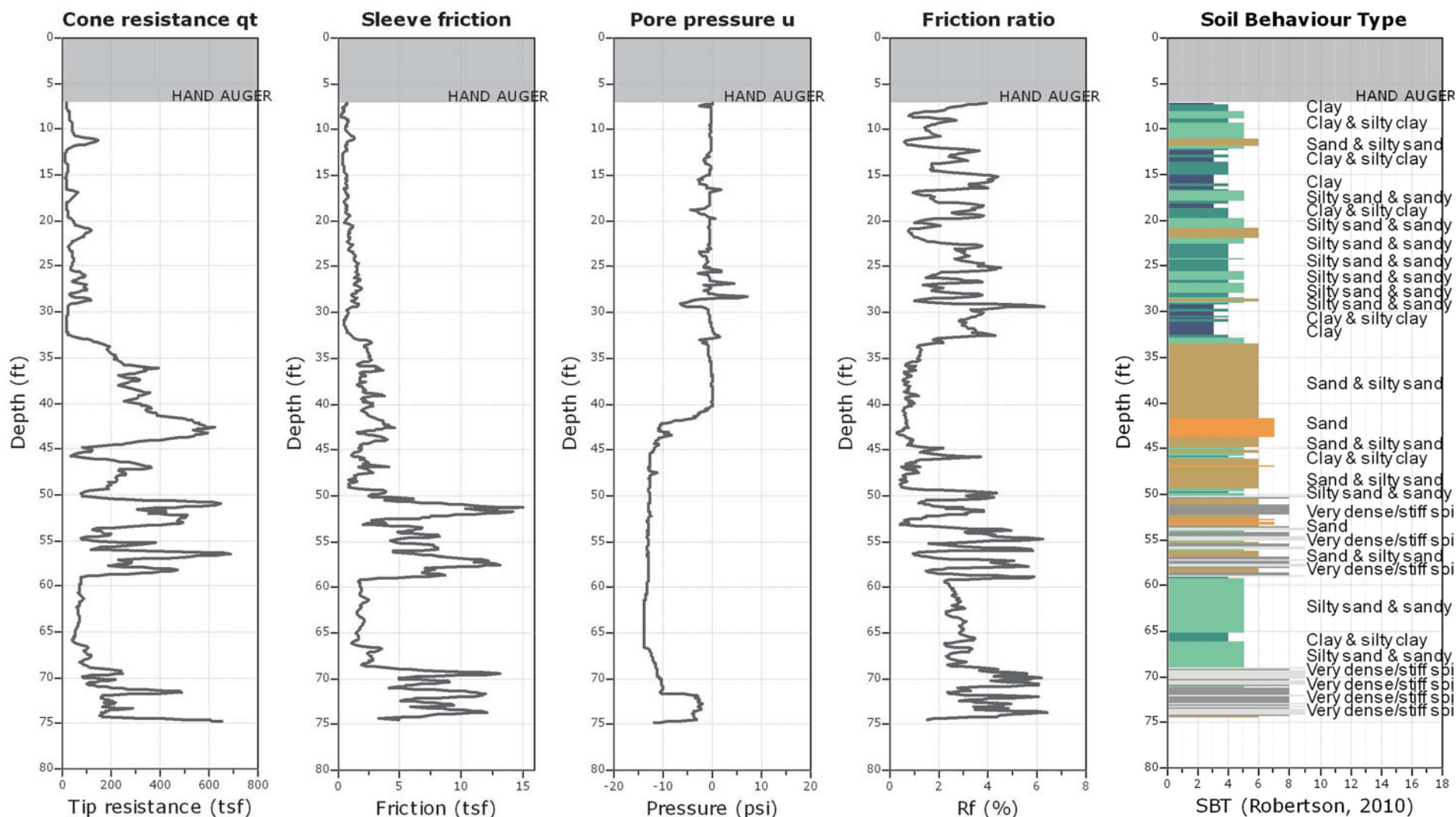


Figure C-2.11



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C10

Total depth: 78.06 ft, Date: 10/1/2015
 Cone Type: Vertek

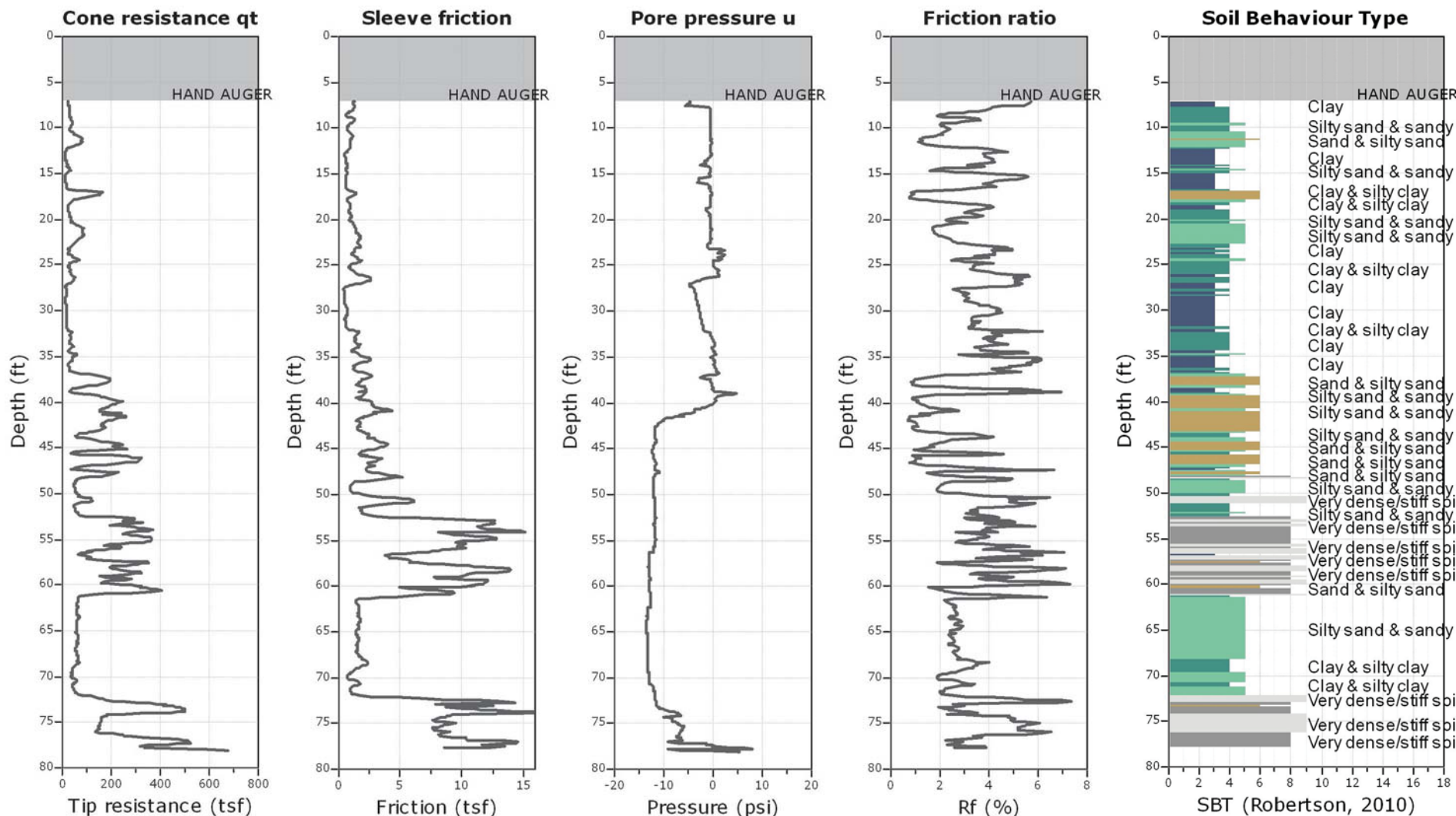


Figure C-2.12



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C11

Total depth: 80.39 ft, Date: 9/30/2015

Cone Type: Vertek

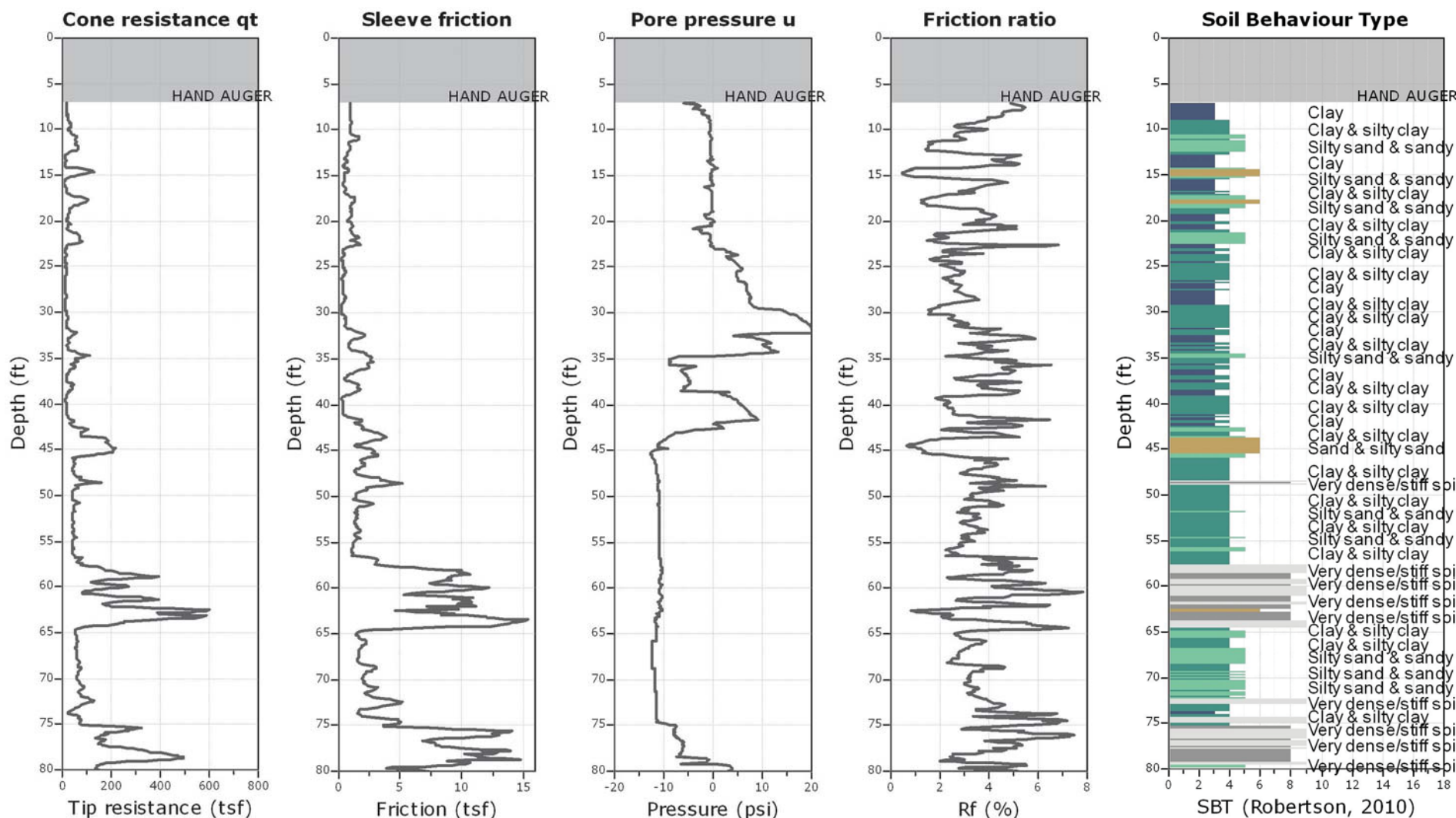


Figure C-2.13



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C12

Total depth: 80.22 ft, Date: 9/22/2015

Cone Type: Vertek

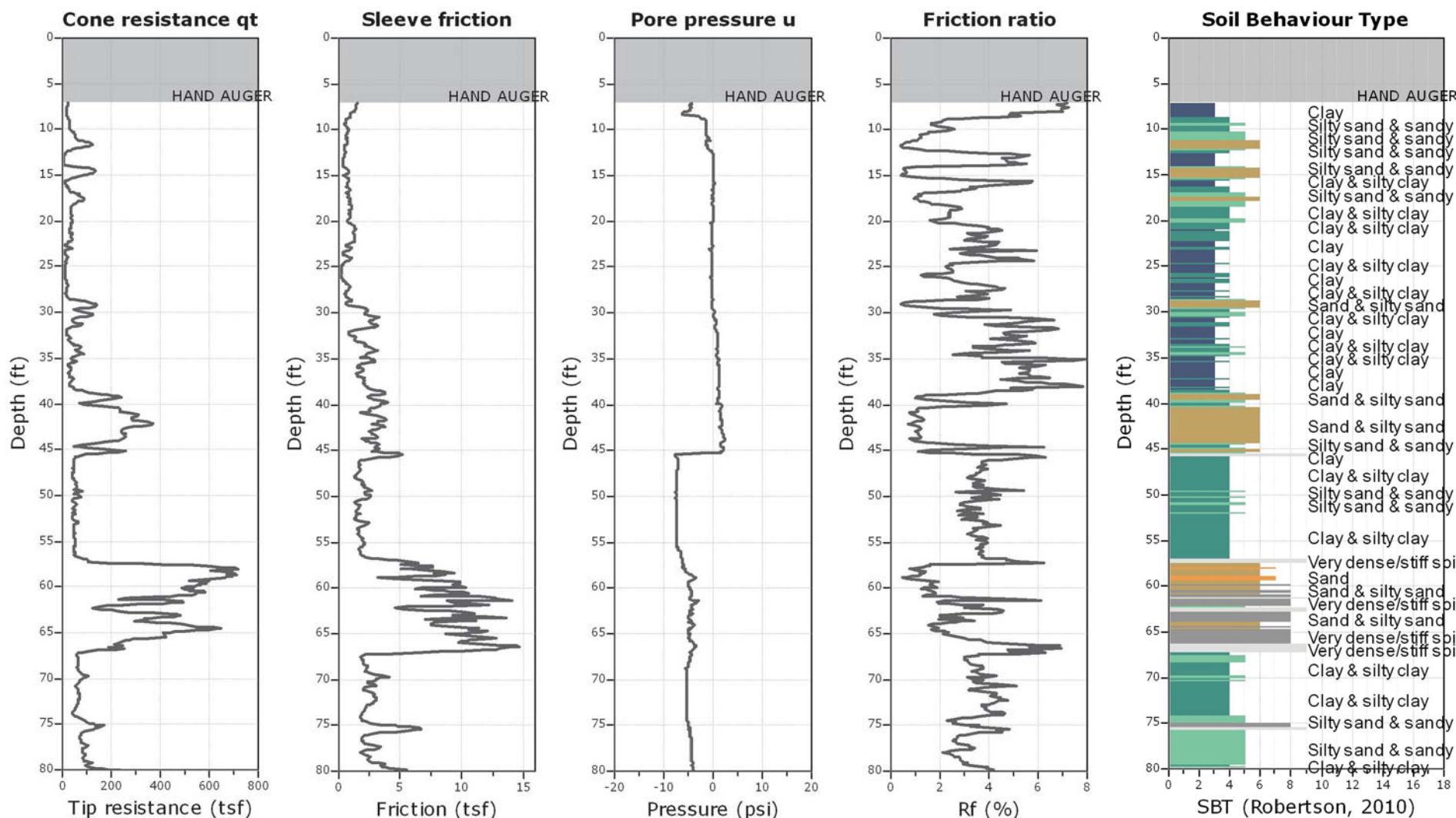


Figure C-2.14



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C13

Total depth: 80.37 ft, Date: 9/22/2015

Cone Type: Vertek

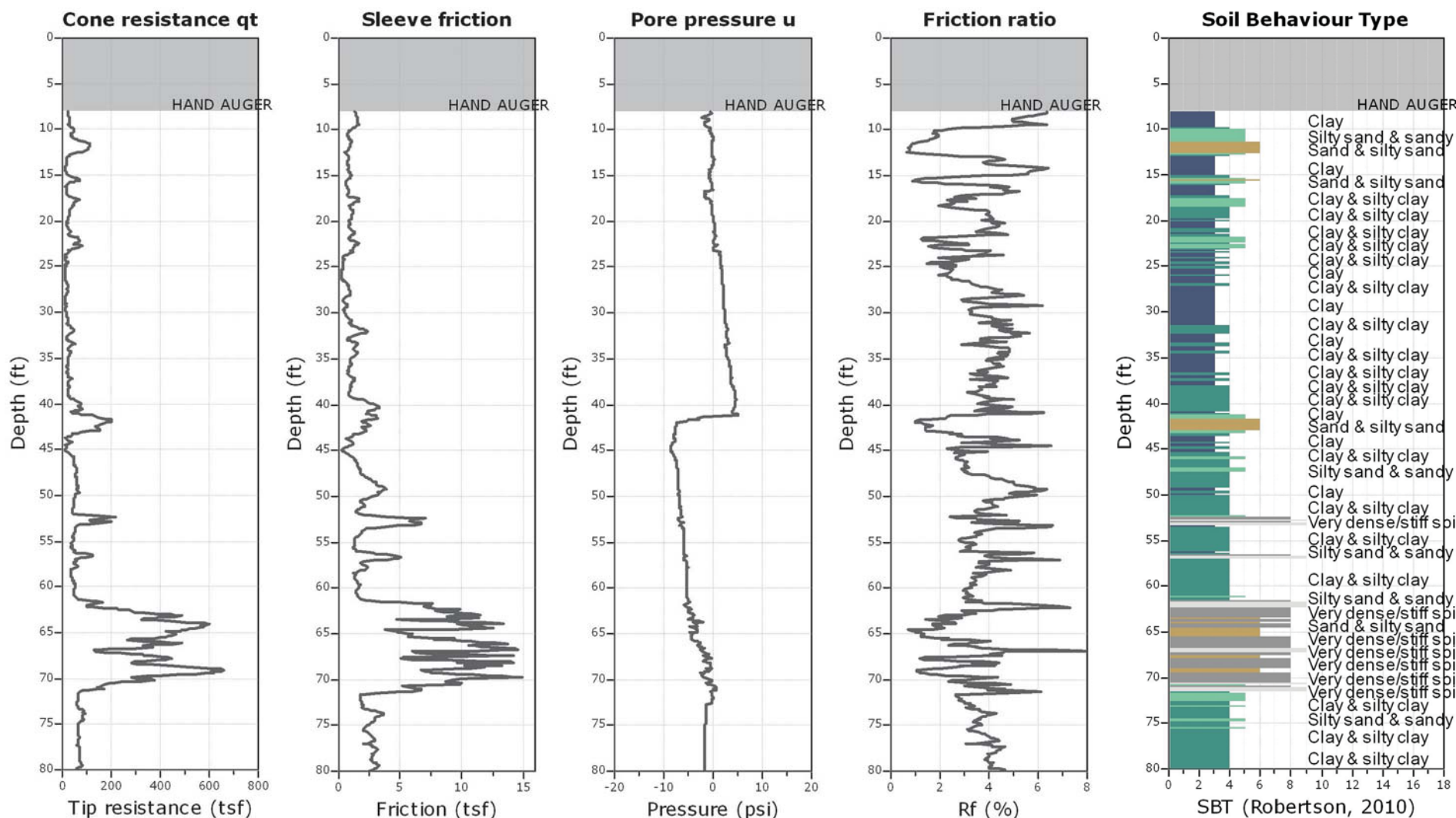


Figure C-2.15



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C14

Total depth: 80.51 ft, Date: 9/24/2015

Cone Type: Vertek

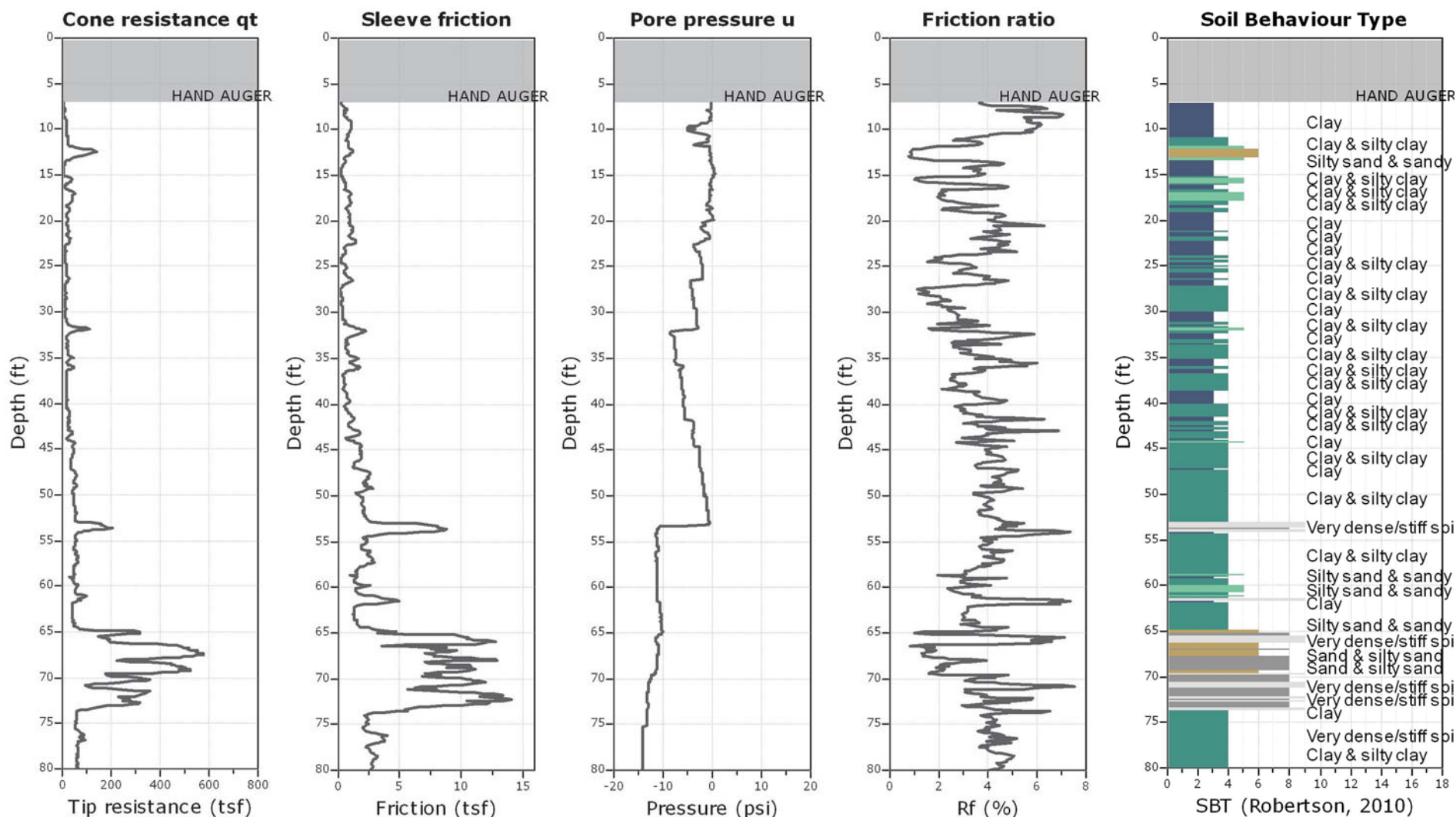


Figure C-2.16



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C15

Total depth: 80.32 ft, Date: 9/24/2015

Cone Type: Vertek

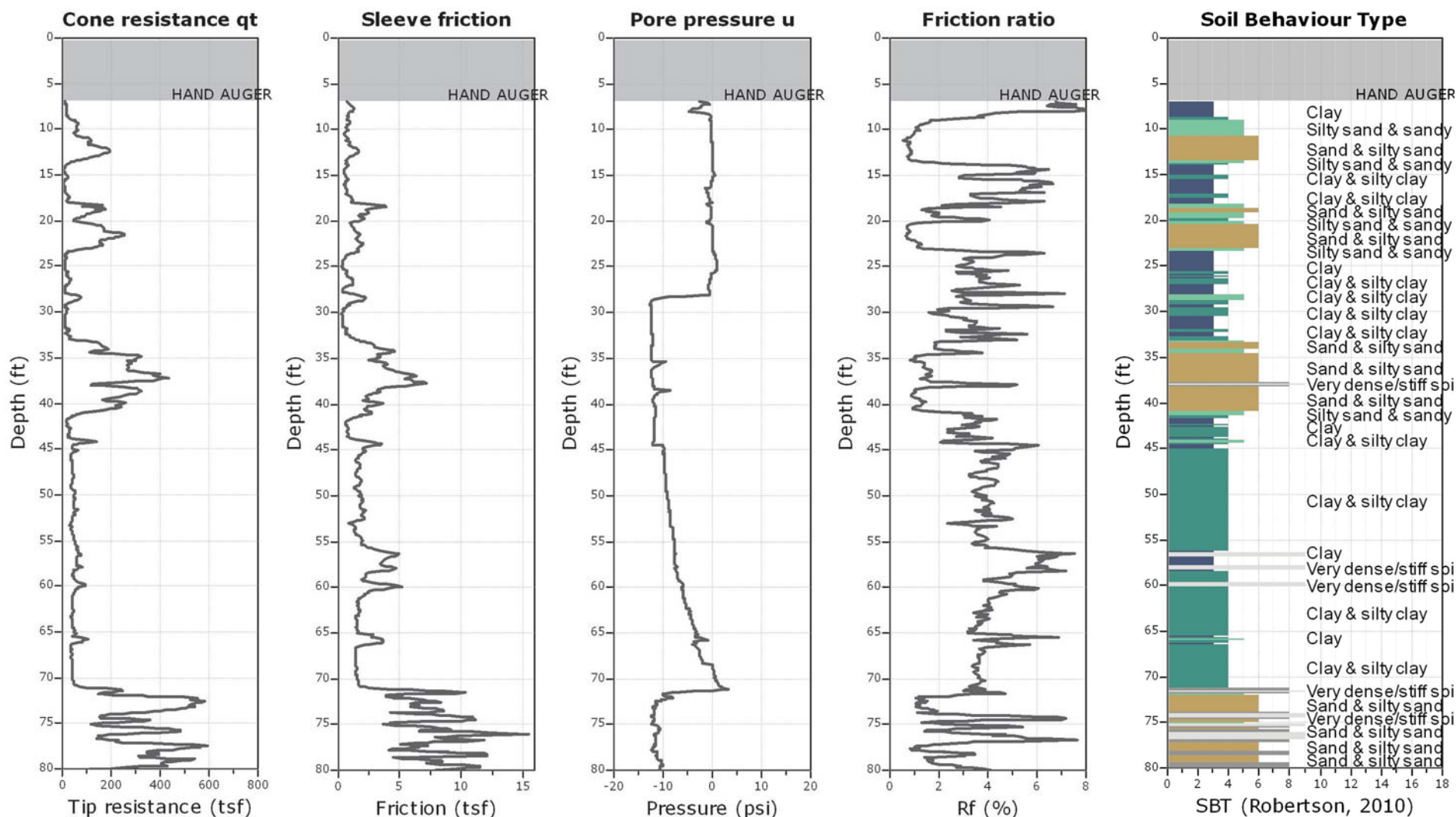


Figure C-2.17



Kehoe Testing and Engineering
 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C16

Total depth: 80.27 ft, Date: 9/29/2015

Cone Type: Vertek

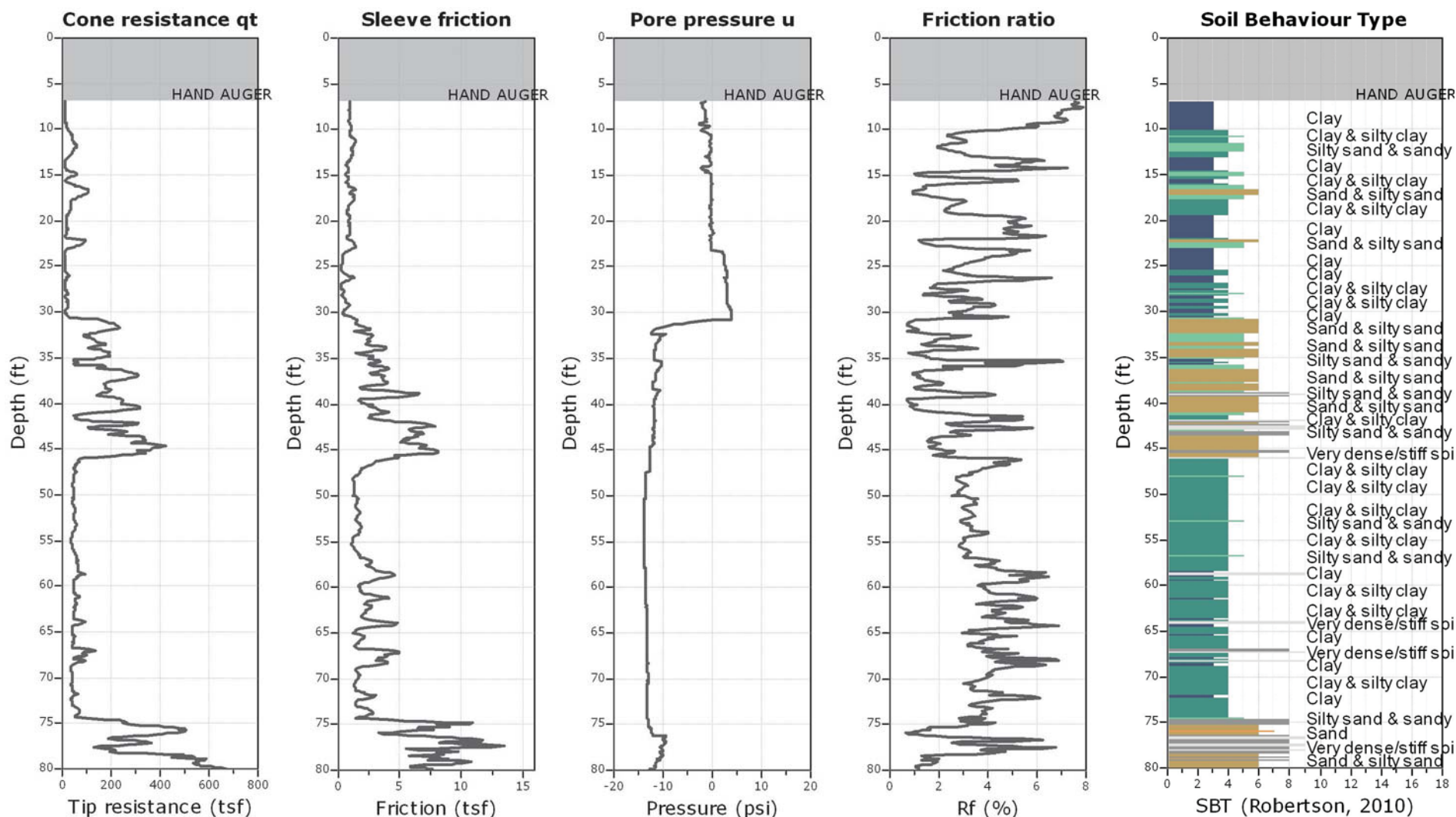


Figure C-2.18



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 714-901-7270
 rich@kehoetesting.com
 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C17

Total depth: 80.15 ft, Date: 9/29/2015

Cone Type: Vertek

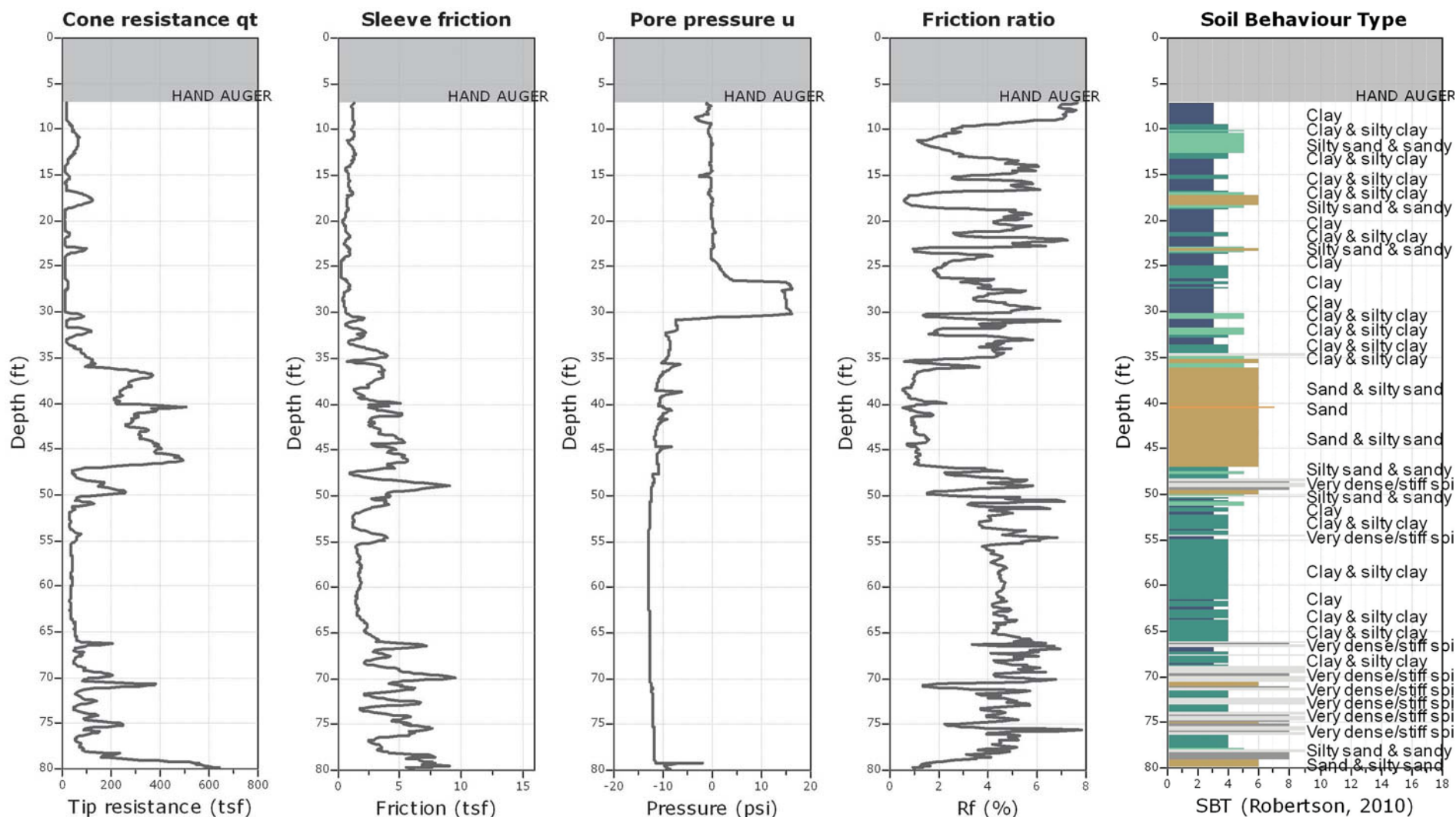


Figure C-2.19



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C18

Total depth: 80.75 ft, Date: 9/29/2015

Cone Type: Vertek

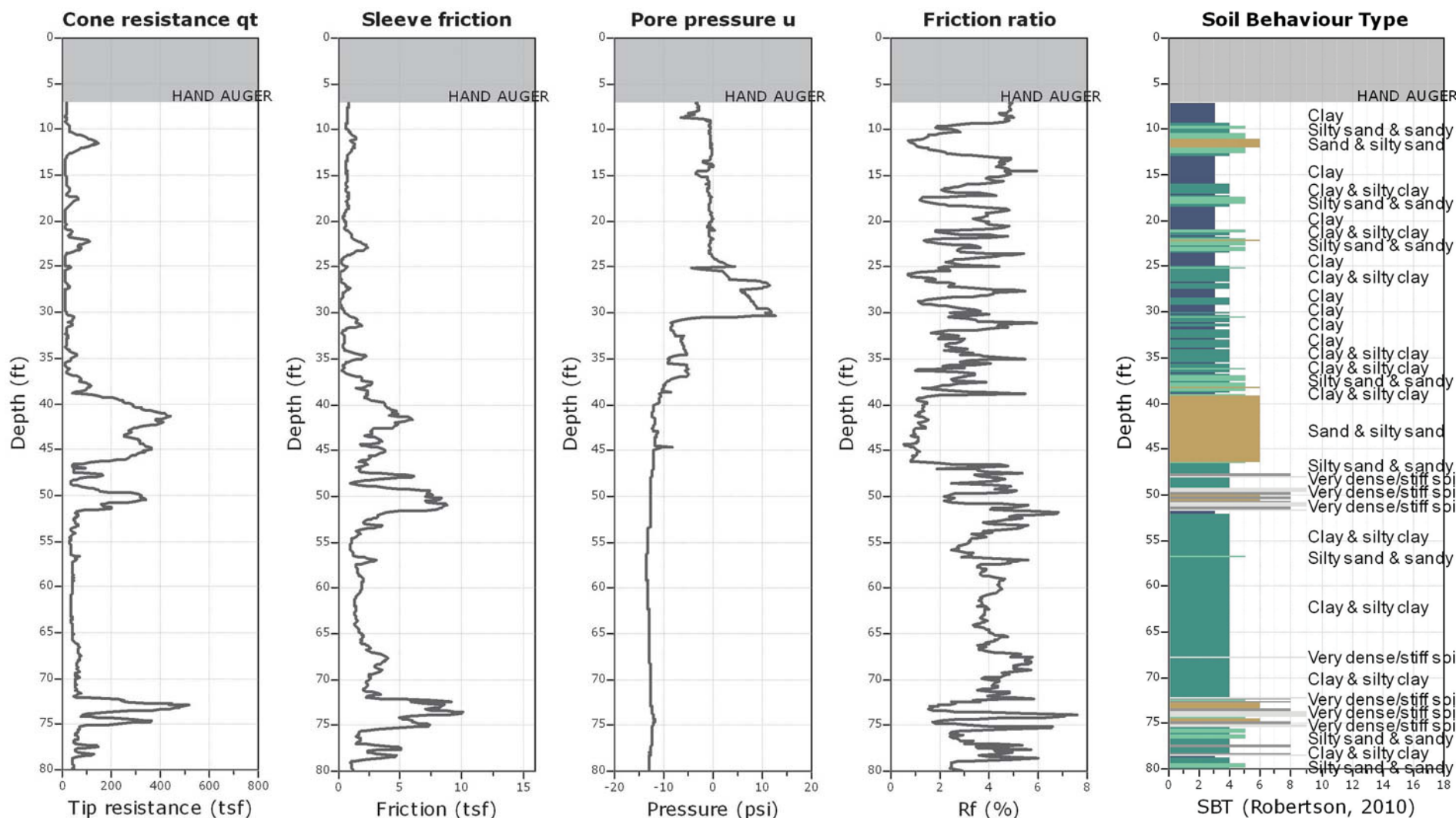


Figure C-2.20

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C19
Total depth: 98.31 ft, Date: 10/20/2015
Cone Type: Vertek

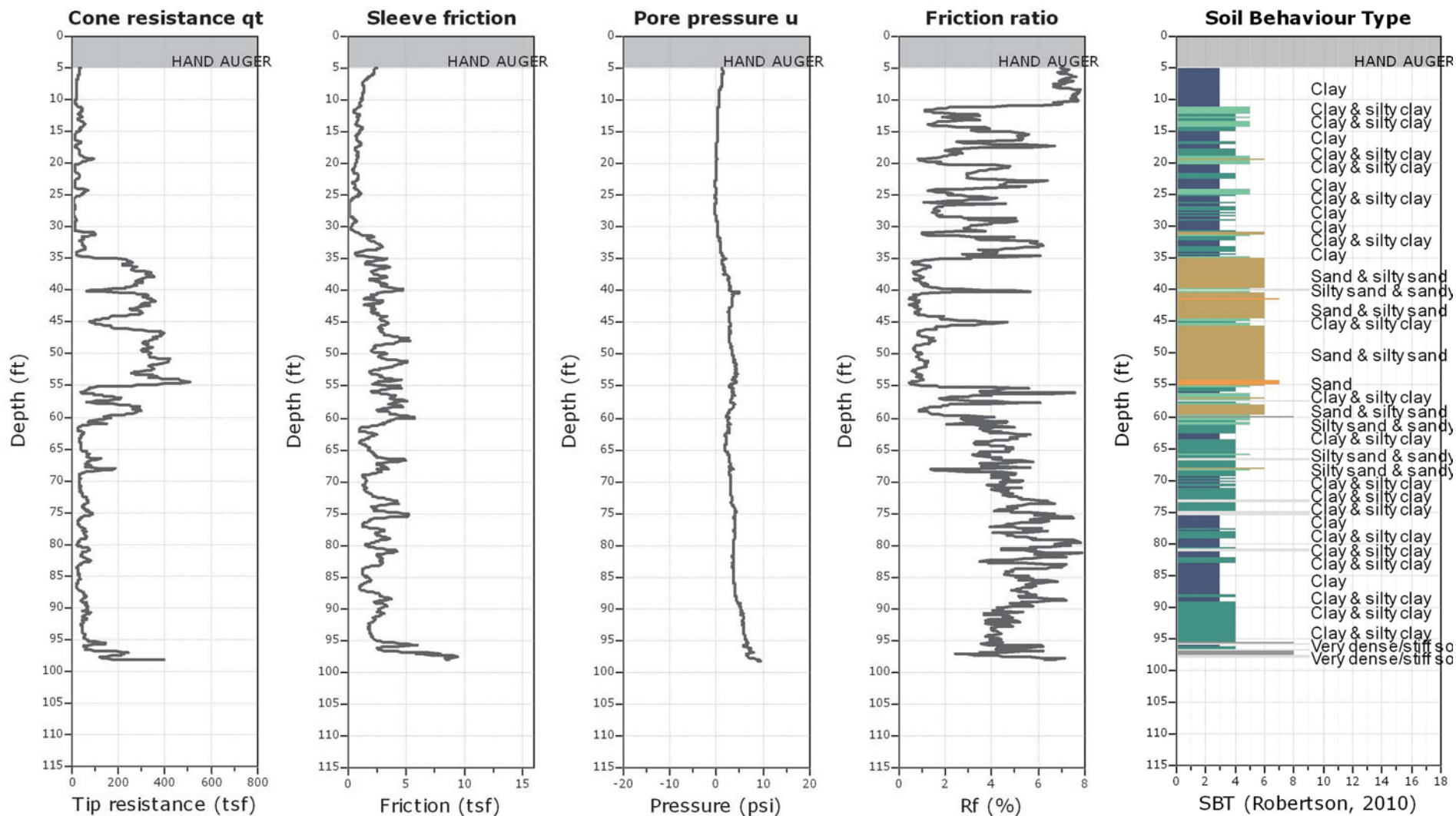


Figure C-2.21



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C20

Total depth: 114.55 ft, Date: 10/21/2015

Cone Type: Vertek

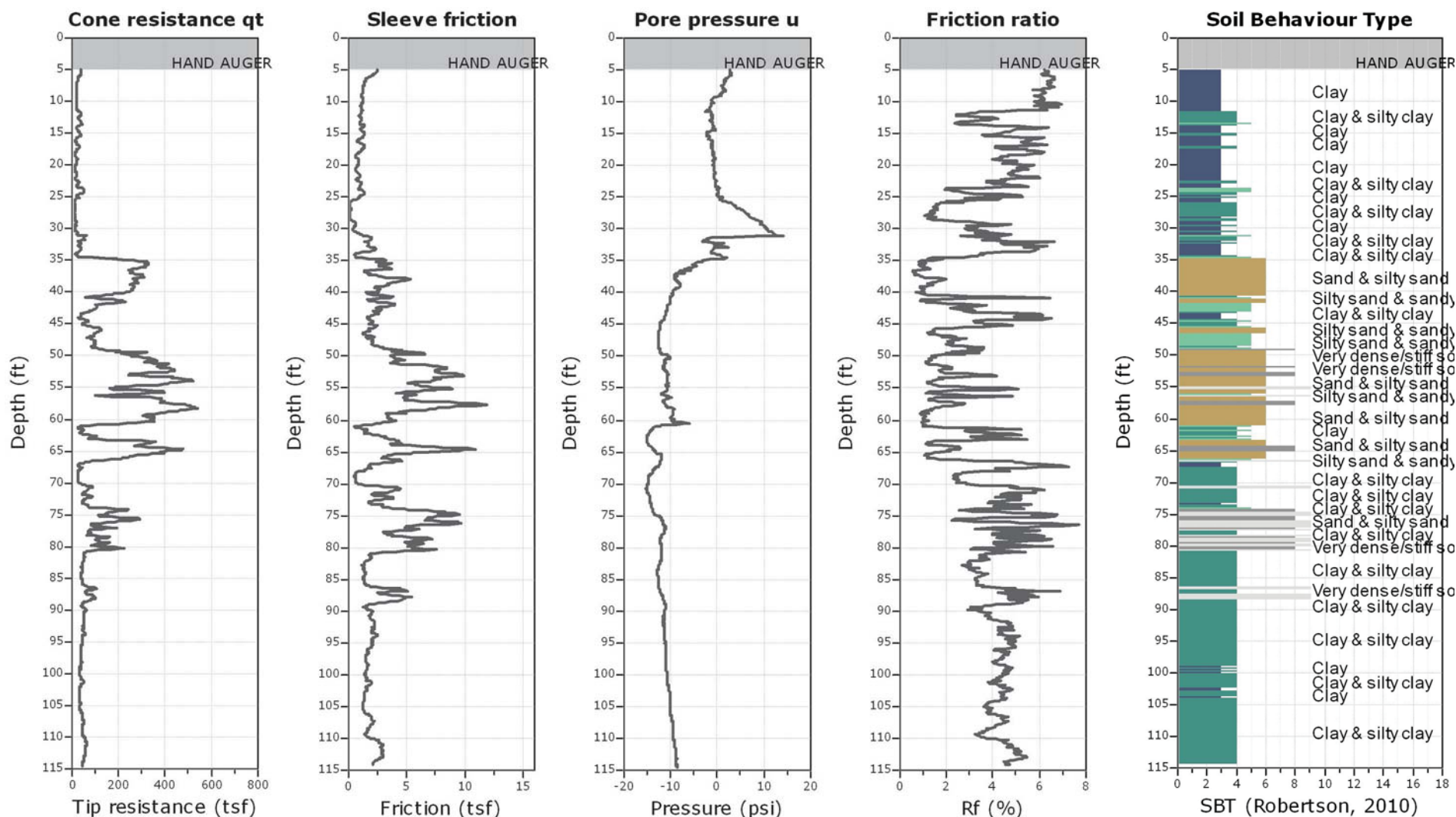


Figure C-2.22



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C21

Total depth: 49.44 ft, Date: 10/21/2015

Cone Type: Vertek

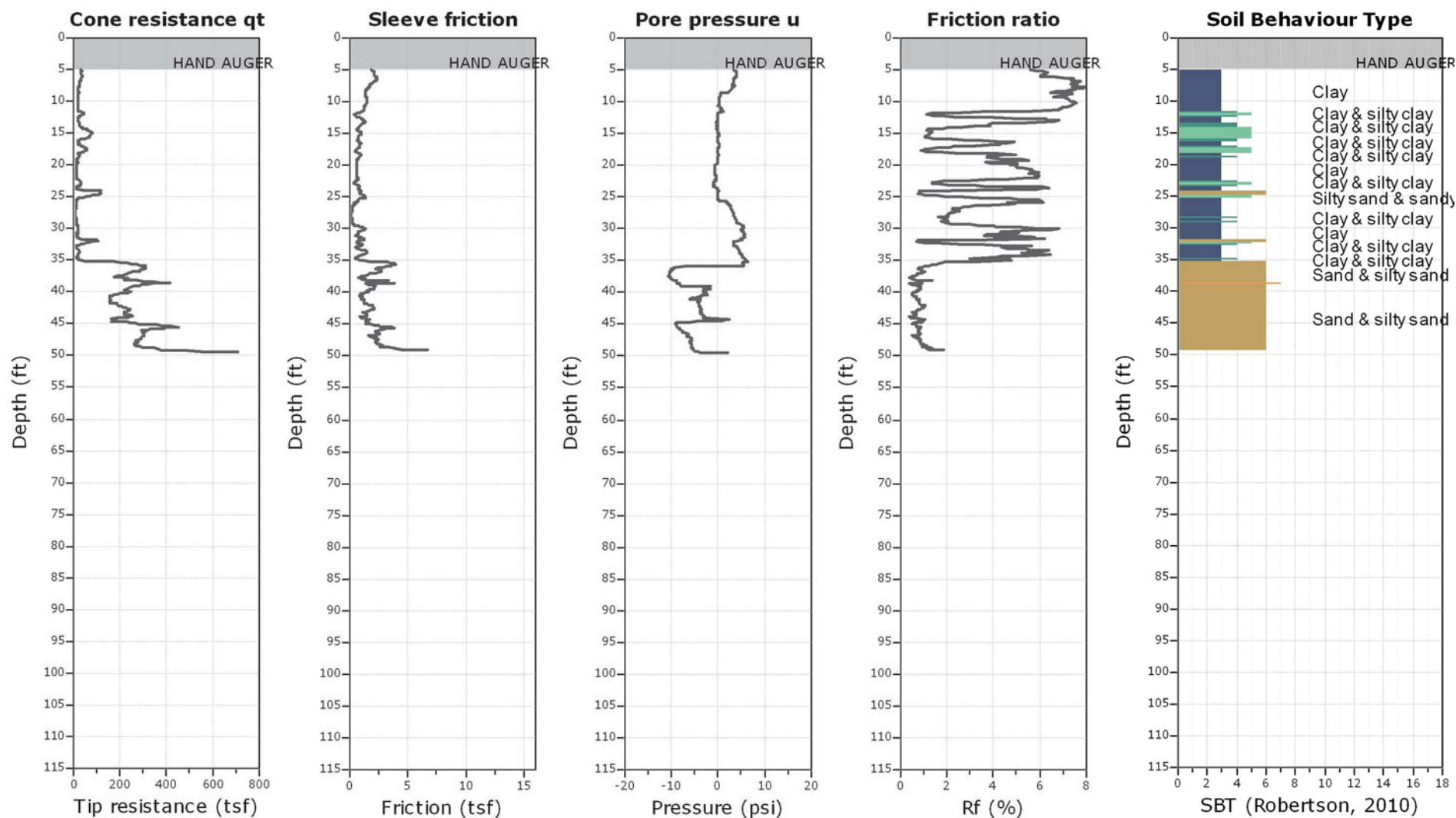


Figure C-2.23



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C21A

Total depth: 45.93 ft, Date: 10/21/2015

Cone Type: Vertek

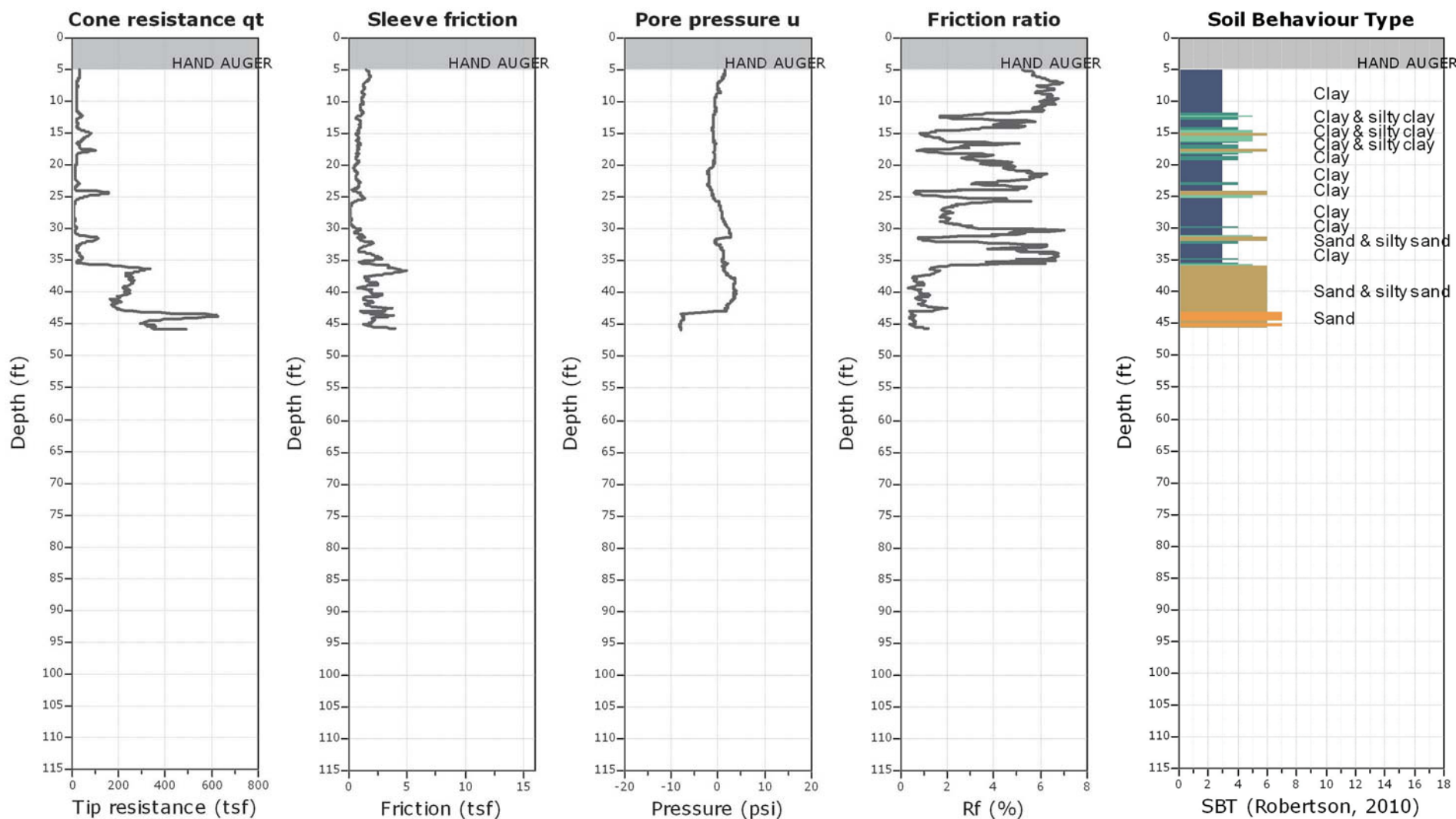


Figure C-2.24



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C22

Total depth: 110.50 ft, Date: 10/20/2015

Cone Type: Vertek

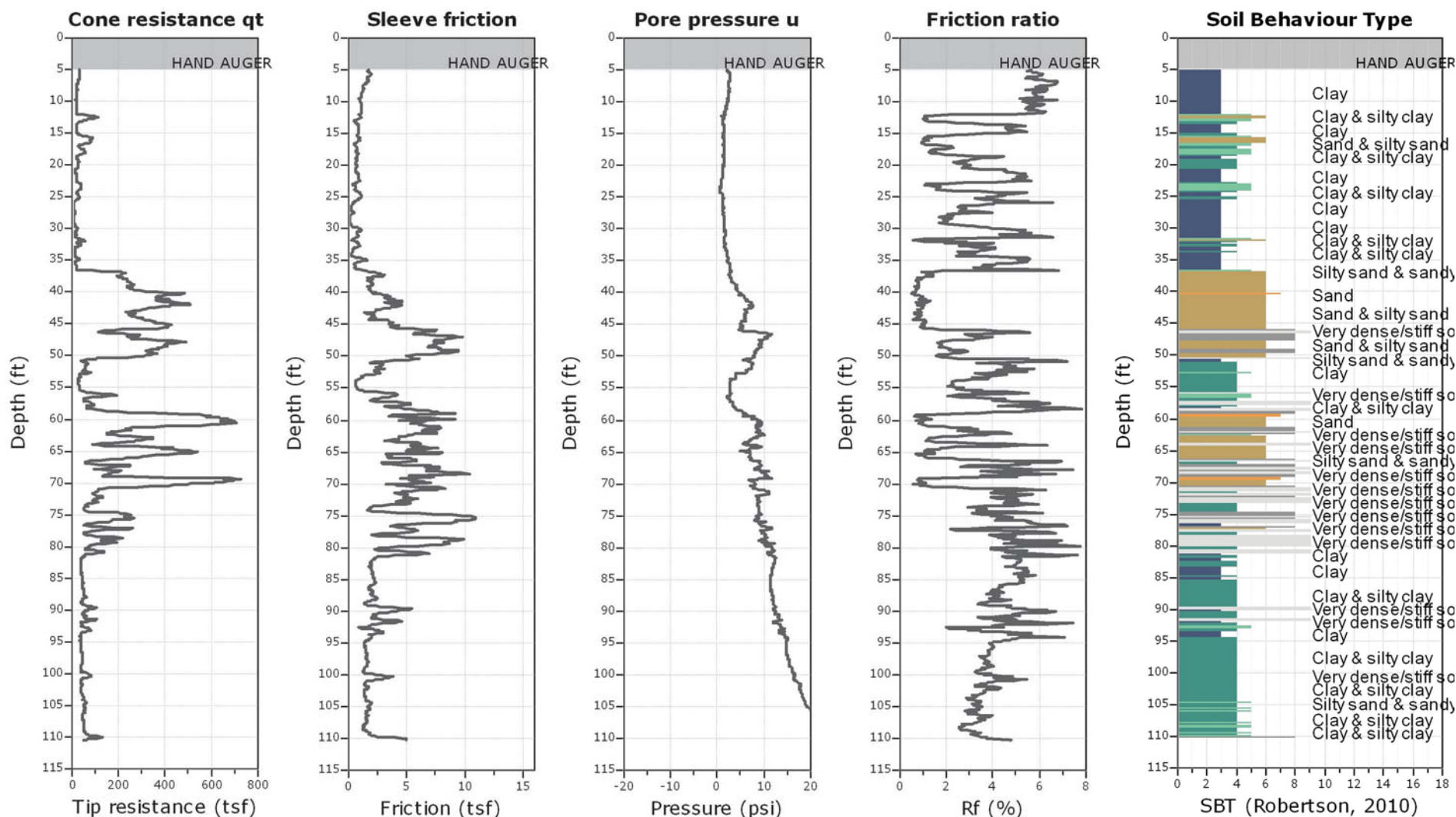


Figure C-2.25



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 www.kehoetesting.com

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C22A

Total depth: 50.08 ft, Date: 10/20/2015

Cone Type: Vertek

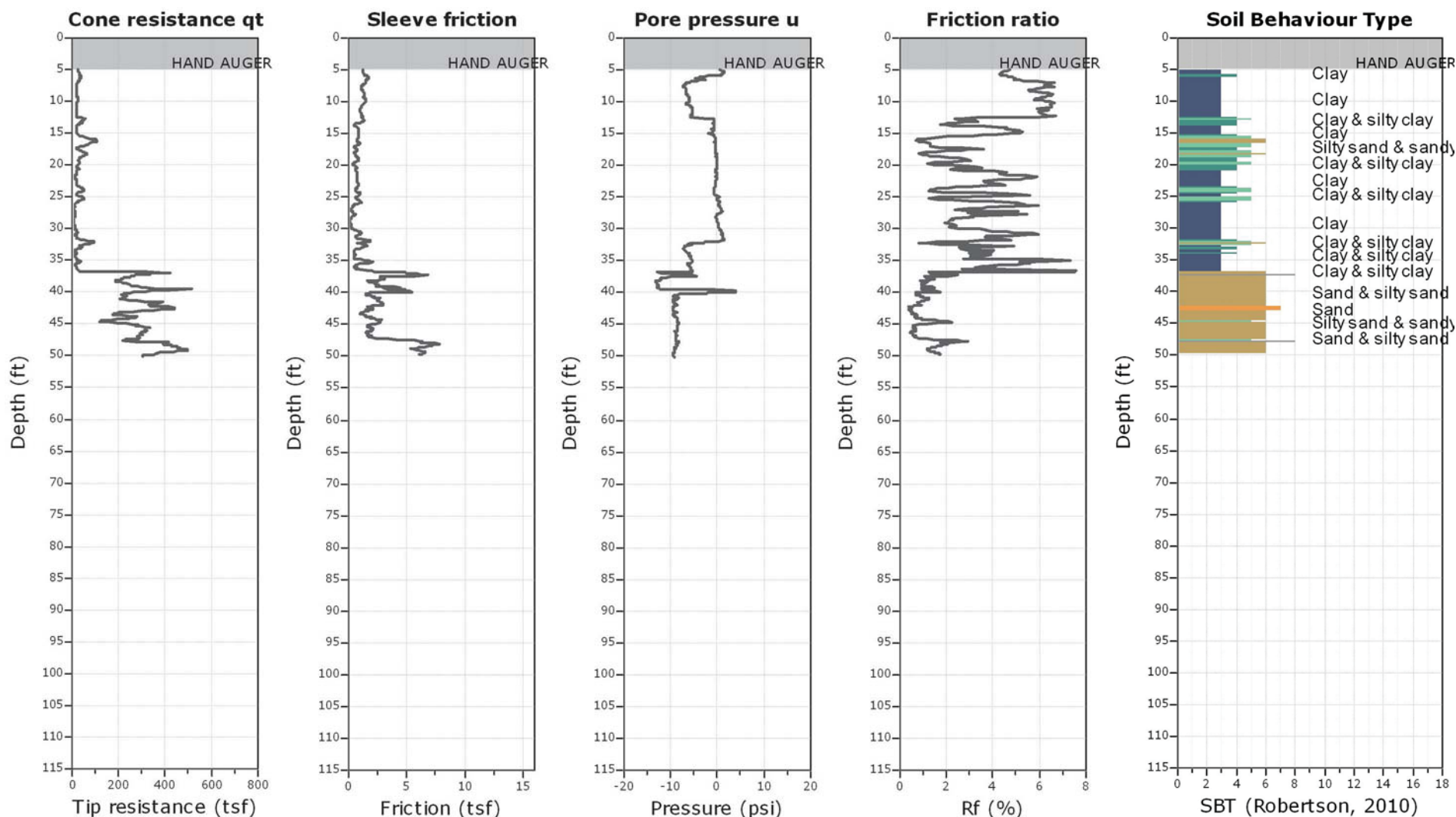


Figure C-2.26

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C23

Total depth: 102.93 ft, Date: 10/19/2015

Cone Type: Vertek

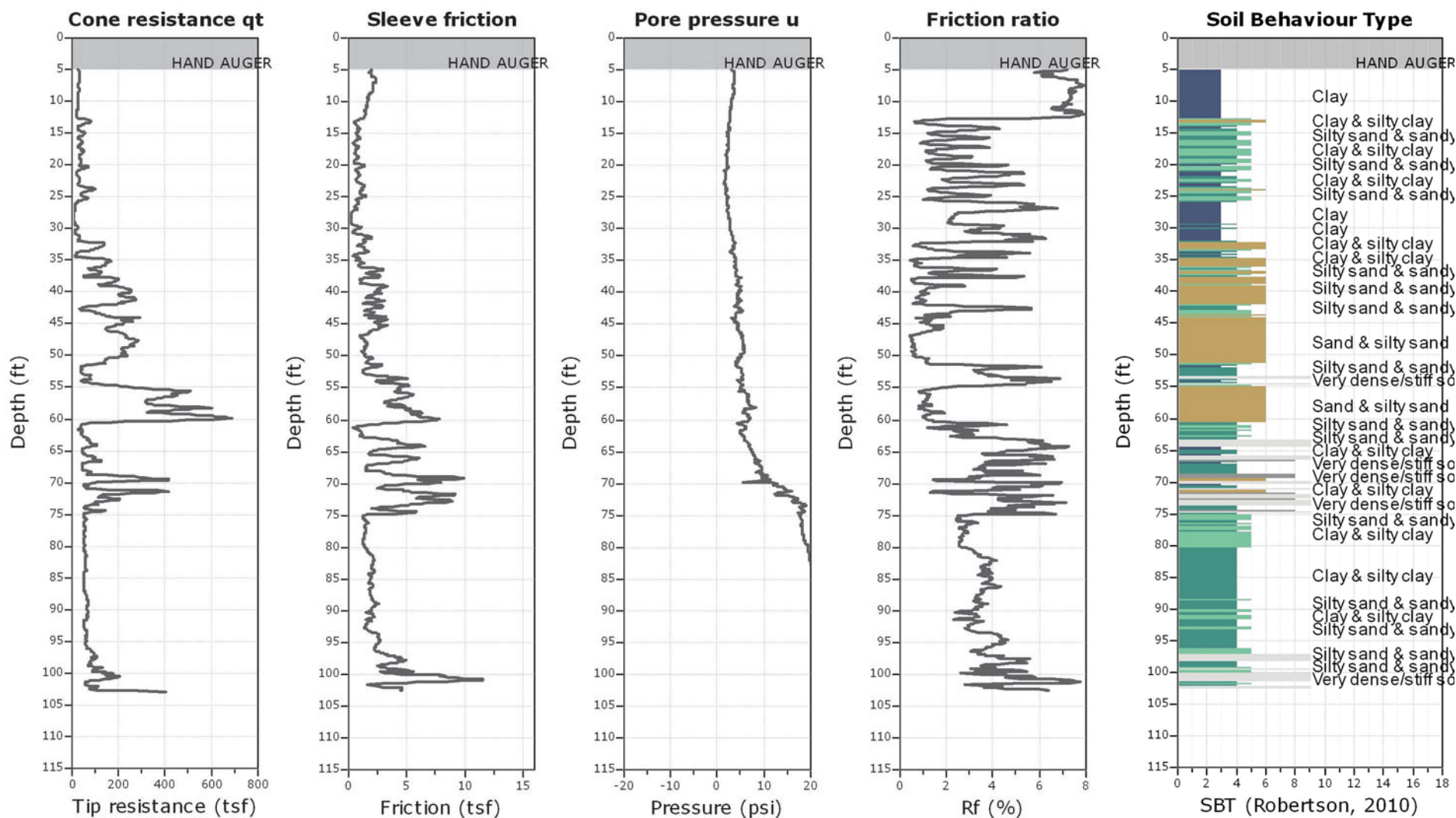


Figure C-2.27



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C24

Total depth: 91.89 ft, Date: 10/19/2015

Cone Type: Vertek

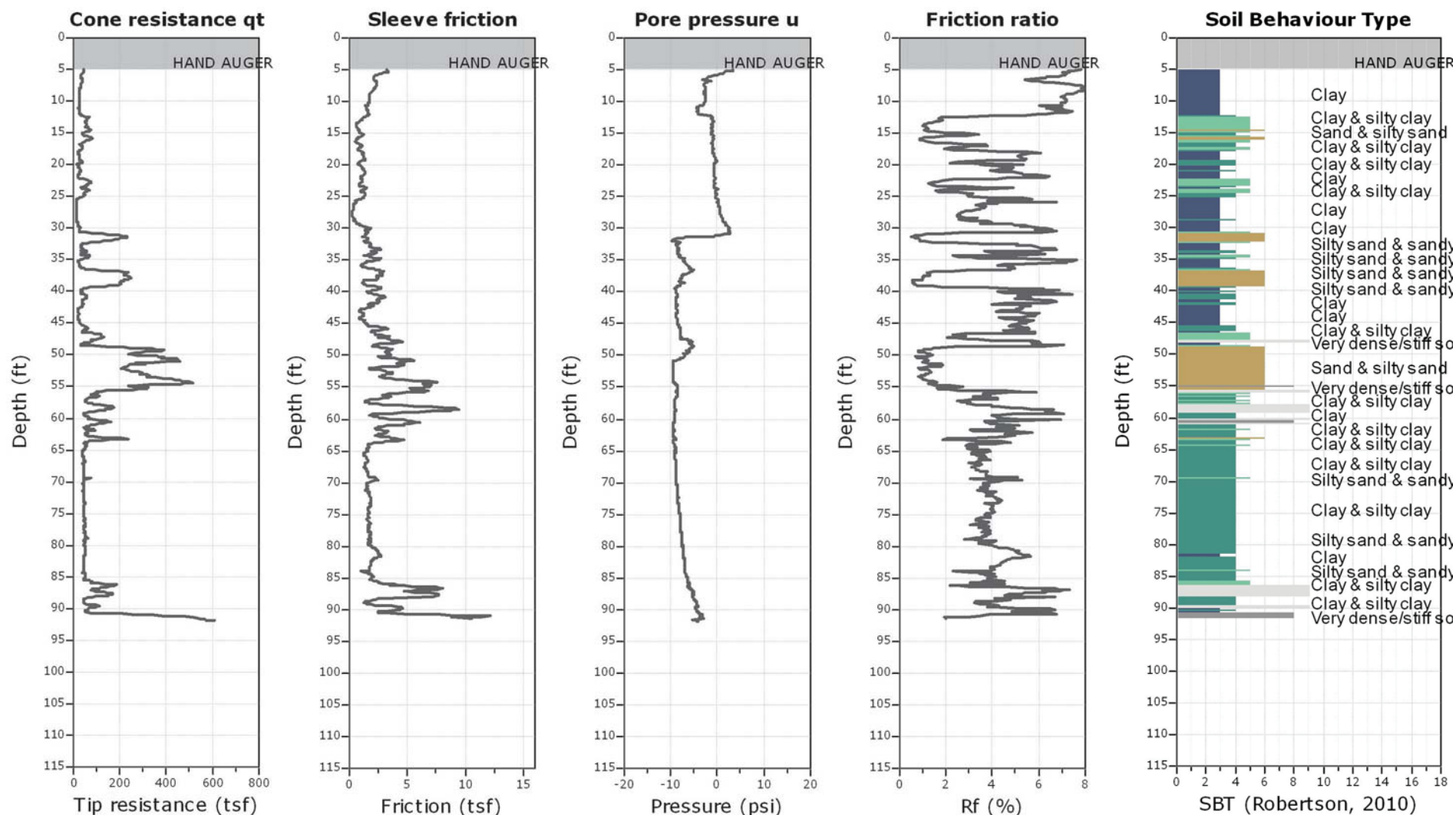


Figure C-2.28



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C25

Total depth: 94.51 ft, Date: 10/26/2015

Cone Type: Vertek

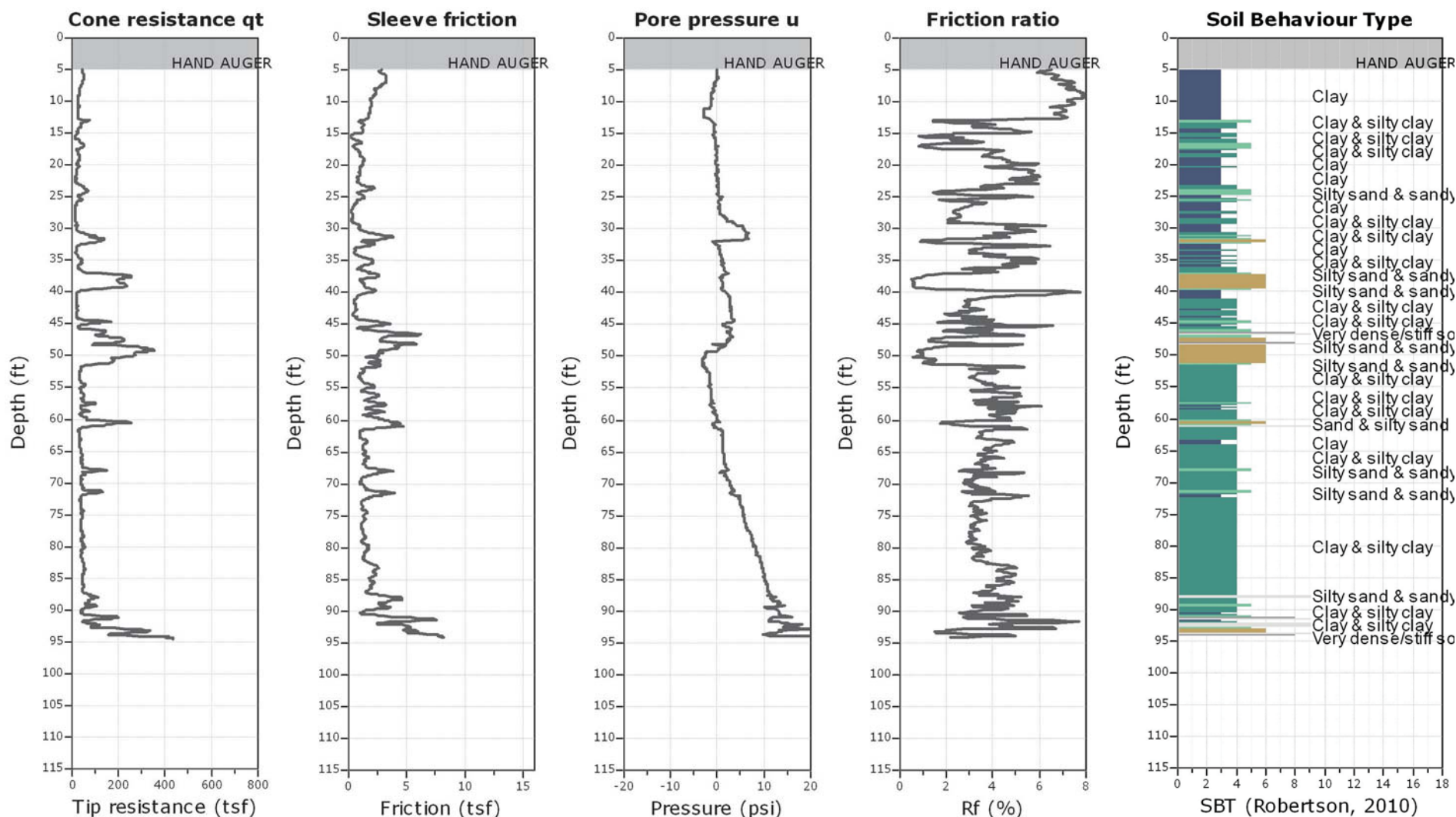


Figure C-2.29

Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C26

Total depth: 96.14 ft, Date: 10/26/2015

Cone Type: Vertek

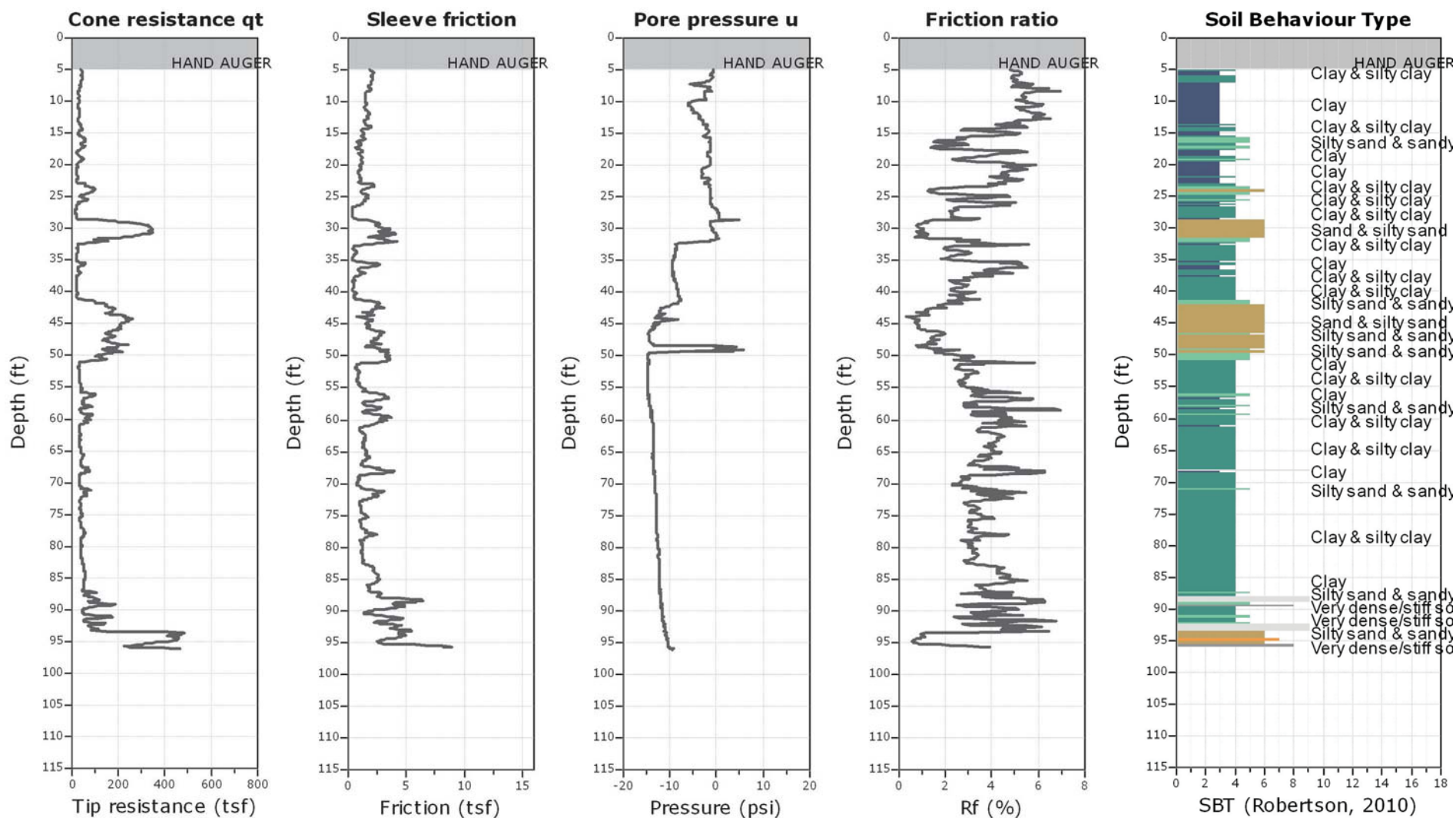


Figure C-2.30



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C27

Total depth: 117.31 ft, Date: 11/9/2015

Cone Type: Vertek

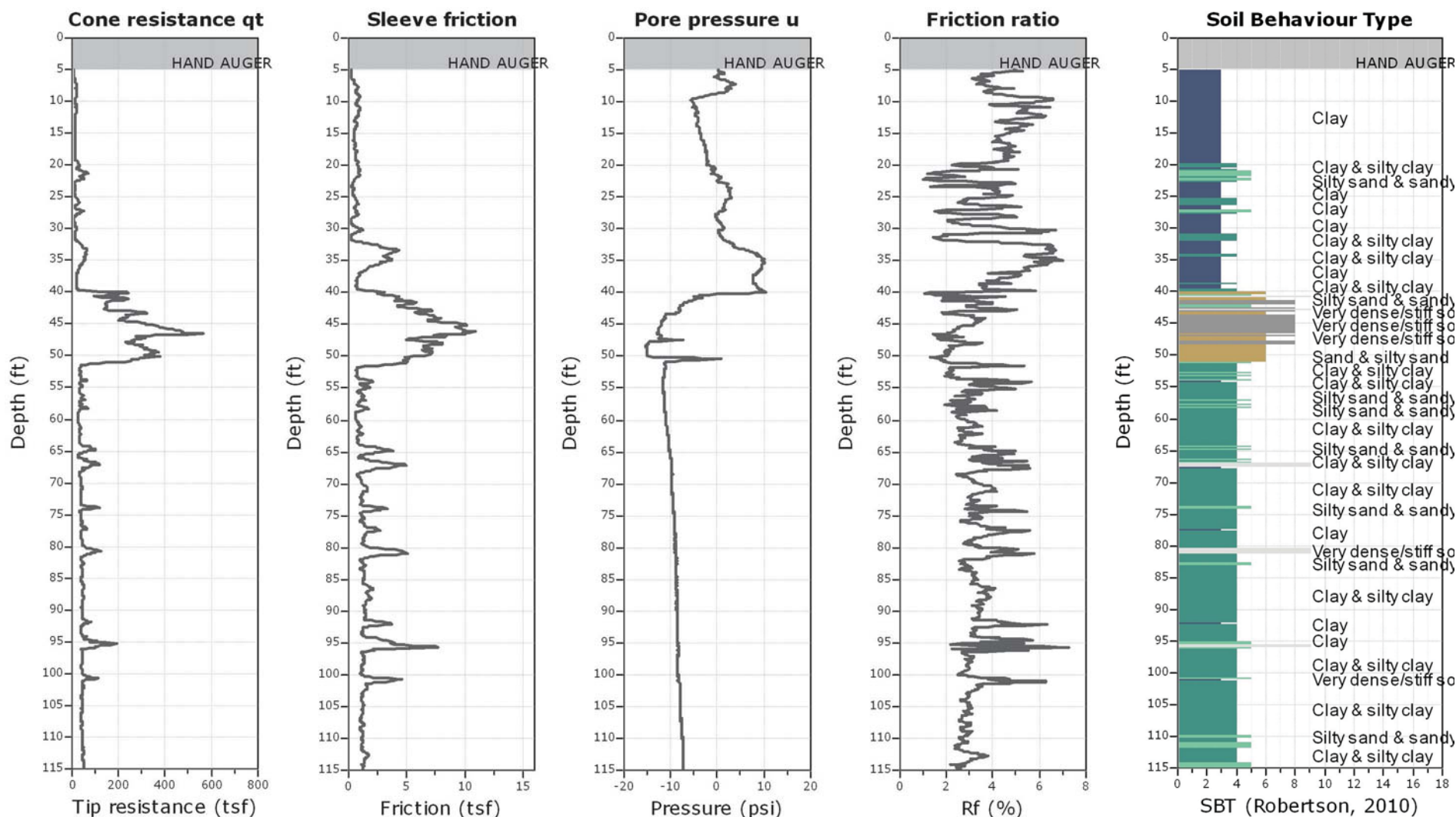


Figure C-2.31



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C28

Total depth: 112.09 ft, Date: 11/9/2015

Cone Type: Vertek

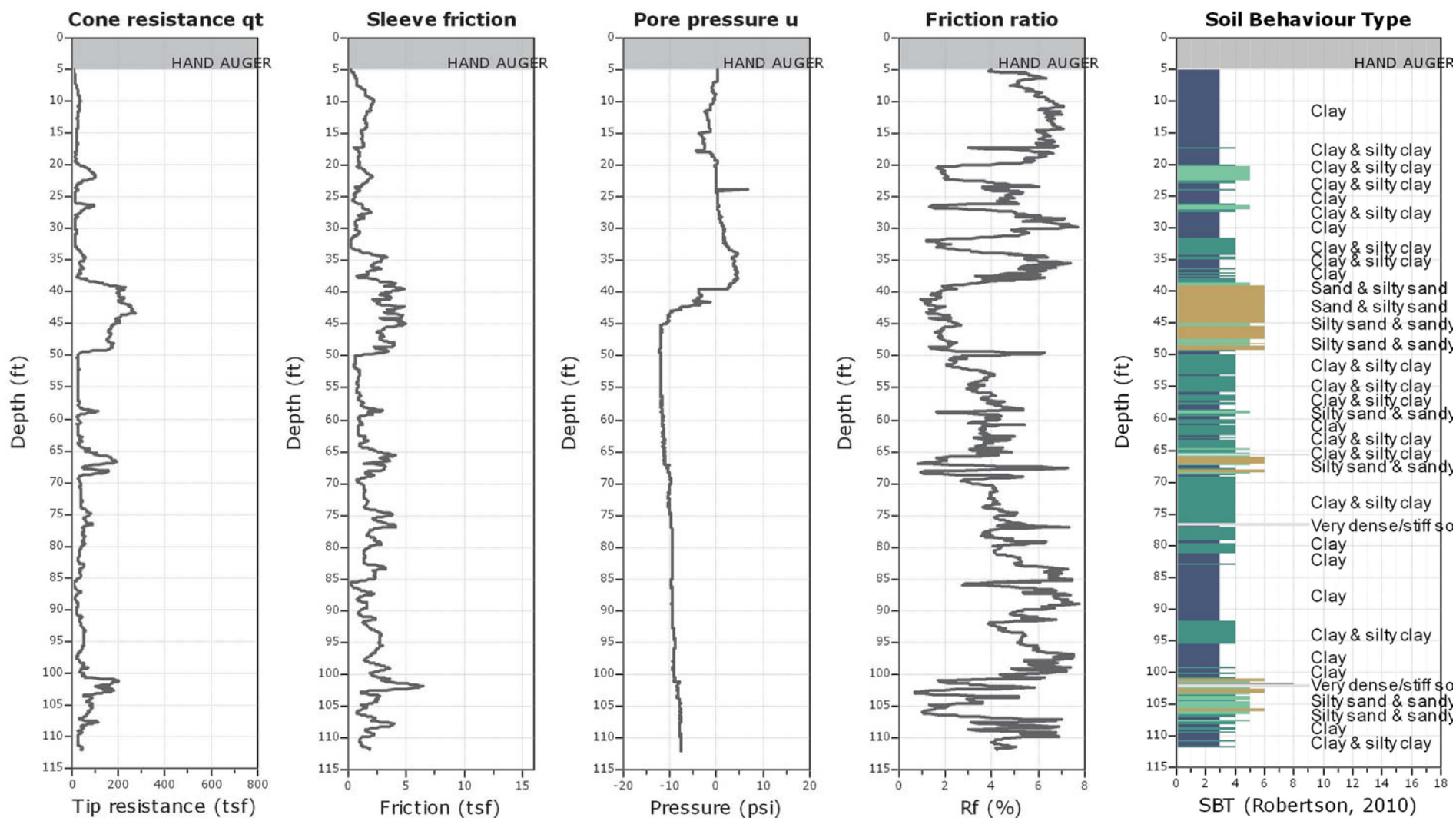


Figure C-2.32



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C29

Total depth: 96.98 ft, Date: 11/9/2015

Cone Type: Vertek

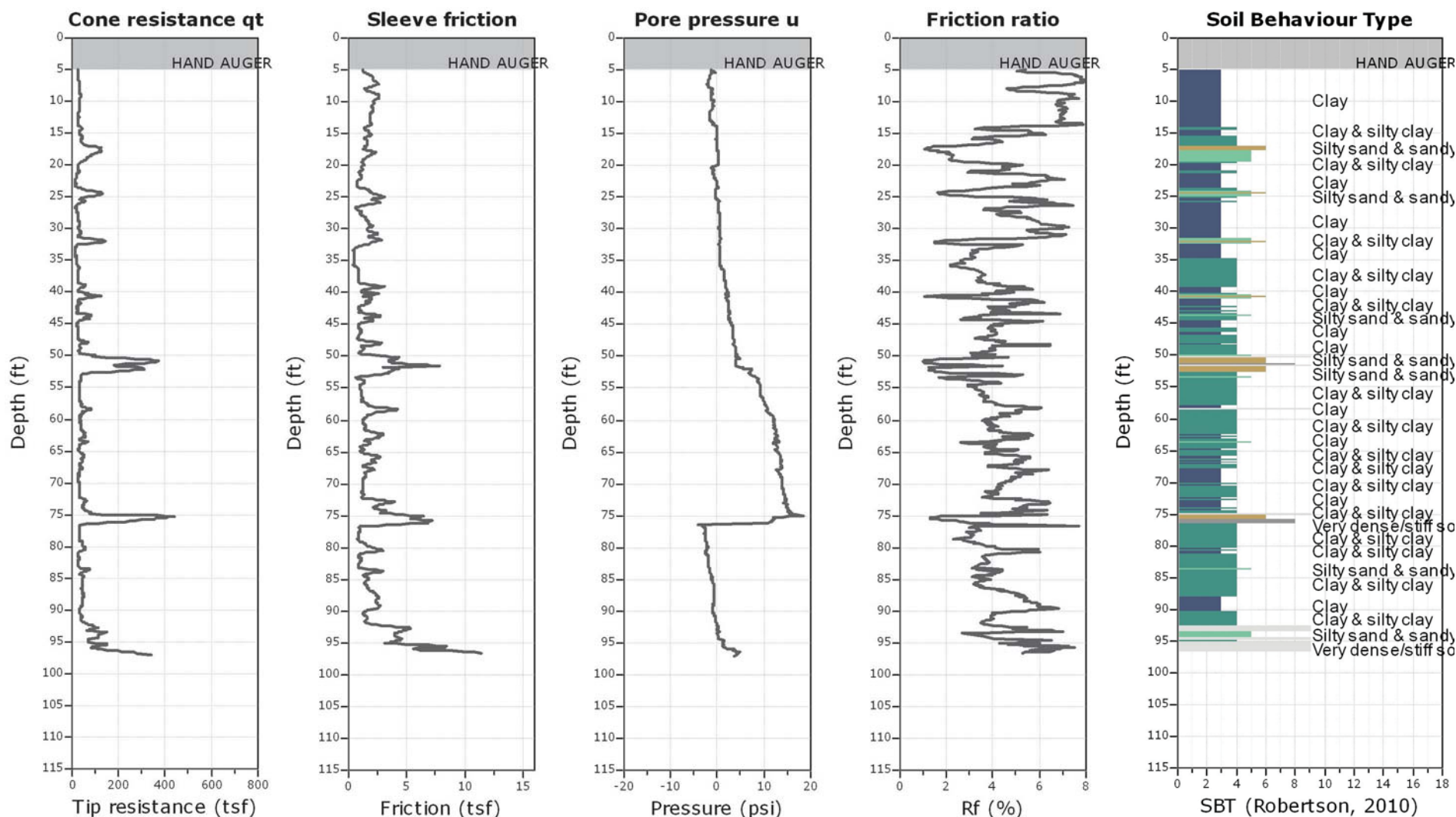


Figure C-2.33



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C30

Total depth: 95.63 ft, Date: 11/10/2015

Cone Type: Vertek

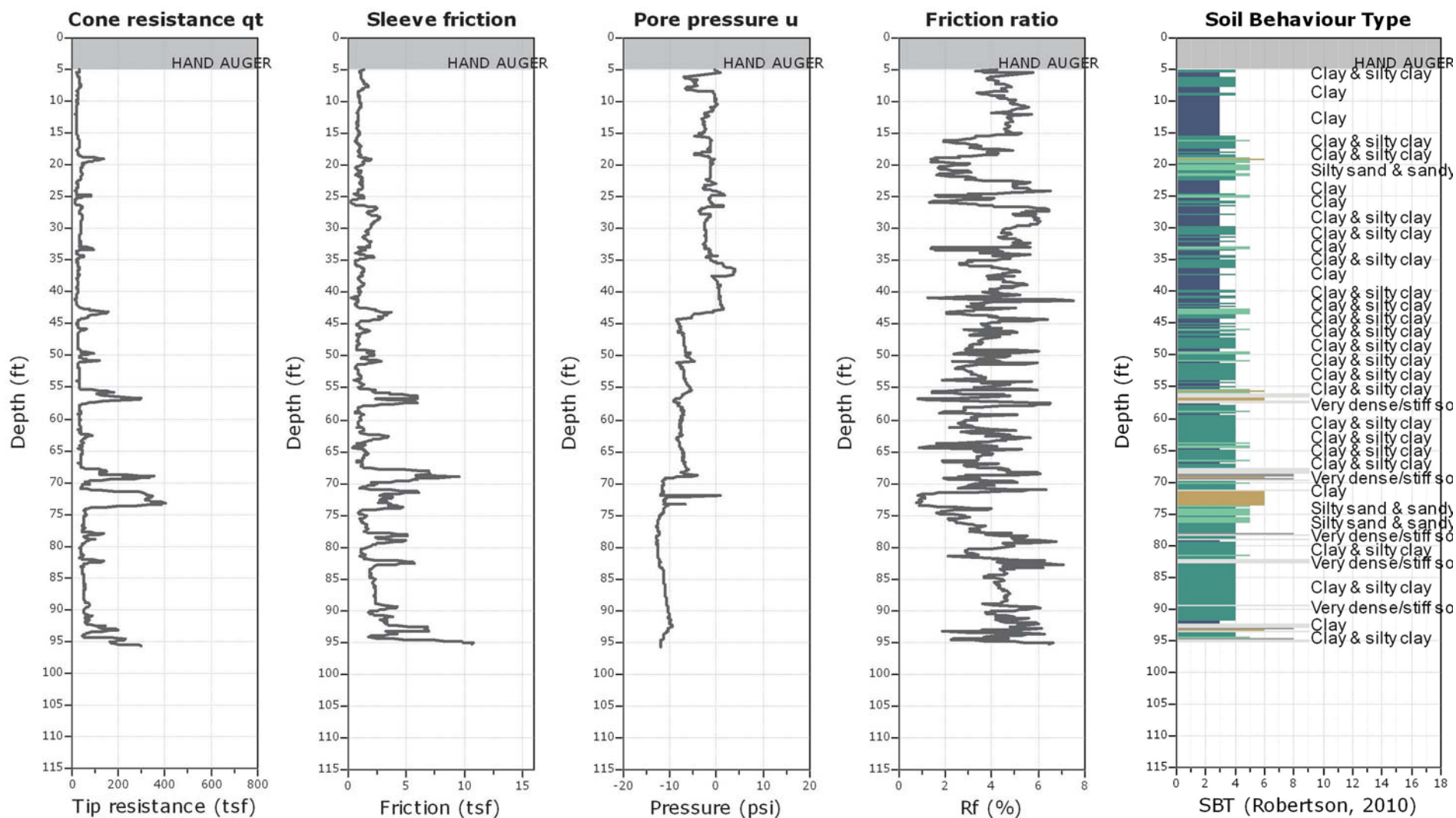


Figure C-2.34



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C31

Total depth: 97.74 ft, Date: 11/10/2015

Cone Type: Vertek

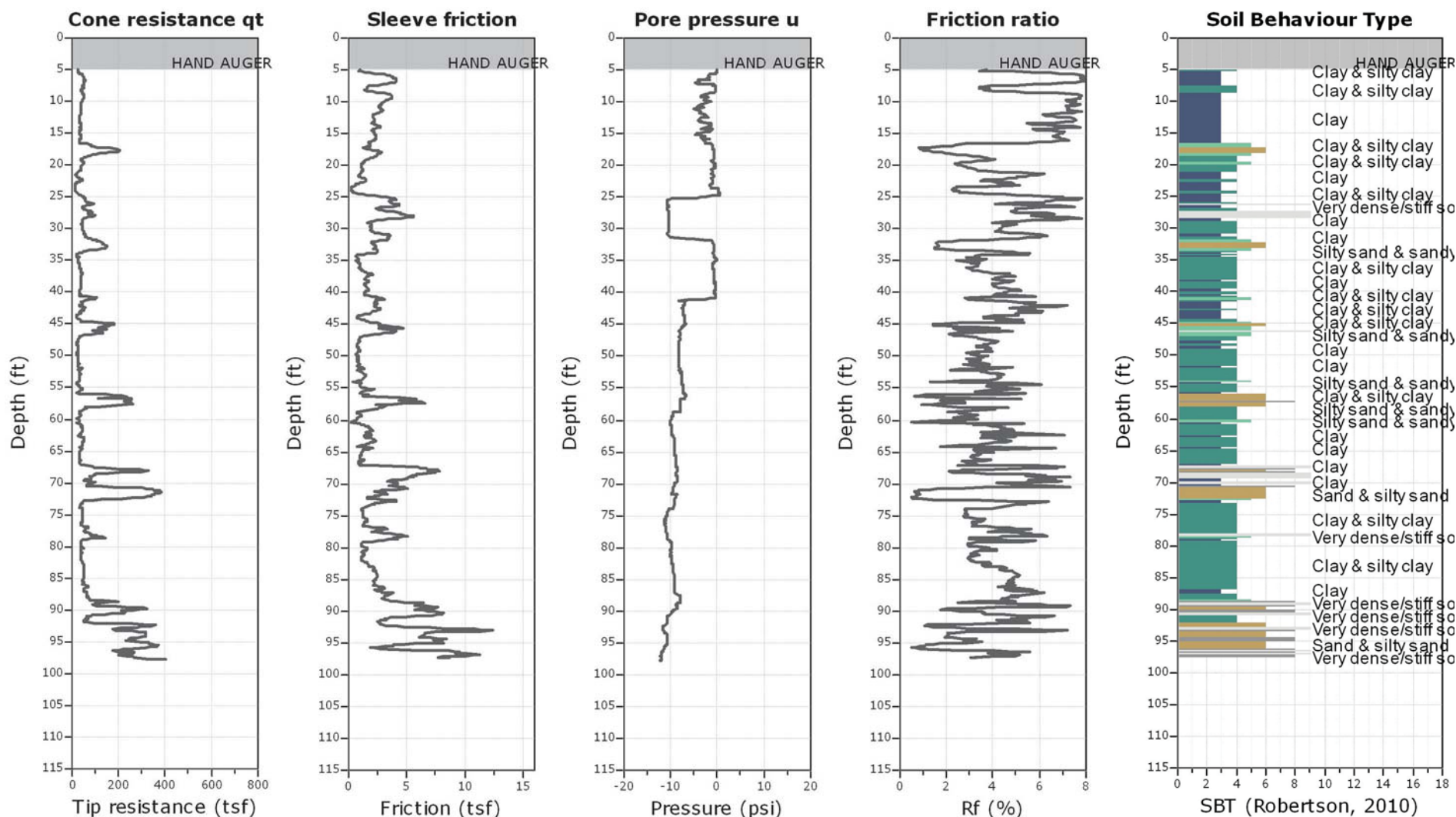


Figure C-2.35



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C32

Total depth: 98.62 ft, Date: 11/23/2015

Cone Type: Vertek

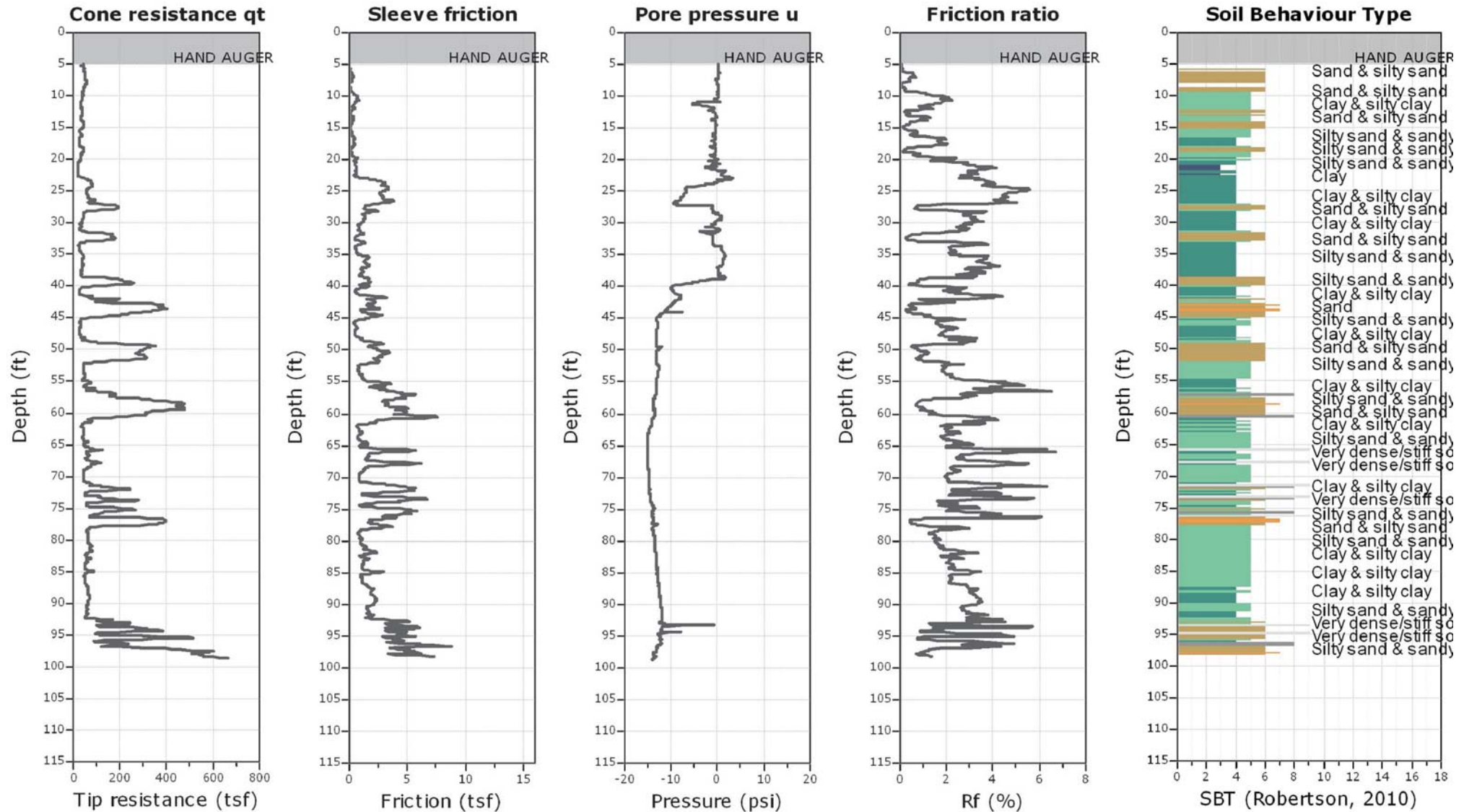


Figure C-2.36



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Project: AMEC Foster Wheeler/Westside Subway Extension (WSE) Mod 52
Location: S. Lasky Dr & Moreno Dr Beverly Hills, CA

CPT: T9-C33

Total depth: 100.21 ft, Date: 11/23/2015

Cone Type: Vertek

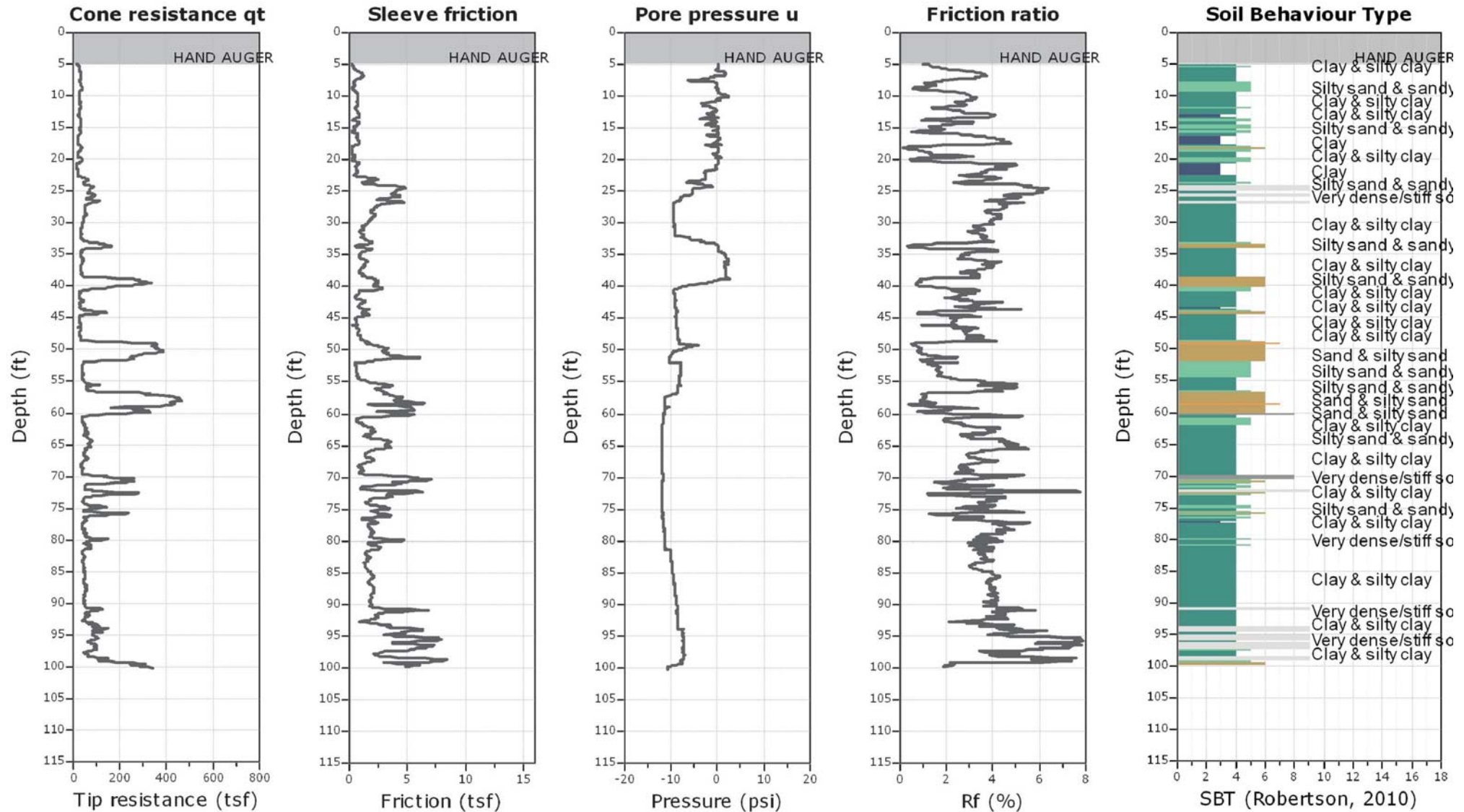


Figure C-2.37



**WESTSIDE METRO EXTENSION MOD 41
WEST LOS ANGELES
SUSPENSION PS VELOCITIES
BORINGS G-406, G-408 & G-409**

**October 15, 2015
Report 15347-01 rev 0**

**WESTSIDE METRO EXTENSION MOD 41
WEST LOS ANGELES
SUSPENSION PS VELOCITIES
BORINGS G-406, G-408 & G-409**

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Project 15347**

**October 15, 2015
Report 15347-01 rev 0**

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APPENDICES

APPENDIX A	SUSPENSION VELOCITY MEASUREMENT QUALITY ASSURANCE SUSPENSION SOURCE TO RECEIVER ANALYSIS RESULTS
APPENDIX B	GEOPHYSICAL LOGGING SYSTEMS - NIST TRACEABLE CALIBRATION RECORDS

INTRODUCTION

Suspension PS velocity measurements were collected in three borings on Wilshire Blvd in Beverly Hills, California. Data acquisition was performed on September 25th and October 5th, 2015 by Jonathan Jordan, October 9th, 2015 by Victor Gonzalez of **GEOVision**. Data analysis and report preparation were performed by Emily Feldman and Jonathan Jordan and reviewed by Victor Gonzalez of **GEOVision**. The work was performed for AMEC Foster Wheeler (AMEC) with Angel Recio serving as the point of contact.

This report describes the field measurements, data analysis, and results of this work.

SCOPE OF WORK

This report presents the results of boring geophysical measurements collected between September 25th and October 9th, 2015 as detailed in Table 1. The purpose of this study was to supplement stratigraphic information obtained during AMEC's geotechnical sampling program and to acquire shear wave velocities and compressional wave velocities as a function of depth.

The OYO Suspension PS Logging System (Suspension System) was used to obtain in-situ horizontal shear (S_H) and compressional (P) wave velocity measurements in three uncased borings at 1.6 foot intervals. Measurements followed **GEOVision** Procedure for P-S Suspension Seismic Velocity Logging, revision 1.5. The acquired data was analyzed and a profile of velocity versus depth was produced for both compressional and horizontally polarized shear waves.

A detailed reference for the suspension PS velocity measurement techniques used in this study is:

Guidelines for Determining Design Basis Ground Motions, Report TR-102293,
Electric Power Research Institute, Palo Alto, California, November 1993, Sections
7 and 8.

INSTRUMENTATION

Suspension Velocity Instrumentation

Suspension velocity measurements were performed using the suspension PS logging system, manufactured by OYO Corporation, and their subsidiary, Robertson Geologging. This system directly determines the average velocity of a 3.3-foot high segment of the soil column surrounding the boring of interest by measuring the elapsed time between arrivals of a wave propagating upward through the soil column. The receivers that detect the wave, and the source that generates the wave, are moved as a unit in the boring producing relatively constant amplitude signals at all depths.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave source (S_H) and compressional-wave source (P), joined to two biaxial receivers by a flexible isolation cylinder, as shown in Figure 1. The separation of the two receivers is 3.3 feet, allowing average wave velocity in the region between the receivers to be determined by inversion of the wave travel time between the two receivers. The total length of the probe as used in these surveys is approximately 22 feet, with the center point of the receiver pair 12.5 feet above the bottom end of the probe.

The probe receives control signals from, and sends the digitized receiver signals to, instrumentation on the surface via an armored conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide probe depth data using a sheave of known circumference fitted with a digital rotary encoder.

The entire probe is suspended in the boring by the cable, therefore, source motion is not coupled directly to the boring walls; rather, the source motion creates a horizontally propagating impulsive pressure wave in the fluid filling the boring and surrounding the source. This pressure wave is converted to P and S_H -waves in the surrounding soil and rock as it passes through the casing and grout annulus and impinges upon the wall of the boring. These waves propagate through the soil

and rock surrounding the boring, in turn causing a pressure wave to be generated in the fluid surrounding the receivers as the soil waves pass their location. Separation of the P and S_H -waves at the receivers is performed using the following steps:

1. Orientation of the horizontal receivers is maintained parallel to the axis of the source, maximizing the amplitude of the recorded S_H -wave signals.
2. At each depth, S_H -wave signals are recorded with the source actuated in opposite directions, producing S_H -wave signals of opposite polarity, providing a characteristic S_H -wave signature distinct from the P-wave signal.
3. The 6.3 foot separation of source and receiver 1 permits the P-wave signal to pass and damp significantly before the slower S_H -wave signal arrives at the receiver.
4. In saturated soils, the received P-wave signal is typically of much higher frequency than the received S_H -wave signal, permitting additional separation of the two signals by low pass filtering.
5. Direct arrival of the original pressure pulse in the fluid is not detected at the receivers because the wavelength of the pressure pulse in fluid is significantly greater than the dimension of the fluid annulus surrounding the probe (feet versus inches scale), preventing significant energy transmission through the fluid medium.

In operation, a distinct, repeatable pattern of impulses is generated at each depth as follows:

1. The source is fired in one direction producing dominantly horizontal shear with some vertical compression, and the signals from the horizontal receivers situated parallel to the axis of motion of the source are recorded.
2. The source is fired again in the opposite direction and the horizontal receiver signals are recorded.
3. The source is fired again and the vertical receiver signals are recorded. The repeated source pattern facilitates the picking of the P and S_H -wave arrivals; reversal of the source changes the polarity of the S_H -wave pattern but not the P-wave pattern.

The data from each receiver during each source activation is recorded as a different channel on the recording system. The Suspension PS system has six channels (two simultaneous recording channels), each with a 1024 sample record. The recorded data are displayed as six channels with a common time scale. Data are stored on disk for further processing.

Review of the displayed data on the recorder or computer screen allows the operator to set the gains, filters, delay time, pulse length (energy), and sample rate to optimize the quality of the data before recording. Verification of the calibration of the Suspension PS digital recorder is performed every twelve months using a NIST traceable frequency source and counter, as presented in Appendix B.

MEASUREMENT PROCEDURES

Suspension Velocity Measurement Procedures

Borings G-406, G-408 and G-409 were logged, uncased and filled with freshwater mud. Measurements followed the **GEOVision** Procedure for P-S Suspension Seismic Velocity Logging, revision 1.5. Prior to each logging run, the probe was positioned with the top of the probe even with a stationary reference point. The electronic depth counter was set to the distance between the mid-point of the receiver and the top of the probe, minus the height of the stationary reference point, if any, verified with a tape measure, and recorded on the field logs. The probe was lowered to the bottom of the borings, stopping at 1.6 foot intervals to collect data, as summarized in Table 2.

At each measurement depth the measurement sequence of two opposite horizontal records and one vertical record was performed, and the gains were adjusted as required. The data from each depth were viewed on the computer display, checked, and recorded on disk before moving to the next depth.

Upon completion of the measurements, the probe zero depth indication at the depth reference point was verified prior to removal from the boring.

DATA ANALYSIS

Suspension Velocity Analysis

Using the proprietary OYO program PSLOG.EXE version 1.0, the recorded digital waveforms were analyzed to locate the most prominent first minima, first maxima, or first break on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between receiver 1 and receiver 2 (R1-R2) arrivals was used to calculate the P-wave velocity for that 1.0 meter segment of the soil column. When observable, P-wave arrivals on the horizontal axis records were used to verify the velocities determined from the vertical axis data. The time picks were then transferred into a Microsoft Excel® template (version 2003 SP2) to complete the velocity calculations based upon the arrival time picks made in PSLOG. The Microsoft Excel® analysis files are included on the data disk that accompanies this report.

The P-wave velocity over the 6.3-foot interval from source to receiver 1 (S-R1) was also picked using PSLOG, and calculated and plotted in Microsoft Excel®, for quality assurance of the velocity derived from the travel time between receivers. In this analysis, the depth values as recorded were increased by 4.8 feet to correspond to the mid-point of the 6.3-foot S-R1 interval. Travel times were obtained by picking the first break of the P-wave signal at receiver 1 and subtracting 0.4 milliseconds, the calculated and experimentally verified delay from source trigger pulse (beginning of record) to source impact. This delay corresponds to the duration of acceleration of the solenoid before impact.

As with the P-wave records, the recorded digital waveforms were analyzed to locate clear S_H -wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the S_H -wave signals from the 'normal' and 'reverse' source pulses are very nearly inverted images of each other. Digital Fast Fourier Transform – Inverse Fast Fourier Transform (FFT – IFFT) lowpass filtering was used to remove the higher frequency P-wave signal from the S_H -wave signal. Different filter cutoffs were used to separate P- and S_H -waves at different depths, ranging from 600 Hz in the slowest zones to 4000 Hz in the regions of highest velocity. At each depth, the

filter frequency was selected to be at least twice the fundamental frequency of the S_H -wave signal being filtered.

Generally, the first maxima were picked for the 'normal' signals and the first minima for the 'reverse' signals, although other points on the waveform were used if the first pulse was distorted. The absolute arrival time of the 'normal' and 'reverse' signals may vary by ± 0.2 milliseconds, due to differences in the actuation time of the solenoid source caused by constant mechanical bias in the source or by boring inclination. This variation does not affect the R1-R2 velocity determinations, as the differential time is measured between arrivals of waves created by the same source actuation. The final velocity value is the average of the values obtained from the 'normal' and 'reverse' source actuations.

As with the P-wave data, S_H -wave velocity calculated from the travel time over the 6.3-foot interval from source to receiver 1 was calculated and plotted for verification of the velocity derived from the travel time between receivers. In this analysis, the depth values were increased by 4.8 feet to correspond to the mid-point of the 6.3-foot S-R1 interval. Travel times were obtained by picking the first break of the S_H -wave signal at the near receiver and subtracting 0.4 milliseconds, the calculated and experimentally verified delay from the beginning of the record at the source trigger pulse to source impact.

These data and analysis were reviewed by John Diehl as a component of **GEOVision's** in-house data validation program.

Figure 2 shows an example of R1 - R2 measurements on a sample filtered suspension record. In Figure 2, the time difference over the 3.3 foot interval of 1.88 milliseconds for the horizontal signals is equivalent to an S_H -wave velocity of 1745 feet/second. Whenever possible, time differences were determined from several phase points on the S_H -waveform records to verify the data obtained from the first arrival of the S_H -wave pulse. Figure 3 displays the same record before filtering of the S_H -waveform record with a 1400 Hz FFT - IFFT digital lowpass filter, illustrating

the presence of higher frequency P-wave energy at the beginning of the record, and distortion of the lower frequency S_H -wave by residual P-wave signal.

RESULTS

Suspension Velocity Results

Suspension R1-R2 P- and S_H -wave velocities for Borings G-406, G-408 and G-409 are plotted in Figures 4 through 6, respectively. The suspension velocity data presented in these figures are also presented in Tables 3 through 5, respectively. The Microsoft Excel® analysis files are included in the data directory that accompanies this report.

P- and S_H -wave velocity data from R1-R2 analysis and quality assurance analysis of S-R1 data are plotted together in Figures A-1 to A-3 to aid in visual comparison. It should be noted that R1-R2 data are an average velocity over a 3.3-foot segment of the soil column; S-R1 data are an average over 6.3 feet, creating a significant smoothing relative to the R1-R2 plots. The S-R1 velocity data displayed in these figures are also presented in Tables A-1 through A-3 and included in the Microsoft Excel® analysis files available in the boring-specific subdirectories that accompany this report. The Microsoft Excel® analysis files include Poisson's Ratio calculations, tabulated data and plots.

SUMMARY

Discussion of Suspension Velocity Results

Suspension PS velocity data are ideally collected in an uncased fluid filled boring, drilled with rotary mud (rotary wash) methods, as were these borings.

Suspension PS velocity data quality is judged based upon 5 criteria.

- Consistent data between receiver to receiver (R1 – R2) and source to receiver (S – R1) data.
- Consistency between data from adjacent depth intervals.
- Consistent relationship between P-wave and S_H -wave (excluding transition to saturated soils)
- Clarity of P-wave and S_H -wave onset, as well as damping of later oscillations.
- Consistency of profile between adjacent borings, if available.

All three borings, G-406, G-408 and G-409, met these criteria, exhibiting consistent data between R1-R2 and S-R1, consistent data between depth intervals, consistent relationship between P- and S-waves except below water table, and good clarity in P- and S-wave onsets making interpretation straightforward. The profiles are consistent between borings.

Quality Assurance

These borehole geophysical measurements were performed using industry-standard or better methods for measurements and analyses. All work was performed under **GEOVision** quality assurance procedures, which include:

- Use of NIST-traceable calibrations, where applicable, for field and laboratory instrumentation
- Use of standard field data logs
- Use of independent verification of velocity data by comparison of receiver-to-receiver and source-to-receiver velocities
- Independent review of calculations and results by a registered professional engineer, geologist, or geophysicist.

Suspension Velocity Data Reliability

P- and S_H-wave velocity measurement using the Suspension Method gives average velocities over a 3.3-foot interval of depth. This high resolution results in the scatter of values shown in the graphs. Individual measurements are very reliable with estimated precision of +/- 5%. Standardized field procedures and quality assurance checks contribute to the reliability of these data.

Table 1. Boring locations and logging dates

BORING DESIGNATION	DATES LOGGED	LOCATION ⁽¹⁾ (DEGREES)	
		LATITUDE	LONGITUDE
G-406	9/16/2015	34.0670485 N	118.3843646 W
G-408	9/21/2015	-	-
G-409	9/25/2015	-	-

(1) Coordinates recorded by GEOVision staff

Table 2. Logging dates and depth ranges

BORING NUMBER	TOOL AND RUN NUMBER	DEPTH RANGE (FEET)	CASED OR UNCASED	SAMPLE INTERVAL (FEET)	DATE LOGGED
G-406	SUSPENSION 01	6.56 – 113.19	UNCASED	1.6	9/16/2015
G-408	SUSPENSION 01	6.56 – 46.5	UNCASED	1.6	9/21/2015
G-409	SUSPENSION 01	1.64 – 144.36	UNCASED	1.6	9/25/2015

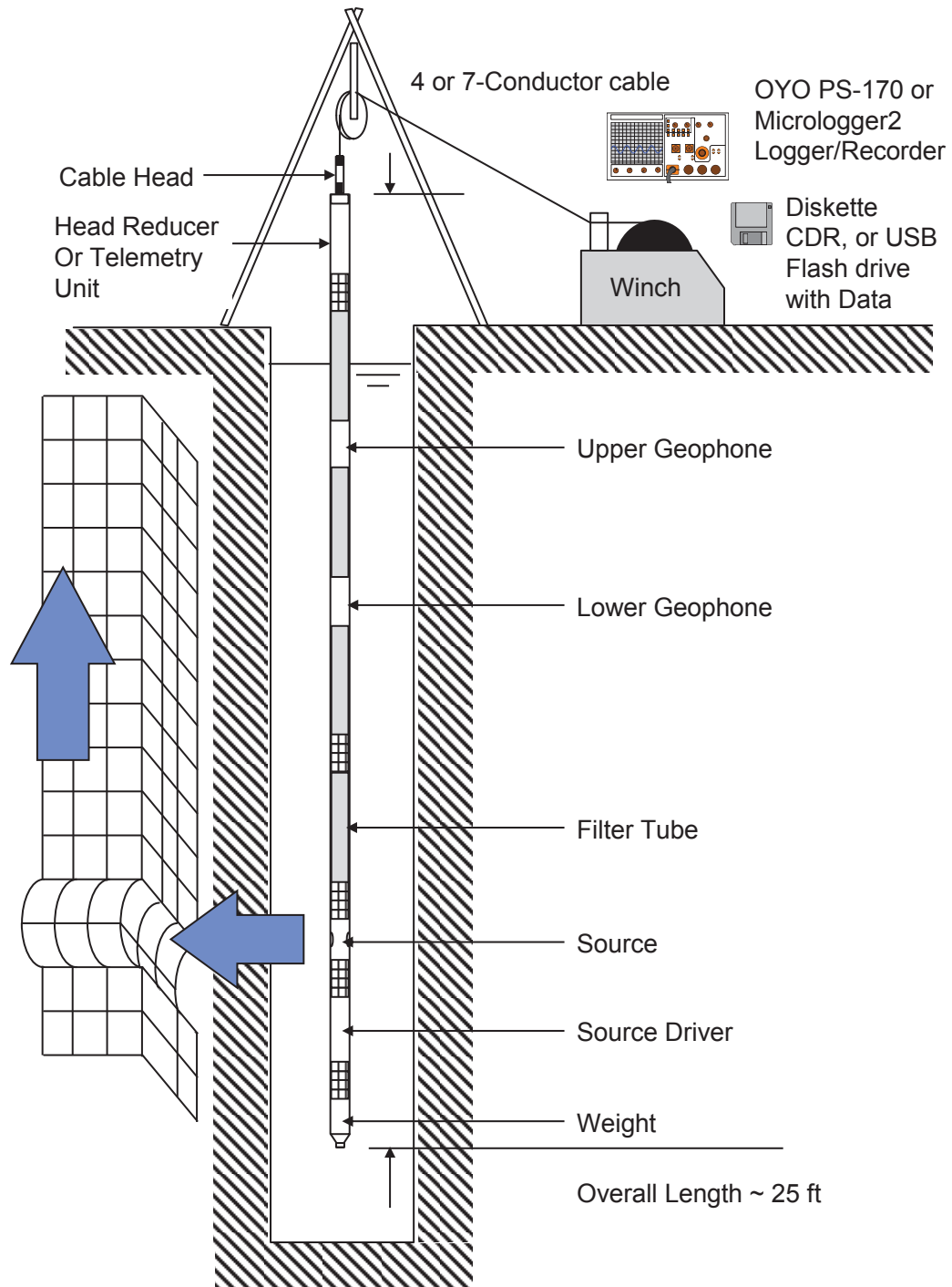


Figure 1: Concept illustration of P-S logging system

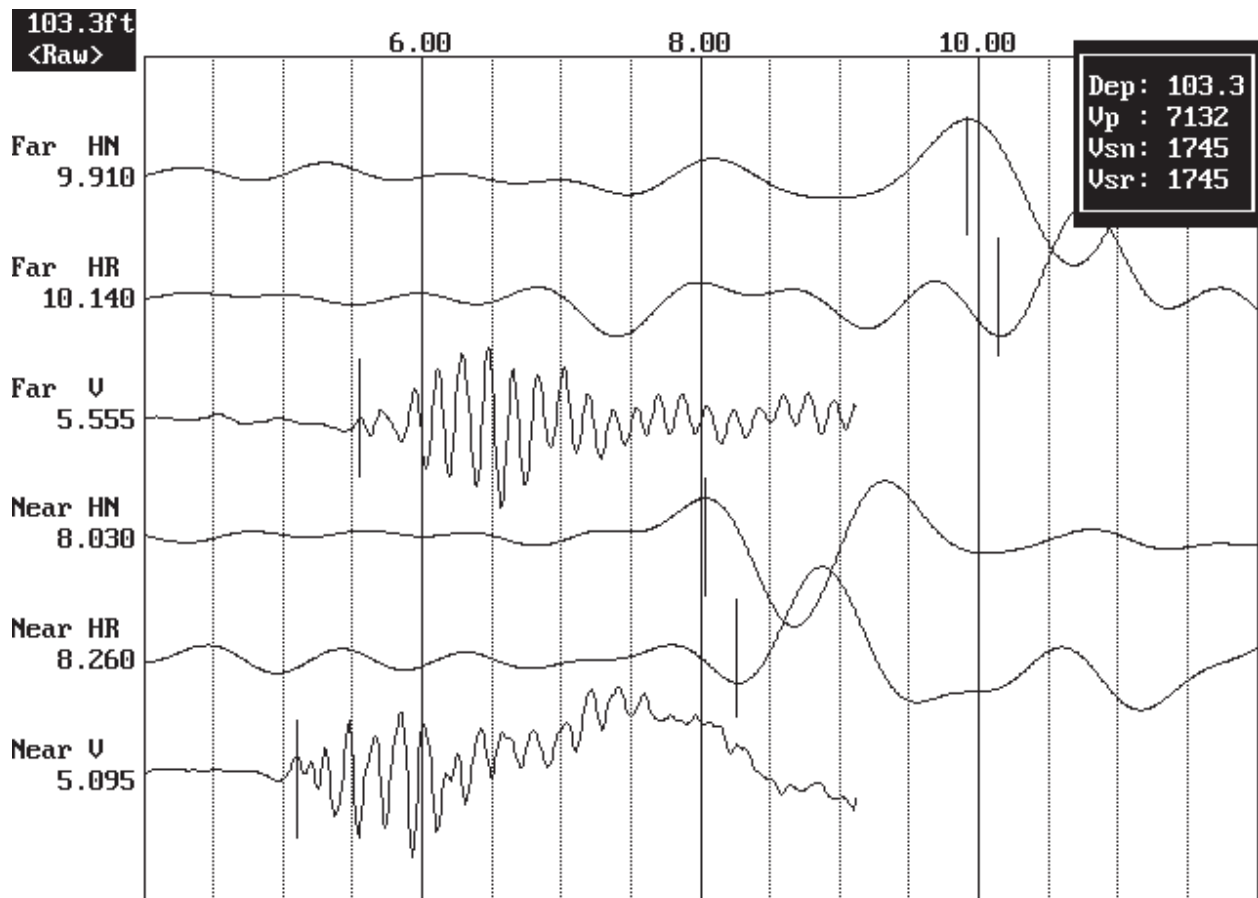


Figure 2: Example of filtered (1400 Hz lowpass) suspension record

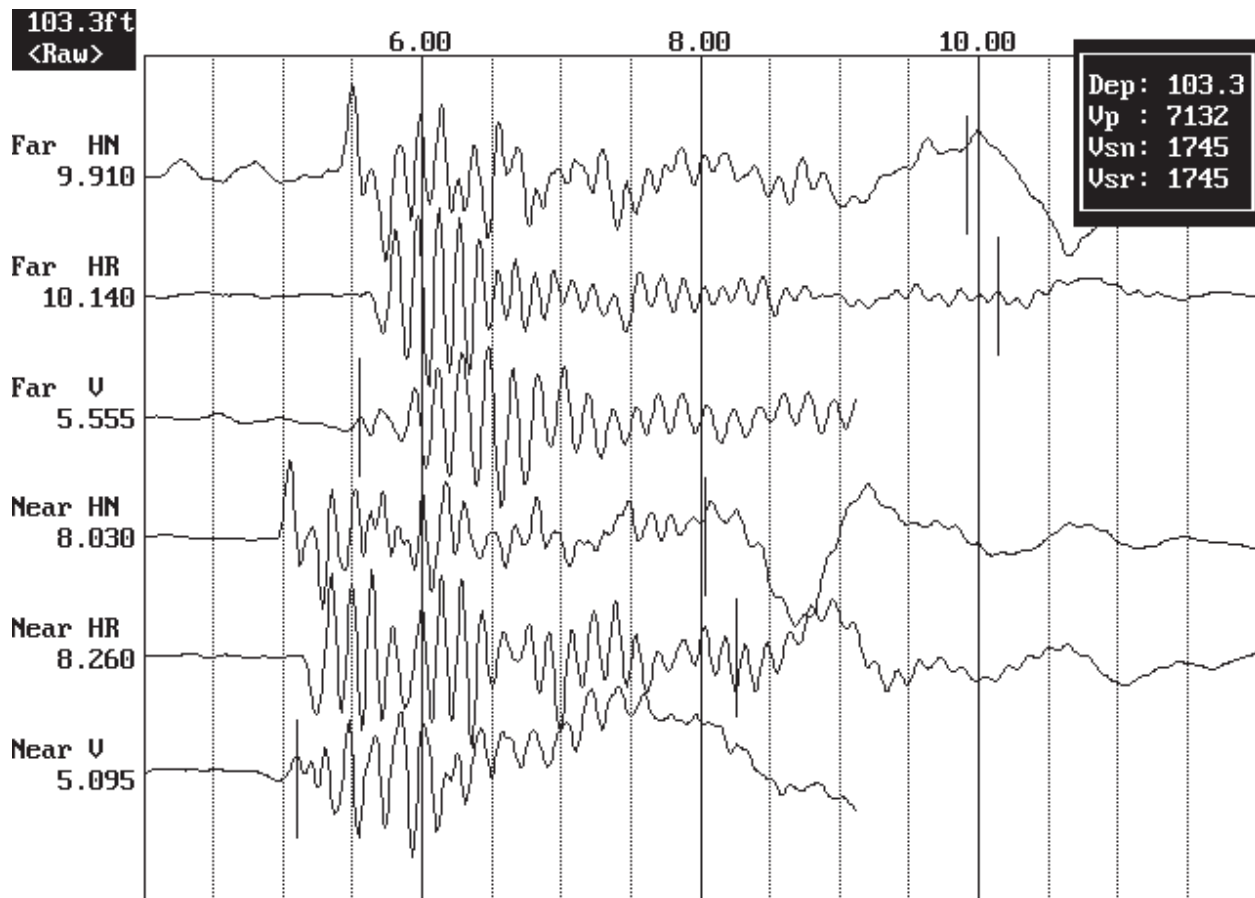


Figure 3. Example of unfiltered suspension record

WSE BOREHOLE G-406 **Receiver to Receiver V_s and V_p Analysis**

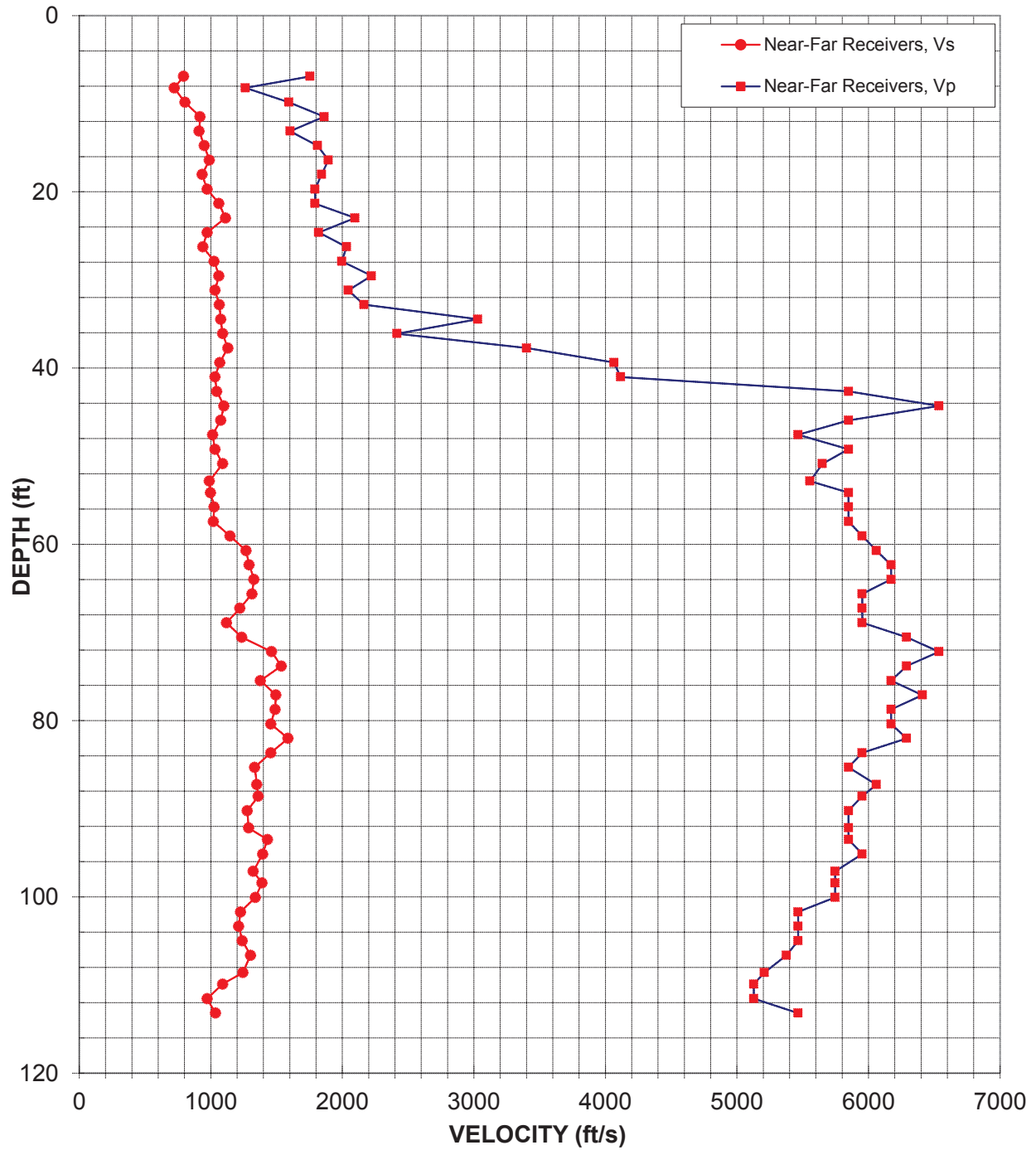


Figure 4: Boring G-406, Suspension R1-R2 P- and S_H -wave velocities

Table 3. Boring G-406, Suspension R1-R2 depths and P- and S_H-wave velocities

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-406**

American Units				Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio	Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
6.9	790	1750	0.37	2.1	240	530	0.37
8.2	720	1260	0.26	2.5	220	380	0.26
9.8	800	1590	0.33	3.0	240	490	0.33
11.5	920	1860	0.34	3.5	280	570	0.34
13.1	910	1600	0.26	4.0	280	490	0.26
14.8	950	1810	0.31	4.5	290	550	0.31
16.4	990	1890	0.31	5.0	300	580	0.31
18.0	930	1840	0.33	5.5	280	560	0.33
19.7	970	1790	0.29	6.0	300	550	0.29
21.3	1060	1790	0.23	6.5	320	550	0.23
23.0	1110	2100	0.30	7.0	340	640	0.30
24.6	970	1820	0.30	7.5	300	560	0.30
26.3	940	2030	0.36	8.0	290	620	0.36
27.9	1030	2000	0.32	8.5	310	610	0.32
29.5	1060	2220	0.35	9.0	320	680	0.35
31.2	1030	2040	0.33	9.5	310	620	0.33
32.8	1060	2160	0.34	10.0	320	660	0.34
34.5	1080	3030	0.43	10.5	330	920	0.43
36.1	1090	2420	0.37	11.0	330	740	0.37
37.7	1130	3400	0.44	11.5	340	1040	0.44
39.4	1070	4070	0.46	12.0	330	1240	0.46
41.0	1030	4120	0.47	12.5	310	1250	0.47
42.7	1040	5850	0.48	13.0	320	1780	0.48
44.3	1100	6540	0.49	13.5	340	1990	0.49
45.9	1080	5850	0.48	14.0	330	1780	0.48
47.6	1010	5460	0.48	14.5	310	1670	0.48
49.2	1030	5850	0.48	15.0	310	1780	0.48
50.9	1090	5650	0.48	15.5	330	1720	0.48
52.8	990	5560	0.48	16.1	300	1690	0.48
54.1	1000	5850	0.49	16.5	300	1780	0.49
55.8	1030	5850	0.48	17.0	310	1780	0.48
57.4	1020	5850	0.48	17.5	310	1780	0.48
59.1	1150	5950	0.48	18.0	350	1810	0.48
60.7	1270	6060	0.48	18.5	390	1850	0.48
62.3	1290	6170	0.48	19.0	390	1880	0.48
64.0	1330	6170	0.48	19.5	400	1880	0.48
65.6	1310	5950	0.47	20.0	400	1810	0.47

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-406**

American Units				Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio	Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
67.3	1220	5950	0.48	20.5	370	1810	0.48
68.9	1120	5950	0.48	21.0	340	1810	0.48
70.5	1230	6290	0.48	21.5	380	1920	0.48
72.2	1460	6540	0.47	22.0	450	1990	0.47
73.8	1540	6290	0.47	22.5	470	1920	0.47
75.5	1380	6170	0.47	23.0	420	1880	0.47
77.1	1490	6410	0.47	23.5	460	1950	0.47
78.7	1490	6170	0.47	24.0	450	1880	0.47
80.4	1460	6170	0.47	24.5	440	1880	0.47
82.0	1590	6290	0.47	25.0	480	1920	0.47
83.7	1460	5950	0.47	25.5	440	1810	0.47
85.3	1330	5850	0.47	26.0	410	1780	0.47
87.3	1350	6060	0.47	26.6	410	1850	0.47
88.6	1360	5950	0.47	27.0	410	1810	0.47
90.2	1280	5850	0.47	27.5	390	1780	0.47
92.2	1290	5850	0.47	28.1	390	1780	0.47
93.5	1430	5850	0.47	28.5	440	1780	0.47
95.1	1390	5950	0.47	29.0	430	1810	0.47
97.1	1320	5750	0.47	29.6	400	1750	0.47
98.4	1390	5750	0.47	30.0	420	1750	0.47
100.1	1340	5750	0.47	30.5	410	1750	0.47
101.7	1230	5460	0.47	31.0	370	1670	0.47
103.4	1210	5460	0.47	31.5	370	1670	0.47
105.0	1240	5460	0.47	32.0	380	1670	0.47
106.6	1300	5380	0.47	32.5	400	1640	0.47
108.6	1240	5210	0.47	33.1	380	1590	0.47
109.9	1090	5130	0.48	33.5	330	1560	0.48
111.6	970	5130	0.48	34.0	300	1560	0.48
113.2	1040	5460	0.48	34.5	320	1670	0.48

WSE BOREHOLE G-408 **Receiver to Receiver V_s and V_p Analysis**

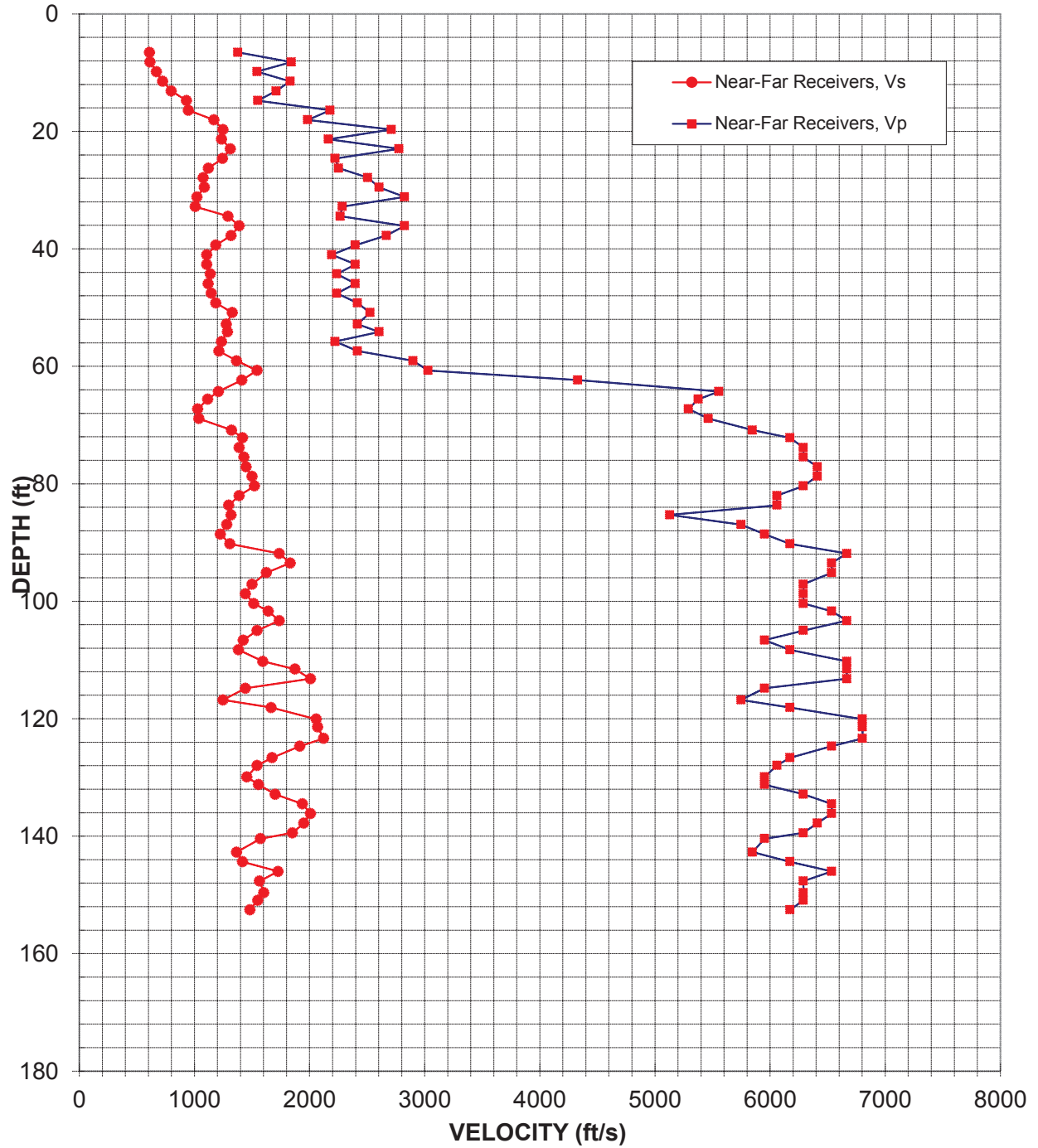


Figure 5: Boring G-408, Suspension R1-R2 P- and S_H -wave velocities

Table 4. Boring G-408, Suspension R1-R2 depths and P- and S_H-wave velocities

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-408**

American Units				Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio	Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
6.6	610	1380	0.38	2.0	190	420	0.38
8.2	610	1840	0.44	2.5	190	560	0.44
9.8	670	1540	0.38	3.0	200	470	0.38
11.5	720	1830	0.41	3.5	220	560	0.41
13.1	800	1710	0.36	4.0	240	520	0.36
14.8	930	1550	0.22	4.5	280	470	0.22
16.4	950	2180	0.38	5.0	290	660	0.38
18.0	1170	1980	0.23	5.5	360	600	0.23
19.7	1250	2710	0.37	6.0	380	830	0.37
21.3	1230	2160	0.26	6.5	380	660	0.26
23.0	1310	2780	0.36	7.0	400	850	0.36
24.6	1240	2220	0.27	7.5	380	680	0.27
26.3	1120	2250	0.33	8.0	340	690	0.33
27.9	1080	2510	0.39	8.5	330	760	0.39
29.5	1090	2600	0.39	9.0	330	790	0.39
31.2	1020	2820	0.42	9.5	310	860	0.42
32.8	1010	2280	0.38	10.0	310	700	0.38
34.5	1290	2270	0.26	10.5	390	690	0.26
36.1	1390	2820	0.34	11.0	420	860	0.34
37.7	1320	2670	0.34	11.5	400	810	0.34
39.4	1190	2400	0.34	12.0	360	730	0.34
41.0	1110	2190	0.33	12.5	340	670	0.33
42.7	1110	2400	0.36	13.0	340	730	0.36
44.3	1140	2240	0.33	13.5	350	680	0.33
45.9	1120	2400	0.36	14.0	340	730	0.36
47.6	1150	2240	0.32	14.5	350	680	0.32
49.2	1190	2420	0.34	15.0	360	740	0.34
50.9	1330	2530	0.31	15.5	400	770	0.31
52.8	1280	2420	0.31	16.1	390	740	0.31
54.1	1290	2600	0.34	16.5	390	790	0.34
55.8	1230	2220	0.28	17.0	380	680	0.28
57.4	1210	2420	0.33	17.5	370	740	0.33
59.1	1370	2900	0.36	18.0	420	880	0.36
60.7	1540	3030	0.32	18.5	470	920	0.32
62.3	1410	4330	0.44	19.0	430	1320	0.44
64.3	1210	5560	0.48	19.6	370	1690	0.48
65.6	1110	5380	0.48	20.0	340	1640	0.48

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-408**

American Units				Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio	Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
67.3	1030	5290	0.48	20.5	310	1610	0.48
68.9	1040	5460	0.48	21.0	320	1670	0.48
70.9	1320	5850	0.47	21.6	400	1780	0.47
72.2	1420	6170	0.47	22.0	430	1880	0.47
73.8	1390	6290	0.47	22.5	420	1920	0.47
75.5	1430	6290	0.47	23.0	440	1920	0.47
77.1	1450	6410	0.47	23.5	440	1950	0.47
78.7	1500	6410	0.47	24.0	460	1950	0.47
80.4	1520	6290	0.47	24.5	460	1920	0.47
82.0	1390	6060	0.47	25.0	420	1850	0.47
83.7	1300	6060	0.48	25.5	400	1850	0.48
85.3	1320	5130	0.46	26.0	400	1560	0.46
86.9	1280	5750	0.47	26.5	390	1750	0.47
88.6	1230	5950	0.48	27.0	370	1810	0.48
90.2	1310	6170	0.48	27.5	400	1880	0.48
91.9	1740	6670	0.46	28.0	530	2030	0.46
93.5	1830	6540	0.46	28.5	560	1990	0.46
95.1	1630	6540	0.47	29.0	500	1990	0.47
97.1	1500	6290	0.47	29.6	460	1920	0.47
98.8	1440	6290	0.47	30.1	440	1920	0.47
100.4	1520	6290	0.47	30.6	460	1920	0.47
101.7	1640	6540	0.47	31.0	500	1990	0.47
103.3	1740	6670	0.46	31.5	530	2030	0.46
105.0	1540	6290	0.47	32.0	470	1920	0.47
106.6	1420	5950	0.47	32.5	430	1810	0.47
108.3	1380	6170	0.47	33.0	420	1880	0.47
110.2	1590	6670	0.47	33.6	490	2030	0.47
111.6	1870	6670	0.46	34.0	570	2030	0.46
113.2	2010	6670	0.45	34.5	610	2030	0.45
114.8	1440	5950	0.47	35.0	440	1810	0.47
116.8	1250	5750	0.48	35.6	380	1750	0.48
118.1	1670	6170	0.46	36.0	510	1880	0.46
120.1	2060	6800	0.45	36.6	630	2070	0.45
121.4	2070	6800	0.45	37.0	630	2070	0.45
123.4	2120	6800	0.45	37.6	650	2070	0.45
124.7	1920	6540	0.45	38.0	580	1990	0.45
126.6	1680	6170	0.46	38.6	510	1880	0.46
128.0	1540	6060	0.47	39.0	470	1850	0.47
129.9	1460	5950	0.47	39.6	440	1810	0.47
131.2	1560	5950	0.46	40.0	470	1810	0.46

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-408**

American Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p	
(ft)	(ft/s)	(ft/s)	
132.9	1700	6290	0.46
134.5	1940	6540	0.45
136.2	2010	6540	0.45
137.8	1950	6410	0.45
139.4	1850	6290	0.45
140.4	1570	5950	0.46
142.7	1370	5850	0.47
144.4	1420	6170	0.47
146.0	1730	6540	0.46
147.6	1560	6290	0.47
149.6	1600	6290	0.47
150.9	1550	6290	0.47
152.6	1480	6170	0.47

Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p	
(m)	(m/s)	(m/s)	
40.5	520	1920	0.46
41.0	590	1990	0.45
41.5	610	1990	0.45
42.0	590	1950	0.45
42.5	560	1920	0.45
42.8	480	1810	0.46
43.5	420	1780	0.47
44.0	430	1880	0.47
44.5	530	1990	0.46
45.0	480	1920	0.47
45.6	490	1920	0.47
46.0	470	1920	0.47
46.5	450	1880	0.47

WSE BOREHOLE G-409 **Receiver to Receiver V_s and V_p Analysis**

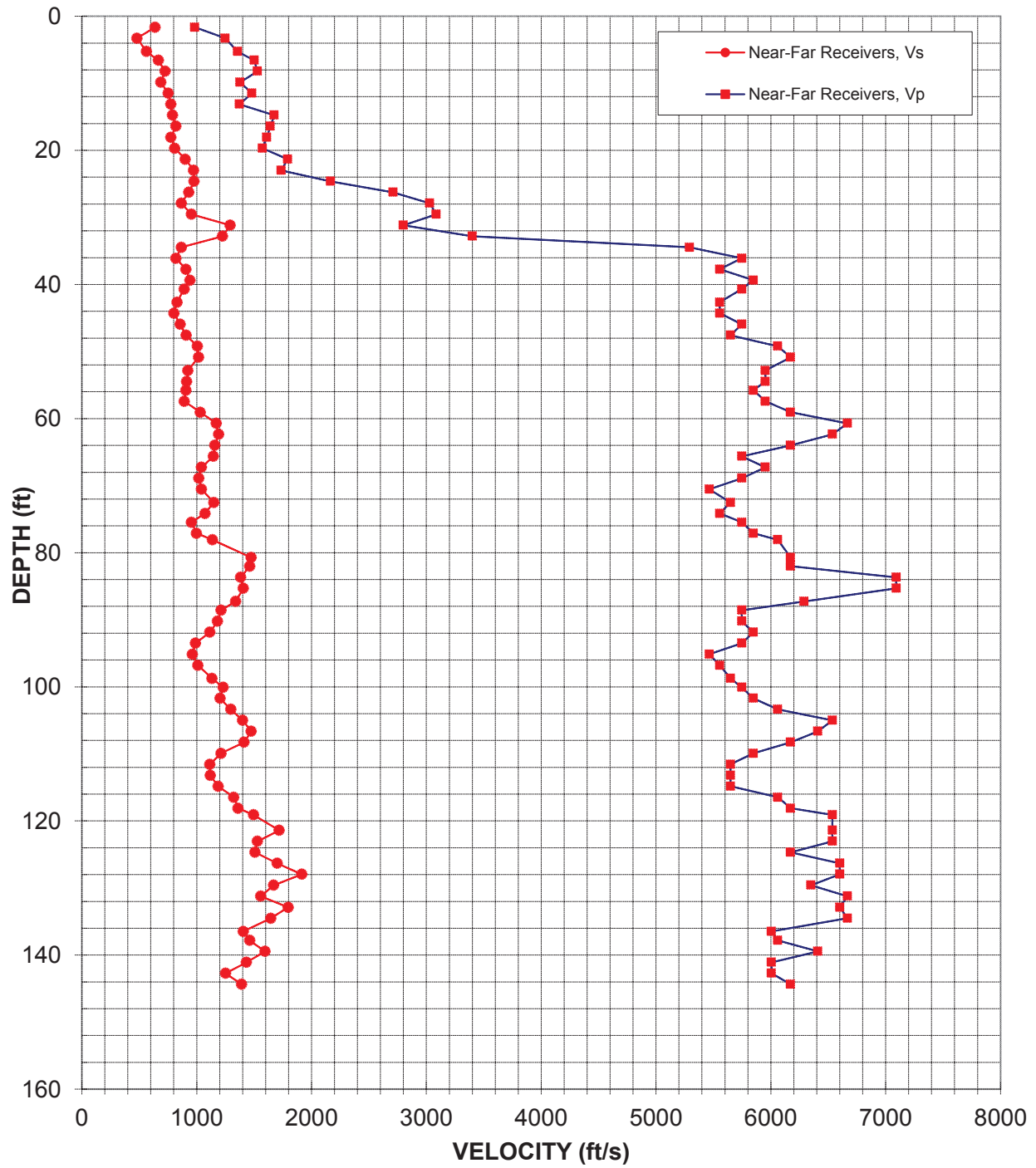


Figure 6: Boring G-409, Suspension R1-R2 P- and S_H -wave velocities

Table 5. Boring G-409, Suspension R1-R2 depths and P- and S_H-wave velocities

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-409**

American Units				Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio	Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
1.6	640	980	0.14	0.5	190	300	0.14
3.3	480	1250	0.41	1.0	150	380	0.41
5.3	560	1360	0.40	1.6	170	410	0.40
6.6	670	1500	0.38	2.0	200	460	0.38
8.2	720	1530	0.36	2.5	220	470	0.36
9.8	690	1380	0.33	3.0	210	420	0.33
11.5	750	1480	0.33	3.5	230	450	0.33
13.1	780	1370	0.27	4.0	240	420	0.27
14.8	790	1680	0.36	4.5	240	510	0.36
16.4	820	1640	0.33	5.0	250	500	0.33
18.0	780	1610	0.35	5.5	240	490	0.35
19.7	810	1570	0.32	6.0	250	480	0.32
21.3	900	1790	0.33	6.5	270	550	0.33
23.0	970	1740	0.27	7.0	300	530	0.27
24.6	980	2160	0.37	7.5	300	660	0.37
26.3	930	2710	0.43	8.0	280	830	0.43
27.9	870	3030	0.46	8.5	260	920	0.46
29.5	960	3090	0.45	9.0	290	940	0.45
31.2	1290	2800	0.36	9.5	390	850	0.36
32.8	1230	3400	0.43	10.0	370	1040	0.43
34.5	870	5290	0.49	10.5	260	1610	0.49
36.1	820	5750	0.49	11.0	250	1750	0.49
37.7	910	5560	0.49	11.5	280	1690	0.49
39.4	940	5850	0.49	12.0	290	1780	0.49
40.7	890	5750	0.49	12.4	270	1750	0.49
42.7	830	5560	0.49	13.0	250	1690	0.49
44.3	800	5560	0.49	13.5	240	1690	0.49
45.9	860	5750	0.49	14.0	260	1750	0.49
47.6	910	5650	0.49	14.5	280	1720	0.49
49.2	1010	6060	0.49	15.0	310	1850	0.49
50.9	1020	6170	0.49	15.5	310	1880	0.49
52.8	920	5950	0.49	16.1	280	1810	0.49
54.5	910	5950	0.49	16.6	280	1810	0.49
55.8	910	5850	0.49	17.0	280	1780	0.49
57.4	890	5950	0.49	17.5	270	1810	0.49
59.1	1030	6170	0.49	18.0	310	1880	0.49
60.7	1170	6670	0.48	18.5	360	2030	0.48
62.3	1190	6540	0.48	19.0	360	1990	0.48

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-409**

American Units				Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio	Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
64.0	1160	6170	0.48	19.5	350	1880	0.48
65.6	1150	5750	0.48	20.0	350	1750	0.48
67.3	1040	5950	0.48	20.5	320	1810	0.48
68.9	1020	5750	0.48	21.0	310	1750	0.48
70.5	1040	5460	0.48	21.5	320	1670	0.48
72.5	1150	5650	0.48	22.1	350	1720	0.48
74.2	1070	5560	0.48	22.6	330	1690	0.48
75.5	960	5750	0.49	23.0	290	1750	0.49
77.1	1000	5850	0.49	23.5	300	1780	0.49
78.1	1140	6060	0.48	23.8	350	1850	0.48
80.7	1470	6170	0.47	24.6	450	1880	0.47
82.0	1460	6170	0.47	25.0	450	1880	0.47
83.7	1380	7090	0.48	25.5	420	2160	0.48
85.3	1410	7090	0.48	26.0	430	2160	0.48
87.3	1340	6290	0.48	26.6	410	1920	0.48
88.6	1210	5750	0.48	27.0	370	1750	0.48
90.2	1180	5750	0.48	27.5	360	1750	0.48
91.9	1110	5850	0.48	28.0	340	1780	0.48
93.5	990	5750	0.48	28.5	300	1750	0.48
95.1	960	5460	0.48	29.0	290	1670	0.48
96.8	1010	5560	0.48	29.5	310	1690	0.48
98.8	1130	5650	0.48	30.1	350	1720	0.48
100.1	1230	5750	0.48	30.5	370	1750	0.48
101.7	1200	5850	0.48	31.0	370	1780	0.48
103.4	1300	6060	0.48	31.5	400	1850	0.48
105.0	1400	6540	0.48	32.0	430	1990	0.48
106.6	1470	6410	0.47	32.5	450	1950	0.47
108.3	1410	6170	0.47	33.0	430	1880	0.47
109.9	1210	5850	0.48	33.5	370	1780	0.48
111.6	1110	5650	0.48	34.0	340	1720	0.48
113.2	1120	5650	0.48	34.5	340	1720	0.48
114.8	1190	5650	0.48	35.0	360	1720	0.48
116.5	1320	6060	0.47	35.5	400	1850	0.47
118.1	1360	6170	0.47	36.0	410	1880	0.47
119.1	1490	6540	0.47	36.3	460	1990	0.47
121.4	1720	6540	0.46	37.0	520	1990	0.46
123.0	1530	6540	0.47	37.5	470	1990	0.47
124.7	1510	6170	0.47	38.0	460	1880	0.47
126.3	1700	6600	0.46	38.5	520	2010	0.46
128.0	1920	6600	0.45	39.0	580	2010	0.45

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Receiver-to-Receiver Travel Time Data - Borehole G-409**

American Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p	
(ft)	(ft/s)	(ft/s)	
129.6	1670	6350	0.46
131.2	1560	6670	0.47
132.9	1800	6600	0.46
134.5	1650	6670	0.47
136.5	1410	6010	0.47
137.8	1460	6060	0.47
139.4	1590	6410	0.47
141.1	1430	6010	0.47
142.7	1250	6010	0.48
144.4	1390	6170	0.47

Metric Units			
Depth at Midpoint Between Receivers	Velocity		Poisson's Ratio
	V _s	V _p	
(m)	(m/s)	(m/s)	
39.5	510	1940	0.46
40.0	470	2030	0.47
40.5	550	2010	0.46
41.0	500	2030	0.47
41.6	430	1830	0.47
42.0	450	1850	0.47
42.5	490	1950	0.47
43.0	440	1830	0.47
43.5	380	1830	0.48
44.0	420	1880	0.47

APPENDIX A

SUSPENSION VELOCITY MEASUREMENT QUALITY ASSURANCE SUSPENSION SOURCE TO RECEIVER ANALYSIS RESULTS

WSE BOREHOLE G-406 **Source to Receiver and Receiver to Receiver Analysis**

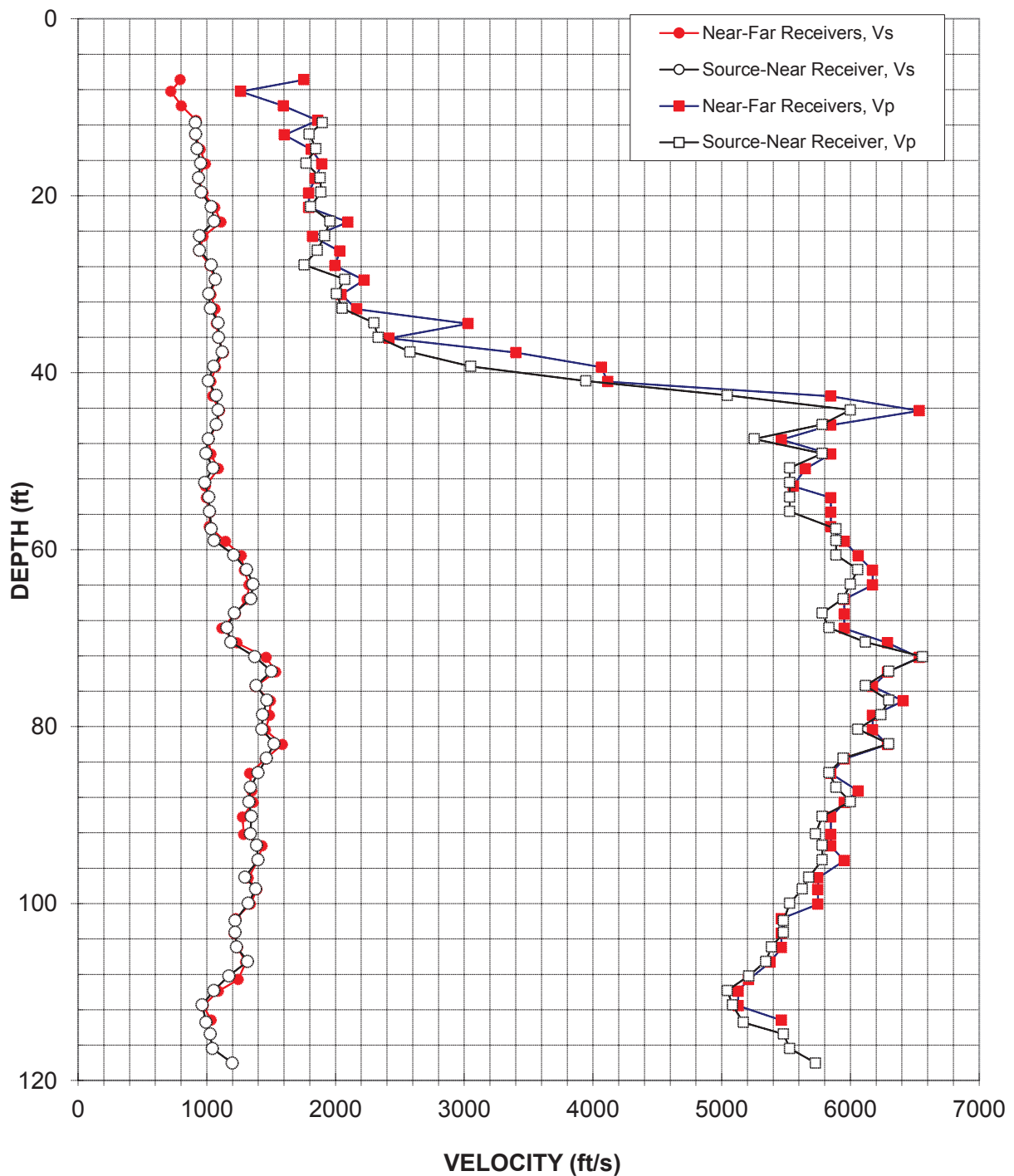


Figure A-1: Boring G-406, Suspension S-R1 P- and S_H-wave velocities

Table A-1. Boring G-406, S - R1 quality assurance analysis P- and S_H-wave data

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-406**

American Units				Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio	Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
11.7	910	1900	0.35	3.6	280	580	0.35
13.0	910	1800	0.33	4.0	280	550	0.33
14.7	920	1850	0.33	4.5	280	560	0.33
16.3	950	1770	0.30	5.0	290	540	0.30
18.0	940	1880	0.34	5.5	290	570	0.34
19.6	960	1890	0.33	6.0	290	580	0.33
21.2	1040	1810	0.26	6.5	320	550	0.26
22.9	1060	1960	0.29	7.0	320	600	0.29
24.5	940	1920	0.34	7.5	290	580	0.34
26.2	940	1860	0.33	8.0	290	570	0.33
27.8	1040	1760	0.23	8.5	320	540	0.23
29.4	1070	2070	0.32	9.0	330	630	0.32
31.1	1020	2010	0.33	9.5	310	610	0.33
32.7	1030	2050	0.33	10.0	310	630	0.33
34.4	1090	2300	0.36	10.5	330	700	0.36
36.0	1090	2330	0.36	11.0	330	710	0.36
37.6	1120	2580	0.38	11.5	340	790	0.38
39.3	1050	3050	0.43	12.0	320	930	0.43
40.9	1010	3940	0.46	12.5	310	1200	0.46
42.6	1070	5040	0.48	13.0	330	1540	0.48
44.2	1090	6000	0.48	13.5	330	1830	0.48
45.8	1070	5780	0.48	14.0	330	1760	0.48
47.5	1010	5250	0.48	14.5	310	1600	0.48
49.1	990	5780	0.48	15.0	300	1760	0.48
50.8	1050	5530	0.48	15.5	320	1690	0.48
52.4	980	5530	0.48	16.0	300	1690	0.48
54.0	1020	5530	0.48	16.5	310	1690	0.48
55.7	1020	5530	0.48	17.0	310	1690	0.48
57.7	1040	5890	0.48	17.6	320	1790	0.48
59.0	1060	5890	0.48	18.0	320	1790	0.48
60.6	1210	5890	0.48	18.5	370	1790	0.48
62.2	1310	6060	0.48	19.0	400	1850	0.48
63.9	1360	6000	0.47	19.5	410	1830	0.47
65.5	1340	5940	0.47	20.0	410	1810	0.47
67.2	1210	5780	0.48	20.5	370	1760	0.48
68.8	1160	5830	0.48	21.0	350	1780	0.48
70.5	1190	6120	0.48	21.5	360	1860	0.48

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-406**

American Units				Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio	Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
72.1	1370	6560	0.48	22.0	420	2000	0.48
73.7	1500	6300	0.47	22.5	460	1920	0.47
75.4	1380	6120	0.47	23.0	420	1860	0.47
77.0	1470	6300	0.47	23.5	450	1920	0.47
78.7	1430	6240	0.47	24.0	440	1900	0.47
80.3	1430	6060	0.47	24.5	440	1850	0.47
81.9	1520	6300	0.47	25.0	460	1920	0.47
83.6	1460	5940	0.47	25.5	450	1810	0.47
85.2	1400	5830	0.47	26.0	430	1780	0.47
86.9	1340	5890	0.47	26.5	410	1790	0.47
88.5	1330	6000	0.47	27.0	400	1830	0.47
90.1	1350	5780	0.47	27.5	410	1760	0.47
92.1	1340	5730	0.47	28.1	410	1750	0.47
93.4	1390	5780	0.47	28.5	420	1760	0.47
95.1	1400	5780	0.47	29.0	430	1760	0.47
97.0	1300	5680	0.47	29.6	390	1730	0.47
98.3	1380	5630	0.47	30.0	420	1720	0.47
100.0	1320	5530	0.47	30.5	400	1690	0.47
101.9	1220	5480	0.47	31.1	370	1670	0.47
103.3	1220	5480	0.47	31.5	370	1670	0.47
104.9	1230	5390	0.47	32.0	380	1640	0.47
106.5	1320	5340	0.47	32.5	400	1630	0.47
108.2	1170	5210	0.47	33.0	360	1590	0.47
109.8	1050	5040	0.48	33.5	320	1540	0.48
111.5	960	5080	0.48	34.0	290	1550	0.48
113.4	990	5170	0.48	34.6	300	1580	0.48
114.7	1030	5480	0.48	35.0	310	1670	0.48
116.4	1040	5530	0.48	35.5	320	1690	0.48
118.0	1200	5730	0.48	36.0	370	1750	0.48

WSE BOREHOLE G-408 **Source to Receiver and Receiver to Receiver Analysis**

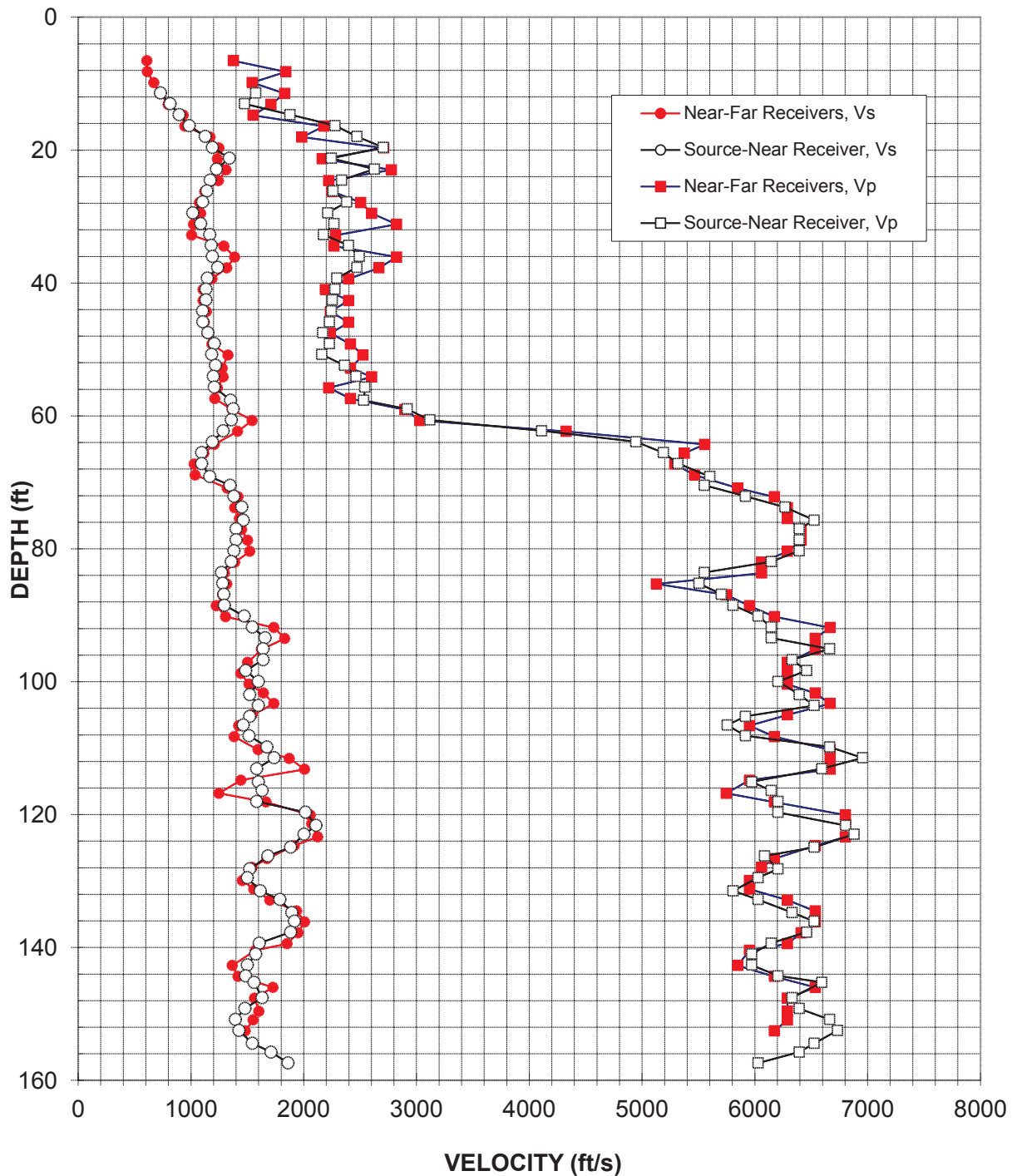


Figure A-2: Boring G-408, Suspension S-R1 P- and S_H-wave velocities

Table A-2. Boring G-408, S - R1 quality assurance analysis P- and S_H-wave data

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-408**

American Units				Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio	Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
11.4	730	1570	0.36	3.5	220	480	0.36
13.0	810	1480	0.28	4.0	250	450	0.28
14.7	900	1880	0.35	4.5	270	570	0.35
16.3	990	2280	0.38	5.0	300	690	0.38
18.0	1130	2470	0.37	5.5	340	750	0.37
19.6	1190	2710	0.38	6.0	360	820	0.38
21.2	1340	2240	0.22	6.5	410	680	0.22
22.9	1230	2630	0.36	7.0	370	800	0.36
24.5	1170	2340	0.33	7.5	360	710	0.33
26.2	1140	2260	0.33	8.0	350	690	0.33
27.8	1100	2380	0.36	8.5	340	730	0.36
29.4	1020	2210	0.37	9.0	310	670	0.37
31.1	1090	2270	0.35	9.5	330	690	0.35
32.7	1170	2180	0.30	10.0	360	660	0.30
34.4	1180	2400	0.34	10.5	360	730	0.34
36.0	1190	2490	0.35	11.0	360	760	0.35
37.6	1240	2470	0.33	11.5	380	750	0.33
39.3	1150	2290	0.33	12.0	350	700	0.33
40.9	1130	2280	0.33	12.5	350	690	0.33
42.6	1130	2250	0.33	13.0	350	690	0.33
44.2	1100	2240	0.34	13.5	340	680	0.34
45.8	1110	2230	0.34	14.0	340	680	0.34
47.5	1150	2170	0.30	14.5	350	660	0.30
49.1	1210	2230	0.29	15.0	370	680	0.29
50.8	1190	2160	0.28	15.5	360	660	0.28
52.4	1220	2360	0.32	16.0	370	720	0.32
54.0	1200	2460	0.34	16.5	370	750	0.34
55.7	1210	2540	0.35	17.0	370	770	0.35
57.7	1350	2530	0.30	17.6	410	770	0.30
59.0	1380	2920	0.36	18.0	420	890	0.36
60.6	1360	3120	0.38	18.5	410	950	0.38
62.2	1290	4110	0.45	19.0	390	1250	0.45
63.9	1190	4950	0.47	19.5	360	1510	0.47
65.5	1100	5190	0.48	20.0	330	1580	0.48
67.2	1100	5320	0.48	20.5	330	1620	0.48
69.1	1170	5600	0.48	21.1	360	1710	0.48
70.5	1350	5550	0.47	21.5	410	1690	0.47

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-408**

American Units				Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio	Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
72.1	1380	5920	0.47	22.0	420	1800	0.47
73.7	1450	6270	0.47	22.5	440	1910	0.47
75.7	1470	6530	0.47	23.1	450	1990	0.47
77.0	1400	6390	0.47	23.5	430	1950	0.47
78.7	1400	6390	0.47	24.0	430	1950	0.47
80.3	1380	6390	0.48	24.5	420	1950	0.48
81.9	1360	6150	0.47	25.0	410	1870	0.47
83.6	1270	5550	0.47	25.5	390	1690	0.47
85.2	1280	5500	0.47	26.0	390	1680	0.47
86.9	1290	5700	0.47	26.5	390	1740	0.47
88.5	1300	5810	0.47	27.0	400	1770	0.47
90.1	1470	6030	0.47	27.5	450	1840	0.47
91.8	1540	6150	0.47	28.0	470	1870	0.47
93.4	1660	6150	0.46	28.5	510	1870	0.46
95.1	1640	6660	0.47	29.0	500	2030	0.47
96.7	1640	6330	0.46	29.5	500	1930	0.46
98.3	1490	6460	0.47	30.0	450	1970	0.47
100.0	1600	6210	0.46	30.5	490	1890	0.46
101.9	1520	6390	0.47	31.1	460	1950	0.47
103.6	1600	6530	0.47	31.6	490	1990	0.47
105.2	1520	5920	0.46	32.1	460	1800	0.46
106.5	1470	5750	0.47	32.5	450	1750	0.47
108.1	1510	5920	0.46	33.0	460	1800	0.46
109.8	1670	6660	0.47	33.5	510	2030	0.47
111.5	1740	6960	0.47	34.0	530	2120	0.47
113.1	1580	6590	0.47	34.5	480	2010	0.47
115.1	1600	5970	0.46	35.1	490	1820	0.46
116.4	1630	6150	0.46	35.5	500	1870	0.46
118.0	1580	6210	0.47	36.0	480	1890	0.47
119.7	2020	6210	0.44	36.5	610	1890	0.44
121.6	2110	6810	0.45	37.1	640	2070	0.45
122.9	2000	6880	0.45	37.5	610	2100	0.45
124.9	1880	6530	0.45	38.1	570	1990	0.45
126.2	1680	6090	0.46	38.5	510	1860	0.46
128.2	1520	6210	0.47	39.1	460	1890	0.47
129.5	1500	6030	0.47	39.5	460	1840	0.47
131.5	1610	5810	0.46	40.1	490	1770	0.46
132.8	1790	6030	0.45	40.5	550	1840	0.45
134.8	1900	6330	0.45	41.1	580	1930	0.45
136.1	1920	6530	0.45	41.5	580	1990	0.45

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-408**

American Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p	
(ft)	(ft/s)	(ft/s)	
137.7	1880	6460	0.45
139.3	1610	6150	0.46
141.0	1570	5970	0.46
142.6	1500	5970	0.47
144.3	1490	6210	0.47
145.3	1560	6590	0.47
147.6	1630	6330	0.46
149.2	1480	6390	0.47
150.8	1390	6660	0.48
152.5	1430	6730	0.48
154.4	1540	6530	0.47
155.8	1710	6390	0.46
157.4	1860	6030	0.45

Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p	
(m)	(m/s)	(m/s)	
42.0	570	1970	0.45
42.5	490	1870	0.46
43.0	480	1820	0.46
43.5	460	1820	0.47
44.0	450	1890	0.47
44.3	480	2010	0.47
45.0	500	1930	0.46
45.5	450	1950	0.47
46.0	420	2030	0.48
46.5	430	2050	0.48
47.1	470	1990	0.47
47.5	520	1950	0.46
48.0	570	1840	0.45

WSE BOREHOLE G-409 **Source to Receiver and Receiver to Receiver Analysis**

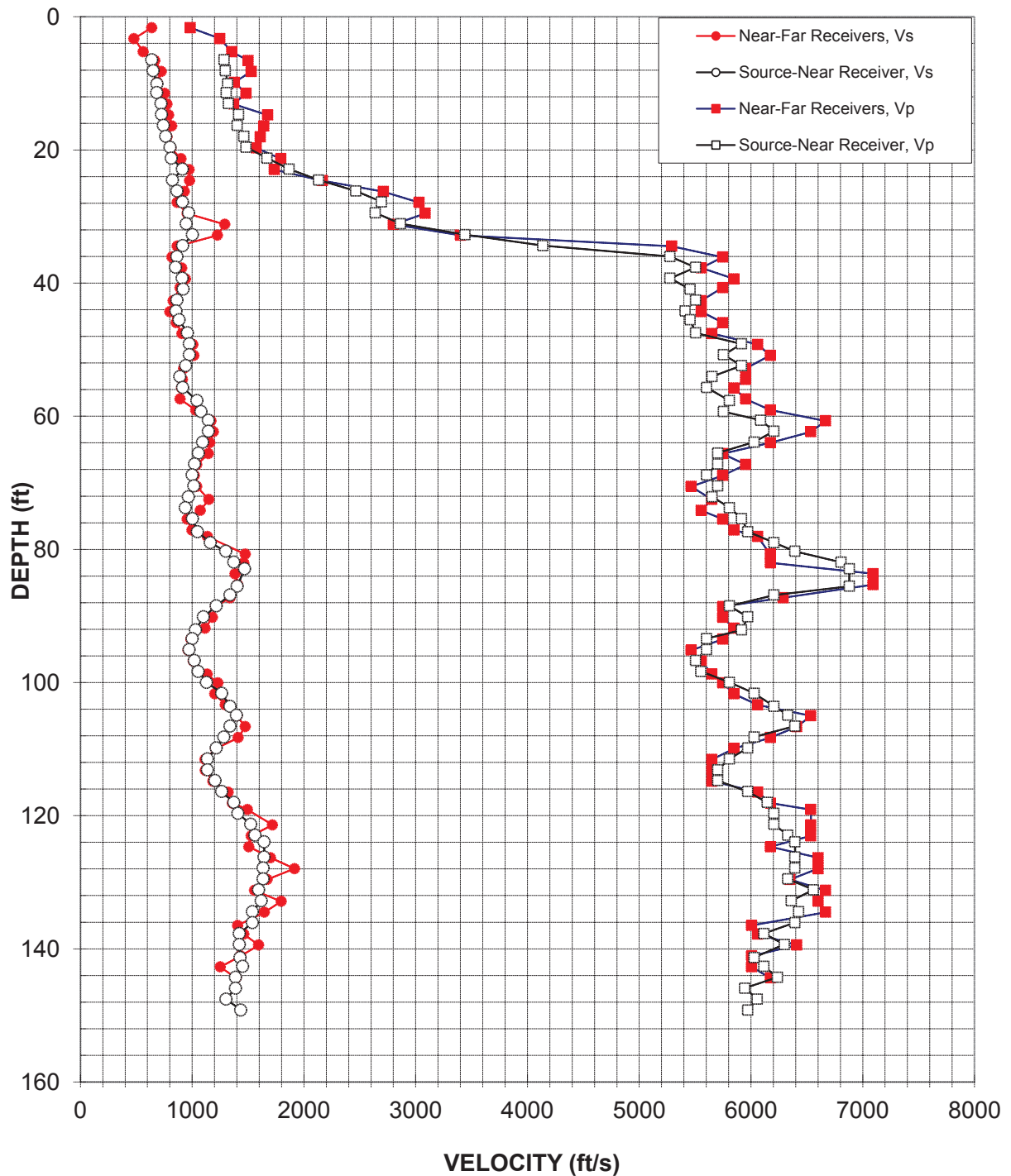


Figure A-3: Boring G-409, Suspension S-R1 P- and S_H-wave velocities

Table A-3. Boring G-409, S - R1 quality assurance analysis P- and S_H-wave data

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-409**

American Units				Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio	Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
6.5	640	1290	0.34	2.0	190	390	0.34
8.1	650	1300	0.33	2.5	200	400	0.33
10.1	690	1320	0.31	3.1	210	400	0.31
11.4	680	1310	0.31	3.5	210	400	0.31
13.0	720	1320	0.29	4.0	220	400	0.29
14.7	730	1420	0.32	4.5	220	430	0.32
16.3	740	1400	0.31	5.0	230	430	0.31
18.0	760	1460	0.31	5.5	230	450	0.31
19.6	800	1480	0.29	6.0	240	450	0.29
21.2	810	1670	0.34	6.5	250	510	0.34
22.9	910	1870	0.34	7.0	280	570	0.34
24.5	820	2130	0.41	7.5	250	650	0.41
26.2	860	2460	0.43	8.0	260	750	0.43
27.8	910	2690	0.44	8.5	280	820	0.44
29.4	970	2640	0.42	9.0	300	800	0.42
31.1	950	2860	0.44	9.5	290	870	0.44
32.7	1000	3440	0.45	10.0	310	1050	0.45
34.4	920	4140	0.47	10.5	280	1260	0.47
36.0	860	5280	0.49	11.0	260	1610	0.49
37.6	850	5500	0.49	11.5	260	1680	0.49
39.3	910	5280	0.48	12.0	280	1610	0.48
40.9	920	5460	0.49	12.5	280	1660	0.49
42.6	860	5500	0.49	13.0	260	1680	0.49
44.2	860	5410	0.49	13.5	260	1650	0.49
45.5	880	5460	0.49	13.9	270	1660	0.49
47.5	960	5500	0.48	14.5	290	1680	0.48
49.1	980	5920	0.49	15.0	300	1800	0.49
50.8	980	5750	0.49	15.5	300	1750	0.49
52.4	940	5920	0.49	16.0	290	1800	0.49
54.0	890	5650	0.49	16.5	270	1720	0.49
55.7	920	5600	0.49	17.0	280	1710	0.49
57.7	1040	5810	0.48	17.6	320	1770	0.48
59.3	1080	5750	0.48	18.1	330	1750	0.48
60.6	1140	6090	0.48	18.5	350	1860	0.48
62.2	1140	6210	0.48	19.0	350	1890	0.48
63.9	1090	6030	0.48	19.5	330	1840	0.48
65.5	1060	5700	0.48	20.0	320	1740	0.48
67.2	1020	5700	0.48	20.5	310	1740	0.48
68.8	1000	5600	0.48	21.0	300	1710	0.48

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-409**

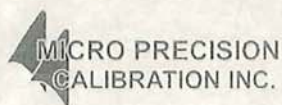
American Units				Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio	Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
70.5	1020	5700	0.48	21.5	310	1740	0.48
72.1	970	5650	0.48	22.0	290	1720	0.48
73.7	940	5810	0.49	22.5	290	1770	0.49
75.4	1000	5920	0.49	23.0	310	1800	0.49
77.3	1050	5970	0.48	23.6	320	1820	0.48
79.0	1160	6210	0.48	24.1	350	1890	0.48
80.3	1300	6390	0.48	24.5	400	1950	0.48
81.9	1370	6810	0.48	25.0	420	2070	0.48
82.9	1470	6880	0.48	25.3	450	2100	0.48
85.5	1400	6880	0.48	26.1	430	2100	0.48
86.9	1340	6210	0.48	26.5	410	1890	0.48
88.5	1210	5810	0.48	27.0	370	1770	0.48
90.1	1100	5970	0.48	27.5	340	1820	0.48
92.1	1030	5920	0.48	28.1	310	1800	0.48
93.4	1000	5600	0.48	28.5	300	1710	0.48
95.1	970	5600	0.48	29.0	300	1710	0.48
96.7	1020	5500	0.48	29.5	310	1680	0.48
98.3	1050	5550	0.48	30.0	320	1690	0.48
100.0	1130	5810	0.48	30.5	340	1770	0.48
101.6	1260	6030	0.48	31.0	390	1840	0.48
103.6	1340	6210	0.48	31.6	410	1890	0.48
104.9	1400	6330	0.47	32.0	430	1930	0.47
106.5	1340	6390	0.48	32.5	410	1950	0.48
108.2	1280	6030	0.48	33.0	390	1840	0.48
109.8	1210	5970	0.48	33.5	370	1820	0.48
111.5	1140	5810	0.48	34.0	350	1770	0.48
113.1	1140	5700	0.48	34.5	350	1740	0.48
114.7	1210	5700	0.48	35.0	370	1740	0.48
116.4	1260	5970	0.48	35.5	390	1820	0.48
118.0	1370	6150	0.47	36.0	420	1870	0.47
119.7	1410	6210	0.47	36.5	430	1890	0.47
121.3	1530	6210	0.47	37.0	460	1890	0.47
122.9	1560	6330	0.47	37.5	480	1930	0.47
123.9	1640	6390	0.46	37.8	500	1950	0.46
126.2	1640	6390	0.46	38.5	500	1950	0.46
127.9	1640	6390	0.46	39.0	500	1950	0.46
129.5	1640	6330	0.46	39.5	500	1930	0.46
131.1	1590	6560	0.47	40.0	490	2000	0.47
132.8	1620	6360	0.47	40.5	490	1940	0.47
134.4	1540	6430	0.47	41.0	470	1960	0.47

**Summary of Compressional Wave Velocity, Shear Wave Velocity, and Poisson's Ratio
Based on Source-to-Receiver Travel Time Data - Borehole G-409**

American Units				Metric Units			
Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio	Depth at Midpoint Between Source and Near Receiver	Velocity		Poisson's Ratio
	V _s	V _p			V _s	V _p	
(ft)	(ft/s)	(ft/s)		(m)	(m/s)	(m/s)	
136.1	1540	6390	0.47	41.5	470	1950	0.47
137.7	1420	6120	0.47	42.0	430	1860	0.47
139.3	1420	6300	0.47	42.5	430	1920	0.47
141.3	1430	6030	0.47	43.1	440	1840	0.47
142.6	1450	6120	0.47	43.5	440	1860	0.47
144.3	1390	6240	0.47	44.0	420	1900	0.47
145.9	1390	5940	0.47	44.5	420	1810	0.47
147.6	1300	6060	0.48	45.0	400	1850	0.48
149.2	1440	5970	0.47	45.5	440	1820	0.47

APPENDIX B

**BORING GEOPHYSICAL LOGGING
SYSTEMS - NIST TRACEABLE
CALIBRATION RECORDS**



MICRO PRECISION CALIBRATION, INC
2165 N. Glassell St.,
Orange, CA 92865
714-901-5659



Certificate of Calibration

Date: Jul 21, 2015

Cert No. 222008122590036

Customer:

GEOVISION

1124 OLYMPIC DRIVE
CORONA CA 92881

MPC Control #: AM6767
Asset ID: 160023
Gage Type: LOGGER
Manufacturer: OYO
Model Number: 3403
Size: N/A
Temp/RH: 72.0°F / 54.0%

Work Order #: LA-90018075
Purchase Order #: OH-150720-01
Serial Number: 160023
Department: N/A
Performed By: TYLER MCKEEN
Received Condition: IN TOLERANCE
Returned Condition: IN TOLERANCE
Cal. Date: July 10, 2015
Cal. Interval: 12 MONTHS
Cal. Due Date: July 10, 2016

Calibration Notes:

This certificate supersedes cert#222008122588682
See attached data sheet for calculations. (1 Page)
Calibrated IAW customer supplied data form Rev 2.1
Frequency measurement uncertainty = 0.0005 Hz
Unit calibrated with Laptop Panasonic Model CF-29,s/n: 4FKSA41798
Calibrated To 4:1 Accuracy Ratio

Standards Used to Calibrate Equipment

I.D.	Description.	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
BD9000	CALIBRATOR	5500A	7375008	FLUKE	Jul 28, 2015	220081222200295
T1100	UNIVERSAL COUNTER	53131A	3546A09912	HEWLETT PACKARD	Jan 28, 2016	222008122578634
DB8748	GPS TIME AND FREQUENCY RECEIVER	58503A	3625A01225	HEWLETT PACKARD	Jun 17, 2016	222008122553843

Procedures Used in this Event

Procedure Name	Description
GEOVISION SEISMIC	Suspension PS Seismic Logger/Recorder Calibration Procedure

Calibrating Technician:

TYLER MCKEEN

QC Approval:

Jim Williams

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA's Publication and NIST Technical Note 1297, 1994 Edition. Services rendered comply with ISO 17025:2005, ANSI/NCCL Z540-1, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to SI through the National Institute of Standards and Technology (NIST) and/or recognized national or international standards laboratories. Services rendered include proper manufacturer's service instruction and are warranted for no less than thirty (30) days. This report may not be reproduced in part or in a whole without the prior written approval of the issuing MPC lab.

SUSPENSION PS SEISMIC LOGGER/RECORDER CALIBRATION DATA FORM

INSTRUMENT DATA

System mfg.: <u>RG</u>	Model no.: <u>3403</u>
Serial no.: <u>16023</u>	Calibration date: <u>7/10/15</u>
By: <u>EFeldman @ MPI</u>	Due date: <u>7/10/16</u>
Counter mfg.: <u>Hewlett Packard</u>	Model no.: <u>53131A</u>
Serial no.: <u>3416A05377</u>	Calibration date: <u>8/1/14</u>
By: <u>MPI</u>	Due date: <u>8/1/15</u>
Signal generator mfg.: <u>Fiske</u>	Model no.: <u>5500A</u>
Serial no.: <u>7375008</u>	Calibration date: <u>7/28/14</u>
By: <u>MPI</u>	Due date: <u>7/28/15</u>
Laptop controller mfg.: <u>Panasonic</u>	Model no.: <u>CF-29</u>
Serial no.: <u>4EKSA41798</u>	Calibration date: <u>N/A</u>

SYSTEM SETTINGS:

Gain:	<u>2</u>
Filter:	<u>open</u>
Range:	<u>200-5 mSec</u>
Delay:	<u>none</u>
Stack (1 std):	<u>1</u>
System date = correct date and time:	<u>yes</u>

PROCEDURE:

Set sine wave frequency to target frequency with amplitude of approximately 0.25 volt peak
 Note actual frequency on data form.
 Set sample period and record data file to disk. Note file name on data form.
 Pick duration of 9 cycles using PSLOG.EXE program, note duration on data form, and save as .sps file. Calculate average frequency for each channel pair and note on data form.
 Average frequency must be within +/- 1% of actual frequency at all data points.

Maximum error ((AVG-ACT)/ACT*100)% As found 0.11% As left 0.11%

Target Frequency (Hz)	Actual Frequency (Hz)	Sample Period (microS)	File Name	Time for 9 cycles Hn (msec)	Average Frequency Hn (Hz)	Time for 9 cycles Hr (msec)	Average Frequency Hr (Hz)	Time for 9 cycles V (msec)	Average Frequency V (Hz)
50.00	<u>50</u>	<u>200</u>	<u>003</u>	<u>180</u>	<u>50</u>	<u>179.8</u>	<u>50.07</u>	<u>180</u>	<u>50</u>
100.0	<u>100</u>	<u>100</u>	<u>004</u>	<u>90</u>	<u>100</u>	<u>90</u>	<u>100</u>	<u>90</u>	<u>100</u>
200.0	<u>200</u>	<u>50</u>	<u>005</u>	<u>45</u>	<u>200</u>	<u>44.95</u>	<u>200.2</u>	<u>45</u>	<u>200</u>
500.0	<u>500</u>	<u>20</u>	<u>006</u>	<u>18</u>	<u>500</u>	<u>18</u>	<u>500</u>	<u>18</u>	<u>500</u>
1000	<u>1000</u>	<u>10</u>	<u>007</u>	<u>9</u>	<u>1000</u>	<u>9</u>	<u>1000</u>	<u>9</u>	<u>1000</u>
2000	<u>2000</u>	<u>5</u>	<u>008</u>	<u>4.505</u>	<u>4.50</u>	<u>4.505</u>	<u>1997.8</u>	<u>4.9505</u>	<u>1997.8</u>

Calibrated by:

Name

Date

Signature

Witnessed by:

Name

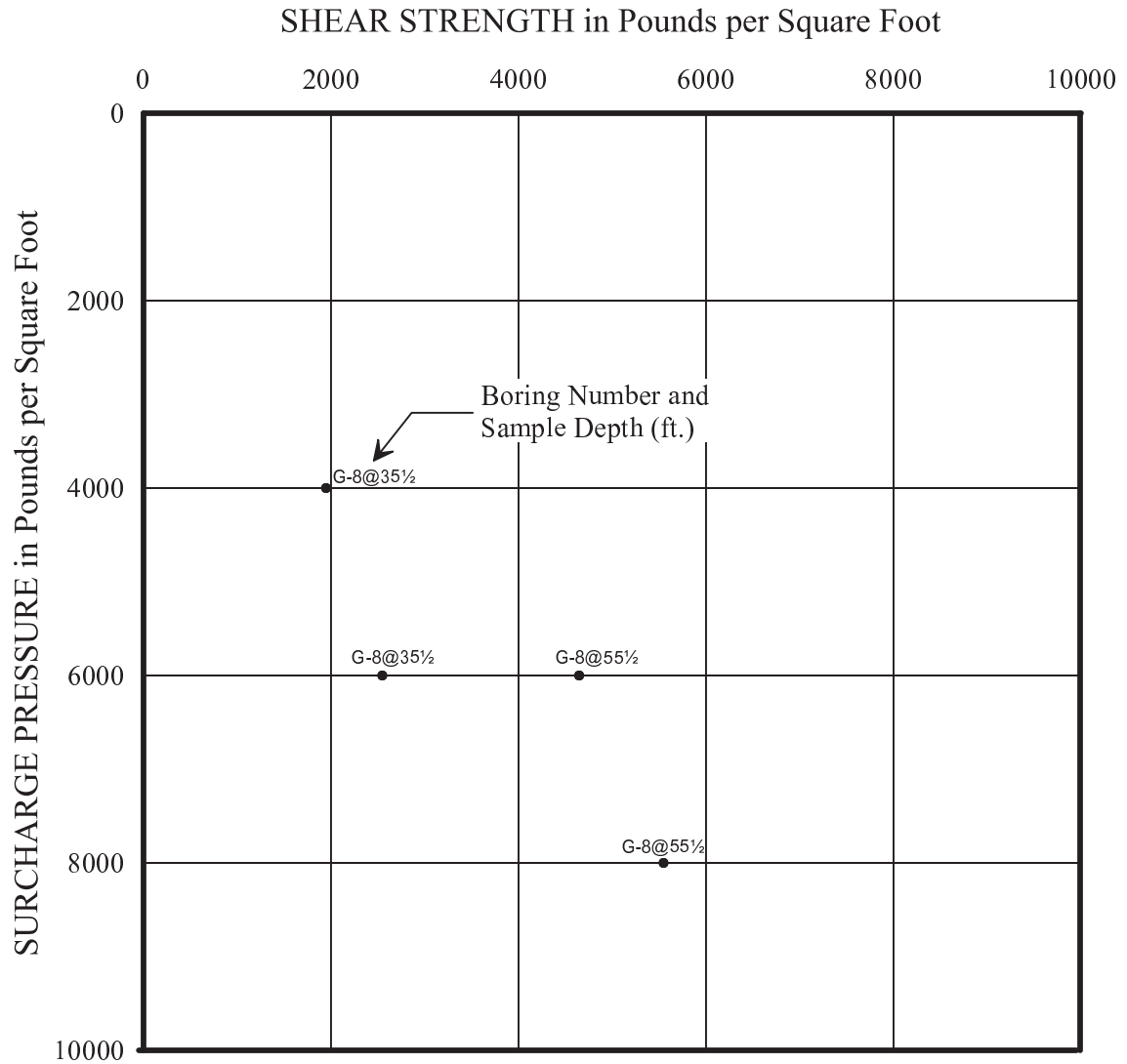
Date

Signature

APPENDIX D GEOTECHNICAL LABORATORY TEST RESULTS

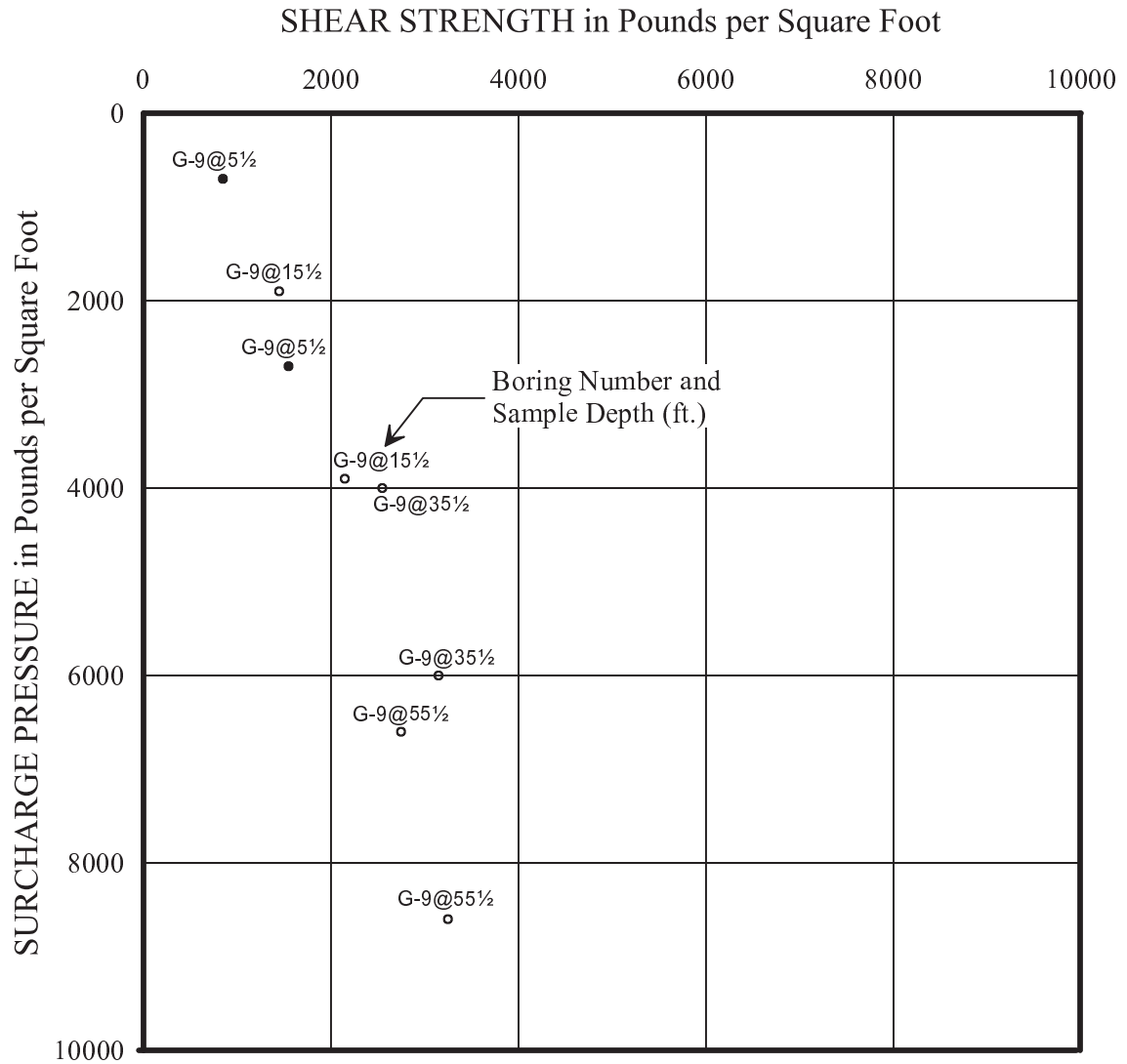
Appendix D

Figure D-1.1: Direct Shear Test Results (ACE Phase)
Figure D-1.2: Direct Shear Test Results (PE Phase)
Figure D-1.3: Direct Shear Test Results (Adv. PE Phase)
Figure D-1.4: Direct Shear Test Results (Prior Projects)
Figure D-2.1: Triaxial Test Results (PE Phase)
Figure D-2.2: Triaxial Test Results (Adv. PE Phase)
Figure D-3.1: Consolidation Test Results (ACE Phase)
Figure D-3.2: Consolidation Test Results (PE Phase)
Figure D-3.3: Consolidation Test Results (Adv. PE Phase)
Figure D-3.4: Consolidation Test Results (Prior Projects)
Figure D-4.1: Hydroconsolidation Test Results (ACE Phase)
Figure D-4.2: Hydroconsolidation Test Results (PE Phase)
Figure D-4.3: Hydroconsolidation Test Results (Adv. PE Phase)
Figure D-5.1: Particle Size Distribution Test Results (ACE Phase)
Figure D-5.2: Particle Size Distribution Test Results (PE Phase)
Figure D-5.3: Particle Size Distribution Test Results (Adv. PE Phase)
Figure D-6.1: Atterberg Limits Test Results (ACE Phase)
Figure D-6.2: Atterberg Limits Test Results (PE Phase)
Figure D-6.3: Atterberg Limits Test Results (Adv. PE Phase)-
Figure D-7.1: Corrosion Test Results (ACE Phase)
Figure D-7.2: Corrosion Test Results (PE Phase)
Figure D-7.3: Corrosion Evaluation Report (Adv. PE Phase)
Figure D-8.1: Abrasion Test Results (PE Phase)
Figure D-8.2: Abrasion Test Results (Adv. PE Phase)



KEY: • Sample tested at field moisture content
 ○ Samples tested to a moisture content near saturation

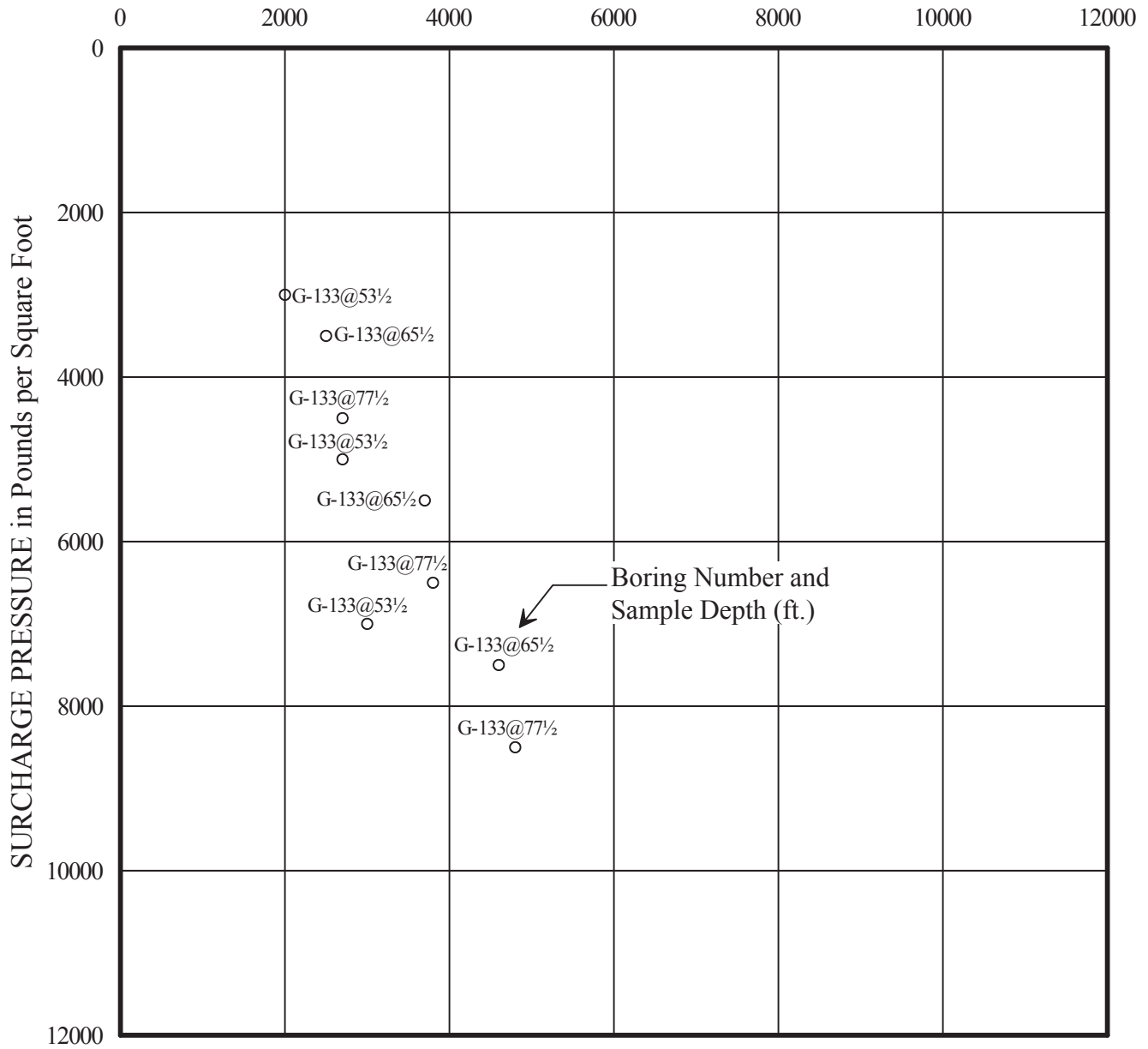
Prepared/Date: NH 9/01/11
 Checked/Date: LH 9/12/12



KEY: ● Sample tested at field moisture content
○ Samples tested to a moisture content near saturation

Prepared/Date: NH 9/01/11
Checked/Date: LH 9/12/12

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

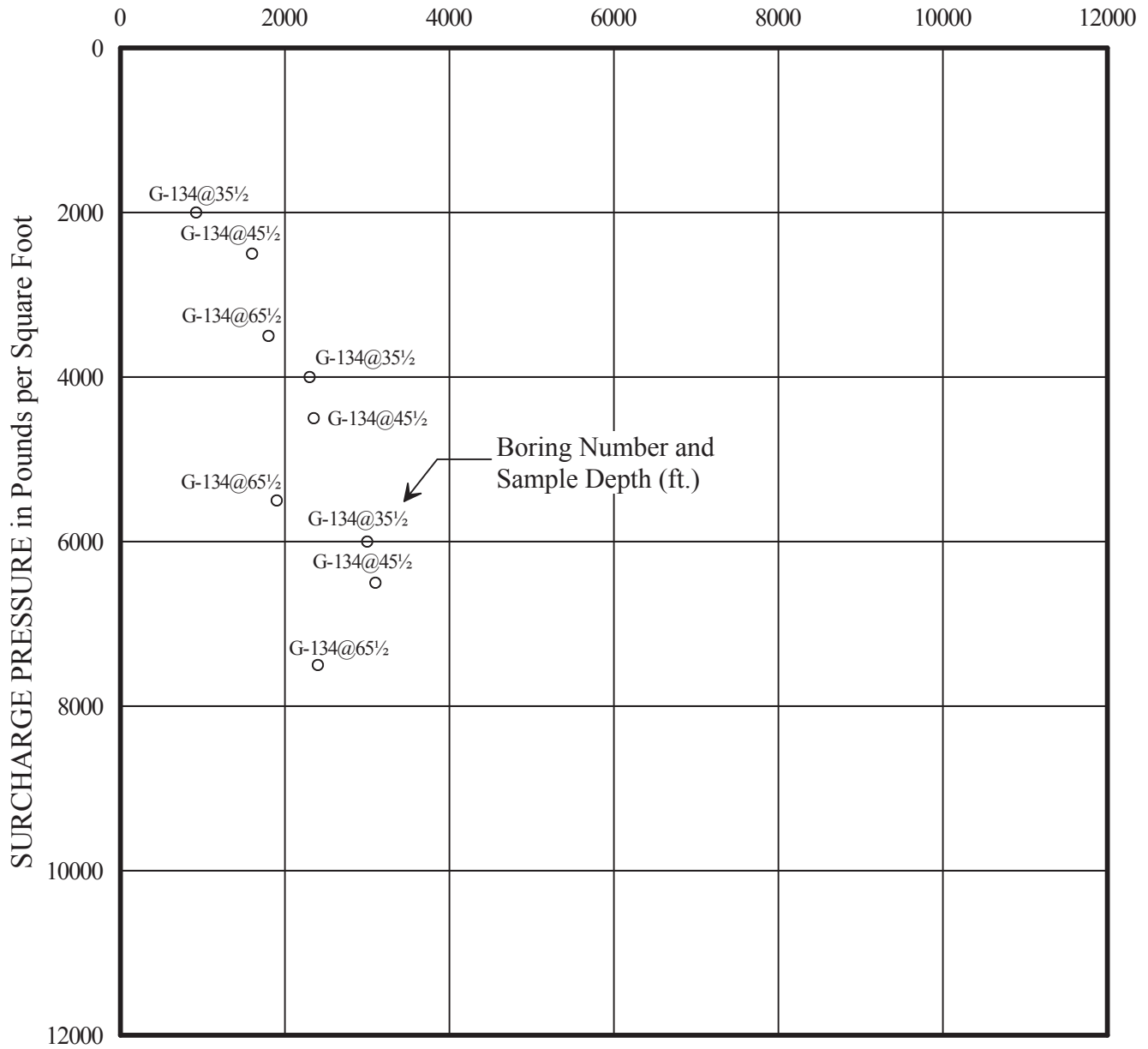
Prepared/Date: JF 9/29/11
Checked/Date: LT 9/29/11

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.1

SHEAR STRENGTH in Pounds per Square Foot



KEY: ● Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

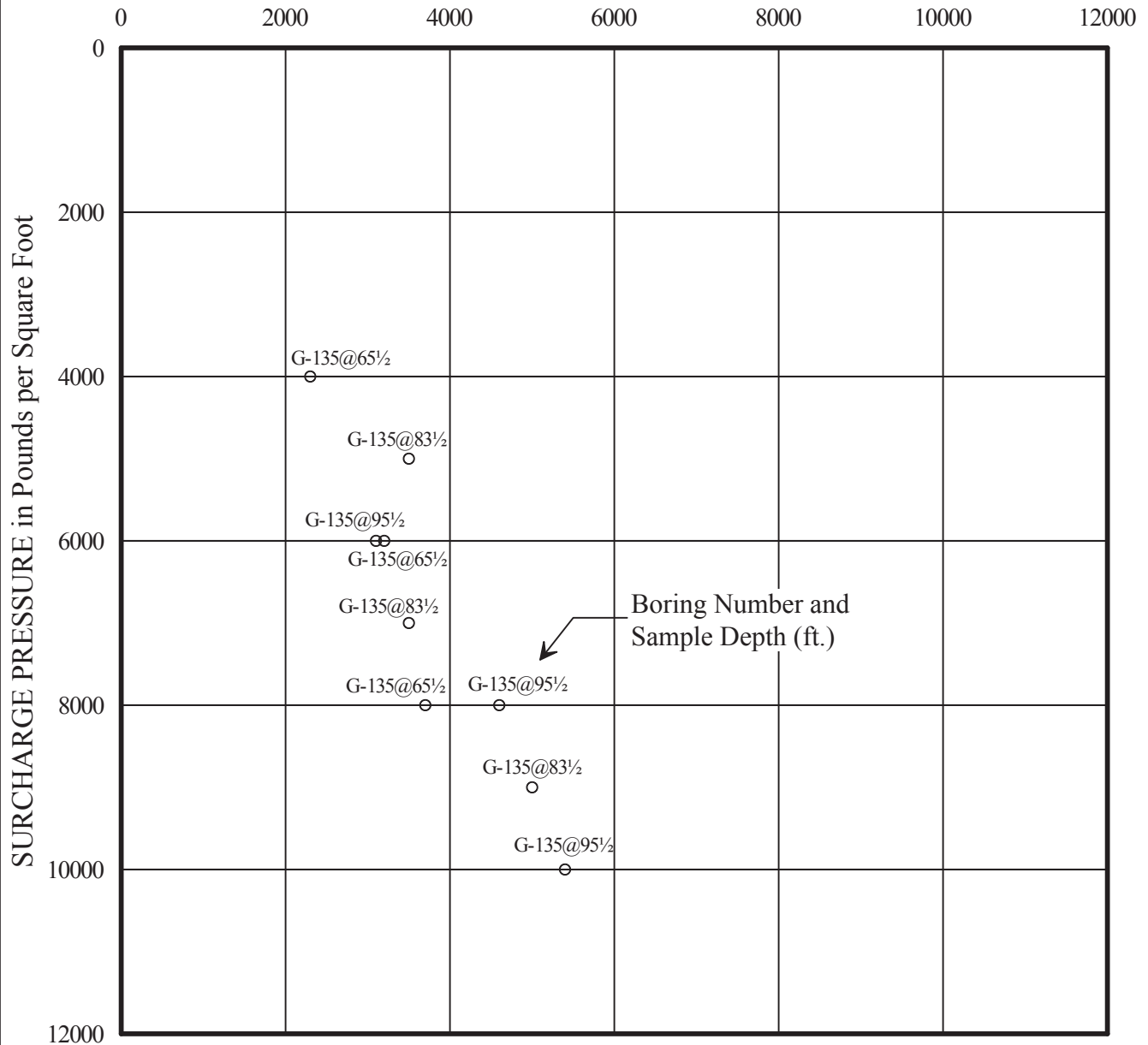
Prepared/Date: WL 10/4/11
Checked/Date: LT 10/4/11

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Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.2

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

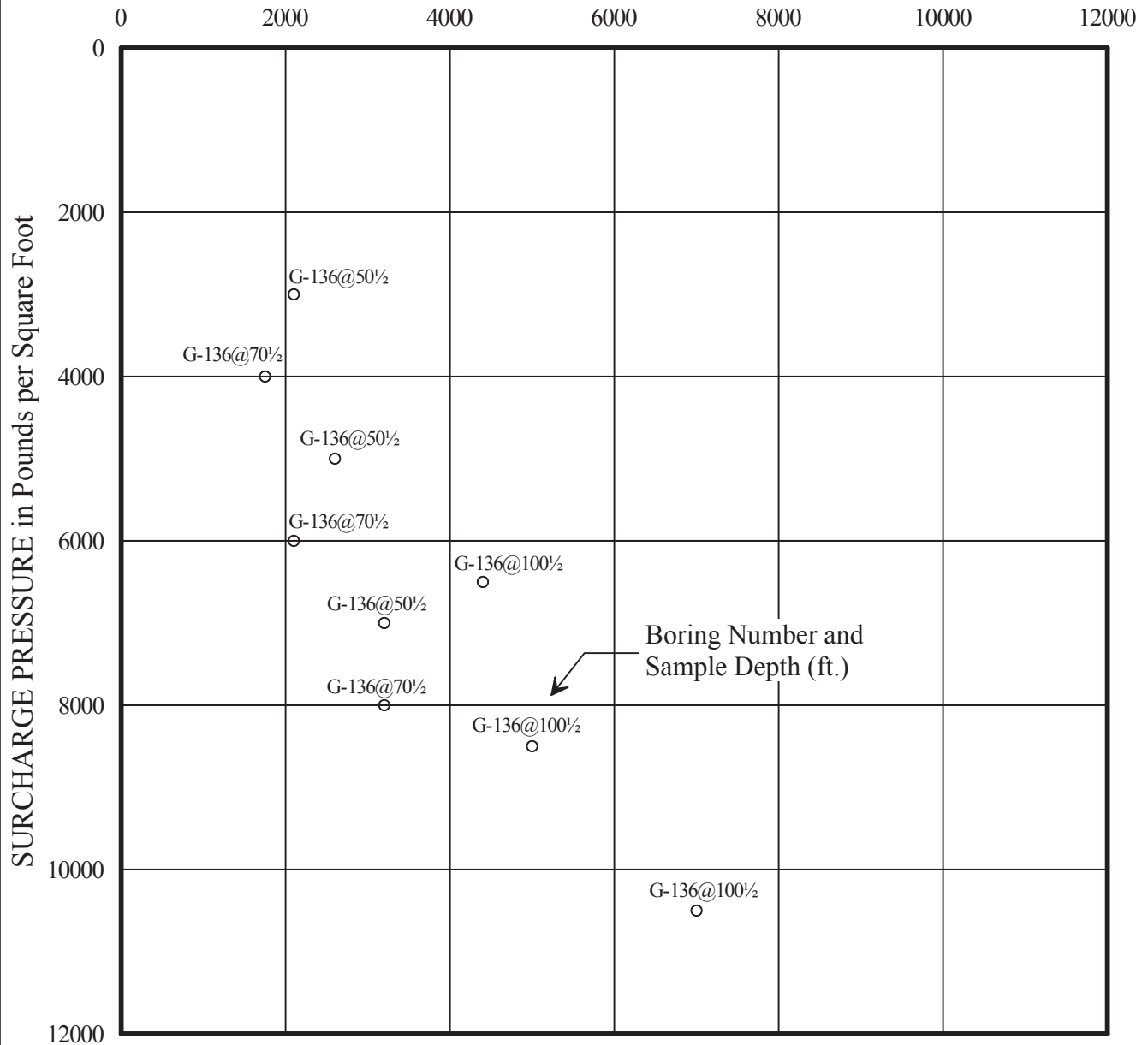
Prepared/Date: WL 10/4/11
Checked/Date: LT 10/4/11

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Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.3

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

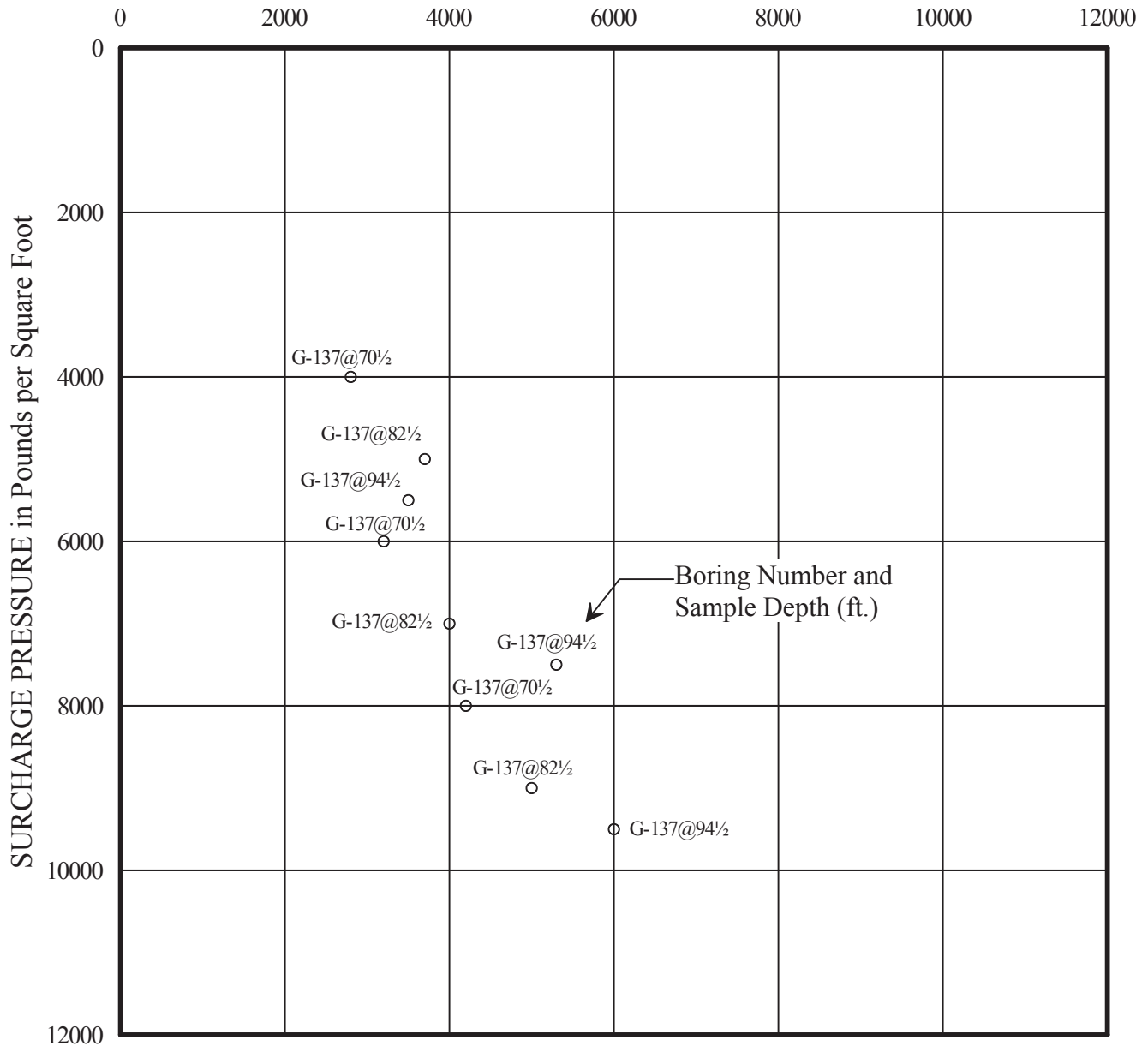
Prepared/Date: WL 10/4/11
Checked/Date: LT 10/4/11

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Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.4

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

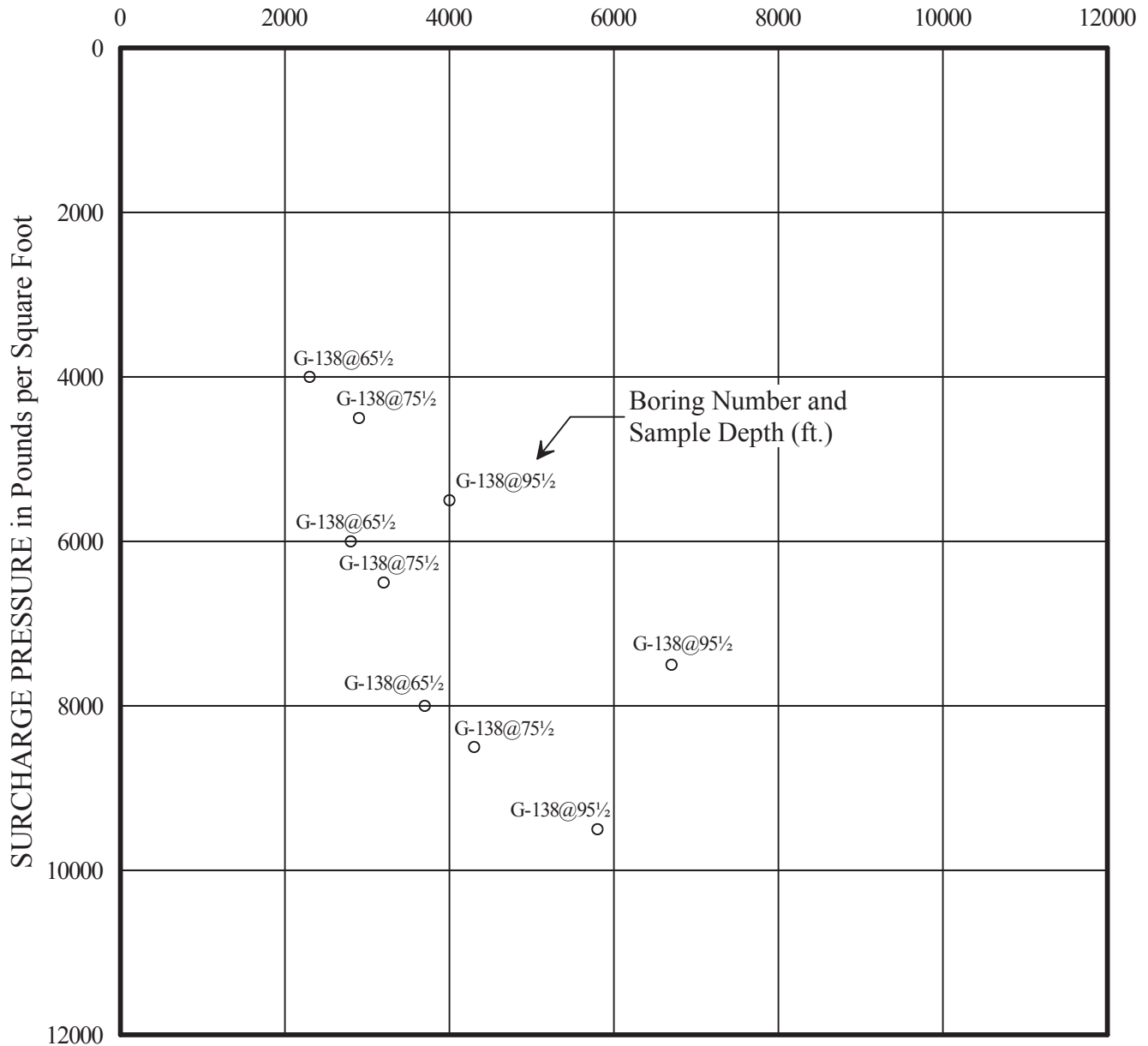
Prepared/Date: JF 10/4/11
Checked/Date: LT 10/4/11

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DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.5

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

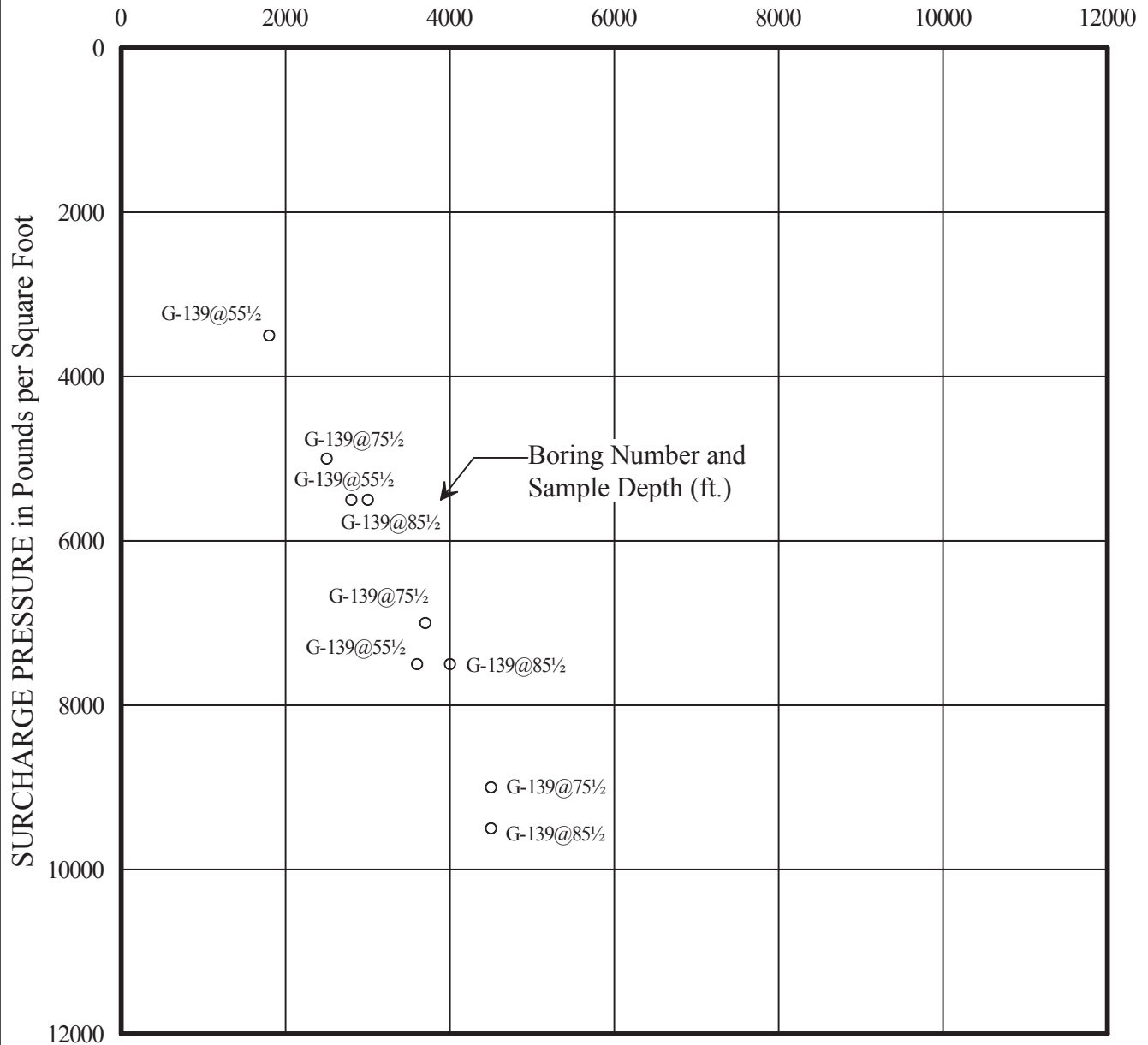
Prepared/Date: YN 10/4/11
Checked/Date: LT 10/4/11

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Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.6

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

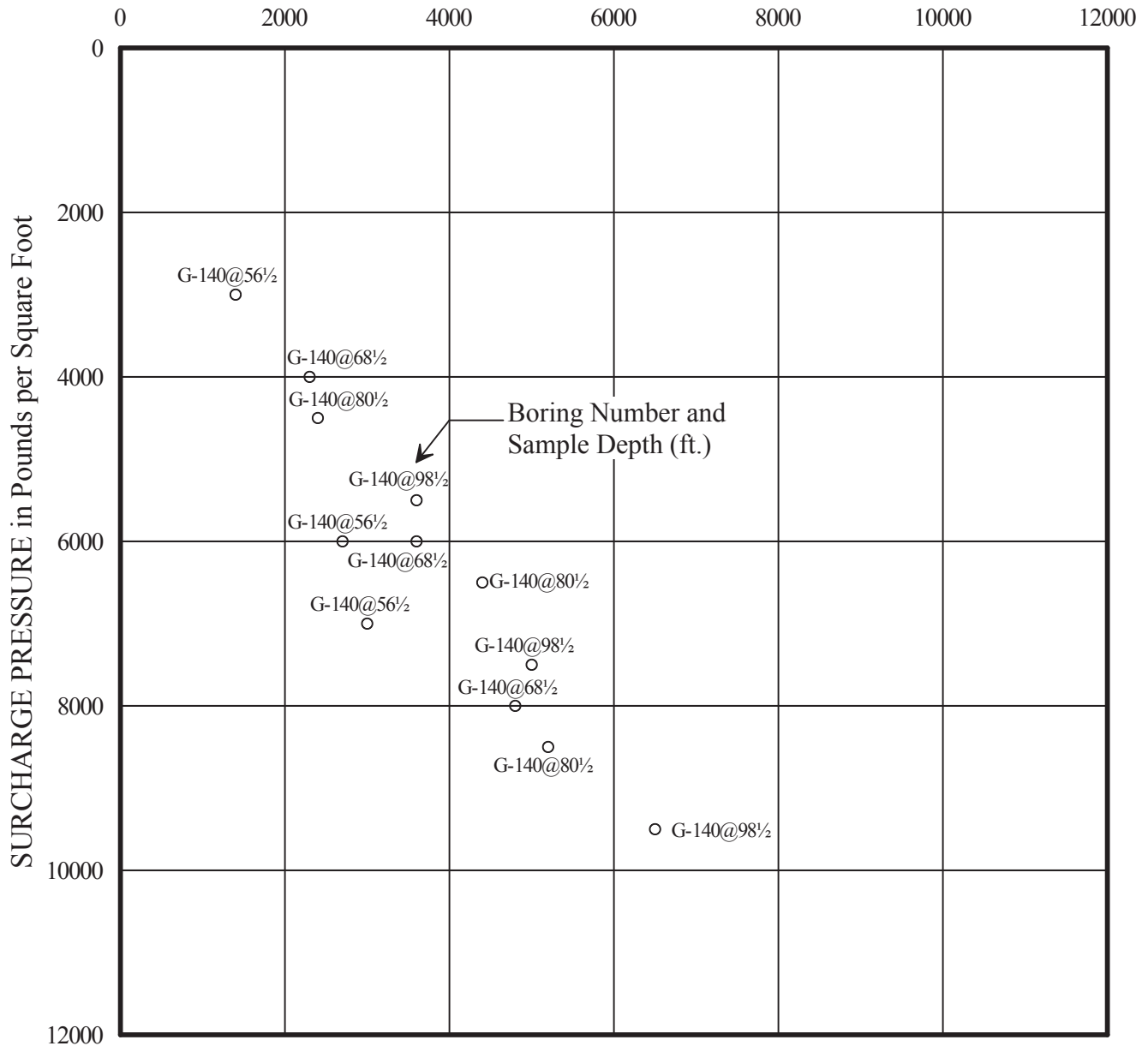
Prepared/Date: WL 10/5/11
Checked/Date: LT 10/6/11

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Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.7

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

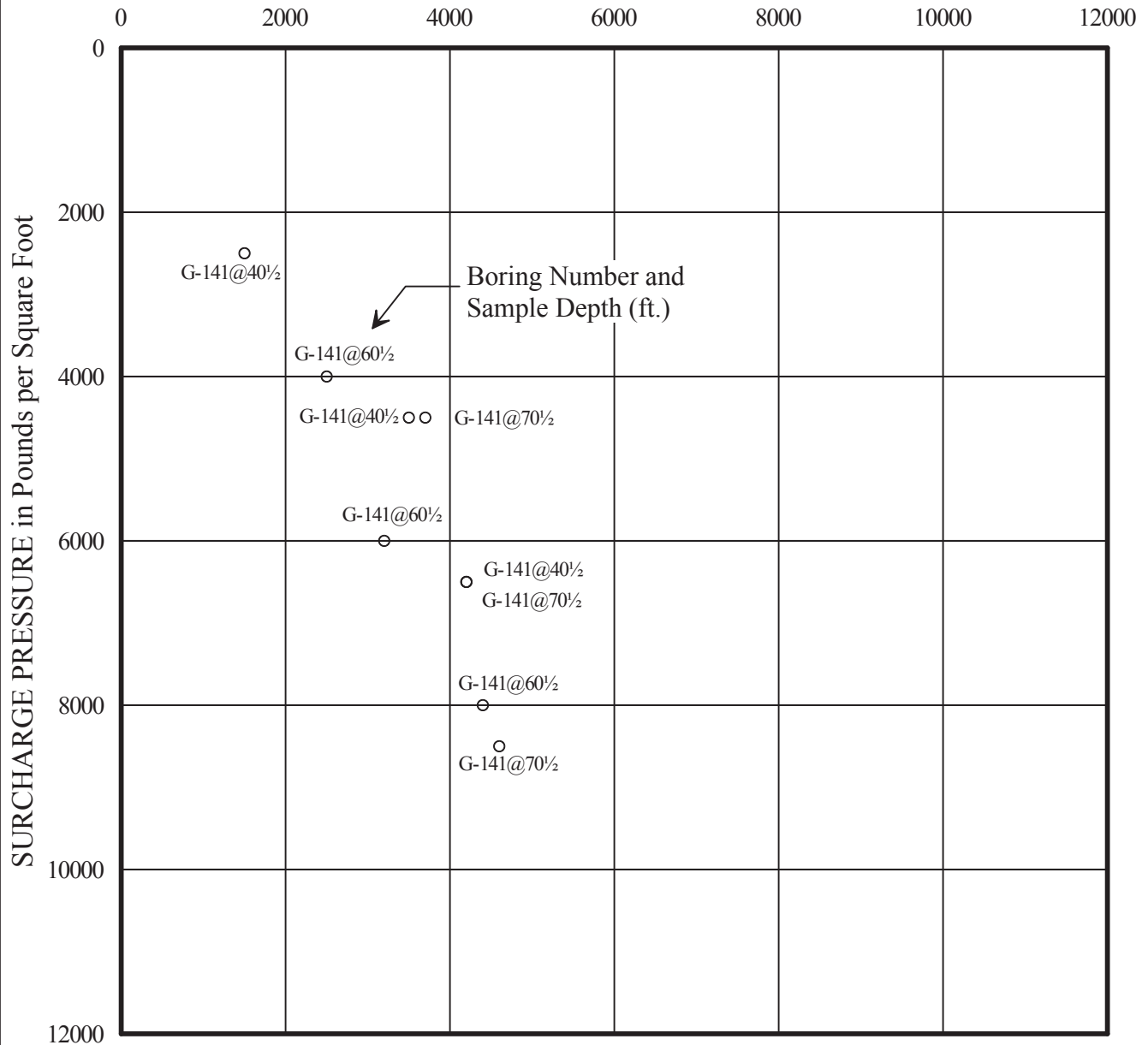
Prepared/Date: JF 10/4/11
Checked/Date: LT10/4/11

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Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.8

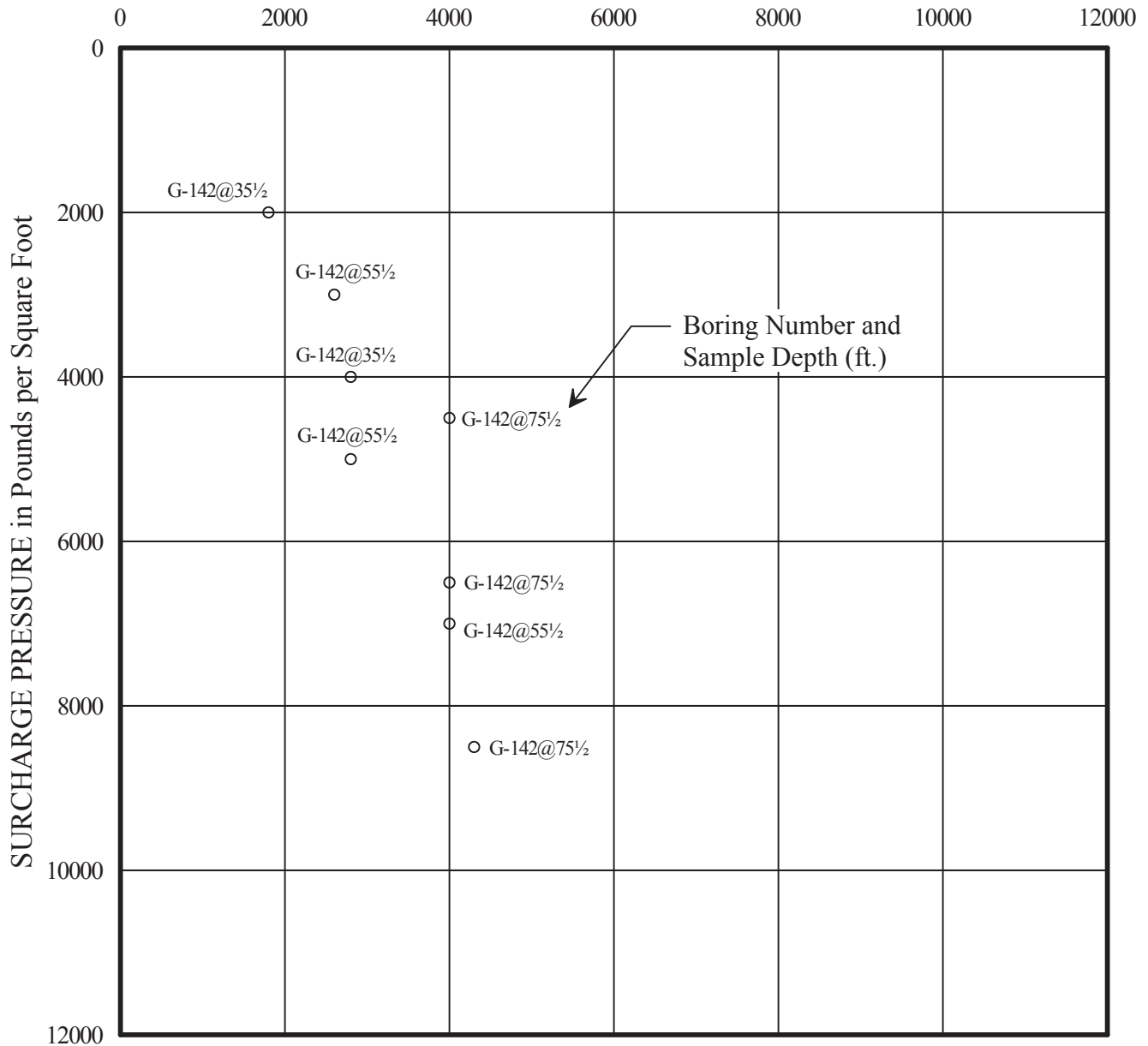
SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
 ◦ Samples soaked to a moisture content near saturation

Prepared/Date: WL 10/4/11
 Checked/Date: LT 10/4/11

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
 ○ Samples soaked to a moisture content near saturation

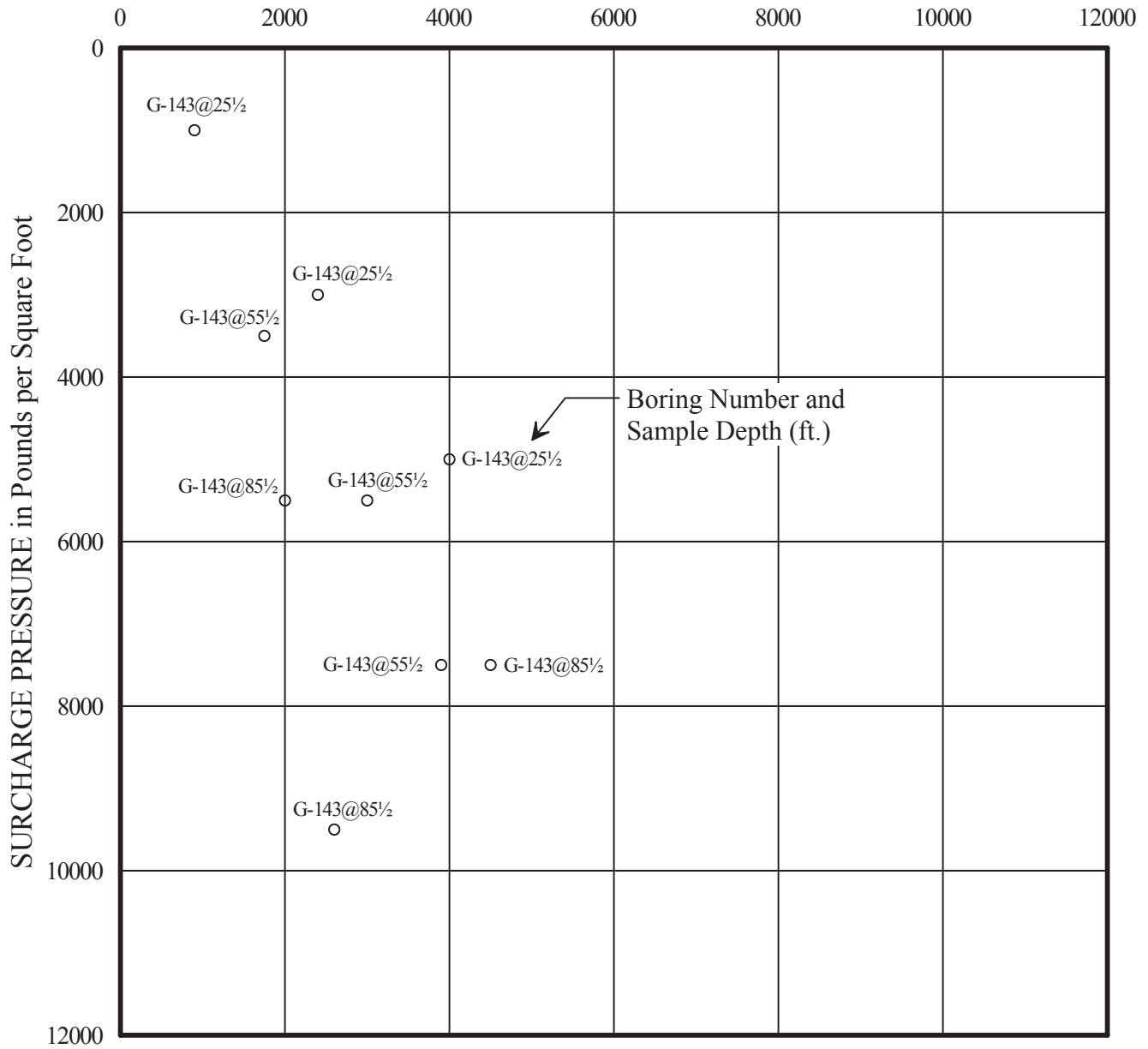
Prepared/Date: WL 10/6/11
 Checked/Date: LT 10/6/11

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 Los Angeles, California



DIRECT SHEAR TEST DATA
 Project No.: 4953-10-1561
 Figure D-1.2.10

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

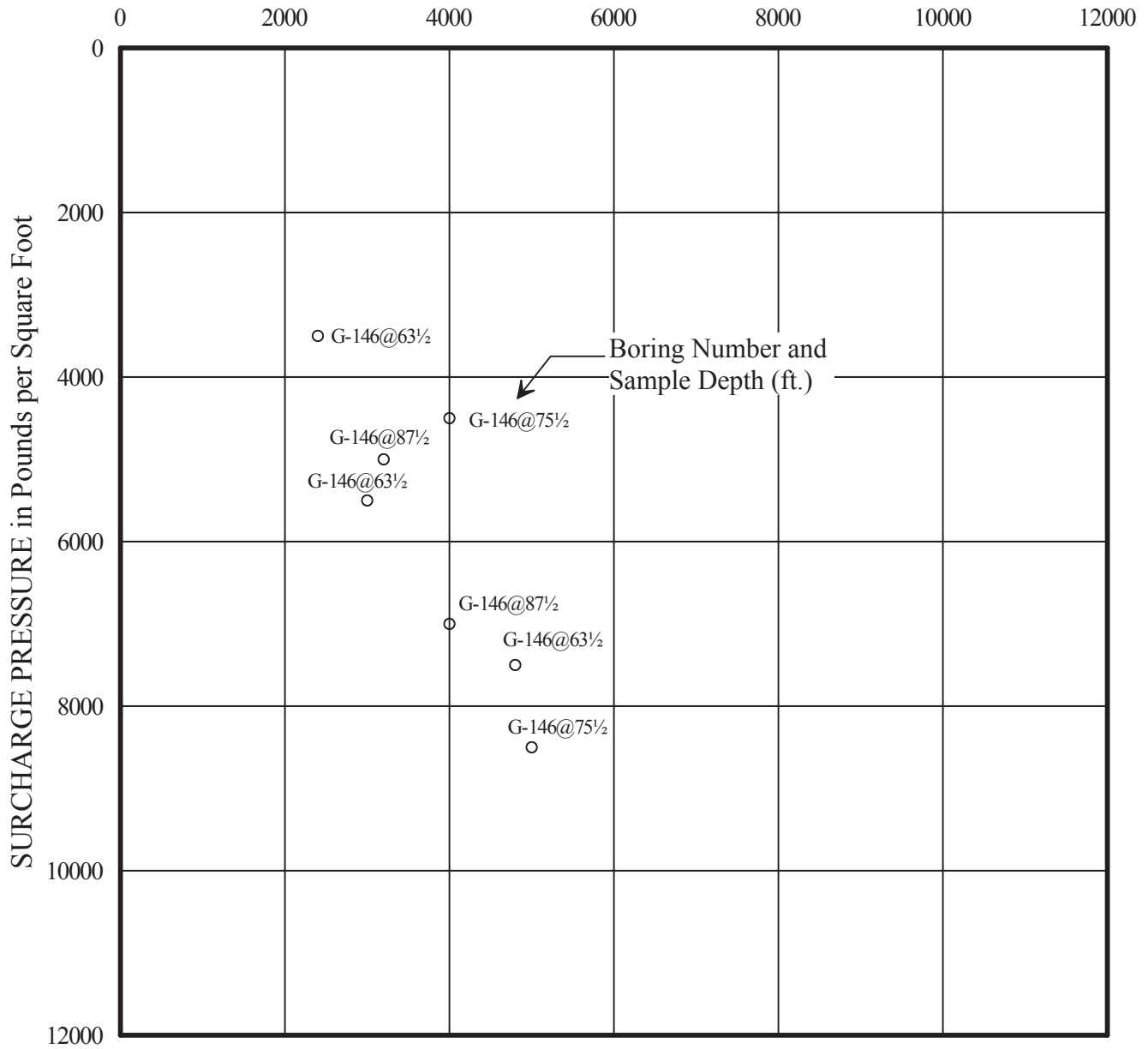
Prepared/Date: WL 10/2/11
Checked/Date: LT 10/3/11

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Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.11

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

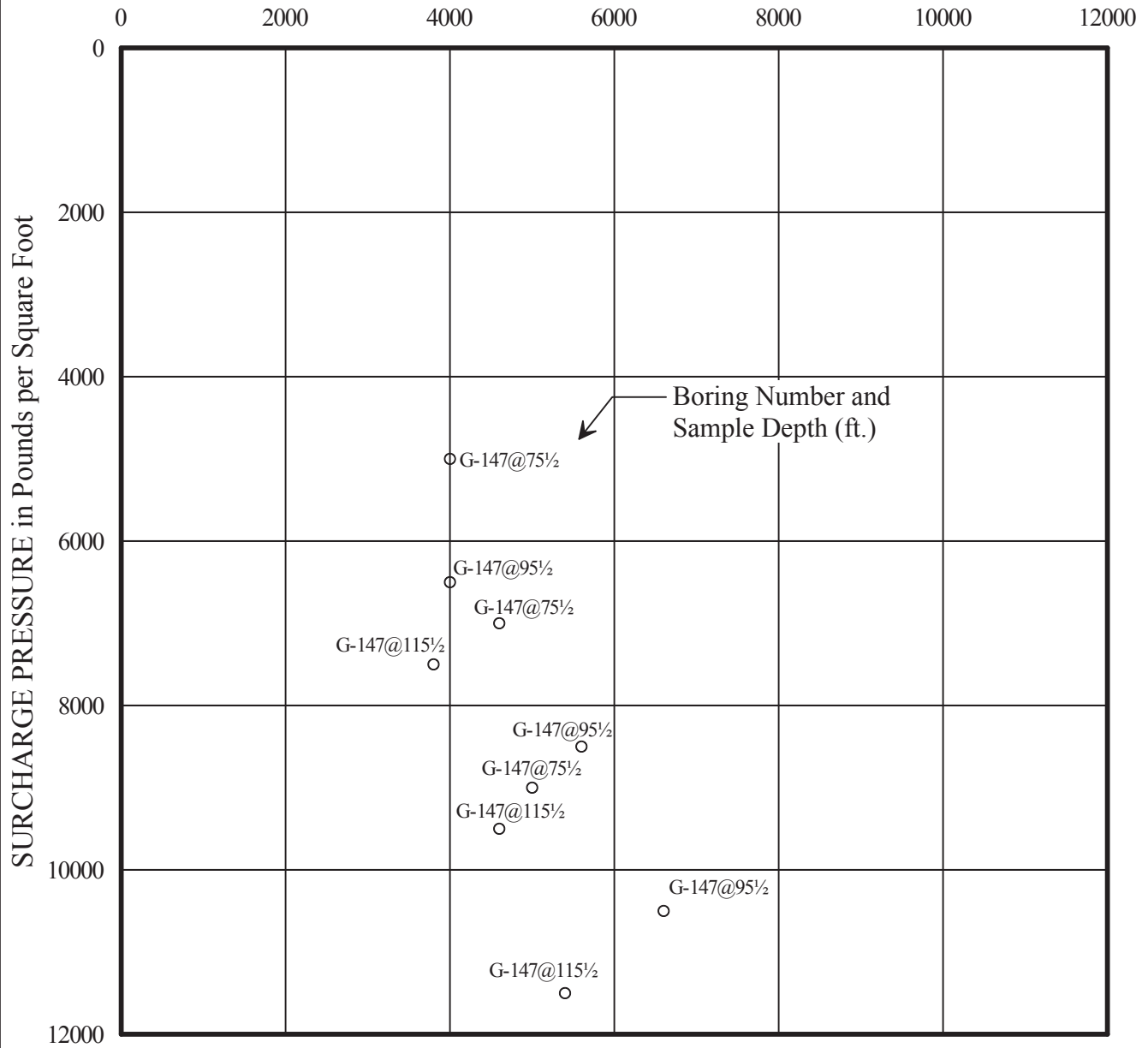
Prepared/Date: JF 10/4/11
Checked/Date: LT 10/4/11

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.13

SHEAR STRENGTH in Pounds per Square Foot



KEY: ● Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

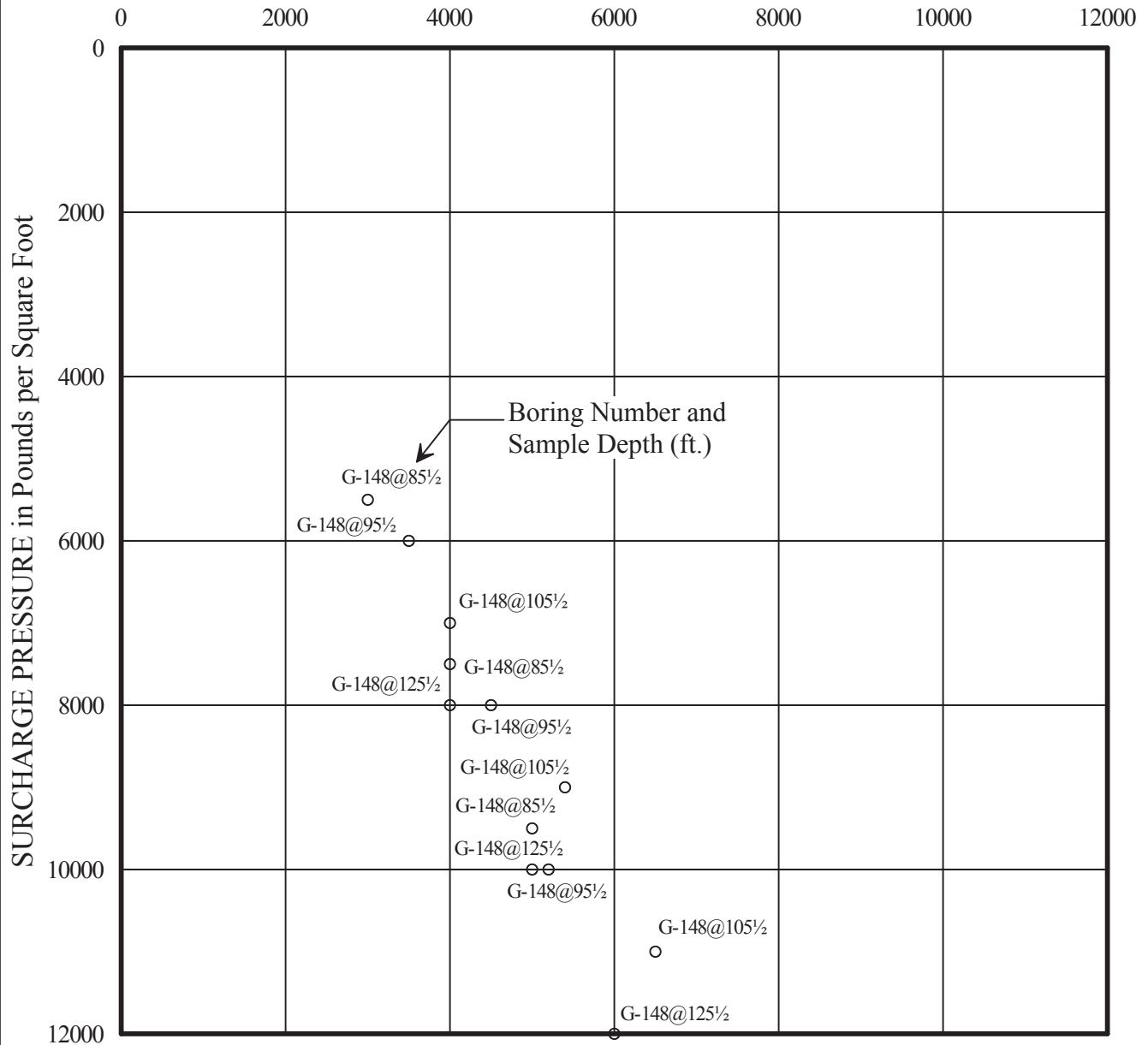
Prepared/Date: WL 10/2/11
Checked/Date: LT 10/3/11

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.14

SHEAR STRENGTH in Pounds per Square Foot

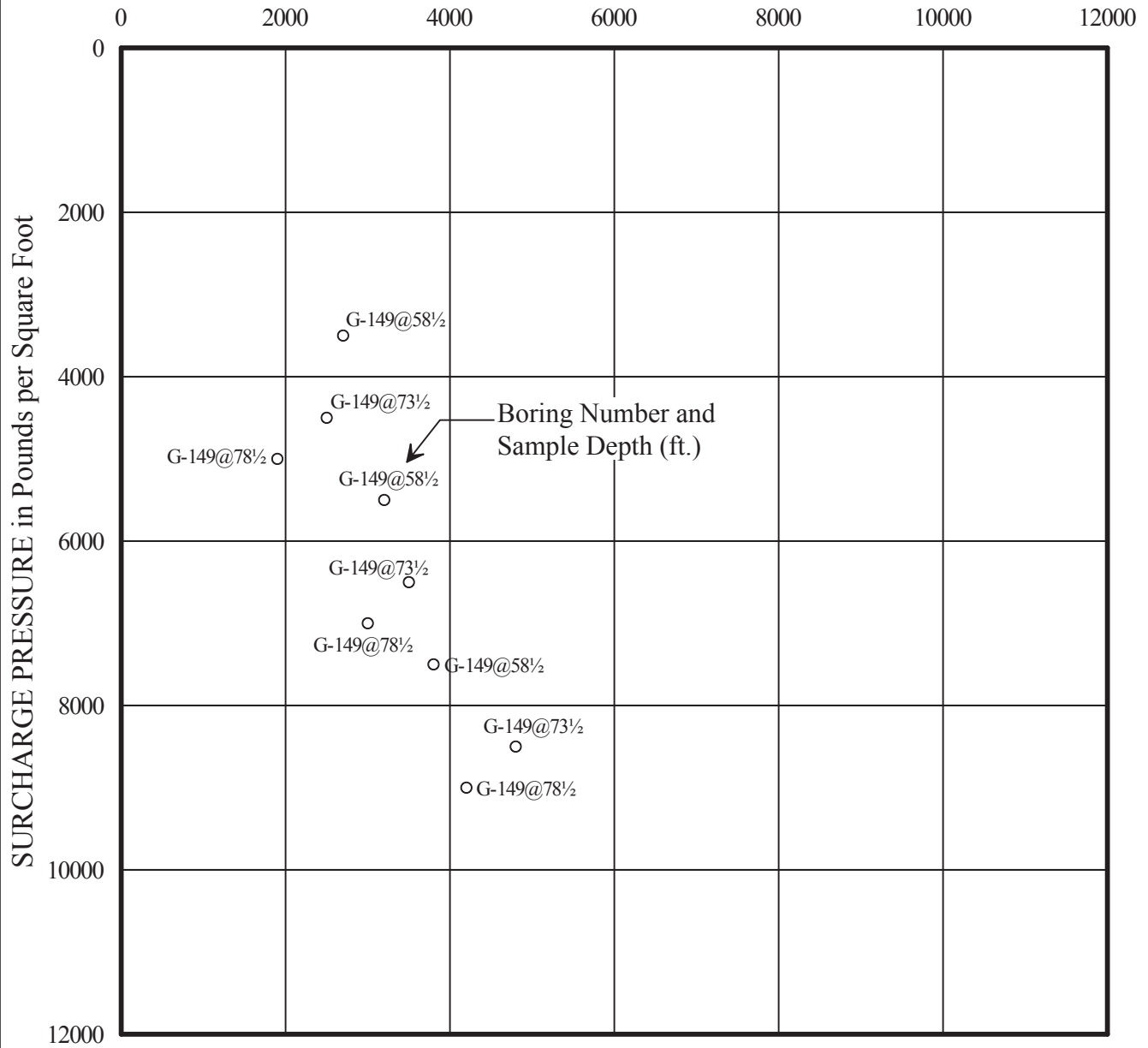


KEY:

- Samples tested at field moisture content
- Samples soaked to a moisture content near saturation

Prepared/Date: WL 10/5/11
Checked/Date: LT 10/6/11

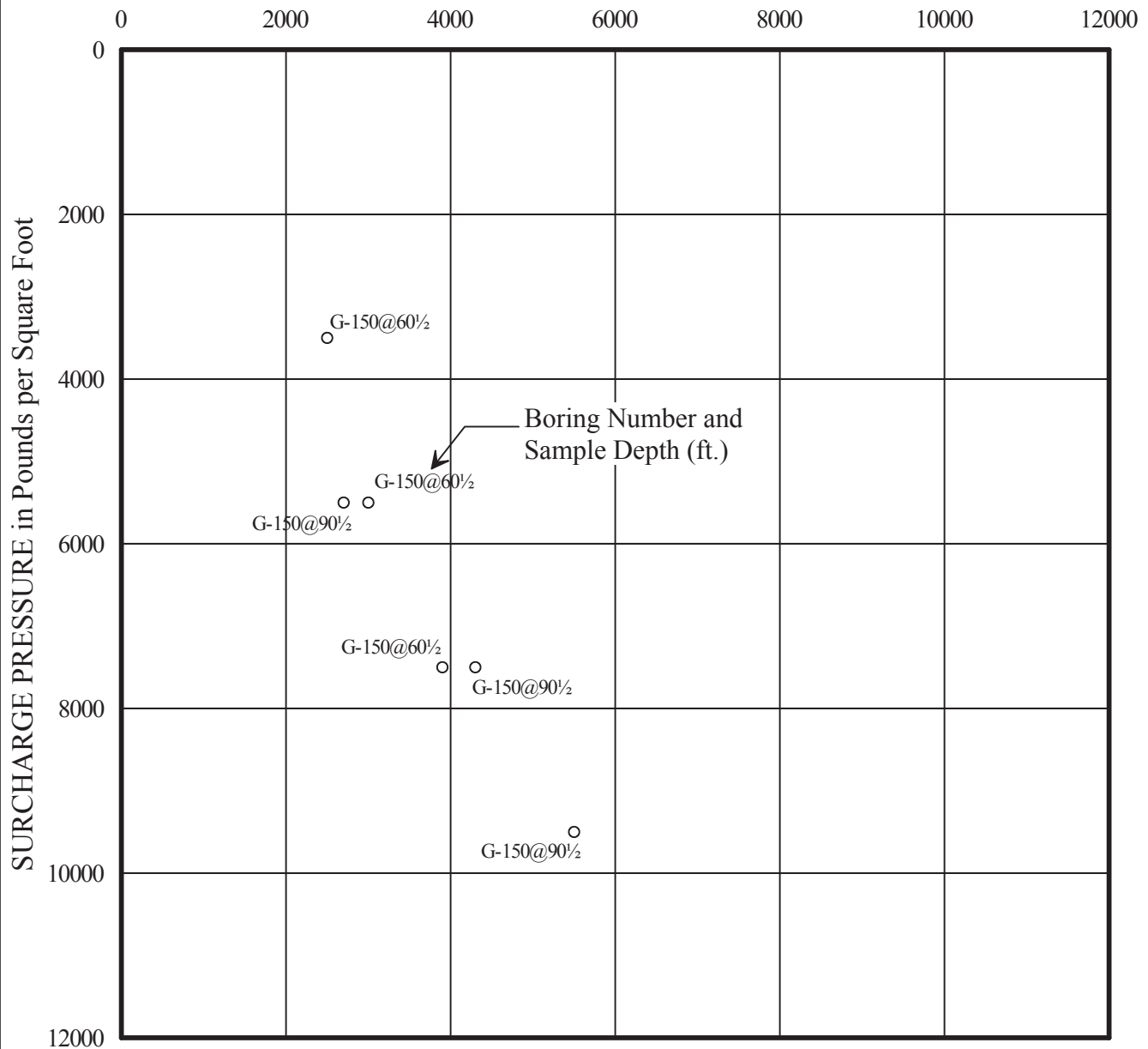
SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

Prepared/Date: WL 10/4/11
Checked/Date: LT 10/4/11

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

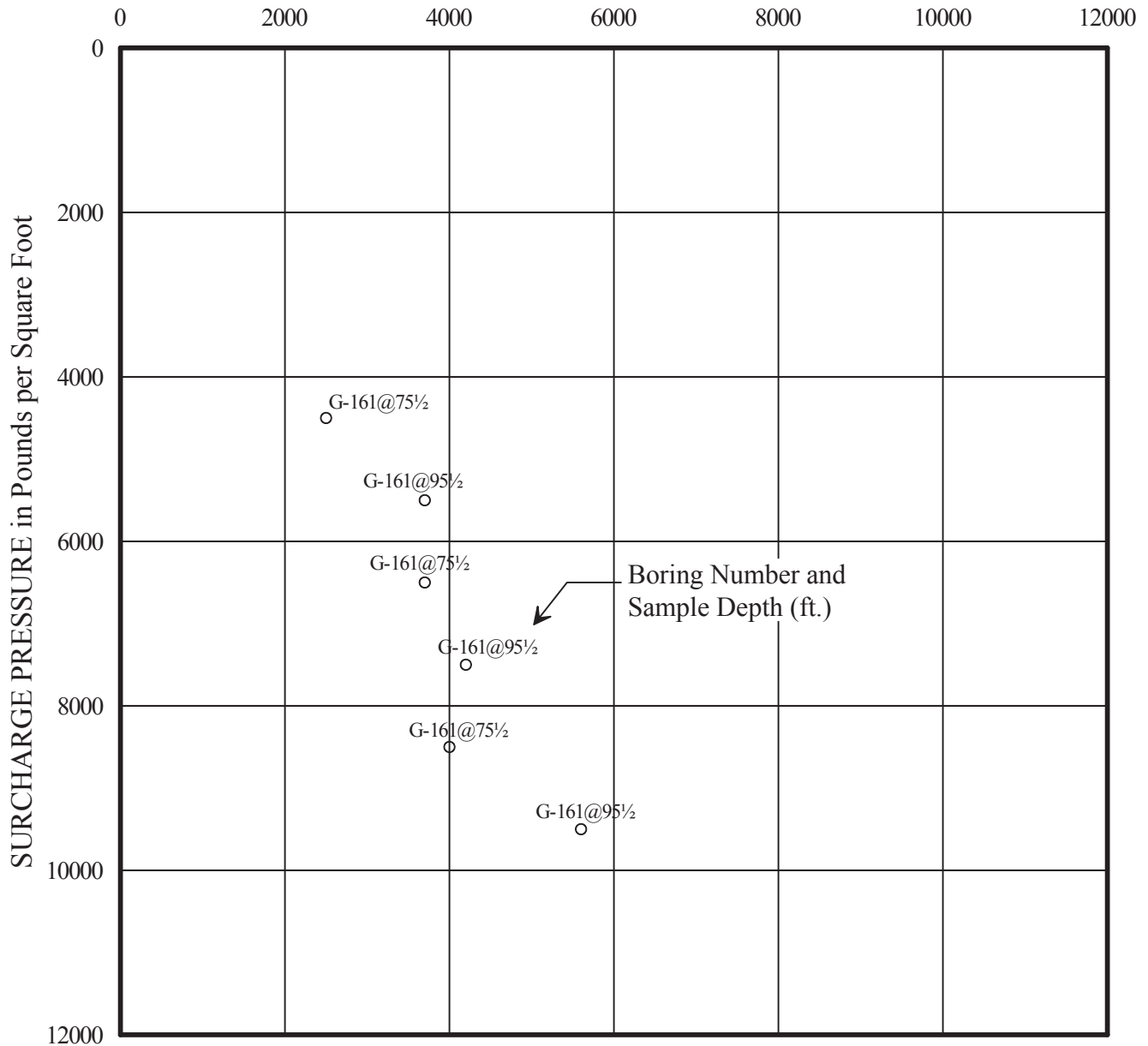
Prepared/Date: WL 10/4/11
Checked/Date: LT 10/4/11

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.17

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
 ○ Samples soaked to a moisture content near saturation

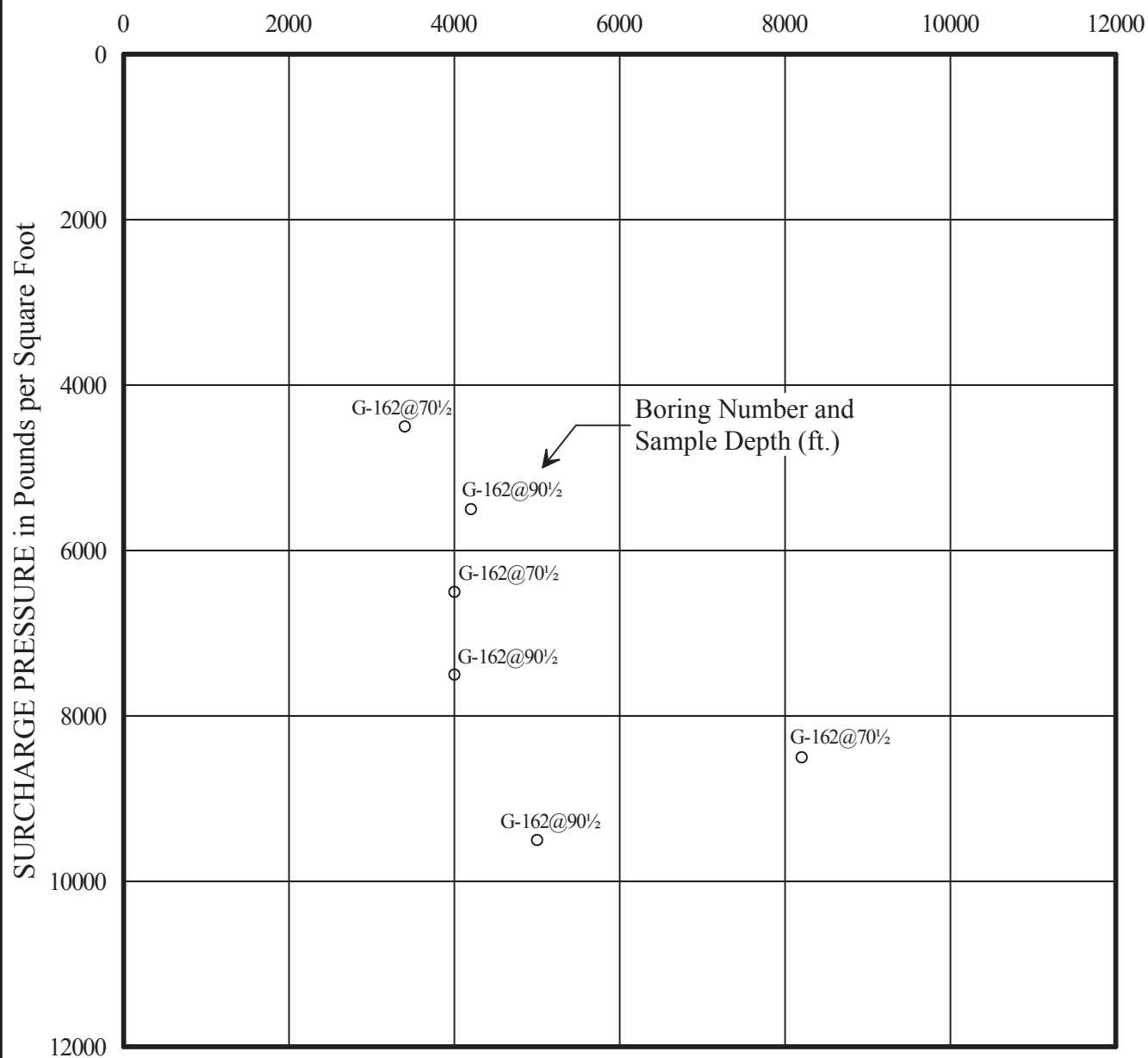
Prepared/Date: YN 10/3/11
 Checked/Date: LT 10/3/11

MTA Westside Subway Extension
 Los Angeles, California



DIRECT SHEAR TEST DATA
 Project No.: 4953-10-1561
 Figure D-1.2.18

SHEAR STRENGTH in Pounds per Square Foot



KEY:

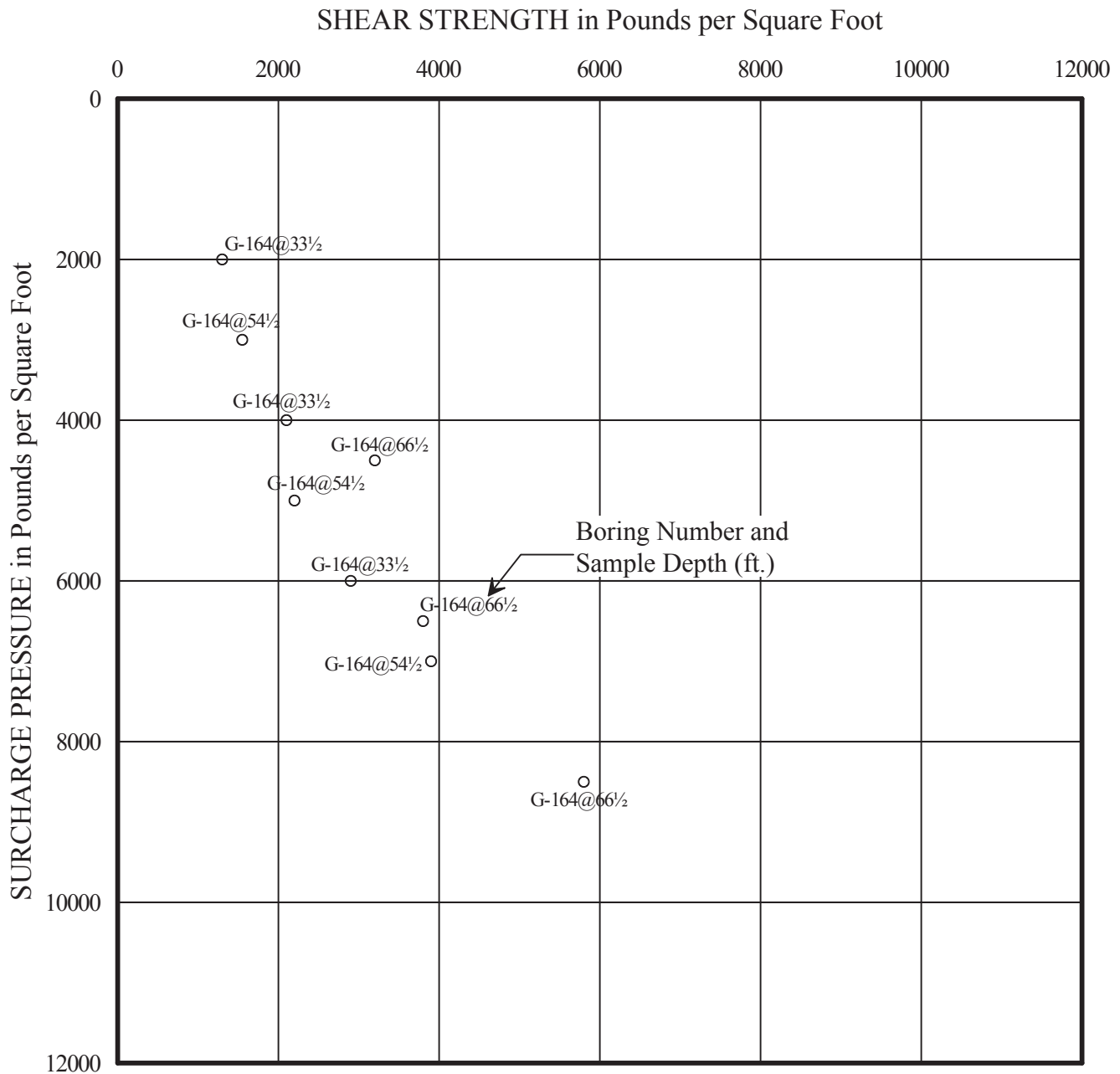
- Samples tested at field moisture content
- Samples soaked to a moisture content near saturation

Prepared/Date: YN 10/3/11
Checked/Date: LT 10/3/11

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.19



KEY:

- Samples tested at field moisture content
- Samples soaked to a moisture content near saturation

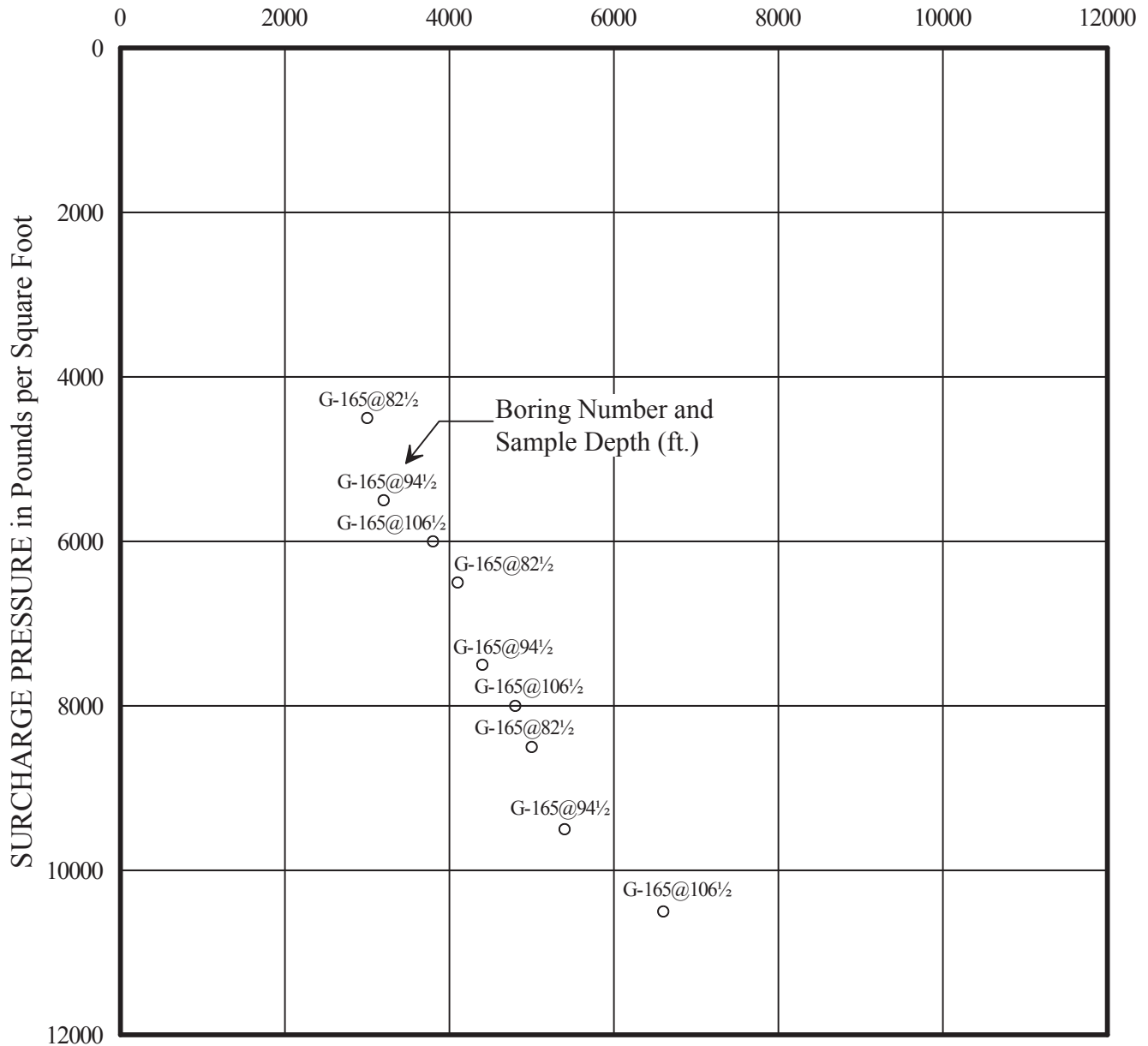
Prepared/Date: YN 10/4/11
Checked/Date: LT 10/4/11

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.20

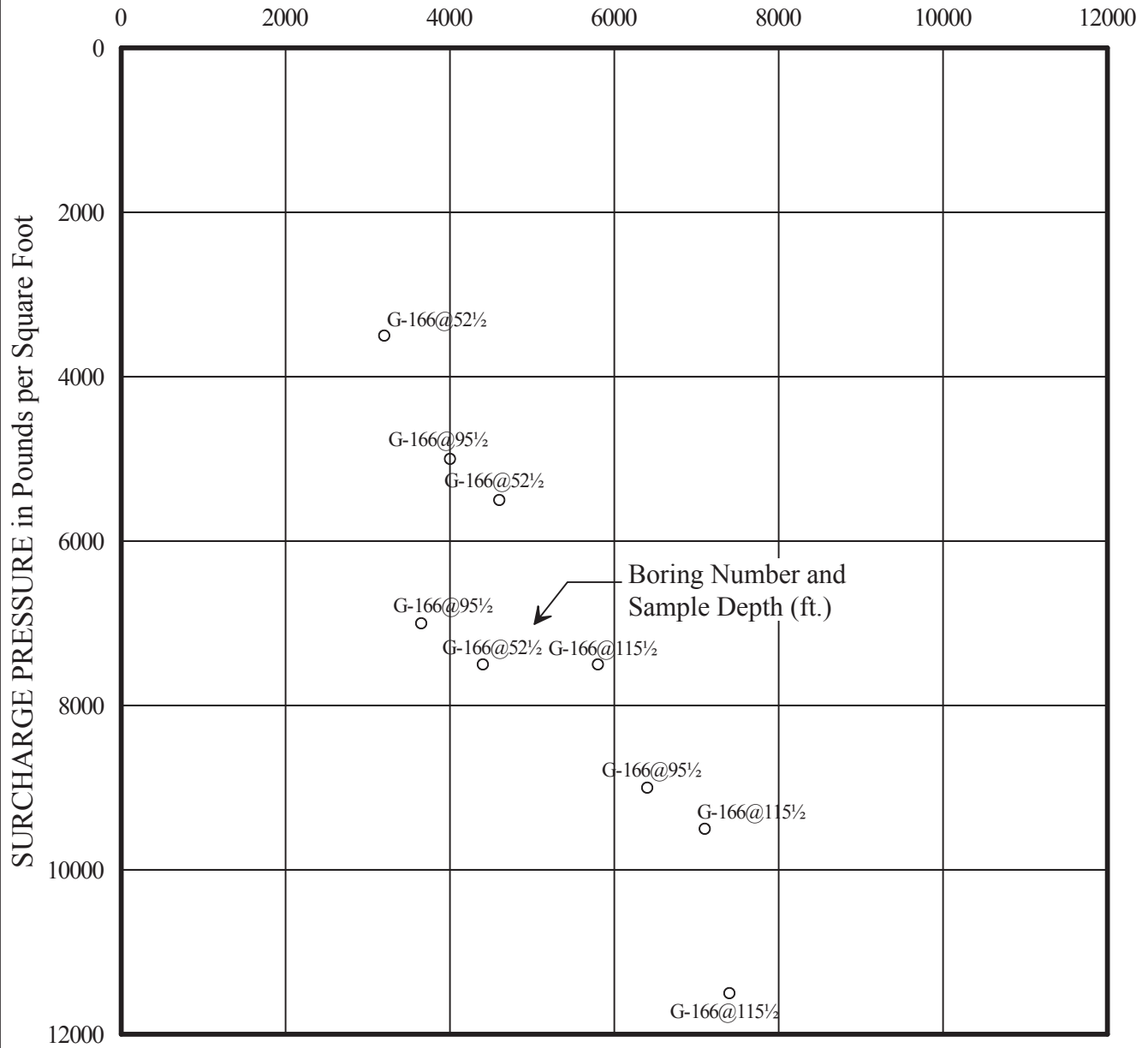
SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

Prepared/Date: YN 10/3/11
Checked/Date: LT 10/3/11

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

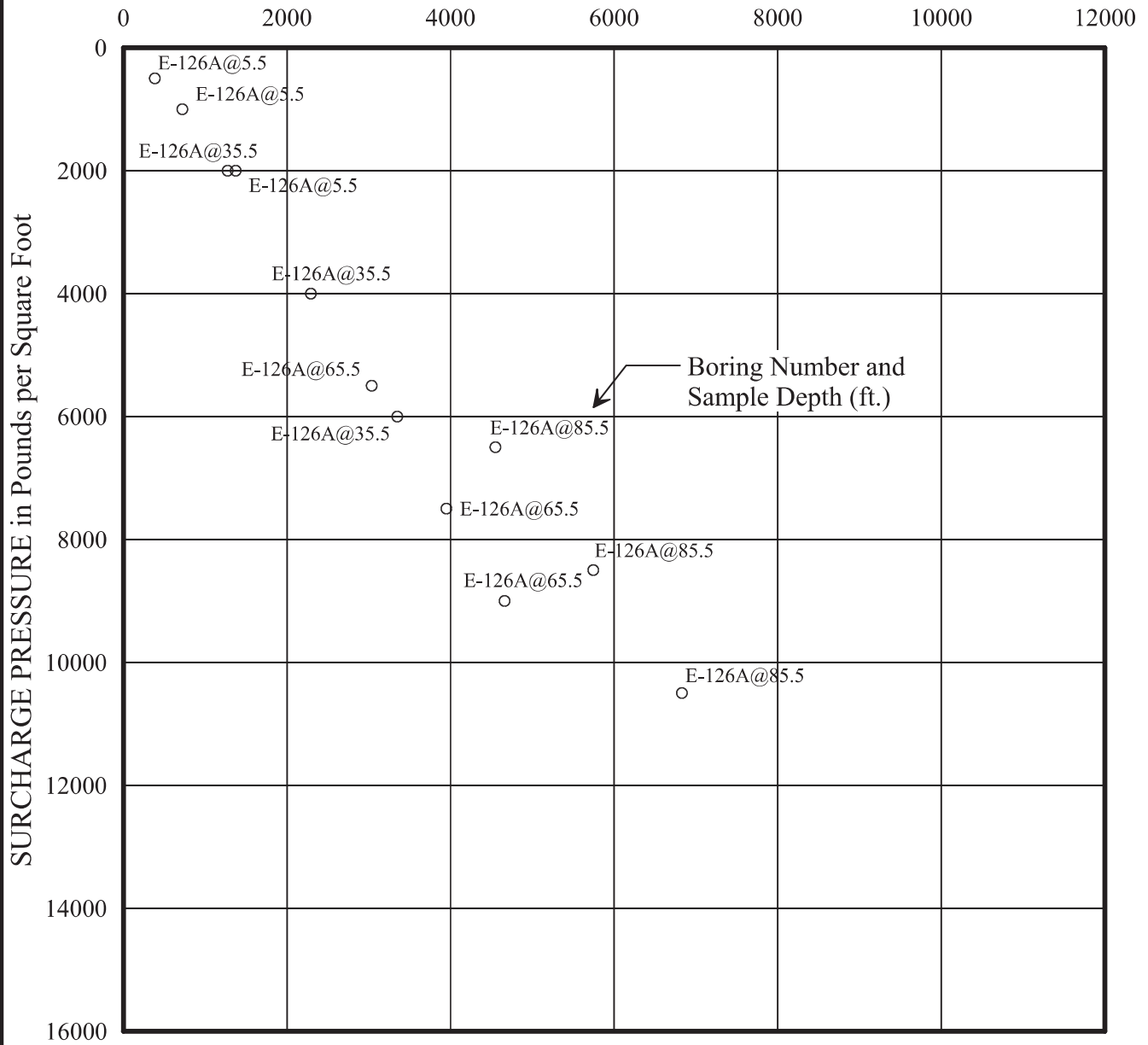
Prepared/Date: YN 10/3/11
Checked/Date: LT 10/3/11

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-10-1561
Figure D-1.2.22

SHEAR STRENGTH in Pounds per Square Foot



KEY:

- Samples tested at field moisture content
- Samples soaked to a moisture content near saturation

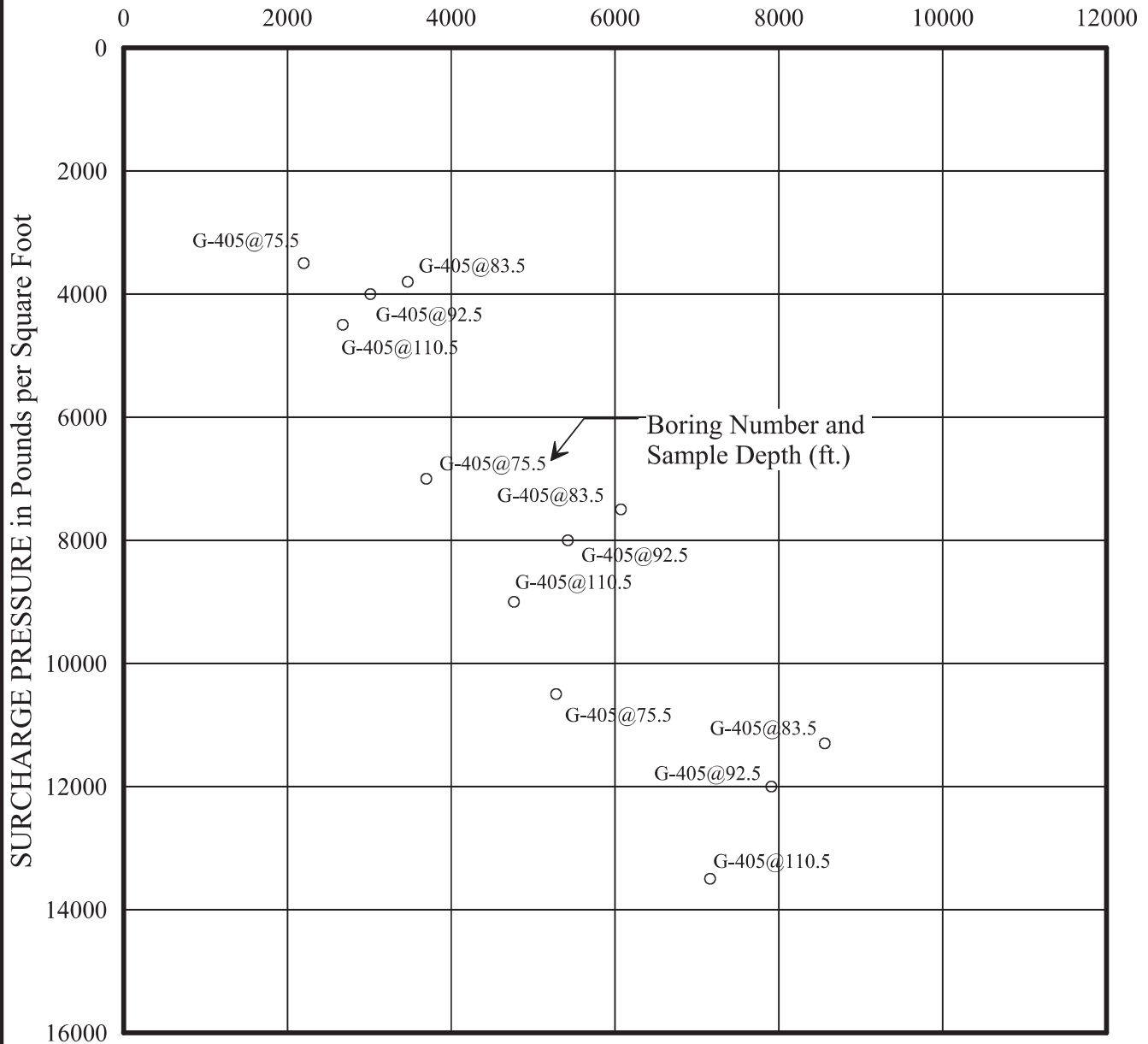
Prepared/Date: KC 12/3/15
Checked/Date: HP 12/4/15

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-11-1423
Figure D-1.3.1

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

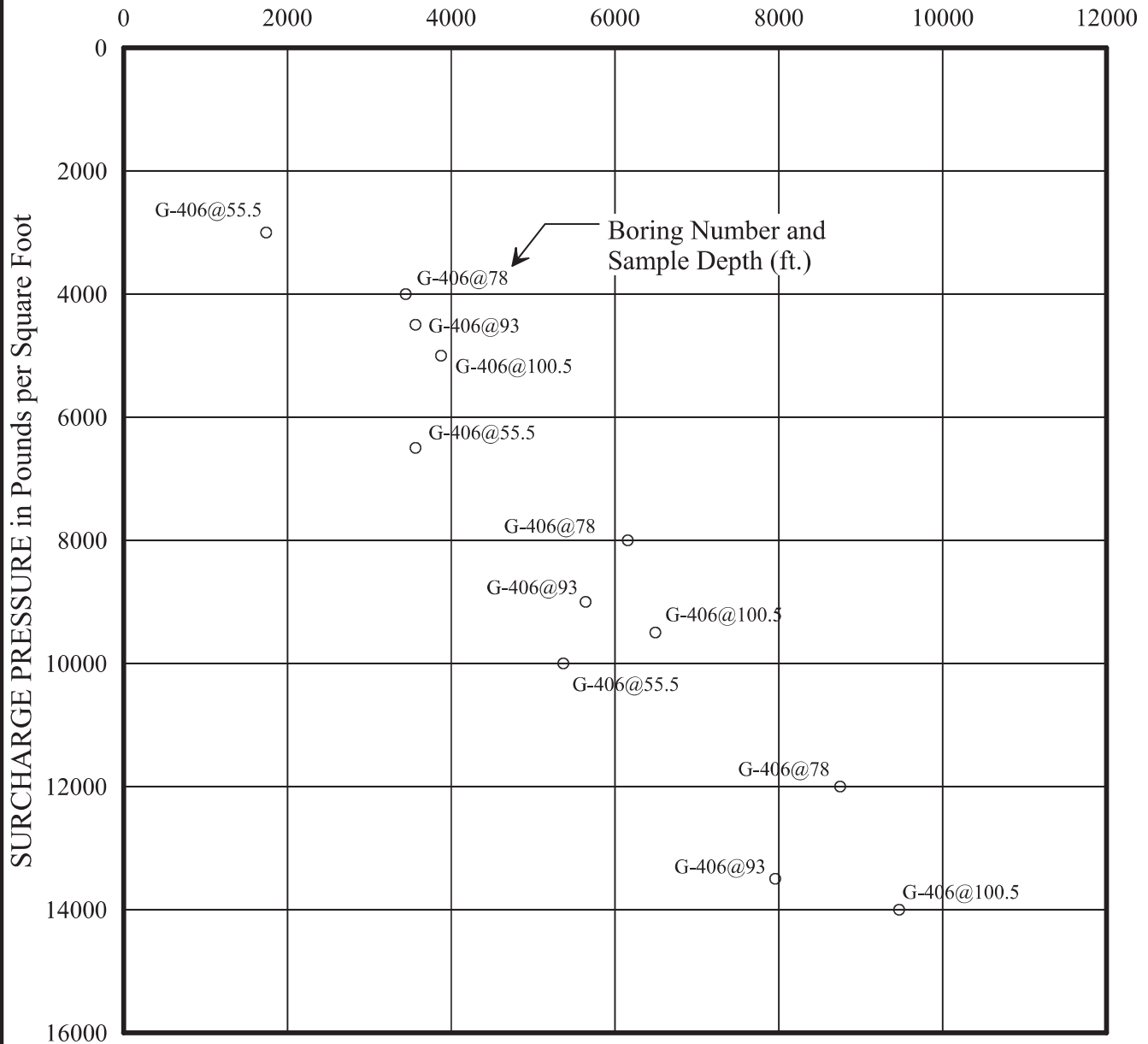
Prepared/Date: KC 12/3/15
Checked/Date: HP 12/4/15

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-11-1423
Figure D-1.3.2

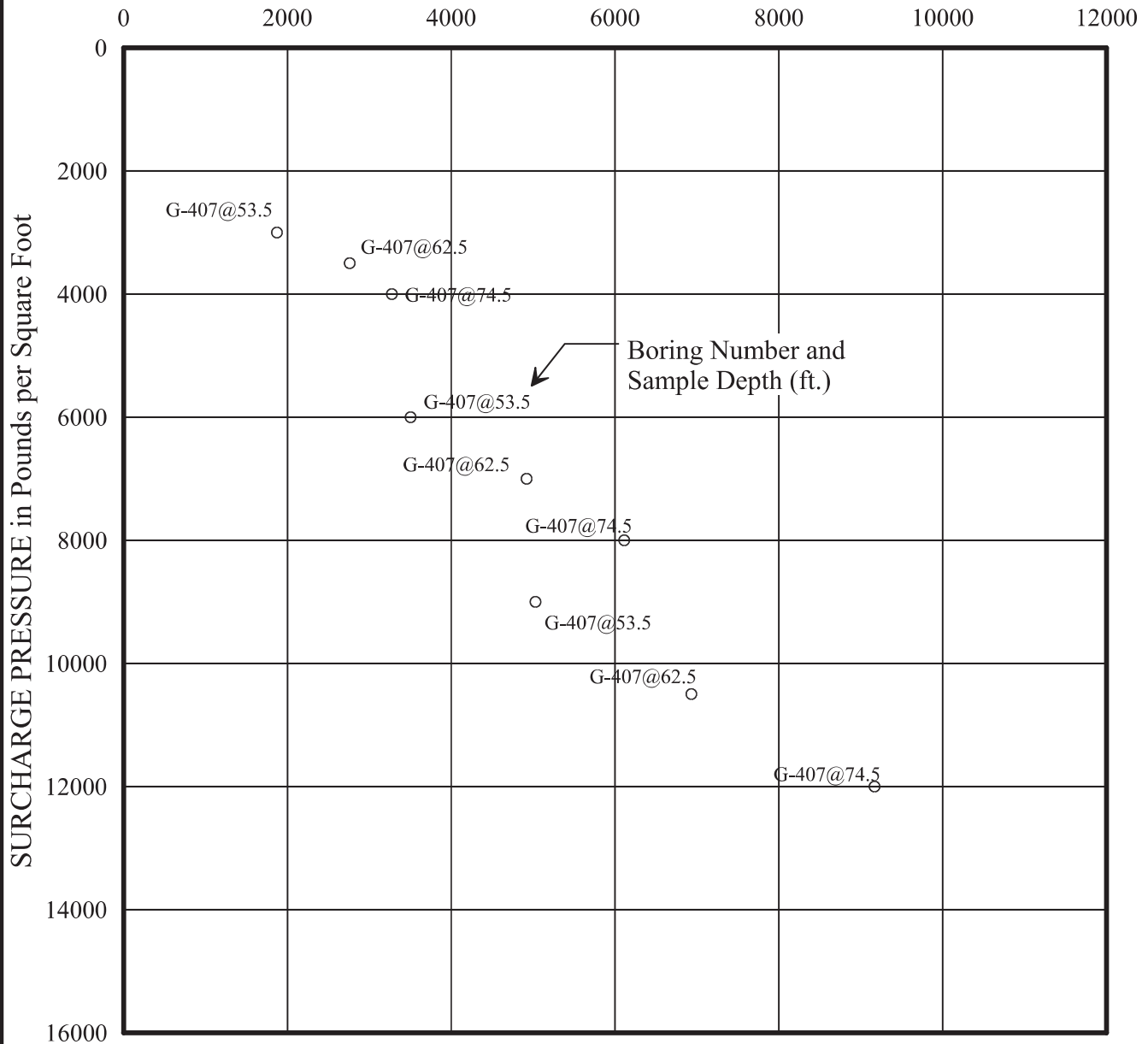
SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

Prepared/Date: KC 12/3/15
Checked/Date: HP 12/4/15

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

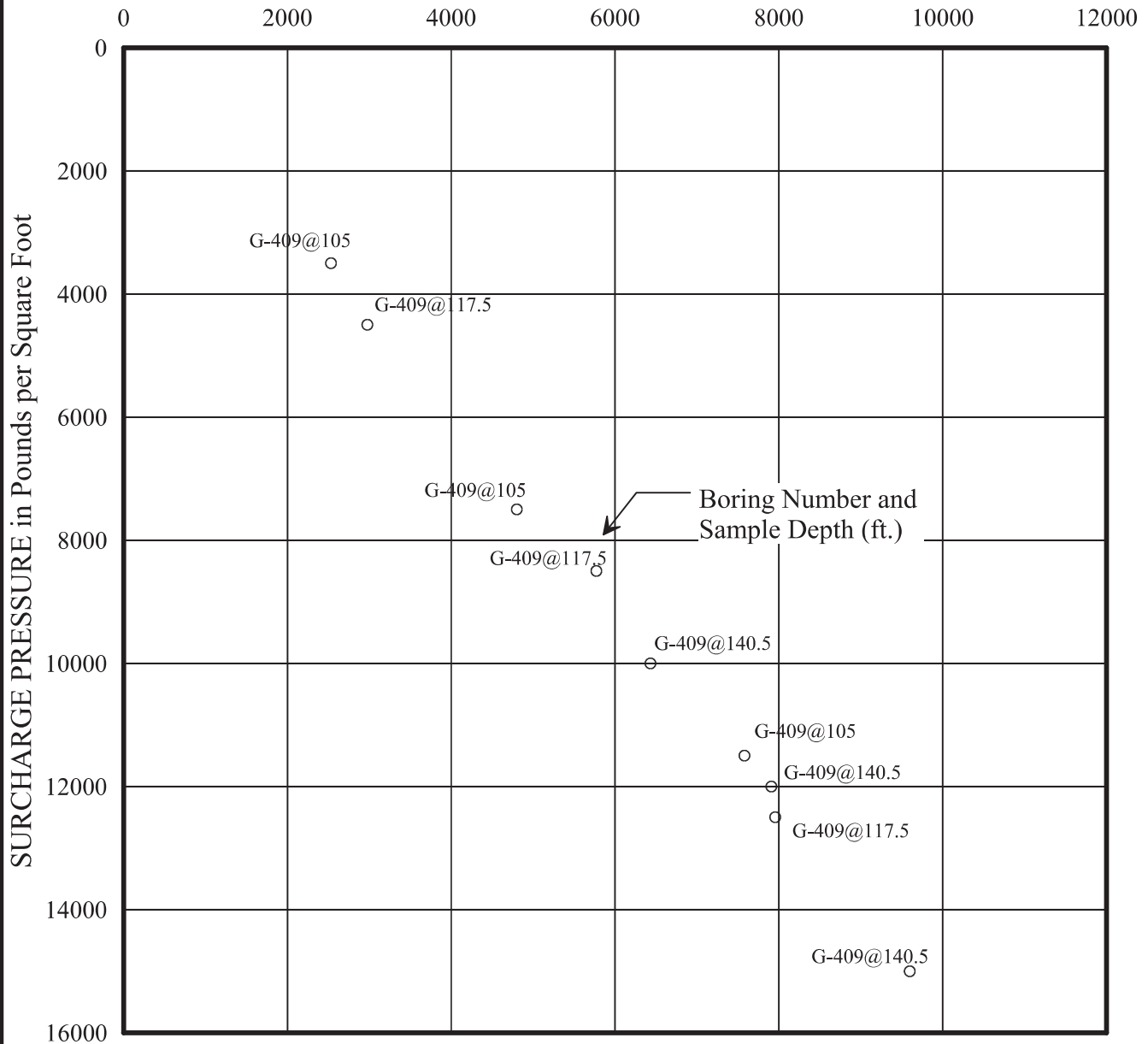
Prepared/Date: KC 12/3/15
Checked/Date: HP 12/4/15

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-11-1423
Figure D-1.3.4

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

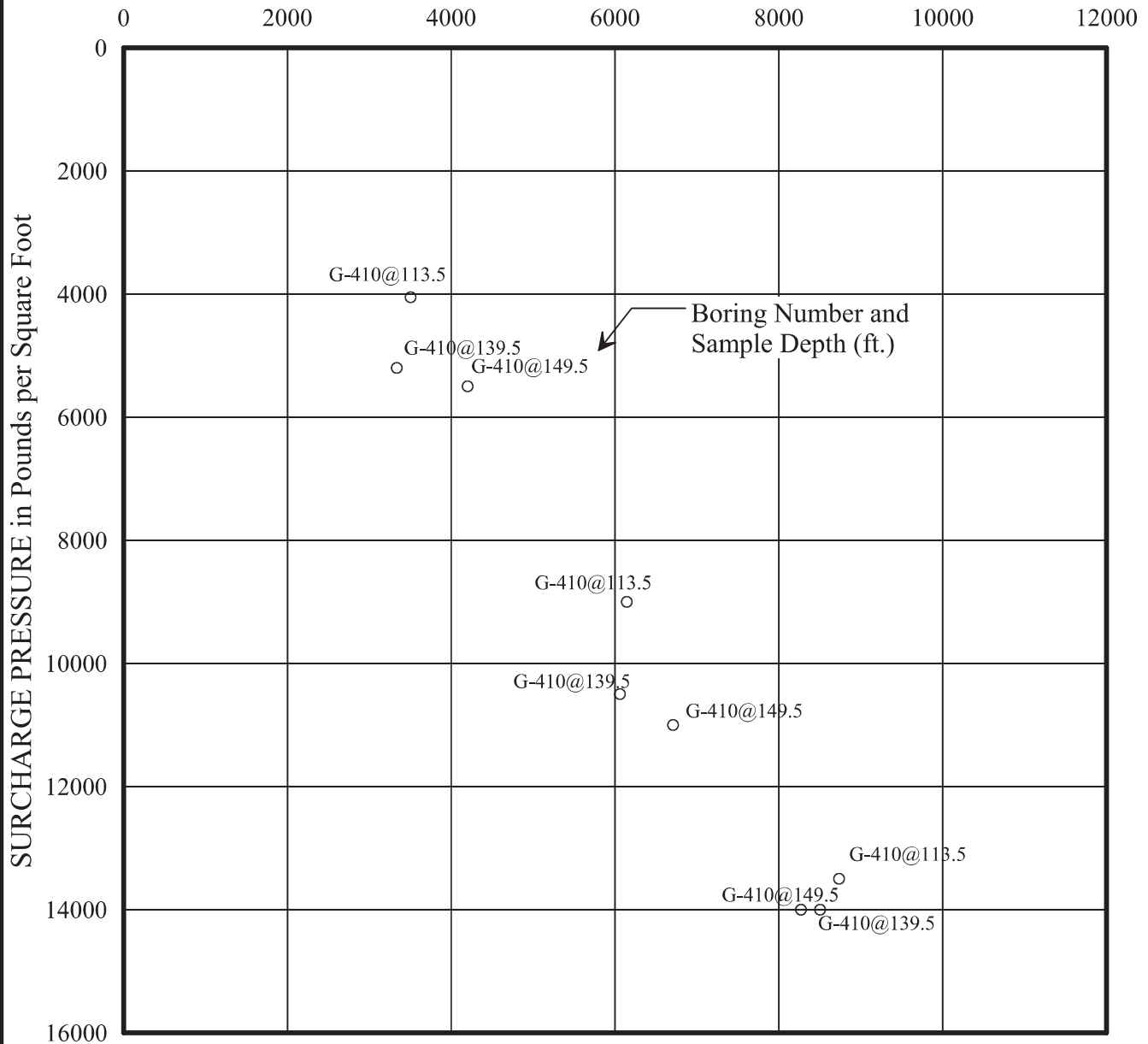
Prepared/Date: KC 12/3/15
Checked/Date: HP 12/4/15

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-11-1423
Figure D-1.3.5

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

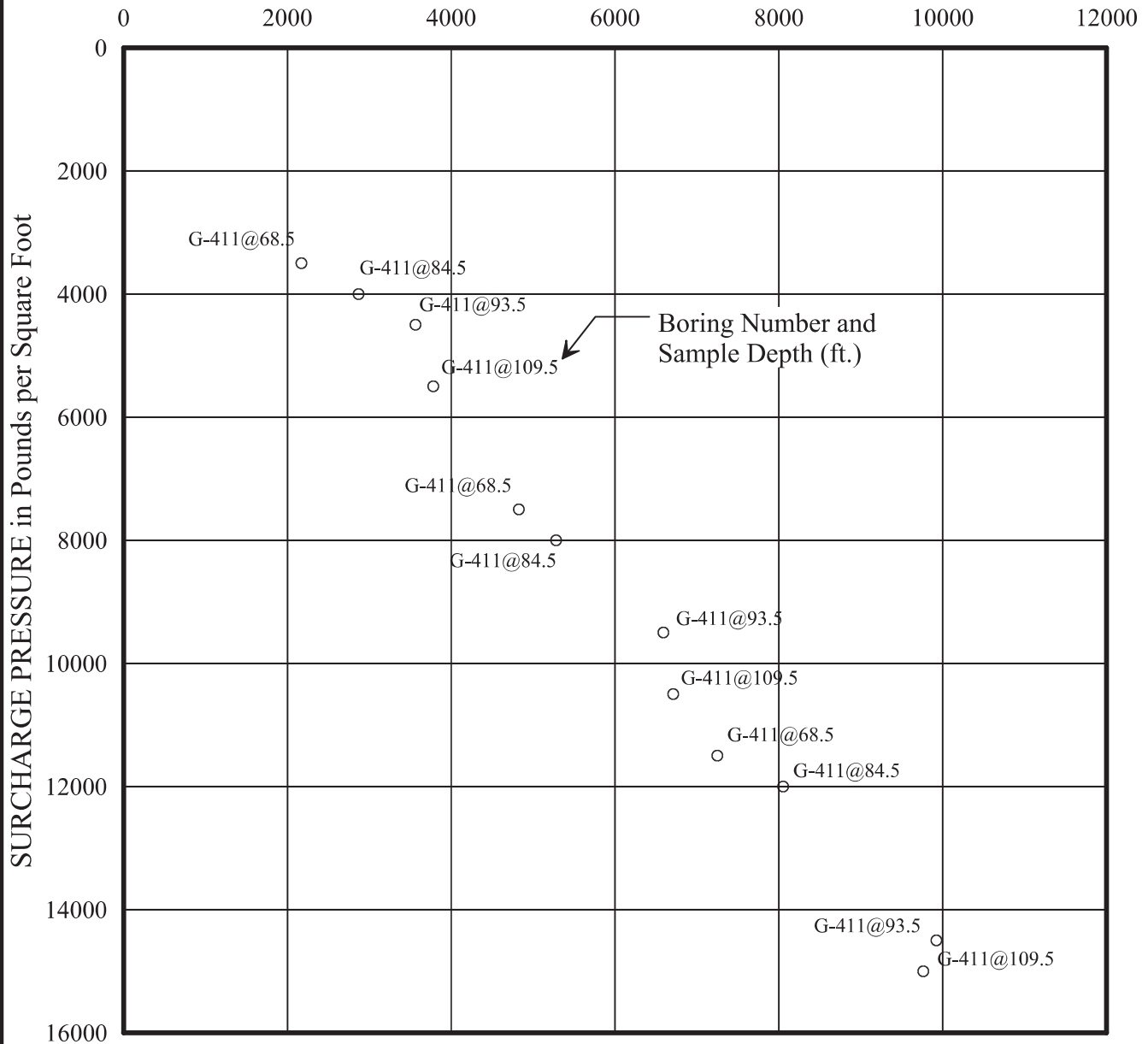
Prepared/Date: FYW 1/6/16
Checked/Date: HP 1/7/16

MTA Westside Subway Extension
Los Angeles, California



DIRECT SHEAR TEST DATA
Project No.: 4953-11-1423
Figure D-1.3.6

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
 ◦ Samples soaked to a moisture content near saturation

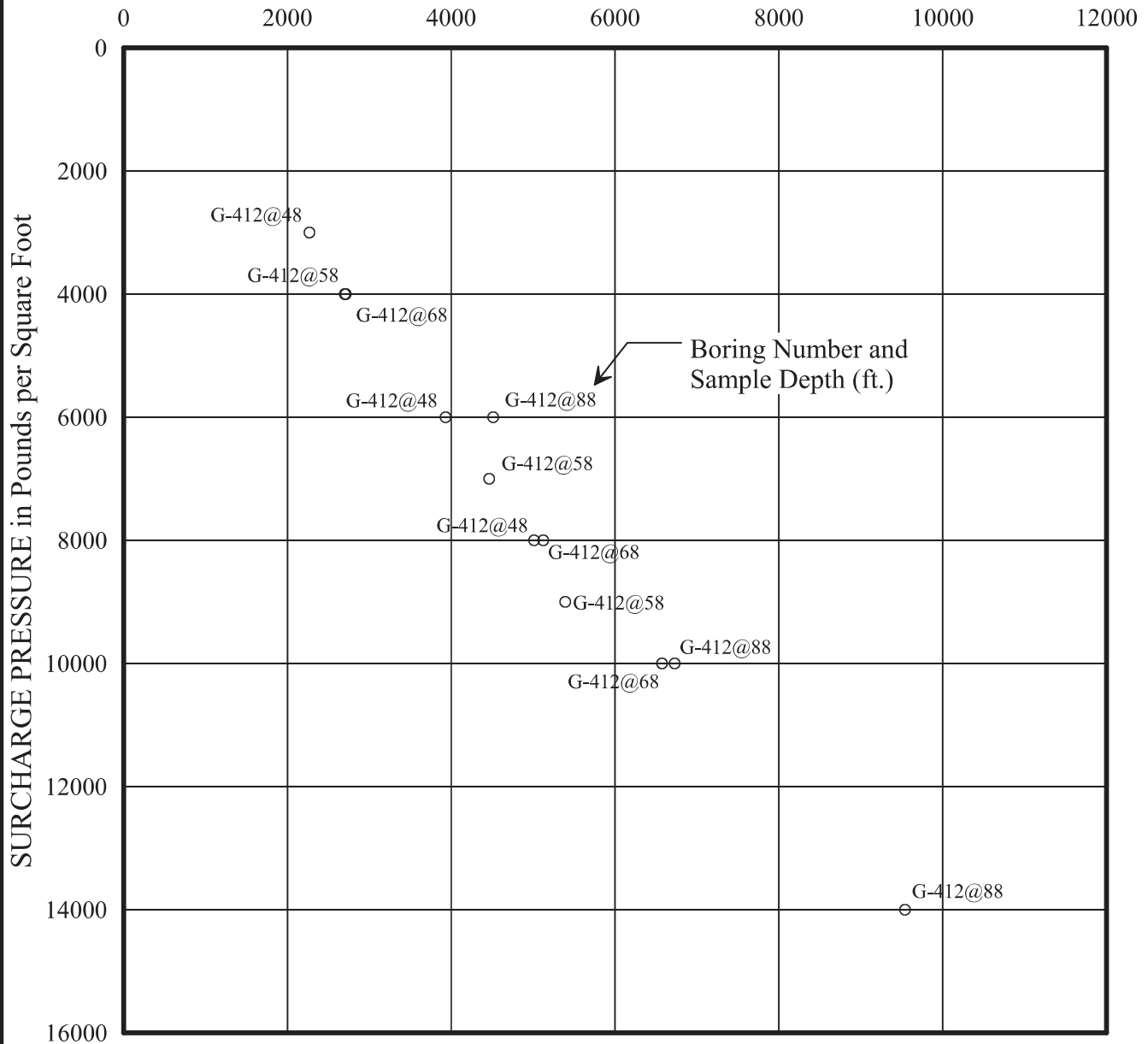
Prepared/Date: KC 12/3/15
 Checked/Date: HP 12/4/15

MTA Westside Subway Extension
 Los Angeles, California



DIRECT SHEAR TEST DATA
 Project No.: 4953-11-1423
 Figure D-1.3.7

SHEAR STRENGTH in Pounds per Square Foot



KEY: • Samples tested at field moisture content
○ Samples soaked to a moisture content near saturation

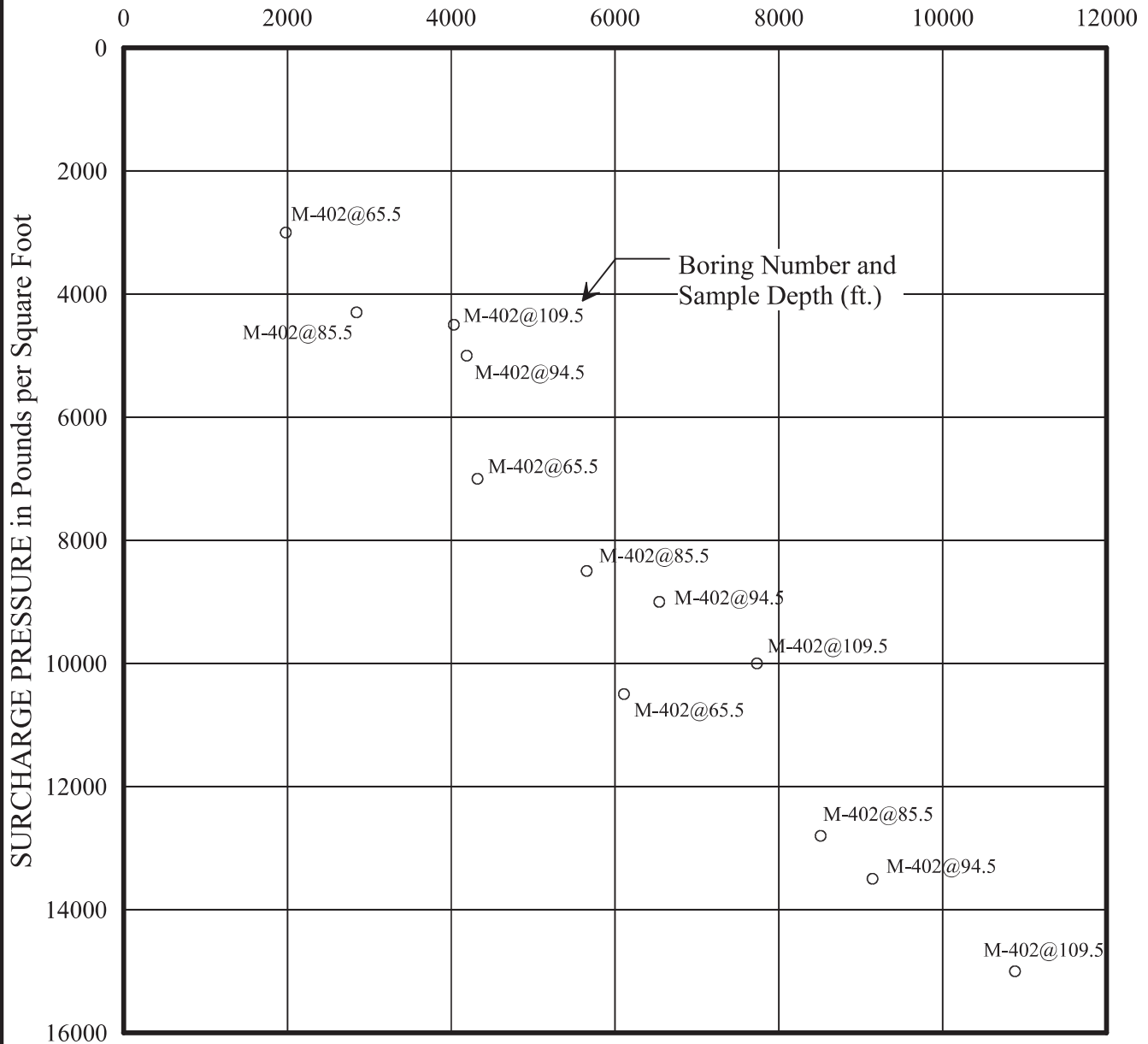
Prepared/Date: KC 12/3/15
Checked/Date: HP 12/4/15

MTA Westside Subway Extension
Los Angeles, California



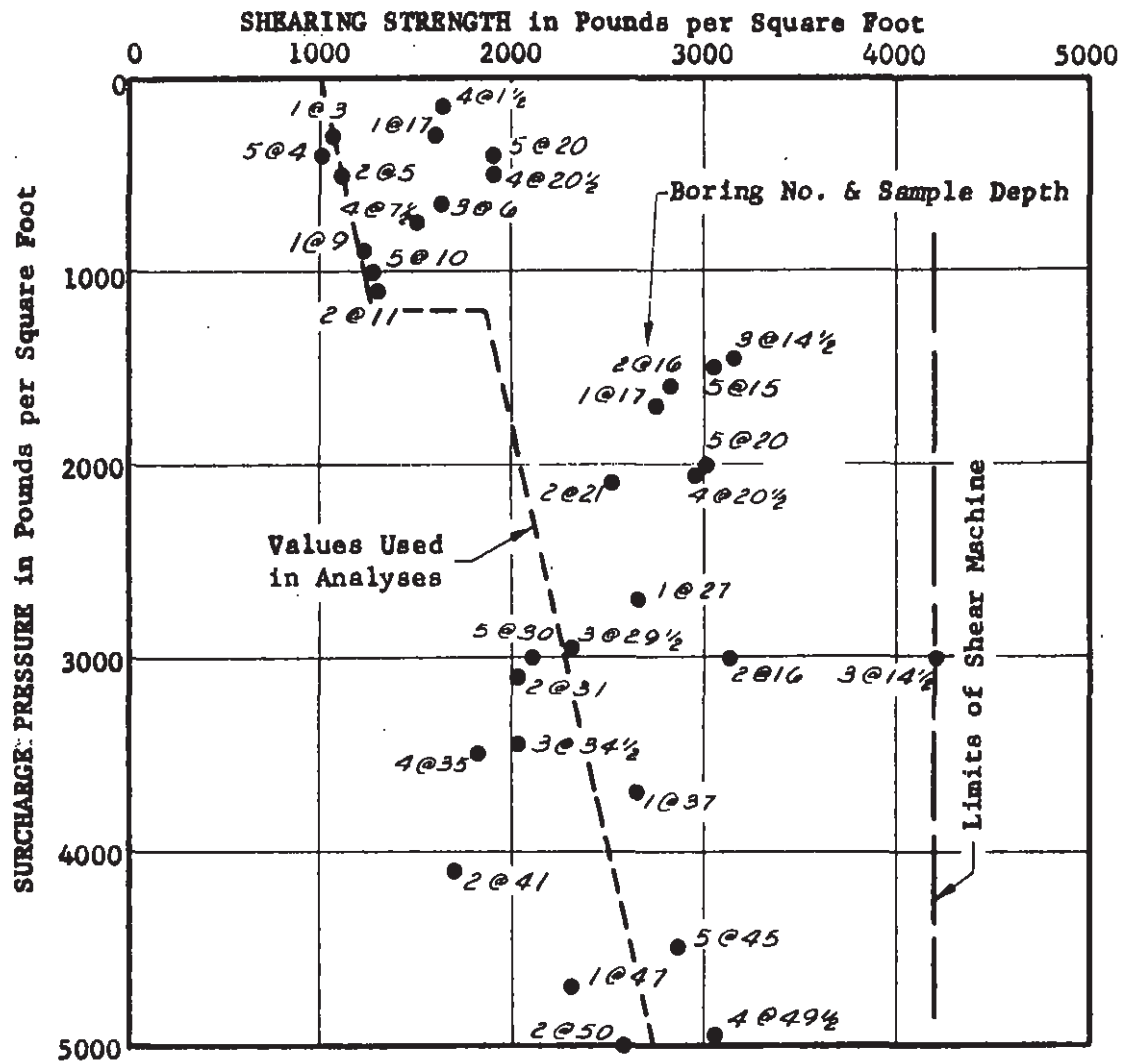
DIRECT SHEAR TEST DATA
Project No.: 4953-11-1423
Figure D-1.3.8

SHEAR STRENGTH in Pounds per Square Foot



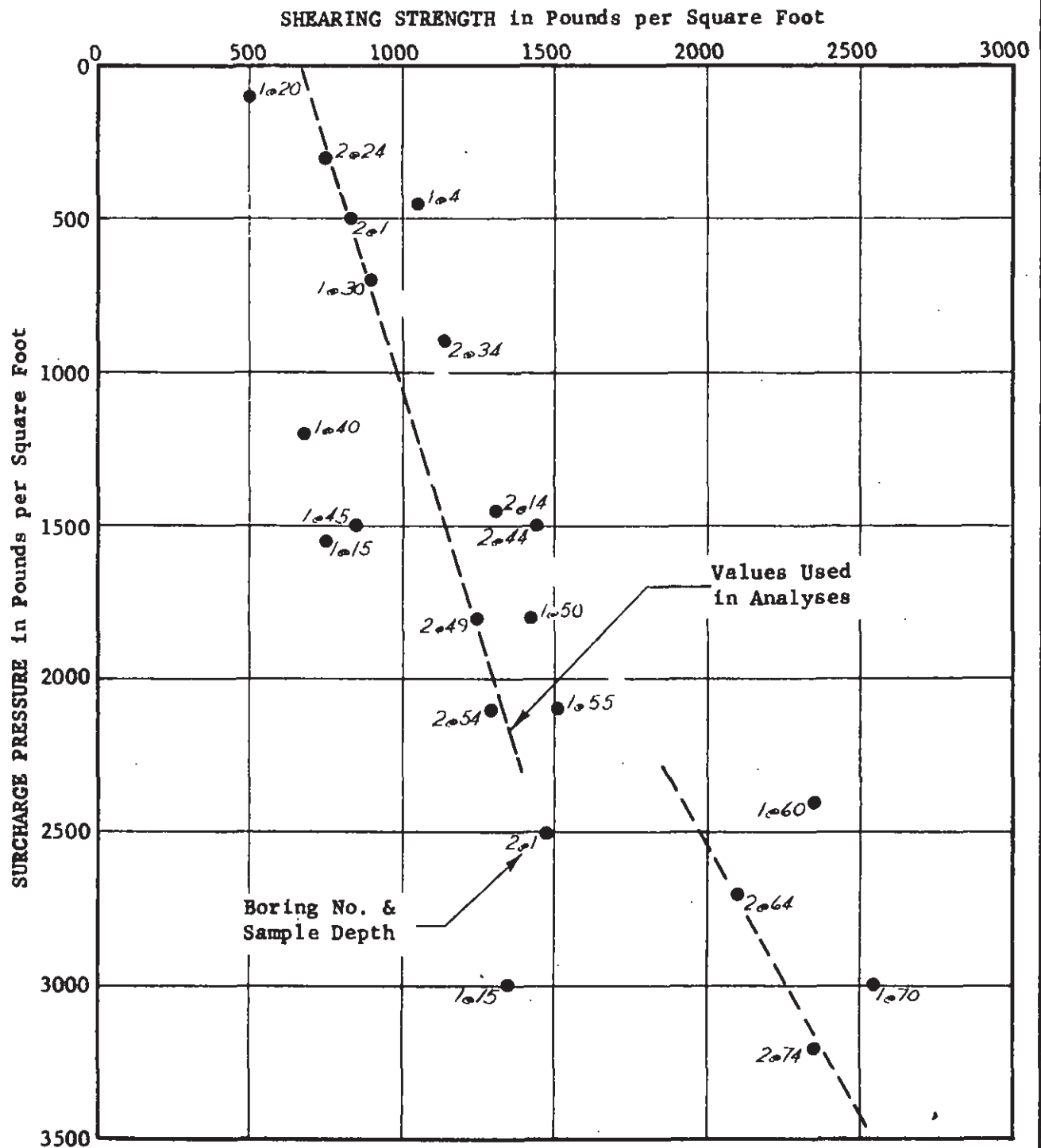
KEY: • Samples tested at field moisture content
 ◦ Samples soaked to a moisture content near saturation

Prepared/Date: KC 12/3/15
 Checked/Date: HP 12/4/15



S H E A R S U M M A R Y

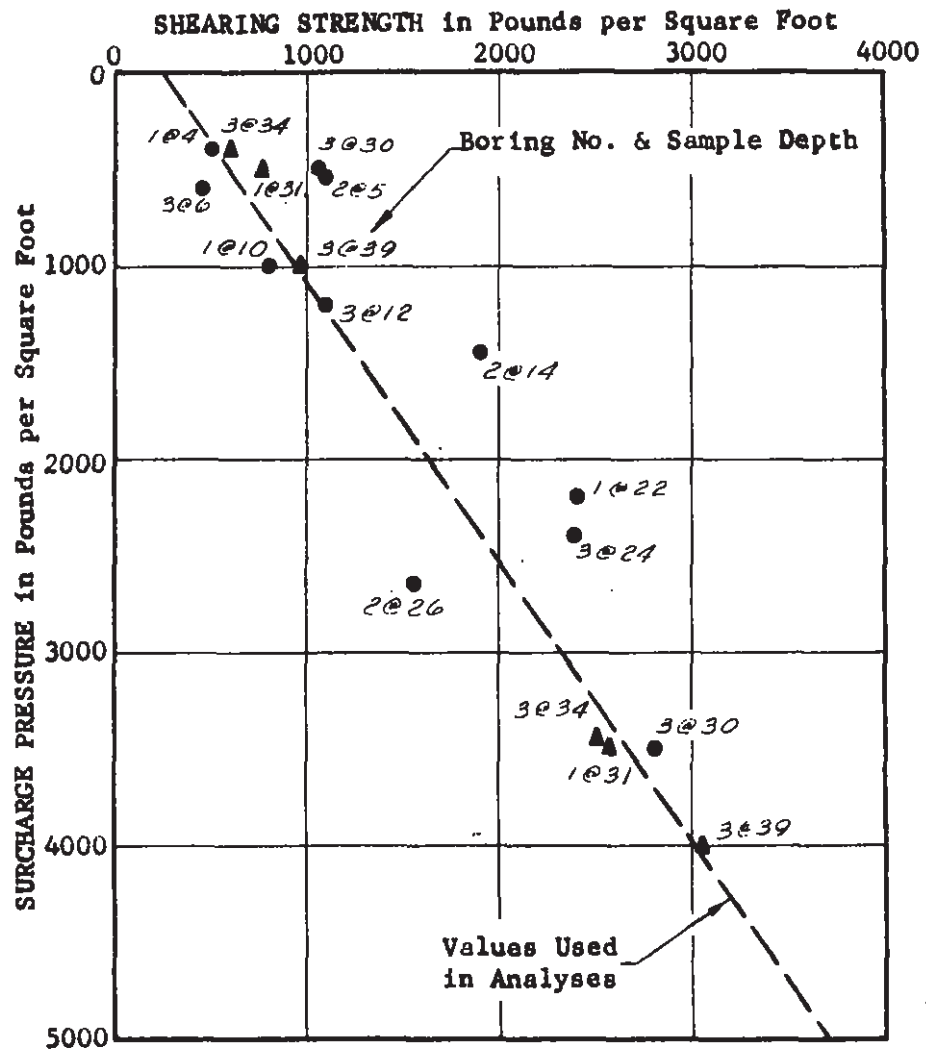
M 62217



NOTE: Tests at field moisture content.

S H E A R S U M M A R Y

LEROY CRANDALL & ASSOCIATES



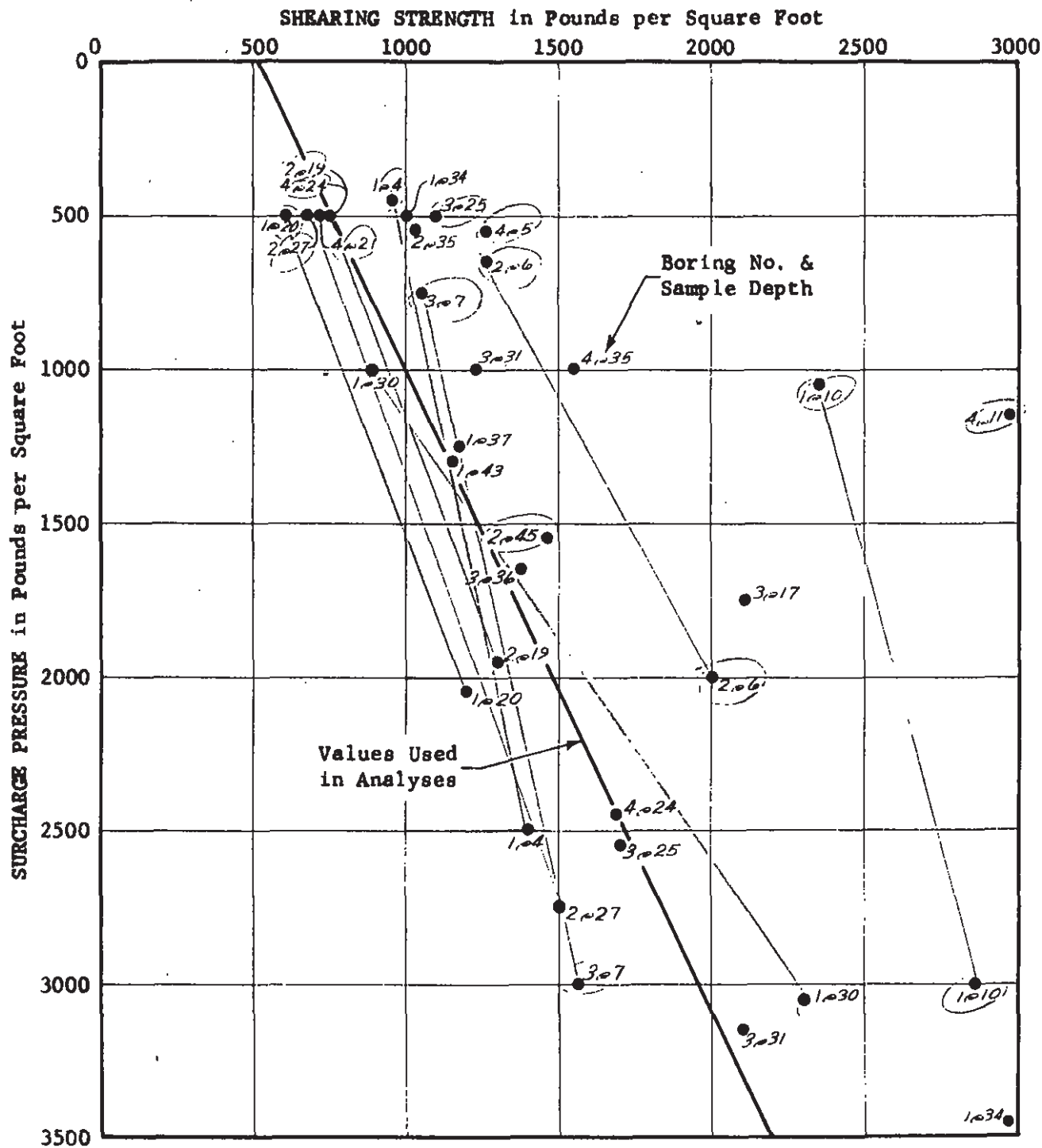
KEY:

- Cohesive soils
- ▲ Sands
- Tests at field moisture content

D I R E C T S H E A R T E S T D A T A

(Borings 1 through 3)

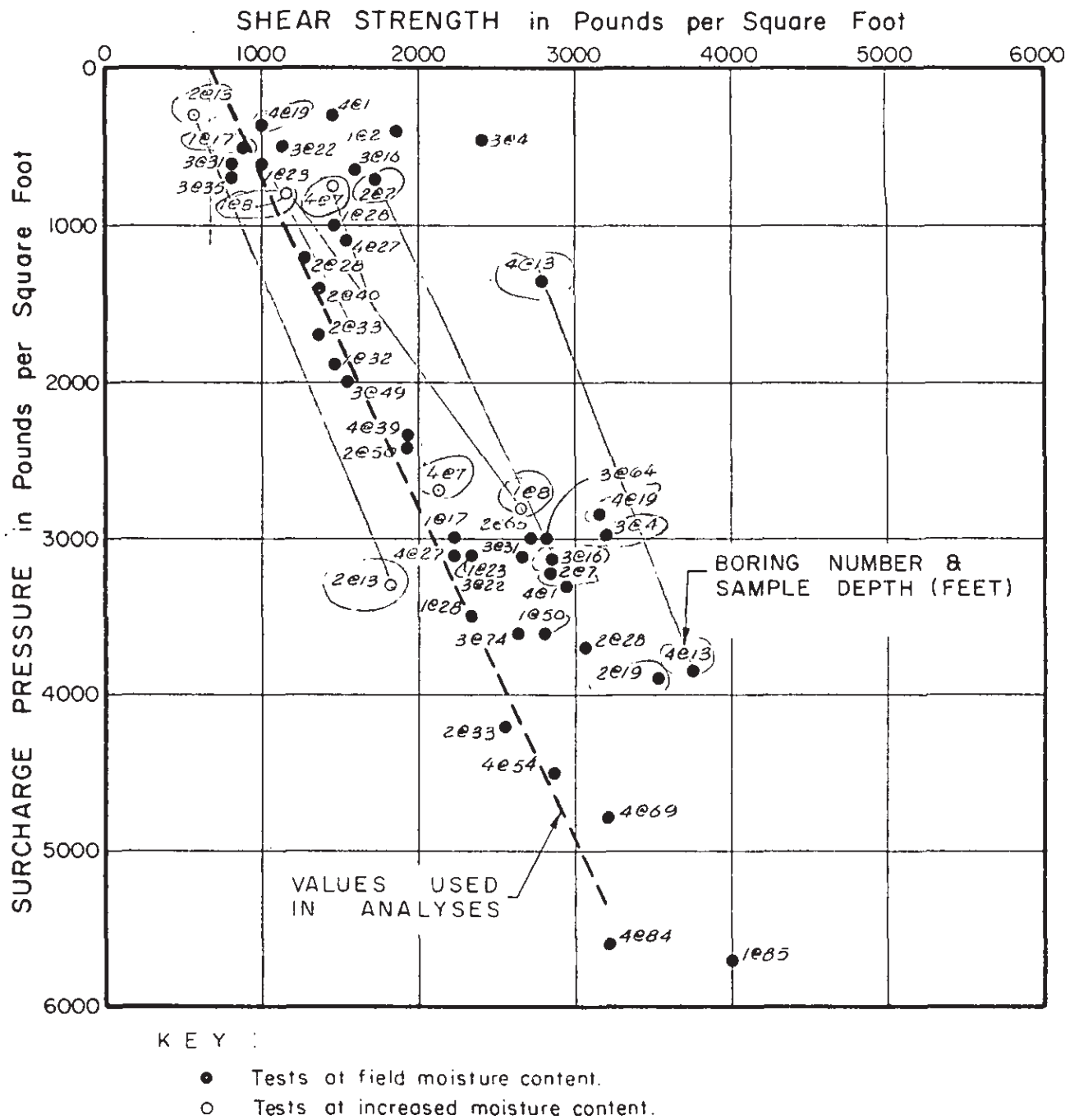
JOB 62348 DATE 11-2-68 BY RCL mp



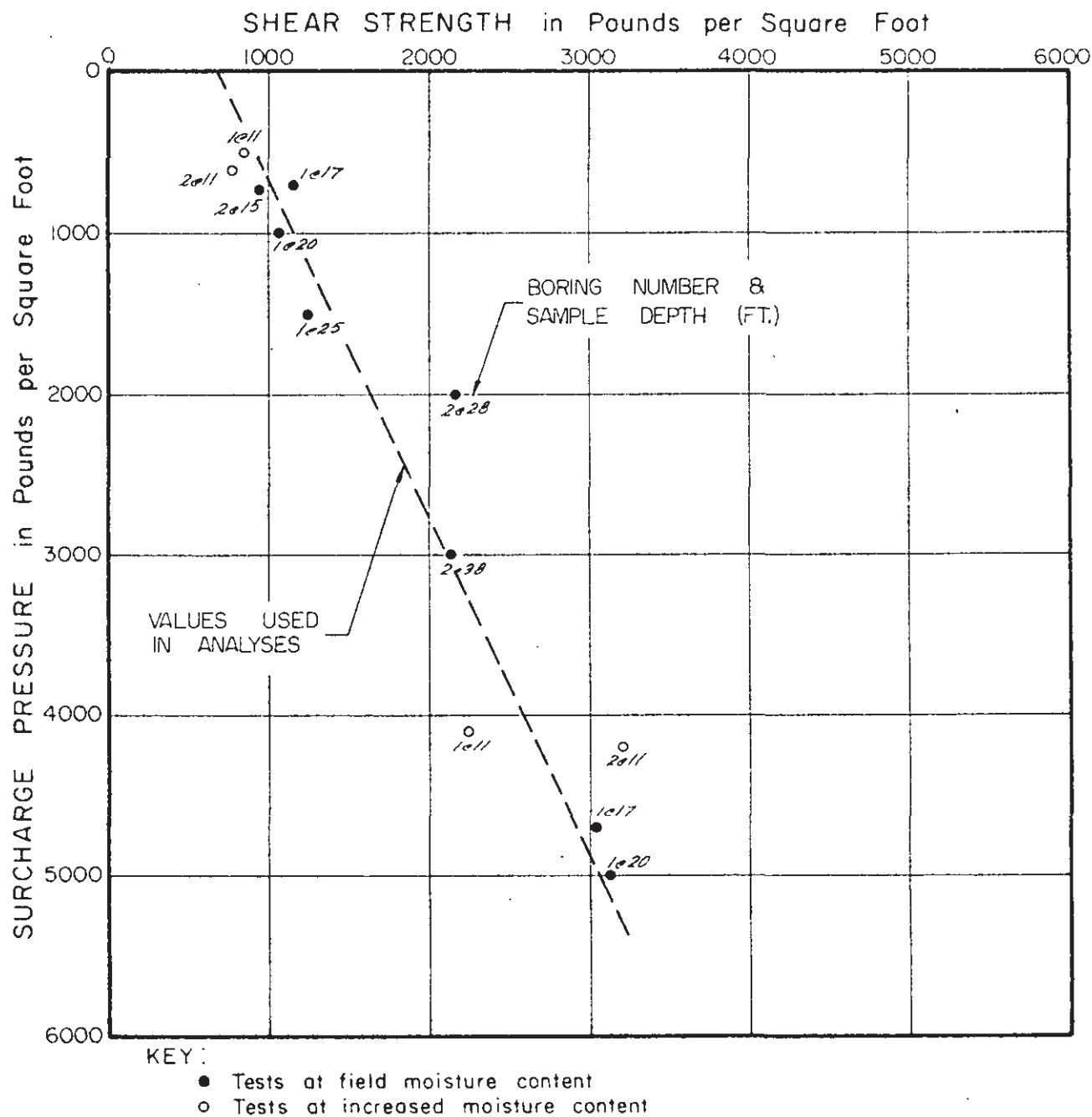
NOTE: Samples tested at field moisture content.

S H E A R S U M M A R Y

LEROY CRANDALL & ASSOCIATES



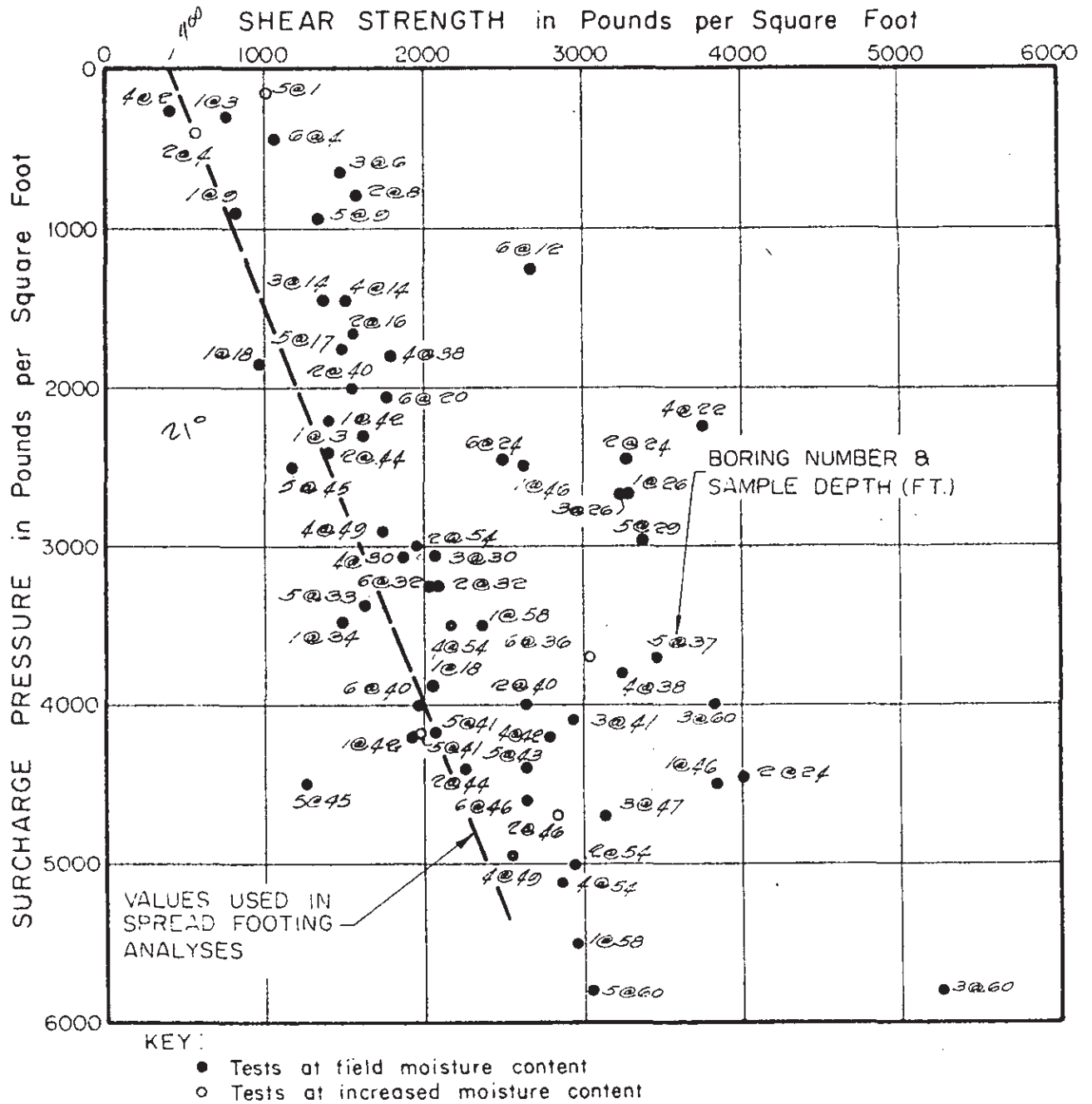
DIRECT SHEAR TEST DATA



DIRECT SHEAR TEST DATA

LEROY CRANDALL & ASSOCIATES

JOB 4-69300 DATE 12/19/69 DR TCH O.E. 1/11 CHKD. ACH

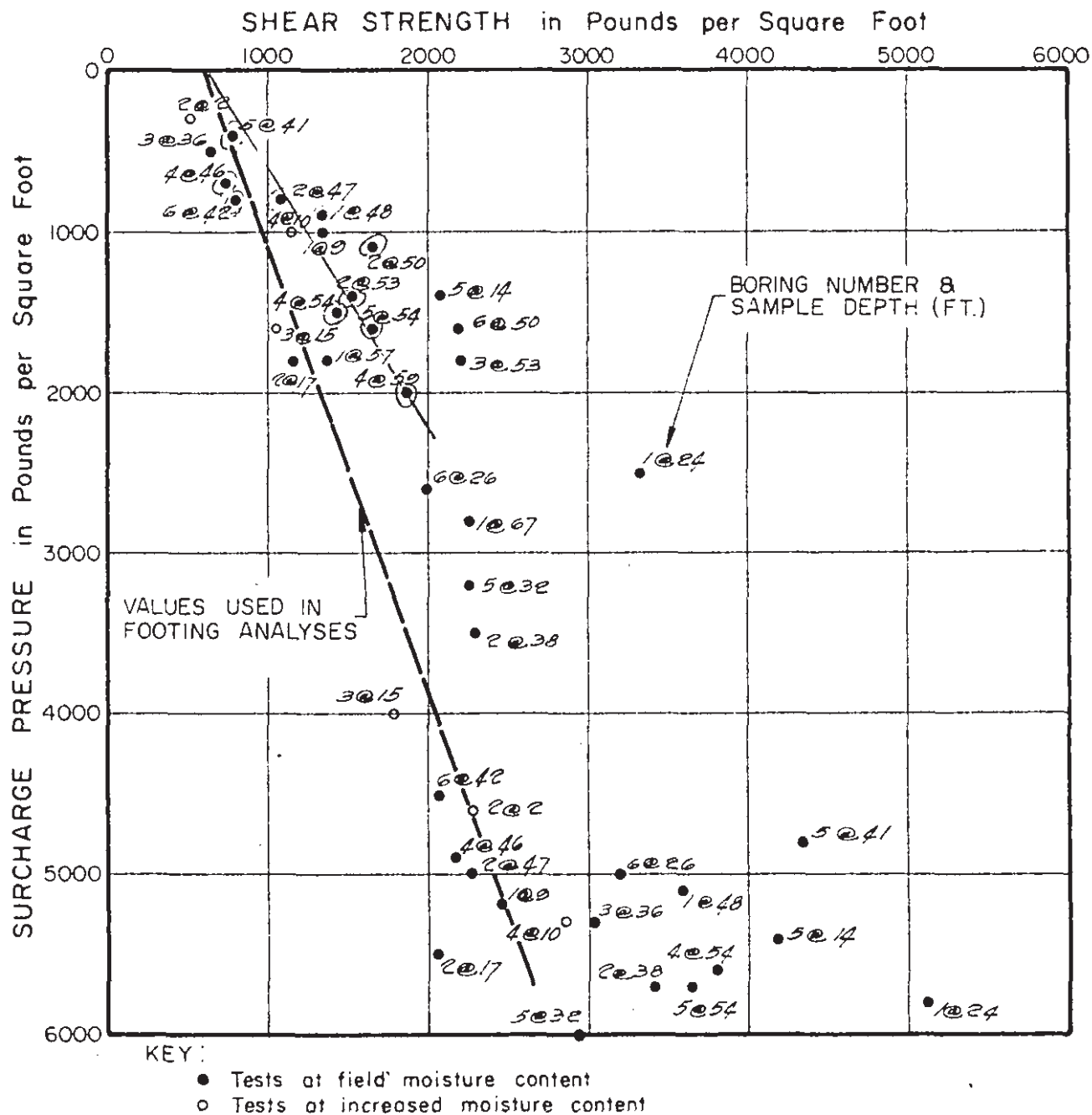


DIRECT SHEAR TEST DATA

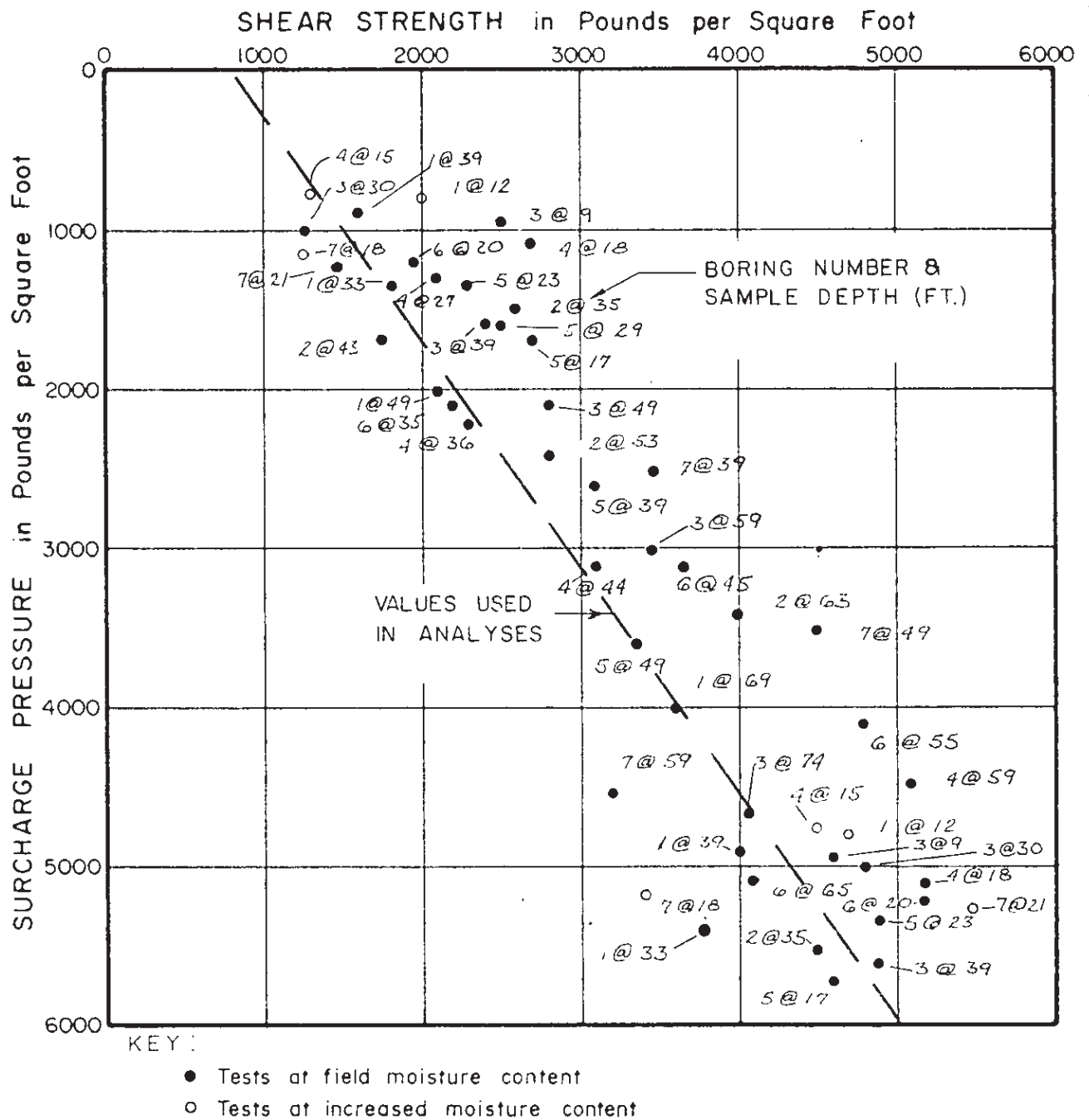
LEROY CRANDALL & ASSOCIATES

PLATE C

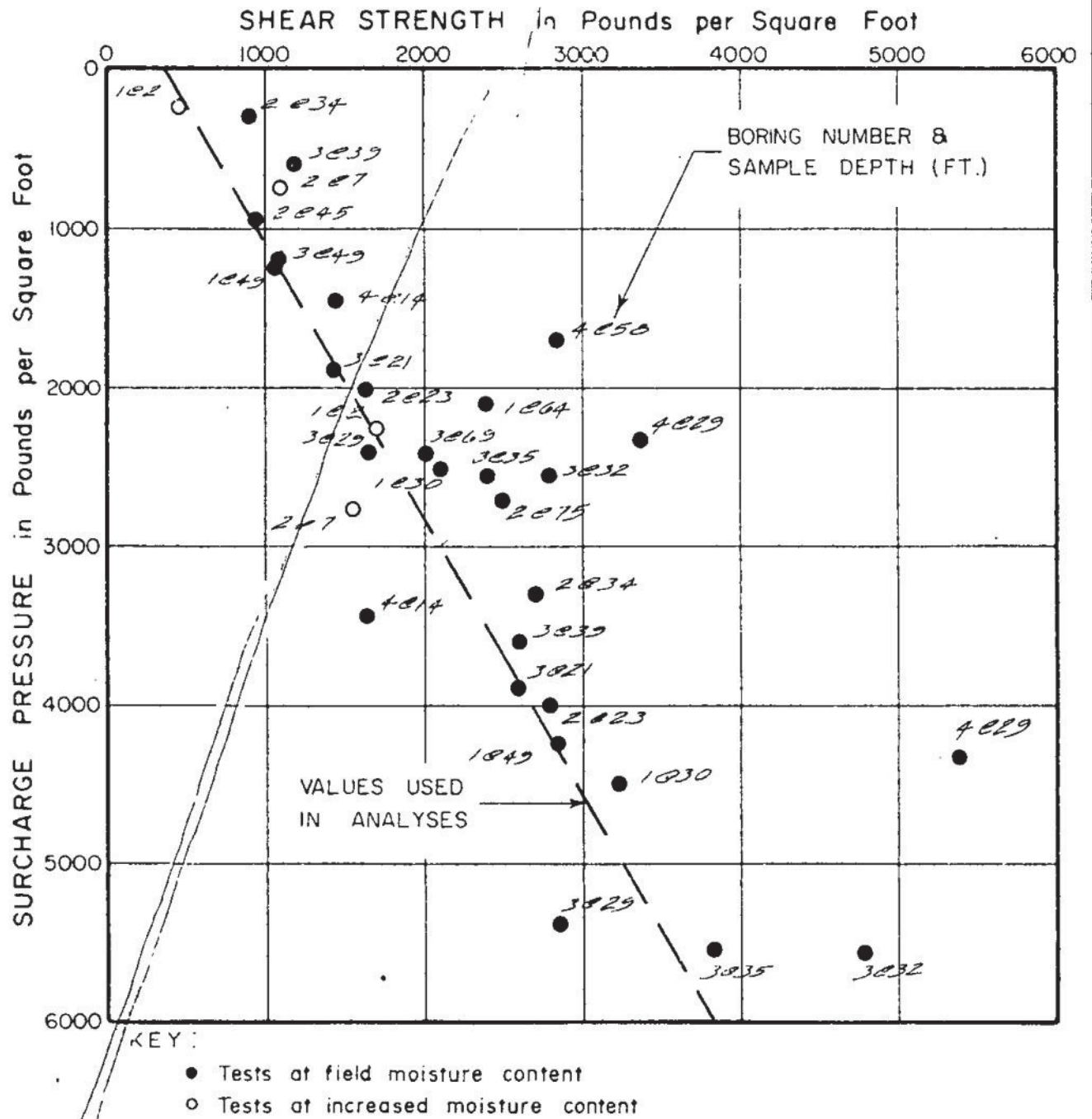
Figure D-1.4.7



DIRECT SHEAR TEST DATA

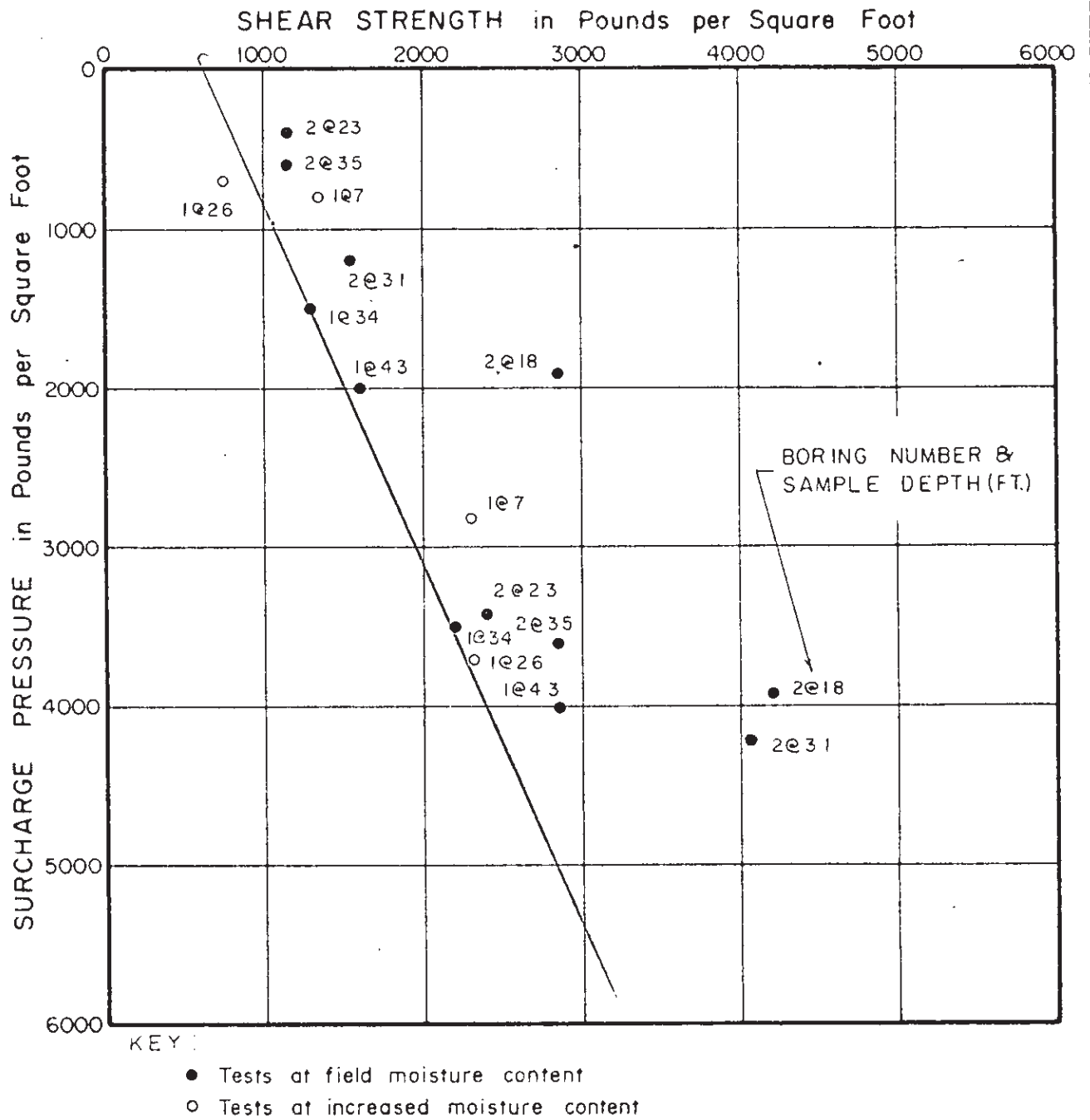


DIRECT SHEAR TEST DATA



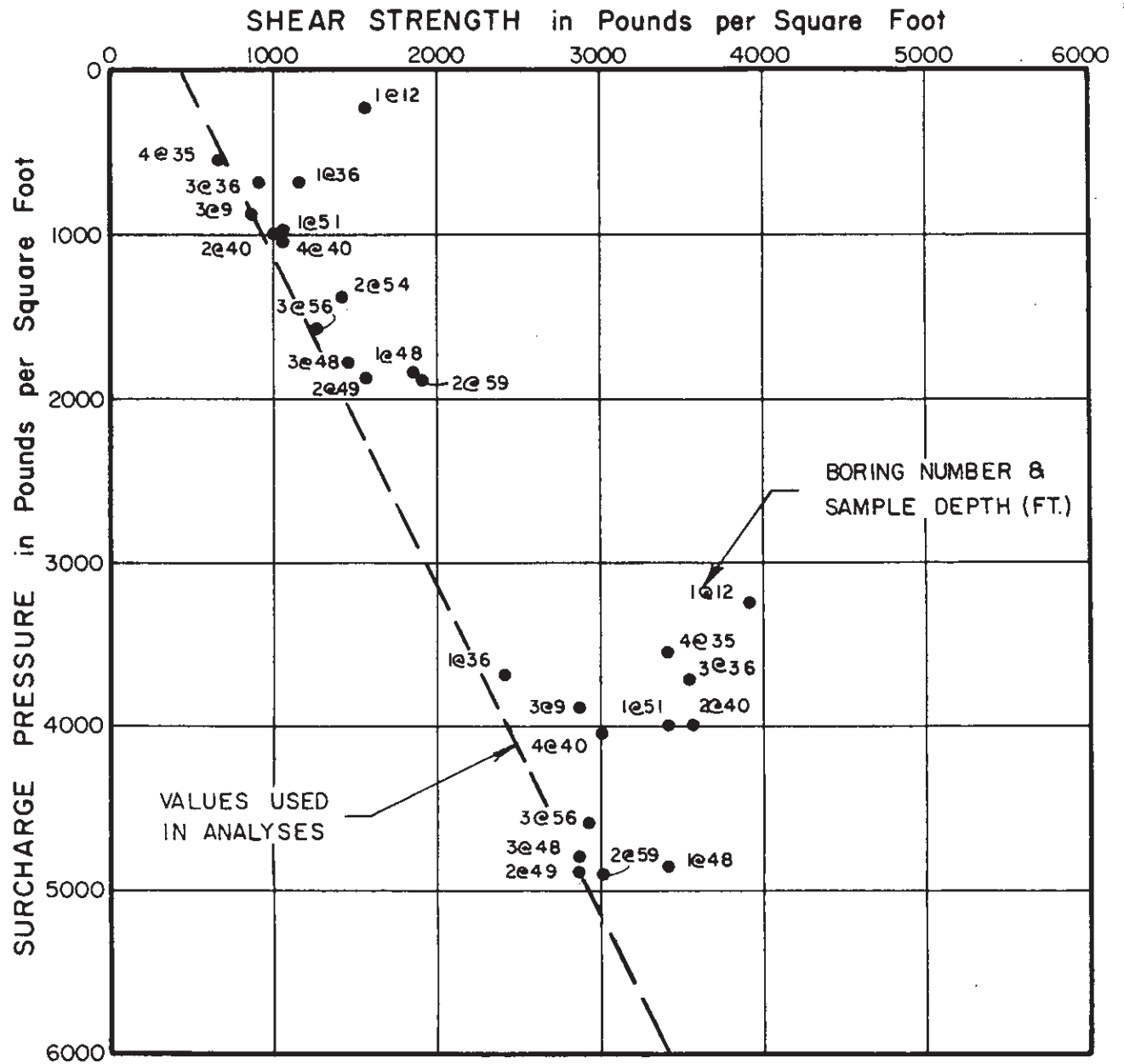
DIRECT SHEAR TEST DATA

108 JOB H-80025 DATE 2-28-82 DR O.E. CHKD. YK



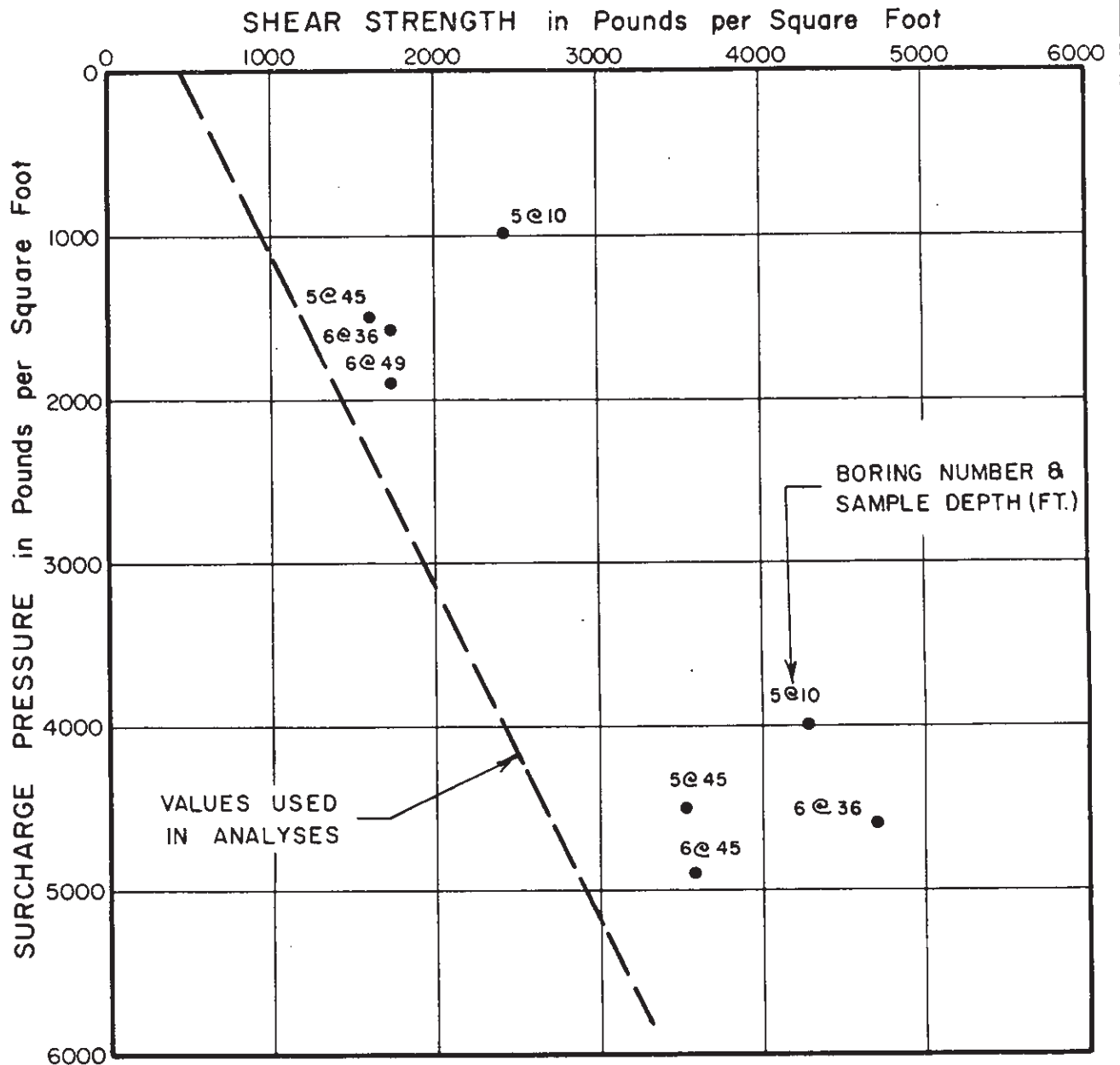
DIRECT SHEAR TEST DATA

JOB A-82144 DATE 6/8/82 DR JOHN O.E. MS CHKD. PM 108



NOTE: All samples tested at field moisture content

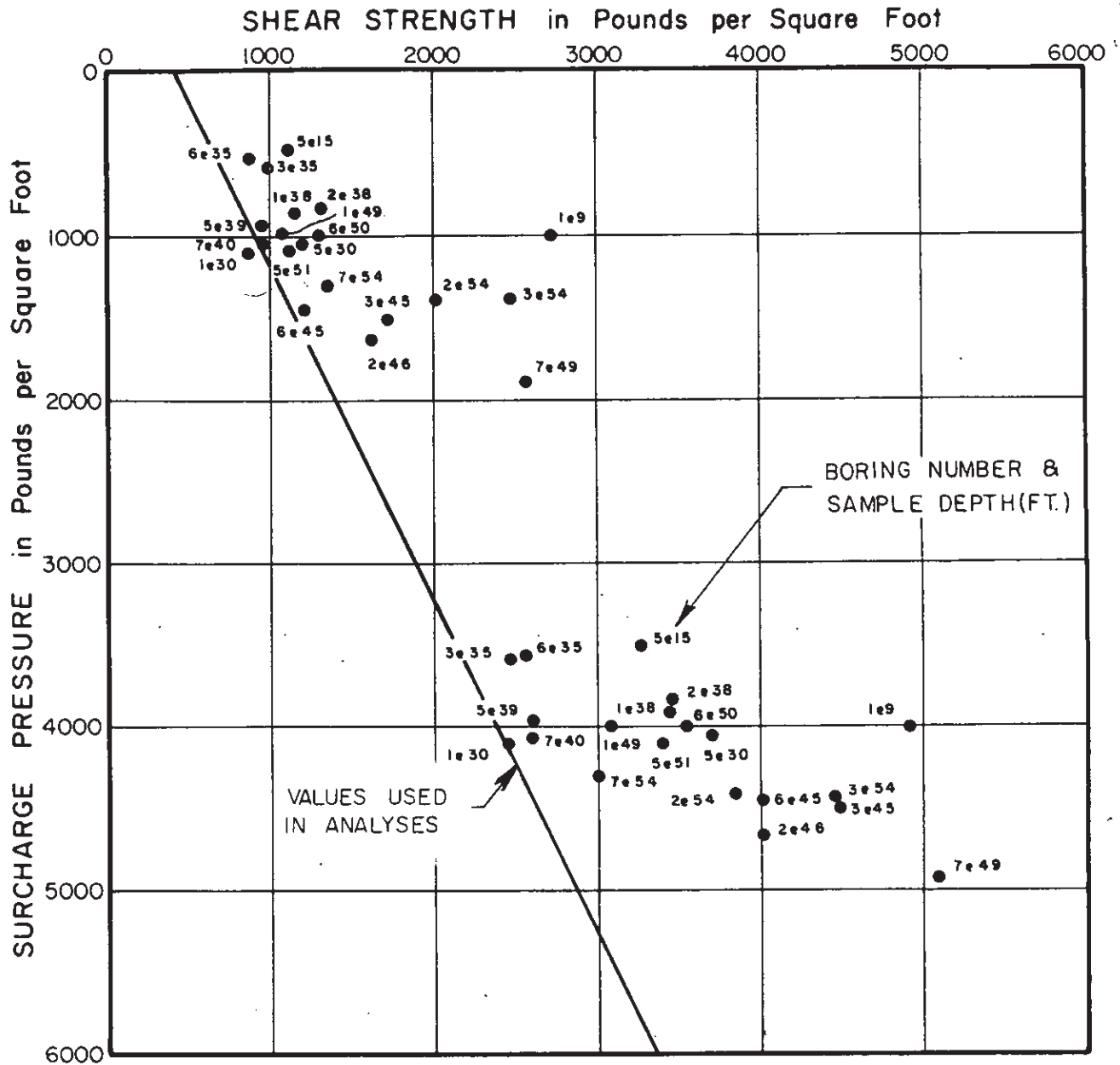
DIRECT SHEAR TEST DATA



NOTE: Samples tested at field moisture content

DIRECT SHEAR TEST DATA

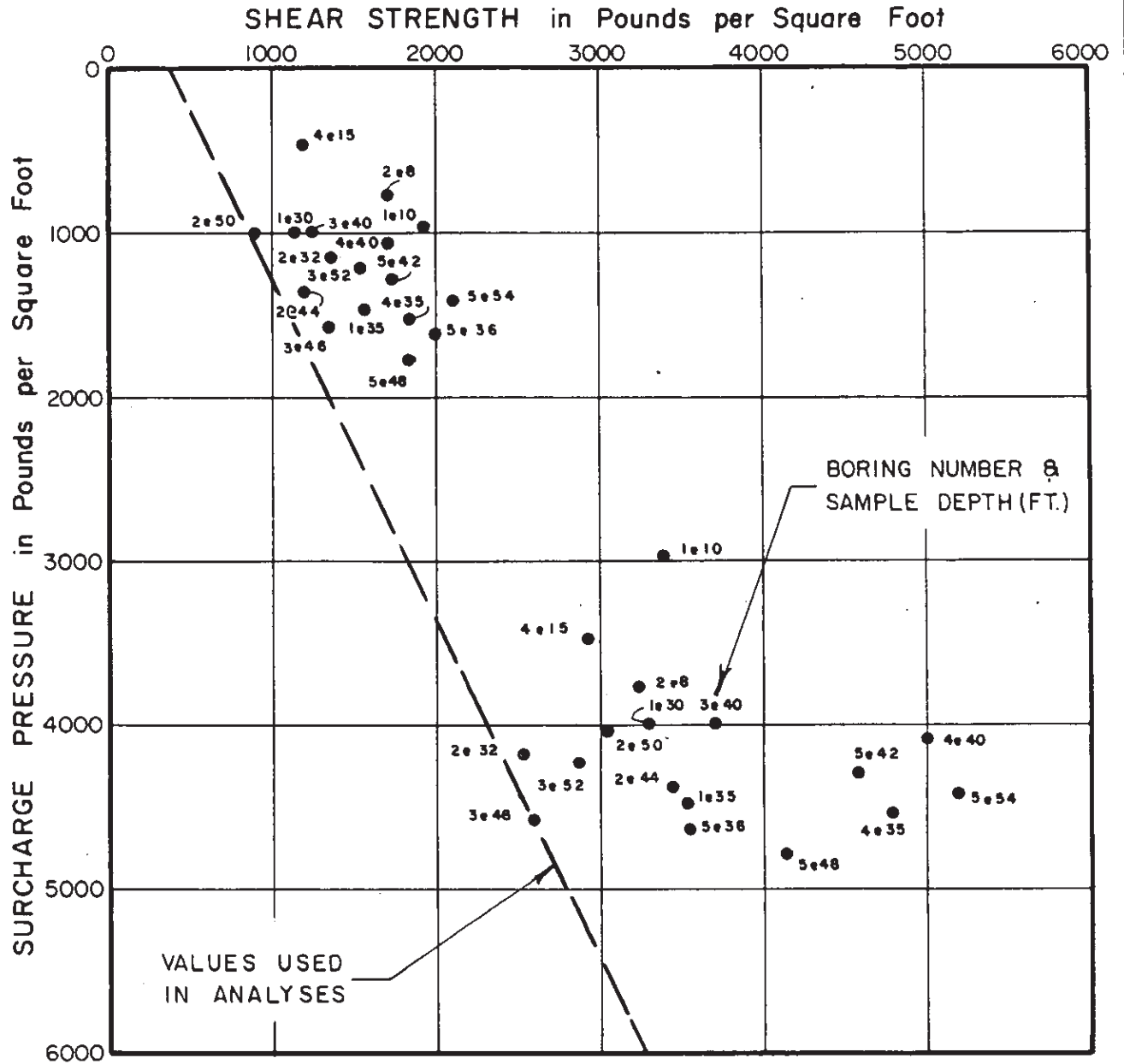
LEROY CRANDALL & ASSOCIATES



NOTE: All samples tested at field moisture content

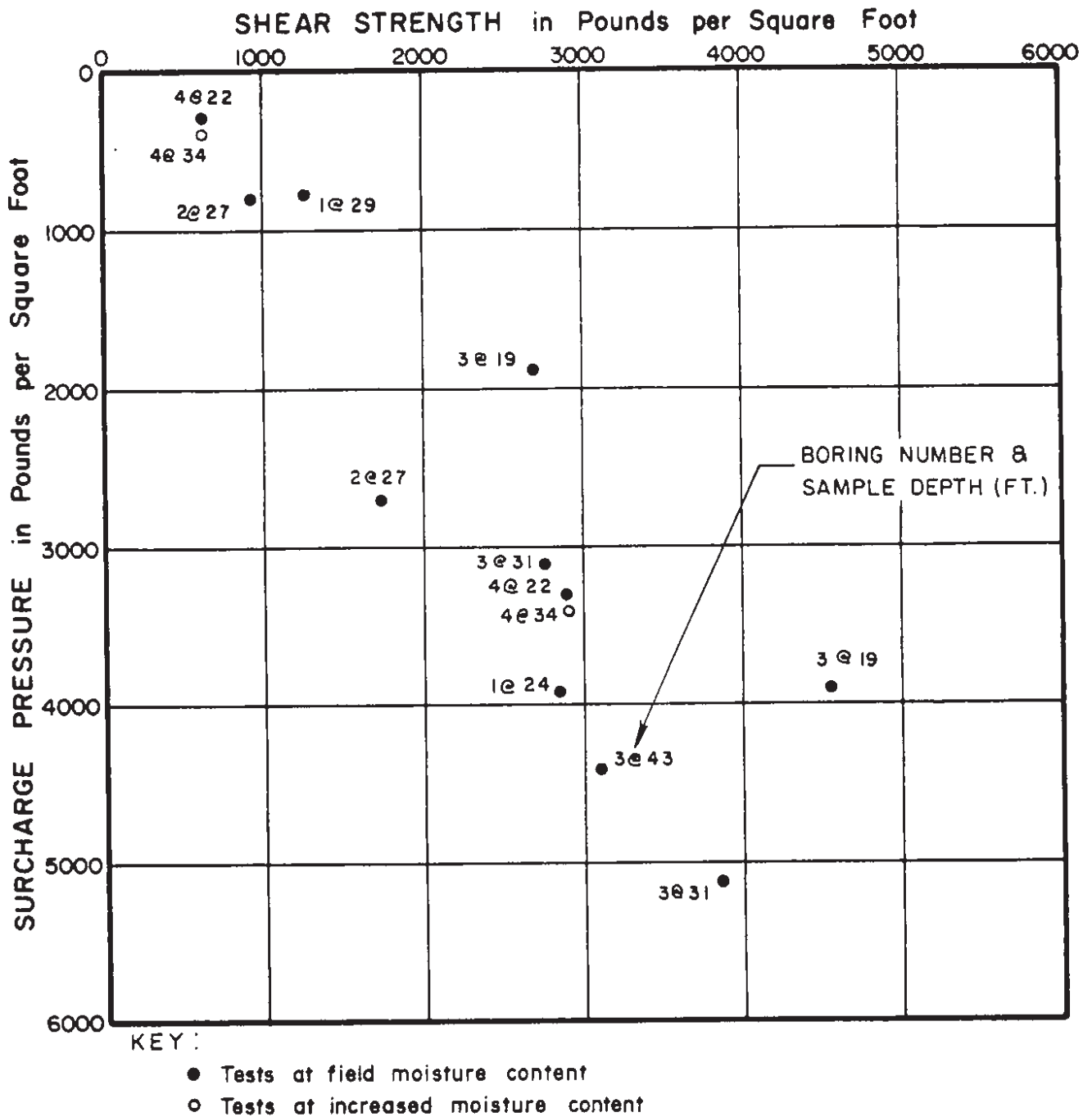
DIRECT SHEAR TEST DATA

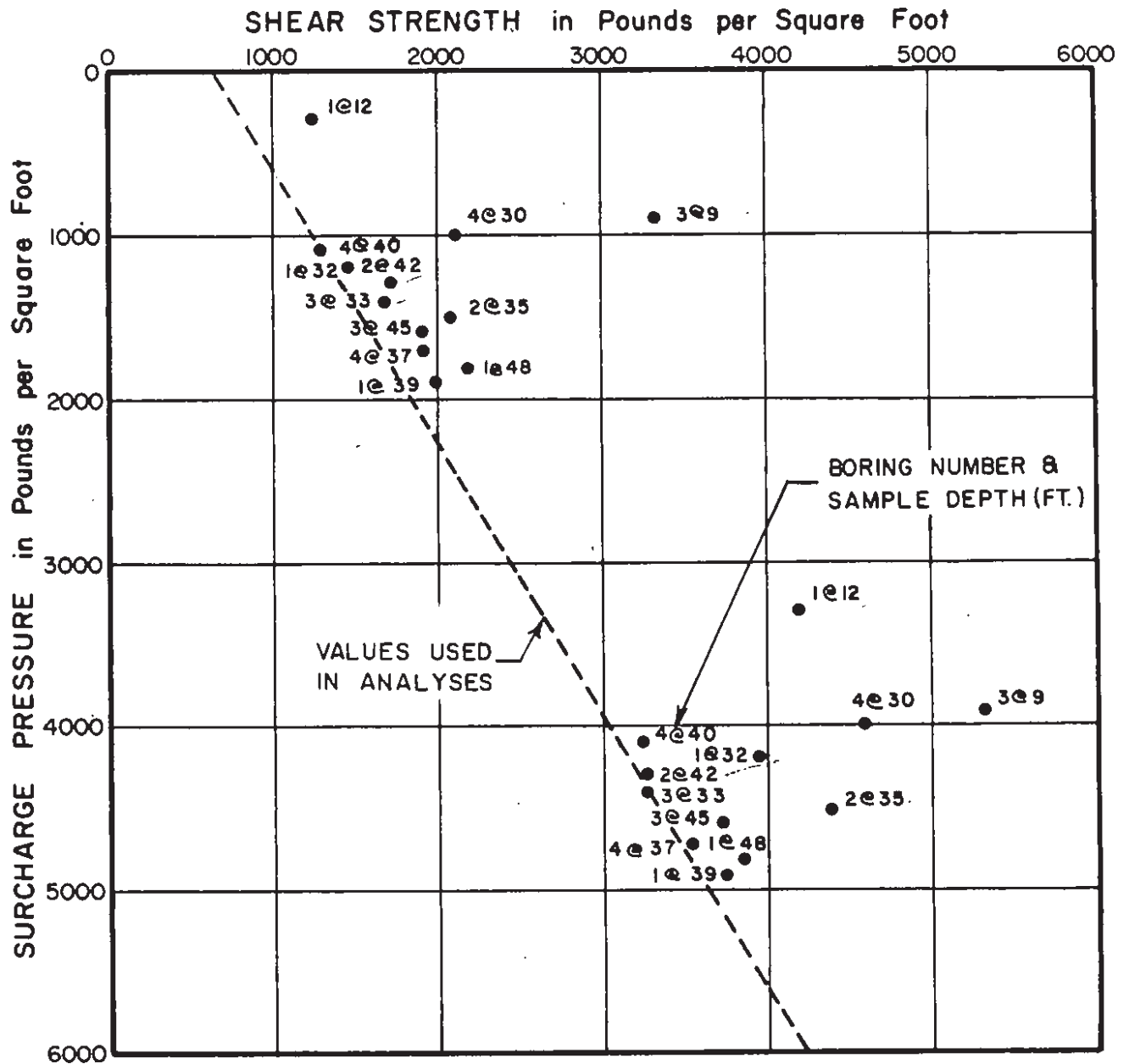
LEROY CRANDALL & ASSOCIATES



NOTE: All samples tested at field moisture content

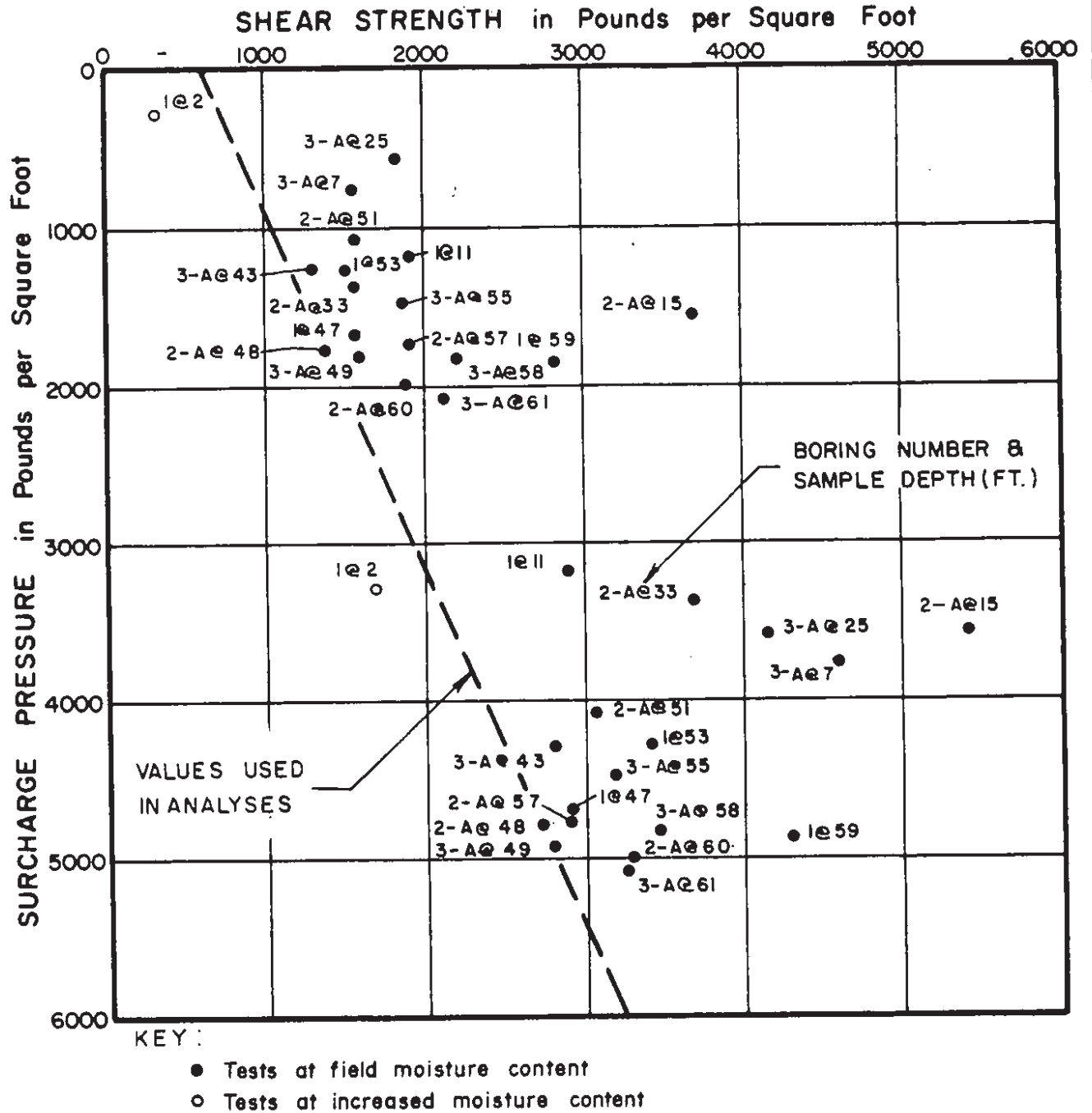
DIRECT SHEAR TEST DATA

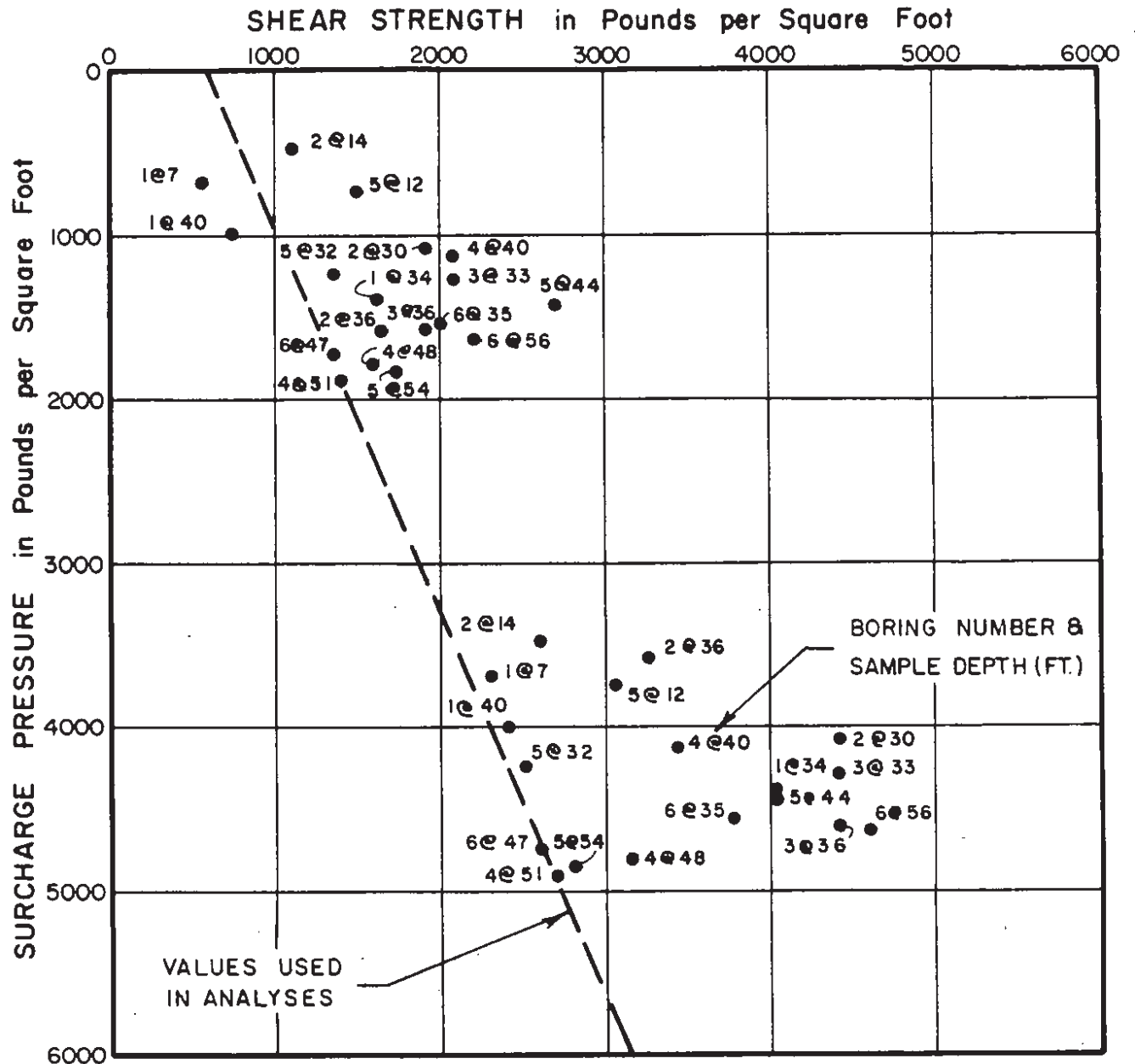
**DIRECT SHEAR TEST DATA**



NOTE: Samples tested at field moisture content

DIRECT SHEAR TEST DATA

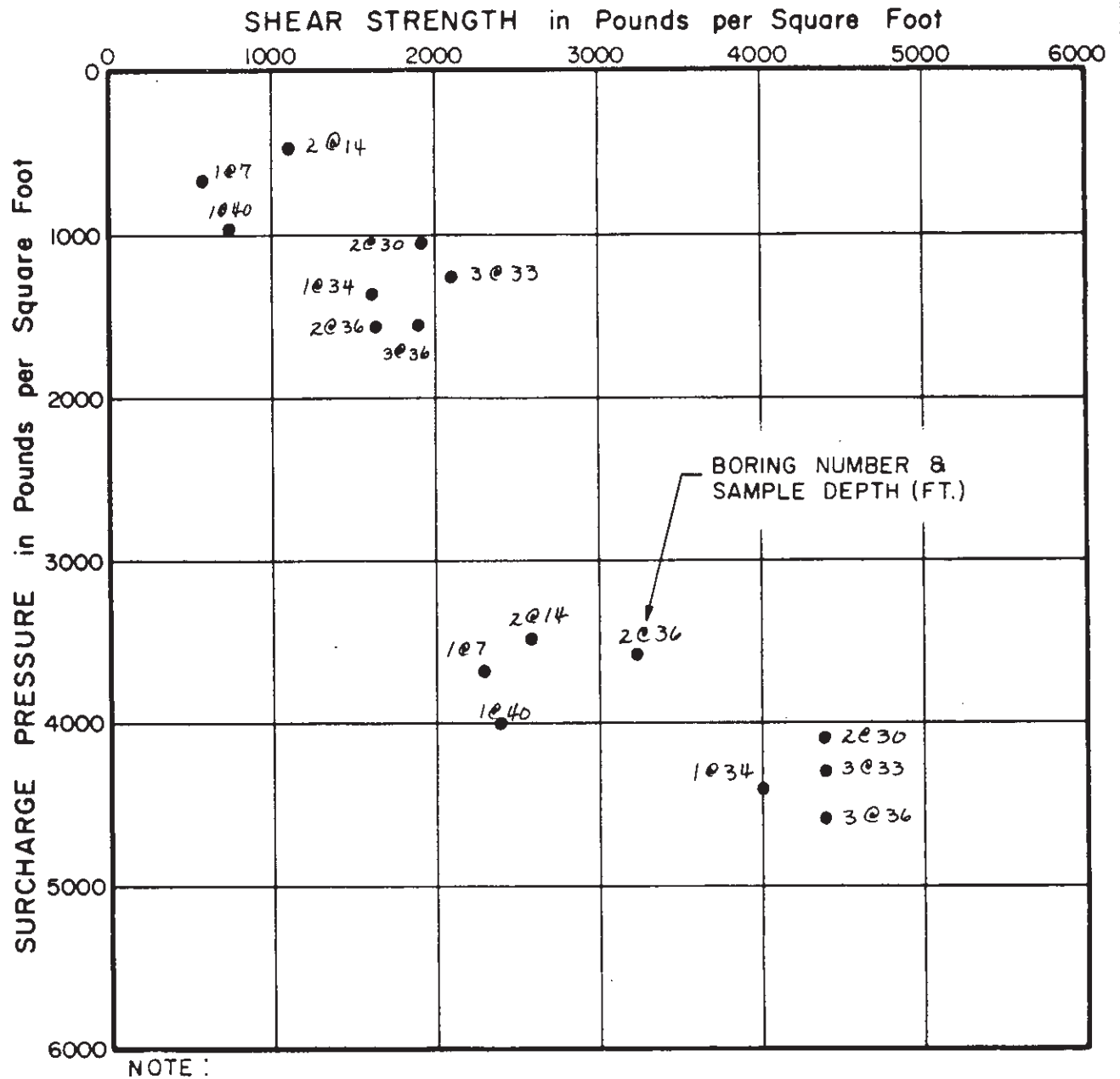
**DIRECT SHEAR TEST DATA**



NOTE: Samples tested at field moisture content

DIRECT SHEAR TEST DATA

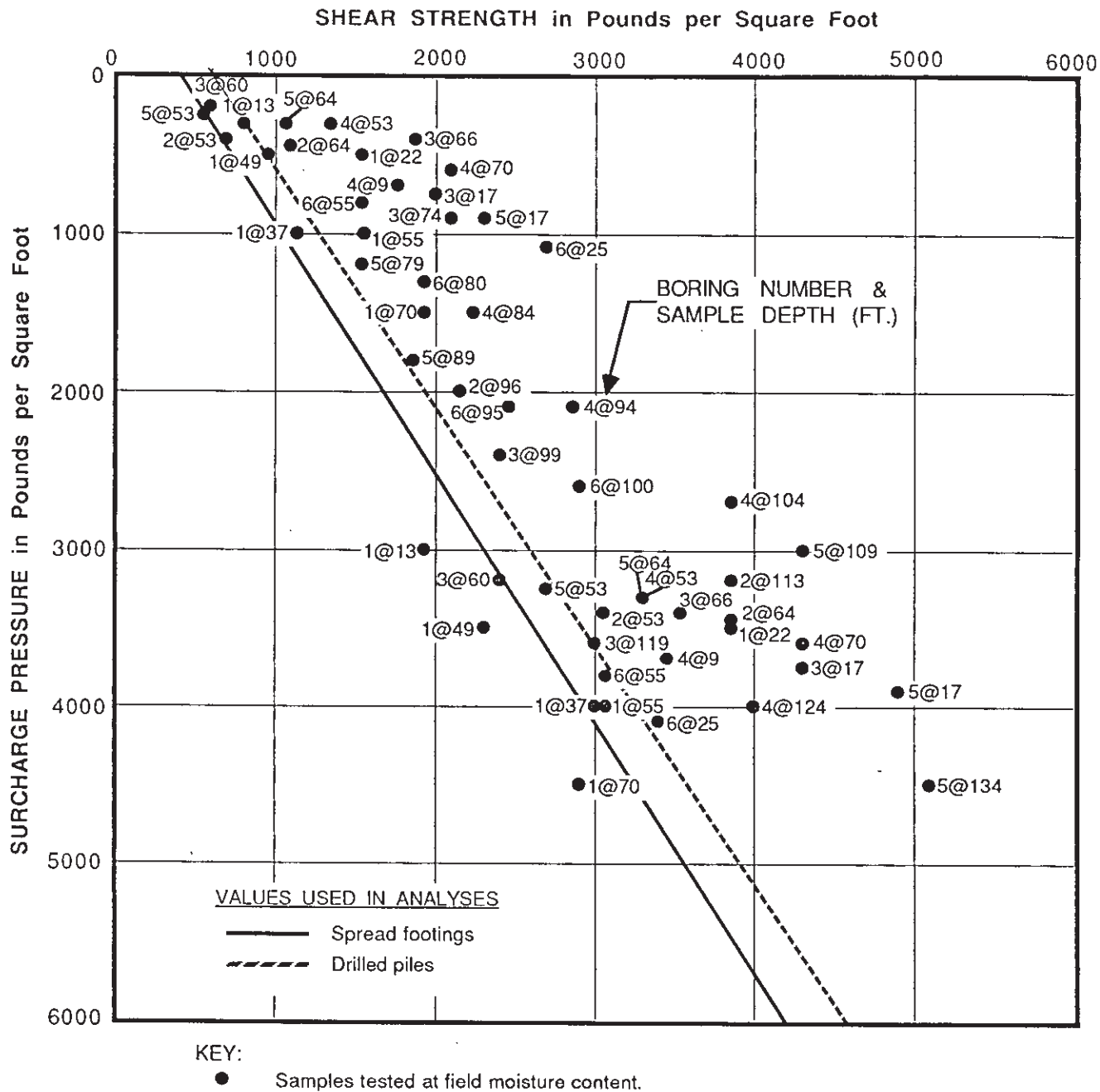
LEROY CRANDALL & ASSOCIATES



NOTE :

Samples tested at field moisture content.

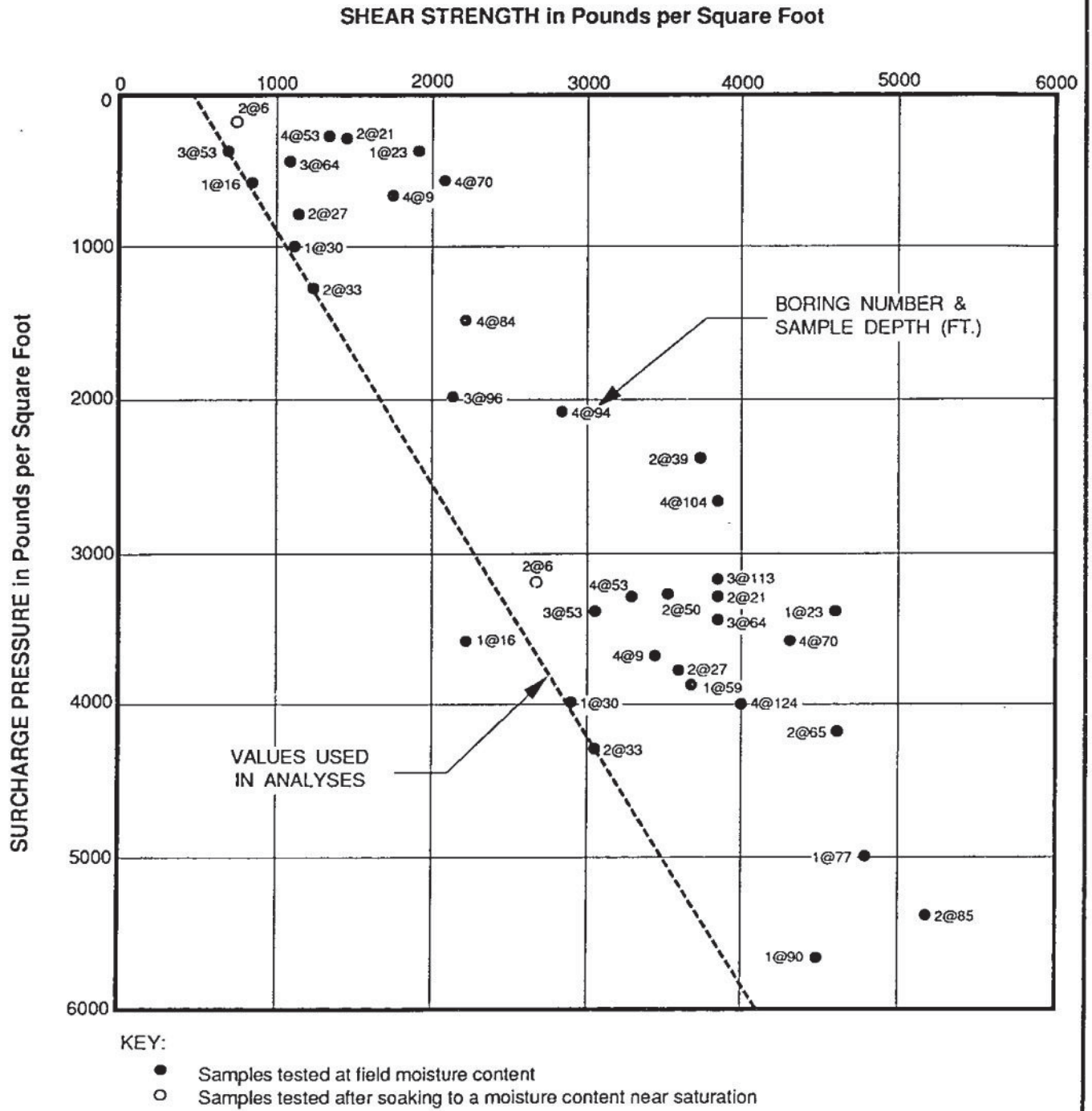
DIRECT SHEAR TEST DATA



DIRECT SHEAR TEST DATA

LeROY CRANDALL AND ASSOCIATES

PLATE A-3



DIRECT SHEAR TEST DATA



Figure D-1.4.22

CHKD

MS

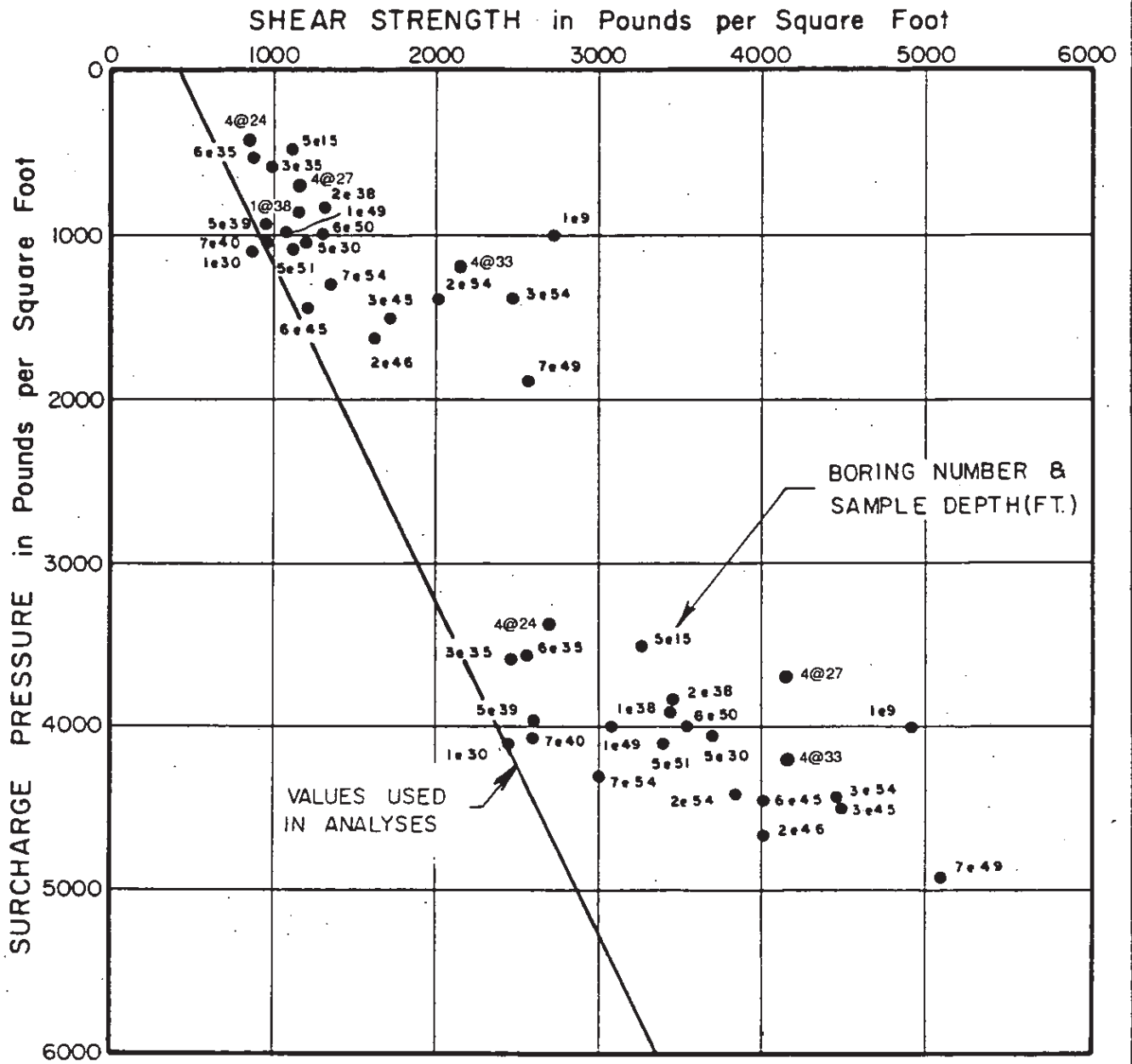
O.E.

R. JULIANA

F.T.

DATE 4/28/95

JOB 2661.50190.0001



NOTE: All samples tested at field moisture content

DIRECT SHEAR TEST DATA

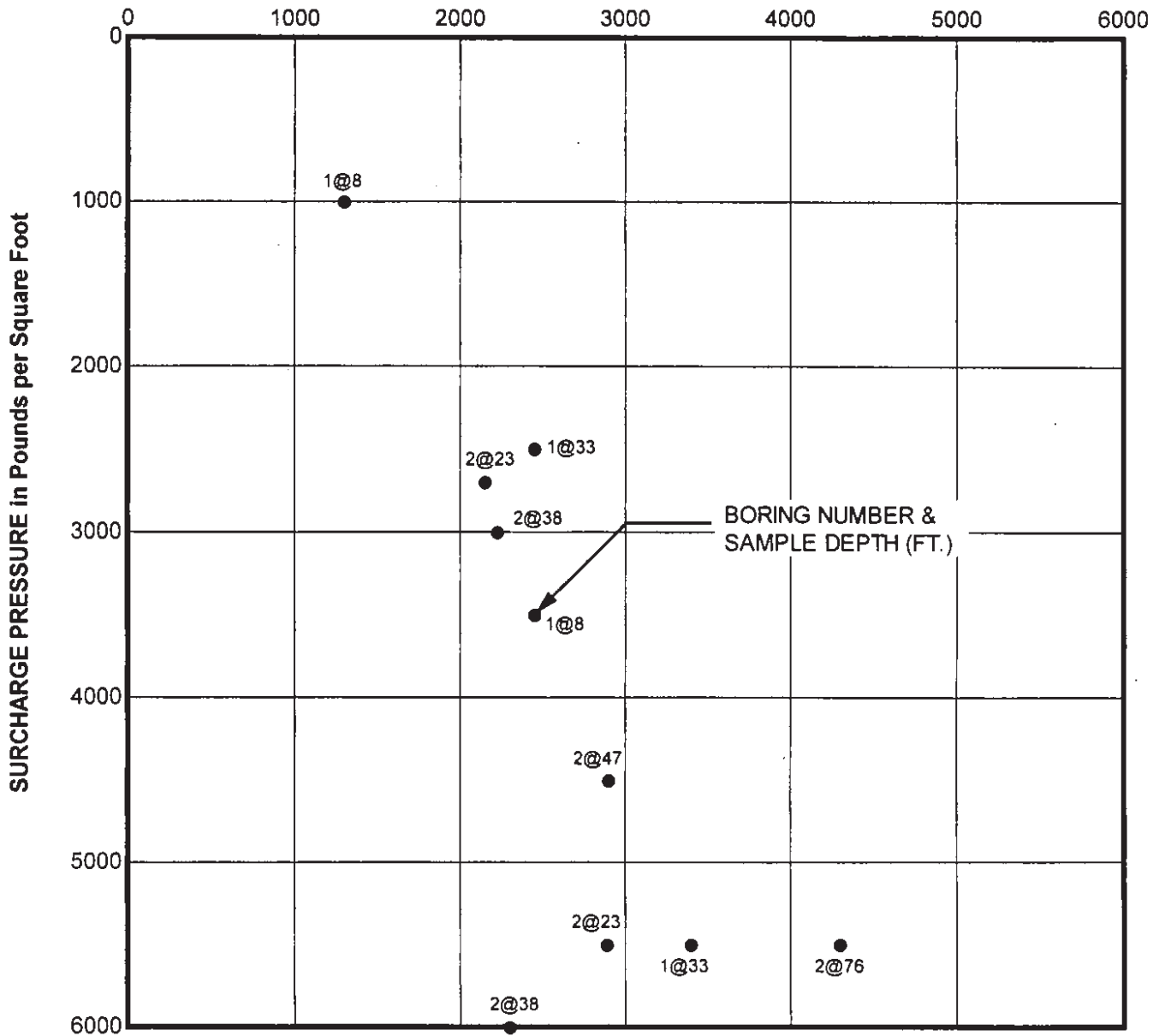
LAW/CRANDALL, INC.



FIGURE A-3

Figure D-1.4.23

SHEAR STRENGTH in Pounds per Square Foot



KEY:
 ● Samples tested at field moisture content
 — Natural soils

DIRECT SHEAR TEST DATA

LAW/CRANDALL

FIGURE A - 3

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	West Subway Extension	Tested by:	AP	Date:	06-15-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	06-28-11
Test Pit:	G-143	Reviewed by:	AP	Date:	06-28-11
Sample No.:	-	Sample Description: Sandy Clay w/gravel			
Depth(ft):	15.5				
Sample Type:	Mod. Cal.	Confining Pressure = 5.0 psi			

Diameter (in)	<u>2.611</u>	<u>2.611</u>	<u>2.611</u>	Avg. =	2.611
Height (in)	<u>5.685</u>	<u>5.685</u>	<u>5.685</u>	Avg. =	5.685

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.354	5.354
Moisture Content (%)	12.52	14.90
Wet Weight (gms)	113.82	1264.02
Dry Weight (gms)	106.80	1119.85
Container Weight (gms)	50.71	152.01
Density and Saturation		
Wet Weight (gms)	1093.82	
Container Weight (gms)	0.00	
Wet Density (pcf)	136.9	
Dry Density (pcf)	121.7	
Initial Void Ratio	0.385	
% Saturation	87.8	



Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	55.0	Initial Burette Ht.(cm)=	0.0
Back Pressure(psi) =	50.0	Final Burette Ht.(cm)=	0.0
Eff. Consol. Stress (psi) =	5.0	Final Height (in)=	5.685
Induced OCR =	1.0	Initial Volume (cu.in)=	30.439
Change in Ht. of Specimen (in) =	0.0000	Final Volume (cu.in) =	30.439

ShearAt Failure

Rate of Deformation (in/min)=	0.008	Deviator Stress (ksf) =	3.70
Time to 50% primary Consolidation (min) =	3	Eff. Minor Principal stress (ksf) =	0.90
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	4.60
		Axial Strain (%) =	5.19

Figure D-2.1.1

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	West Subway Extension	Tested by:	AP	Date:	06-15-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	06-28-11
Test Pit:	G-143	Reviewed by:	AP	Date:	06-28-11
Sample No.:	-	Sample Description:	Sandy Clay w/gravel		
Depth(ft):	15.5				
Sample Type:	Mod. Cal.	Confining Pressure =	15.0 psi		

Diameter (in)	<u>2.611</u>	<u>2.611</u>	<u>2.611</u>	Avg. =	2.611
Height (in)	<u>5.685</u>	<u>5.685</u>	<u>5.685</u>	Avg. =	5.685

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.354	5.319
Moisture Content (%)	12.52	14.90
Wet Weight (gms)	113.82	1264.02
Dry Weight (gms)	106.80	1119.85
Container Weight (gms)	50.71	152.01
Density and Saturation		
Wet Weight (gms)	1093.82	
Container Weight (gms)	0.00	
Wet Density (pcf)	136.9	
Dry Density (pcf)	121.7	
Initial Void Ratio	0.385	
% Saturation	87.8	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	65.0	Initial Burette Ht.(cm)=	59.8
Back Pressure(psi) =	50.0	Final Burette Ht.(cm)=	56.2
Eff. Consol. Stress (psi) =	15.0	Final Height (in)=	5.681
Induced OCR=	1.0	Initial Volume (cu.in)=	30.439
Change in Ht. of Specimen (in) =	0.0040	Final Volume (cu.in) =	30.220

Shear

Rate of Deformation (in/min)=	0.008	At Failure	
Time to 50% primary Consolidation =	3	Deviator Stress (ksf) =	6.79
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	2.07
		Eff. Major Principal stress (ksf) =	8.86
		Axial Strain (%) =	5.01

Figure D-2.1.2

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	West Subway Extension	Tested by:	AP	Date:	06-15-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	06-28-11
Test Pit:	G-143	Reviewed by:	AP	Date:	06-28-11
Sample No.:	-	Sample Description: Sandy Clay w/gravel			
Depth(ft):	15.5				
Sample Type:	Mod. Cal.	Confining Pressure = 25.0 psi			

Diameter (in)	<u>2.611</u>	<u>2.611</u>	<u>2.611</u>	Avg. =	2.611
Height (in)	<u>5.685</u>	<u>5.685</u>	<u>5.685</u>	Avg. =	5.685

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.354	5.331
Moisture Content (%)	12.52	14.90
Wet Weight (gms)	113.82	1264.02
Dry Weight (gms)	106.80	1119.85
Container Weight (gms)	50.71	152.01
Density and Saturation		
Wet Weight (gms)	1093.82	
Container Weight (gms)	0.00	
Wet Density (pcf)	136.9	
Dry Density (pcf)	121.7	
Initial Void Ratio	0.385	
% Saturation	87.8	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	75.0	Initial Burette Ht.(cm)=	56.2
Back Pressure(psi) =	50.0	Final Burette Ht.(cm)=	53.2
Eff. Consol. Stress (psi) =	25.0	Final Height (in)=	5.676
Induced OCR =	1.0	Initial Volume (cu.in)=	30.439
Change in Ht. of Specimen (in) =	0.0092	Final Volume (cu.in) =	30.256

Shear

Rate of Deformation (in/min)=	0.008	At Failure	
Time to 50% primary Consolidation =	3	Deviator Stress (ksf) =	9.80
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	3.30
		Eff. Major Principal stress (ksf) =	13.10
		Axial Strain (%) =	5.32

Figure D-2.1.3

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name: West Subway Extension
 Project No: 4953-10-1561
 Test Pit: G-143
 Depth(ft): 15.5
 Sample No.: -
 Sample Type: Mod. Cal.
 Sample Description: Sandy Clay w/gravel

Cell Pressure: 55.0 psi
 Back Pressure: 50.0 psi
 Consolidation Pressure: 5.0 psi
 Initial Sample Height: 5.685 in
 Initial Area of Sample: 5.354 sq. in.
 Final Sample Ht.* (L): 5.685 in
 Final Sample Area (A)*: 5.354 sq. in.
 Induced OCR= 1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
55.0	0	0.000	50.0	0.00	0.00	0.00	0.00	0.72
55.0	9	0.023	50.3	0.24	0.40	0.04	0.12	0.80
55.0	37	0.037	51.6	0.99	0.65	0.23	0.49	0.98
55.0	51	0.050	52.2	1.36	0.88	0.32	0.68	1.08
55.0	62	0.064	52.4	1.65	1.12	0.34	0.82	1.20
55.0	71	0.077	52.3	1.88	1.36	0.33	0.94	1.33
55.0	78	0.091	52.2	2.06	1.61	0.31	1.03	1.44
55.0	85	0.106	52.0	2.24	1.86	0.28	1.12	1.56
55.0	90	0.121	51.7	2.37	2.12	0.25	1.18	1.66
55.0	95	0.135	51.5	2.49	2.37	0.21	1.25	1.75
55.0	99	0.150	51.2	2.59	2.63	0.18	1.30	1.84
55.0	104	0.164	51.0	2.72	2.89	0.14	1.36	1.94
55.0	108	0.179	50.7	2.81	3.14	0.11	1.41	2.02
55.0	113	0.193	50.5	2.94	3.39	0.07	1.47	2.12
55.0	117	0.207	50.2	3.03	3.63	0.03	1.52	2.20
55.0	122	0.221	50.0	3.15	3.89	0.00	1.58	2.30
55.0	127	0.237	49.7	3.27	4.16	-0.04	1.64	2.40
55.0	131	0.251	49.5	3.37	4.41	-0.07	1.68	2.48
55.0	136	0.265	49.2	3.49	4.66	-0.11	1.74	2.57
55.0	140	0.281	49.0	3.58	4.93	-0.14	1.79	2.65
55.0	145	0.295	48.7	3.70	5.19	-0.18	1.85	2.75

Figure D-2.1.4



CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	West Subway Extension	Cell Pressure:	65.0 psi
Project No:	4953-10-1561	Back Pressure :	50.0 psi
Test Pit:	G-143	Consolidation Pressure :	15.0 psi
Depth(ft):	15.5	Initial Sample Height:	5.685 in
Sample No.:	-	Initial Area of Sample:	5.354 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.681 in
Sample Description:	Sandy Clay w/gravel	Final Sample Area (A)*:	5.319 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
65.0	0	0.000	50.0	0.00	0.00	0.00	0.00	2.16
65.0	3	0.001	50.0	0.08	0.01	0.00	0.04	2.20
65.0	18	0.002	50.6	0.49	0.03	0.09	0.24	2.31
65.0	80	0.010	54.1	2.16	0.18	0.59	1.08	2.65
65.0	111	0.020	55.5	2.99	0.35	0.80	1.50	2.86
65.0	136	0.028	56.2	3.66	0.49	0.90	1.83	3.10
65.0	155	0.037	56.5	4.17	0.65	0.93	2.08	3.31
65.0	169	0.046	56.5	4.54	0.81	0.93	2.27	3.50
65.0	178	0.056	56.3	4.77	0.99	0.90	2.39	3.64
65.0	185	0.065	56.0	4.95	1.14	0.87	2.48	3.77
65.0	191	0.075	55.7	5.10	1.31	0.83	2.55	3.88
65.0	196	0.084	55.5	5.23	1.48	0.78	2.61	3.99
65.0	200	0.094	55.2	5.32	1.65	0.75	2.66	4.08
65.0	204	0.103	54.9	5.42	1.81	0.71	2.71	4.16
65.0	208	0.112	54.7	5.52	1.98	0.67	2.76	4.25
65.0	212	0.122	54.4	5.62	2.15	0.63	2.81	4.33
65.0	215	0.132	54.2	5.69	2.31	0.60	2.84	4.41
65.0	219	0.141	53.9	5.78	2.48	0.56	2.89	4.49
65.0	223	0.151	53.7	5.88	2.65	0.53	2.94	4.57
65.0	226	0.160	53.4	5.95	2.82	0.50	2.97	4.64
65.0	229	0.169	53.2	6.01	2.98	0.46	3.01	4.70
65.0	233	0.179	53.0	6.11	3.15	0.43	3.05	4.79
65.0	236	0.189	52.8	6.18	3.33	0.40	3.09	4.85
65.0	238	0.198	52.6	6.22	3.49	0.37	3.11	4.90
65.0	241	0.208	52.3	6.28	3.66	0.33	3.14	4.97
65.0	244	0.218	52.1	6.35	3.84	0.30	3.18	5.03
65.0	247	0.227	51.9	6.42	4.00	0.27	3.21	5.10
65.0	250	0.237	51.7	6.49	4.16	0.24	3.24	5.17
65.0	253	0.247	51.4	6.55	4.34	0.21	3.28	5.23
65.0	256	0.256	51.2	6.62	4.50	0.18	3.31	5.29
65.0	259	0.266	51.0	6.68	4.68	0.14	3.34	5.36
65.0	262	0.275	50.8	6.75	4.85	0.11	3.37	5.42
65.0	264	0.284	50.6	6.79	5.01	0.09	3.39	5.47

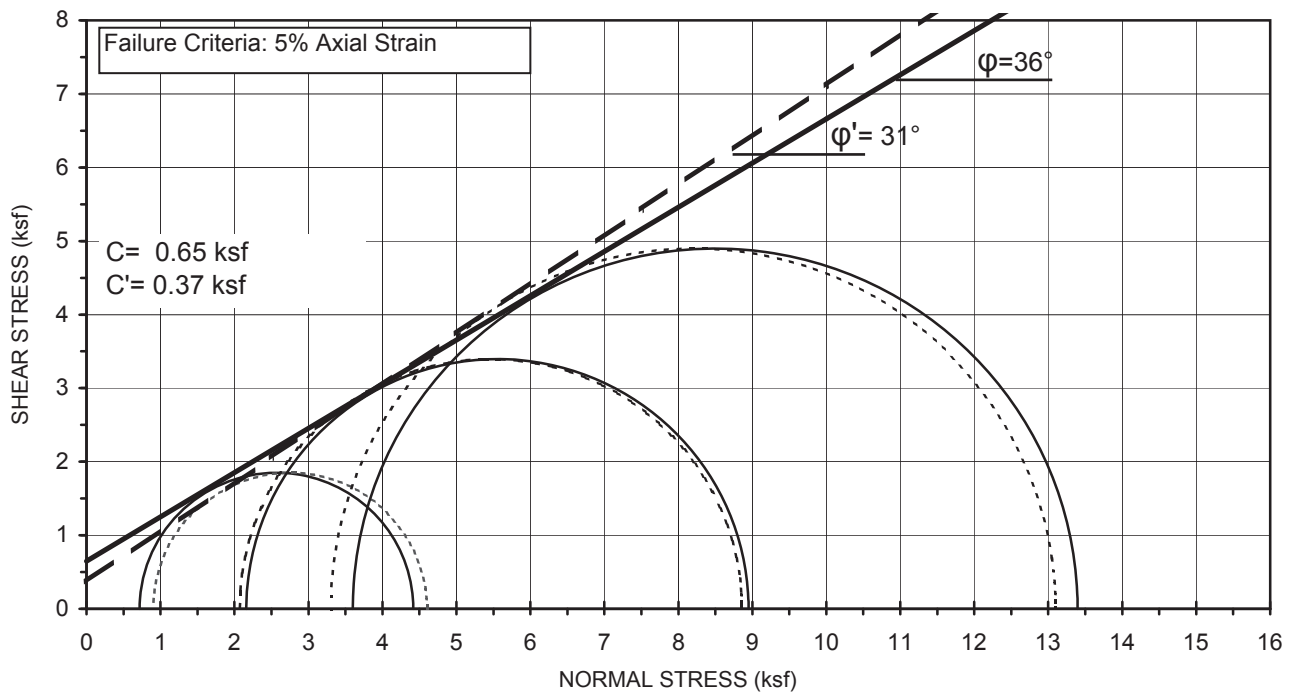
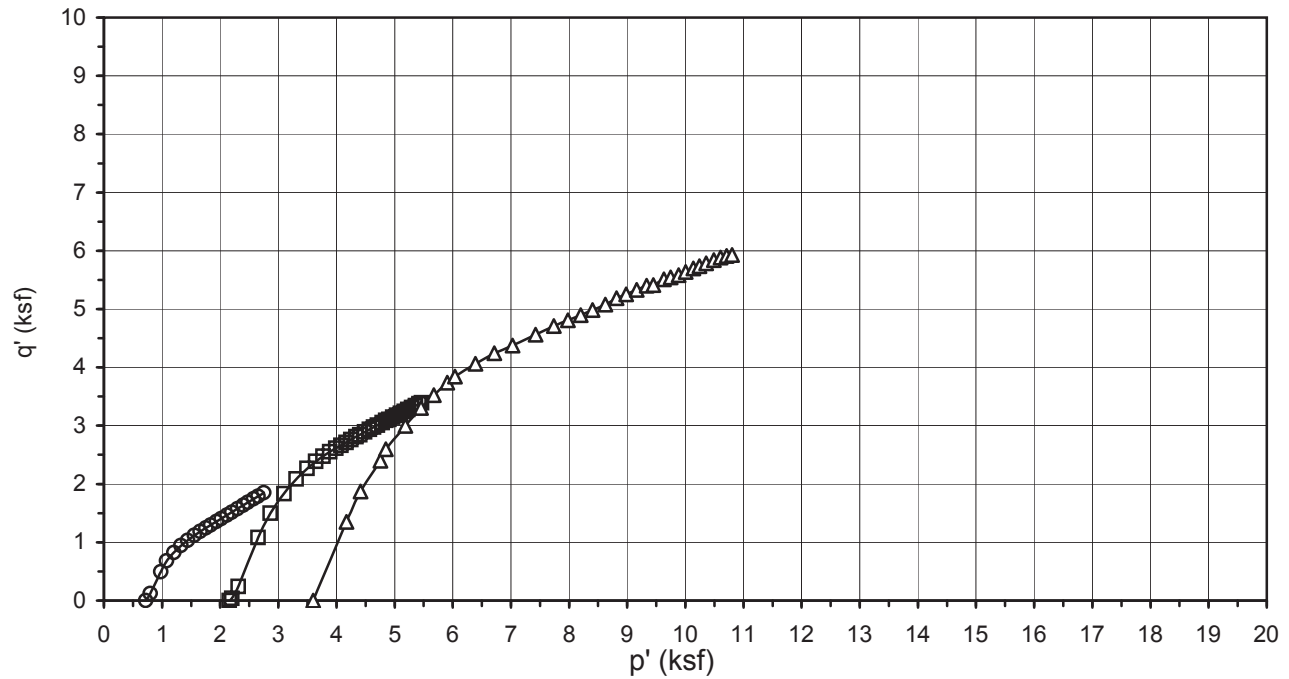
Figure D-2.1.5

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	West Subway Extension	Cell Pressure:	75.0 psi
Project No:	4953-10-1561	Back Pressure :	50.0 psi
Test Pit:	G-143	Consolidation Pressure :	25.0 psi
Depth(ft):	15.5	Initial Sample Height:	5.685 in
Sample No.:	-	Initial Area of Sample:	5.354 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.676 in
Sample Description:	Sandy Clay w/gravel	Final Sample Area (A)*:	5.331 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
75.0	0	0.000	50.0	0.00	0.00	0.00	0.00	3.60
75.0	100	0.006	55.4	2.70	0.11	0.78	1.35	4.17
75.0	139	0.012	57.3	3.75	0.21	1.06	1.87	4.42
75.0	178	0.018	58.6	4.79	0.32	1.24	2.40	4.75
75.0	193	0.024	59.3	5.19	0.42	1.34	2.60	4.85
75.0	223	0.030	59.8	5.99	0.53	1.41	3.00	5.18
75.0	246	0.036	60.1	6.60	0.63	1.45	3.30	5.45
75.0	263	0.042	60.1	7.05	0.74	1.45	3.53	5.67
75.0	279	0.048	59.9	7.47	0.85	1.43	3.74	5.91
75.0	287	0.054	59.7	7.68	0.95	1.40	3.84	6.04
75.0	305	0.080	58.8	8.12	1.41	1.27	4.06	6.39
75.0	319	0.090	57.8	8.48	1.59	1.12	4.24	6.72
75.0	331	0.120	56.6	8.75	2.11	0.95	4.38	7.03
75.0	348	0.167	55.1	9.12	2.95	0.74	4.56	7.42
75.0	362	0.212	54.0	9.41	3.73	0.57	4.71	7.74
75.0	373	0.257	53.0	9.62	4.54	0.43	4.81	7.98
75.0	383	0.302	52.1	9.80	5.32	0.30	4.90	8.20
75.0	393	0.347	51.2	9.97	6.12	0.18	4.98	8.41
75.0	404	0.393	50.4	10.16	6.92	0.06	5.08	8.62
75.0	416	0.438	49.8	10.37	7.72	-0.03	5.18	8.82
75.0	425	0.484	49.1	10.50	8.53	-0.13	5.25	8.98
75.0	435	0.529	48.4	10.65	9.33	-0.24	5.33	9.16
75.0	445	0.574	47.7	10.80	10.12	-0.33	5.40	9.33
75.0	450	0.621	47.0	10.83	10.93	-0.43	5.41	9.45
75.0	462	0.666	46.4	11.02	11.73	-0.52	5.51	9.63
75.0	469	0.710	45.8	11.08	12.52	-0.61	5.54	9.75
75.0	477	0.756	45.1	11.17	13.32	-0.70	5.58	9.88
75.0	486	0.802	44.7	11.27	14.13	-0.77	5.64	10.01
75.0	496	0.847	44.2	11.40	14.92	-0.84	5.70	10.14
75.0	504	0.893	43.7	11.47	15.73	-0.91	5.74	10.24
75.0	513	0.938	43.2	11.57	16.53	-0.98	5.78	10.36
75.0	523	0.984	42.7	11.68	17.34	-1.05	5.84	10.49
75.0	532	1.029	42.2	11.77	18.13	-1.12	5.88	10.61
75.0	540	1.075	41.7	11.83	18.93	-1.20	5.91	10.71
75.0	547	1.120	41.2	11.86	19.74	-1.27	5.93	10.80

Figure D-2.1.6

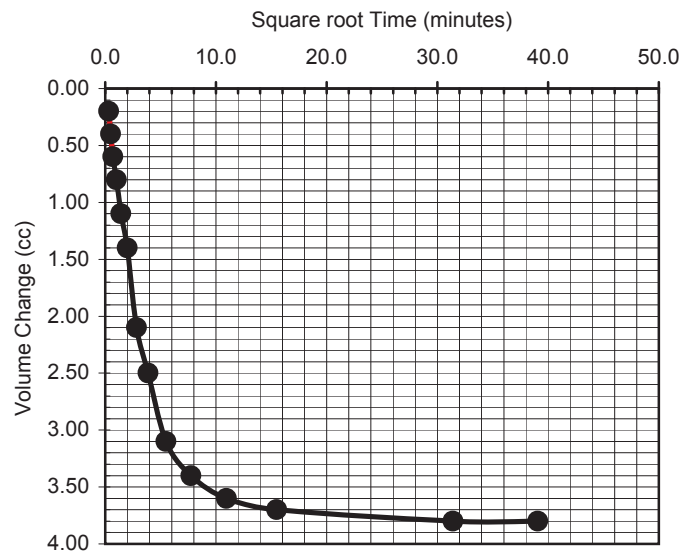
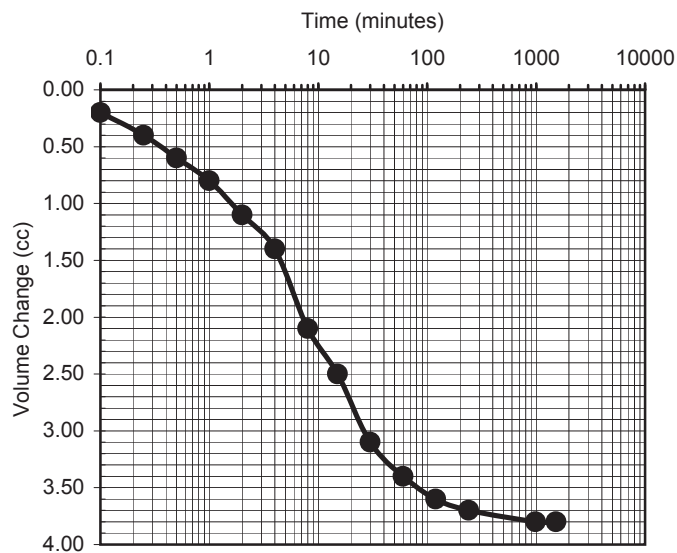


Project Name: West Subway Extension
Project No.: 4953-10-1561
Test Pit: G-143
Sample No.: -
Depth (ft): 15.5

Sample Type: Mod. Cal.
Sample Description: Sandy Clay w/gravel
Avg. Dry Unit Weight (pcf): 121.7
Avg. Initial Moisture Content (%): 12.5
Confining Pressure: 5.0, 15.0, 25.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

Figure D-2.1.7



Test Pit: G-143
 Sample No.: -
 Depth (feet): 15.5

Sample Type: Mod. Cal.
 Soil Description: Sandy Clay w/gravel
 Eff. Confining Pressure (ksf): 15.0

Time (minutes)	Volume Change (cc)
0	0.0000
0.1	0.2000
0.25	0.4000
0.5	0.6000
1	0.8000
2	1.1000
4	1.4000
8	2.1000
15	2.5000
30	3.1000
60	3.4000
120	3.6000
240	3.7000
987	3.8000
1527	3.8000

SQRT Time (minutes)	Volume Change (cc)
0.0000	0.0000
0.3162	0.2000
0.5000	0.4000
0.7071	0.6000
1.0000	0.8000
1.4142	1.1000
2.0000	1.4000
2.8284	2.1000
3.8730	2.5000
5.4772	3.1000
7.7460	3.4000
10.9545	3.6000
15.4919	3.7000
31.4166	3.8000
39.0768	3.8000

**TIME RATE CONSOLIDATION CURVE
 ASTM D 2435**


Project Name: West Subway Extension
 Project No.: 4953-10-1561
 Date: 06/15/11

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	West Subway Extension	Tested by:	AP	Date:	06-15-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	06-28-11
Test Pit:	G-143	Reviewed by:	AP	Date:	06-28-11
Sample No.:	-	Sample Description: Yell. Brown Clay w/sand			
Depth(ft):	45.5				
Sample Type:	Mod. Cal.	Confining Pressure = 15.0 psi			

Diameter (in)	<u>2.599</u>	<u>2.599</u>	<u>2.599</u>	Avg. =	2.599
Height (in)	<u>5.584</u>	<u>5.584</u>	<u>5.584</u>	Avg. =	5.584

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.305	5.334
Moisture Content (%)	22.62	24.92
Wet Weight (gms)	103.70	1109.64
Dry Weight (gms)	93.75	918.08
Container Weight (gms)	49.77	149.44
Density and Saturation		
Wet Weight (gms)	975.32	
Container Weight (gms)	0.00	
Wet Density (pcf)	125.4	
Dry Density (pcf)	102.3	
Initial Void Ratio	0.647	
% Saturation	94.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	96	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	45.0	Initial Burette Ht.(cm)=	65.5
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	63.1
Eff. Consol. Stress (psi) =	15.0	Final Height (in)=	5.526
Induced OCR =	1.0	Initial Volume (cu.in)=	29.624
Change in Ht. of Specimen (in) =	0.0578	Final Volume (cu.in) =	29.478

Shear

Rate of Deformation (in/min)=	0.008	<u>At Failure</u>	
Time to 50% primary Consolidation (min) =	3	Deviator Stress (ksf) =	2.91
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	1.01
		Eff. Major Principal stress (ksf) =	3.91
		Axial Strain (%) =	4.69

Figure D-2.1.9

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	West Subway Extension	Tested by:	AP	Date:	06-15-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	06-28-11
Test Pit:	G-143	Reviewed by:	AP	Date:	06-28-11
Sample No.:	-	Sample Description: Yell. Brown Clay w/sand			
Depth(ft):	45.5				
Sample Type:	Mod. Cal.	Confining Pressure = 30.0 psi			

Diameter (in)	<u>2.599</u>	<u>2.599</u>	<u>2.599</u>	Avg. =	2.599
Height (in)	<u>5.584</u>	<u>5.584</u>	<u>5.584</u>	Avg. =	5.584

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.305	5.289
Moisture Content (%)	22.62	24.92
Wet Weight (gms)	103.70	1109.64
Dry Weight (gms)	93.75	918.08
Container Weight (gms)	49.77	149.44
Density and Saturation		
Wet Weight (gms)	975.32	
Container Weight (gms)	0.00	
Wet Density (pcf)	125.4	
Dry Density (pcf)	102.3	
Initial Void Ratio	0.647	
% Saturation	94.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	96	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	60.0	Initial Burette Ht.(cm)=	63.3
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	58.9
Eff. Consol. Stress (psi) =	30.0	Final Height (in)=	5.551
Induced OCR=	1.0	Initial Volume (cu.in)=	29.624
Change in Ht. of Specimen (in) =	0.0333	Final Volume (cu.in) =	29.356

Shear

Rate of Deformation (in/min)=	0.008	At Failure	
Time to 50% primary Consolidation =	3	Deviator Stress (ksf) =	6.22
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	2.37
		Eff. Major Principal stress (ksf) =	8.60
		Axial Strain (%) =	5.29

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	West Subway Extension	Tested by:	AP	Date:	06-15-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	06-28-11
Test Pit:	G-143	Reviewed by:	AP	Date:	06-28-11
Sample No.:	-	Sample Description: Yell. Brown Clay w/sand			
Depth(ft):	45.5				
Sample Type:	Mod. Cal.	Confining Pressure = 45.0 psi			

Diameter (in)	<u>2.599</u>	<u>2.599</u>	<u>2.599</u>	Avg. =	2.599
Height (in)	<u>5.584</u>	<u>5.584</u>	<u>5.584</u>	Avg. =	5.584

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.305	5.197
Moisture Content (%)	22.62	24.92
Wet Weight (gms)	103.70	1109.64
Dry Weight (gms)	93.75	918.08
Container Weight (gms)	49.77	149.44
Density and Saturation		
Wet Weight (gms)	975.32	
Container Weight (gms)	0.00	
Wet Density (pcf)	125.4	
Dry Density (pcf)	102.3	
Initial Void Ratio	0.647	
% Saturation	94.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	96	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	75.0	Initial Burette Ht.(cm)=	55.1
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	45.0
Eff. Consol. Stress (psi) =	45.0	Final Height (in)=	5.582
Induced OCR =	1.0	Initial Volume (cu.in)=	29.624
Change in Ht. of Specimen (in) =	0.0018	Final Volume (cu.in) =	29.008

Shear

Rate of Deformation (in/min)=	0.008	At Failure	
Time to 50% primary Consolidation =	3	Deviator Stress (ksf) =	10.66
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	4.93
		Eff. Major Principal stress (ksf) =	15.58
		Axial Strain (%) =	4.81

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name: West Subway Extension
 Project No: 4953-10-1561
 Test Pit: G-143
 Depth(ft): 45.5
 Sample No.: -
 Sample Type: Mod. Cal.
 Sample Description: Yell. Brown Clay w/sand

Cell Pressure: 45.0 psi
 Back Pressure: 30.0 psi
 Consolidation Pressure: 15.0 psi
 Initial Sample Height: 5.584 in
 Initial Area of Sample: 5.305 sq. in.
 Final Sample Ht.* (L): 5.526 in
 Final Sample Area (A)*: 5.334 sq. in.
 Induced OCR= 1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress (S1-S3)	Axial Strain	Pore Pressure Change	Shear Stress q' (S1-S3)/2	Normal Stress p' (S1'+S3')/2
(psi)	(lbs)	(in)	(psi)	(ksf)	(%)	(ksf)	(ksf)	(ksf)
45.0	0	0.000	30.0	0.00	0.00	0.00	0.00	2.16
45.0	36	0.011	32.7	0.97	0.20	0.38	0.48	2.26
45.0	49	0.025	34.4	1.32	0.44	0.62	0.66	2.19
45.0	57	0.039	35.4	1.53	0.70	0.77	0.76	2.15
45.0	63	0.053	36.1	1.68	0.95	0.88	0.84	2.13
45.0	68	0.067	36.6	1.81	1.21	0.95	0.91	2.11
45.0	73	0.081	37.0	1.94	1.47	1.01	0.97	2.12
45.0	77	0.097	37.4	2.04	1.75	1.05	1.02	2.13
45.0	81	0.112	37.6	2.14	2.02	1.09	1.07	2.14
45.0	85	0.127	37.8	2.24	2.29	1.12	1.12	2.17
45.0	88	0.142	37.9	2.31	2.56	1.14	1.16	2.18
45.0	91	0.155	38.0	2.39	2.80	1.15	1.19	2.20
45.0	95	0.170	38.1	2.49	3.07	1.16	1.24	2.24
45.0	98	0.184	38.1	2.56	3.32	1.17	1.28	2.27
45.0	101	0.198	38.2	2.63	3.59	1.17	1.31	2.31
45.0	104	0.213	38.2	2.70	3.86	1.17	1.35	2.34
45.0	107	0.228	38.1	2.77	4.12	1.17	1.38	2.38
45.0	110	0.244	38.1	2.84	4.41	1.16	1.42	2.42
45.0	113	0.259	38.0	2.91	4.69	1.15	1.45	2.46

Figure D-2.1.12



CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	West Subway Extension	Cell Pressure:	60.0 psi
Project No.:	4953-10-1561	Back Pressure :	30.0 psi
Test Pit:	G-143	Consolidation Pressure :	30.0 psi
Depth(ft):	45.5	Initial Sample Height:	5.584 in
Sample No.:	-	Initial Area of Sample:	5.305 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.551 in
Sample Description:	Yell. Brown Clay w/sand	Final Sample Area (A)*:	5.289 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
60.0	0	0.000	30.0	0.00	0.00	0.00	0.00	4.32
60.0	42	0.002	32.6	1.14	0.04	0.38	0.57	4.51
60.0	67	0.006	34.6	1.81	0.10	0.66	0.90	4.57
60.0	84	0.011	36.1	2.27	0.19	0.88	1.14	4.57
60.0	97	0.015	37.4	2.63	0.26	1.06	1.32	4.57
60.0	108	0.020	38.4	2.94	0.35	1.21	1.47	4.58
60.0	118	0.025	39.2	3.19	0.44	1.33	1.60	4.59
60.0	126	0.029	39.9	3.42	0.52	1.43	1.71	4.60
60.0	134	0.033	40.5	3.63	0.59	1.51	1.81	4.62
60.0	141	0.037	41.1	3.80	0.67	1.59	1.90	4.63
60.0	146	0.042	41.5	3.95	0.75	1.65	1.98	4.65
60.0	152	0.046	41.9	4.10	0.84	1.71	2.05	4.66
60.0	157	0.051	42.2	4.23	0.92	1.76	2.11	4.67
60.0	162	0.056	42.5	4.35	1.01	1.80	2.18	4.69
60.0	184	0.087	43.8	4.94	1.57	1.98	2.47	4.81
60.0	191	0.101	44.1	5.10	1.82	2.02	2.55	4.85
60.0	211	0.164	44.3	5.57	2.96	2.06	2.79	5.05
60.0	215	0.179	44.3	5.66	3.22	2.05	2.83	5.10
60.0	219	0.193	44.2	5.74	3.47	2.04	2.87	5.15
60.0	221	0.206	44.1	5.80	3.71	2.03	2.90	5.19
60.0	225	0.220	44.0	5.89	3.96	2.02	2.94	5.24
60.0	229	0.235	43.9	5.97	4.22	2.00	2.99	5.30
60.0	232	0.249	43.9	6.03	4.48	1.99	3.01	5.34
60.0	235	0.264	43.8	6.09	4.75	1.98	3.04	5.38
60.0	238	0.279	43.7	6.14	5.02	1.96	3.07	5.43
60.0	241	0.294	43.5	6.22	5.29	1.95	3.11	5.48

Figure D-2.1.13

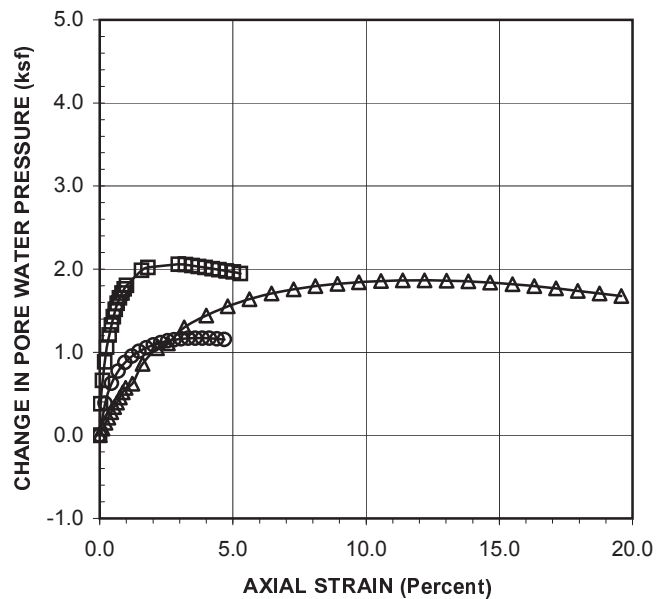
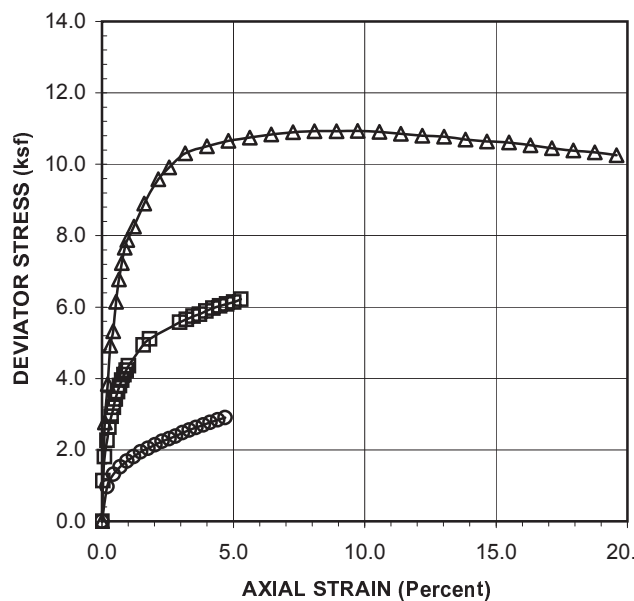
**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name: West Subway Extension
 Project No: 4953-10-1561
 Test Pit: G-143
 Depth(ft): 45.5
 Sample No.: -
 Sample Type: Mod. Cal.
 Sample Description: Yell. Brown Clay w/sand

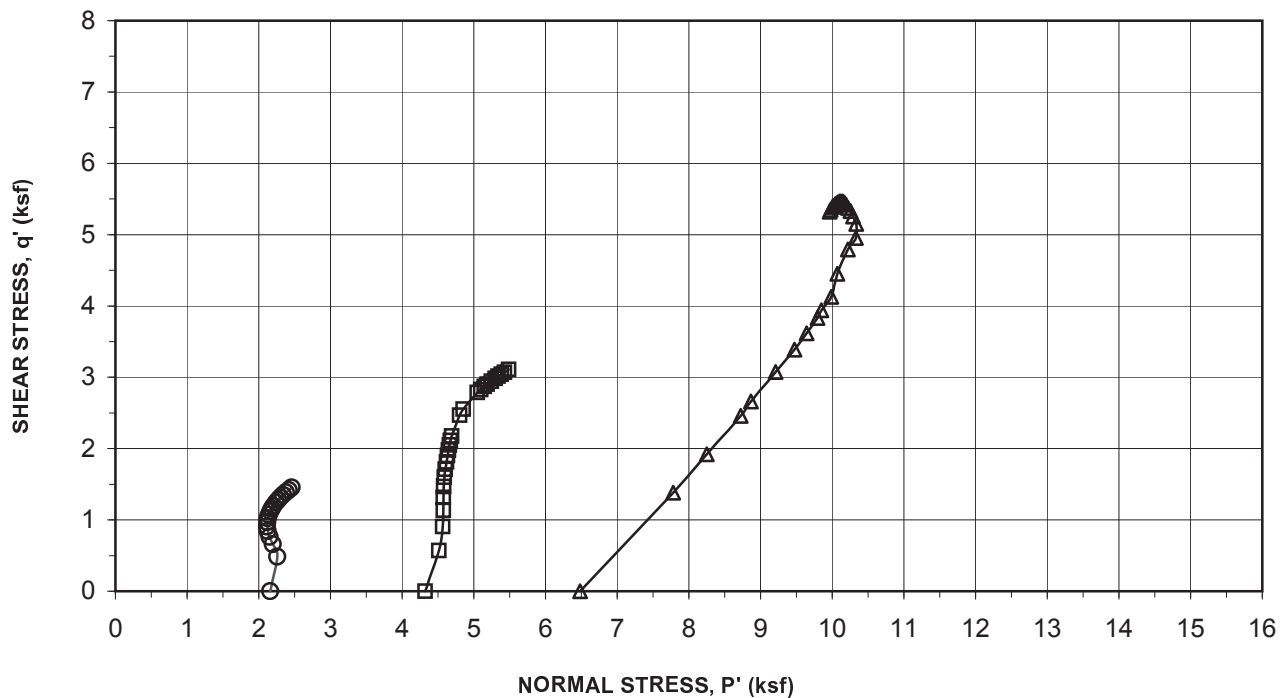
Cell Pressure: 75.0 psi
 Back Pressure: 30.0 psi
 Consolidation Pressure: 45.0 psi
 Initial Sample Height: 5.584 in
 Initial Area of Sample: 5.305 sq. in.
 Final Sample Ht.* (L): 5.582 in
 Final Sample Area (A)*: 5.197 sq. in.
 Induced OCR= 1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
75.0	0	0.000	30.0	0.00	0.00	0.00	0.00	6.48
75.0	100	0.006	30.6	2.77	0.11	0.08	1.38	7.78
75.0	139	0.012	31.0	3.84	0.21	0.15	1.92	8.25
75.0	178	0.018	31.5	4.92	0.32	0.21	2.46	8.72
75.0	193	0.024	31.9	5.33	0.43	0.28	2.66	8.86
75.0	223	0.030	32.4	6.15	0.54	0.34	3.07	9.21
75.0	246	0.036	32.7	6.77	0.64	0.39	3.39	9.47
75.0	263	0.042	33.2	7.23	0.75	0.46	3.62	9.64
75.0	279	0.048	33.6	7.66	0.86	0.52	3.83	9.80
75.0	287	0.054	34.0	7.88	0.97	0.57	3.94	9.85
75.0	302	0.068	34.3	8.26	1.22	0.62	4.13	9.99
75.0	327	0.090	36.0	8.90	1.61	0.86	4.45	10.07
75.0	353	0.120	37.3	9.58	2.15	1.05	4.79	10.22
75.0	367	0.143	37.7	9.91	2.56	1.11	4.95	10.33
75.0	384	0.177	39.0	10.30	3.17	1.30	5.15	10.33
75.0	395	0.223	40.0	10.51	3.99	1.44	5.25	10.29
75.0	404	0.268	40.8	10.66	4.81	1.55	5.33	10.26
75.0	411	0.314	41.4	10.75	5.63	1.64	5.37	10.22
75.0	418	0.360	41.9	10.84	6.45	1.71	5.42	10.19
75.0	424	0.406	42.2	10.89	7.27	1.76	5.45	10.17
75.0	429	0.452	42.5	10.93	8.09	1.79	5.46	10.15
75.0	433	0.498	42.7	10.93	8.92	1.82	5.46	10.12
75.0	437	0.543	42.8	10.93	9.73	1.84	5.47	10.10
75.0	440	0.589	42.9	10.91	10.56	1.86	5.45	10.08
75.0	442	0.635	43.0	10.85	11.38	1.86	5.43	10.04
75.0	444	0.681	43.0	10.80	12.19	1.86	5.40	10.02
75.0	447	0.727	42.9	10.77	13.03	1.86	5.39	10.00
75.0	448	0.773	42.9	10.70	13.84	1.85	5.35	9.98
75.0	450	0.818	42.8	10.64	14.66	1.84	5.32	9.96
75.0	453	0.865	42.6	10.61	15.49	1.82	5.30	9.97
75.0	454	0.910	42.5	10.53	16.31	1.79	5.26	9.95
75.0	455	0.956	42.3	10.45	17.12	1.77	5.22	9.94
75.0	457	1.002	42.1	10.39	17.94	1.74	5.20	9.94
75.0	459	1.047	41.9	10.33	18.76	1.71	5.17	9.94
75.0	460	1.093	41.7	10.25	19.58	1.68	5.13	9.93

Figure D-2.1.14



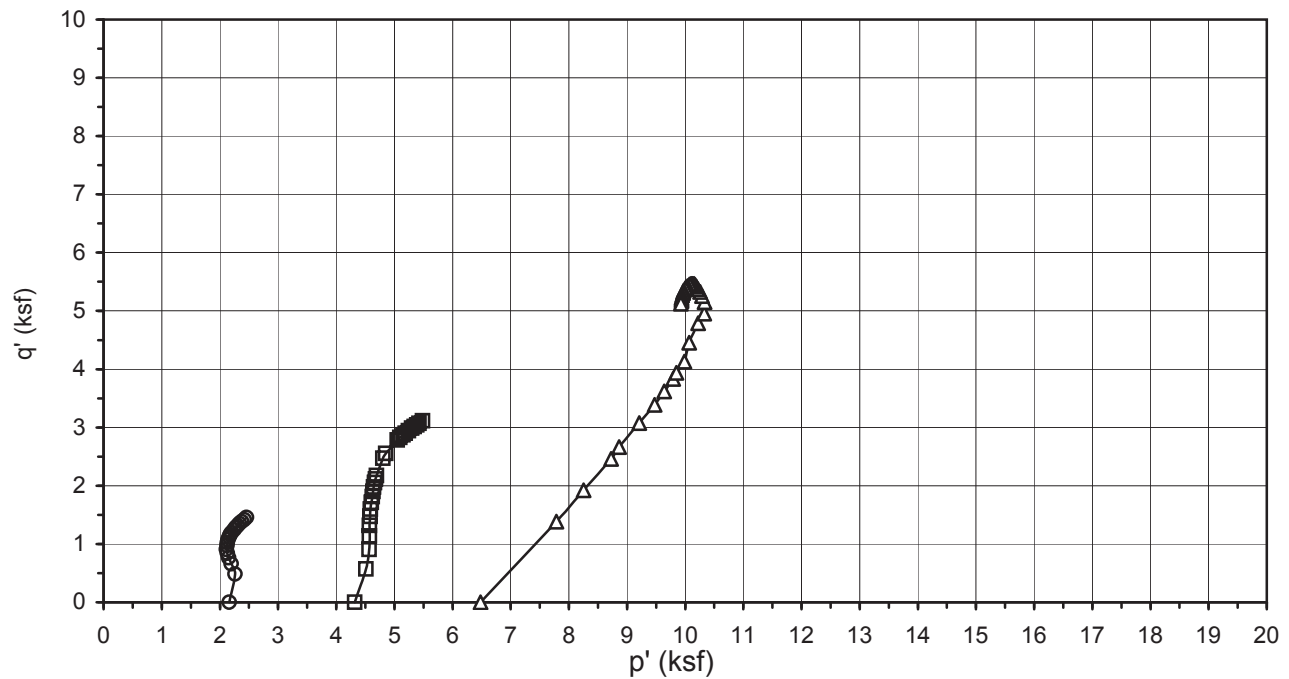
LEGEND: CONFINING PRESSURES= ○ 15 psi □ 30 psi △ 45 psi



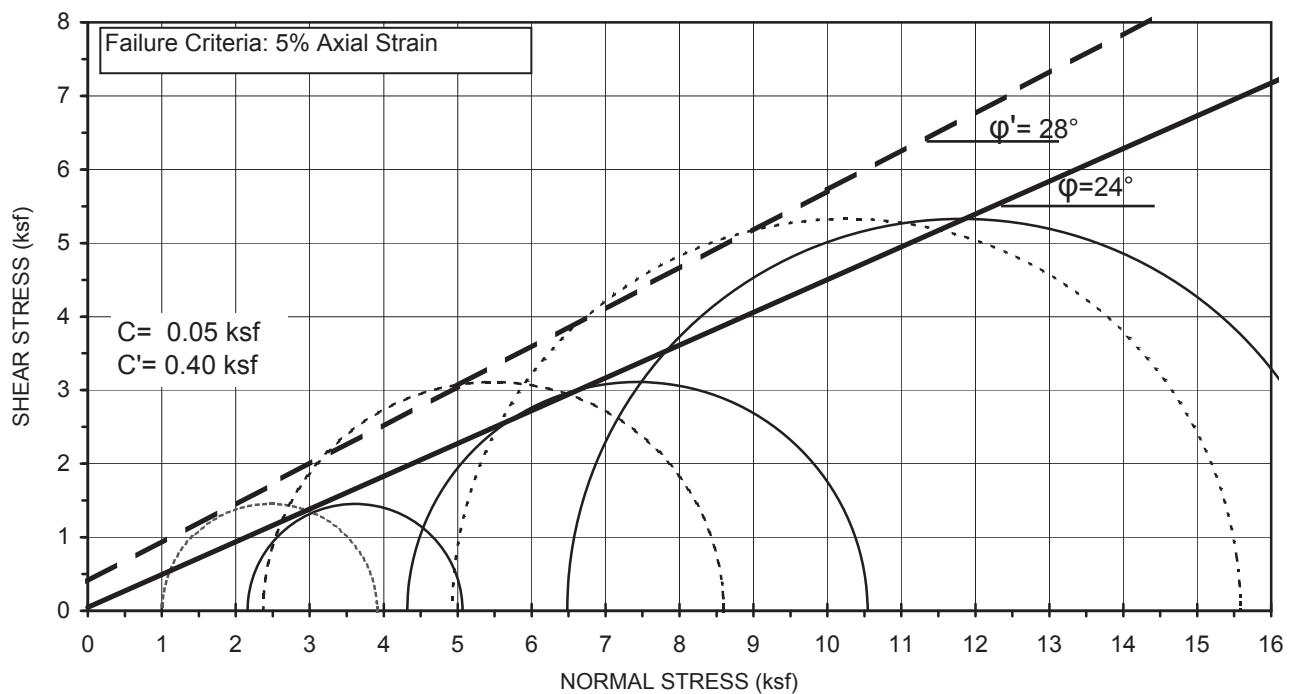
Project Name: West Subway Extension
Project No.: 4953-10-1561
Test Pit: G-143
Sample No.: -
Depth (ft): 45.5

Sample Type: Mod. Cal.
Sample Description: Yell. Brown Clay w/sand
Avg. Dry Unit Weight (pcf): 102.3
Avg. Initial Moisture Content (%): 22.6
Confining Pressure: 15.0, 30.0, 45.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767



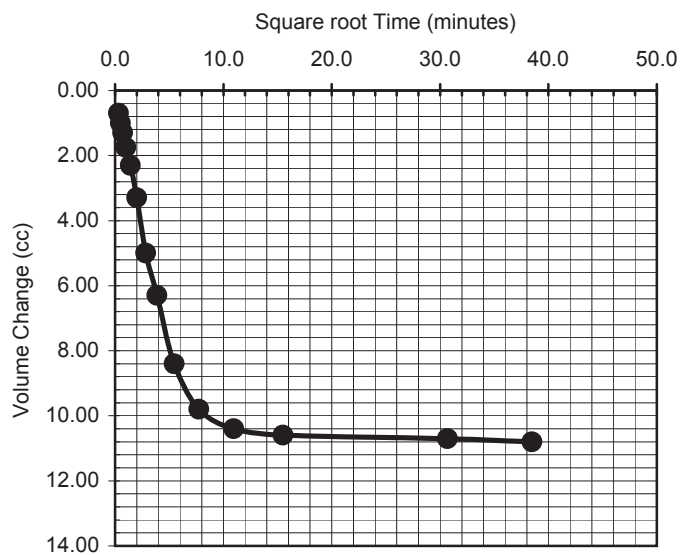
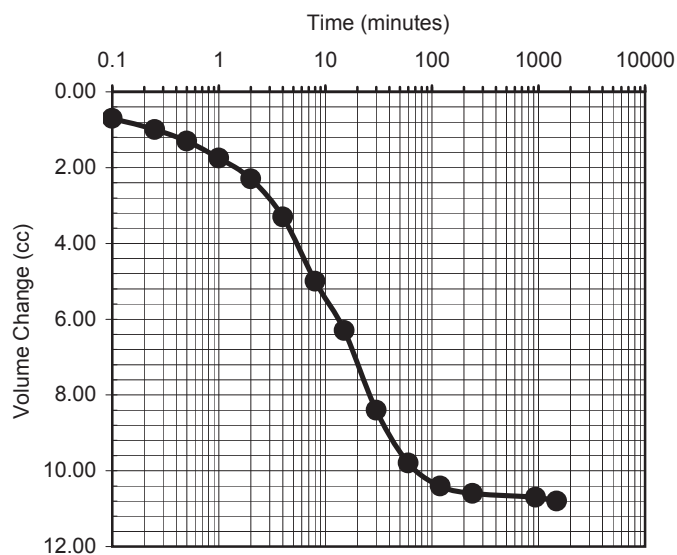
LEGEND: CONFINING PRESSURES= ○ 15 psi □ 30 psi △ 45 psi



Project Name:	West Subway Extension	Sample Type:	Mod. Cal.
Project No.:	4953-10-1561	Sample Description:	Yell. Brown Clay w/sand
Test Pit:	G-143	Avg. Dry Unit Weight (pcf):	102.3
Sample No.:	-	Avg. Initial Moisture Content (%):	22.6
Depth (ft):	45.5	Confining Pressure:	15.0, 30.0, 45.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

Figure D-2.1.16



Test Pit: G-143
 Sample No.: -
 Depth (feet): 45.5

Sample Type: Mod. Cal.
 Soil Description: Yell. Brown Clay w/sand
 Eff. Confining Pressure (psi): 30.0

Time (minutes)	Volume Change (cc)
0	0.0000
0.1	0.7000
0.25	1.0000
0.5	1.3000
1	1.7500
2	2.3000
4	3.3000
8	5.0000
15	6.3000
30	8.4000
60	9.8000
120	10.4000
240	10.6000
941	10.7000
1481	10.8000

SQRT Time (minutes)	Volume Change (cc)
0.0000	0.0000
0.3162	0.7000
0.5000	1.0000
0.7071	1.3000
1.0000	1.7500
1.4142	2.3000
2.0000	3.3000
2.8284	5.0000
3.8730	6.3000
5.4772	8.4000
7.7460	9.8000
10.9545	10.4000
15.4919	10.6000
30.6757	10.7000
38.4838	10.8000

**TIME RATE CONSOLIDATION CURVE
 ASTM D 2435**


Project Name: West Subway Extension
 Project No.: 4953-10-1561
 Date: 06/15/11

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	Westside Subway Extension	Tested by:	ST	Date:	07-22-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	08-03-11
Test Pit:	G-145	Reviewed by:	AP	Date:	08-03-11
Sample No.:	1	Sample Description:	Sandy Clay		
Depth(ft):	10.5				
Sample Type:	Mod. Cal.	Confining Pressure =	5.0 psi		

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>4.746</u>	<u>4.746</u>	<u>4.746</u>	Avg. =	4.746

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	5.405
Moisture Content (%)	18.84	23.48
Wet Weight (gms)	294.10	1003.62
Dry Weight (gms)	271.20	841.62
Container Weight (gms)	149.67	151.61
Density and Saturation		
Wet Weight (gms)	830.48	
Container Weight (gms)	0.00	
Wet Density (pcf)	124.1	
Dry Density (pcf)	104.4	
Initial Void Ratio	0.613	
% Saturation	83.0	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	96	Change in Ht. of the Specimen (in)=	0
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Consolidation

Cell Pressure (psi) =	45.0	Initial Burette Ht.(cm)=	74.1
Back Pressure(psi) =	40.0	Final Burette Ht.(cm)=	73.0
Eff. Consol. Stress (psi) =	5.0	Final Height (in)=	4.704
Induced OCR =	1.0	Initial Volume (cu.in)=	25.489
Change in Ht. of Specimen (in) =	0.0424	Final Volume (cu.in) =	25.422

Shear

Rate of Deformation (in/min)=	0.005	At Failure	
Time to 50% primary Consolidation (min) =	5	Deviator Stress (ksf) =	2.07
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	0.42
		Eff. Major Principal stress (ksf) =	2.49
		Axial Strain (%) =	5.34

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	Westside Subway Extension	Tested by:	ST	Date:	07-22-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	08-03-11
Test Pit:	G-145	Reviewed by:	AP	Date:	08-03-11
Sample No.:	1	Sample Description:	Sandy Clay		
Depth(ft):	10.5				
Sample Type:	Mod. Cal.	Confining Pressure =	10.0 psi		

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>4.746</u>	<u>4.746</u>	<u>4.746</u>	Avg. =	4.746

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	5.285
Moisture Content (%)	18.84	23.48
Wet Weight (gms)	294.10	1003.62
Dry Weight (gms)	271.20	841.62
Container Weight (gms)	149.67	151.61
Density and Saturation		
Wet Weight (gms)	830.48	
Container Weight (gms)	0.00	
Wet Density (pcf)	124.1	
Dry Density (pcf)	104.4	
Initial Void Ratio	0.613	
% Saturation	83.0	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	96	Change in Ht. of the Specimen (in)=	0
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Consolidation

Cell Pressure (psi) =	50.0	Initial Burette Ht.(cm)=	73.0
Back Pressure(psi) =	40.0	Final Burette Ht.(cm)=	66.3
Eff. Consol. Stress (psi) =	10.0	Final Height (in)=	4.746
Induced OCR=	1.0	Initial Volume (cu.in)=	25.489
Change in Ht. of Specimen (in) =	0.0000	Final Volume (cu.in) =	25.081

Shear

Rate of Deformation (in/min)=	0.005	At Failure	
Time to 50% primary Consolidation =	5	Deviator Stress (ksf) =	3.18
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	1.02
		Eff. Major Principal stress (ksf) =	4.20
		Axial Strain (%) =	5.28

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	Westside Subway Extension	Tested by:	ST	Date:	07-22-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	08-03-11
Test Pit:	G-145	Reviewed by:	AP	Date:	08-03-11
Sample No.:	1	Sample Description:	Sandy Clay		
Depth(ft):	10.5				
Sample Type:	Mod. Cal.	Confining Pressure =	20.0 psi		

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>4.746</u>	<u>4.746</u>	<u>4.746</u>	Avg. =	4.746

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	8.747
Moisture Content (%)	18.84	23.48
Wet Weight (gms)	294.10	1003.62
Dry Weight (gms)	271.20	841.62
Container Weight (gms)	149.67	151.61
Density and Saturation		
Wet Weight (gms)	830.48	
Container Weight (gms)	0.00	
Wet Density (pcf)	124.1	
Dry Density (pcf)	104.4	
Initial Void Ratio	0.613	
% Saturation	83.0	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	96	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	60.0	Initial Burette Ht.(cm)=	66.3
Back Pressure(psi) =	40.0	Final Burette Ht.(cm)=	328.9
Eff. Consol. Stress (psi) =	20.0	Final Height (in)=	4.746
Induced OCR =	1.0	Initial Volume (cu.in)=	25.489
Change in Ht. of Specimen (in) =	0.0000	Final Volume (cu.in) =	41.511

ShearAt Failure

Rate of Deformation (in/min)=	0.005	Deviator Stress (ksf) =	4.92
Time to 50% primary Consolidation =	5	Eff. Minor Principal stress (ksf) =	1.99
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	6.91
		Axial Strain (%) =	5.64



CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	Westside Subway Extension	Cell Pressure:	45.0 psi
Project No:	4953-10-1561	Back Pressure :	40.0 psi
Test Pit:	G-145	Consolidation Pressure :	5.0 psi
Depth(ft):	10.5	Initial Sample Height:	4.746 in
Sample No.:	1	Initial Area of Sample:	5.371 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	4.704 in
Sample Description:	Sandy Clay	Final Sample Area (A)*:	5.405 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
45.0	0	0.000	40.0	0.00	0.00	0.00	0.00	0.72
45.0	18	0.004	41.0	0.48	0.08	0.14	0.24	0.82
45.0	28	0.009	41.8	0.74	0.19	0.26	0.37	0.83
45.0	34	0.016	42.3	0.90	0.35	0.33	0.45	0.84
45.0	38	0.024	42.7	1.01	0.50	0.38	0.50	0.84
45.0	41	0.030	42.9	1.09	0.64	0.42	0.54	0.84
45.0	44	0.038	43.1	1.16	0.80	0.44	0.58	0.86
45.0	46	0.045	43.2	1.21	0.95	0.46	0.61	0.87
45.0	48	0.052	43.2	1.26	1.11	0.47	0.63	0.88
45.0	50	0.059	43.3	1.32	1.25	0.47	0.66	0.90
45.0	52	0.066	43.3	1.37	1.39	0.48	0.68	0.93
45.0	54	0.073	43.3	1.42	1.55	0.48	0.71	0.95
45.0	55	0.080	43.3	1.44	1.70	0.47	0.72	0.97
45.0	57	0.087	43.3	1.49	1.85	0.47	0.75	0.99
45.0	59	0.094	43.2	1.54	2.00	0.47	0.77	1.02
45.0	60	0.102	43.2	1.56	2.17	0.46	0.78	1.04
45.0	62	0.110	43.2	1.61	2.34	0.46	0.81	1.07
45.0	63	0.117	43.1	1.64	2.49	0.45	0.82	1.09
45.0	64	0.125	43.1	1.66	2.67	0.44	0.83	1.11
45.0	66	0.132	43.0	1.71	2.81	0.43	0.85	1.14
45.0	67	0.140	43.0	1.73	2.98	0.43	0.87	1.16
45.0	68	0.148	42.9	1.75	3.14	0.42	0.88	1.18
45.0	69	0.155	42.8	1.78	3.30	0.41	0.89	1.20
45.0	70	0.162	42.8	1.80	3.45	0.40	0.90	1.22
45.0	71	0.170	42.7	1.82	3.61	0.40	0.91	1.24
45.0	72	0.177	42.7	1.85	3.76	0.39	0.92	1.26
45.0	73	0.184	42.6	1.87	3.92	0.38	0.93	1.28
45.0	74	0.191	42.6	1.89	4.05	0.37	0.95	1.29
45.0	75	0.198	42.5	1.91	4.20	0.36	0.96	1.31
45.0	76	0.205	42.4	1.94	4.36	0.35	0.97	1.33
45.0	77	0.213	42.4	1.96	4.52	0.35	0.98	1.35
45.0	79	0.220	42.3	2.01	4.68	0.34	1.00	1.39
45.0	81	0.235	42.2	2.05	5.00	0.32	1.03	1.43
45.0	82	0.251	42.1	2.07	5.34	0.30	1.03	1.45
45.0	81	0.258	42.0	2.04	5.48	0.29	1.02	1.45

Figure D-2.1.21

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Subway Extension	Cell Pressure:	50.0 psi
Project No:	4953-10-1561	Back Pressure :	40.0 psi
Test Pit:	G-145	Consolidation Pressure :	10.0 psi
Depth(ft):	10.5	Initial Sample Height:	4.746 in
Sample No.:	1	Initial Area of Sample:	5.371 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	4.746 in
Sample Description:	Sandy Clay	Final Sample Area (A)*:	5.285 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
50.0	0	0.000	40.0	0.00	0.00	0.00	0.00	1.44
50.0	34	0.003	41.4	0.93	0.06	0.21	0.47	1.70
50.0	50	0.009	42.5	1.37	0.19	0.36	0.69	1.77
50.0	61	0.017	43.1	1.66	0.35	0.45	0.83	1.82
50.0	69	0.024	43.5	1.88	0.51	0.51	0.94	1.87
50.0	77	0.031	43.8	2.07	0.66	0.55	1.04	1.92
50.0	82	0.038	44.0	2.21	0.81	0.59	1.11	1.96
50.0	87	0.045	44.2	2.36	0.95	0.61	1.18	2.01
50.0	91	0.052	44.3	2.45	1.09	0.62	1.22	2.04
50.0	95	0.058	44.3	2.54	1.23	0.63	1.27	2.08
50.0	97	0.065	44.4	2.61	1.38	0.63	1.31	2.12
50.0	100	0.072	44.3	2.68	1.53	0.63	1.34	2.15
50.0	102	0.080	44.3	2.72	1.68	0.63	1.36	2.18
50.0	104	0.087	44.3	2.77	1.84	0.62	1.38	2.20
50.0	105	0.095	44.3	2.81	2.01	0.62	1.41	2.23
50.0	106	0.103	44.2	2.83	2.17	0.61	1.42	2.24
50.0	108	0.110	44.2	2.87	2.32	0.60	1.44	2.27
50.0	109	0.118	44.1	2.89	2.49	0.60	1.45	2.29
50.0	110	0.125	44.1	2.91	2.63	0.59	1.46	2.31
50.0	111	0.133	44.0	2.93	2.80	0.58	1.47	2.33
50.0	112	0.140	43.9	2.95	2.95	0.57	1.48	2.35
50.0	113	0.147	43.9	2.97	3.10	0.56	1.49	2.37
50.0	113	0.155	43.8	2.99	3.26	0.55	1.49	2.39
50.0	113	0.162	43.7	2.98	3.42	0.54	1.49	2.39
50.0	114	0.169	43.6	3.00	3.57	0.53	1.50	2.41
50.0	115	0.176	43.6	3.02	3.71	0.52	1.51	2.43
50.0	116	0.183	43.5	3.04	3.86	0.51	1.52	2.45
50.0	117	0.191	43.4	3.06	4.02	0.50	1.53	2.47
50.0	118	0.198	43.4	3.08	4.17	0.49	1.54	2.49
50.0	119	0.205	43.3	3.10	4.31	0.48	1.55	2.51
50.0	120	0.212	43.2	3.12	4.47	0.47	1.56	2.53
50.0	121	0.220	43.2	3.13	4.64	0.46	1.57	2.55
50.0	122	0.228	43.1	3.15	4.81	0.45	1.58	2.57
50.0	122	0.236	43.0	3.15	4.96	0.44	1.57	2.57
50.0	123	0.251	42.9	3.18	5.28	0.42	1.59	2.61
	526							

Figure D-2.1.22

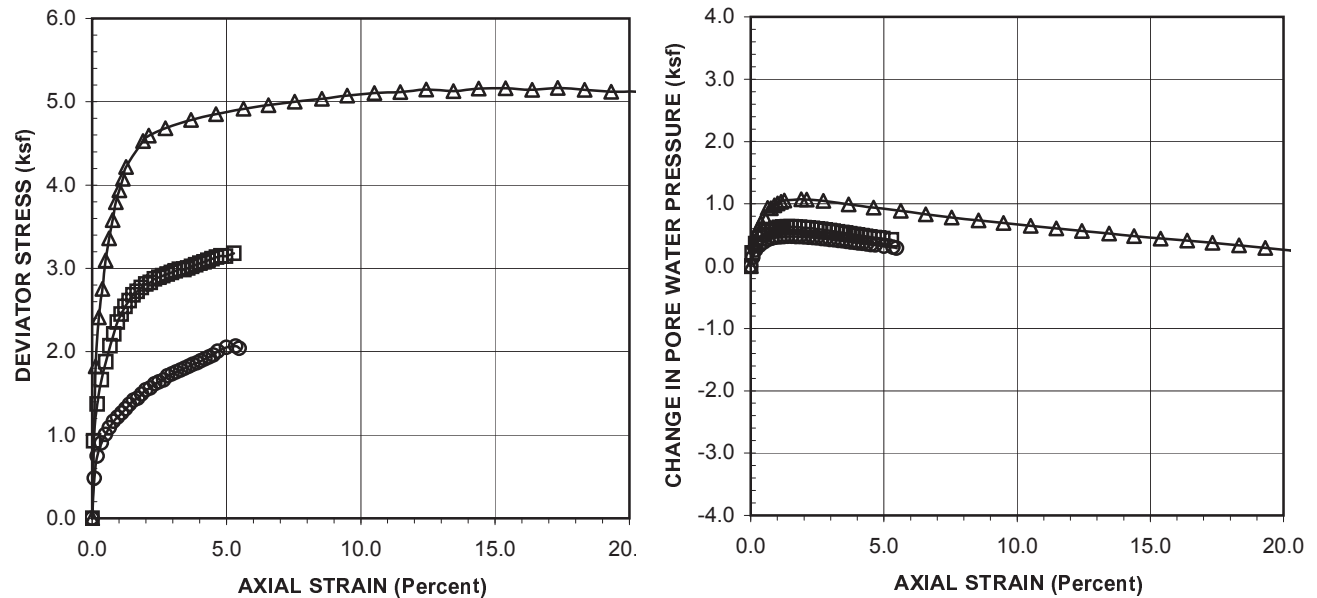
**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name: Westside Subway Extension
 Project No: 4953-10-1561
 Test Pit: G-145
 Depth(ft): 10.5
 Sample No.: 1
 Sample Type: Mod. Cal.
 Sample Description: Sandy Clay

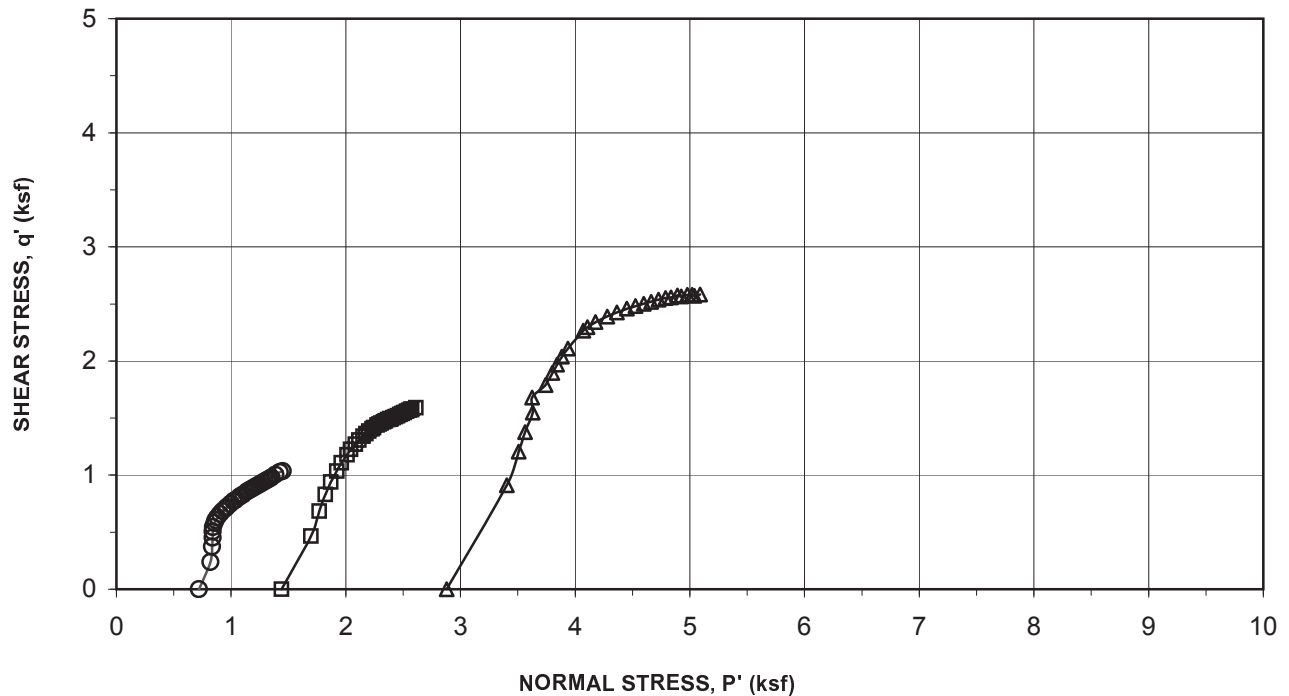
Cell Pressure: 60.0 psi
 Back Pressure: 40.0 psi
 Consolidation Pressure: 20.0 psi
 Initial Sample Height: 4.746 in
 Initial Area of Sample: 5.371 sq. in.
 Final Sample Ht.* (L): 4.746 in
 Final Sample Area (A)*: 8.747 sq. in.
 Induced OCR= 1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress (S1-S3)	Axial Strain (%)	Pore Pressure Change	Shear Stress q' (S1-S3)/2	Normal Stress p' (S1'+S3')/2
(psi)	(lbs)	(in)	(psi)	(ksf)	(%)	(ksf)	(ksf)	(ksf)
60.0	0	0.000	40.0	0.00	0.00	0.00	0.00	2.88
60.0	111	0.006	42.7	1.83	0.13	0.39	0.91	3.40
60.0	147	0.012	44.0	2.41	0.25	0.58	1.21	3.51
60.0	168	0.018	44.8	2.76	0.38	0.69	1.38	3.56
60.0	189	0.024	45.5	3.10	0.51	0.80	1.55	3.63
60.0	206	0.030	46.5	3.36	0.63	0.94	1.68	3.62
60.0	219	0.036	46.4	3.58	0.76	0.93	1.79	3.74
60.0	233	0.042	46.8	3.79	0.88	0.98	1.90	3.80
60.0	242	0.048	47.0	3.94	1.01	1.01	1.97	3.84
60.0	251	0.054	47.2	4.08	1.14	1.03	2.04	3.88
60.0	260	0.060	47.3	4.22	1.26	1.05	2.11	3.94
60.0	281	0.090	47.5	4.53	1.90	1.07	2.27	4.07
60.0	285	0.100	47.4	4.59	2.11	1.07	2.30	4.11
60.0	293	0.129	47.3	4.68	2.73	1.05	2.34	4.18
60.0	302	0.175	46.9	4.78	3.68	0.99	2.39	4.28
60.0	309	0.219	46.5	4.85	4.61	0.94	2.43	4.36
60.0	317	0.268	46.2	4.92	5.64	0.89	2.46	4.45
60.0	323	0.312	45.8	4.96	6.57	0.83	2.48	4.53
60.0	329	0.358	45.4	5.00	7.55	0.78	2.50	4.60
60.0	335	0.406	45.1	5.04	8.56	0.73	2.52	4.66
60.0	341	0.450	44.8	5.07	9.49	0.69	2.54	4.73
60.0	347	0.499	44.5	5.10	10.51	0.65	2.55	4.79
60.0	351	0.544	44.2	5.12	11.47	0.60	2.56	4.83
60.0	357	0.590	43.9	5.15	12.43	0.56	2.57	4.89
60.0	360	0.638	43.6	5.13	13.45	0.52	2.56	4.92
60.0	366	0.683	43.4	5.16	14.39	0.48	2.58	4.98
60.0	371	0.731	43.1	5.16	15.39	0.44	2.58	5.02
60.0	374	0.778	42.9	5.14	16.38	0.41	2.57	5.04
60.0	380	0.822	42.6	5.17	17.33	0.37	2.58	5.09
60.0	383	0.870	42.3	5.14	18.34	0.33	2.57	5.12
60.0	386	0.917	42.0	5.12	19.32	0.29	2.56	5.15
60.0	390	0.962	41.8	5.12	20.27	0.25	2.56	5.19
60.0	392	1.010	41.5	5.07	21.28	0.21	2.54	5.20

Figure D-2.1.23

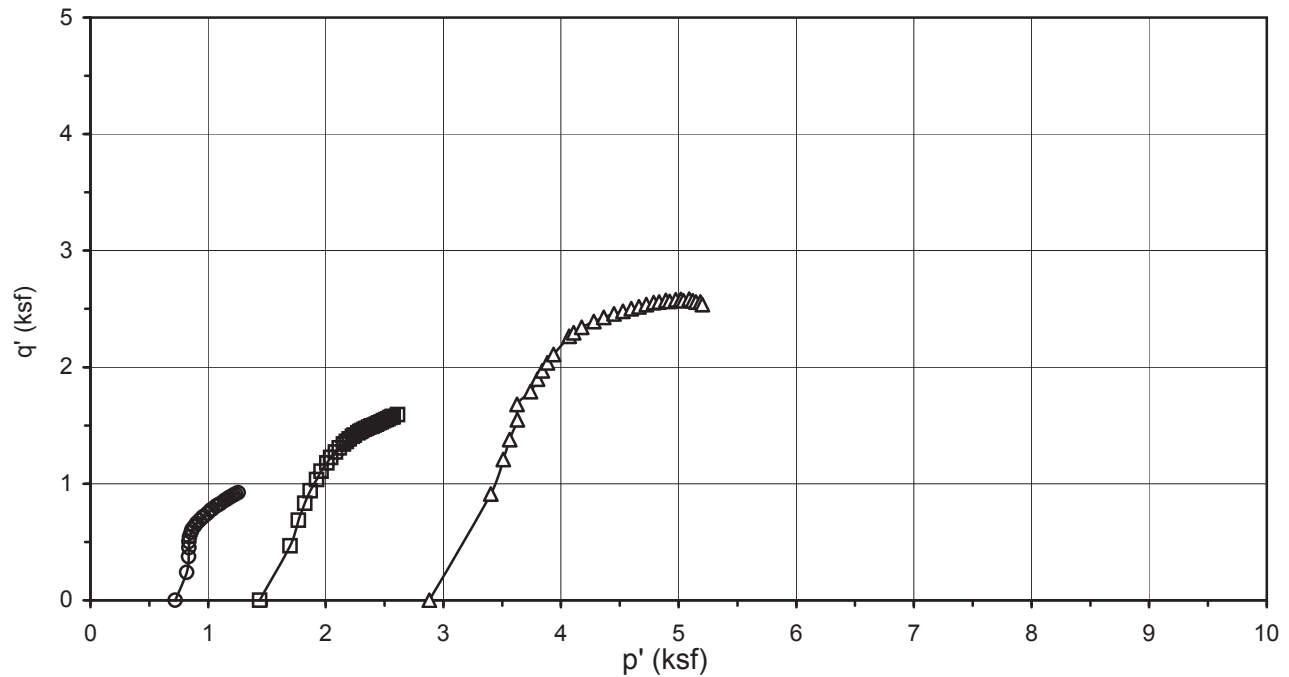


LEGEND: CONFINING PRESSURES= ○ 5 psi □ 10 psi △ 20 psi

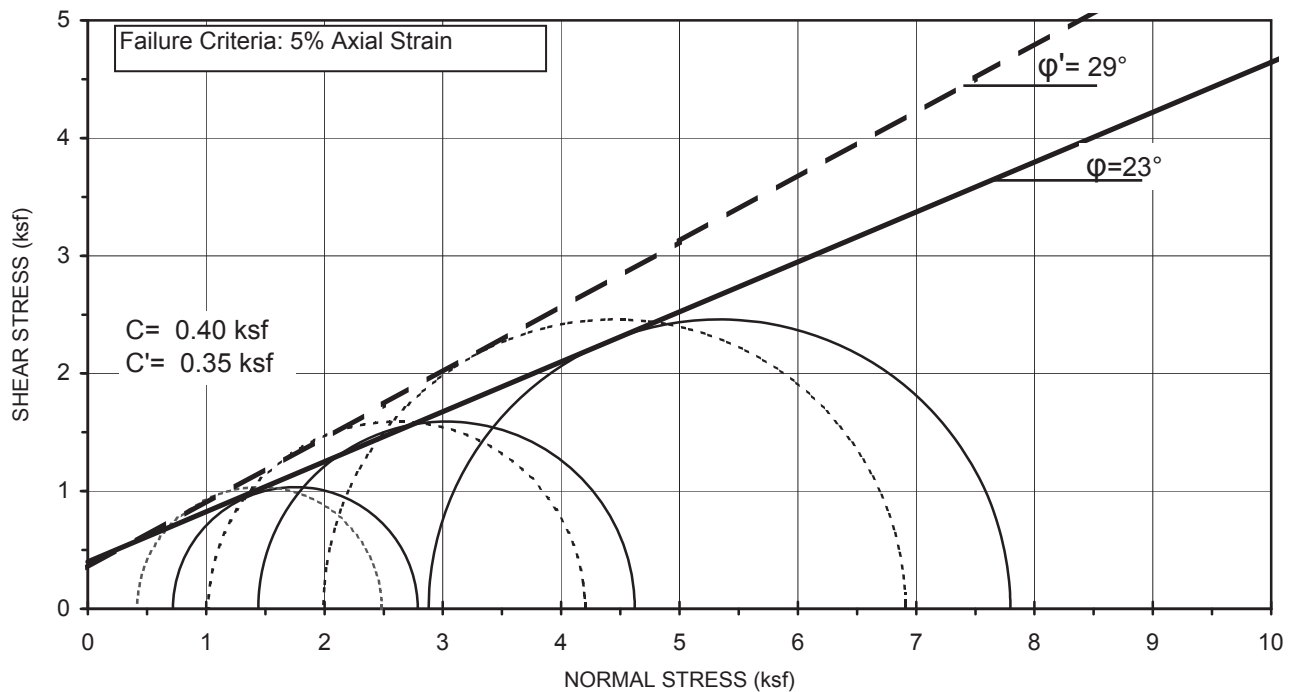


Project Name:	Westside Subway Extension	Sample Type:	Mod. Cal.
Project No.:	4953-10-1561	Sample Description:	Sandy Clay
Test Pit:	G-145	Avg. Dry Unit Weight (pcf):	104.4
Sample No.:	1	Avg. Initial Moisture Content (%):	18.8
Depth (ft):	10.5	Confining Pressure:	5.0, 10.0, 20.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767



LEGEND: CONFINING PRESSURES= ○ 5 psi □ 10 psi △ 20 psi

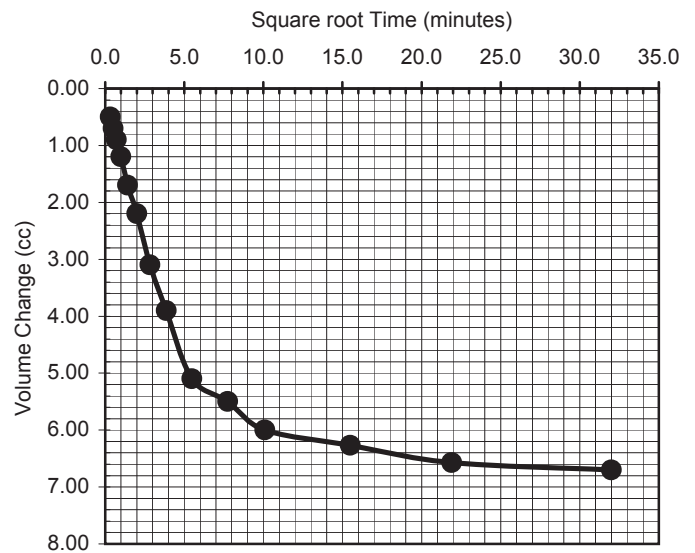
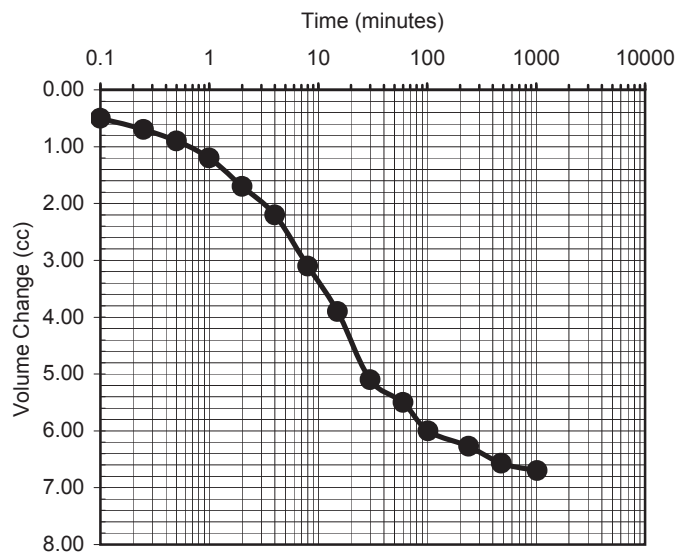


Project Name: Westside Subway Extension
Project No.: 4953-10-1561
Test Pit: G-145
Sample No.: 1
Depth (ft): 10.5

Sample Type: Mod. Cal.
Sample Description: Sandy Clay
Avg. Dry Unit Weight (pcf): 104.4
Avg. Initial Moisture Content (%): 18.8
Confining Pressure: 5.0, 10.0, 20.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

Figure D-2.1.25



Test Pit:	G-145	Sample Type:	Mod. Cal.
Sample No.:	1	Soil Description:	Sandy Clay
Depth (feet):	10.5	Eff. Confining Pressure (psi):	10.0

Time (minutes)	Volume Change (cc)
0	0.0000
0.1	0.5000
0.25	0.7000
0.5	0.9000
1	1.2000
2	1.7000
4	2.2000
8	3.1000
15	3.9000
30	5.1000
60	5.5000
102	6.0000
240	6.2712
480	6.5700
1024	6.7000

SQRT Time (minutes)	Volume Change (cc)
0.0000	0.0000
0.3162	0.5000
0.5000	0.7000
0.7071	0.9000
1.0000	1.2000
1.4142	1.7000
2.0000	2.2000
2.8284	3.1000
3.8730	3.9000
5.4772	5.1000
7.7460	5.5000
10.0995	6.0000
15.4919	6.2712
21.9089	6.5700
32.0000	6.7000

**TIME RATE CONSOLIDATION CURVE
ASTM D 2435**


Project Name: Westside Subway Extension
Project No.: 4953-10-1561
Date: 07/22/11

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	Westside Subway Extension	Tested by:	ST	Date:	07-24-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	08-03-11
Test Pit:	G-145	Reviewed by:	AP	Date:	08-03-11
Sample No.:	12	Sample Description:	Sandy Clay		
Depth(ft):	65.5				
Sample Type:	Mod. Cal.	Confining Pressure =	20.0 psi		

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>5.020</u>	<u>5.020</u>	<u>5.020</u>	Avg. =	5.020

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	5.295
Moisture Content (%)	14.84	19.68
Wet Weight (gms)	23.62	1057.61
Dry Weight (gms)	21.95	908.61
Container Weight (gms)	10.70	151.66
Density and Saturation		
Wet Weight (gms)	905.91	
Container Weight (gms)	0.00	
Wet Density (pcf)	128.0	
Dry Density (pcf)	111.5	
Initial Void Ratio	0.512	
% Saturation	78.3	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
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Consolidation

Cell Pressure (psi) =	60.0	Initial Burette Ht.(cm)=	76.3
Back Pressure(psi) =	40.0	Final Burette Ht.(cm)=	63.2
Eff. Consol. Stress (psi) =	20.0	Final Height (in)=	4.941
Induced OCR =	1.0	Initial Volume (cu.in)=	26.961
Change in Ht. of Specimen (in) =	0.0787	Final Volume (cu.in) =	26.162

Shear

Rate of Deformation (in/min)=	0.006	At Failure	
Time to 50% primary Consolidation (min) =	4	Deviator Stress (ksf) =	4.84
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	1.36
		Eff. Major Principal stress (ksf) =	6.19
		Axial Strain (%) =	5.18

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	Westside Subway Extension	Tested by:	ST	Date:	07-24-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	08-03-11
Test Pit:	G-145	Reviewed by:	AP	Date:	08-03-11
Sample No.:	12	Sample Description:	Sandy Clay		
Depth(ft):	65.5				
Sample Type:	Mod. Cal.	Confining Pressure =	40.0 psi		

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>5.020</u>	<u>5.020</u>	<u>5.020</u>	Avg. =	5.020

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	5.331
Moisture Content (%)	14.84	19.68
Wet Weight (gms)	23.62	1057.61
Dry Weight (gms)	21.95	908.61
Container Weight (gms)	10.70	151.66
Density and Saturation		
Wet Weight (gms)	905.91	
Container Weight (gms)	0.00	
Wet Density (pcf)	128.0	
Dry Density (pcf)	111.5	
Initial Void Ratio	0.512	
% Saturation	78.3	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	80.0	Initial Burette Ht.(cm)=	60.0
Back Pressure(psi) =	40.0	Final Burette Ht.(cm)=	56.7
Eff. Consol. Stress (psi) =	40.0	Final Height (in)=	5.020
Induced OCR=	1.0	Initial Volume (cu.in)=	26.961
Change in Ht. of Specimen (in) =	0.0000	Final Volume (cu.in) =	26.760

Shear

Rate of Deformation (in/min)=	0.006	At Failure	
Time to 50% primary Consolidation =	4	Deviator Stress (ksf) =	9.84
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	3.58
		Eff. Major Principal stress (ksf) =	13.42
		Axial Strain (%) =	5.11

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	Westside Subway Extension	Tested by:	ST	Date:	07-24-11
Project No.:	4953-10-1561	Input Data by:	KM	Date:	08-03-11
Test Pit:	G-145	Reviewed by:	AP	Date:	08-03-11
Sample No.:	12	Sample Description:	Sandy Clay		
Depth(ft):	65.5				
Sample Type:	Mod. Cal.	Confining Pressure =	60.0 psi		

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>5.020</u>	<u>5.020</u>	<u>5.020</u>	Avg. =	5.020

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	5.271
Moisture Content (%)	14.84	19.68
Wet Weight (gms)	23.62	1057.61
Dry Weight (gms)	21.95	908.61
Container Weight (gms)	10.70	151.66
Density and Saturation		
Wet Weight (gms)	905.91	
Container Weight (gms)	0.00	
Wet Density (pcf)	128.0	
Dry Density (pcf)	111.5	
Initial Void Ratio	0.512	
% Saturation	78.3	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	100.0	Initial Burette Ht.(cm)=	53.5
Back Pressure(psi) =	40.0	Final Burette Ht.(cm)=	45.3
Eff. Consol. Stress (psi) =	60.0	Final Height (in)=	5.020
Induced OCR =	1.0	Initial Volume (cu.in)=	26.961
Change in Ht. of Specimen (in) =	0.0000	Final Volume (cu.in) =	26.461

Shear

Rate of Deformation (in/min)=	0.006	At Failure	
Time to 50% primary Consolidation =	4	Deviator Stress (ksf) =	15.45
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	6.59
		Eff. Major Principal stress (ksf) =	22.04
		Axial Strain (%) =	4.20



CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	Westside Subway Extension	Cell Pressure:	60.0 psi
Project No:	4953-10-1561	Back Pressure :	40.0 psi
Test Pit:	G-145	Consolidation Pressure :	20.0 psi
Depth(ft):	65.5	Initial Sample Height:	5.020 in
Sample No.:	12	Initial Area of Sample:	5.371 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	4.941 in
Sample Description:	Sandy Clay	Final Sample Area (A)*:	5.295 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
60.0	0	0.000	40.0	0.00	0.00	0.00	0.00	2.88
60.0	48	0.006	40.9	1.29	0.12	0.12	0.65	3.40
60.0	68	0.013	42.0	1.83	0.26	0.28	0.92	3.51
60.0	78	0.021	43.1	2.10	0.42	0.44	1.05	3.48
60.0	86	0.028	44.2	2.33	0.57	0.60	1.17	3.45
60.0	93	0.035	45.1	2.50	0.70	0.73	1.25	3.39
60.0	98	0.042	46.0	2.63	0.86	0.86	1.31	3.34
60.0	101	0.049	46.7	2.73	1.00	0.96	1.36	3.28
60.0	105	0.058	47.4	2.82	1.16	1.06	1.41	3.23
60.0	109	0.065	47.9	2.92	1.31	1.14	1.46	3.20
60.0	113	0.071	48.4	3.02	1.44	1.21	1.51	3.18
60.0	115	0.079	48.8	3.08	1.60	1.27	1.54	3.15
60.0	119	0.086	49.2	3.17	1.74	1.32	1.59	3.15
60.0	123	0.093	49.5	3.27	1.89	1.37	1.63	3.15
60.0	126	0.101	49.8	3.36	2.04	1.40	1.68	3.16
60.0	129	0.108	50.0	3.43	2.19	1.44	1.71	3.16
60.0	131	0.115	50.2	3.49	2.34	1.46	1.74	3.16
60.0	135	0.123	50.4	3.58	2.49	1.49	1.79	3.18
60.0	138	0.131	50.5	3.64	2.65	1.50	1.82	3.20
60.0	141	0.138	50.6	3.73	2.79	1.52	1.87	3.23
60.0	143	0.145	50.7	3.76	2.93	1.53	1.88	3.23
60.0	146	0.153	50.7	3.85	3.10	1.54	1.93	3.27
60.0	149	0.160	50.8	3.91	3.25	1.55	1.96	3.29
60.0	151	0.168	50.8	3.97	3.39	1.56	1.99	3.31
60.0	154	0.175	50.9	4.03	3.54	1.56	2.02	3.34
60.0	156	0.183	50.9	4.09	3.70	1.56	2.05	3.37
60.0	159	0.190	50.9	4.15	3.84	1.56	2.08	3.39
60.0	161	0.197	50.9	4.21	3.98	1.56	2.11	3.42
60.0	165	0.204	50.9	4.30	4.13	1.56	2.15	3.47
60.0	168	0.212	50.8	4.36	4.28	1.56	2.18	3.50
60.0	171	0.219	50.8	4.45	4.42	1.55	2.23	3.55
60.0	175	0.226	50.8	4.54	4.58	1.55	2.27	3.60
60.0	178	0.234	50.7	4.60	4.73	1.54	2.30	3.64
60.0	181	0.241	50.7	4.69	4.87	1.54	2.34	3.69
60.0	188	0.256	50.6	4.84	5.18	1.52	2.42	3.78

Figure D-2.1.30

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name: Westside Subway Extension
 Project No: 4953-10-1561
 Test Pit: G-145
 Depth(ft): 65.5
 Sample No.: 12
 Sample Type: Mod. Cal.
 Sample Description: Sandy Clay

Cell Pressure: 80.0 psi
 Back Pressure: 40.0 psi
 Consolidation Pressure: 40.0 psi
 Initial Sample Height: 5.020 in
 Initial Area of Sample: 5.371 sq. in.
 Final Sample Ht.* (L): 5.020 in
 Final Sample Area (A)*: 5.331 sq. in.
 Induced OCR= 1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
80.0	0	0.000	40.0	0.00	0.00	0.00	0.00	5.76
80.0	90	0.004	41.4	2.43	0.09	0.21	1.21	6.77
80.0	137	0.011	43.2	3.69	0.21	0.46	1.85	7.14
80.0	169	0.018	44.9	4.55	0.35	0.70	2.27	7.33
80.0	193	0.024	46.3	5.19	0.47	0.91	2.59	7.44
80.0	211	0.031	47.6	5.67	0.61	1.10	2.83	7.49
80.0	226	0.038	48.8	6.06	0.75	1.26	3.03	7.53
80.0	239	0.044	49.7	6.40	0.87	1.40	3.20	7.56
80.0	248	0.051	50.6	6.63	1.01	1.52	3.32	7.55
80.0	257	0.058	51.3	6.86	1.15	1.63	3.43	7.56
80.0	264	0.064	52.0	7.04	1.27	1.72	3.52	7.56
80.0	272	0.070	52.5	7.24	1.40	1.80	3.62	7.58
80.0	278	0.077	53.0	7.39	1.54	1.87	3.70	7.59
80.0	284	0.084	53.4	7.54	1.68	1.93	3.77	7.60
80.0	289	0.091	53.8	7.67	1.81	1.98	3.83	7.61
80.0	294	0.098	54.1	7.79	1.96	2.03	3.89	7.63
80.0	299	0.106	54.4	7.91	2.11	2.07	3.95	7.65
80.0	304	0.114	54.6	8.03	2.27	2.10	4.01	7.67
80.0	309	0.121	54.8	8.15	2.40	2.13	4.07	7.70
80.0	313	0.129	55.0	8.24	2.56	2.16	4.12	7.72
80.0	318	0.136	55.1	8.36	2.71	2.18	4.18	7.76
80.0	322	0.144	55.2	8.45	2.86	2.19	4.22	7.79
80.0	326	0.151	55.3	8.54	3.01	2.21	4.27	7.82
80.0	330	0.157	55.4	8.64	3.13	2.22	4.32	7.86
80.0	334	0.164	55.5	8.73	3.27	2.23	4.36	7.90
80.0	338	0.171	55.5	8.82	3.41	2.23	4.41	7.93
80.0	342	0.178	55.5	8.91	3.55	2.24	4.46	7.98
80.0	346	0.184	55.6	9.00	3.67	2.24	4.50	8.02
80.0	351	0.191	55.6	9.12	3.81	2.24	4.56	8.08
80.0	355	0.198	55.6	9.21	3.94	2.24	4.61	8.13
80.0	359	0.204	55.5	9.30	4.07	2.24	4.65	8.17
80.0	363	0.212	55.5	9.39	4.22	2.23	4.70	8.22
80.0	371	0.227	55.4	9.57	4.52	2.22	4.78	8.33
80.0	378	0.242	55.3	9.72	4.82	2.20	4.86	8.42
80.0	384	0.257	55.1	9.84	5.11	2.18	4.92	8.50

Figure D-2.1.31

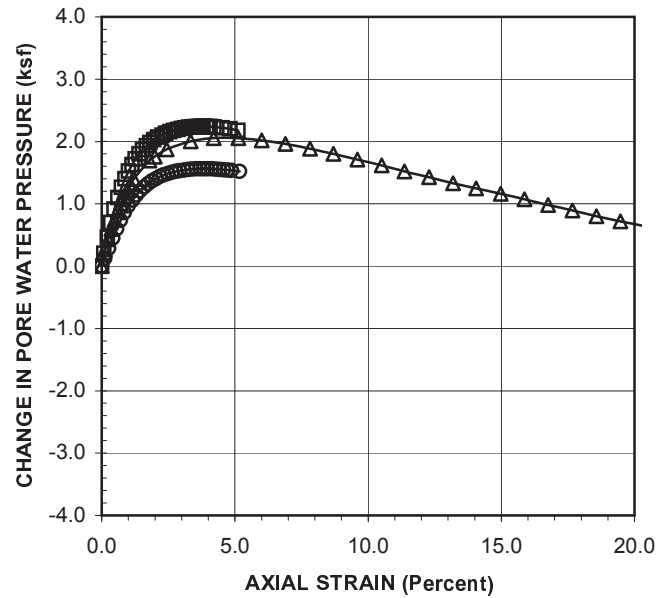
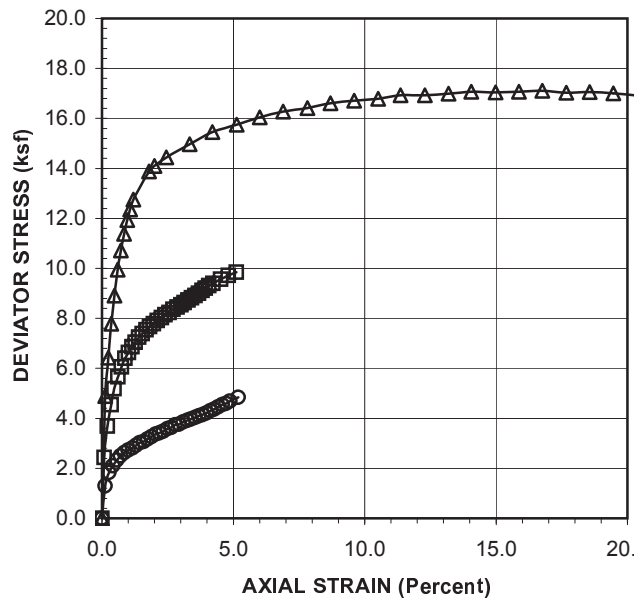


CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

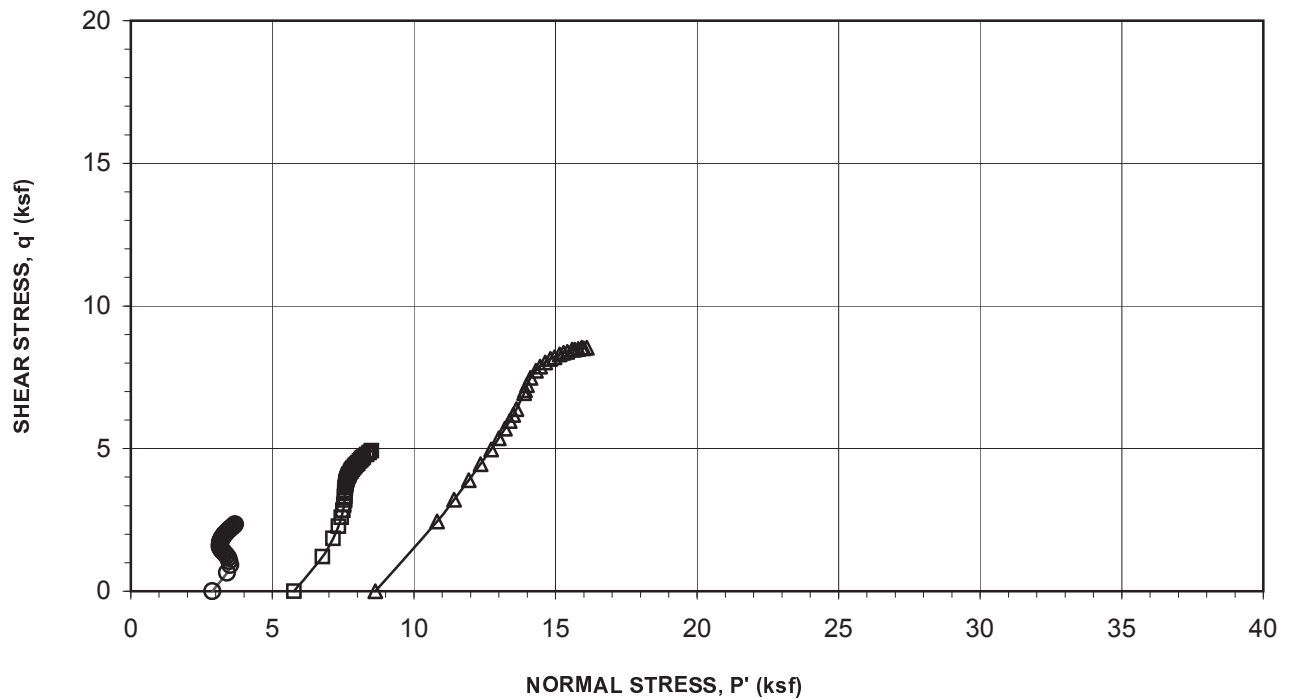
Project Name:	Westside Subway Extension	Cell Pressure:	100.0 psi
Project No:	4953-10-1561	Back Pressure :	40.0 psi
Test Pit:	G-145	Consolidation Pressure :	60.0 psi
Depth(ft):	65.5	Initial Sample Height:	5.020 in
Sample No.:	12	Initial Area of Sample:	5.371 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.020 in
Sample Description:	Sandy Clay	Final Sample Area (A)*:	5.271 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress (S1-S3)	Axial Strain (%)	Pore Pressure Change (ksf)	Shear Stress q' (S1-S3)/2 (ksf)	Normal Stress p' (S1'+S3')/2 (ksf)
(psi)	(lbs)	(in)	(psi)	(ksf)	(%)	(ksf)	(ksf)	(ksf)
100.0	0	0.000	40.0	0.00	0.00	0.00	0.00	8.64
100.0	179	0.006	41.9	4.89	0.12	0.27	2.44	10.81
100.0	236	0.012	43.0	6.43	0.24	0.43	3.21	11.42
100.0	286	0.018	44.1	7.79	0.36	0.60	3.90	11.94
100.0	328	0.024	45.1	8.91	0.48	0.74	4.45	12.35
100.0	366	0.030	46.2	9.95	0.60	0.89	4.97	12.73
100.0	395	0.036	47.0	10.72	0.72	1.01	5.36	12.99
100.0	420	0.042	47.8	11.39	0.84	1.12	5.69	13.21
100.0	441	0.048	48.5	11.93	0.96	1.22	5.97	13.38
100.0	457	0.054	49.1	12.36	1.08	1.31	6.18	13.51
100.0	473	0.060	49.7	12.75	1.20	1.40	6.38	13.62
100.0	518	0.090	51.8	13.88	1.79	1.69	6.94	13.89
100.0	527	0.100	52.2	14.10	1.99	1.76	7.05	13.93
100.0	542	0.123	53.0	14.44	2.44	1.87	7.22	13.99
100.0	567	0.168	53.9	14.97	3.34	2.00	7.49	14.12
100.0	590	0.211	54.3	15.45	4.20	2.05	7.73	14.31
100.0	608	0.258	54.3	15.74	5.13	2.05	7.87	14.46
100.0	625	0.301	54.0	16.04	6.00	2.02	8.02	14.64
100.0	640	0.346	53.6	16.28	6.89	1.96	8.14	14.82
100.0	652	0.392	53.1	16.41	7.81	1.88	8.20	14.96
100.0	666	0.437	52.5	16.61	8.70	1.80	8.31	15.14
100.0	677	0.482	51.9	16.71	9.60	1.71	8.36	15.29
100.0	687	0.527	51.2	16.79	10.51	1.62	8.39	15.42
100.0	699	0.571	50.6	16.93	11.37	1.52	8.47	15.58
100.0	707	0.617	49.9	16.93	12.29	1.43	8.46	15.68
100.0	716	0.662	49.2	16.99	13.19	1.33	8.50	15.80
100.0	727	0.706	48.7	17.07	14.06	1.25	8.54	15.93
100.0	734	0.752	48.1	17.04	14.98	1.16	8.52	16.00
100.0	743	0.797	47.4	17.07	15.87	1.07	8.53	16.10
100.0	752	0.841	46.8	17.11	16.76	0.98	8.55	16.21
100.0	757	0.887	46.2	17.02	17.67	0.89	8.51	16.26
100.0	767	0.932	45.6	17.06	18.57	0.80	8.53	16.37
100.0	773	0.977	45.0	17.01	19.47	0.72	8.50	16.43
100.0	778	1.023	44.4	16.91	20.38	0.64	8.46	16.46

Figure D-2.1.32



LEGEND: CONFINING PRESSURES= ○ 20 psi □ 40 psi △ 60 psi

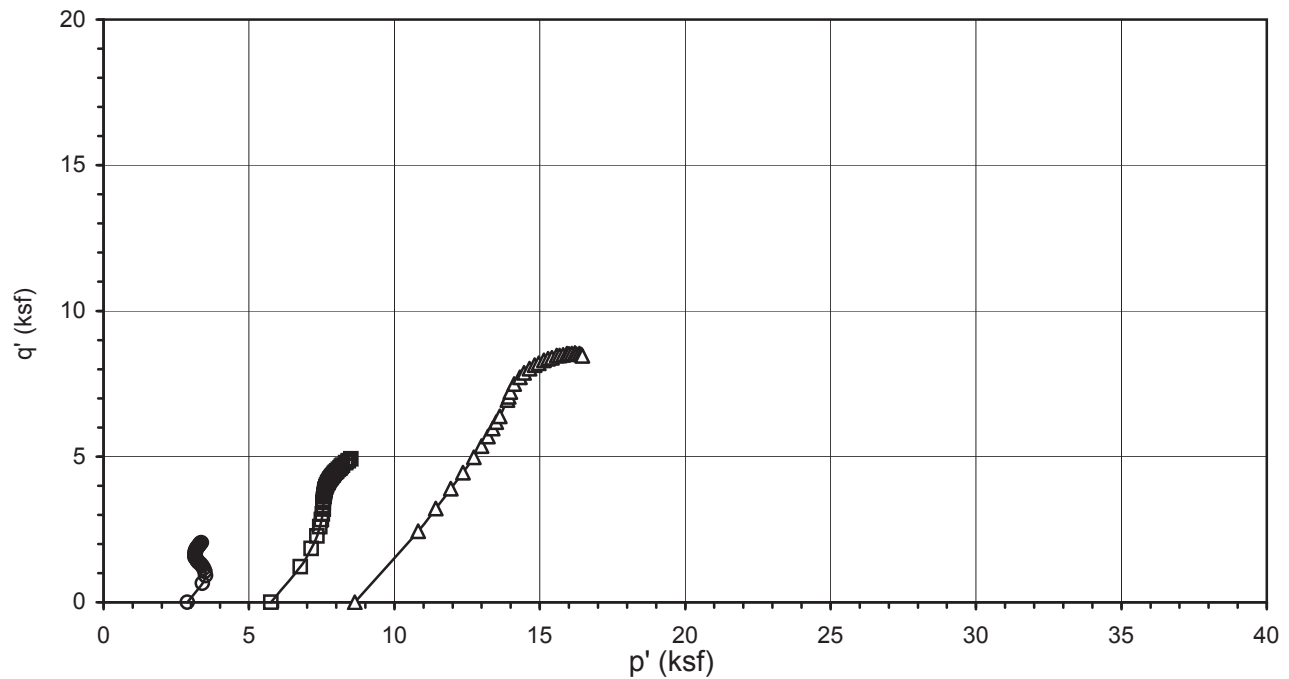


Project Name: Westside Subway Extension
Project No.: 4953-10-1561
Test Pit: G-145
Sample No.: 12
Depth (ft): 65.5

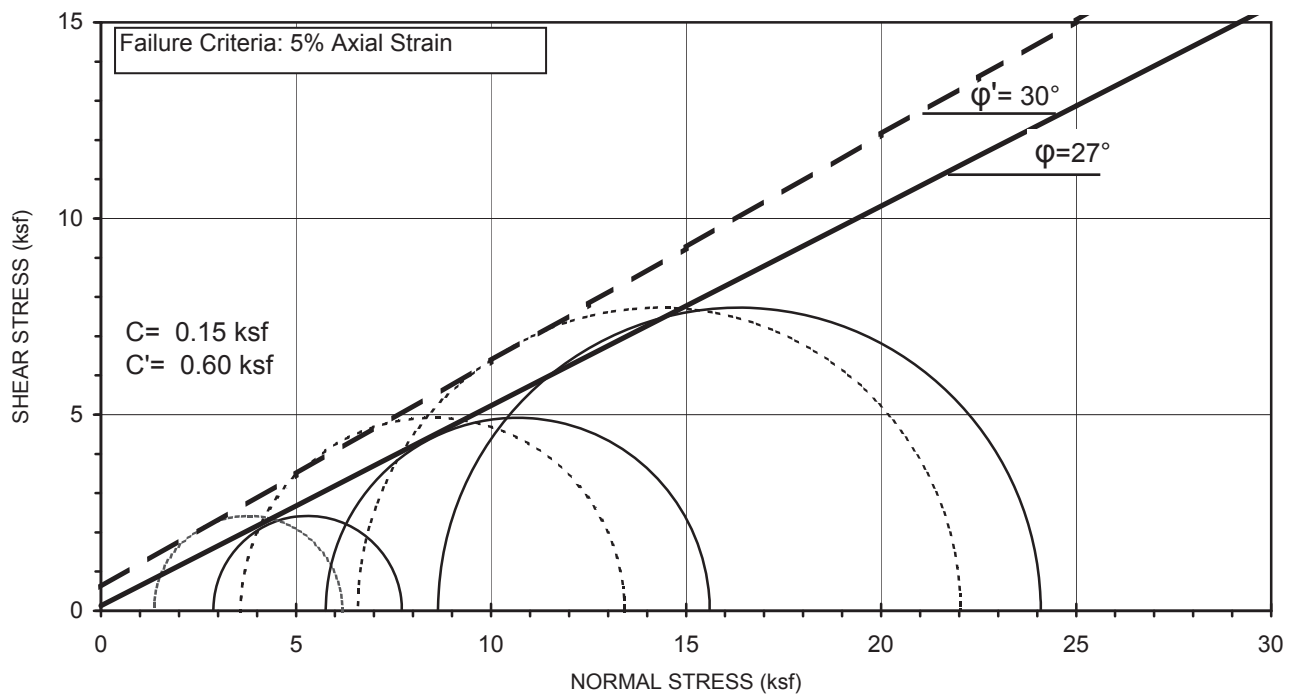
Sample Type: Mod. Cal.
Sample Description: Sandy Clay
Avg. Dry Unit Weight (pcf): 111.5
Avg. Initial Moisture Content (%): 14.8
Confining Pressure: 20.0, 40.0, 60.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

Figure D-2.1.33



LEGEND: CONFINING PRESSURES= ○ 20 psi □ 40 psi △ 60 psi

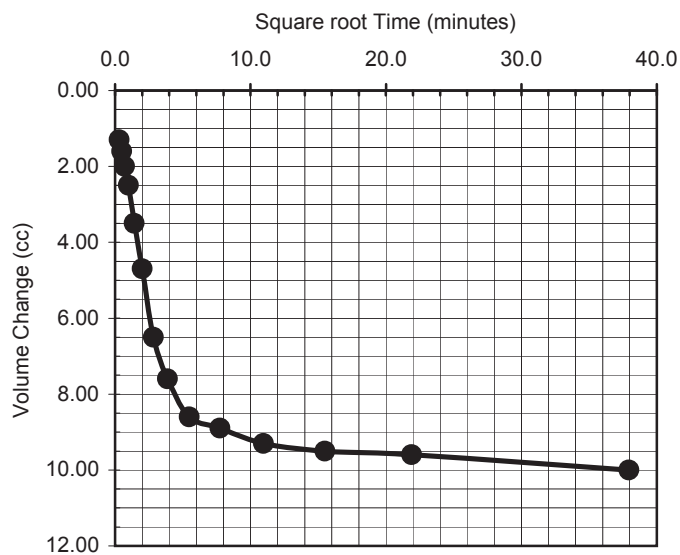
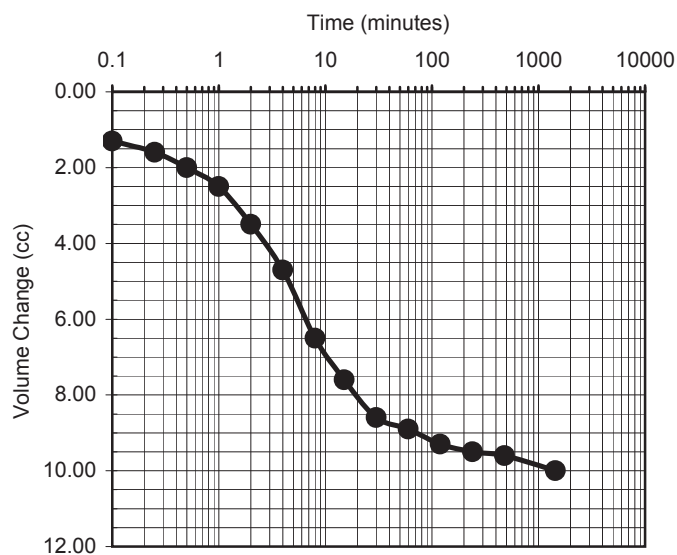


Project Name: Westside Subway Extension
Project No.: 4953-10-1561
Test Pit: G-145
Sample No.: 12
Depth (ft): 65.5

Sample Type: Mod. Cal.
Sample Description: Sandy Clay
Avg. Dry Unit Weight (pcf): 111.5
Avg. Initial Moisture Content (%): 14.8
Confining Pressure: 20.0, 40.0, 60.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

Figure D-2.1.34



Test Pit: G-145
 Sample No.: 12
 Depth (feet): 65.5

Sample Type: Mod. Cal.
 Soil Description: Sandy Clay
 Eff. Confining Pressure (psi): 40.0

Time (minutes)	Volume Change (cc)
0	0.0000
0.1	1.3000
0.25	1.6000
0.5	2.0000
1	2.5000
2	3.5000
4	4.7000
8	6.5000
15	7.6000
30	8.6000
60	8.9000
120	9.3000
240	9.5000
480	9.6000
1440	10.0000

SQRT Time (minutes)	Volume Change (cc)
0.0000	0.0000
0.3162	1.3000
0.5000	1.6000
0.7071	2.0000
1.0000	2.5000
1.4142	3.5000
2.0000	4.7000
2.8284	6.5000
3.8730	7.6000
5.4772	8.6000
7.7460	8.9000
10.9545	9.3000
15.4919	9.5000
21.9089	9.6000
37.9473	10.0000

**TIME RATE CONSOLIDATION CURVE
 ASTM D 2435**

Project Name: Westside Subway Extension
 Project No.: 4953-10-1561
 Date: 07/24/11




CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Test Procedure: ASTM D 4767

Project Name:	Westside Purple Line Extension	Tested by:	ST	Date:	10-31-15
Project No.:	4953-11-1423	Input Data by:	AP	Date:	11-02-15
Boring No.:	E-126A	Reviewed by:	AP	Date:	11-06-15
Sample No.:	11	Sample Description: Yellowish Brown Clay w/sand			
Depth(ft):	55.5				
Sample Type:	Mod. Cal.	Confining Pressure = 30.0 psi			

Diameter (in)	<u>2.623</u>	<u>2.623</u>	<u>2.623</u>	Avg. =	2.623
Height (in)	<u>5.875</u>	<u>5.875</u>	<u>5.875</u>	Avg. =	5.875

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.404	5.348
Moisture Content (%)	19.87	20.74
Wet Weight (gms)	1081.54	1231.09
Dry Weight (gms)	902.28	1044.00
Container Weight (gms)	0.00	141.72
Density and Saturation		
Wet Weight (gms)	1081.54	
Container Weight (gms)	0.00	
Wet Density (pcf)	129.8	
Dry Density (pcf)	108.3	
Initial Void Ratio	0.556	
% Saturation	96.5	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
---------------	----	-------------------------------------	---

Consolidation

Cell Pressure (psi) =	60.0	Initial Burette Ht.(cm)=	78.6
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	69.4
Eff. Consol. Stress (psi) =	30.0	Final Height (in)=	5.831
Induced OCR =	1.0	Initial Volume (cu.in)=	31.746
Change in Ht. of Specimen (in) =	0.0438	Final Volume (cu.in) =	31.185

Shear

Rate of Deformation (in/min)=	0.004	At Failure	
Time to 50% primary Consolidation (min) =	15	Deviator Stress (ksf) =	10.82
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	2.45
		Eff. Major Principal stress (ksf) =	13.27
		Axial Strain (%) =	5.03

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Purple Line Extension Tested by: ST Date: 10-31-15
 Project No.: 4953-11-1423 Input Data by: AP Date: 11-02-15
 Boring No.: E-126A Reviewed by: AP Date: 11-06-15
 Sample No.: 11 Sample Description: Yellowish Brown Clay w/sand
 Depth(ft): 55.5
 Sample Type: Mod. Cal. Confining Pressure = 45.0 psi

Diameter (in)	<u>2.623</u>	<u>2.623</u>	<u>2.623</u>	Avg. =	2.623
Height (in)	<u>5.875</u>	<u>5.875</u>	<u>5.875</u>	Avg. =	5.875

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.404	5.942
Moisture Content (%)	19.87	20.74
Wet Weight (gms)	1081.54	1231.09
Dry Weight (gms)	902.28	1044.00
Container Weight (gms)	0.00	141.72
Density and Saturation		
Wet Weight (gms)	1081.54	
Container Weight (gms)	0.00	
Wet Density (pcf)	129.8	
Dry Density (pcf)	108.3	
Initial Void Ratio	0.556	
% Saturation	96.5	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in)= 0

Consolidation

Cell Pressure (psi) =	<u>75.0</u>	Initial Burette Ht.(cm)=	<u>69.4</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>65.2</u>
Eff. Consol. Stress (psi) =	<u>45.0</u>	Final Height (in)=	<u>5.581</u>
Induced OCR=	<u>1.0</u>	Initial Volume (cu.in)=	<u>31.746</u>
Change in Ht. of Specimen (in) =	<u>0.2943</u>	Final Volume (cu.in) =	<u>31.490</u>

ShearAt Failure

Rate of Deformation (in/min)=	<u>0.004</u>	Deviator Stress (ksf) =	<u>15.59</u>
Time to 50% primary Consolidation =	<u>15</u>	Eff. Minor Principal stress (ksf) =	<u>4.60</u>
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	<u>20.20</u>
		Axial Strain (%) =	<u>5.37</u>

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Purple Line Extension Tested by: ST Date: 10-31-15
 Project No.: 4953-11-1423 Input Data by: AP Date: 11-02-15
 Boring No.: E-126A Reviewed by: AP Date: 11-06-15
 Sample No.: 11 Sample Description: Yellowish Brown Clay w/sand
 Depth(ft): 55.5
 Sample Type: Mod. Cal. Confining Pressure = 60.0 psi

Diameter (in)	<u>2.623</u>	<u>2.623</u>	<u>2.623</u>	Avg. =	2.623
Height (in)	<u>5.875</u>	<u>5.875</u>	<u>5.875</u>	Avg. =	5.875

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.404	5.991
Moisture Content (%)	19.87	20.74
Wet Weight (gms)	1081.54	1231.09
Dry Weight (gms)	902.28	1044.00
Container Weight (gms)	0.00	141.72
Density and Saturation		
Wet Weight (gms)	1081.54	
Container Weight (gms)	0.00	
Wet Density (pcf)	129.8	
Dry Density (pcf)	108.3	
Initial Void Ratio	0.556	
% Saturation	96.5	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in)= 0

Consolidation

Cell Pressure (psi) =	<u>90.0</u>	Initial Burette Ht.(cm)=	<u>65.2</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>61.9</u>
Eff. Consol. Stress (psi) =	<u>60.0</u>	Final Height (in)=	<u>5.564</u>
Induced OCR =	<u>1.0</u>	Initial Volume (cu.in)=	<u>31.746</u>
Change in Ht. of Specimen (in) =	<u>0.3112</u>	Final Volume (cu.in) =	<u>31.545</u>

ShearAt Failure

Rate of Deformation (in/min)=	<u>0.004</u>	Deviator Stress (ksf) =	<u>19.41</u>
Time to 50% primary Consolidation =	<u>15</u>	Eff. Minor Principal stress (ksf) =	<u>6.91</u>
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	<u>26.32</u>
		Axial Strain (%) =	<u>8.66</u>



CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	Westside Purple Line Extension	Cell Pressure:	60.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	30.0 psi
Depth(ft):	55.5	Initial Sample Height:	5.875 in
Sample No.:	11	Initial Area of Sample:	5.404 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.831 in
Sample Description:	Yellowish Brown Clay w/sand	Final Sample Area (A)*:	5.348 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
60.0	0	0.000	30.0	0.00	0.00	0.00	0.00	4.32
60.0	61	0.006	33.8	1.64	0.10	0.55	0.82	4.59
60.0	100	0.013	36.4	2.69	0.22	0.93	1.34	4.74
60.0	125	0.020	38.5	3.35	0.34	1.22	1.68	4.78
60.0	144	0.027	40.1	3.86	0.45	1.45	1.93	4.80
60.0	161	0.034	41.4	4.31	0.58	1.64	2.16	4.83
60.0	175	0.041	42.4	4.68	0.69	1.79	2.34	4.87
60.0	187	0.048	43.3	4.99	0.82	1.91	2.50	4.91
60.0	198	0.056	43.9	5.28	0.96	2.01	2.64	4.95
60.0	209	0.063	44.5	5.57	1.07	2.08	2.78	5.02
60.0	219	0.070	44.9	5.83	1.19	2.14	2.91	5.09
60.0	228	0.076	45.2	6.06	1.30	2.19	3.03	5.16
60.0	237	0.083	45.5	6.29	1.42	2.23	3.15	5.24
60.0	246	0.090	45.7	6.52	1.55	2.25	3.26	5.33
60.0	253	0.098	45.8	6.70	1.67	2.28	3.35	5.39
60.0	260	0.105	45.9	6.88	1.79	2.29	3.44	5.47
60.0	267	0.112	46.0	7.05	1.91	2.30	3.53	5.55
60.0	281	0.127	46.1	7.40	2.17	2.31	3.70	5.71
60.0	288	0.134	46.1	7.58	2.30	2.32	3.79	5.79
60.0	294	0.142	46.1	7.72	2.43	2.31	3.86	5.87
60.0	307	0.156	45.9	8.05	2.67	2.29	4.02	6.05
60.0	313	0.163	45.8	8.19	2.79	2.28	4.10	6.14
60.0	320	0.170	45.7	8.36	2.92	2.27	4.18	6.24
60.0	333	0.185	45.5	8.68	3.17	2.23	4.34	6.43
60.0	340	0.192	45.4	8.85	3.29	2.21	4.43	6.53
60.0	352	0.206	45.1	9.14	3.53	2.17	4.57	6.72
60.0	359	0.213	44.9	9.31	3.66	2.15	4.66	6.83
60.0	371	0.227	44.6	9.60	3.90	2.11	4.80	7.01
60.0	376	0.235	44.5	9.72	4.03	2.08	4.86	7.10
60.0	382	0.242	44.3	9.86	4.14	2.06	4.93	7.19
60.0	393	0.257	43.9	10.12	4.41	2.01	5.06	7.37
60.0	399	0.264	43.8	10.26	4.53	1.98	5.13	7.47
60.0	405	0.272	43.6	10.40	4.66	1.95	5.20	7.57
60.0	417	0.286	43.2	10.68	4.91	1.90	5.34	7.76
60.0	423	0.294	43.0	10.82	5.03	1.87	5.41	7.86

Figure D-2.2.4

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Purple Line Extension	Cell Pressure:	75.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	45.0 psi
Depth(ft):	55.5	Initial Sample Height:	5.875 in
Sample No.:	11	Initial Area of Sample:	5.404 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.581 in
Sample Description:	Yellowish Brown Clay w/sand	Final Sample Area (A)*:	5.942 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
75.0	0	0.000	30.0	0.00	0.00	0.00	0.00	6.48
75.0	114	0.005	37.3	2.76	0.08	1.05	1.38	6.81
75.0	181	0.011	41.4	4.38	0.20	1.64	2.19	7.03
75.0	229	0.018	44.0	5.53	0.33	2.01	2.77	7.23
75.0	270	0.025	45.9	6.51	0.45	2.29	3.26	7.44
75.0	309	0.033	47.5	7.44	0.58	2.51	3.72	7.69
75.0	344	0.039	48.6	8.28	0.69	2.68	4.14	7.94
75.0	379	0.046	49.6	9.11	0.82	2.82	4.55	8.21
75.0	410	0.053	50.3	9.84	0.94	2.93	4.92	8.47
75.0	438	0.059	50.8	10.50	1.05	3.00	5.25	8.74
75.0	462	0.066	51.0	11.06	1.18	3.03	5.53	8.98
75.0	480	0.073	51.1	11.48	1.30	3.03	5.74	9.19
75.0	496	0.079	51.0	11.85	1.41	3.02	5.93	9.38
75.0	509	0.086	50.9	12.15	1.54	3.00	6.07	9.55
75.0	520	0.093	50.6	12.39	1.66	2.97	6.20	9.70
75.0	530	0.100	50.4	12.61	1.79	2.94	6.31	9.85
75.0	538	0.108	50.2	12.79	1.93	2.91	6.39	9.97
75.0	553	0.122	49.7	13.11	2.19	2.84	6.55	10.20
75.0	566	0.137	49.2	13.38	2.46	2.76	6.69	10.41
75.0	572	0.145	48.9	13.50	2.59	2.72	6.75	10.51
75.0	578	0.152	48.7	13.63	2.71	2.69	6.81	10.61
75.0	591	0.166	48.1	13.90	2.97	2.61	6.95	10.82
75.0	597	0.172	47.9	14.02	3.08	2.57	7.01	10.92
75.0	610	0.186	47.3	14.29	3.33	2.49	7.15	11.13
75.0	620	0.199	46.8	14.49	3.57	2.42	7.24	11.31
75.0	626	0.206	46.5	14.61	3.68	2.38	7.31	11.41
75.0	636	0.220	46.0	14.81	3.94	2.30	7.40	11.58
75.0	640	0.227	45.7	14.88	4.07	2.27	7.44	11.65
75.0	644	0.235	45.5	14.95	4.21	2.23	7.48	11.73
75.0	648	0.242	45.2	15.02	4.34	2.19	7.51	11.81
75.0	651	0.250	44.9	15.07	4.49	2.15	7.53	11.87
75.0	659	0.264	44.4	15.21	4.74	2.07	7.61	12.02
75.0	667	0.279	43.8	15.36	5.00	1.99	7.68	12.16
75.0	672	0.286	43.6	15.45	5.12	1.96	7.73	12.25
75.0	680	0.300	43.1	15.59	5.37	1.88	7.80	12.40

Figure D-2.2.5

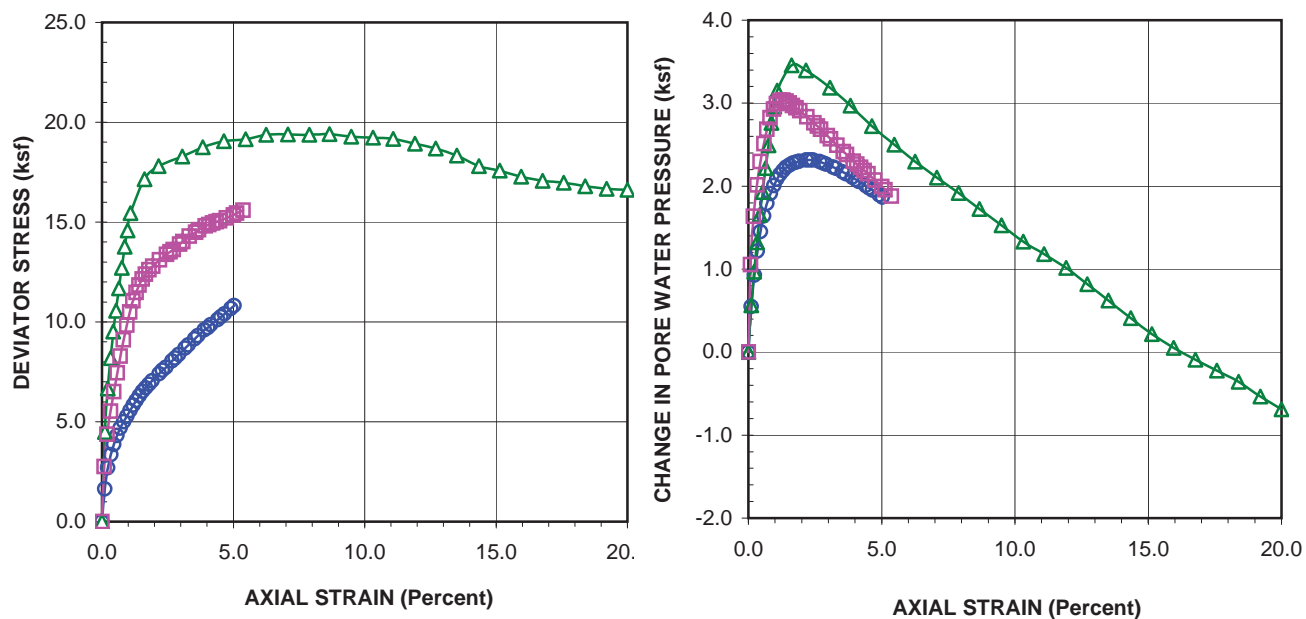


CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	Westside Purple Line Extension	Cell Pressure:	90.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	60.0 psi
Depth(ft):	55.5	Initial Sample Height:	5.875 in
Sample No.:	11	Initial Area of Sample:	5.404 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.564 in
Sample Description:	Yellowish Brown Clay w/sand	Final Sample Area (A)*:	5.991 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
90.0	0	0.000	30.0	0.00	0.00	0.00	0.00	8.64
90.0	187	0.006	33.9	4.49	0.11	0.57	2.24	10.32
90.0	278	0.012	36.7	6.67	0.22	0.97	3.33	11.00
90.0	342	0.018	39.2	8.19	0.32	1.32	4.10	11.41
90.0	398	0.024	41.5	9.52	0.43	1.66	4.76	11.75
90.0	442	0.030	43.4	10.57	0.54	1.93	5.28	11.99
90.0	489	0.036	45.4	11.68	0.65	2.22	5.84	12.26
90.0	533	0.042	47.3	12.71	0.75	2.49	6.36	12.51
90.0	578	0.048	49.2	13.77	0.86	2.76	6.89	12.76
90.0	613	0.054	50.5	14.59	0.97	2.96	7.29	12.98
90.0	650	0.060	51.9	15.45	1.08	3.15	7.73	13.21
90.0	725	0.090	54.0	17.14	1.62	3.46	8.57	13.75
90.0	757	0.120	53.6	17.80	2.16	3.39	8.90	14.15
90.0	785	0.170	52.1	18.29	3.06	3.19	9.14	14.60
90.0	811	0.213	50.6	18.74	3.84	2.97	9.37	15.04
90.0	831	0.258	48.9	19.05	4.64	2.72	9.52	15.44
90.0	843	0.305	47.4	19.15	5.47	2.50	9.58	15.71
90.0	860	0.348	45.9	19.38	6.25	2.29	9.69	16.03
90.0	868	0.393	44.6	19.39	7.07	2.10	9.69	16.23
90.0	875	0.439	43.3	19.37	7.89	1.92	9.69	16.41
90.0	884	0.482	42.0	19.41	8.66	1.73	9.70	16.62
90.0	886	0.528	40.6	19.27	9.49	1.53	9.64	16.75
90.0	892	0.574	39.3	19.23	10.31	1.33	9.61	16.92
90.0	897	0.617	38.2	19.17	11.09	1.18	9.58	17.04
90.0	894	0.663	37.0	18.93	11.92	1.01	9.46	17.09
90.0	891	0.707	35.7	18.69	12.71	0.82	9.35	17.17
90.0	882	0.752	34.3	18.33	13.51	0.62	9.17	17.19
90.0	865	0.798	32.8	17.81	14.34	0.41	8.90	17.13
90.0	862	0.842	31.5	17.58	15.14	0.22	8.79	17.21
90.0	855	0.888	30.4	17.27	15.95	0.05	8.64	17.22
90.0	853	0.933	29.4	17.06	16.77	-0.09	8.53	17.26
90.0	857	0.978	28.5	16.98	17.57	-0.22	8.49	17.35
90.0	856	1.023	27.5	16.79	18.39	-0.36	8.39	17.39
90.0	858	1.069	26.3	16.66	19.21	-0.54	8.33	17.51
90.0	864	1.113	25.2	16.61	20.00	-0.69	8.31	17.64

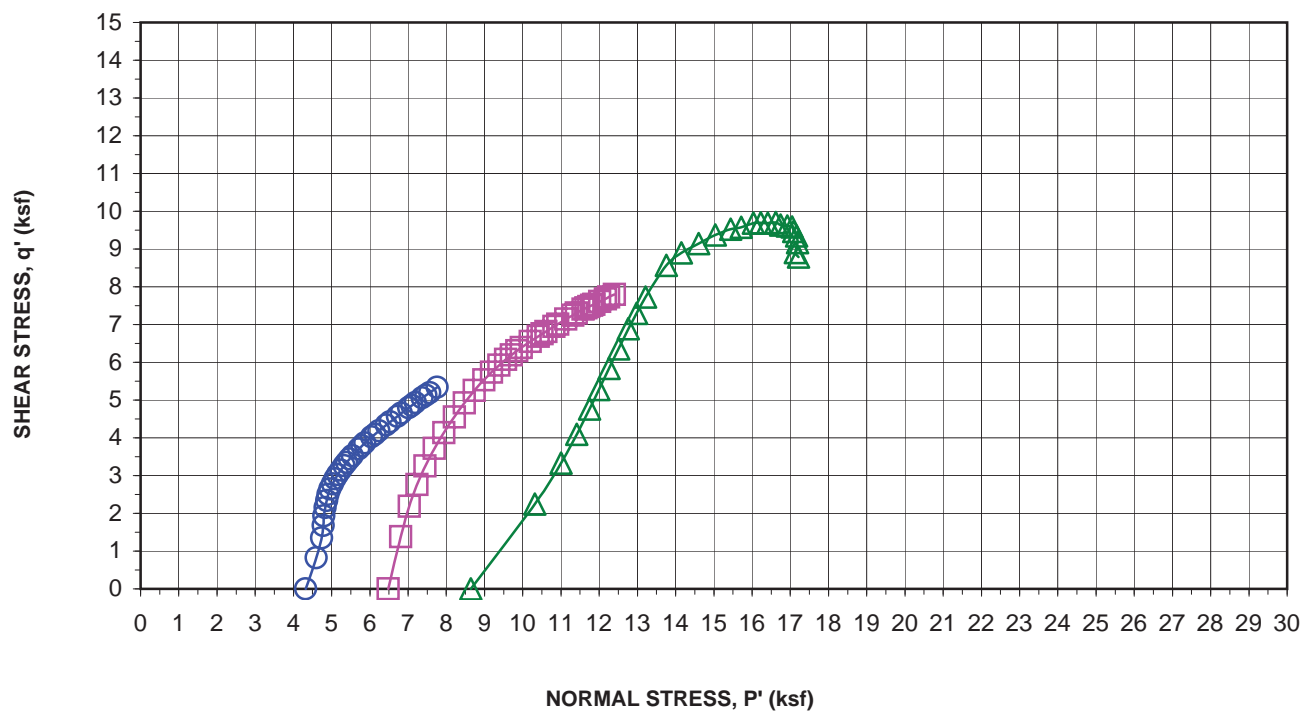
Figure D-2.2.6



○ Confining Pressure = 30.0 psi

□ Confining Pressure = 45.0 psi

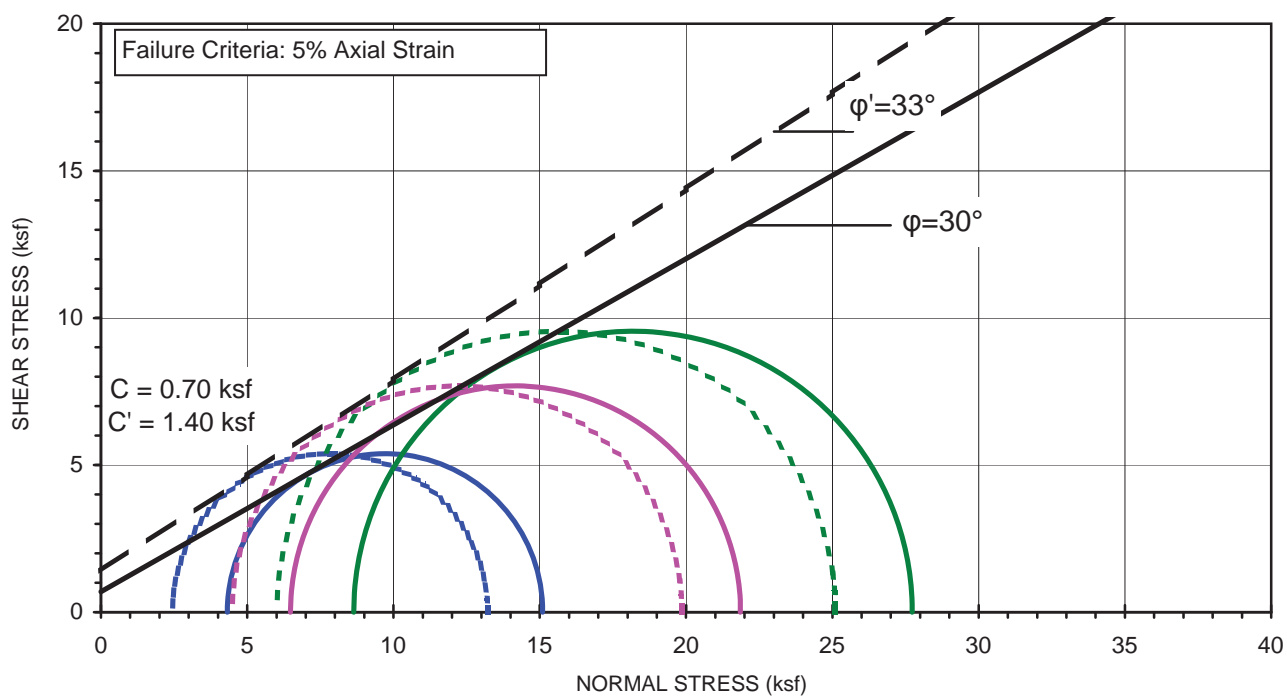
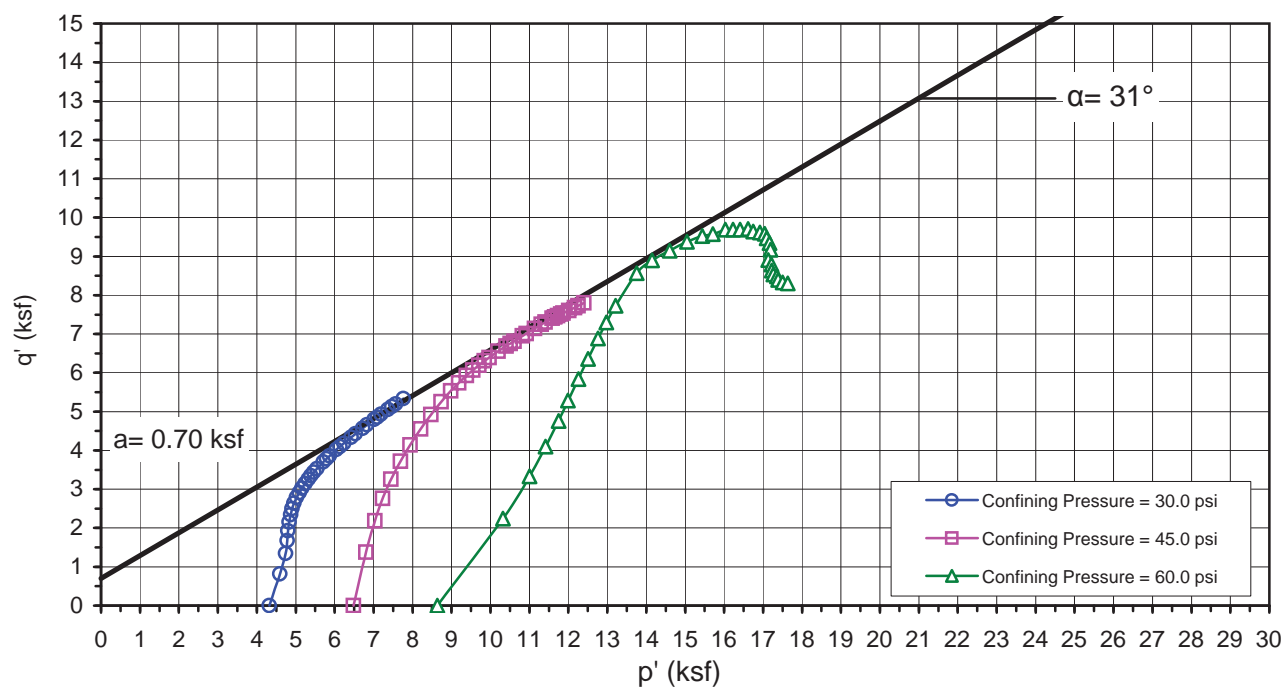
△ Confining Pressure = 60.0 psi



Project Name:	Westside Purple Line Extension	Sample Type:	Mod. Cal.
Project No.:	4953-11-1423	Sample Description:	Yellowish Brown Clay w/sand
Boring No.:	E-126A	Avg. Dry Unit Weight (pcf):	108.3
Sample No.:	11	Avg. Initial Moisture Content (%):	19.9
Depth (ft):	55.5	Confining Pressure:	30.0, 45.0, 60.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

Figure D-2.2.7



Project Name:	Westside Purple Line Extension	Sample Type:	Mod. Cal.
Project No.:	4953-11-1423	Sample Description:	Yellowish Brown Clay w/sand
Boring No.:	E-126A	Avg. Dry Unit Weight (pcf):	108.3
Sample No.:	11	Avg. Initial Moisture Content (%):	19.9
Depth (ft):	55.5	Confining Pressures:	30.0, 45.0, 60.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767


Figure D-2.2.8

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Purple Line Extension Tested by: ST Date: 10-31-15
 Project No.: 4953-11-1423 Input Data by: AP Date: 11-02-15
 Boring No.: E-126A Reviewed by: AP Date: 11-06-15
 Sample No.: 15 Sample Description: Yellowish Brown Silty Sand
 Depth(ft): 75.5
 Sample Type: Mod. Cal. Confining Pressure = 40.0 psi

Diameter (in)	<u>2.616</u>	<u>2.616</u>	<u>2.616</u>	Avg. =	2.616
Height (in)	<u>5.728</u>	<u>5.728</u>	<u>5.728</u>	Avg. =	5.728

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.375	5.298
Moisture Content (%)	14.38	12.33
Wet Weight (gms)	1119.87	1243.05
Dry Weight (gms)	979.10	1122.28
Container Weight (gms)	0.00	143.18
Density and Saturation		
Wet Weight (gms)	1119.87	
Container Weight (gms)	0.00	
Wet Density (pcf)	138.6	
Dry Density (pcf)	121.2	
Initial Void Ratio	0.391	
% Saturation	99.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 98 Change in Ht. of the Specimen (in) = 0

Consolidation

Cell Pressure (psi) =	<u>70.0</u>	Initial Burette Ht.(cm)=	<u>77.6</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>63.9</u>
Eff. Consol. Stress (psi) =	<u>40.0</u>	Final Height (in)=	<u>5.654</u>
Induced OCR =	<u>1.0</u>	Initial Volume (cu.in)=	<u>30.787</u>
Change in Ht. of Specimen (in) =	<u>0.0745</u>	Final Volume (cu.in) =	<u>29.951</u>

ShearAt Failure

Rate of Deformation (in/min)=	<u>0.004</u>	Deviator Stress (ksf) =	<u>10.20</u>
Time to 50% primary Consolidation (min) =	<u>15</u>	Eff. Minor Principal stress (ksf) =	<u>2.62</u>
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	<u>12.82</u>
		Axial Strain (%) =	<u>5.15</u>

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Purple Line Extension Tested by: ST Date: 10-31-15
 Project No.: 4953-11-1423 Input Data by: AP Date: 11-02-15
 Boring No.: E-126A Reviewed by: AP Date: 11-06-15
 Sample No.: 15 Sample Description: Yellowish Brown Silty Sand
 Depth(ft): 75.5
 Sample Type: Mod. Cal. Confining Pressure = 60.0 psi

Diameter (in)	<u>2.616</u>	<u>2.616</u>	<u>2.616</u>	Avg. =	2.616
Height (in)	<u>5.728</u>	<u>5.728</u>	<u>5.728</u>	Avg. =	5.728

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.375	5.965
Moisture Content (%)	14.38	12.33
Wet Weight (gms)	1119.87	1243.05
Dry Weight (gms)	979.10	1122.28
Container Weight (gms)	0.00	143.18
Density and Saturation		
Wet Weight (gms)	1119.87	
Container Weight (gms)	0.00	
Wet Density (pcf)	138.6	
Dry Density (pcf)	121.2	
Initial Void Ratio	0.391	
% Saturation	99.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 98 Change in Ht. of the Specimen (in) = 0

Consolidation

Cell Pressure (psi) =	<u>90.0</u>	Initial Burette Ht.(cm)=	<u>63.9</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>57.7</u>
Eff. Consol. Stress (psi) =	60.0	Final Height (in)=	<u>5.375</u>
Induced OCR=	<u>1.0</u>	Initial Volume (cu.in)=	<u>30.787</u>
Change in Ht. of Specimen (in) =	0.3533	Final Volume (cu.in) =	<u>30.409</u>

ShearAt Failure

Rate of Deformation (in/min)=	0.004	Deviator Stress (ksf) =	15.26
Time to 50% primary Consolidation =	15	Eff. Minor Principal stress (ksf) =	5.50
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	20.76
		Axial Strain (%) =	5.65

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Purple Line Extension Tested by: ST Date: 10-31-15
 Project No.: 4953-11-1423 Input Data by: AP Date: 11-02-15
 Boring No.: E-126A Reviewed by: AP Date: 11-06-15
 Sample No.: 15 Sample Description: Yellowish Brown Silty Sand
 Depth(ft): 75.5
 Sample Type: Mod. Cal. Confining Pressure = 80.0 psi

Diameter (in)	<u>2.616</u>	<u>2.616</u>	<u>2.616</u>	Avg. =	2.616
Height (in)	<u>5.728</u>	<u>5.728</u>	<u>5.728</u>	Avg. =	5.728

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.375	6.358
Moisture Content (%)	14.38	12.33
Wet Weight (gms)	1119.87	1243.05
Dry Weight (gms)	979.10	1122.28
Container Weight (gms)	0.00	143.18
Density and Saturation		
Wet Weight (gms)	1119.87	
Container Weight (gms)	0.00	
Wet Density (pcf)	138.6	
Dry Density (pcf)	121.2	
Initial Void Ratio	0.391	
% Saturation	99.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 98 Change in Ht. of the Specimen (in)= 0

Consolidation

Cell Pressure (psi) =	<u>110.0</u>	Initial Burette Ht.(cm)=	<u>57.7</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>55.2</u>
Eff. Consol. Stress (psi) =	80.0	Final Height (in)=	<u>5.107</u>
Induced OCR =	<u>1.0</u>	Initial Volume (cu.in)=	<u>30.787</u>
Change in Ht. of Specimen (in) =	0.6212	Final Volume (cu.in) =	<u>30.635</u>

ShearAt Failure

Rate of Deformation (in/min)=	0.004	Deviator Stress (ksf) =	23.06
Time to 50% primary Consolidation =	15	Eff. Minor Principal stress (ksf) =	9.46
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	32.52
		Axial Strain (%) =	21.55



CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	Westside Purple Line Extension	Cell Pressure:	70.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	40.0 psi
Depth(ft):	75.5	Initial Sample Height:	5.728 in
Sample No.:	15	Initial Area of Sample:	5.375 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.654 in
Sample Description:	Yellowish Brown Silty Sand	Final Sample Area (A)*:	5.298 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
70.0	0	0.000	30.0	0.00	0.00	0.00	0.00	5.76
70.0	105	0.005	37.2	2.84	0.09	1.04	1.42	6.15
70.0	146	0.012	41.5	3.96	0.22	1.65	1.98	6.09
70.0	171	0.019	44.5	4.64	0.34	2.08	2.32	6.00
70.0	189	0.027	46.6	5.10	0.47	2.39	2.55	5.93
70.0	201	0.034	48.2	5.44	0.60	2.62	2.72	5.86
70.0	213	0.042	49.4	5.74	0.74	2.80	2.87	5.83
70.0	222	0.049	50.4	5.98	0.86	2.94	2.99	5.81
70.0	231	0.056	51.3	6.22	0.99	3.07	3.11	5.80
70.0	238	0.063	52.0	6.40	1.11	3.17	3.20	5.79
70.0	246	0.070	52.6	6.61	1.24	3.25	3.30	5.81
70.0	253	0.076	53.0	6.78	1.35	3.31	3.39	5.84
70.0	259	0.084	53.4	6.93	1.48	3.37	3.46	5.86
70.0	266	0.090	53.7	7.11	1.59	3.41	3.55	5.90
70.0	271	0.097	53.9	7.25	1.72	3.44	3.62	5.94
70.0	277	0.104	54.1	7.39	1.84	3.47	3.70	5.99
70.0	290	0.117	54.3	7.71	2.06	3.50	3.86	6.12
70.0	296	0.123	54.3	7.86	2.18	3.50	3.93	6.18
70.0	301	0.131	54.4	8.00	2.32	3.51	4.00	6.25
70.0	312	0.146	54.3	8.25	2.58	3.50	4.13	6.39
70.0	316	0.153	54.3	8.36	2.71	3.49	4.18	6.45
70.0	320	0.160	54.2	8.44	2.84	3.48	4.22	6.50
70.0	329	0.176	54.0	8.66	3.11	3.46	4.33	6.63
70.0	334	0.183	53.9	8.77	3.23	3.45	4.39	6.70
70.0	343	0.196	53.7	8.99	3.46	3.42	4.50	6.84
70.0	347	0.203	53.6	9.10	3.59	3.40	4.55	6.91
70.0	352	0.210	53.5	9.21	3.72	3.38	4.60	6.98
70.0	361	0.225	53.2	9.43	3.97	3.34	4.71	7.13
70.0	366	0.232	53.1	9.53	4.09	3.32	4.77	7.21
70.0	374	0.247	52.8	9.72	4.36	3.28	4.86	7.34
70.0	378	0.254	52.6	9.82	4.49	3.25	4.91	7.42
70.0	382	0.262	52.5	9.90	4.63	3.23	4.95	7.48
70.0	389	0.277	52.1	10.05	4.90	3.19	5.02	7.60
70.0	393	0.284	52.0	10.15	5.02	3.17	5.08	7.67
70.0	396	0.291	51.8	10.20	5.15	3.14	5.10	7.72

Figure D-2.2.12

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Purple Line Extension	Cell Pressure:	90.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	60.0 psi
Depth(ft):	75.5	Initial Sample Height:	5.728 in
Sample No.:	15	Initial Area of Sample:	5.375 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.375 in
Sample Description:	Yellowish Brown Silty Sand	Final Sample Area (A)*:	5.965 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
90.0	0	0.000	30.0	0.00	0.00	0.00	0.00	8.64
90.0	168	0.006	42.3	4.05	0.11	1.77	2.03	8.90
90.0	261	0.013	48.7	6.29	0.24	2.70	3.14	9.09
90.0	330	0.019	52.7	7.94	0.35	3.27	3.97	9.34
90.0	384	0.026	55.3	9.23	0.48	3.64	4.61	9.61
90.0	427	0.033	57.1	10.25	0.61	3.90	5.12	9.86
90.0	459	0.040	58.2	11.00	0.74	4.06	5.50	10.08
90.0	482	0.046	58.8	11.54	0.85	4.15	5.77	10.26
90.0	500	0.052	59.1	11.95	0.97	4.19	5.98	10.42
90.0	513	0.058	59.1	12.25	1.08	4.19	6.13	10.57
90.0	523	0.065	59.0	12.47	1.20	4.18	6.24	10.70
90.0	532	0.071	58.8	12.67	1.32	4.15	6.34	10.83
90.0	539	0.077	58.5	12.82	1.44	4.11	6.41	10.94
90.0	547	0.084	58.3	13.00	1.56	4.07	6.50	11.07
90.0	554	0.091	57.9	13.15	1.69	4.02	6.57	11.19
90.0	560	0.098	57.7	13.27	1.83	3.98	6.64	11.29
90.0	566	0.106	57.5	13.40	1.96	3.95	6.70	11.38
90.0	571	0.113	57.2	13.49	2.10	3.91	6.75	11.48
90.0	581	0.128	56.7	13.69	2.38	3.84	6.85	11.64
90.0	585	0.135	56.5	13.77	2.51	3.81	6.88	11.72
90.0	589	0.143	56.2	13.84	2.66	3.78	6.92	11.78
90.0	597	0.157	55.8	13.99	2.91	3.71	7.00	11.93
90.0	601	0.164	55.5	14.07	3.05	3.68	7.03	12.00
90.0	604	0.170	55.3	14.12	3.17	3.65	7.06	12.05
90.0	611	0.184	54.9	14.25	3.42	3.59	7.12	12.17
90.0	614	0.190	54.8	14.30	3.54	3.56	7.15	12.22
90.0	622	0.204	54.4	14.45	3.79	3.51	7.22	12.35
90.0	632	0.218	54.0	14.64	4.05	3.46	7.32	12.50
90.0	635	0.225	53.8	14.69	4.18	3.43	7.34	12.56
90.0	639	0.232	53.6	14.76	4.32	3.40	7.38	12.62
90.0	645	0.247	53.2	14.85	4.60	3.35	7.43	12.72
90.0	649	0.255	53.1	14.92	4.74	3.32	7.46	12.78
90.0	661	0.283	52.3	15.12	5.27	3.21	7.56	12.99
90.0	664	0.290	52.2	15.17	5.39	3.19	7.58	13.03
90.0	670	0.304	51.8	15.26	5.65	3.14	7.63	13.13

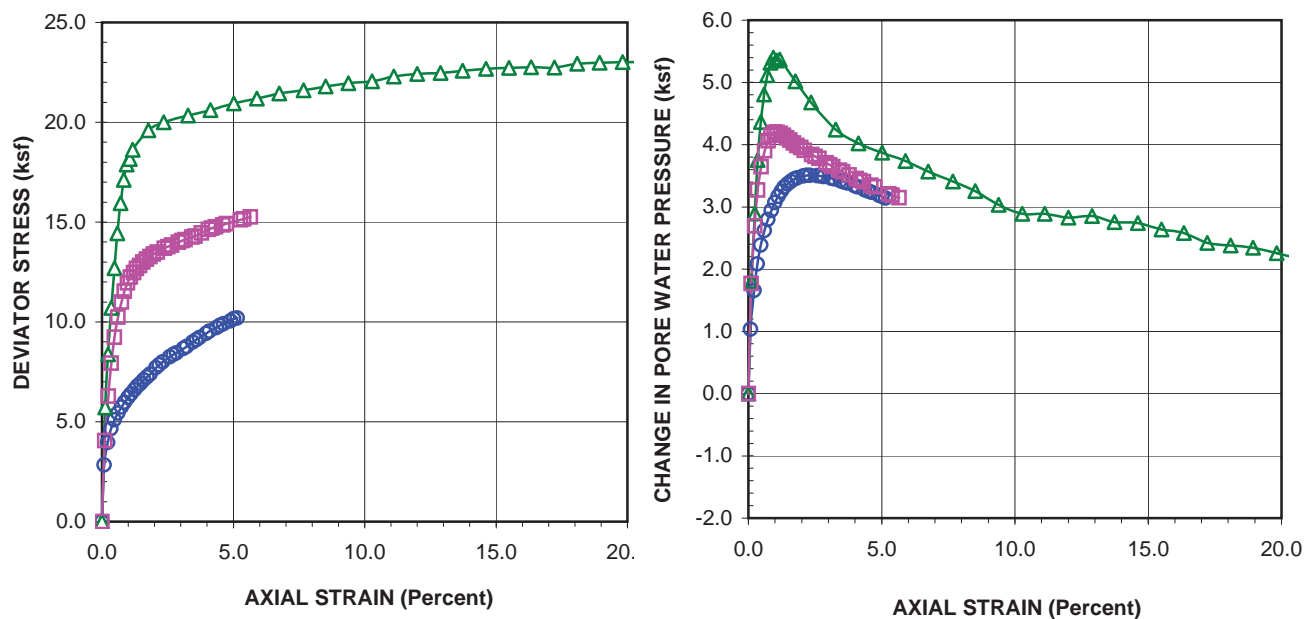
Figure D-2.2.13

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

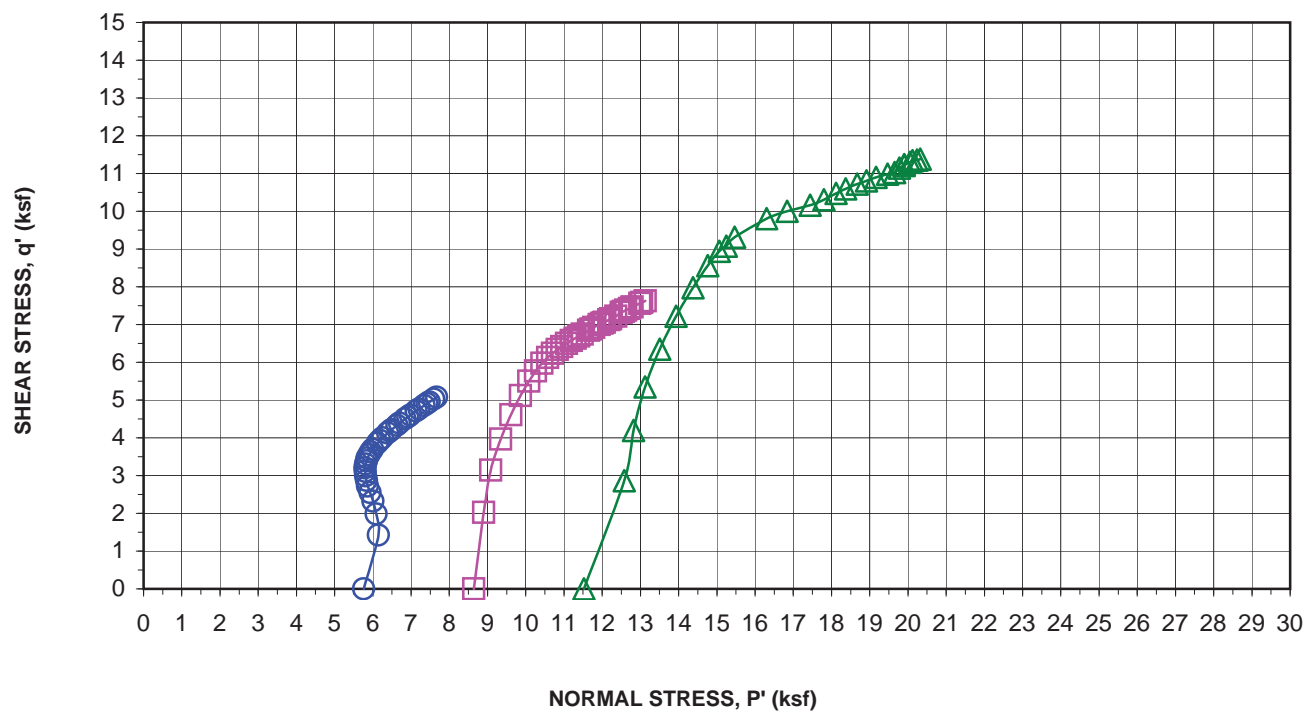
Project Name:	Westside Purple Line Extension	Cell Pressure:	110.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	80.0 psi
Depth(ft):	75.5	Initial Sample Height:	5.728 in
Sample No.:	15	Initial Area of Sample:	5.375 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.107 in
Sample Description:	Yellowish Brown Silty Sand	Final Sample Area (A)*:	6.358 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
110.0	0	0.000	30.0	0.00	0.00	0.00	0.00	11.52
110.0	253	0.006	42.5	5.72	0.12	1.81	2.86	12.58
110.0	371	0.012	50.1	8.38	0.23	2.90	4.19	12.82
110.0	474	0.018	56.1	10.70	0.35	3.75	5.35	13.12
110.0	563	0.024	60.3	12.69	0.47	4.36	6.35	13.50
110.0	641	0.030	63.4	14.43	0.59	4.81	7.22	13.93
110.0	709	0.036	65.5	15.94	0.70	5.12	7.97	14.38
110.0	762	0.042	66.9	17.12	0.82	5.32	8.56	14.76
110.0	797	0.048	67.5	17.88	0.94	5.40	8.94	15.06
110.0	810	0.054	67.2	18.15	1.06	5.35	9.08	15.24
110.0	832	0.060	67.3	18.62	1.17	5.37	9.31	15.47
110.0	881	0.090	64.9	19.60	1.76	5.02	9.80	16.30
110.0	904	0.120	62.5	19.99	2.35	4.68	10.00	16.84
110.0	928	0.167	59.4	20.33	3.28	4.24	10.16	17.44
110.0	949	0.211	57.9	20.61	4.13	4.02	10.30	17.80
110.0	974	0.257	56.9	20.95	5.02	3.87	10.48	18.12
110.0	994	0.301	56.0	21.19	5.89	3.74	10.59	18.37
110.0	1015	0.345	54.8	21.44	6.75	3.57	10.72	18.67
110.0	1033	0.392	53.7	21.60	7.67	3.41	10.80	18.91
110.0	1052	0.435	52.6	21.80	8.51	3.26	10.90	19.16
110.0	1070	0.479	51.1	21.96	9.38	3.03	10.98	19.47
110.0	1085	0.525	50.1	22.05	10.28	2.89	11.02	19.65
110.0	1107	0.567	50.1	22.29	11.11	2.89	11.14	19.77
110.0	1125	0.613	49.7	22.42	12.00	2.83	11.21	19.90
110.0	1139	0.658	49.8	22.47	12.89	2.85	11.24	19.90
110.0	1156	0.701	49.2	22.59	13.73	2.76	11.29	20.06
110.0	1173	0.746	49.0	22.68	14.62	2.74	11.34	20.12
110.0	1187	0.791	48.3	22.72	15.49	2.64	11.36	20.24
110.0	1201	0.834	47.9	22.76	16.34	2.58	11.38	20.32
110.0	1213	0.879	46.8	22.74	17.22	2.42	11.37	20.47
110.0	1236	0.924	46.5	22.93	18.09	2.38	11.46	20.61
110.0	1252	0.967	46.3	22.99	18.94	2.34	11.49	20.67
110.0	1267	1.012	45.7	23.01	19.82	2.26	11.50	20.76
110.0	1281	1.056	45.0	23.01	20.67	2.17	11.51	20.86
110.0	1298	1.101	44.3	23.06	21.55	2.06	11.53	20.99

Figure D-2.2.14

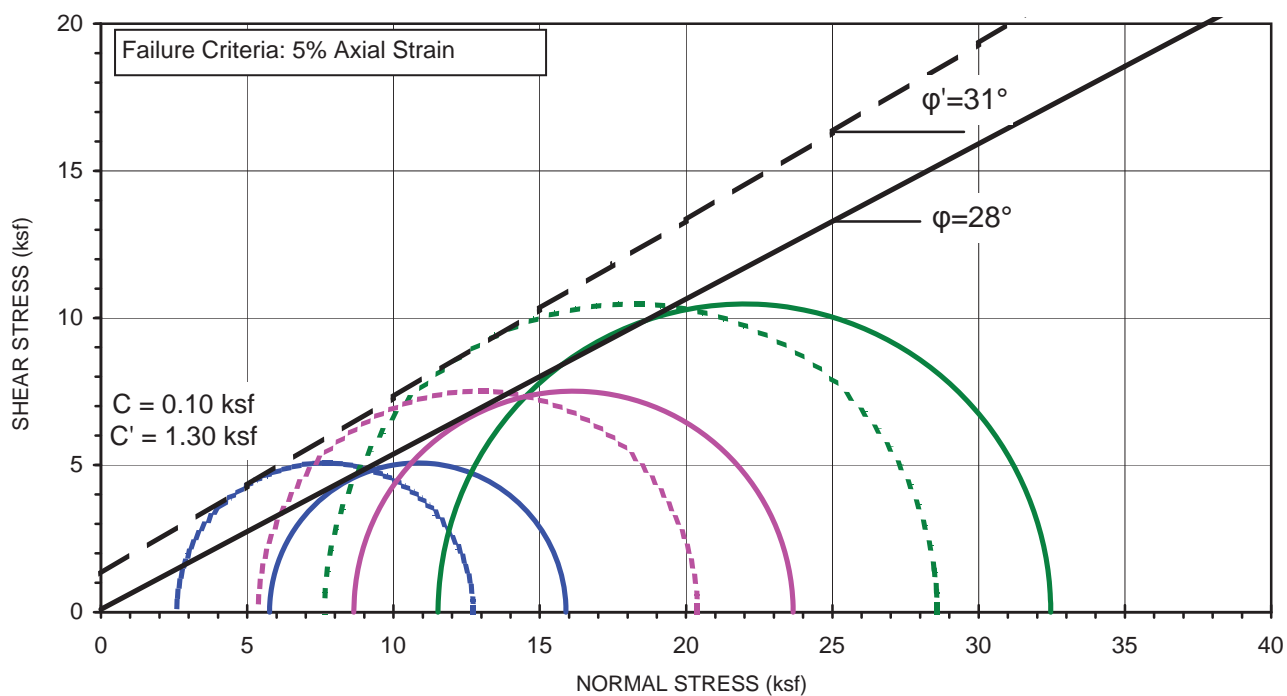
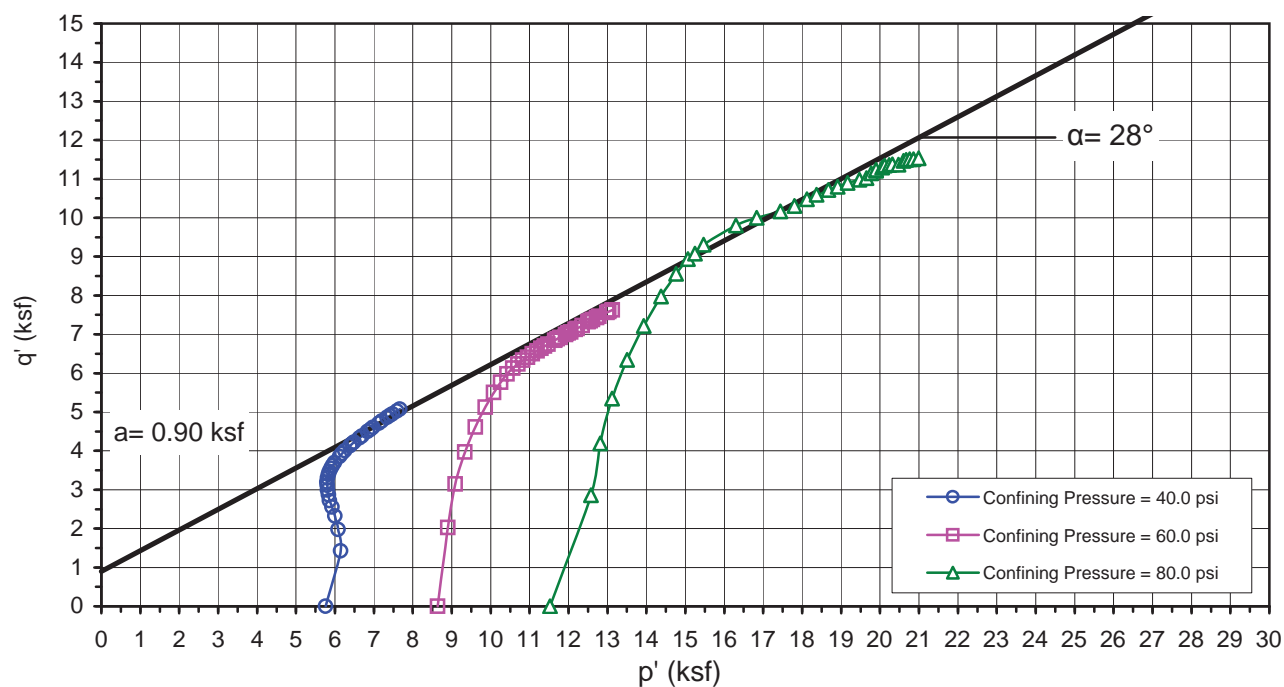


—○— Confining Pressure = 40.0 psi —□— Confining Pressure = 60.0 psi —△— Confining Pressure = 80.0 psi



Project Name:	Westside Purple Line Extension	Sample Type:	Mod. Cal.
Project No.:	4953-11-1423	Sample Description:	Yellowish Brown Silty Sand
Boring No.:	E-126A	Avg. Dry Unit Weight (pcf):	121.2
Sample No.:	15	Avg. Initial Moisture Content (%):	14.4
Depth (ft):	75.5	Confining Pressure:	40.0, 60.0, 80.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767



Project Name:	Westside Purple Line Extension	Sample Type:	Mod. Cal.
Project No.:	4953-11-1423	Sample Description:	Yellowish Brown Silty Sand
Boring No.:	E-126A	Avg. Dry Unit Weight (pcf):	121.2
Sample No.:	15	Avg. Initial Moisture Content (%):	14.4
Depth (ft):	75.5	Confining Pressures:	40.0, 60.0, 80.0 psi


CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name:	Westside Purple Line Extension	Tested by:	ST	Date:	10-31-15
Project No.:	4953-11-1423	Input Data by:	AP	Date:	11-02-15
Boring No.:	E-126A	Reviewed by:	AP	Date:	11-06-15
Sample No.:	19	Sample Description: Brown Sandy Clay			
Depth(ft):	95.5				
Sample Type:	Mod. Cal.	Confining Pressure = 35.0 psi			

Diameter (in)	<u>2.621</u>	<u>2.621</u>	<u>2.621</u>	Avg. =	2.621
Height (in)	<u>5.843</u>	<u>5.843</u>	<u>5.843</u>	Avg. =	5.843

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.395	5.336
Moisture Content (%)	17.72	16.05
Wet Weight (gms)	1107.88	1241.86
Dry Weight (gms)	941.51	1090.74
Container Weight (gms)	2.63	149.23
Density and Saturation		
Wet Weight (gms)	1107.88	
Container Weight (gms)	0.00	
Wet Density (pcf)	133.9	
Dry Density (pcf)	113.7	
Initial Void Ratio	0.481	
% Saturation	99.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) =	94	Change in Ht. of the Specimen (in)=	0
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Consolidation

Cell Pressure (psi) =	65.0	Initial Burette Ht.(cm)=	73.6
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	63.3
Eff. Consol. Stress (psi) =	35.0	Final Height (in)=	5.791
Induced OCR =	1.0	Initial Volume (cu.in)=	31.525
Change in Ht. of Specimen (in) =	0.0523	Final Volume (cu.in) =	30.897

Shear

Rate of Deformation (in/min)=	0.004	At Failure	
Time to 50% primary Consolidation (min) =	15	Deviator Stress (ksf) =	8.17
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	2.20
		Eff. Major Principal stress (ksf) =	10.37
		Axial Strain (%) =	5.17

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Purple Line Extension Tested by: ST Date: 10-31-15
 Project No.: 4953-11-1423 Input Data by: AP Date: 11-02-15
 Boring No.: E-126A Reviewed by: AP Date: 11-06-15
 Sample No.: 19 Sample Description: Brown Sandy Clay
 Depth(ft): 95.5
 Sample Type: Mod. Cal. Confining Pressure = 55.0 psi

Diameter (in)	<u>2.621</u>	<u>2.621</u>	<u>2.621</u>	Avg. =	2.621
Height (in)	<u>5.843</u>	<u>5.843</u>	<u>5.843</u>	Avg. =	5.843

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.395	5.928
Moisture Content (%)	17.72	16.05
Wet Weight (gms)	1107.88	1241.86
Dry Weight (gms)	941.51	1090.74
Container Weight (gms)	2.63	149.23
Density and Saturation		
Wet Weight (gms)	1107.88	
Container Weight (gms)	0.00	
Wet Density (pcf)	133.9	
Dry Density (pcf)	113.7	
Initial Void Ratio	0.481	
% Saturation	99.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in)= 0

Consolidation

Cell Pressure (psi) =	<u>85.0</u>	Initial Burette Ht.(cm)=	<u>63.3</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>55.4</u>
Eff. Consol. Stress (psi) =	<u>55.0</u>	Final Height (in)=	<u>5.522</u>
Induced OCR=	<u>1.0</u>	Initial Volume (cu.in)=	<u>31.525</u>
Change in Ht. of Specimen (in) =	<u>0.3209</u>	Final Volume (cu.in) =	<u>31.043</u>

ShearAt Failure

Rate of Deformation (in/min)=	<u>0.004</u>	Deviator Stress (ksf) =	<u>12.71</u>
Time to 50% primary Consolidation =	<u>15</u>	Eff. Minor Principal stress (ksf) =	<u>3.91</u>
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	<u>16.61</u>
		Axial Strain (%) =	<u>5.41</u>

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Purple Line Extension Tested by: ST Date: 10-31-15
 Project No.: 4953-11-1423 Input Data by: AP Date: 11-02-15
 Boring No.: E-126A Reviewed by: AP Date: 11-06-15
 Sample No.: 19 Sample Description: Brown Sandy Clay
 Depth(ft): 95.5
 Sample Type: Mod. Cal. Confining Pressure = 75.0 psi

Diameter (in)	<u>2.621</u>	<u>2.621</u>	<u>2.621</u>	Avg. =	2.621
Height (in)	<u>5.843</u>	<u>5.843</u>	<u>5.843</u>	Avg. =	5.843

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.395	6.252
Moisture Content (%)	17.72	16.05
Wet Weight (gms)	<u>1107.88</u>	<u>1241.86</u>
Dry Weight (gms)	<u>941.51</u>	<u>1090.74</u>
Container Weight (gms)	<u>2.63</u>	<u>149.23</u>
Density and Saturation		
Wet Weight (gms)	<u>1107.88</u>	
Container Weight (gms)	<u>0.00</u>	
Wet Density (pcf)	133.9	
Dry Density (pcf)	113.7	
Initial Void Ratio	0.481	
% Saturation	99.4	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in)= 0

Consolidation

Cell Pressure (psi) =	<u>105.0</u>	Initial Burette Ht.(cm)=	<u>55.4</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>48.8</u>
Eff. Consol. Stress (psi) =	<u>75.0</u>	Final Height (in)=	<u>5.262</u>
Induced OCR =	<u>1.0</u>	Initial Volume (cu.in)=	<u>31.525</u>
Change in Ht. of Specimen (in) =	<u>0.5807</u>	Final Volume (cu.in) =	<u>31.123</u>

ShearAt Failure

Rate of Deformation (in/min)=	<u>0.004</u>	Deviator Stress (ksf) =	<u>19.34</u>
Time to 50% primary Consolidation =	<u>15</u>	Eff. Minor Principal stress (ksf) =	<u>8.65</u>
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	<u>28.00</u>
		Axial Strain (%) =	<u>20.03</u>

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Purple Line Extension	Cell Pressure:	65.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	35.0 psi
Depth(ft):	95.5	Initial Sample Height:	5.843 in
Sample No.:	19	Initial Area of Sample:	5.395 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.791 in
Sample Description:	Brown Sandy Clay	Final Sample Area (A)*:	5.336 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
65.0	0	0.000	30.0	0.00	0.00	0.00	0.00	5.04
65.0	88	0.006	35.0	2.36	0.10	0.72	1.18	5.50
65.0	119	0.013	38.0	3.20	0.23	1.15	1.60	5.49
65.0	137	0.021	40.2	3.68	0.36	1.46	1.84	5.42
65.0	150	0.029	41.7	4.03	0.50	1.69	2.01	5.37
65.0	161	0.036	42.9	4.31	0.61	1.86	2.16	5.34
65.0	169	0.044	43.8	4.53	0.75	1.99	2.27	5.32
65.0	178	0.051	44.7	4.75	0.89	2.11	2.38	5.30
65.0	184	0.059	45.4	4.90	1.02	2.21	2.45	5.28
65.0	190	0.066	46.0	5.06	1.14	2.30	2.53	5.27
65.0	194	0.073	46.5	5.18	1.25	2.37	2.59	5.26
65.0	199	0.080	46.9	5.30	1.38	2.43	2.65	5.26
65.0	204	0.087	47.3	5.42	1.50	2.49	2.71	5.27
65.0	209	0.094	47.6	5.54	1.63	2.53	2.77	5.28
65.0	212	0.102	47.9	5.63	1.75	2.57	2.82	5.28
65.0	221	0.116	48.3	5.84	2.00	2.64	2.92	5.32
65.0	226	0.124	48.5	5.96	2.14	2.67	2.98	5.35
65.0	229	0.131	48.7	6.05	2.26	2.69	3.02	5.37
65.0	238	0.146	49.0	6.25	2.52	2.73	3.13	5.43
65.0	242	0.153	49.1	6.37	2.64	2.75	3.18	5.48
65.0	246	0.161	49.2	6.45	2.78	2.76	3.23	5.51
65.0	254	0.175	49.3	6.66	3.02	2.78	3.33	5.59
65.0	258	0.182	49.3	6.74	3.15	2.78	3.37	5.63
65.0	265	0.197	49.4	6.91	3.40	2.80	3.46	5.70
65.0	269	0.204	49.5	7.00	3.52	2.81	3.50	5.73
65.0	272	0.211	49.6	7.08	3.64	2.82	3.54	5.76
65.0	278	0.226	50.2	7.22	3.90	2.90	3.61	5.75
65.0	282	0.232	50.1	7.31	4.00	2.90	3.65	5.79
65.0	290	0.248	50.1	7.50	4.28	2.89	3.75	5.90
65.0	294	0.255	50.1	7.59	4.40	2.89	3.79	5.95
65.0	298	0.262	50.0	7.67	4.53	2.88	3.83	5.99
65.0	302	0.270	50.0	7.78	4.67	2.88	3.89	6.05
65.0	311	0.285	49.9	7.98	4.92	2.86	3.99	6.16
65.0	316	0.292	49.8	8.09	5.04	2.85	4.04	6.23
65.0	319	0.299	49.7	8.17	5.17	2.84	4.08	6.28

Figure D-2.2.20



CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

Project Name:	Westside Purple Line Extension	Cell Pressure:	85.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	55.0 psi
Depth(ft):	95.5	Initial Sample Height:	5.843 in
Sample No.:	19	Initial Area of Sample:	5.395 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.522 in
Sample Description:	Brown Sandy Clay	Final Sample Area (A)*:	5.928 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
85.0	0	0.000	30.0	0.00	0.00	0.00	0.00	7.92
85.0	118	0.004	38.2	2.86	0.08	1.18	1.43	8.18
85.0	189	0.011	44.4	4.58	0.20	2.08	2.29	8.13
85.0	236	0.018	48.6	5.71	0.33	2.68	2.86	8.09
85.0	273	0.025	51.7	6.60	0.46	3.13	3.30	8.09
85.0	303	0.033	54.0	7.32	0.59	3.46	3.66	8.12
85.0	327	0.039	55.8	7.89	0.71	3.71	3.94	8.15
85.0	347	0.046	57.1	8.36	0.83	3.91	4.18	8.19
85.0	363	0.054	58.2	8.73	0.97	4.05	4.37	8.23
85.0	377	0.060	58.9	9.06	1.09	4.16	4.53	8.29
85.0	387	0.067	59.4	9.29	1.21	4.24	4.64	8.32
85.0	396	0.074	59.8	9.49	1.33	4.29	4.75	8.37
85.0	403	0.080	60.1	9.65	1.45	4.33	4.82	8.41
85.0	410	0.087	60.2	9.80	1.58	4.35	4.90	8.47
85.0	416	0.094	60.4	9.93	1.71	4.37	4.97	8.51
85.0	421	0.101	60.4	10.04	1.83	4.37	5.02	8.57
85.0	431	0.116	60.4	10.25	2.09	4.38	5.13	8.67
85.0	436	0.123	60.4	10.35	2.23	4.37	5.18	8.72
85.0	441	0.130	60.4	10.46	2.36	4.38	5.23	8.77
85.0	451	0.146	60.3	10.67	2.64	4.36	5.33	8.89
85.0	456	0.152	60.2	10.77	2.76	4.35	5.39	8.95
85.0	461	0.160	60.2	10.87	2.90	4.35	5.44	9.01
85.0	471	0.173	60.0	11.08	3.14	4.31	5.54	9.15
85.0	476	0.180	59.8	11.19	3.26	4.30	5.59	9.22
85.0	486	0.194	59.6	11.39	3.51	4.26	5.70	9.35
85.0	489	0.201	59.5	11.45	3.63	4.24	5.72	9.40
85.0	498	0.213	59.3	11.63	3.86	4.21	5.81	9.52
85.0	503	0.221	59.1	11.73	4.00	4.20	5.86	9.59
85.0	511	0.234	59.0	11.89	4.23	4.17	5.94	9.69
85.0	515	0.241	58.9	11.96	4.37	4.16	5.98	9.74
85.0	524	0.257	58.6	12.14	4.64	4.12	6.07	9.87
85.0	529	0.264	58.5	12.24	4.77	4.11	6.12	9.93
85.0	543	0.286	58.2	12.51	5.17	4.06	6.25	10.12
85.0	548	0.292	58.0	12.61	5.29	4.04	6.30	10.19
85.0	553	0.299	57.9	12.71	5.41	4.01	6.35	10.26

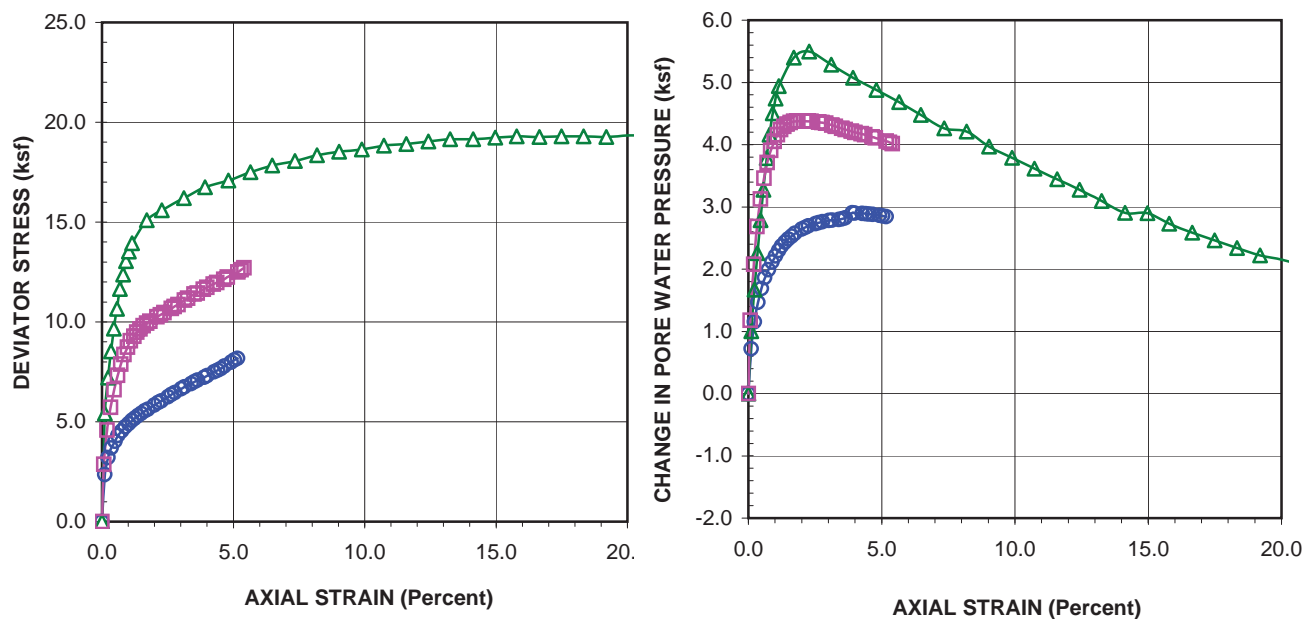
Figure D-2.2.21

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

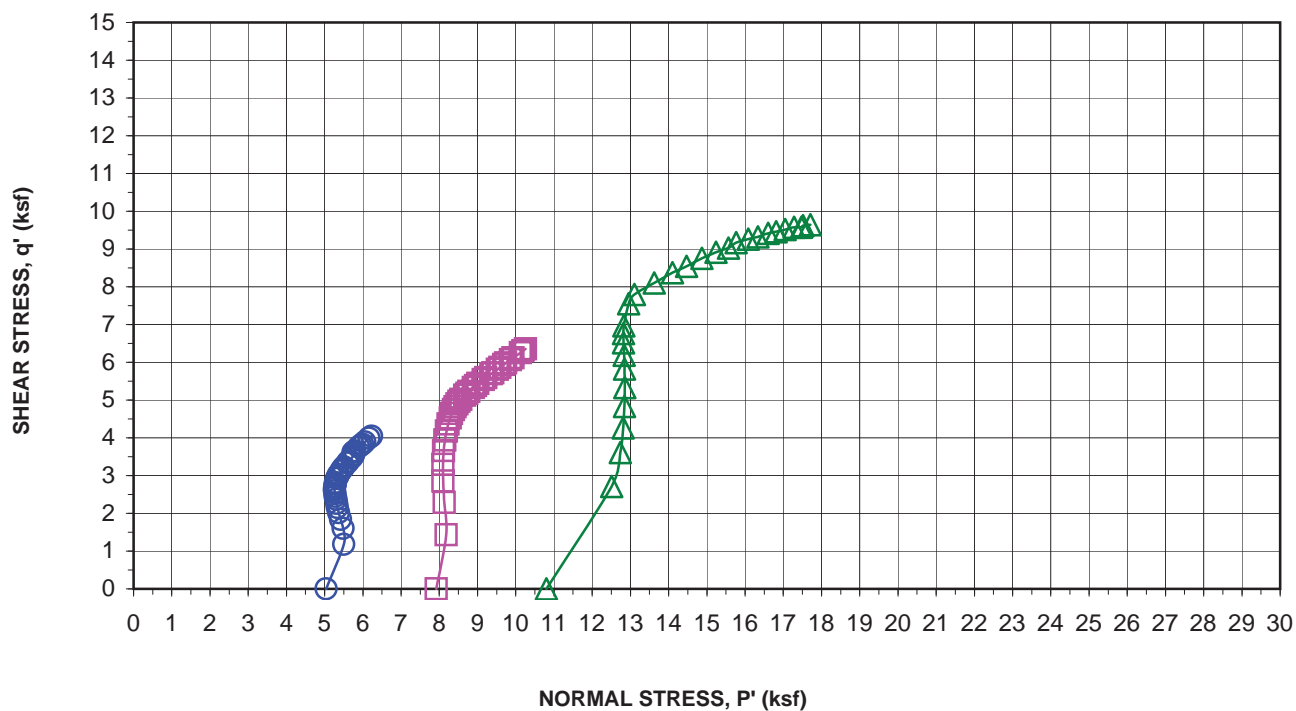
Project Name:	Westside Purple Line Extension	Cell Pressure:	105.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Boring No.:	E-126A	Consolidation Pressure :	75.0 psi
Depth(ft):	95.5	Initial Sample Height:	5.843 in
Sample No.:	19	Initial Area of Sample:	5.395 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.262 in
Sample Description:	Brown Sandy Clay	Final Sample Area (A)*:	6.252 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
105.0	0	0.000	30.0	0.00	0.00	0.00	0.00	10.80
105.0	236	0.006	37.0	5.42	0.11	1.00	2.71	12.51
105.0	314	0.012	41.6	7.22	0.23	1.67	3.61	12.74
105.0	372	0.018	45.7	8.53	0.34	2.26	4.27	12.81
105.0	421	0.024	49.4	9.66	0.46	2.79	4.83	12.84
105.0	465	0.030	52.7	10.66	0.57	3.27	5.33	12.85
105.0	509	0.036	56.3	11.65	0.68	3.78	5.83	12.84
105.0	542	0.042	58.9	12.38	0.80	4.16	6.19	12.83
105.0	572	0.048	61.3	13.04	0.91	4.50	6.52	12.82
105.0	593	0.054	62.9	13.52	1.03	4.74	6.76	12.82
105.0	612	0.060	64.3	13.93	1.14	4.94	6.97	12.83
105.0	667	0.090	67.5	15.10	1.71	5.40	7.55	12.95
105.0	693	0.120	68.2	15.60	2.28	5.49	7.80	13.10
105.0	726	0.164	66.7	16.21	3.11	5.28	8.10	13.62
105.0	757	0.206	65.2	16.75	3.92	5.07	8.37	14.10
105.0	779	0.253	63.9	17.09	4.81	4.88	8.54	14.47
105.0	806	0.298	62.5	17.50	5.66	4.68	8.75	14.87
105.0	828	0.341	61.1	17.84	6.47	4.48	8.92	15.24
105.0	846	0.387	59.6	18.05	7.34	4.26	9.03	15.56
105.0	868	0.431	59.2	18.35	8.19	4.21	9.17	15.76
105.0	884	0.475	57.6	18.52	9.02	3.97	9.26	16.09
105.0	898	0.521	56.3	18.64	9.89	3.79	9.32	16.33
105.0	916	0.565	55.1	18.84	10.73	3.61	9.42	16.60
105.0	929	0.610	53.9	18.91	11.58	3.44	9.46	16.81
105.0	944	0.654	52.7	19.04	12.43	3.27	9.52	17.05
105.0	959	0.698	51.5	19.15	13.25	3.09	9.57	17.28
105.0	968	0.744	50.2	19.15	14.13	2.90	9.58	17.47
105.0	982	0.788	50.2	19.23	14.97	2.90	9.61	17.51
105.0	995	0.831	49.0	19.29	15.79	2.73	9.64	17.71
105.0	1004	0.876	48.0	19.26	16.65	2.59	9.63	17.84
105.0	1015	0.920	47.1	19.29	17.49	2.46	9.65	17.98
105.0	1026	0.964	46.3	19.30	18.33	2.34	9.65	18.11
105.0	1035	1.010	45.4	19.26	19.20	2.22	9.63	18.21
105.0	1050	1.054	44.9	19.34	20.03	2.15	9.67	18.32
105.0	1060	1.099	44.2	19.32	20.87	2.05	9.66	18.41

Figure D-2.2.22

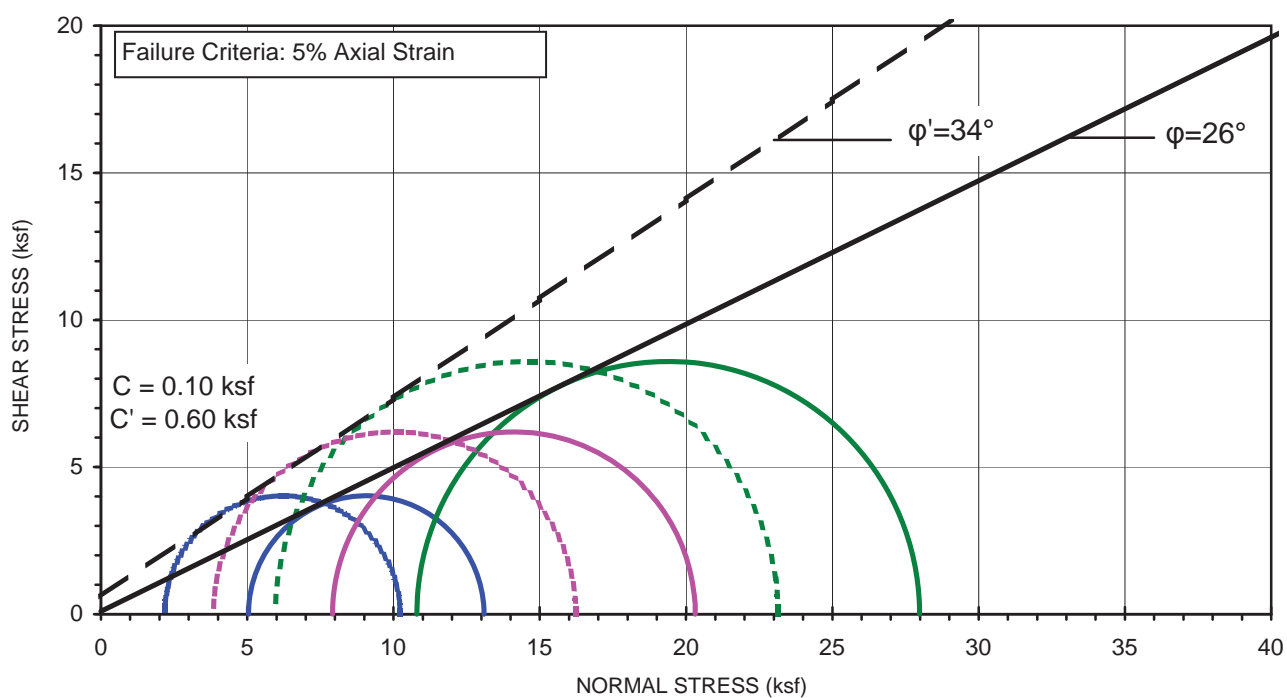
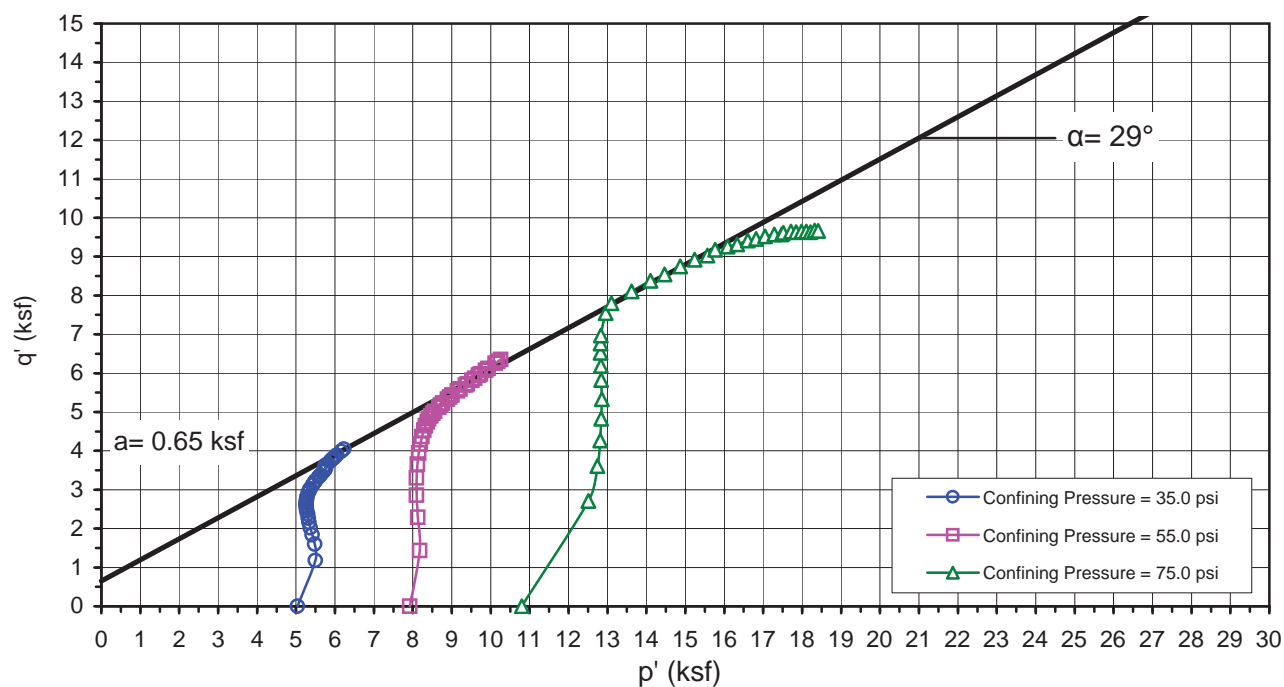


—○— Confining Pressure = 35.0 psi
 —□— Confining Pressure = 55.0 psi
 —△— Confining Pressure = 75.0 psi



Project Name:	Westside Purple Line Extension	Sample Type:	Mod. Cal.
Project No.:	4953-11-1423	Sample Description:	Brown Sandy Clay
Boring No.:	E-126A	Avg. Dry Unit Weight (pcf):	113.7
Sample No.:	19	Avg. Initial Moisture Content (%):	17.7
Depth (ft):	95.5	Confining Pressure:	35.0, 55.0, 75.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767



Project Name: Westside Purple Line Extension
Project No.: 4953-11-1423
Boring No.: E-126A
Sample No.: 19
Depth (ft): 95.5

Sample Type: Mod. Cal.
Sample Description: Brown Sandy Clay
Avg. Dry Unit Weight (pcf): 113.7
Avg. Initial Moisture Content (%): 17.7
Confining Pressures: 35.0, 55.0, 75.0 psi


CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Subway Extension Tested by: ST Date: 04-08-15
 Project No.: 4953-11-1423 Input Data by: KM Date: 04-17-15
 Test Pit: G-142 Reviewed by: AP Date: 04-17-15
 Sample No.: 3 Sample Description: Brown Lean Clay with sand
 Depth(ft): 15.5
 Sample Type: Mod. Cal. Confining Pressure = 5.0 psi

Diameter (in)	<u>2.623</u>	<u>2.623</u>	<u>2.623</u>	Avg. =	2.623
Height (in)	<u>5.721</u>	<u>5.721</u>	<u>5.721</u>	Avg. =	5.721

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.404	5.404
Moisture Content (%)	14.64	19.87
Wet Weight (gms)	15.82	1238.18
Dry Weight (gms)	14.13	1057.63
Container Weight (gms)	2.59	149.20
Density and Saturation		
Wet Weight (gms)	1079.47	
Container Weight (gms)	0.00	
Wet Density (pcf)	133.0	
Dry Density (pcf)	116.0	
Initial Void Ratio	0.452	
% Saturation	87.5	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in) = 0

Consolidation

Cell Pressure (psi) =	35.0	Initial Burette Ht.(cm)=	0.0
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	0.0
Eff. Consol. Stress (psi) =	5.0	Final Height (in)=	5.721
Induced OCR =	1.0	Initial Volume (cu.in)=	30.914
Change in Ht. of Specimen (in) =	0.0000	Final Volume (cu.in) =	30.914

Shear

Rate of Deformation (in/min)=	0.005	At Failure	
Time to 50% primary Consolidation (min) =	15	Deviator Stress (ksf) =	4.90
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	0.55
		Eff. Major Principal stress (ksf) =	5.45
		Axial Strain (%) =	5.19

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Subway Extension Tested by: ST Date: 04-08-15
 Project No.: 4953-11-1423 Input Data by: KM Date: 04-17-15
 Test Pit: G-142 Reviewed by: AP Date: 04-17-15
 Sample No.: 3 Sample Description: Brown Lean Clay with sand
 Depth(ft): 15.5
 Sample Type: Mod. Cal. Confining Pressure = 15.0 psi

Diameter (in)	<u>2.623</u>	<u>2.623</u>	<u>2.623</u>	Avg. =	2.623
Height (in)	<u>5.721</u>	<u>5.721</u>	<u>5.721</u>	Avg. =	5.721

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.404	5.664
Moisture Content (%)	14.64	19.87
Wet Weight (gms)	<u>15.82</u>	<u>1238.18</u>
Dry Weight (gms)	<u>14.13</u>	<u>1057.63</u>
Container Weight (gms)	<u>2.59</u>	<u>149.20</u>
Density and Saturation		
Wet Weight (gms)	<u>1079.47</u>	
Container Weight (gms)	<u>0.00</u>	
Wet Density (pcf)	133.0	
Dry Density (pcf)	116.0	
Initial Void Ratio	0.452	
% Saturation	87.5	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in)= 0

Consolidation

Cell Pressure (psi) =	<u>45.0</u>	Initial Burette Ht.(cm)=	<u>88.3</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>84.6</u>
Eff. Consol. Stress (psi) =	<u>15.0</u>	Final Height (in)=	<u>5.715</u>
Induced OCR=	<u>1.0</u>	Initial Volume (cu.in)=	<u>30.914</u>
Change in Ht. of Specimen (in) =	<u>0.0060</u>	Final Volume (cu.in) =	<u>30.688</u>

ShearAt Failure

Rate of Deformation (in/min)=	<u>0.005</u>	Deviator Stress (ksf) =	<u>6.56</u>
Time to 50% primary Consolidation =	<u>15</u>	Eff. Minor Principal stress (ksf) =	<u>1.36</u>
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	<u>7.92</u>
		Axial Strain (%) =	<u>4.76</u>

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Subway Extension Tested by: ST Date: 04-08-15
 Project No.: 4953-11-1423 Input Data by: KM Date: 04-17-15
 Test Pit: G-142 Reviewed by: AP Date: 04-17-15
 Sample No.: 3 Sample Description: Brown Lean Clay with sand
 Depth(ft): 15.5
 Sample Type: Mod. Cal. Confining Pressure = 30.0 psi

Diameter (in)	<u>2.623</u>	<u>2.623</u>	<u>2.623</u>	Avg. =	2.623
Height (in)	<u>5.721</u>	<u>5.721</u>	<u>5.721</u>	Avg. =	5.721

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.404	5.621
Moisture Content (%)	14.64	19.87
Wet Weight (gms)	<u>15.82</u>	<u>1238.18</u>
Dry Weight (gms)	<u>14.13</u>	<u>1057.63</u>
Container Weight (gms)	<u>2.59</u>	<u>149.20</u>
Density and Saturation		
Wet Weight (gms)	<u>1079.47</u>	
Container Weight (gms)	<u>0.00</u>	
Wet Density (pcf)	133.0	
Dry Density (pcf)	116.0	
Initial Void Ratio	0.452	
% Saturation	87.5	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in) = 0

Consolidation

Cell Pressure (psi) =	<u>60.0</u>	Initial Burette Ht.(cm)=	<u>85.2</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>80.4</u>
Eff. Consol. Stress (psi) =	<u>30.0</u>	Final Height (in)=	<u>5.720</u>
Induced OCR =	<u>1.0</u>	Initial Volume (cu.in)=	<u>30.914</u>
Change in Ht. of Specimen (in) =	<u>0.0010</u>	Final Volume (cu.in) =	<u>30.621</u>

Shear

Rate of Deformation (in/min)=	<u>0.005</u>	<u>At Failure</u>	
Time to 50% primary Consolidation =	<u>15</u>	Deviator Stress (ksf) =	<u>9.53</u>
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	<u>3.72</u>
		Eff. Major Principal stress (ksf) =	<u>13.25</u>
		Axial Strain (%) =	<u>14.84</u>

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Subway Extension	Cell Pressure:	35.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Test Pit:	G-142	Consolidation Pressure :	5.0 psi
Depth(ft):	15.5	Initial Sample Height:	5.721 in
Sample No.:	3	Initial Area of Sample:	5.404 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.721 in
Sample Description:	Brown Lean Clay with sand	Final Sample Area (A)*:	5.404 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
35.0	0	0.000	30.0	0.00	0.00	0.00	0.00	0.72
35.0	27	0.005	30.8	0.72	0.08	0.11	0.36	0.97
35.0	47	0.012	31.4	1.25	0.21	0.19	0.62	1.15
35.0	57	0.019	31.7	1.51	0.32	0.24	0.76	1.24
35.0	64	0.026	31.9	1.70	0.45	0.27	0.85	1.30
35.0	70	0.033	32.1	1.85	0.57	0.29	0.93	1.35
35.0	75	0.040	32.2	1.98	0.70	0.31	0.99	1.40
35.0	80	0.047	32.3	2.11	0.82	0.32	1.06	1.45
35.0	83	0.055	32.4	2.19	0.96	0.33	1.10	1.48
35.0	88	0.062	32.4	2.32	1.08	0.34	1.16	1.54
35.0	92	0.069	32.4	2.42	1.21	0.35	1.21	1.59
35.0	95	0.076	32.5	2.50	1.32	0.35	1.25	1.62
35.0	99	0.084	32.5	2.60	1.46	0.35	1.30	1.67
35.0	102	0.090	32.5	2.68	1.57	0.35	1.34	1.71
35.0	106	0.096	32.5	2.78	1.68	0.35	1.39	1.76
35.0	110	0.104	32.5	2.88	1.82	0.35	1.44	1.81
35.0	113	0.111	32.5	2.95	1.94	0.35	1.48	1.85
35.0	117	0.118	32.4	3.05	2.07	0.35	1.53	1.90
35.0	120	0.125	32.4	3.13	2.18	0.34	1.56	1.94
35.0	124	0.132	32.4	3.23	2.31	0.34	1.61	1.99
35.0	127	0.140	32.4	3.30	2.44	0.34	1.65	2.04
35.0	131	0.147	32.3	3.40	2.57	0.33	1.70	2.09
35.0	134	0.154	32.3	3.48	2.68	0.32	1.74	2.13
35.0	137	0.161	32.2	3.55	2.81	0.32	1.77	2.18
35.0	141	0.168	32.2	3.65	2.93	0.31	1.82	2.23
35.0	144	0.175	32.2	3.72	3.06	0.31	1.86	2.27
35.0	148	0.182	32.1	3.82	3.18	0.30	1.91	2.33
35.0	151	0.189	32.1	3.89	3.31	0.30	1.95	2.37
35.0	154	0.197	32.1	3.96	3.43	0.29	1.98	2.41
35.0	158	0.203	32.0	4.06	3.55	0.29	2.03	2.46
35.0	166	0.224	31.9	4.25	3.92	0.26	2.13	2.58
35.0	175	0.246	31.7	4.46	4.30	0.24	2.23	2.72
35.0	184	0.268	31.5	4.67	4.69	0.21	2.34	2.85
35.0	192	0.290	31.3	4.86	5.06	0.18	2.43	2.97
35.0	194	0.297	31.2	4.90	5.19	0.17	2.45	3.00

Figure D-2.2.28

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Subway Extension	Cell Pressure:	45.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Test Pit:	G-142	Consolidation Pressure :	15.0 psi
Depth(ft):	15.5	Initial Sample Height:	5.721 in
Sample No.:	3	Initial Area of Sample:	5.404 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.715 in
Sample Description:	Brown Lean Clay with sand	Final Sample Area (A)*:	5.664 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
45.0	0	0.005	30.0	0.00	0.09	0.00	0.00	2.16
45.0	18	0.002	30.9	0.46	0.03	0.14	0.23	2.25
45.0	56	0.009	32.6	1.42	0.16	0.37	0.71	2.50
45.0	76	0.017	33.3	1.93	0.29	0.48	0.96	2.64
45.0	92	0.024	33.9	2.33	0.42	0.57	1.16	2.76
45.0	106	0.032	34.4	2.68	0.55	0.64	1.34	2.86
45.0	119	0.038	34.8	3.01	0.67	0.70	1.50	2.96
45.0	132	0.045	35.2	3.33	0.79	0.75	1.66	3.07
45.0	144	0.053	35.6	3.63	0.92	0.80	1.81	3.17
45.0	155	0.060	35.9	3.90	1.05	0.85	1.95	3.26
45.0	167	0.066	36.1	4.20	1.16	0.89	2.10	3.37
45.0	178	0.073	36.4	4.47	1.28	0.92	2.23	3.48
45.0	187	0.080	36.5	4.69	1.40	0.94	2.34	3.56
45.0	195	0.087	36.7	4.88	1.52	0.96	2.44	3.64
45.0	202	0.094	36.8	5.05	1.65	0.97	2.53	3.71
45.0	207	0.100	36.8	5.17	1.75	0.98	2.59	3.76
45.0	212	0.108	36.8	5.29	1.88	0.98	2.64	3.82
45.0	217	0.115	36.8	5.41	2.02	0.98	2.70	3.88
45.0	221	0.123	36.8	5.50	2.15	0.98	2.75	3.93
45.0	225	0.130	36.8	5.59	2.27	0.98	2.80	3.98
45.0	228	0.137	36.7	5.66	2.39	0.97	2.83	4.02
45.0	231	0.144	36.7	5.72	2.53	0.97	2.86	4.06
45.0	234	0.151	36.6	5.79	2.65	0.96	2.90	4.10
45.0	237	0.159	36.6	5.86	2.78	0.95	2.93	4.14
45.0	240	0.166	36.5	5.92	2.90	0.94	2.96	4.18
45.0	242	0.173	36.5	5.97	3.03	0.94	2.98	4.21
45.0	245	0.180	36.4	6.03	3.15	0.93	3.02	4.25
45.0	247	0.188	36.4	6.07	3.28	0.92	3.04	4.28
45.0	249	0.194	36.4	6.12	3.40	0.93	3.06	4.29
45.0	252	0.201	36.3	6.18	3.51	0.90	3.09	4.35
45.0	254	0.208	36.2	6.22	3.64	0.90	3.11	4.38
45.0	260	0.229	36.0	6.35	4.00	0.86	3.17	4.47
45.0	266	0.251	35.8	6.47	4.38	0.83	3.23	4.56
45.0	271	0.272	35.5	6.56	4.76	0.80	3.28	4.64
45.0	268	0.293	35.1	6.46	5.12	0.74	3.23	4.65

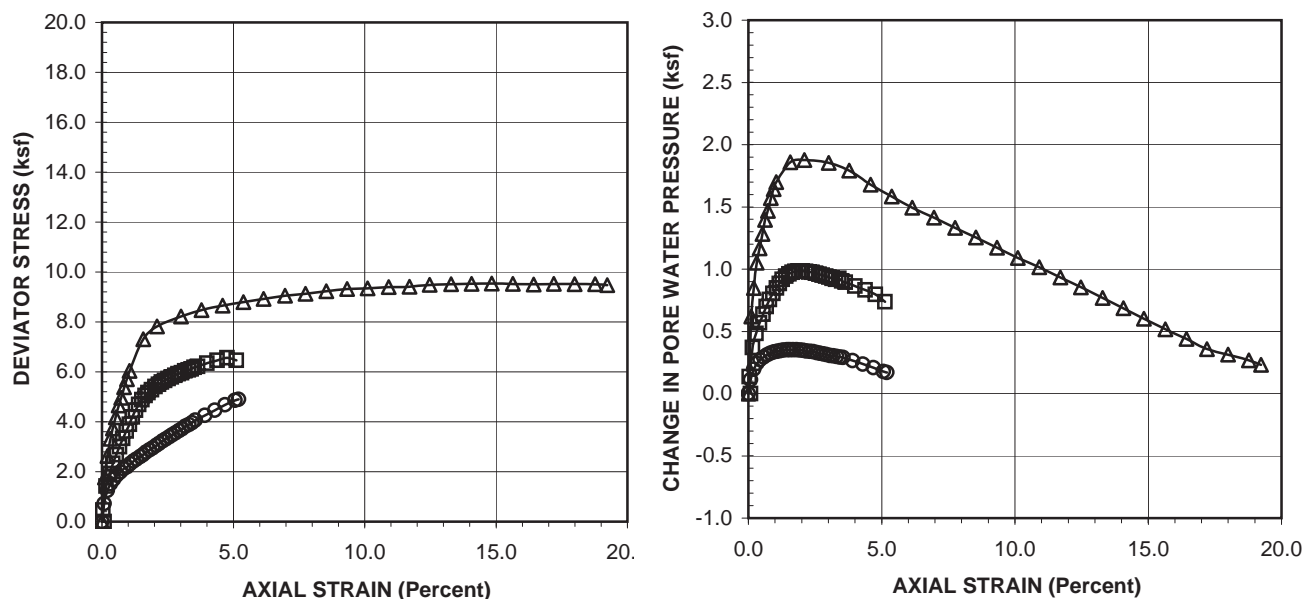
Figure D-2.2.29

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

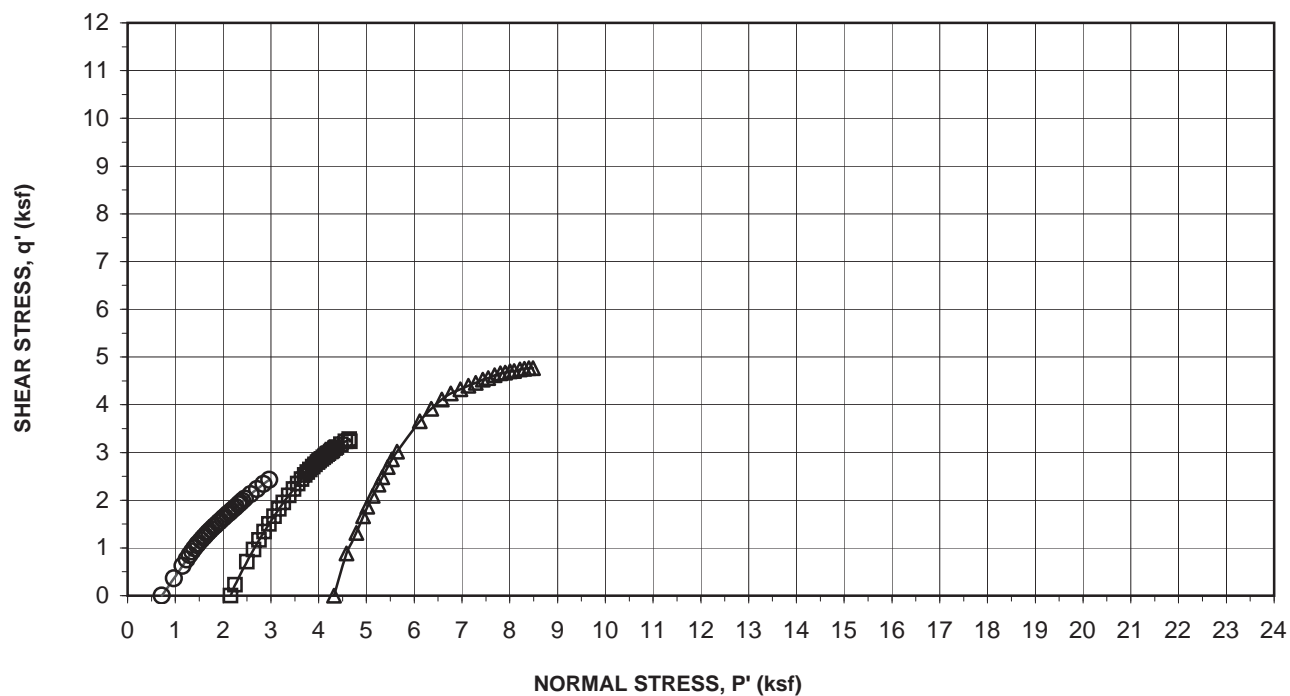
Project Name:	Westside Subway Extension	Cell Pressure:	60.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Test Pit:	G-142	Consolidation Pressure :	30.0 psi
Depth(ft):	15.5	Initial Sample Height:	5.721 in
Sample No.:	3	Initial Area of Sample:	5.404 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.720 in
Sample Description:	Brown Lean Clay with sand	Final Sample Area (A)*:	5.621 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
60.0	0	0.000	30.0	0.00	0.00	0.00	0.00	4.32
60.0	69	0.006	34.3	1.77	0.10	0.62	0.88	4.58
60.0	103	0.012	35.9	2.63	0.21	0.85	1.32	4.79
60.0	130	0.018	37.3	3.32	0.31	1.05	1.66	4.93
60.0	146	0.024	38.1	3.72	0.42	1.17	1.86	5.02
60.0	164	0.030	38.9	4.18	0.52	1.28	2.09	5.13
60.0	183	0.036	39.7	4.66	0.63	1.40	2.33	5.25
60.0	195	0.042	40.2	4.96	0.73	1.47	2.48	5.33
60.0	212	0.048	40.9	5.39	0.84	1.57	2.69	5.44
60.0	225	0.054	41.4	5.71	0.94	1.64	2.85	5.53
60.0	238	0.060	41.8	6.03	1.05	1.70	3.02	5.64
60.0	290	0.090	42.9	7.31	1.57	1.86	3.66	6.12
60.0	312	0.120	43.0	7.83	2.10	1.88	3.91	6.36
60.0	331	0.172	42.9	8.22	3.01	1.85	4.11	6.58
60.0	344	0.217	42.4	8.48	3.79	1.79	4.24	6.77
60.0	354	0.263	41.7	8.65	4.59	1.68	4.33	6.97
60.0	363	0.308	41.0	8.80	5.38	1.58	4.40	7.14
60.0	371	0.352	40.4	8.92	6.15	1.49	4.46	7.29
60.0	380	0.399	39.8	9.06	6.97	1.41	4.53	7.44
60.0	386	0.443	39.2	9.12	7.75	1.33	4.56	7.55
60.0	394	0.488	38.7	9.23	8.53	1.26	4.62	7.68
60.0	401	0.534	38.1	9.31	9.33	1.17	4.66	7.81
60.0	406	0.578	37.6	9.35	10.11	1.09	4.67	7.90
60.0	412	0.624	37.1	9.40	10.91	1.02	4.70	8.01
60.0	416	0.670	36.5	9.41	11.70	0.93	4.70	8.09
60.0	423	0.713	35.9	9.48	12.47	0.85	4.74	8.21
60.0	428	0.760	35.3	9.51	13.28	0.77	4.75	8.30
60.0	433	0.805	34.8	9.53	14.07	0.69	4.77	8.40
60.0	437	0.849	34.2	9.53	14.84	0.60	4.77	8.49
60.0	441	0.895	33.6	9.53	15.65	0.52	4.76	8.57
60.0	444	0.940	33.1	9.51	16.43	0.44	4.75	8.63
60.0	449	0.984	32.5	9.52	17.20	0.36	4.76	8.72
60.0	453	1.029	32.2	9.52	17.99	0.31	4.76	8.77
60.0	457	1.074	31.9	9.51	18.77	0.27	4.75	8.81
60.0	458	1.100	31.6	9.48	19.23	0.23	4.74	8.83

Figure D-2.2.30

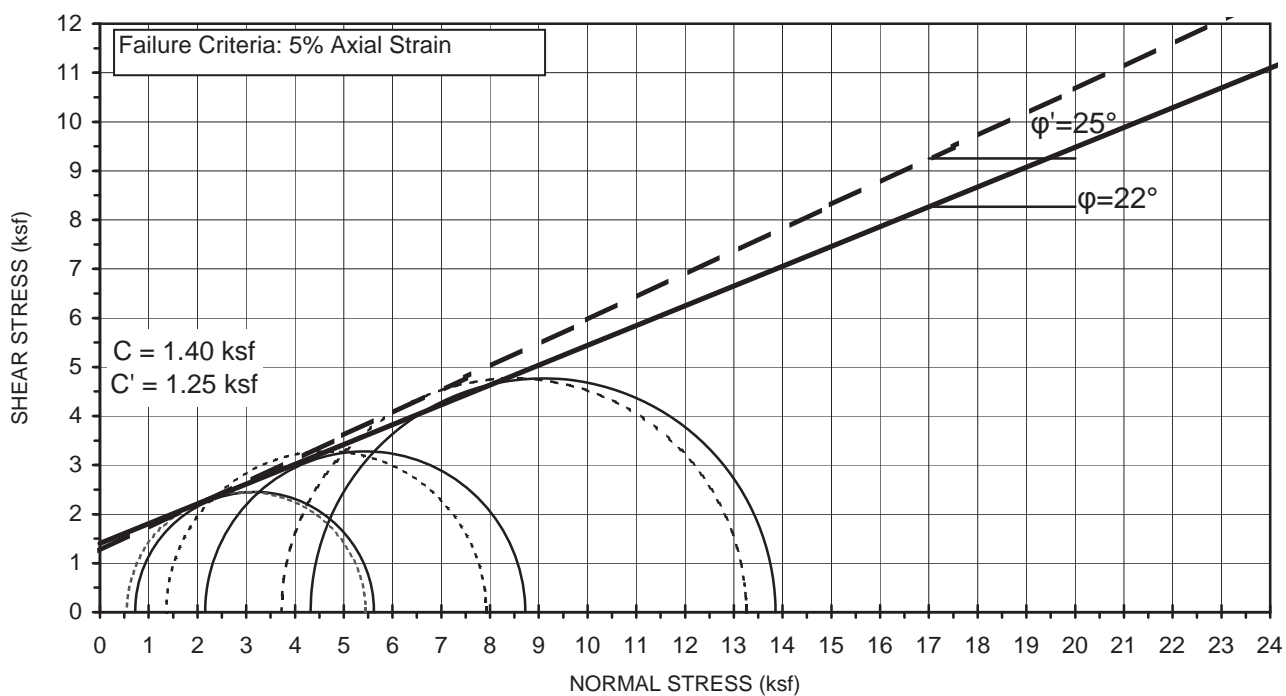
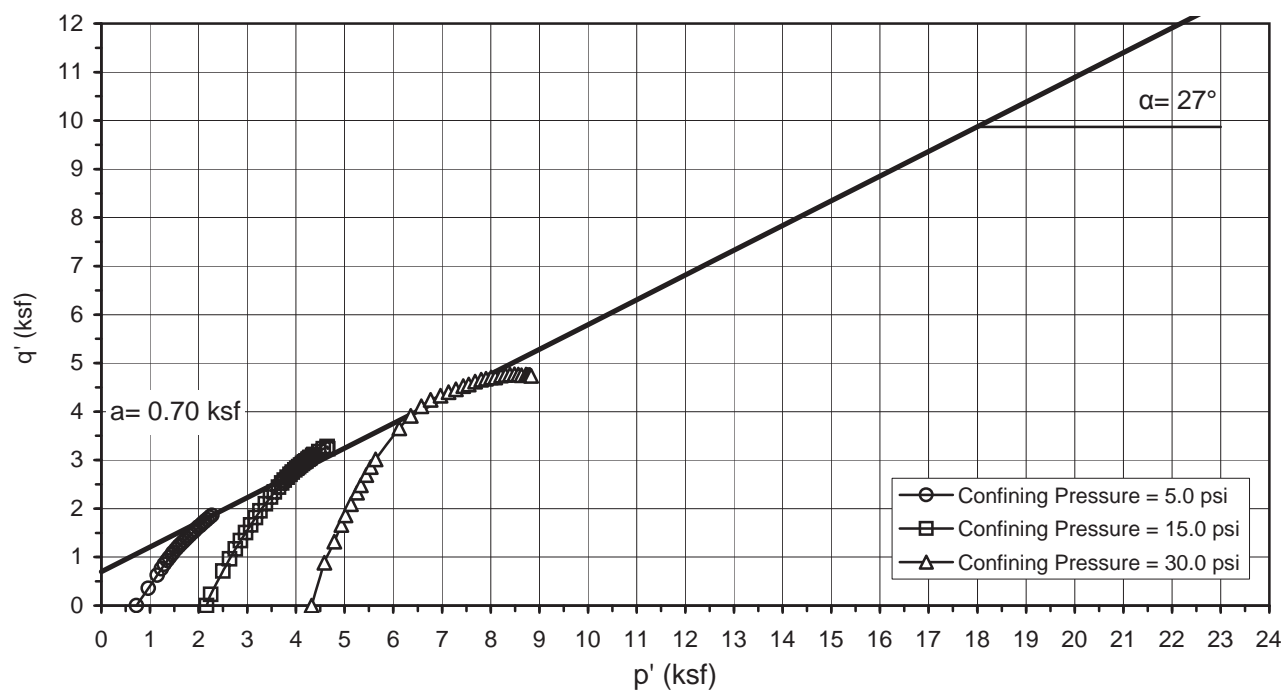


○ Confining Pressure = 5.0 psi □ Confining Pressure = 15.0 psi ▲ Confining Pressure = 30.0 psi



Project Name:	Westside Subway Extension	Confining Pressures:	Mod. Cal.
Project No.:	4953-11-1423	Sample Description:	Brown Lean Clay with sand
Test Pit:	G-142	Avg. Dry Unit Weight (pcf):	116.0
Sample No.:	3	Avg. Initial Moisture Content (%):	14.6
Depth (ft):	15.5	Confining Pressure:	5.0, 15.0, 30.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767



Project Name:	Westside Subway Extension	Sample Type:	Mod. Cal.
Project No.:	4953-11-1423	Sample Description:	Brown Lean Clay with sand
Test Pit:	G-142	Avg. Dry Unit Weight (pcf):	116.0
Sample No.:	3	Avg. Initial Moisture Content (%):	14.6
Depth (ft):	15.5	Confining Pressures:	5.0, 15.0, 30.0 psi


CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Subway Extension Tested by: ST Date: 04-08-15
 Project No.: 4953-11-1423 Input Data by: KM Date: 04-17-15
 Test Pit: G-142 Reviewed by: AP Date: 04-17-15
 Sample No.: 9 Sample Description: Olive Brown Fat Clay
 Depth(ft): 43
 Sample Type: Mod. Cal. Confining Pressure = 25.0 psi

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>5.710</u>	<u>5.710</u>	<u>5.710</u>	Avg. =	5.710

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in²)	5.371	5.371
Moisture Content (%)	18.21	24.20
Wet Weight (gms)	<u>83.89</u>	<u>1214.25</u>
Dry Weight (gms)	<u>78.68</u>	<u>1012.68</u>
Container Weight (gms)	<u>50.07</u>	<u>179.79</u>
Density and Saturation		
Wet Weight (gms)	<u>1025.54</u>	
Container Weight (gms)	<u>0.00</u>	
Wet Density (pcf)	127.4	
Dry Density (pcf)	107.8	
Initial Void Ratio	0.563	
% Saturation	87.3	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in) = 0

Consolidation

Cell Pressure (psi) =	<u>55.0</u>	Initial Burette Ht.(cm)=	<u>0.0</u>
Back Pressure(psi) =	<u>30.0</u>	Final Burette Ht.(cm)=	<u>0.0</u>
Eff. Consol. Stress (psi) =	<u>25.0</u>	Final Height (in)=	<u>5.710</u>
Induced OCR =	<u>1.0</u>	Initial Volume (cu.in)=	<u>30.667</u>
Change in Ht. of Specimen (in) =	<u>0.0000</u>	Final Volume (cu.in) =	<u>30.667</u>

Shear

Rate of Deformation (in/min)=	<u>0.005</u>	<u>At Failure</u>	
Time to 50% primary Consolidation (min) =	<u>15</u>	Deviator Stress (ksf) =	<u>8.92</u>
Failure Mode: Bulging Failure		Eff. Minor Principal stress (ksf) =	<u>2.10</u>
		Eff. Major Principal stress (ksf) =	<u>11.01</u>
		Axial Strain (%) =	<u>5.25</u>

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Subway Extension Tested by: ST Date: 04-08-15
 Project No.: 4953-11-1423 Input Data by: KM Date: 04-17-15
 Test Pit: G-142 Reviewed by: AP Date: 04-17-15
 Sample No.: 9 Sample Description: Olive Brown Clay
 Depth(ft): 43
 Sample Type: Mod. Cal. Confining Pressure = 35.0 psi

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>5.710</u>	<u>5.710</u>	<u>5.710</u>	Avg. =	5.710

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	5.633
Moisture Content (%)	18.21	24.20
Wet Weight (gms)	83.89	1214.25
Dry Weight (gms)	78.68	1012.68
Container Weight (gms)	50.07	179.79
Density and Saturation		
Wet Weight (gms)	1025.54	
Container Weight (gms)	0.00	
Wet Density (pcf)	127.4	
Dry Density (pcf)	107.8	
Initial Void Ratio	0.563	
% Saturation	87.3	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in) = 0

Consolidation

Cell Pressure (psi) =	65.0	Initial Burette Ht.(cm)=	88.3
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	84.6
Eff. Consol. Stress (psi) =	35.0	Final Height (in)=	5.704
Induced OCR=	1.0	Initial Volume (cu.in)=	30.667
Change in Ht. of Specimen (in) =	0.0060	Final Volume (cu.in) =	30.441

ShearAt Failure

Rate of Deformation (in/min)=	0.005	Deviator Stress (ksf) =	10.47
Time to 50% primary Consolidation =	15	Eff. Minor Principal stress (ksf) =	3.51
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	13.98
		Axial Strain (%) =	5.19

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Test Procedure: ASTM D 4767

Project Name: Westside Subway Extension Tested by: ST Date: 04-08-15
 Project No.: 4953-11-1423 Input Data by: KM Date: 04-17-15
 Test Pit: G-142 Reviewed by: AP Date: 04-17-15
 Sample No.: 9 Sample Description: Olive Brown Clay
 Depth(ft): 43
 Sample Type: Mod. Cal. Confining Pressure = 45.0 psi

Diameter (in)	<u>2.615</u>	<u>2.615</u>	<u>2.615</u>	Avg. =	2.615
Height (in)	<u>5.710</u>	<u>5.710</u>	<u>5.710</u>	Avg. =	5.710

	BEFORE CONSOLIDATION	AFTER CONSOLIDATION
Area (in ²)	5.371	5.612
Moisture Content (%)	18.21	24.20
Wet Weight (gms)	83.89	1214.25
Dry Weight (gms)	78.68	1012.68
Container Weight (gms)	50.07	179.79
Density and Saturation		
Wet Weight (gms)	1025.54	
Container Weight (gms)	0.00	
Wet Density (pcf)	127.4	
Dry Density (pcf)	107.8	
Initial Void Ratio	0.563	
% Saturation	87.3	

Assumed Specific Gravity = 2.70

Back Pressure Saturation

B Value (%) = 94 Change in Ht. of the Specimen (in) = 0

Consolidation

Cell Pressure (psi) =	75.0	Initial Burette Ht.(cm)=	85.2
Back Pressure(psi) =	30.0	Final Burette Ht.(cm)=	80.4
Eff. Consol. Stress (psi) =	45.0	Final Height (in)=	5.709
Induced OCR =	1.0	Initial Volume (cu.in)=	30.667
Change in Ht. of Specimen (in) =	0.0010	Final Volume (cu.in) =	30.374

ShearAt Failure

Rate of Deformation (in/min)=	0.005	Deviator Stress (ksf) =	13.20
Time to 50% primary Consolidation =	15	Eff. Minor Principal stress (ksf) =	5.53
Failure Mode: Bulging Failure		Eff. Major Principal stress (ksf) =	18.73
		Axial Strain (%) =	7.97

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Subway Extension	Cell Pressure:	55.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Test Pit:	G-142	Consolidation Pressure :	25.0 psi
Depth(ft):	43	Initial Sample Height:	5.710 in
Sample No.:	9	Initial Area of Sample:	5.371 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.710 in
Sample Description:	Olive Brown Clay	Final Sample Area (A)*:	5.371 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress q'	Normal Stress p'
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	(S1-S3)/2 (ksf)	(S1'+S3')/2 (ksf)
55.0	0	0.000	30.1	0.00	0.00	0.00	0.00	3.60
55.0	44	0.004	32.2	1.18	0.07	0.30	0.59	3.89
55.0	72	0.010	33.5	1.93	0.18	0.49	0.96	4.08
55.0	92	0.017	34.5	2.46	0.30	0.64	1.23	4.19
55.0	109	0.024	35.4	2.91	0.42	0.77	1.46	4.28
55.0	124	0.031	36.3	3.31	0.54	0.89	1.65	4.36
55.0	138	0.038	37.0	3.68	0.66	1.00	1.84	4.44
55.0	150	0.045	37.6	3.99	0.78	1.09	2.00	4.51
55.0	161	0.052	38.2	4.28	0.90	1.17	2.14	4.57
55.0	172	0.059	38.7	4.56	1.04	1.24	2.28	4.64
55.0	181	0.066	39.1	4.80	1.16	1.31	2.40	4.69
55.0	191	0.073	39.5	5.06	1.27	1.36	2.53	4.77
55.0	200	0.080	39.8	5.29	1.40	1.41	2.64	4.84
55.0	209	0.087	40.1	5.52	1.52	1.45	2.76	4.91
55.0	217	0.093	40.4	5.72	1.64	1.48	2.86	4.98
55.0	224	0.100	40.6	5.90	1.75	1.51	2.95	5.04
55.0	231	0.108	40.8	6.08	1.89	1.54	3.04	5.10
55.0	238	0.115	40.9	6.25	2.02	1.57	3.13	5.16
55.0	244	0.123	41.1	6.40	2.15	1.59	3.20	5.22
55.0	251	0.129	41.2	6.58	2.26	1.60	3.29	5.29
55.0	257	0.136	41.3	6.73	2.39	1.62	3.36	5.35
55.0	264	0.144	41.4	6.90	2.52	1.63	3.45	5.42
55.0	270	0.151	41.4	7.05	2.64	1.64	3.52	5.49
55.0	276	0.158	41.5	7.20	2.77	1.64	3.60	5.55
55.0	282	0.164	41.5	7.34	2.87	1.65	3.67	5.62
55.0	289	0.171	41.5	7.52	3.00	1.65	3.76	5.71
55.0	294	0.178	41.5	7.64	3.12	1.65	3.82	5.77
55.0	299	0.185	41.5	7.76	3.25	1.65	3.88	5.83
55.0	304	0.192	41.5	7.88	3.37	1.65	3.94	5.89
55.0	310	0.199	41.5	8.02	3.49	1.64	4.01	5.97
55.0	315	0.206	41.5	8.14	3.60	1.64	4.07	6.03
55.0	320	0.213	41.4	8.26	3.72	1.63	4.13	6.10
55.0	331	0.234	41.2	8.51	4.10	1.61	4.26	6.25
55.0	341	0.257	41.0	8.73	4.50	1.58	4.37	6.39
55.0	351	0.300	40.5	8.92	5.25	1.50	4.46	6.55

Figure D-2.2.36

**CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT**

Project Name:	Westside Subway Extension	Cell Pressure:	65.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Test Pit:	G-142	Consolidation Pressure :	35.0 psi
Depth(ft):	43	Initial Sample Height:	5.710 in
Sample No.:	9	Initial Area of Sample:	5.371 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.704 in
Sample Description:	Olive Brown Clay	Final Sample Area (A)*:	5.633 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
65.0	1	0.000	30.0	0.03	0.00	0.00	0.01	5.05
65.0	34	0.002	31.6	0.87	0.04	0.22	0.43	5.25
65.0	86	0.008	33.9	2.20	0.13	0.56	1.10	5.57
65.0	120	0.014	35.5	3.06	0.25	0.78	1.53	5.79
65.0	145	0.021	36.7	3.69	0.37	0.96	1.85	5.93
65.0	167	0.028	37.7	4.25	0.49	1.10	2.12	6.06
65.0	187	0.035	38.5	4.75	0.62	1.23	2.38	6.19
65.0	205	0.041	39.3	5.20	0.73	1.33	2.60	6.31
65.0	223	0.049	39.9	5.65	0.85	1.43	2.83	6.44
65.0	241	0.055	40.5	6.10	0.96	1.51	3.05	6.58
65.0	258	0.062	41.0	6.52	1.09	1.59	3.26	6.72
65.0	275	0.069	41.5	6.95	1.21	1.65	3.47	6.86
65.0	291	0.075	41.9	7.34	1.32	1.71	3.67	7.00
65.0	306	0.082	42.3	7.71	1.44	1.76	3.86	7.13
65.0	321	0.089	42.5	8.08	1.56	1.80	4.04	7.28
65.0	334	0.095	42.7	8.40	1.67	1.83	4.20	7.41
65.0	345	0.103	42.9	8.66	1.80	1.85	4.33	7.52
65.0	354	0.109	42.9	8.88	1.92	1.86	4.44	7.62
65.0	361	0.116	43.0	9.04	2.04	1.86	4.52	7.70
65.0	367	0.124	42.9	9.18	2.17	1.86	4.59	7.77
65.0	373	0.131	42.9	9.32	2.30	1.86	4.66	7.84
65.0	377	0.139	42.9	9.40	2.44	1.85	4.70	7.89
65.0	382	0.146	42.8	9.52	2.56	1.84	4.76	7.96
65.0	386	0.153	42.7	9.60	2.68	1.83	4.80	8.01
65.0	390	0.160	42.6	9.69	2.81	1.82	4.85	8.07
65.0	394	0.167	42.6	9.78	2.93	1.81	4.89	8.12
65.0	397	0.174	42.5	9.84	3.05	1.79	4.92	8.17
65.0	400	0.181	42.4	9.90	3.17	1.78	4.95	8.21
65.0	403	0.188	42.3	9.96	3.29	1.77	4.98	8.26
65.0	411	0.209	42.0	10.12	3.66	1.73	5.06	8.37
65.0	418	0.229	41.7	10.26	4.02	1.68	5.13	8.48
65.0	422	0.252	41.4	10.31	4.42	1.63	5.16	8.56
65.0	427	0.274	41.0	10.39	4.81	1.58	5.20	8.65
65.0	432	0.296	40.6	10.47	5.19	1.53	5.24	8.75

Figure D-2.2.37

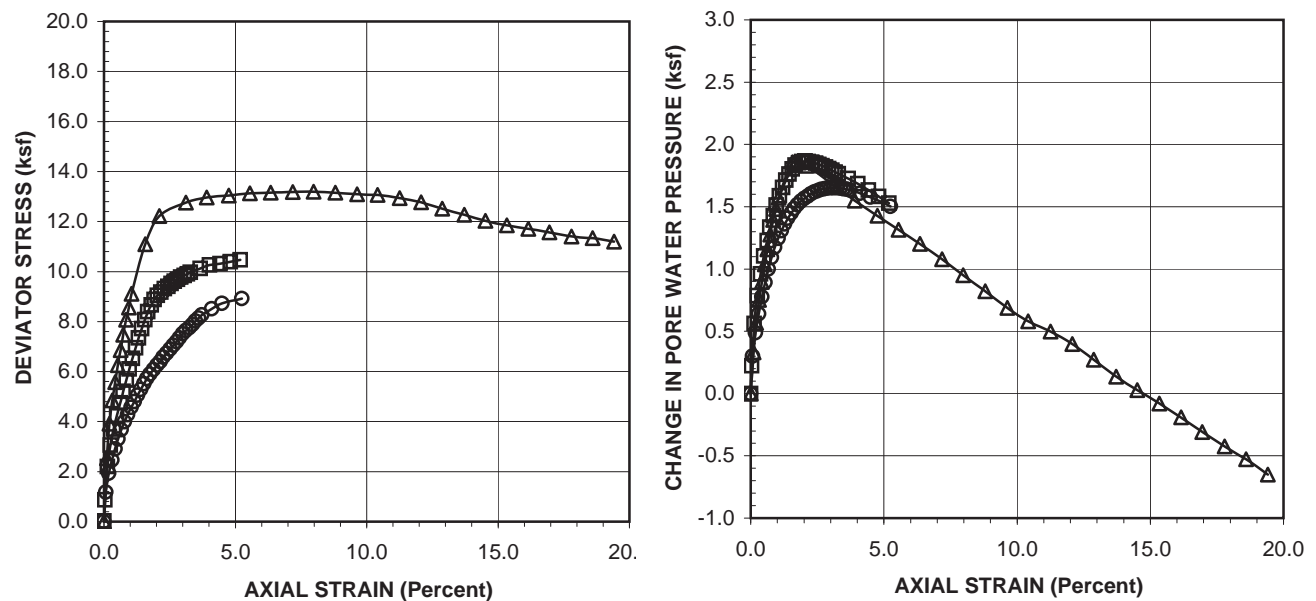


CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENT

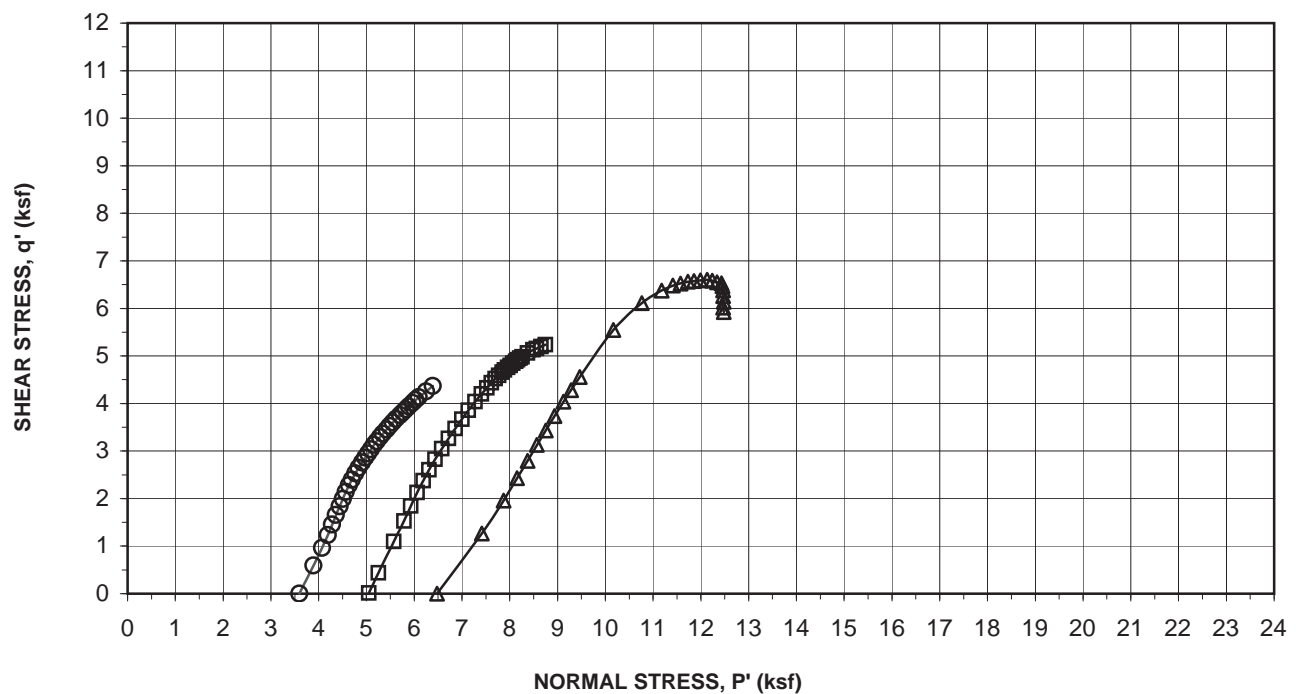
Project Name:	Westside Subway Extension	Cell Pressure:	75.0 psi
Project No:	4953-11-1423	Back Pressure :	30.0 psi
Test Pit:	G-142	Consolidation Pressure :	45.0 psi
Depth(ft):	43	Initial Sample Height:	5.710 in
Sample No.:	9	Initial Area of Sample:	5.371 sq. in.
Sample Type:	Mod. Cal.	Final Sample Ht.* (L):	5.709 in
Sample Description:	Olive Brown Clay	Final Sample Area (A)*:	5.612 sq. in.
		Induced OCR=	1.0

Cell Pressure	Load	Axial Deformation	Back Pressure	Deviator Stress	Axial Strain	Pore Pressure Change	Shear Stress	Normal Stress
(psi)	(lbs)	(in)	(psi)	(S1-S3) (ksf)	(%)	(ksf)	q' (S1-S3)/2 (ksf)	p' (S1'+S3')/2 (ksf)
75.0	0	0.000	30.0	0.00	0.00	0.00	0.00	6.48
75.0	99	0.006	32.3	2.54	0.11	0.33	1.27	7.42
75.0	153	0.012	33.9	3.92	0.21	0.57	1.96	7.87
75.0	190	0.018	35.2	4.85	0.32	0.75	2.43	8.15
75.0	219	0.024	36.2	5.58	0.42	0.90	2.79	8.37
75.0	245	0.030	37.2	6.25	0.53	1.04	3.13	8.57
75.0	269	0.036	38.1	6.86	0.63	1.16	3.43	8.75
75.0	293	0.042	38.9	7.47	0.74	1.28	3.73	8.94
75.0	317	0.048	39.7	8.08	0.84	1.39	4.04	9.12
75.0	337	0.054	40.3	8.56	0.95	1.48	4.28	9.28
75.0	359	0.060	40.9	9.11	1.05	1.57	4.56	9.46
75.0	439	0.090	42.9	11.09	1.58	1.86	5.55	10.17
75.0	486	0.120	42.7	12.22	2.10	1.83	6.11	10.76
75.0	513	0.178	41.6	12.75	3.11	1.67	6.38	11.18
75.0	526	0.223	40.8	12.96	3.90	1.55	6.48	11.41
75.0	534	0.271	39.9	13.04	4.75	1.43	6.52	11.57
75.0	542	0.317	39.1	13.13	5.55	1.31	6.56	11.73
75.0	547	0.363	38.4	13.15	6.35	1.20	6.58	11.85
75.0	553	0.410	37.5	13.17	7.19	1.08	6.59	11.99
75.0	559	0.455	36.6	13.20	7.97	0.95	6.60	12.13
75.0	562	0.503	35.7	13.16	8.80	0.82	6.58	12.24
75.0	565	0.550	34.8	13.09	9.63	0.69	6.55	12.34
75.0	568	0.595	34.0	13.06	10.42	0.58	6.53	12.43
75.0	568	0.643	33.5	12.94	11.25	0.50	6.47	12.45
75.0	566	0.689	32.8	12.77	12.07	0.40	6.38	12.47
75.0	560	0.735	31.9	12.52	12.88	0.27	6.26	12.47
75.0	554	0.783	30.9	12.27	13.72	0.14	6.14	12.48
75.0	549	0.829	30.2	12.03	14.52	0.03	6.02	12.47
75.0	545	0.876	29.4	11.84	15.34	-0.08	5.92	12.48
75.0	544	0.922	28.7	11.70	16.16	-0.19	5.85	12.52
75.0	543	0.968	27.9	11.57	16.95	-0.31	5.78	12.57
75.0	541	1.016	27.1	11.40	17.79	-0.42	5.70	12.60
75.0	543	1.062	26.3	11.34	18.60	-0.53	5.67	12.68
75.0	542	1.108	25.5	11.20	19.41	-0.65	5.60	12.73

Figure D-2.2.38



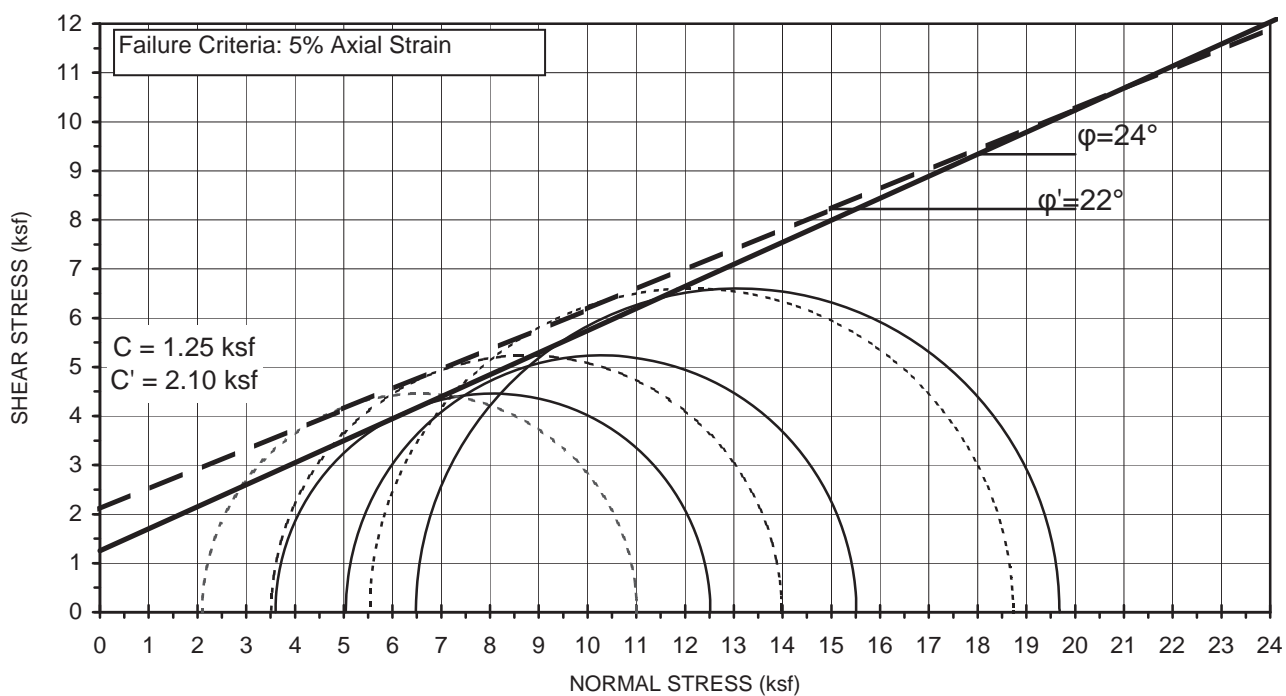
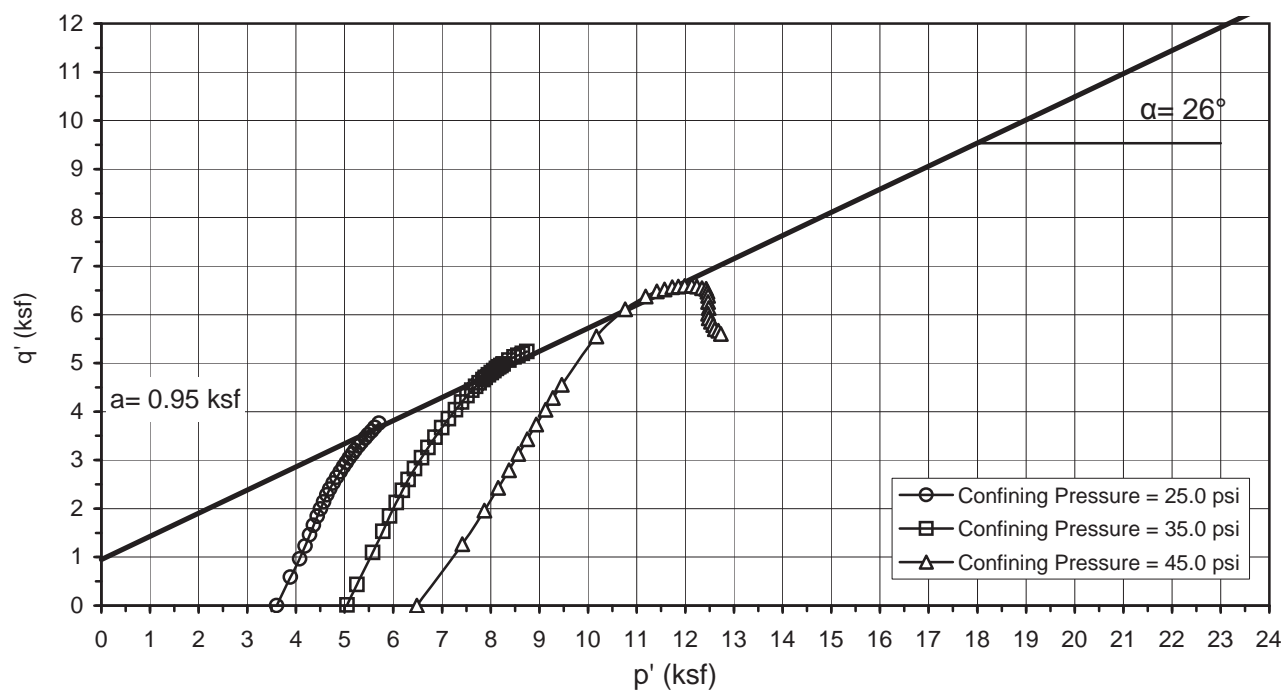
○ Confining Pressure = 25.0 psi □ Confining Pressure = 35.0 psi ▲ Confining Pressure = 45.0 psi



Project Name: Westside Subway Extension
Project No.: 4953-11-1423
Test Pit: G-142
Sample No.: 9
Depth (ft): 43

Confining Pressures: Mod. Cal.
Sample Description: Olive Brown Clay
Avg. Dry Unit Weight (pcf): 107.8
Avg. Initial Moisture Content (%): 18.2
Confining Pressure: 25.0, 35.0, 45.0 psi

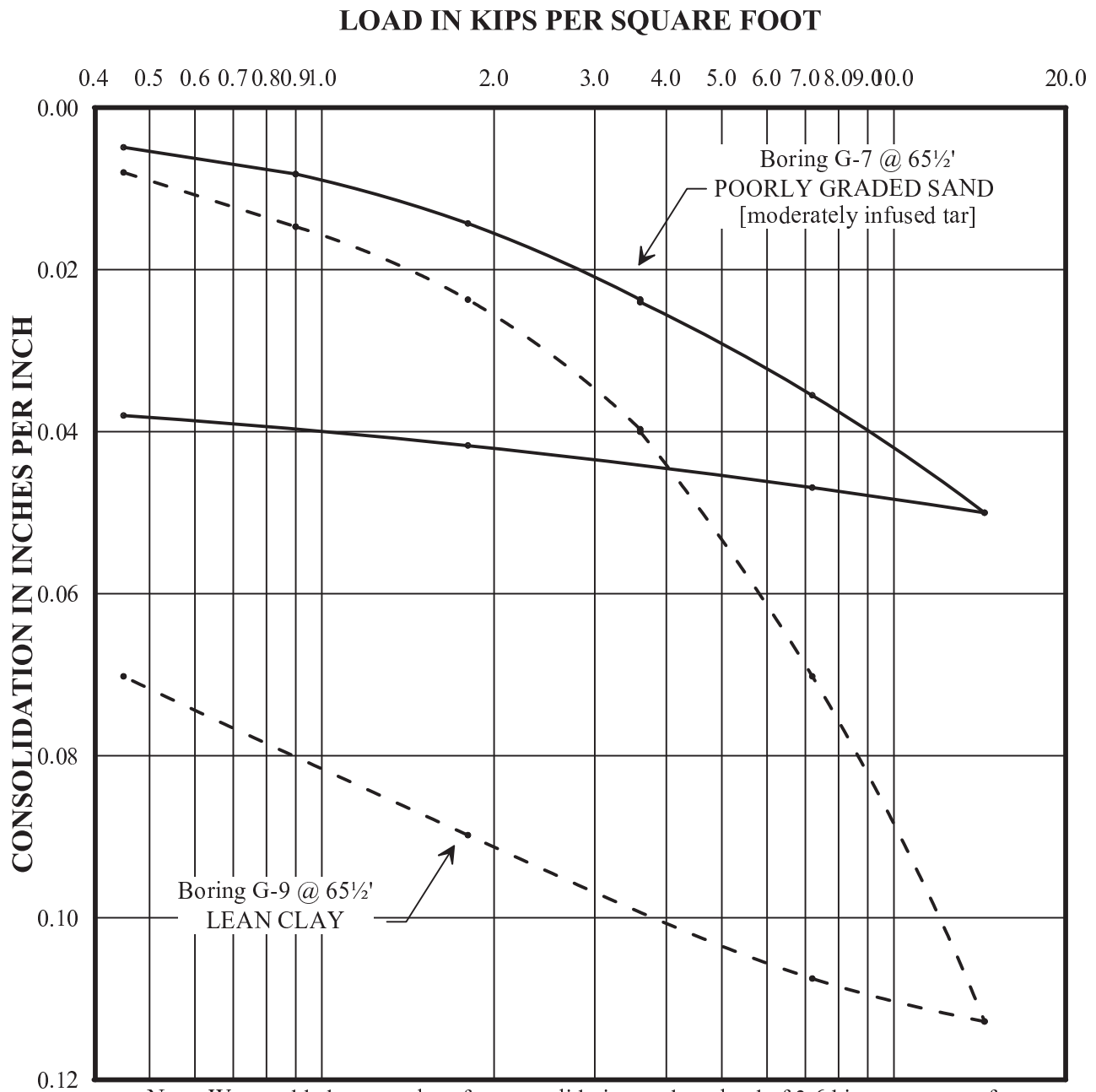
CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767



Project Name: Westside Subway Extension
Project No.: 4953-11-1423
Test Pit: G-142
Sample No.: 9
Depth (ft): 43

Sample Type: Mod. Cal.
Sample Description: Olive Brown Clay
Avg. Dry Unit Weight (pcf): 107.8
Avg. Initial Moisture Content (%): 18.2
Confining Pressures: 25.0, 35.0, 45.0 psi

CU TRIAXIAL MULTI-STAGE TEST WITH PORE PRESSURE MEASUREMENT
ASTM D 4767



Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

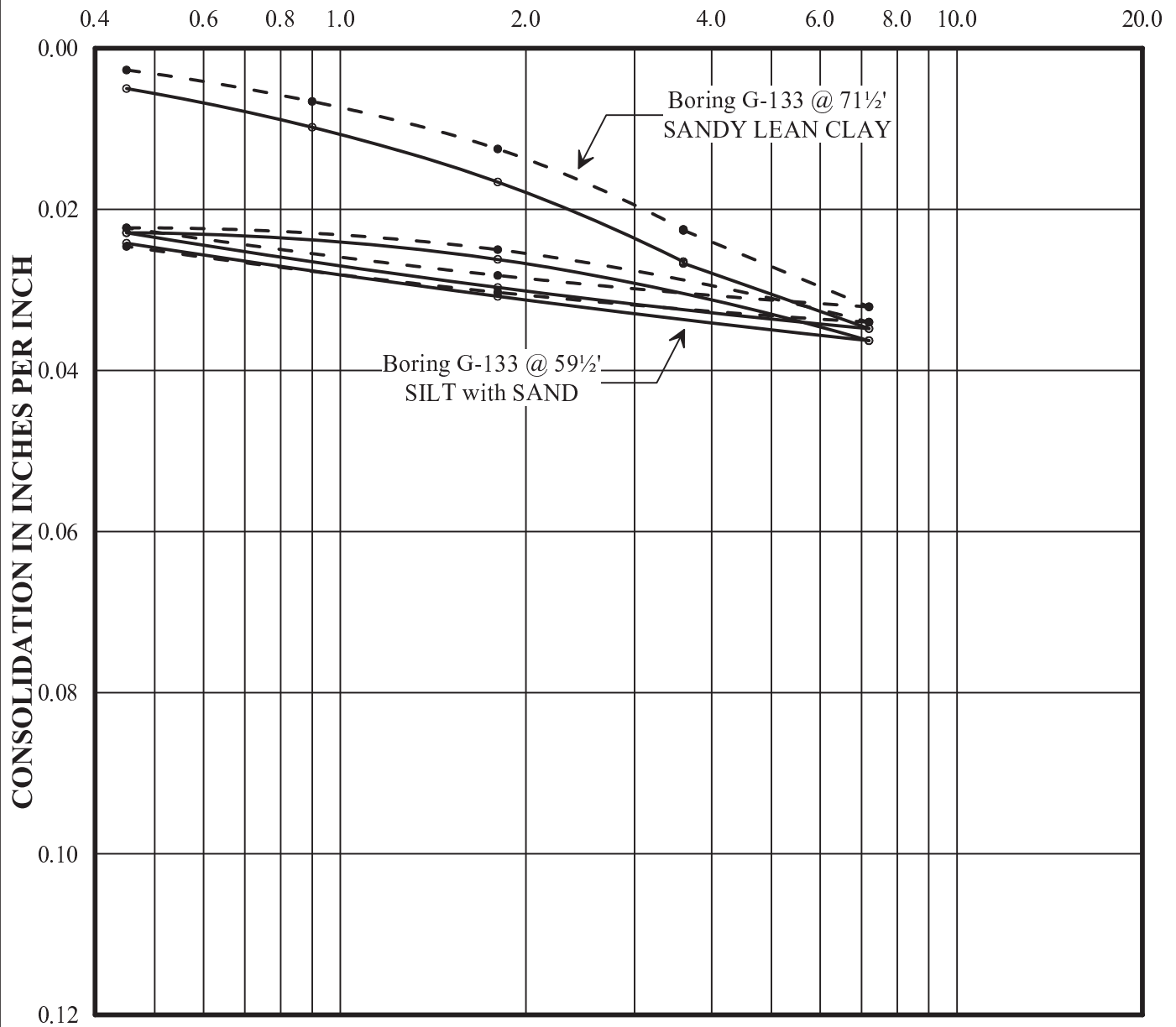
Prepared/Date: NH 08/10/09
Checked/Date: AH 10/02/09

MTA Westside Extension
Los Angeles, California



CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.1

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

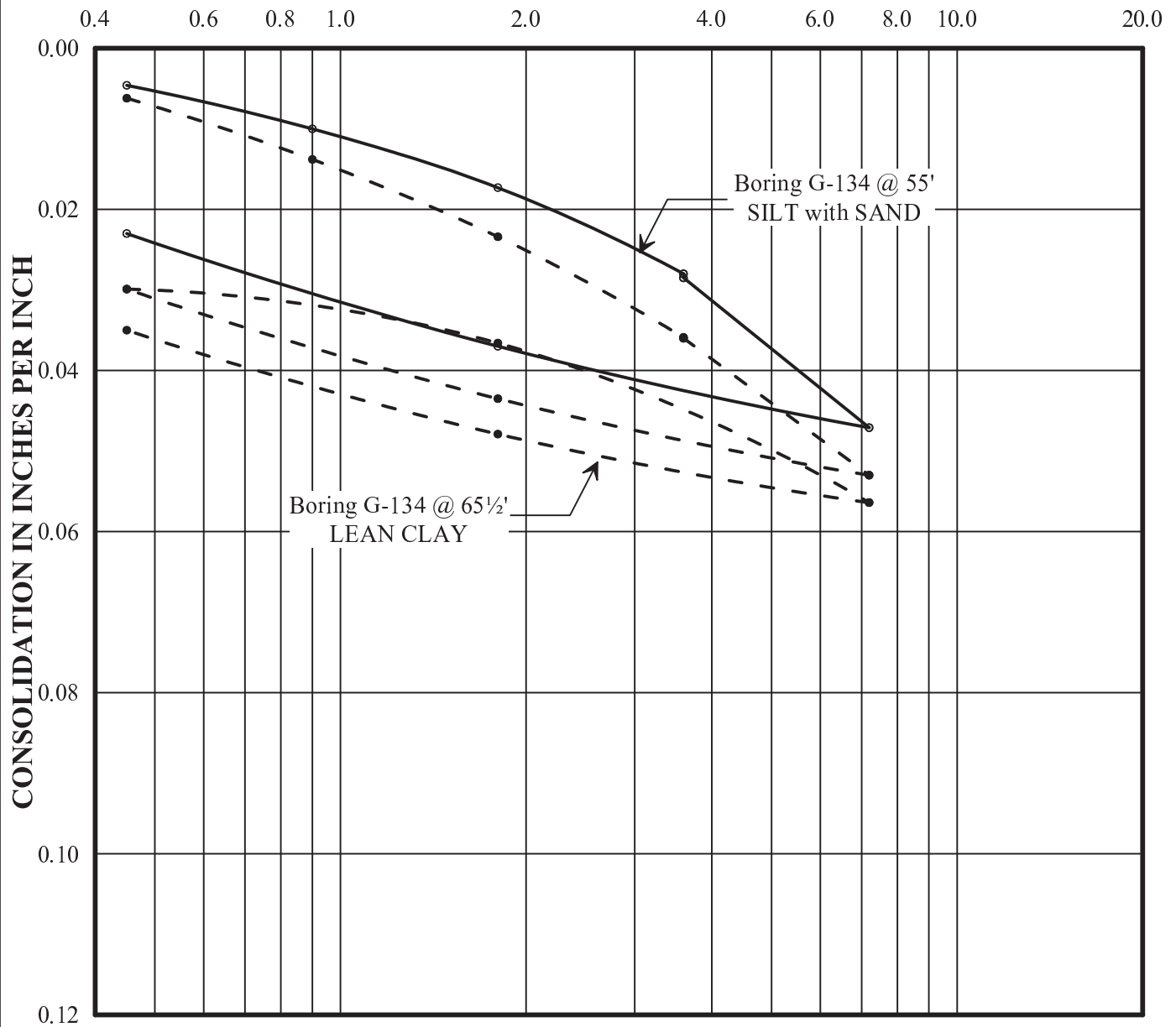
Prepared/Date: AH 6/28/11
Checked/Date: LT 9/15/11

MTA Westside Subway Extension
Los Angeles, California



CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.1

LOAD IN KIPS PER SQUARE FOOT



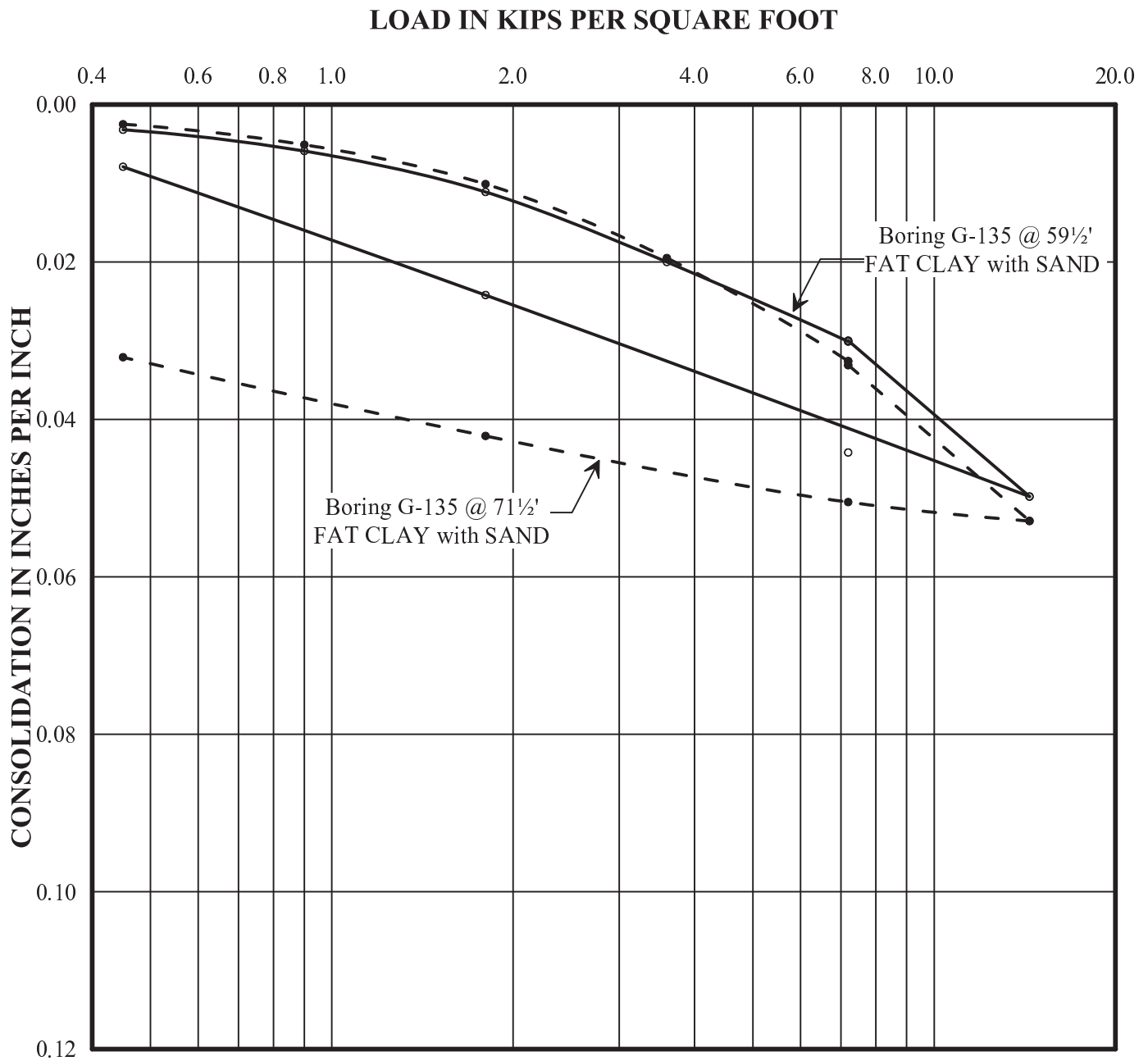
Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

Prepared/Date: AH 5/15/11
Checked/Date: NH 6/3/11

MTA Westside Subway Extension
Los Angeles, California



CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.2



Note: Water added to samples after consolidation under a load of 7.2 kips per square foot.

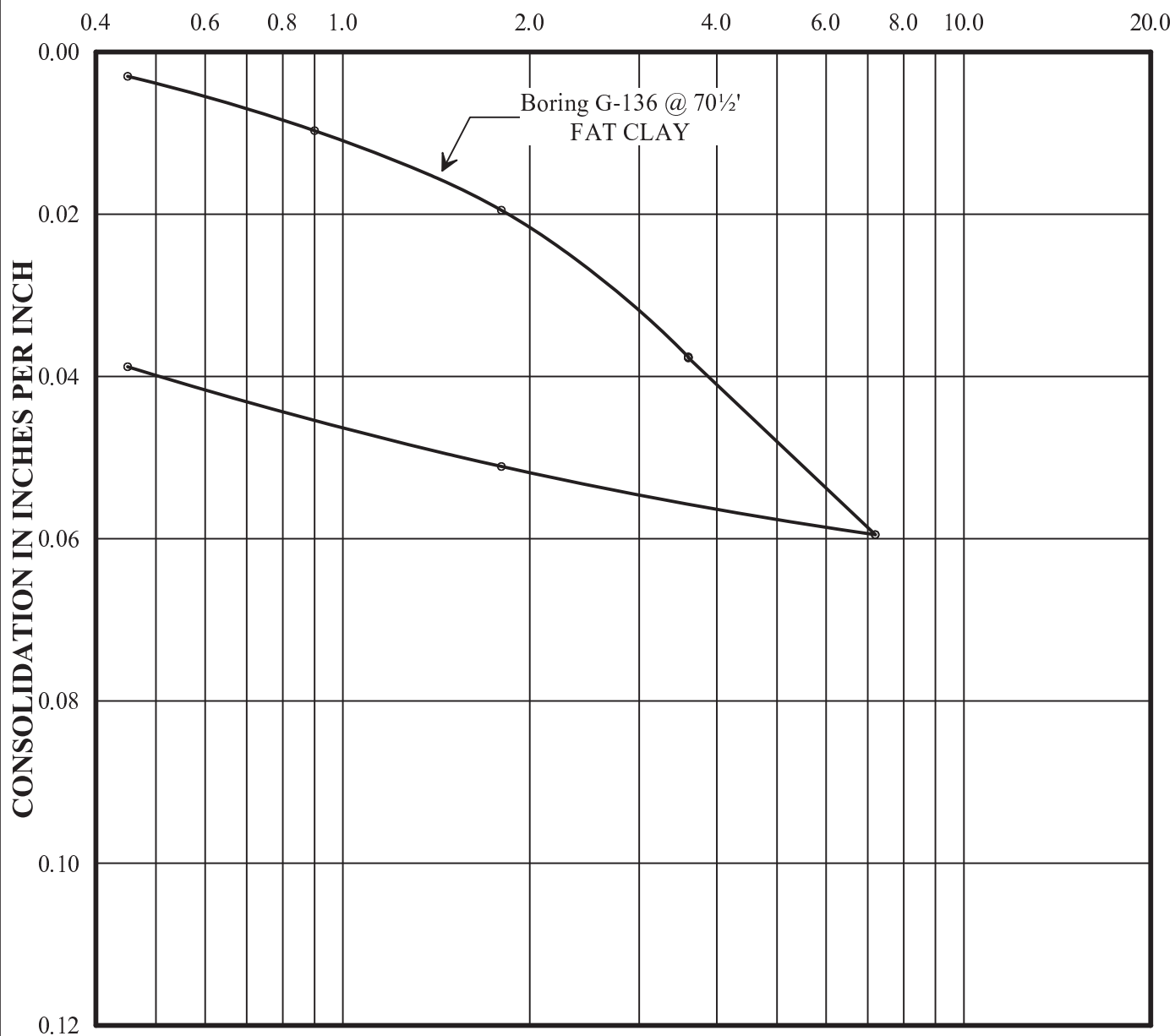
Prepared/Date: AH 8/25/11
Checked/Date: LT 9/15/11

MTA Westside Subway Extension
Los Angeles, California



CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.3

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to sample after consolidation under a load of 3.6 kips per square foot.

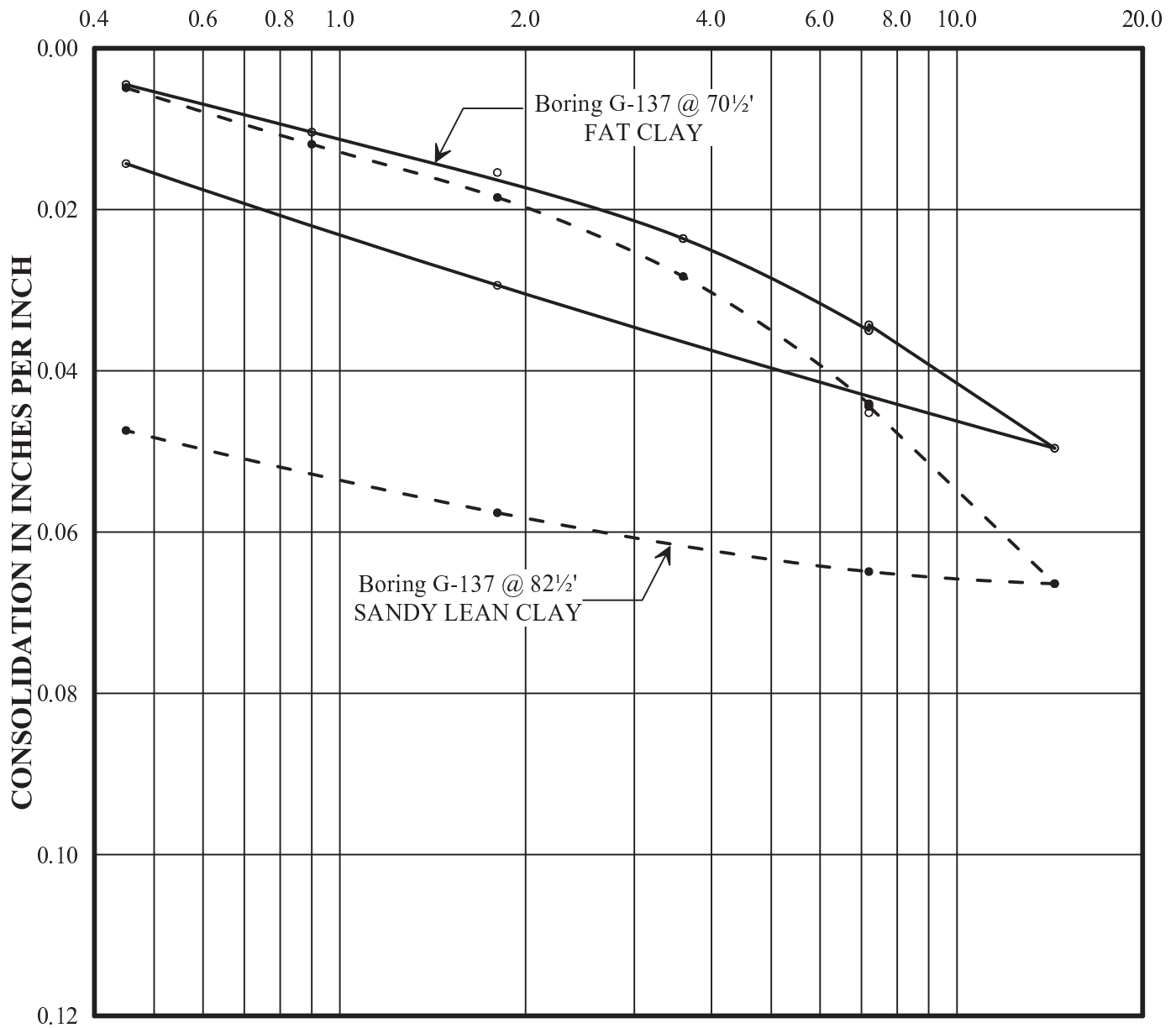
Prepared/Date: AH 7/26/11
Checked/Date: LT 9/12/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.4

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to samples after consolidation under a load of 7.2 kips per square foot.

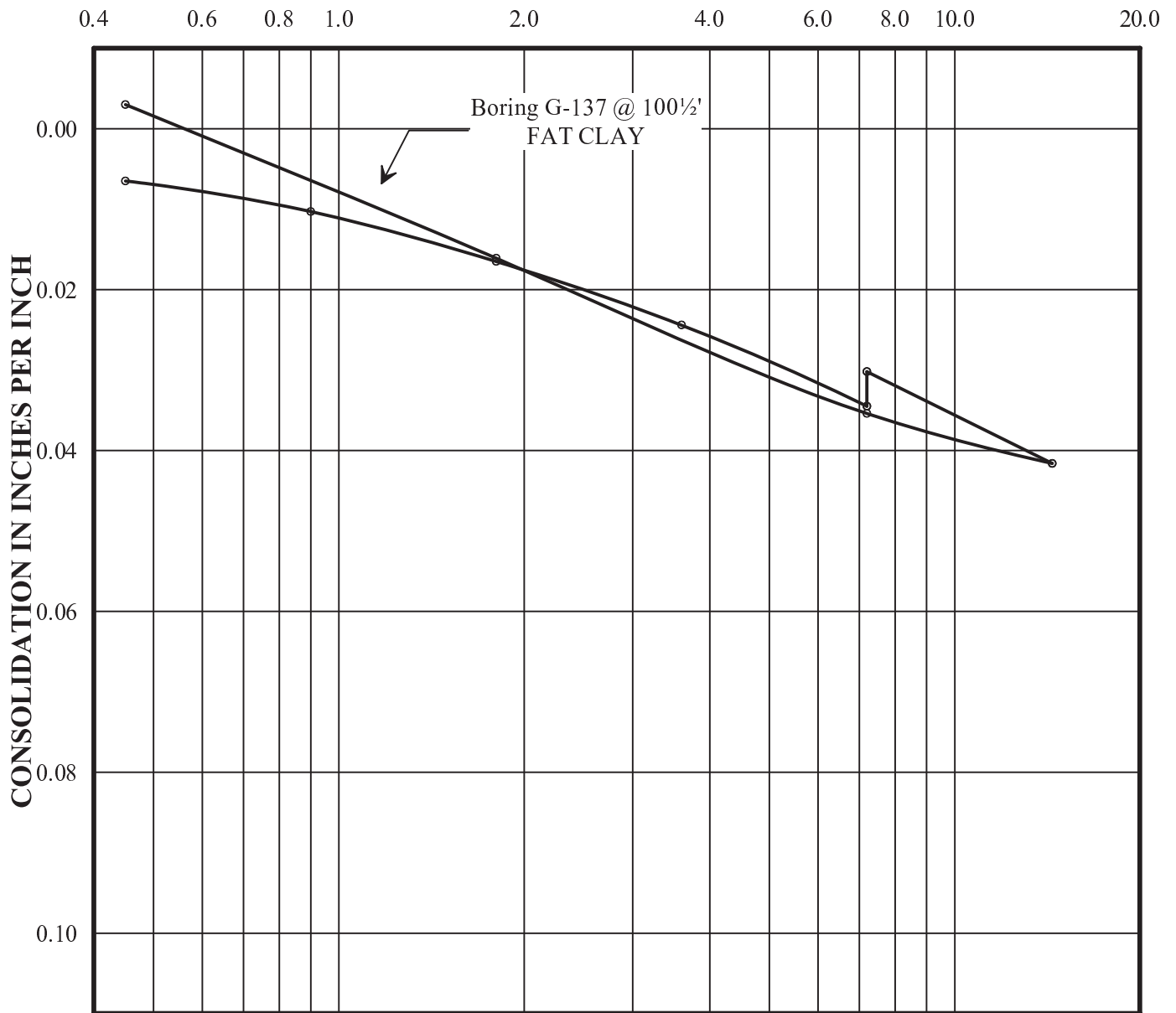
Prepared/Date: AH 8/15/11
Checked/Date: LT 9/12/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.5

LOAD IN KIPS PER SQUARE FOOT



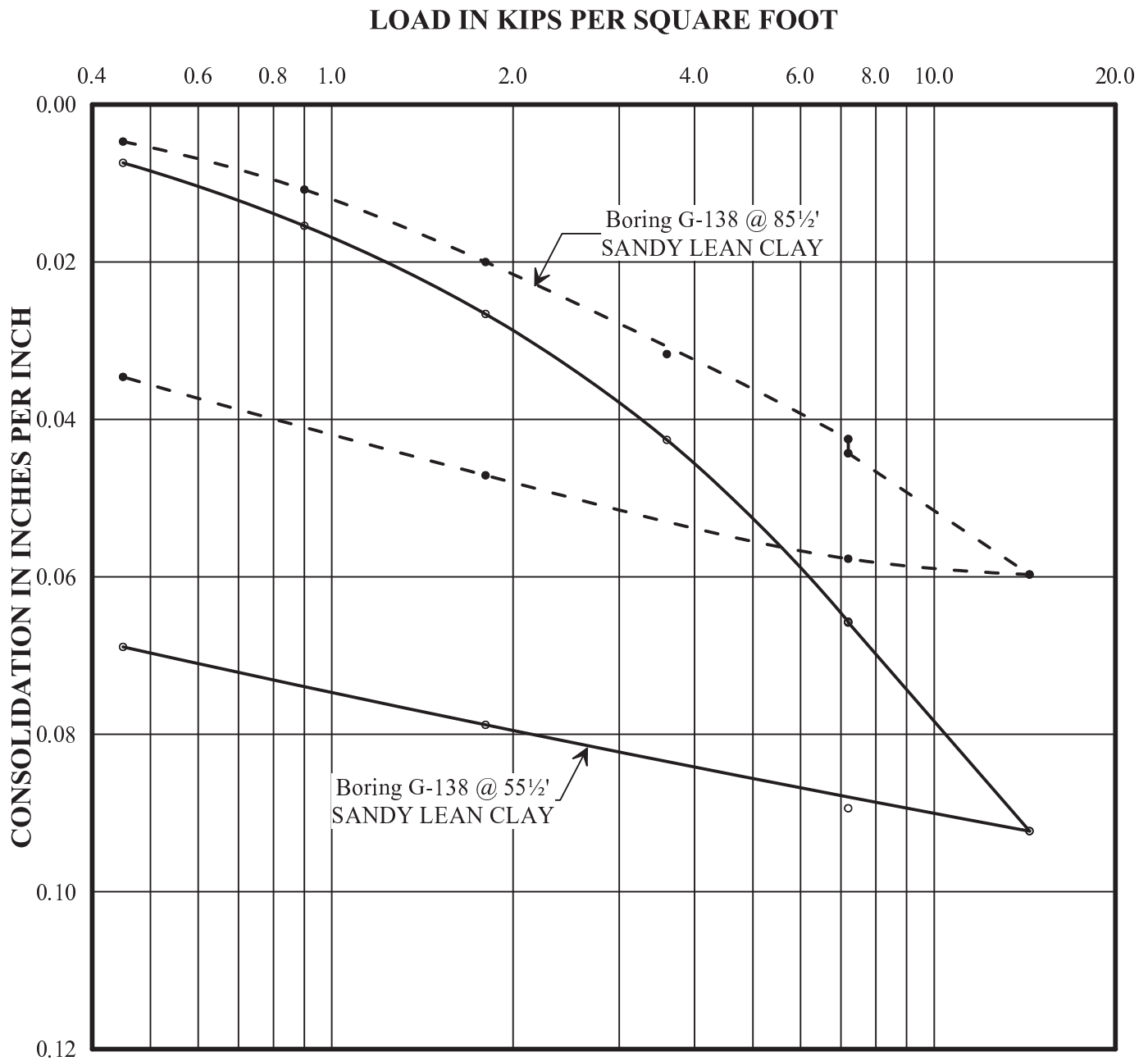
Note: Water added to sample after consolidation under a load of 7.2 kips per square foot.

Prepared/Date: AH 8/25/11
Checked/Date: LT 9/13/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.6



Note: Water added to samples after consolidation under a load of 7.2 kips per square foot.

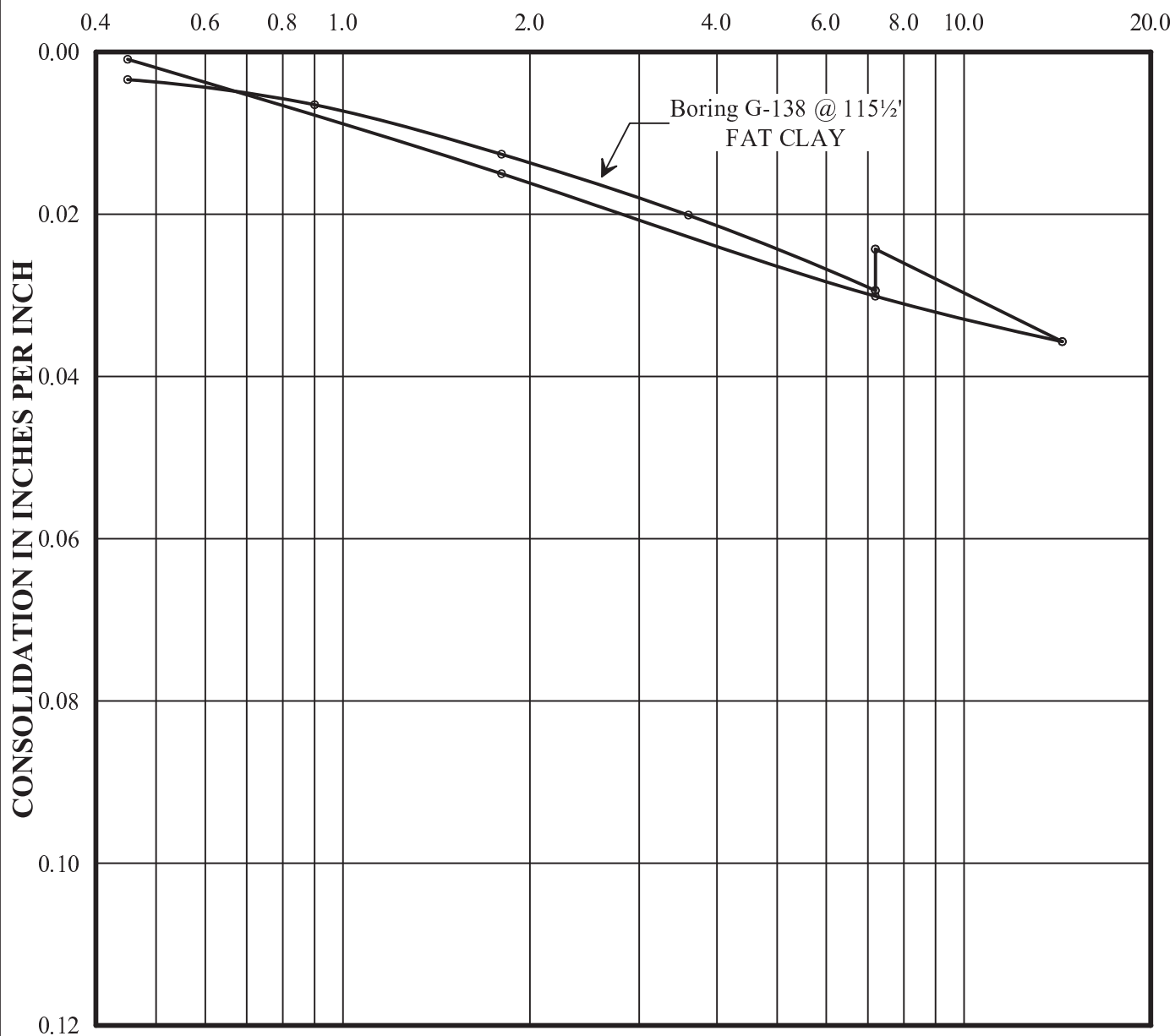
Prepared/Date: AH 8/26/11
Checked/Date: LT 9/15/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.7

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to sample after consolidation under a load of 7.2 kips per square foot.

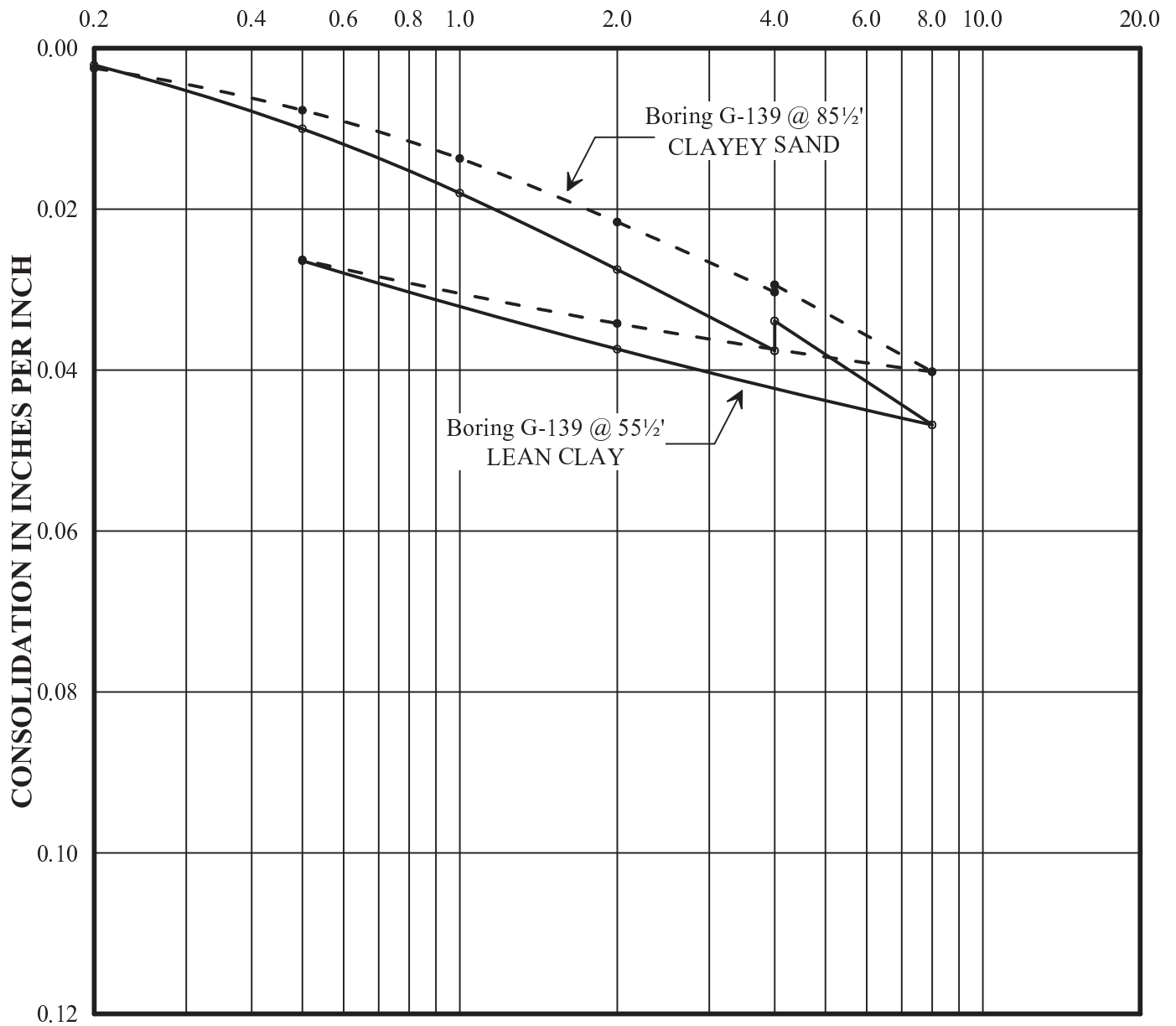
Prepared/Date: AH 8/26/11
Checked/Date: LT 9/15/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.8

LOAD IN KIPS PER SQUARE FOOT



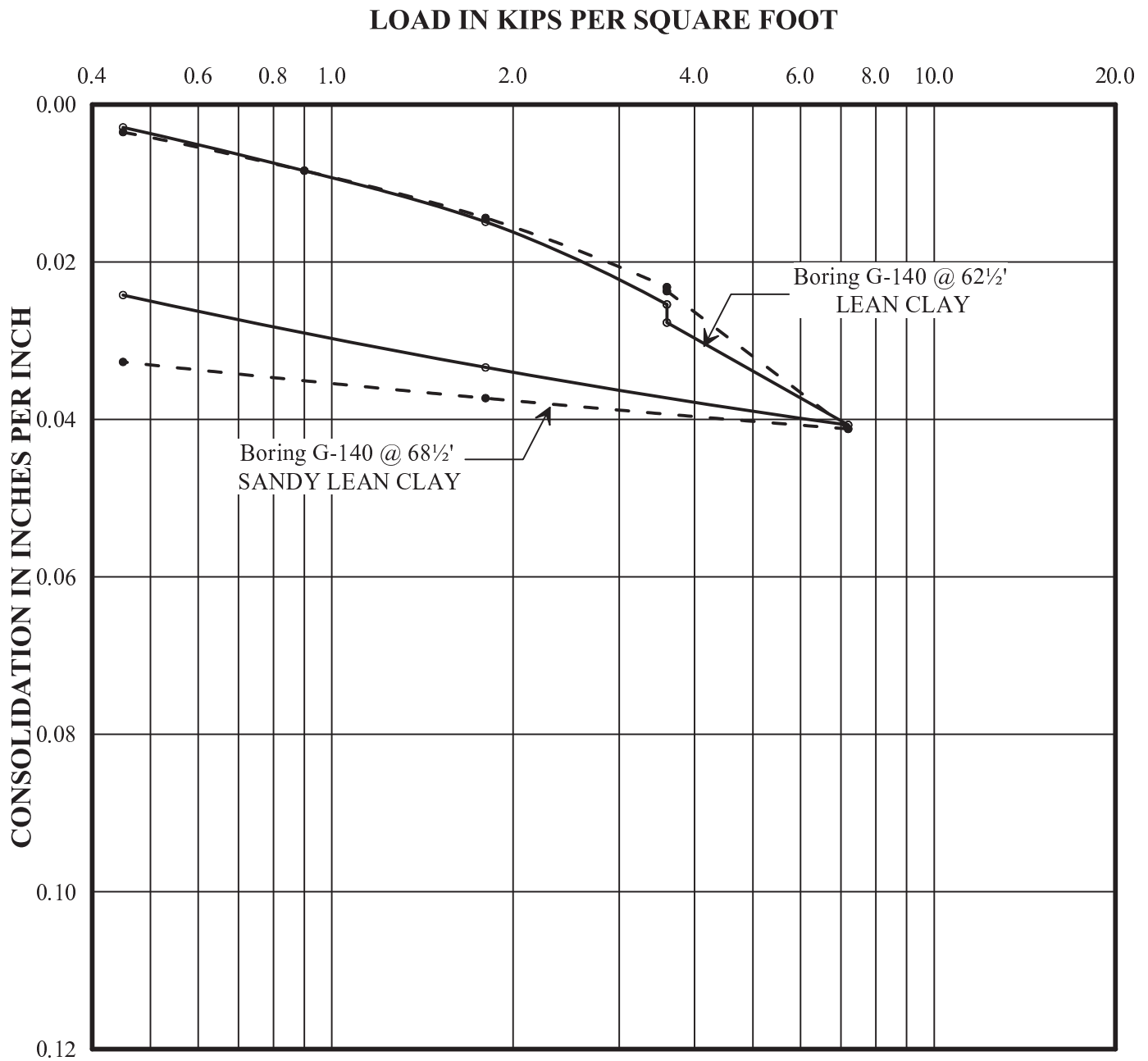
Note: Water added to samples after consolidation under a load of 4.0 kips per square foot.

Prepared/Date: AH 9/20/11
Checked/Date: LT 9/26/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.9



Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

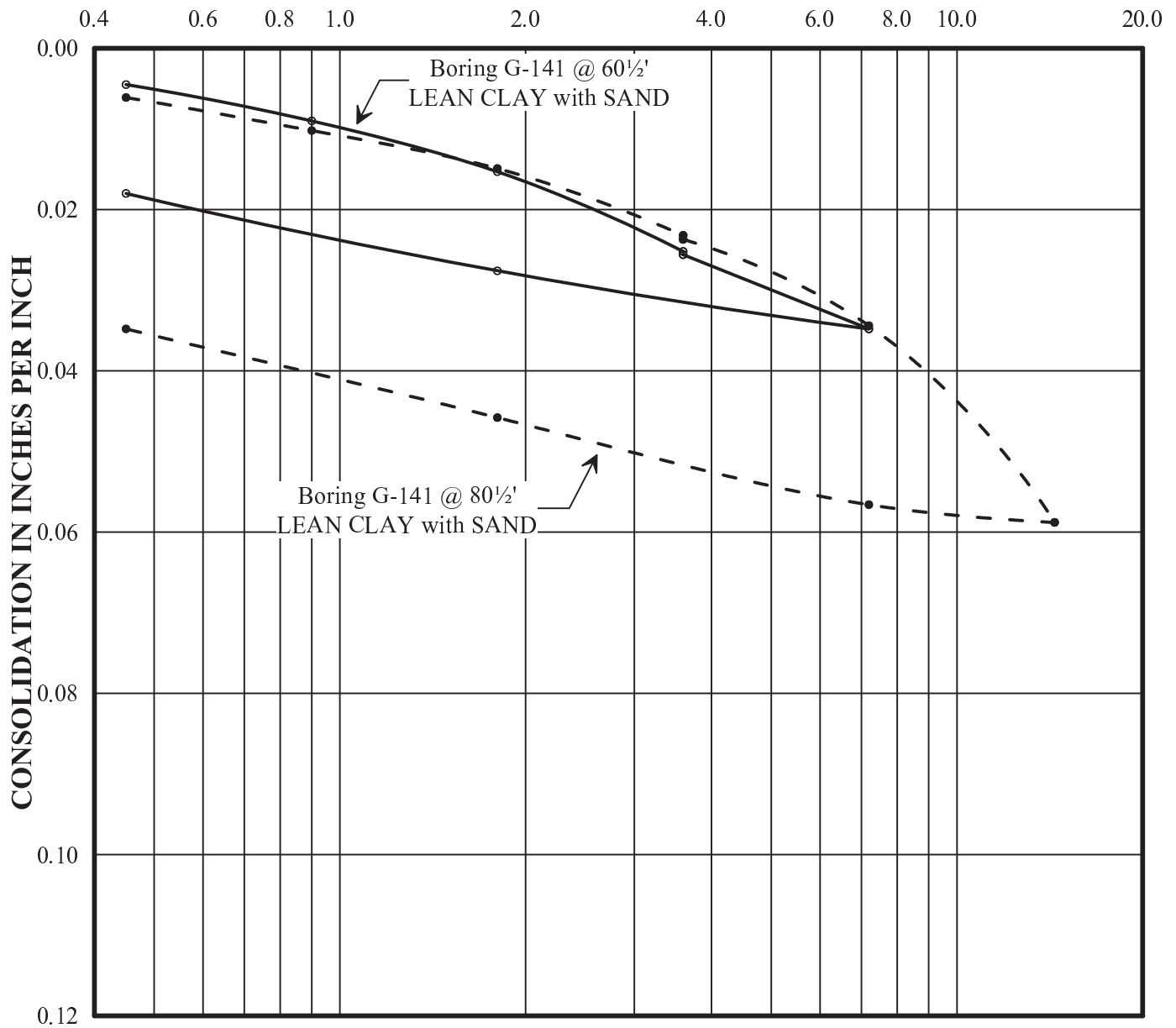
Prepared/Date: AH 5/15/11
Checked/Date: NH 6/3/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.10

LOAD IN KIPS PER SQUARE FOOT



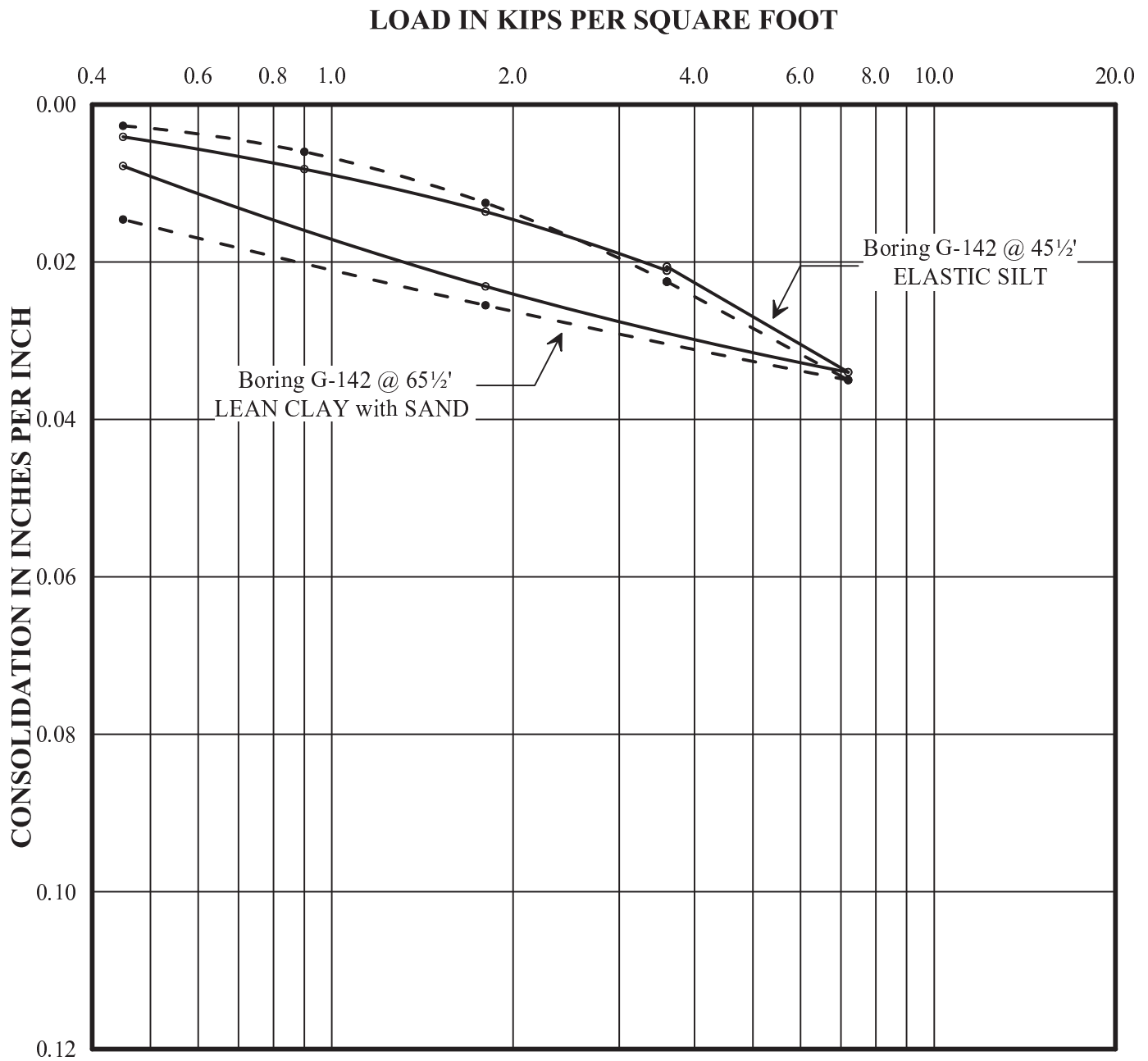
Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

Prepared/Date: JF 9/30/11
Checked/Date: LT 9/30/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.211



Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

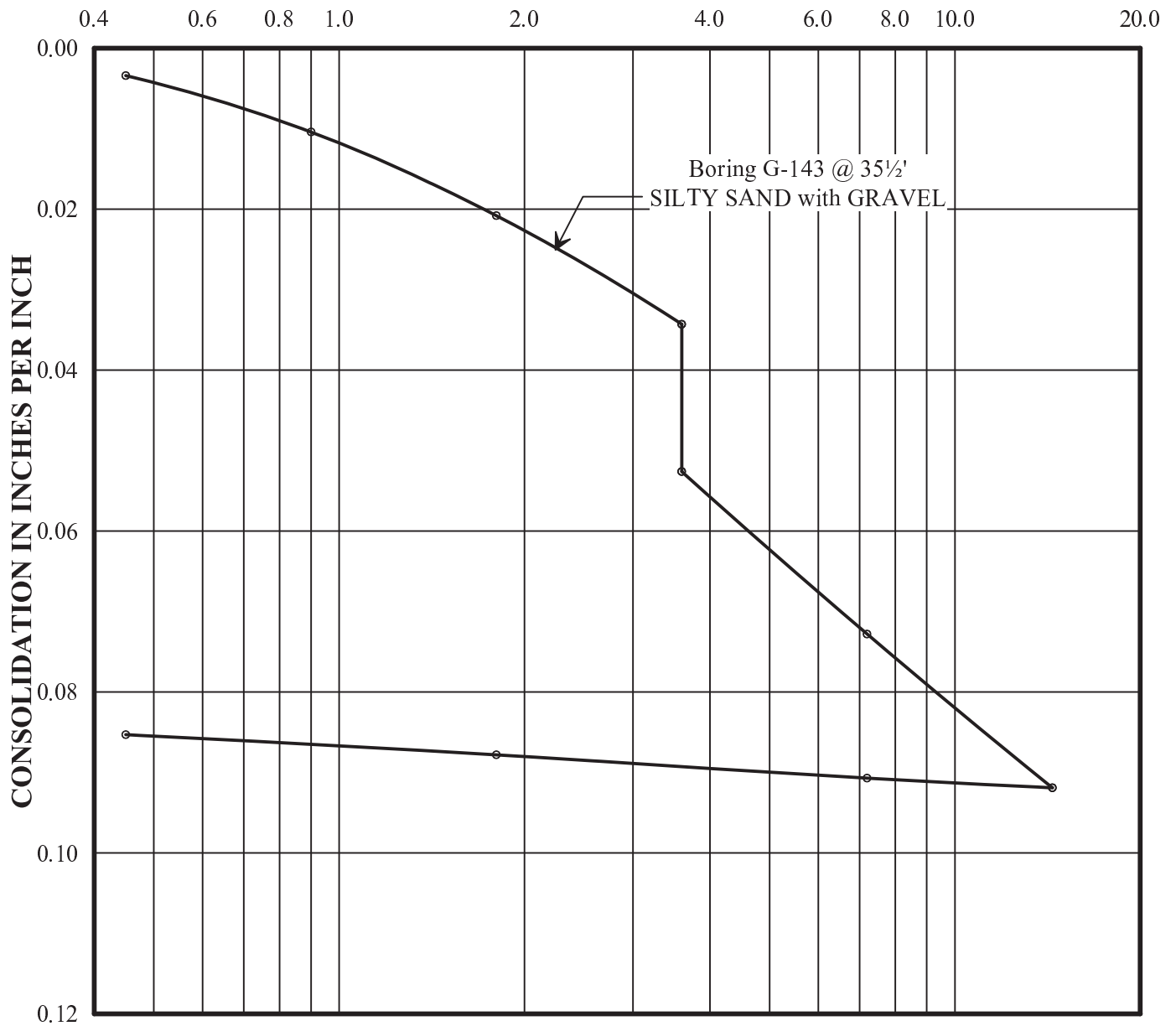
Prepared/Date: AH 8/25/11
Checked/Date: 9/15/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.12

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to sample after consolidation under a load of 3.6 kips per square foot.

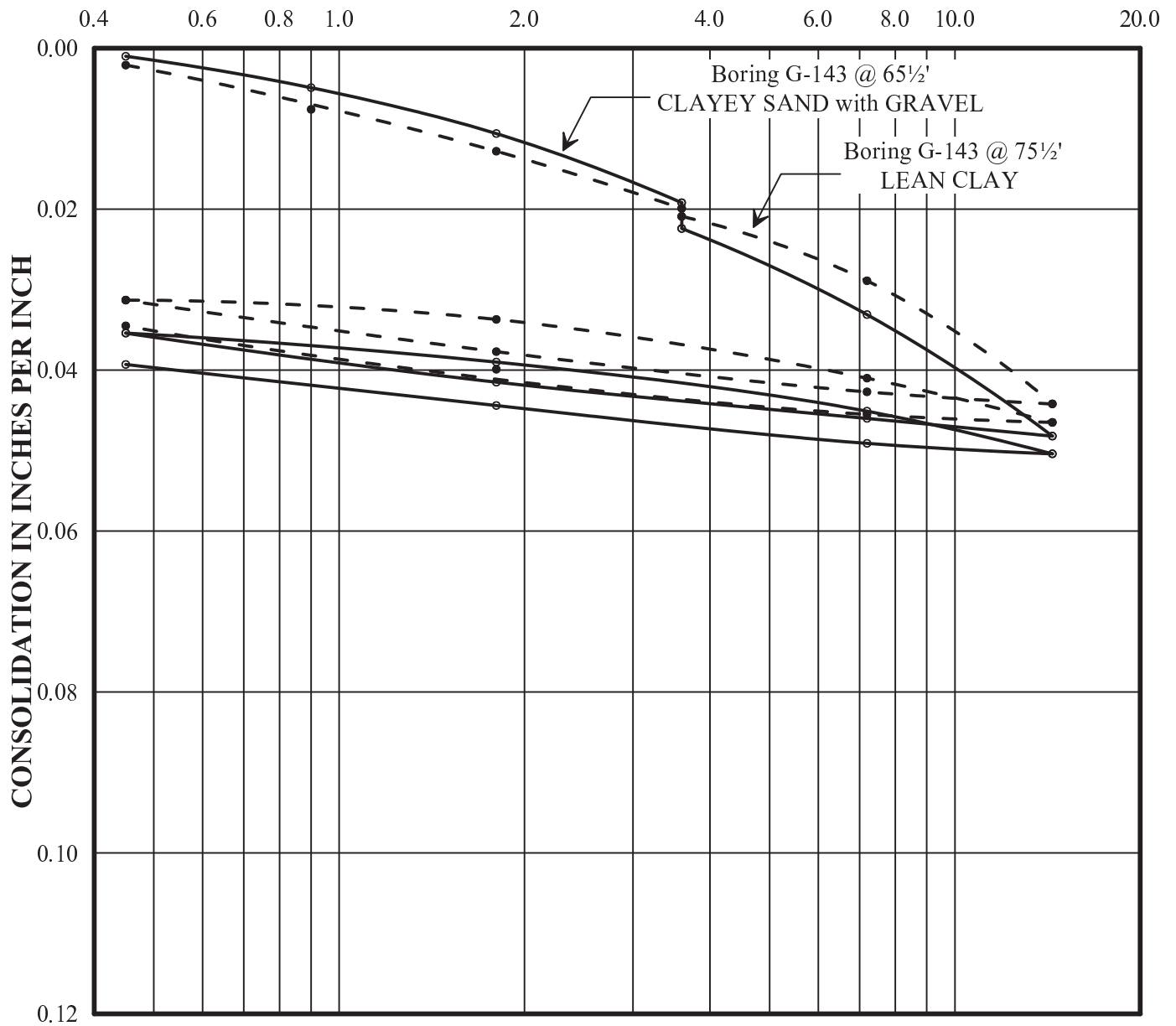
Prepared/Date: AH 7/26/11
Checked/Date: LT 9/27/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.13

LOAD IN KIPS PER SQUARE FOOT



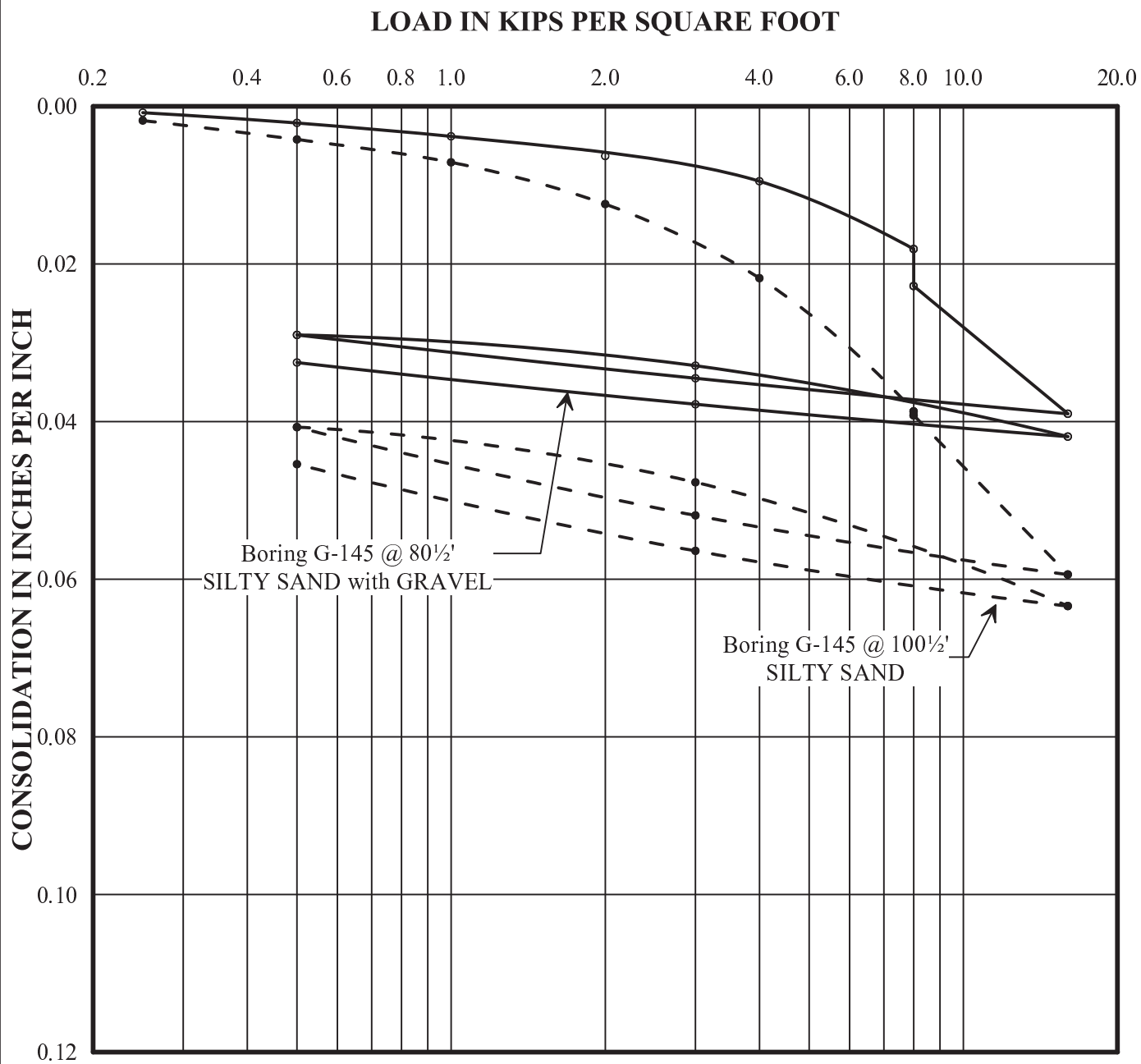
Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

Prepared/Date: AH 8/25/11
Checked/Date: LT 9/27/11

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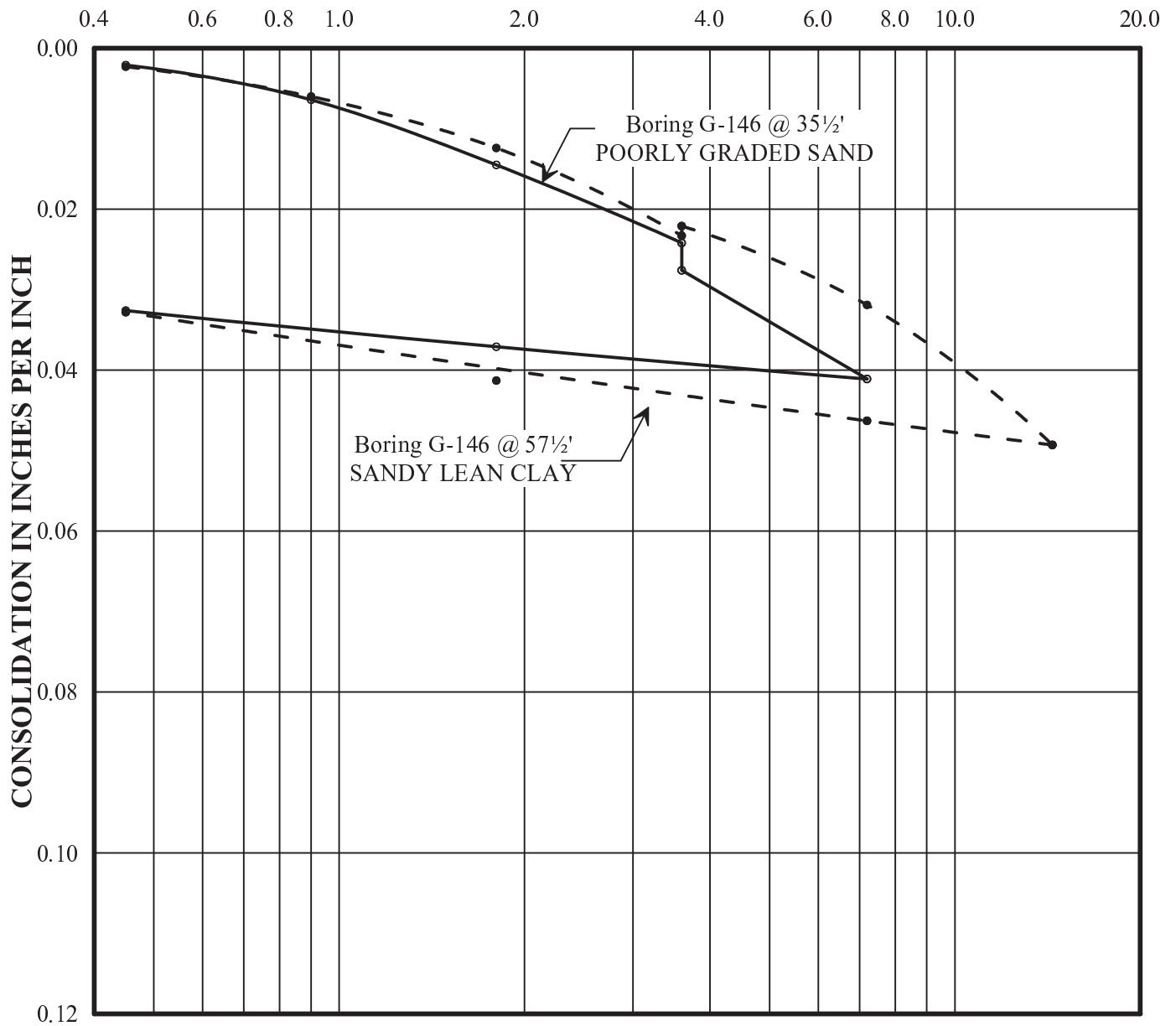
CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.14



Note: Water added to samples after consolidation under a load of 8.0 kips per square foot.

Prepared/Date: AH 9/20/11
Checked/Date: LT 9/26/11

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

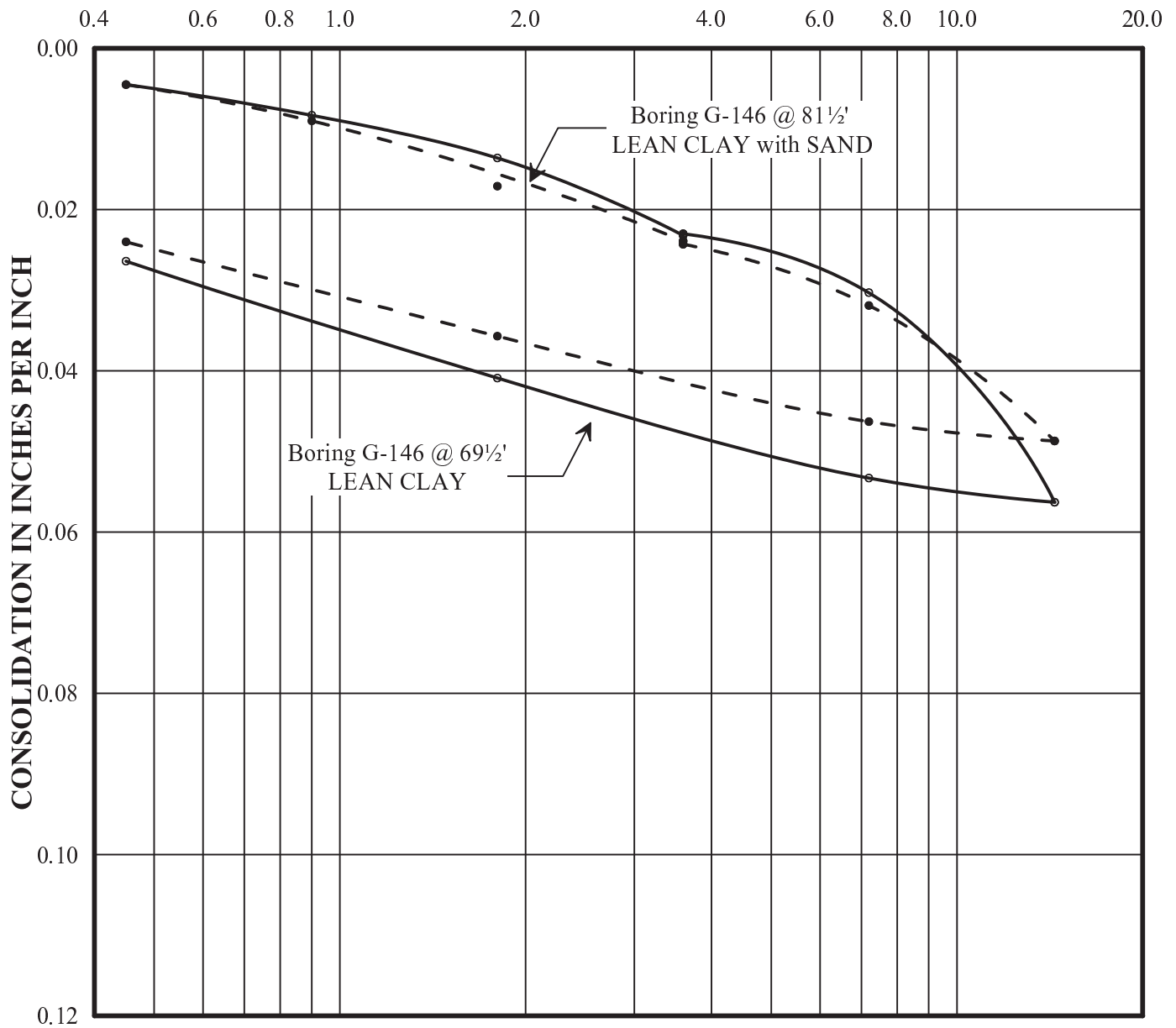
Prepared/Date: AH 7/26/11
Checked/Date: LT 8/8/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.16

LOAD IN KIPS PER SQUARE FOOT



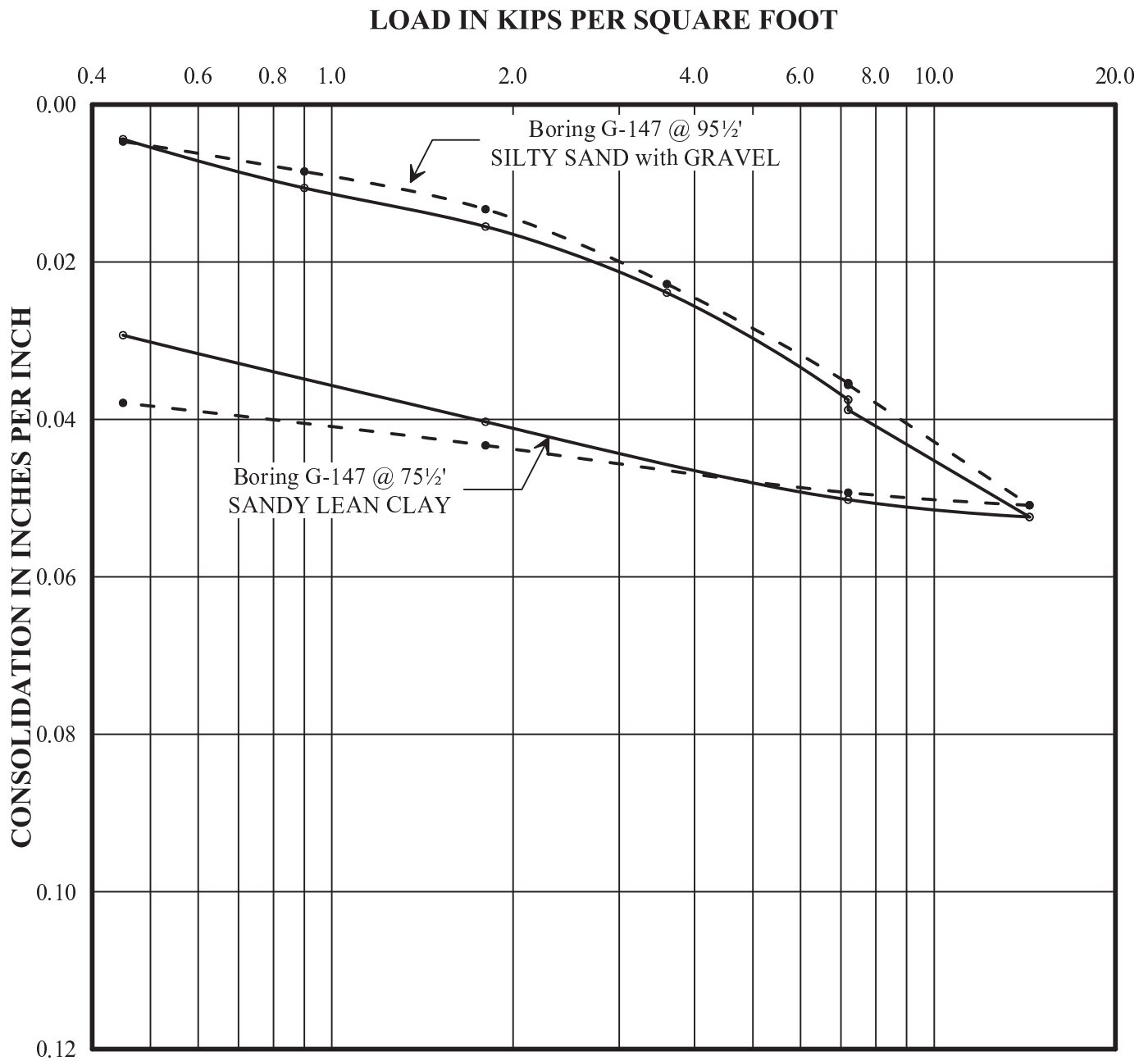
Note: Water added to samples after consolidation under a load of 3.6 kips per square foot.

Prepared/Date: AH 7/26/11
Checked/Date: LT 8/8/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.17



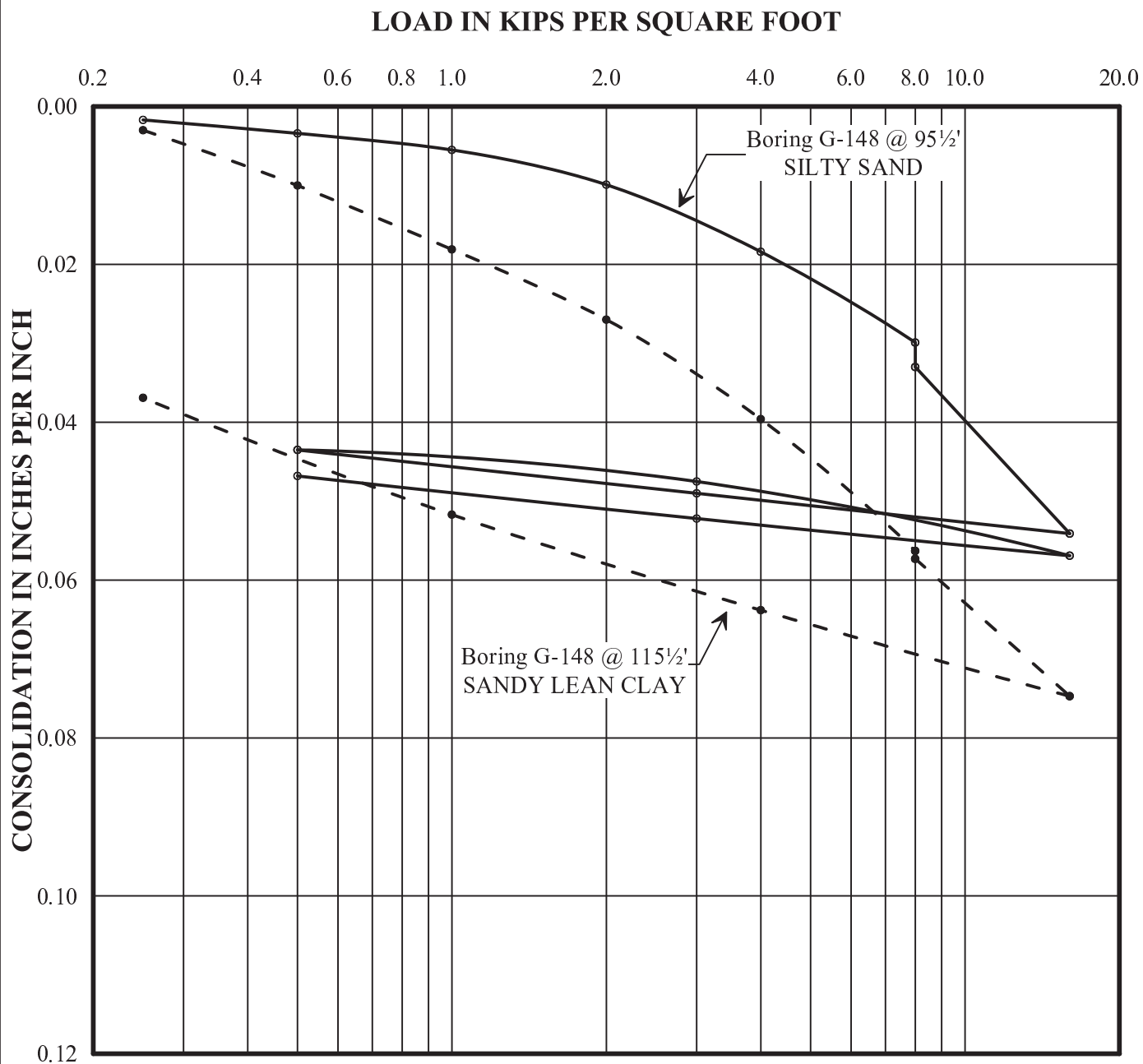
Note: Water added to samples after consolidation under a load of 7.2 kips per square foot.

Prepared/Date: JF 9/28/11
Checked/Date: LT 9/28/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.18



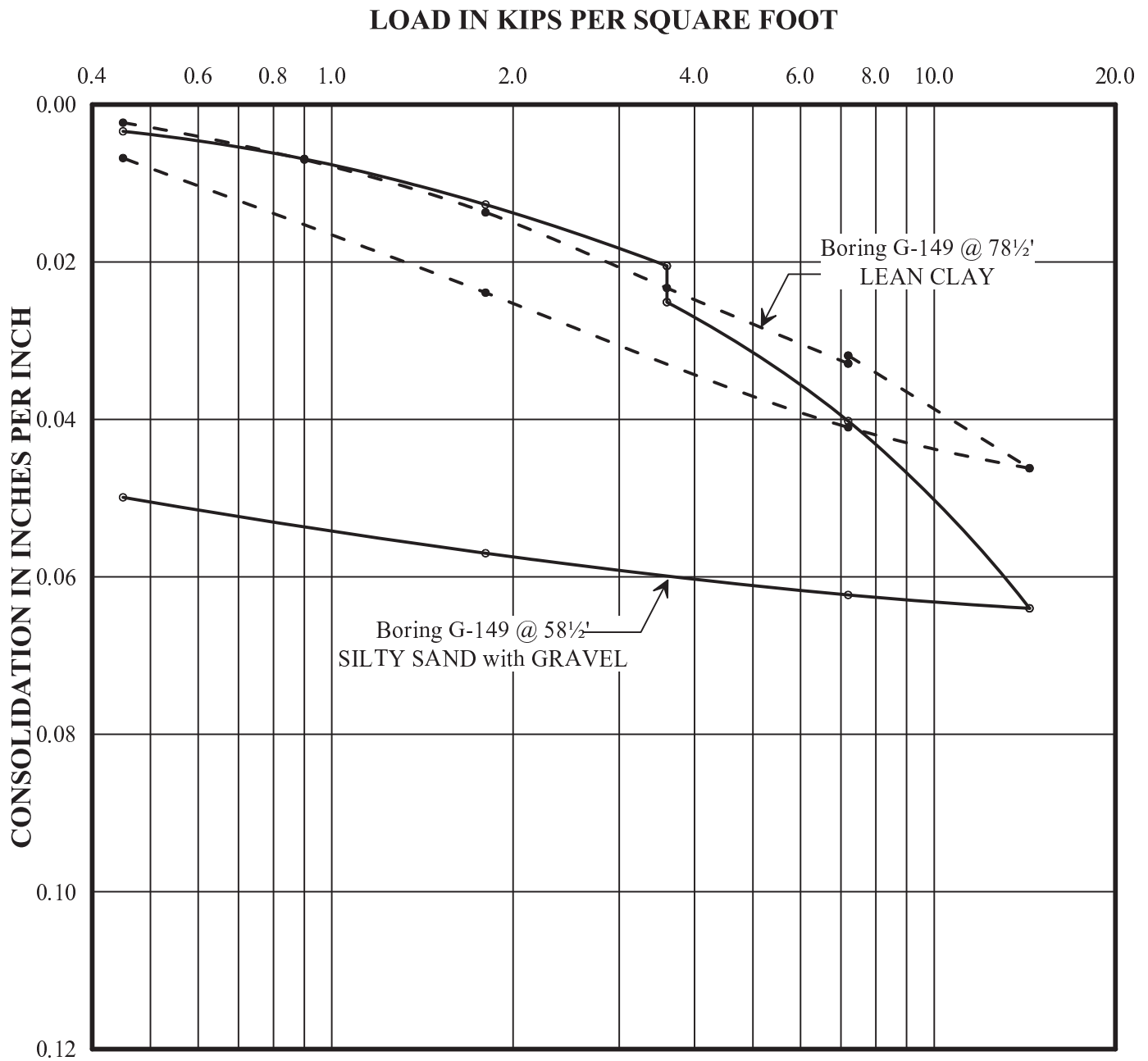
Note: Water added to samples after consolidation under a load of 8.0 kips per square foot.

Prepared/Date: AH 9/20/11
Checked/Date: LT 9/26/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.19



Note: Water added to samples at 58½' and 78½' after consolidation under a load of 3.6 and 7.2 kips per square foot, respectively.

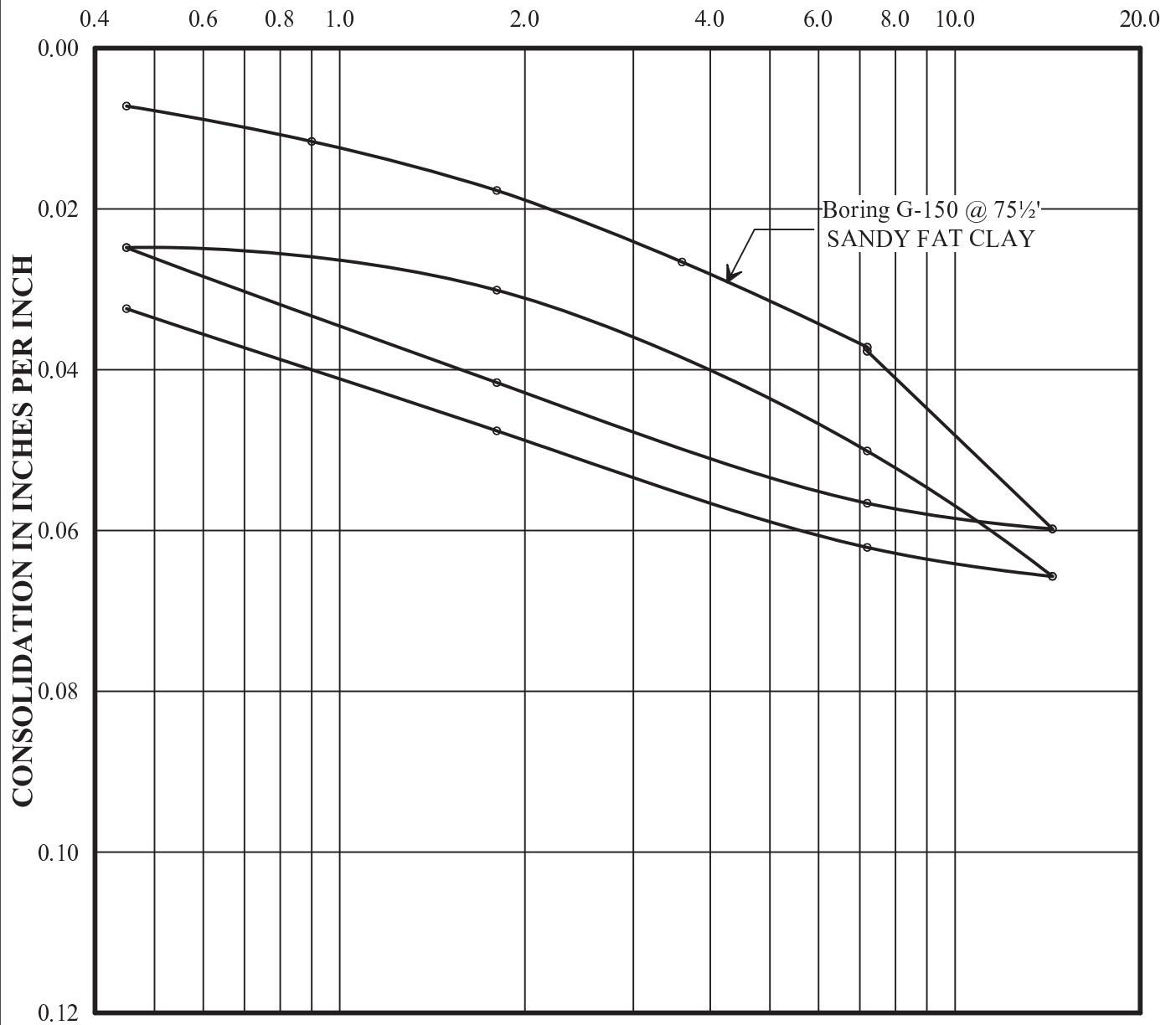
Prepared/Date: AH/JF 5/13/11
Checked/Date: LT 8/16/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.20

LOAD IN KIPS PER SQUARE FOOT



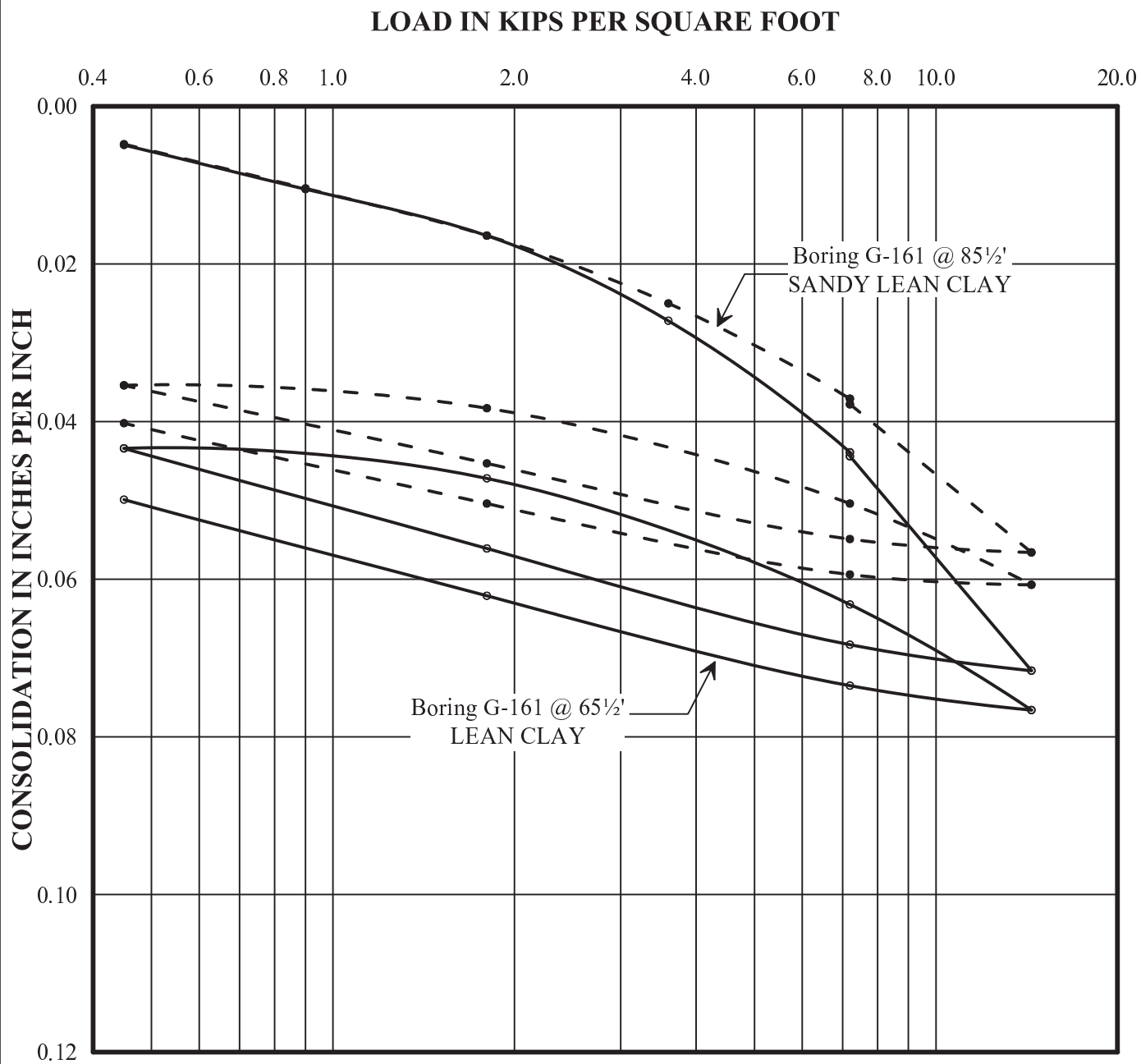
Note: Water added to sample after consolidation under a load of 7.2 kips per square foot.

Prepared/Date: AH/JF 5/15/11
Checked/Date: LT 8/16/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.21



Note: Water added to samples after consolidation under a load of 7.2 kips per square foot.

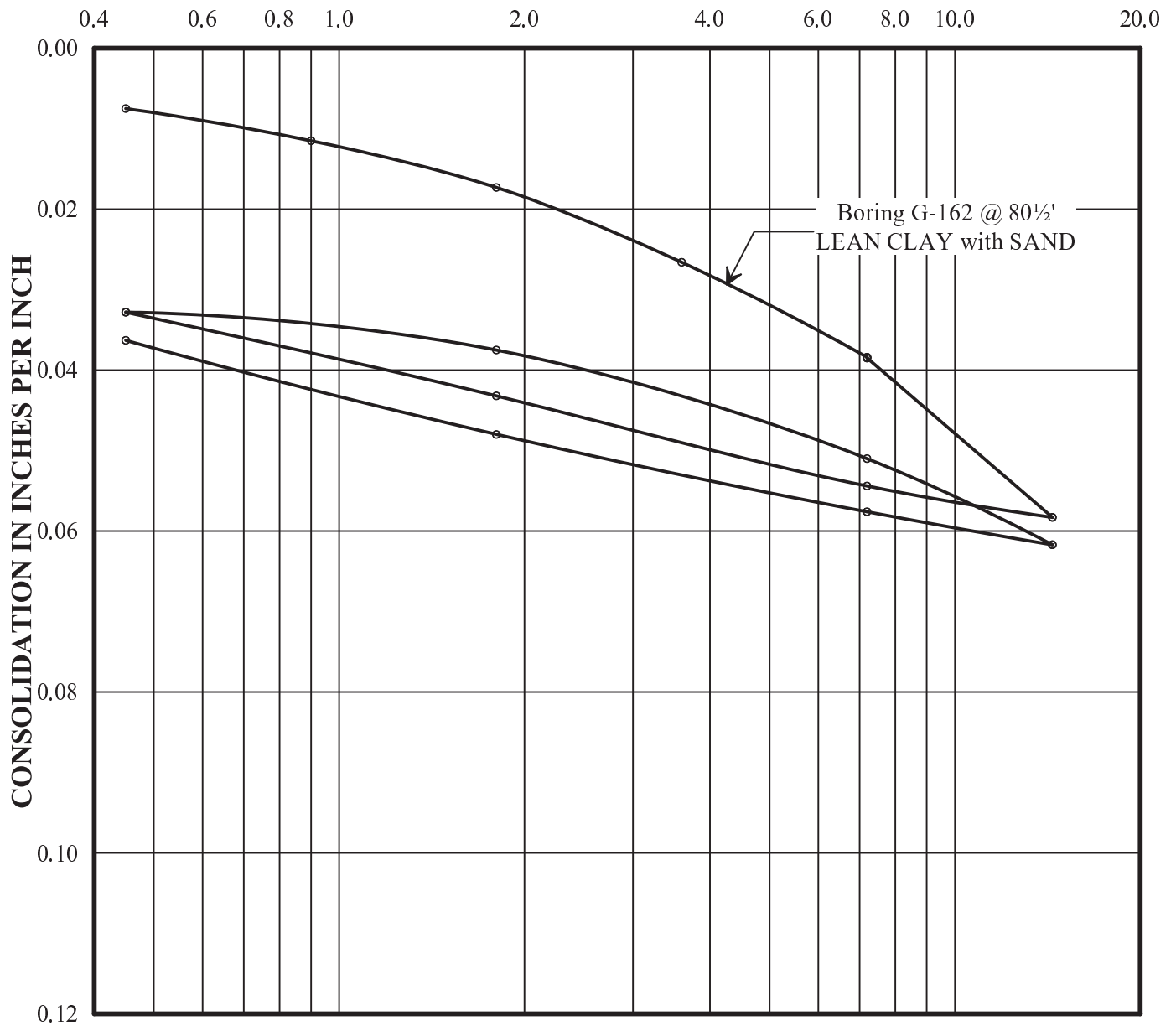
Prepared/Date: AH/JF 5/13/11
Checked/Date: LT 8/16/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.22

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to sample after consolidation under a load of 7.2 kips per square foot.

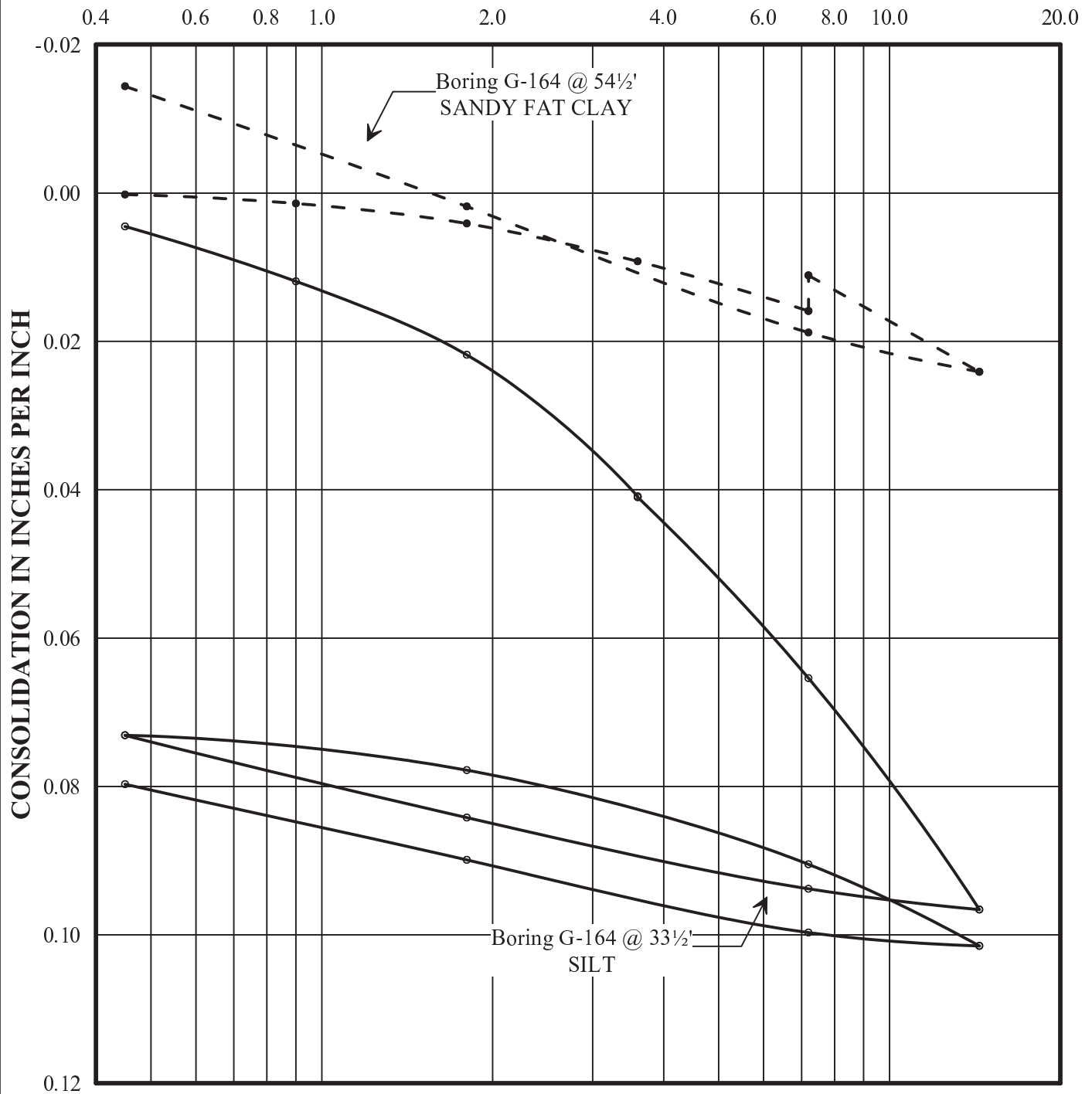
Prepared/Date: AH/JF 5/15/11
Checked/Date: LT 8/16/11

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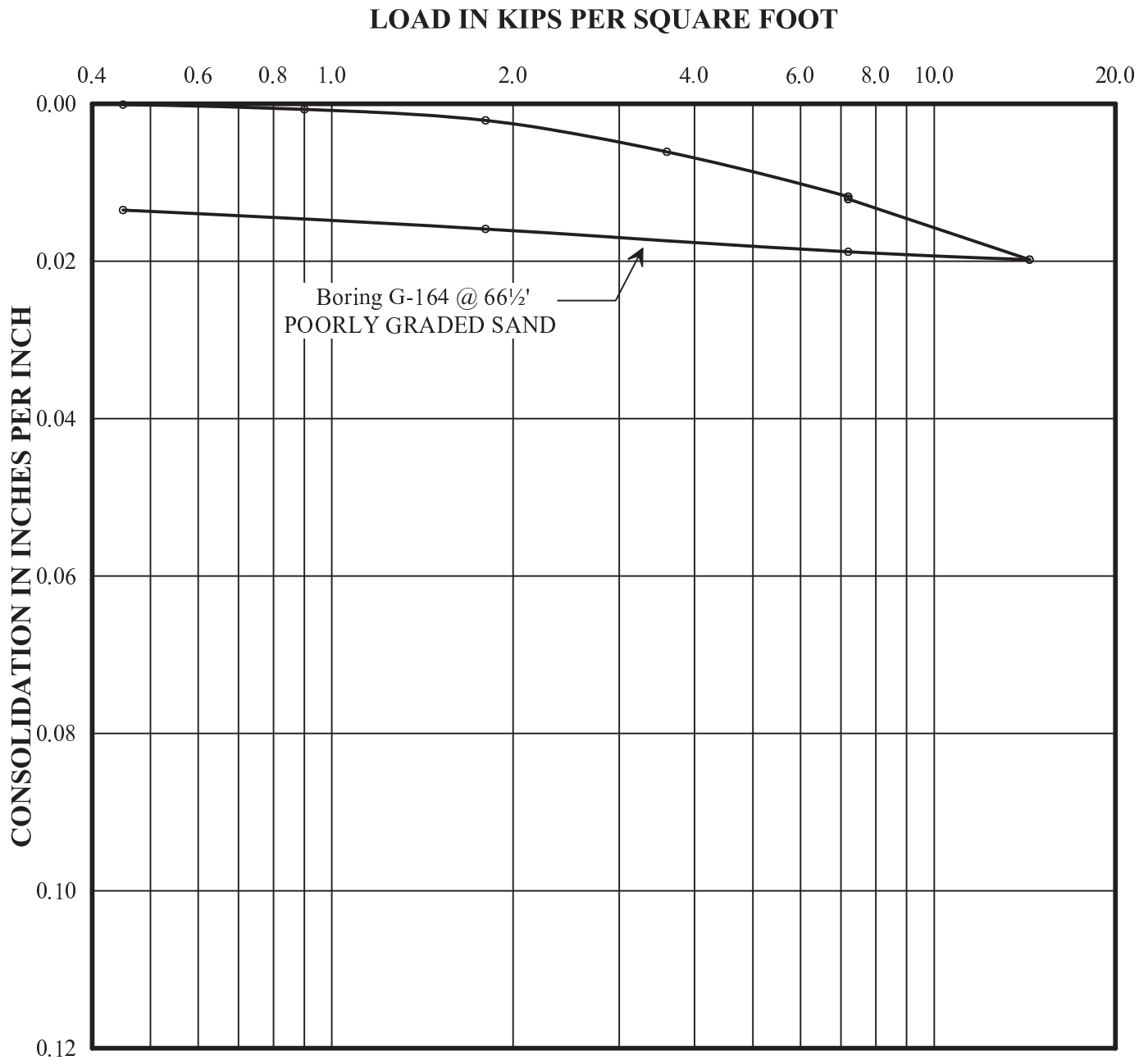
CONSOLIDATION TEST DATA
Project 4953-10-1561
Figure D-3.2.23

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to samples at 33 1/2' and 54 1/2' after consolidation under a load of 3.6 and 7.2 kips per square foot, respectively.

Prepared/Date: AH/JF 5/16/11
Checked/Date: LT 8/16/11



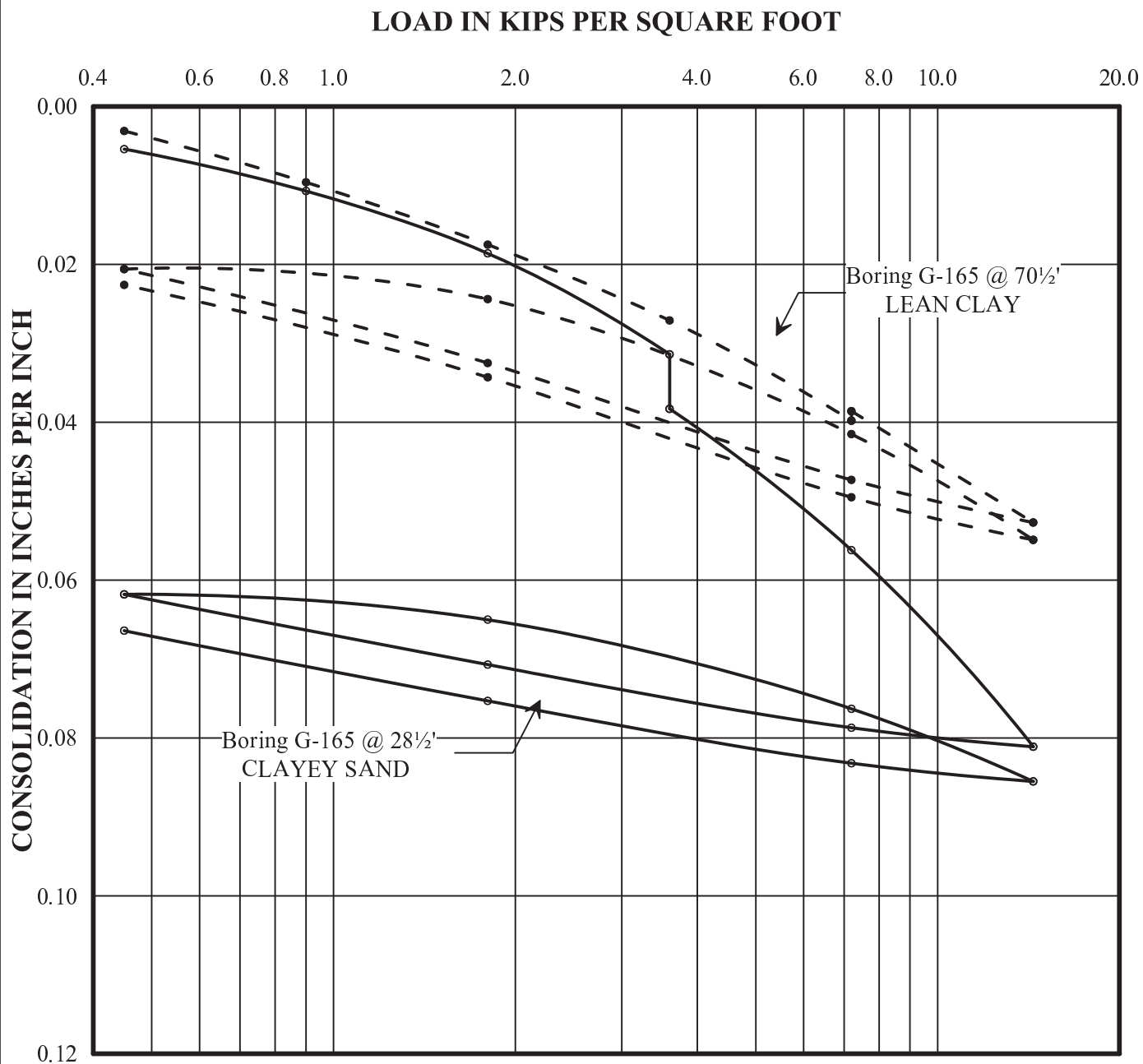
Note: Water added to sample after consolidation under a load of 7.2 kips per square foot.

Prepared/Date: AH/JF 5/16/11
Checked/Date: LT 8/16/11

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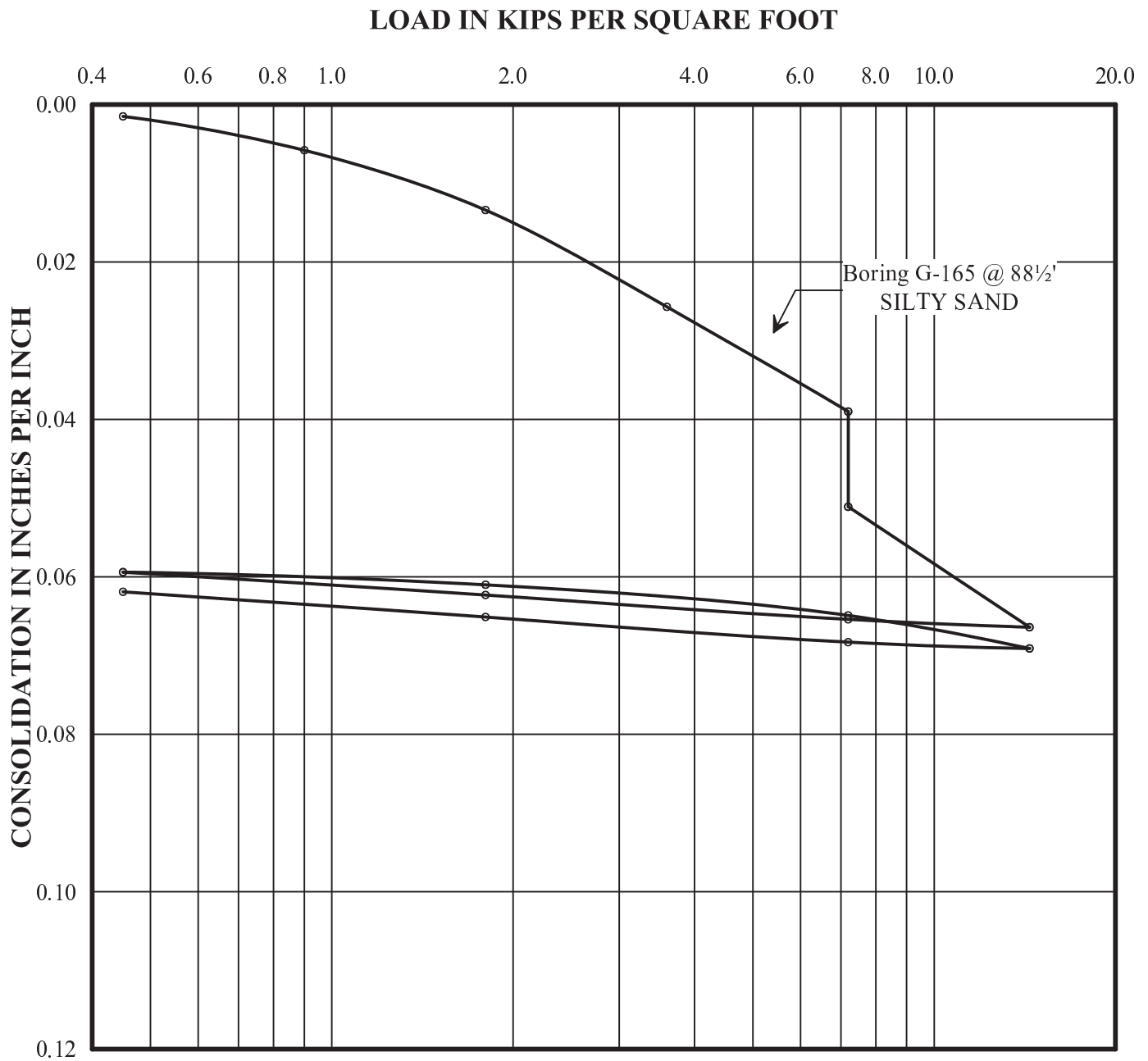


CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.25



Note: Water added to samples at 28½' and 70½' after consolidation under a load of 3.6 and 7.2 kips per square foot, respectively.

Prepared/Date: JF 9/27/11
Checked/Date: LT 9/28/11



Note: Water added to sample after consolidation under a load of 7.2 kips per square foot.

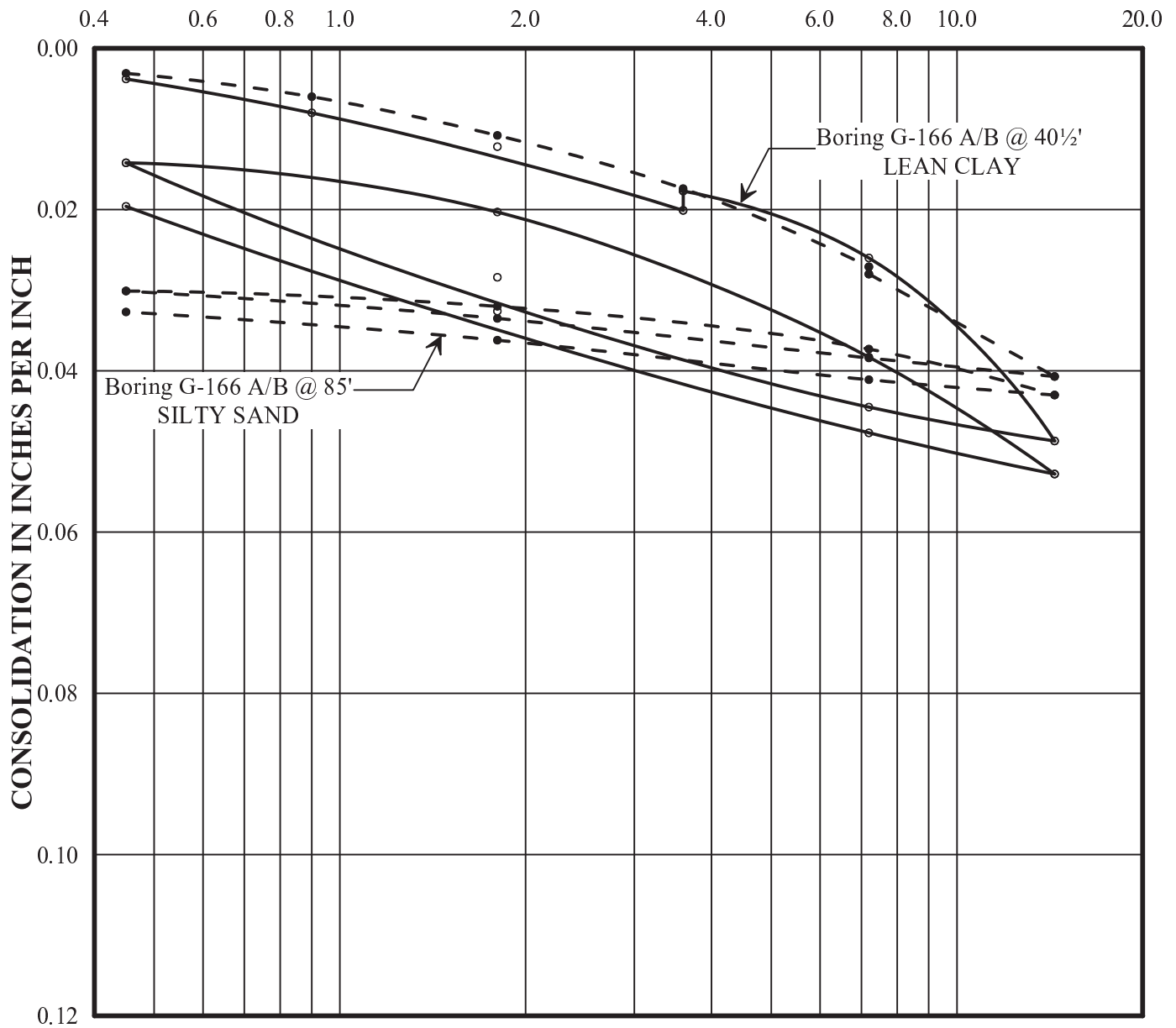
Prepared/Date: JF 9/27/11
Checked/Date: JF 9/28/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.27

LOAD IN KIPS PER SQUARE FOOT



Note: Water added to samples at 40 1/2' and 85' after consolidation under a load of 3.6 and 7.2 kips per square foot, respectively.

Prepared/Date: AH 9/23/11
Checked/Date: LT 9/23/11

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CONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-3.2.28

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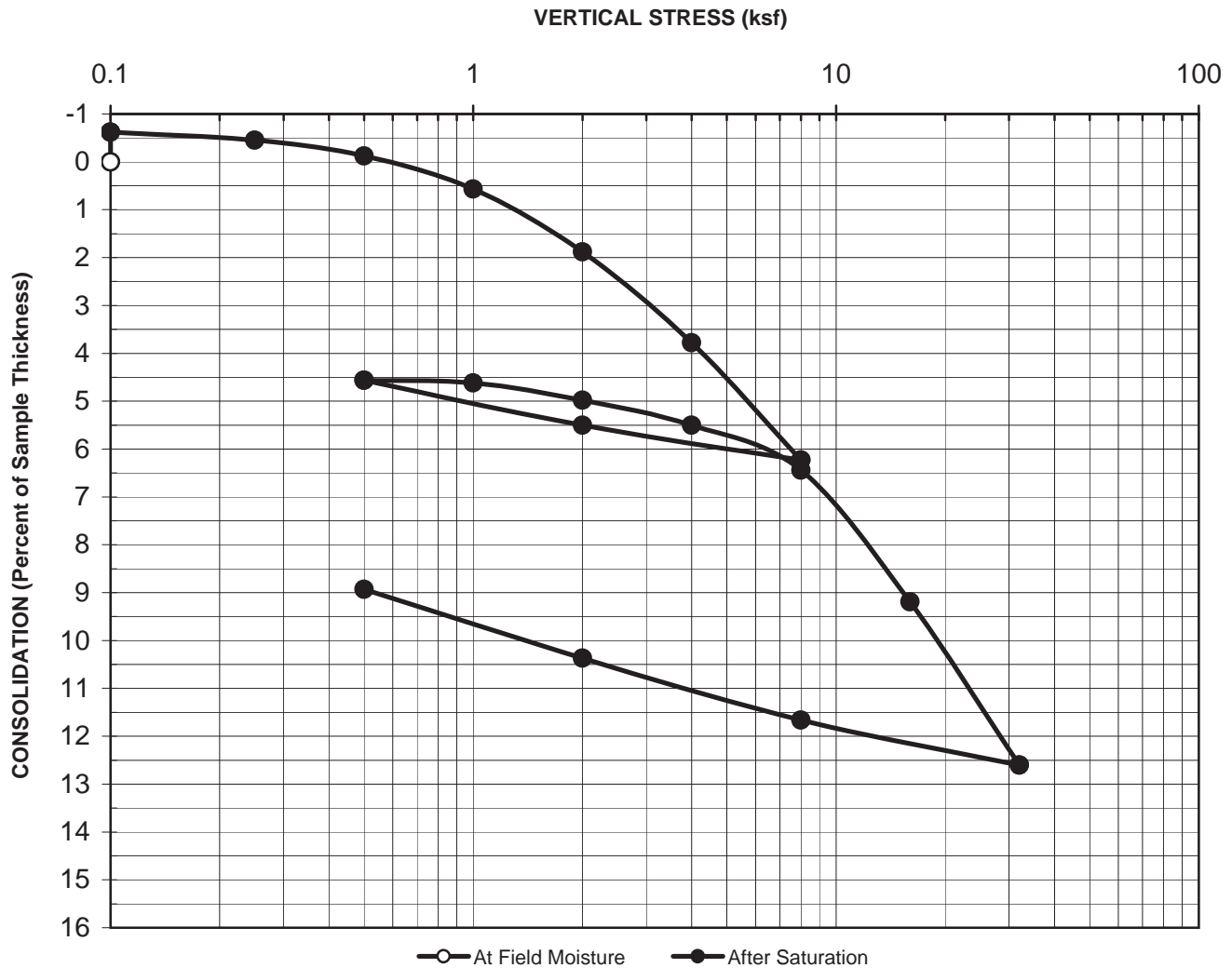
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : E-126AInitial Dry Unit Weight (pcf): 99.3Sample No.: 7Initial Moisture Content (%): 22.6Depth (feet): 35.5Final Moisture Content (%): 22.8Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Lean Clay w/sandInitial Void Ratio: 0.70Remarks: Swell = 0.62% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

Figure D-3.3.1

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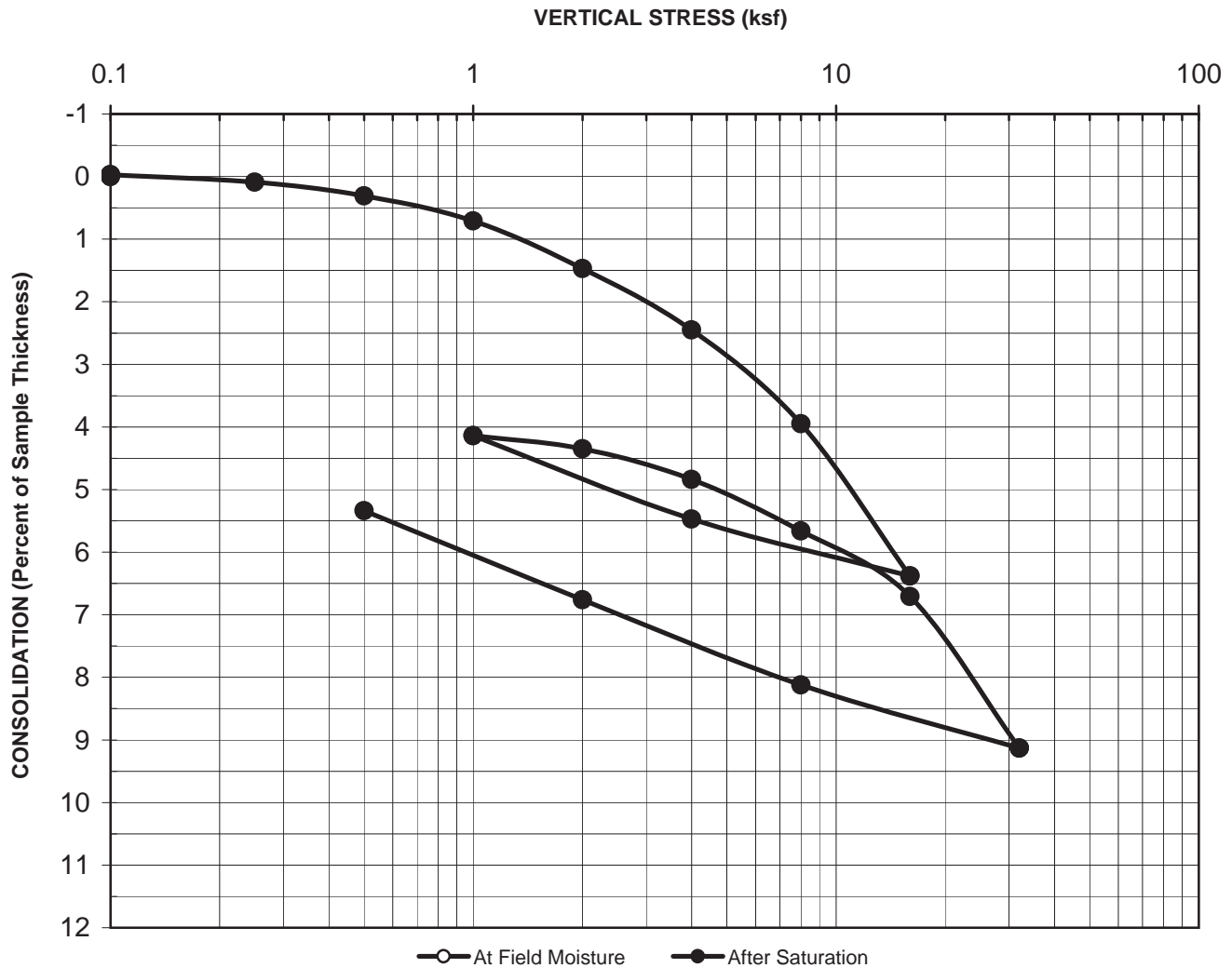
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : E-126AInitial Dry Unit Weight (pcf): 101.1Sample No.: 13Initial Moisture Content (%): 23.9Depth (feet): 65.5Final Moisture Content (%): 23.9Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Lean ClayInitial Void Ratio: 0.67Remarks: Swell = 0.03% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

Figure D-3.3.2

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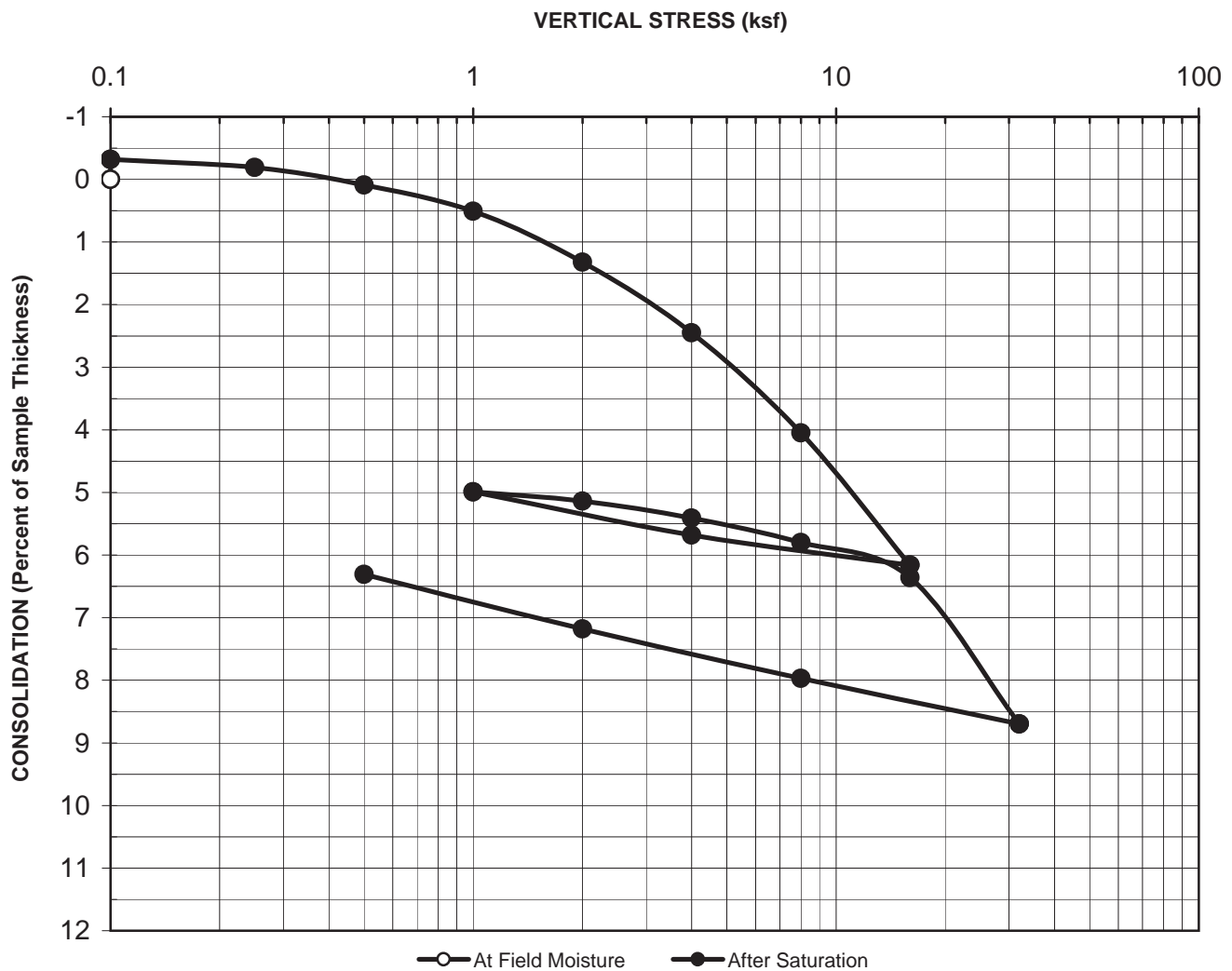
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : E-126AInitial Dry Unit Weight (pcf): 112.4Sample No.: 25Initial Moisture Content (%): 15.9Depth (feet): 125.5Final Moisture Content (%): 17.0Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Sandy ClayInitial Void Ratio: 0.50Remarks: Swell = 0.32% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

Figure D-3.3.3

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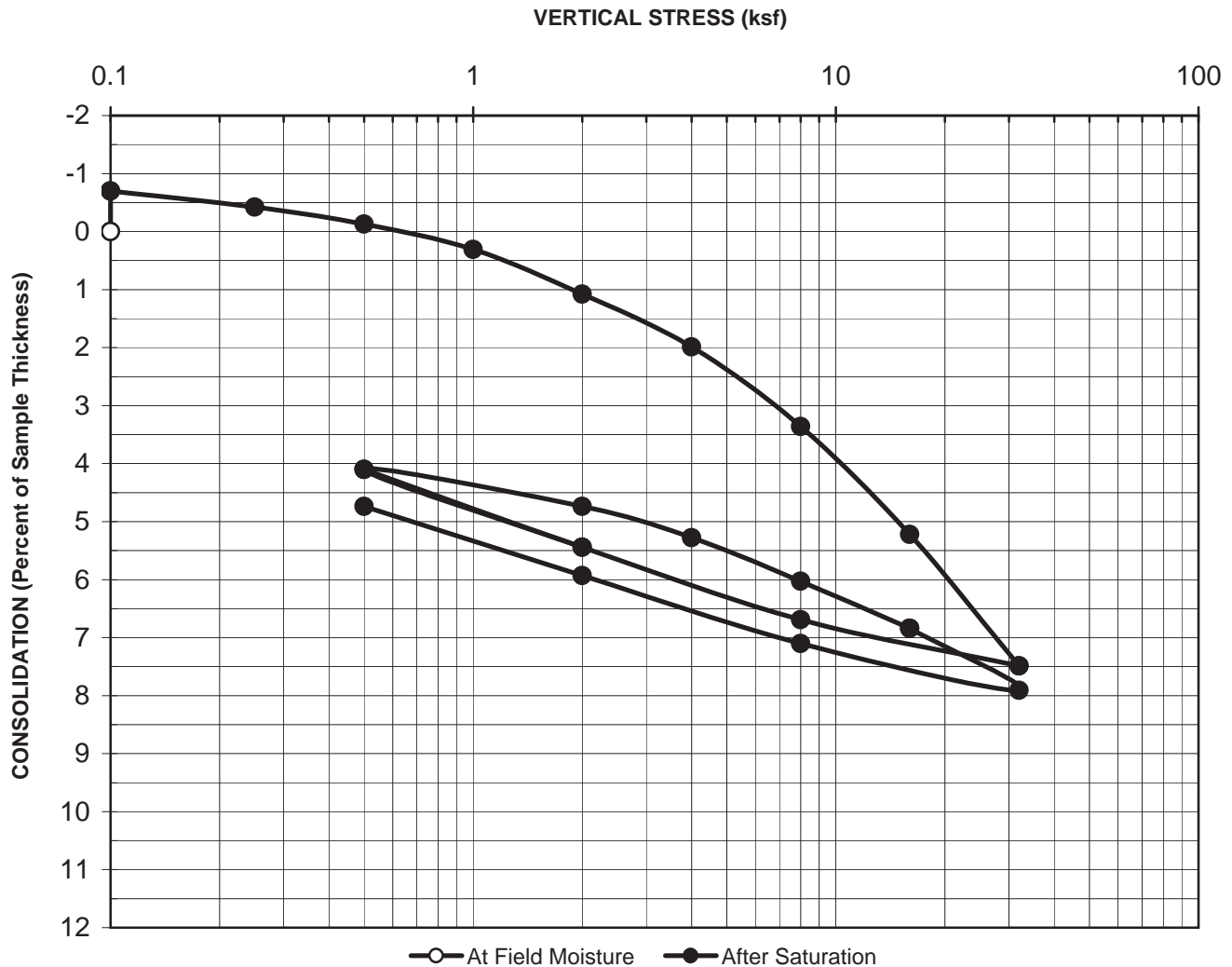
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-405Initial Dry Unit Weight (pcf): 108.8Sample No.: 20Initial Moisture Content (%): 20.9Depth (feet): 92.5Final Moisture Content (%): 20.2Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Sandy Lean ClayInitial Void Ratio: 0.55Remarks: Swell = 0.70% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 11/3/2015AP No: 15-1068

Figure D-3.3.4

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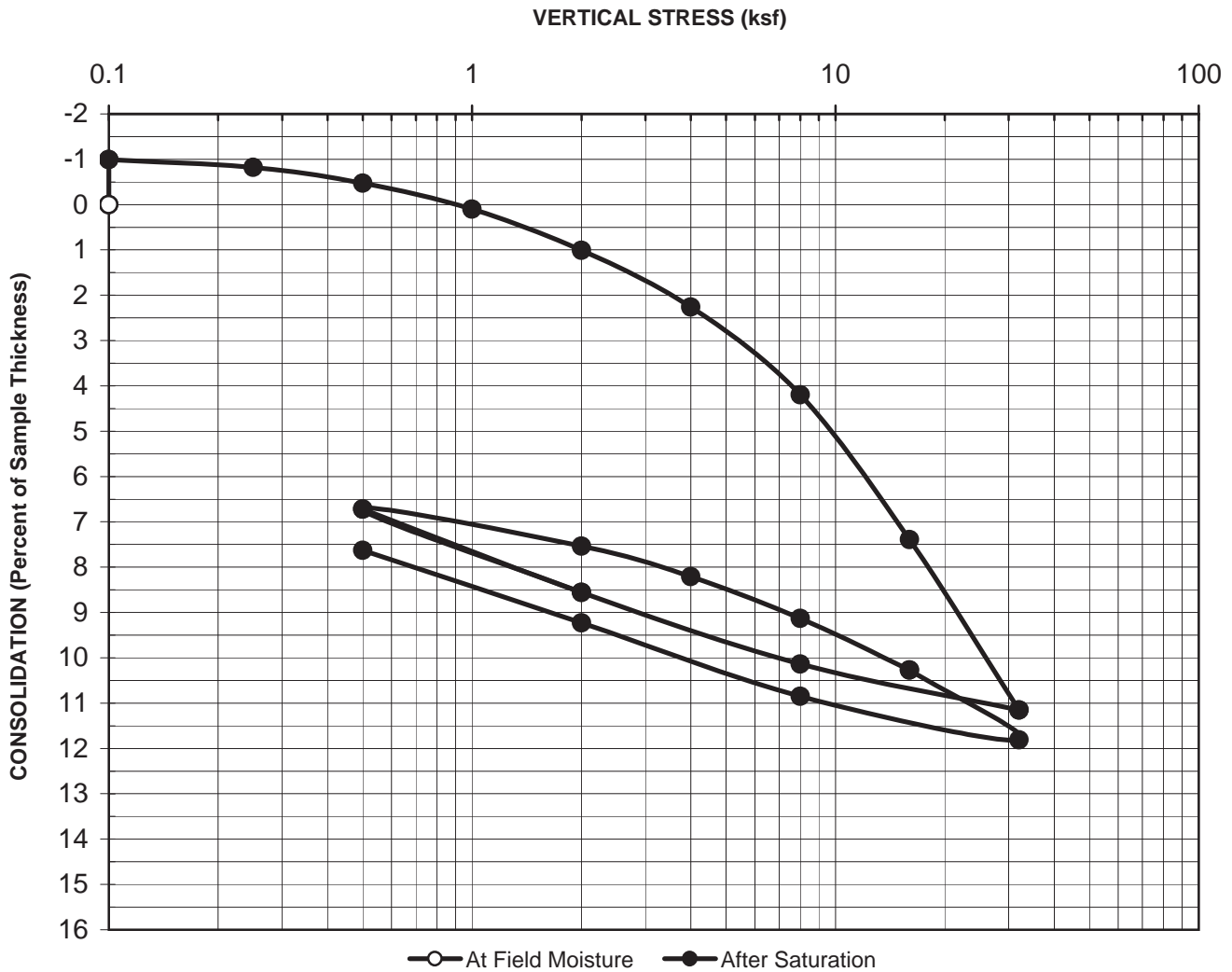
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-405Initial Dry Unit Weight (pcf): 95.4Sample No.: 26Initial Moisture Content (%): 28.8Depth (feet): 110.5Final Moisture Content (%): 27.7Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Lean ClayInitial Void Ratio: 0.77Remarks: Swell = 0.99% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 11/3/2015AP No: 15-1068

Figure D-3.3.5

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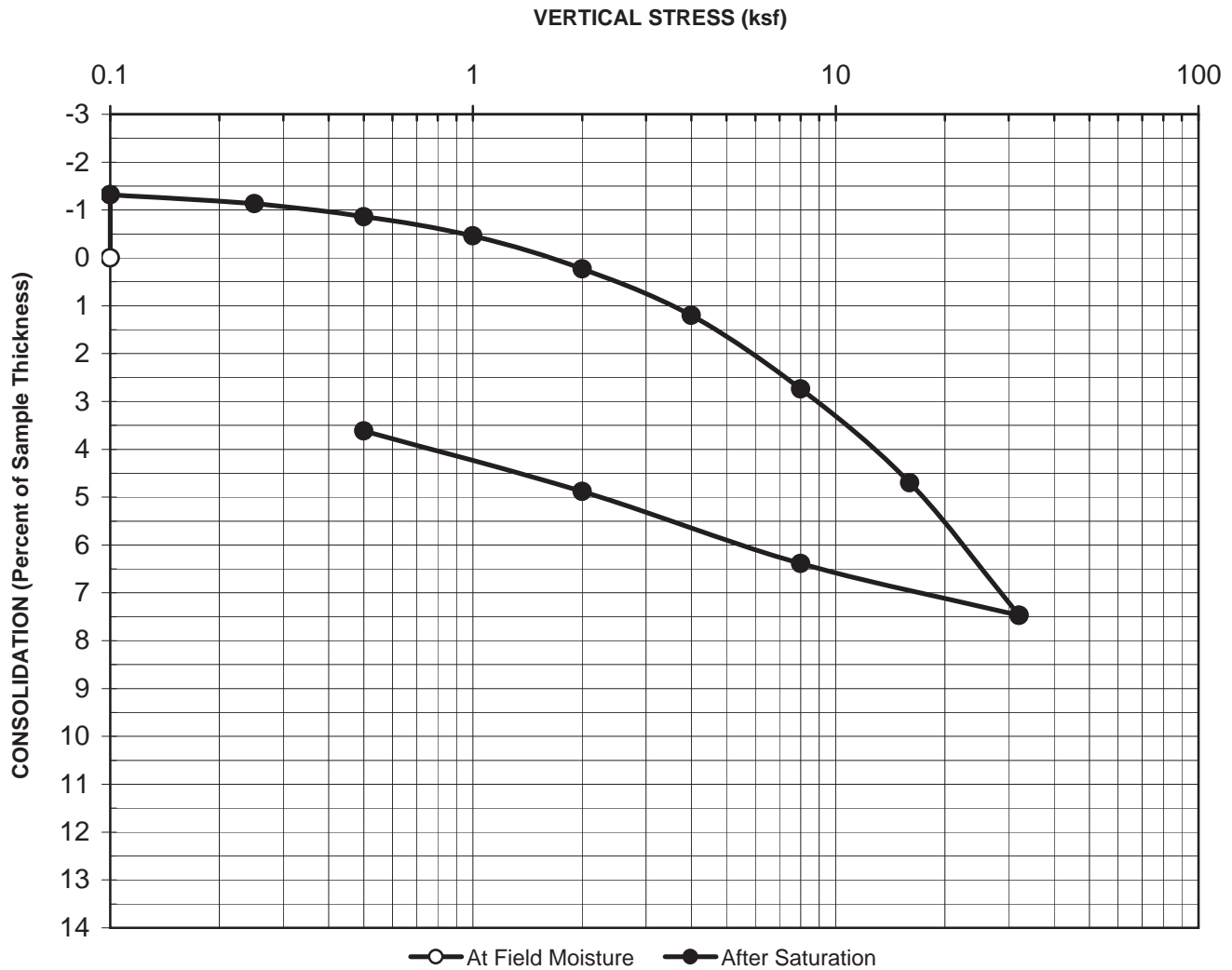
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-406Initial Dry Unit Weight (pcf): 111.6Sample No.: 13Initial Moisture Content (%): 18.3Depth (feet): 65.5Final Moisture Content (%): 18.6Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Lean Clay w/sandInitial Void Ratio: 0.51Remarks: Swell = 1.32% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/5/2015AP No: 15-1004

Figure D-3.3.6

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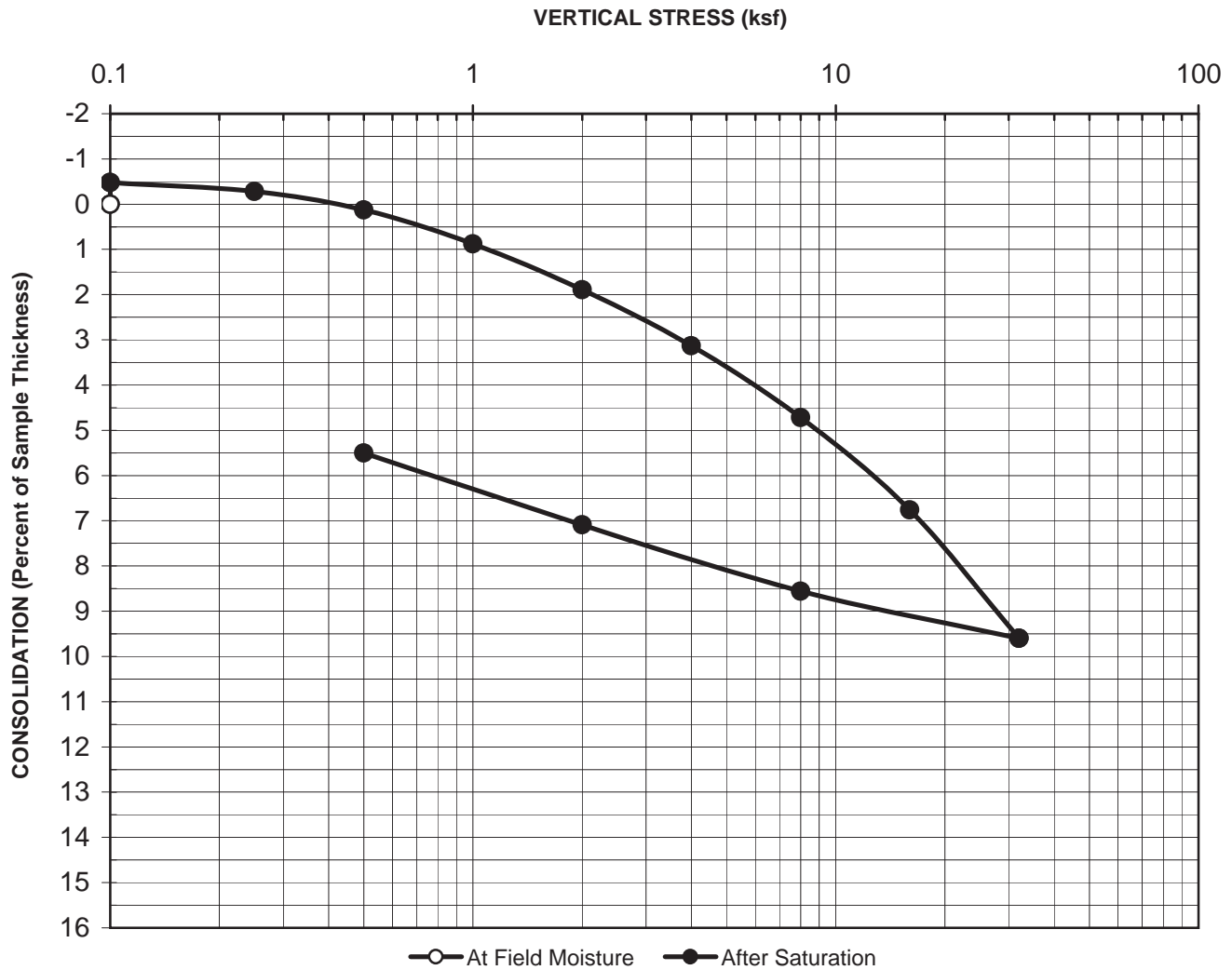
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-406Initial Dry Unit Weight (pcf): 93.7Sample No.: 26Initial Moisture Content (%): 29.6Depth (feet): 110.5Final Moisture Content (%): 28.5Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Sandy ClayInitial Void Ratio: 0.80Remarks: Swell= 0.48% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/5/2015AP No: 15-1004

Figure D-3.3.7

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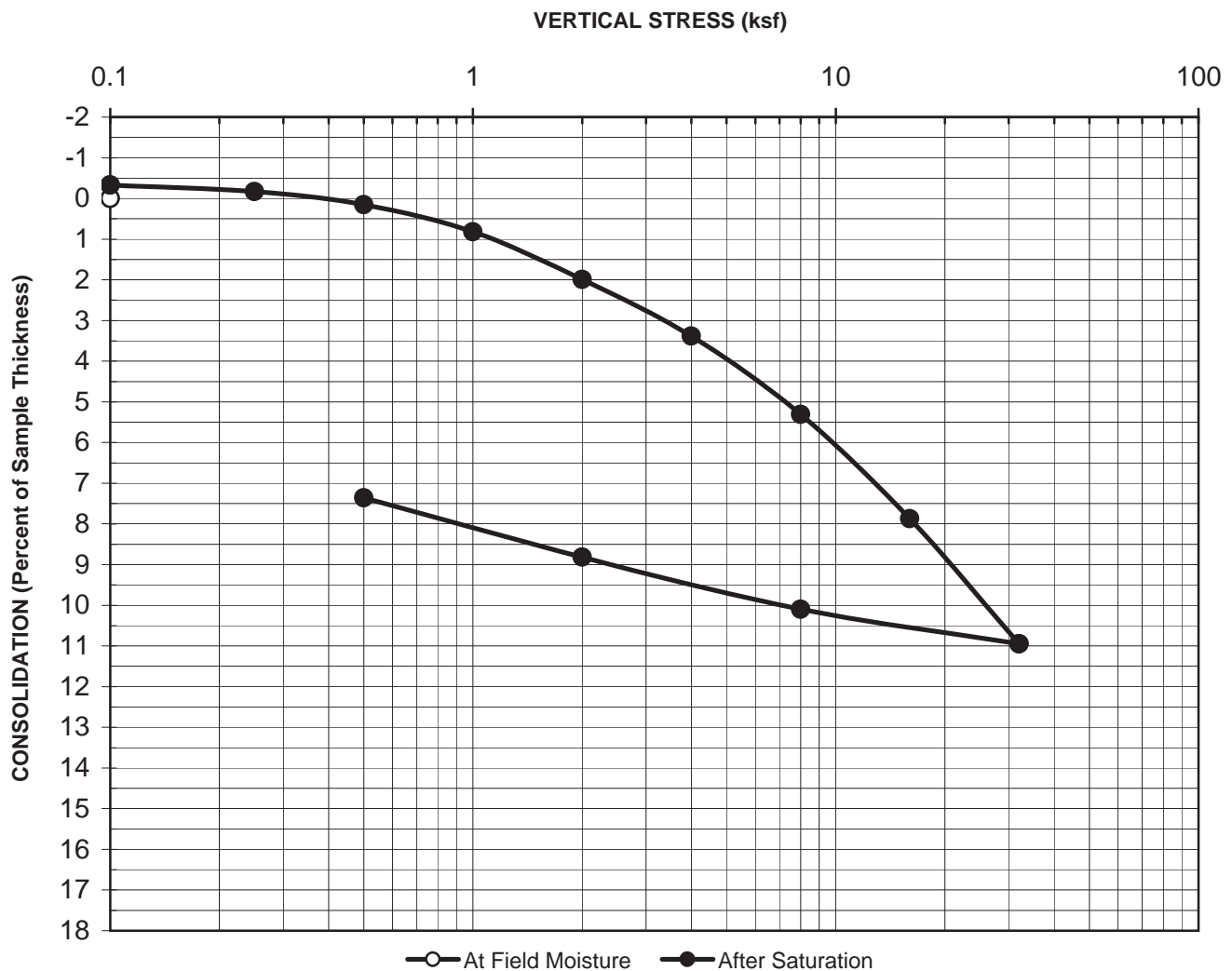
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-407Initial Dry Unit Weight (pcf): 101.8Sample No.: 11Initial Moisture Content (%): 23.2Depth (feet): 47.5Final Moisture Content (%): 23.9Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Lean Clay w/sandInitial Void Ratio: 0.65Remarks: Swell = 0.33% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

Figure D-3.3.8

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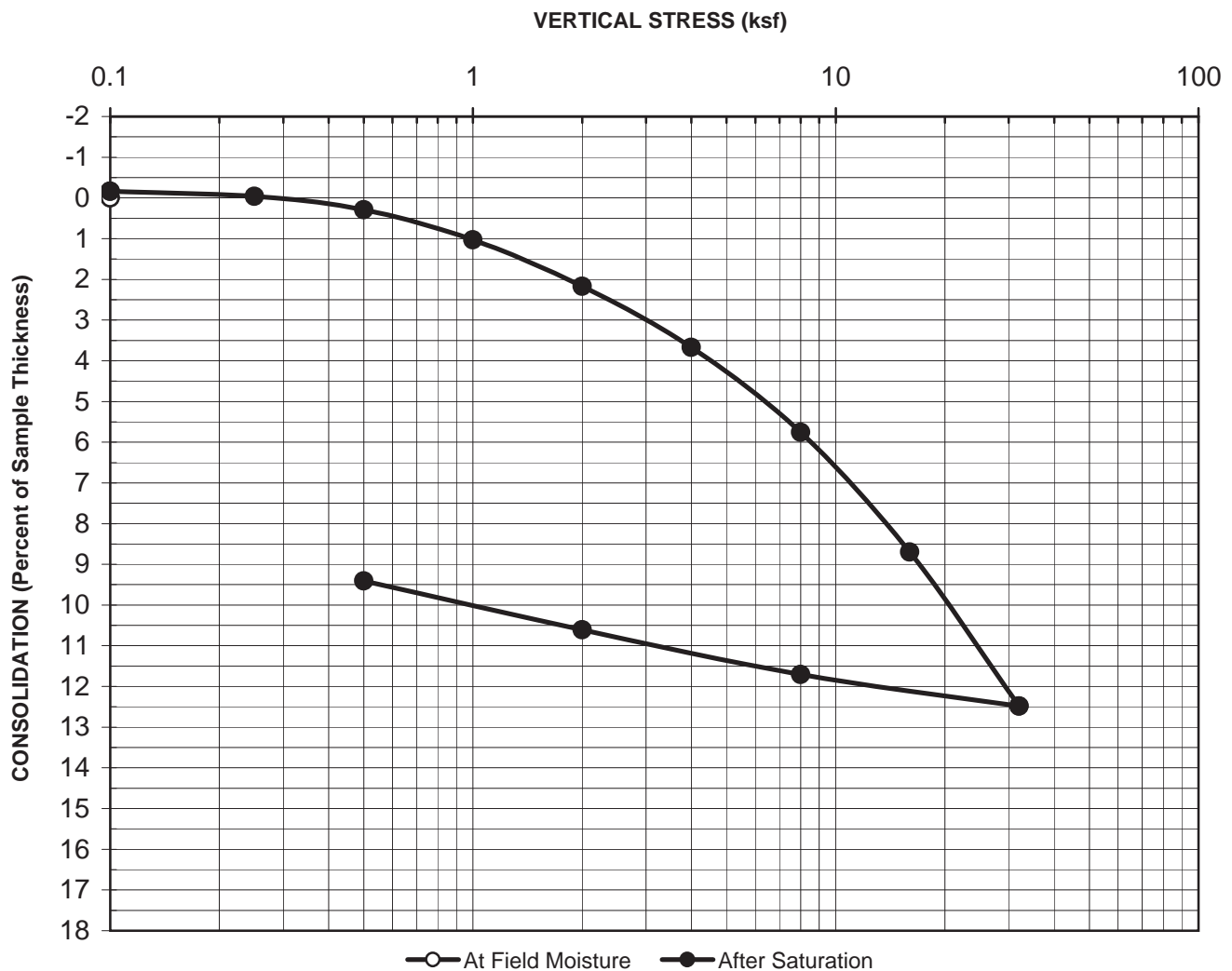
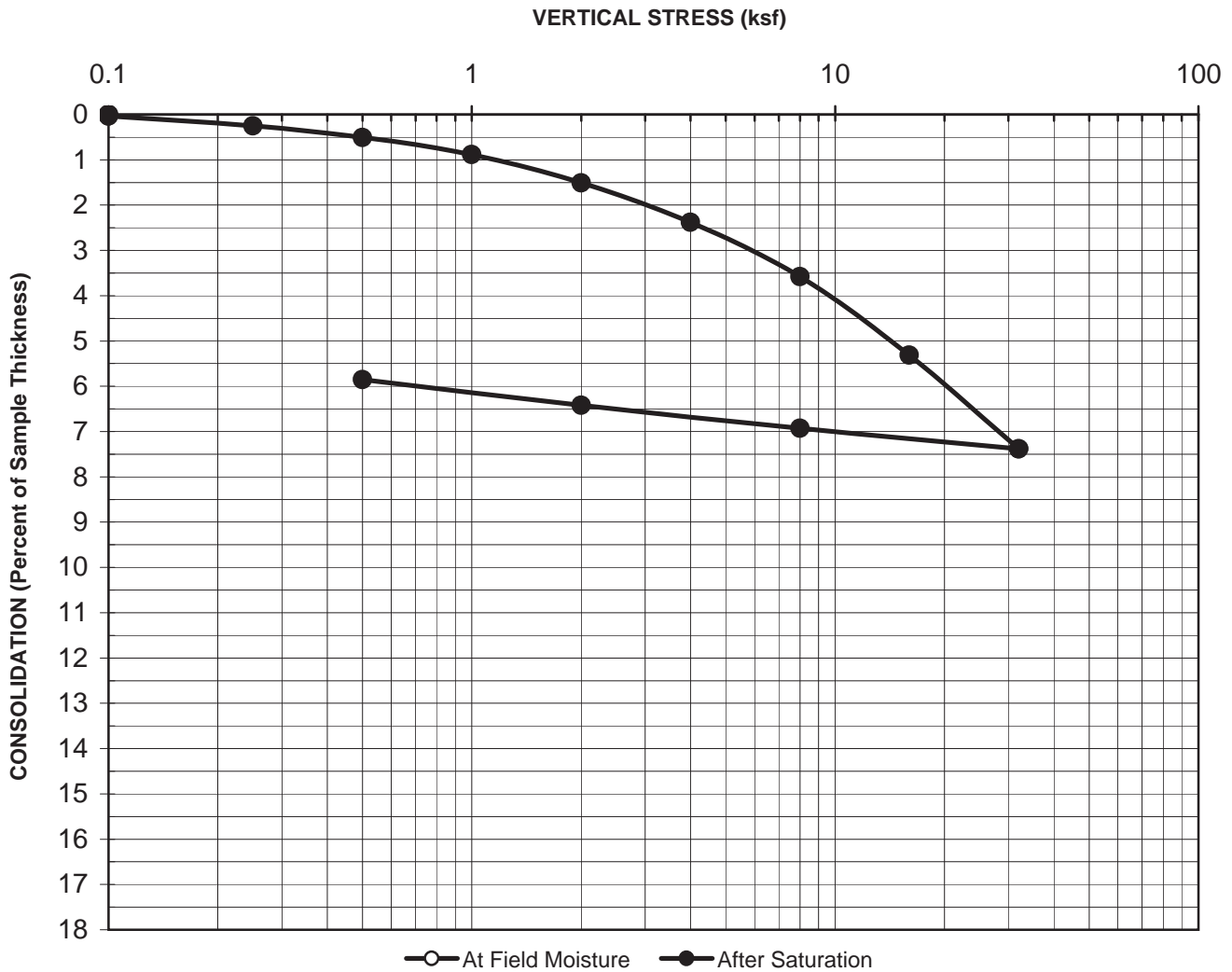
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-407Initial Dry Unit Weight (pcf): 100.1Sample No.: 13Initial Moisture Content (%): 23.9Depth (feet): 53.5Final Moisture Content (%): 24.0Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Lean Clay w/sandInitial Void Ratio: 0.68Remarks: Swell = 0.16% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

Figure D-3.3.9

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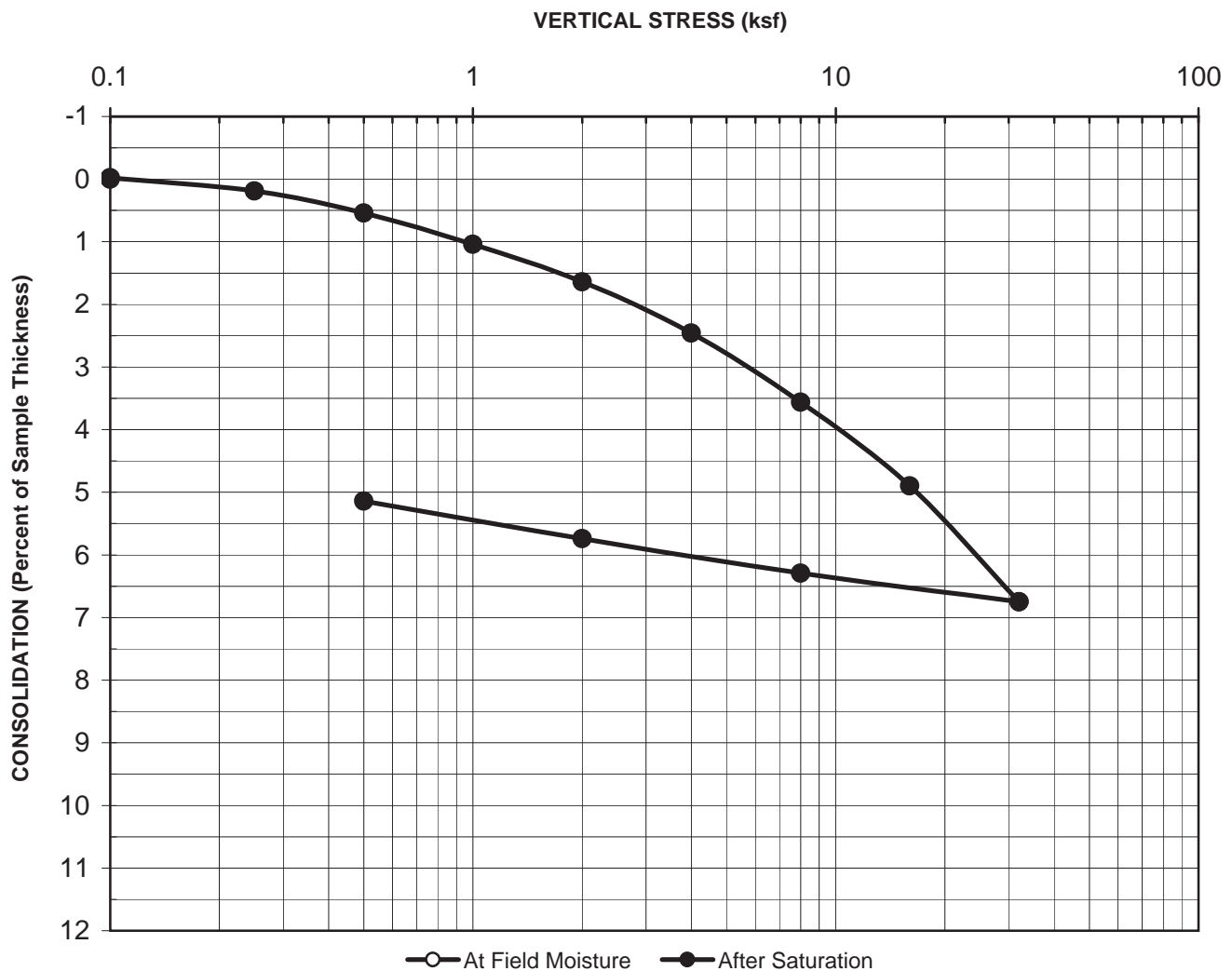
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t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-407Initial Dry Unit Weight (pcf): 108.6Sample No.: 20Initial Moisture Content (%): 14.5Depth (feet): 74.5Final Moisture Content (%): 16.0Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Silty SandInitial Void Ratio: 0.55Remarks: Collapse= 0.03% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

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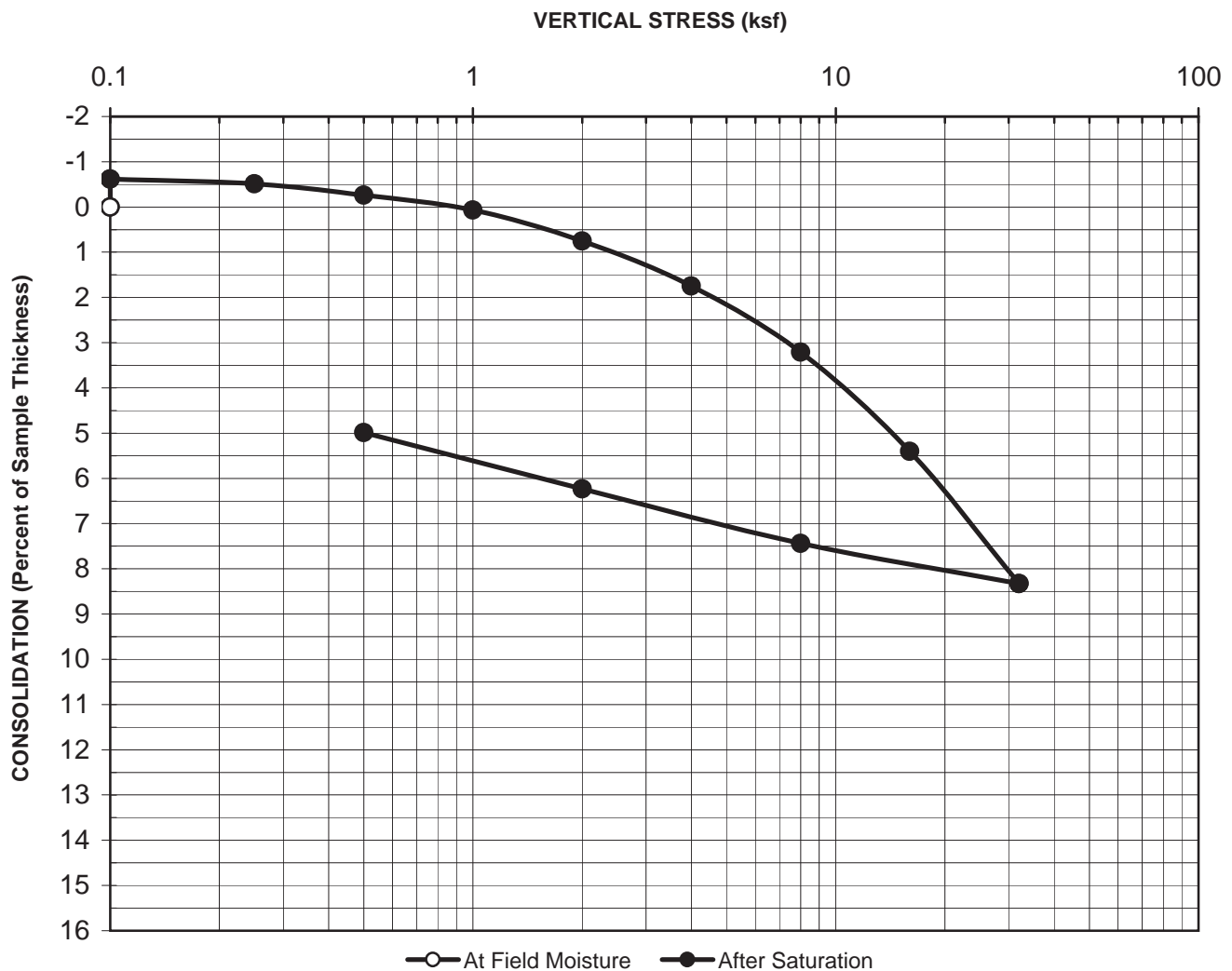
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t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-409Initial Dry Unit Weight (pcf): 106.3Sample No.: 21Initial Moisture Content (%): 19.9Depth (feet): 105Final Moisture Content (%): 20.9Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Silty SandInitial Void Ratio: 0.58Remarks: Swell = 0.02% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

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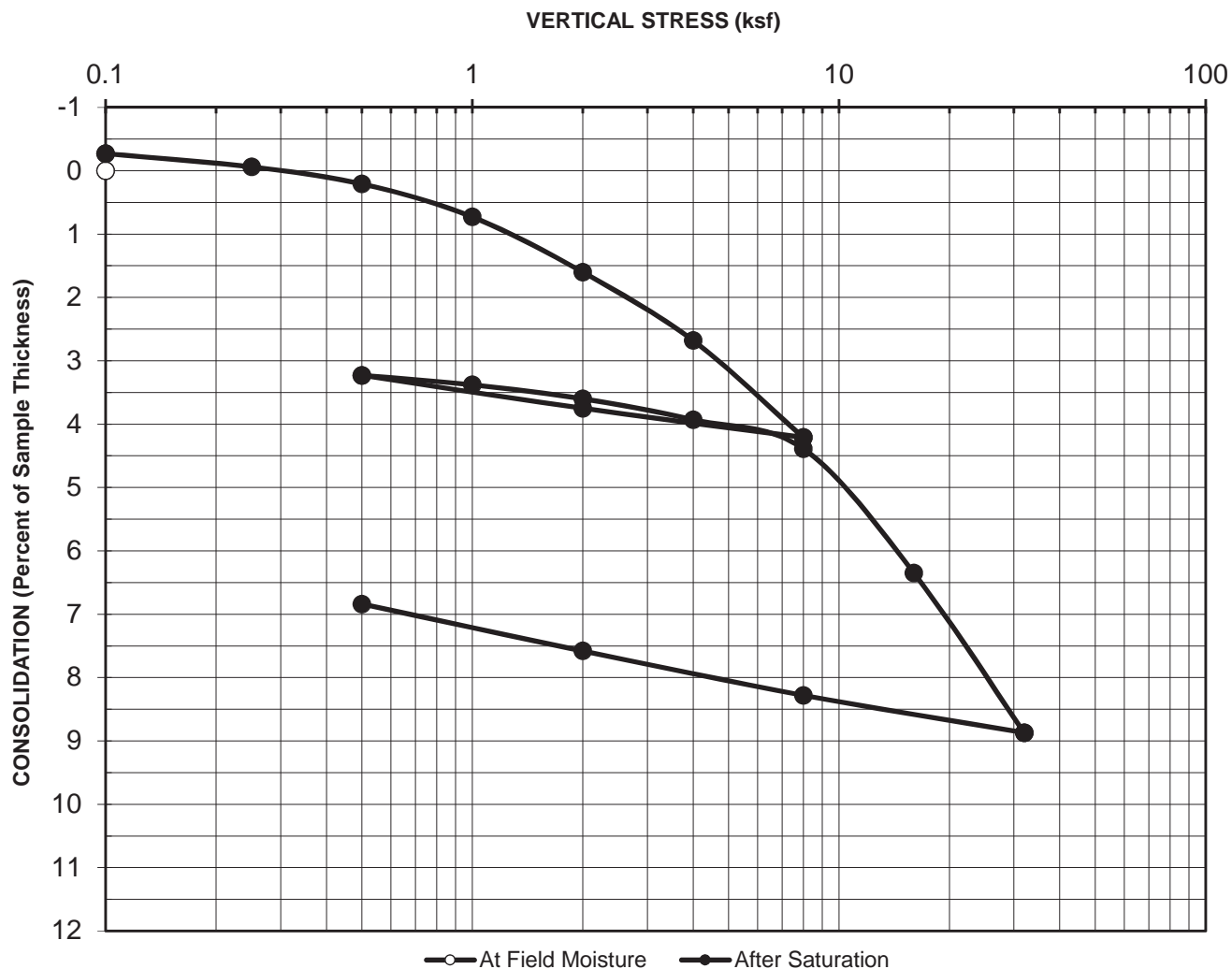
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t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-409Initial Dry Unit Weight (pcf): 108.3Sample No.: 31Initial Moisture Content (%): 18.1Depth (feet): 140.5Final Moisture Content (%): 20.2Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Sandy ClayInitial Void Ratio: 0.56Remarks: Swell = 0.62% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

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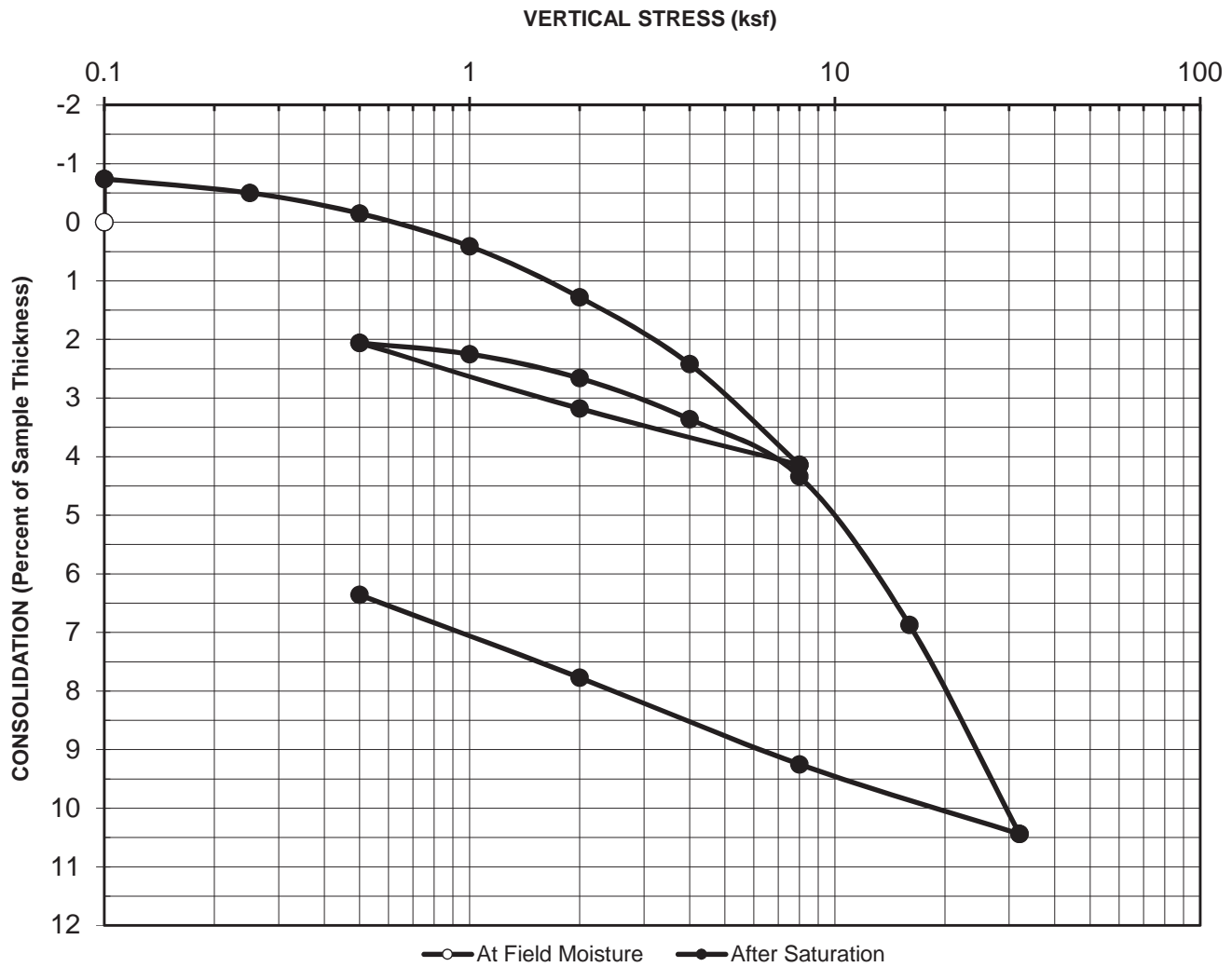
2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-410Initial Dry Unit Weight (pcf): 118.1Sample No.: 32Initial Moisture Content (%): 13.3Depth (feet): 139.5Final Moisture Content (%): 13.9Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Sandy Lean ClayInitial Void Ratio: 0.43Remarks: Swell = 0.27% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 12/1/2015AP No: 15-1163

**AP Engineering and Testing, Inc.**

DBE | MBE | SBE

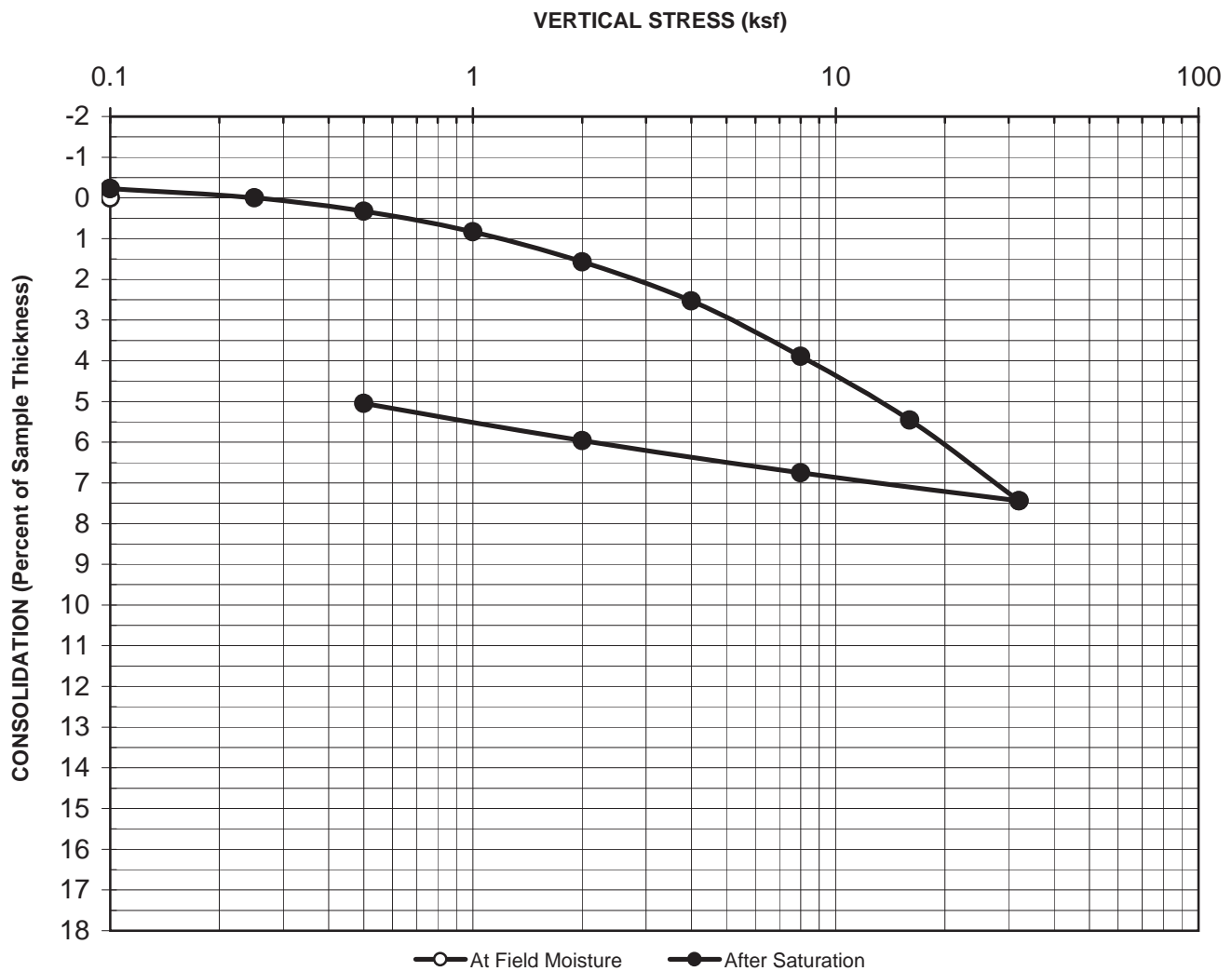
2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-410Initial Dry Unit Weight (pcf): 107.4Sample No.: 34Initial Moisture Content (%): 21.3Depth (feet): 149.5Final Moisture Content (%): 20.2Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Sandy Lean ClayInitial Void Ratio: 0.57Remarks: Swell = 0.74% upon inundation**CONSOLIDATION CURVE
ASTM D 2435****Project Name:** Westside Purple Line Extension**Project No.:** 4953-11-1423**Date:** 12/1/2015**AP No:** 15-1163

**AP Engineering and Testing, Inc.**

DBE | MBE | SBE

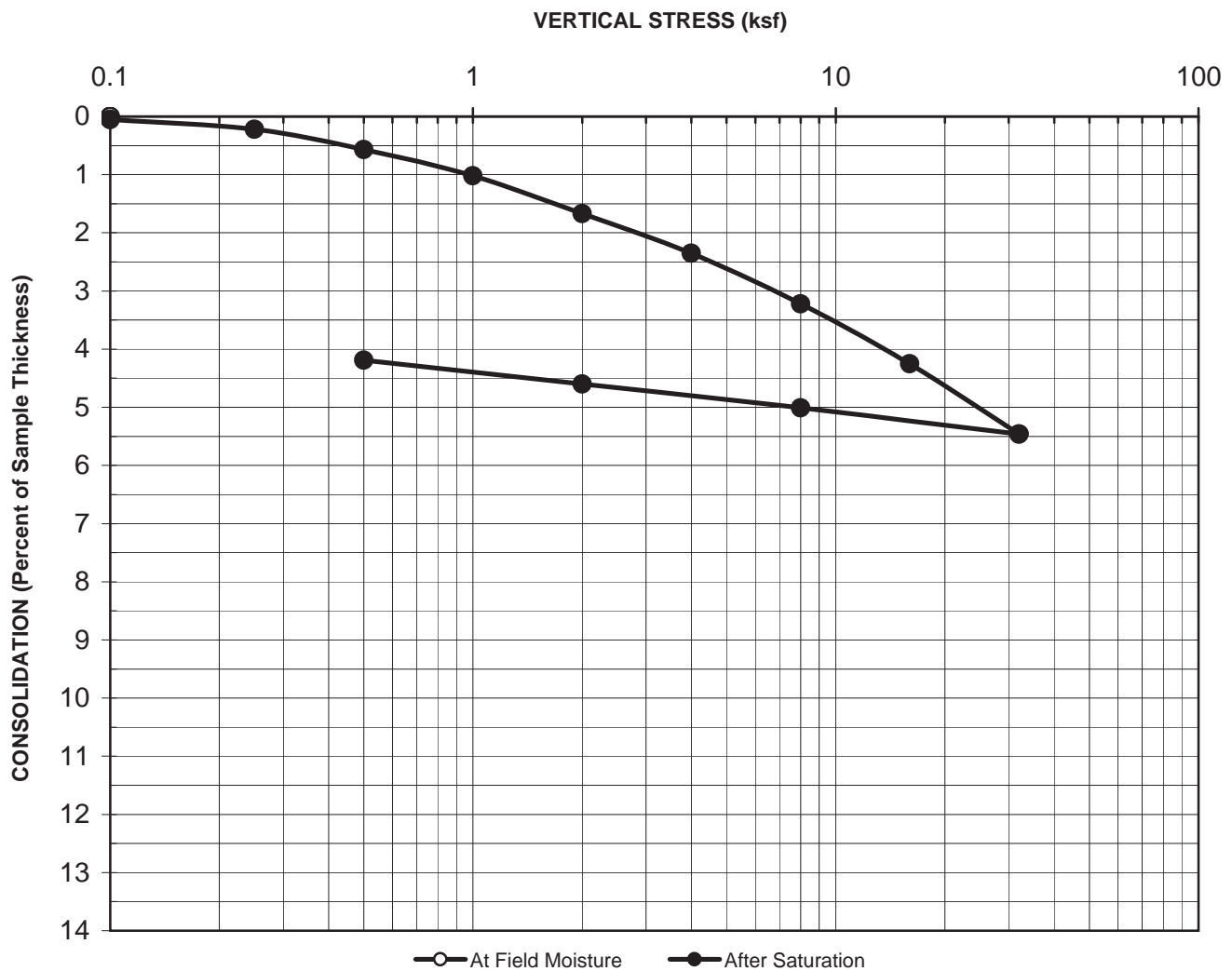
2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-411Initial Dry Unit Weight (pcf): 113.7Sample No.: 5Initial Moisture Content (%): 13.0Depth (feet): 68.5Final Moisture Content (%): 17.6Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Silty SandInitial Void Ratio: 0.48Remarks: Swell = 0.23% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

**AP Engineering and Testing, Inc.**

DBE | MBE | SBE

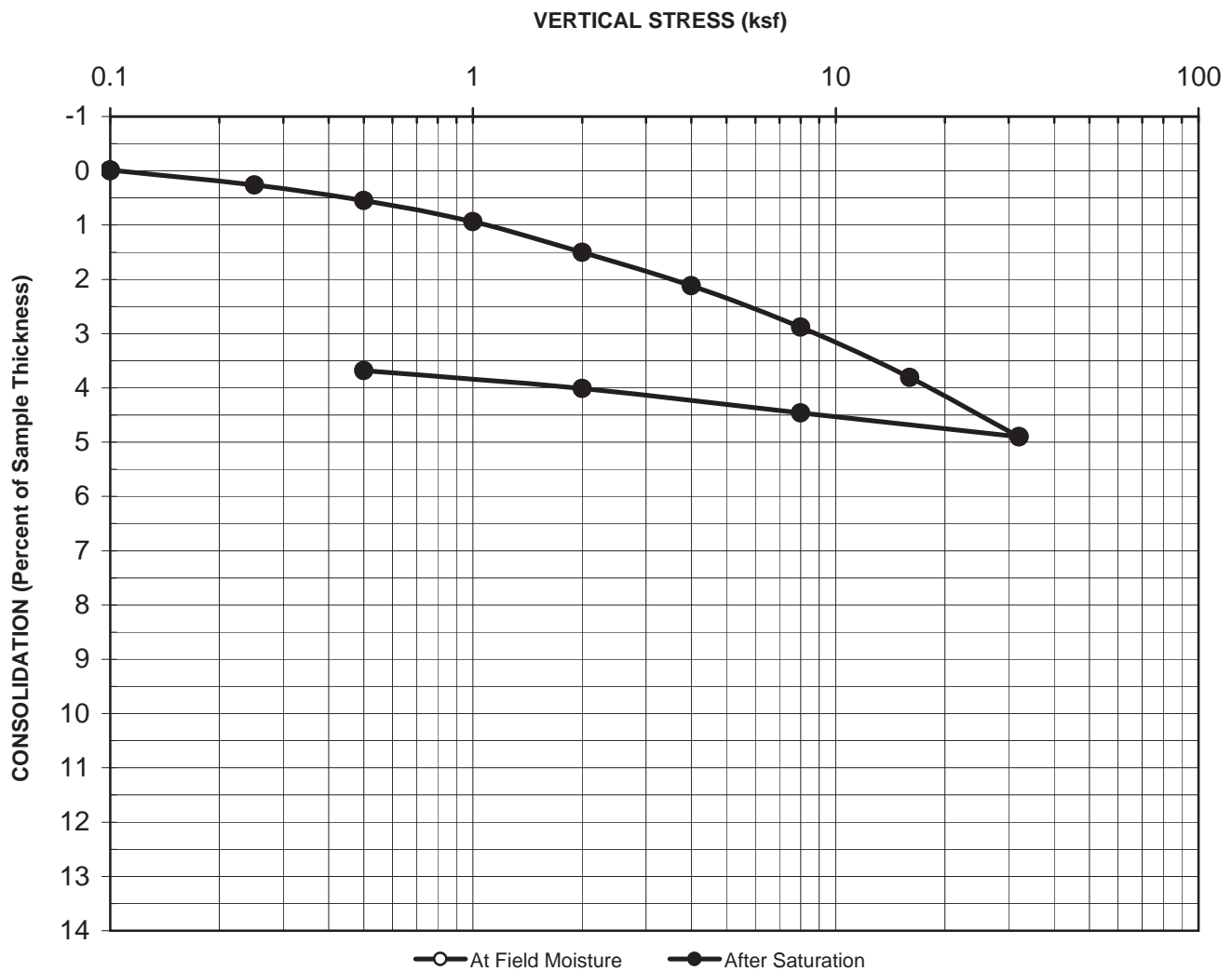
2607 Pomona Boulevard | Pomona, CA 91768

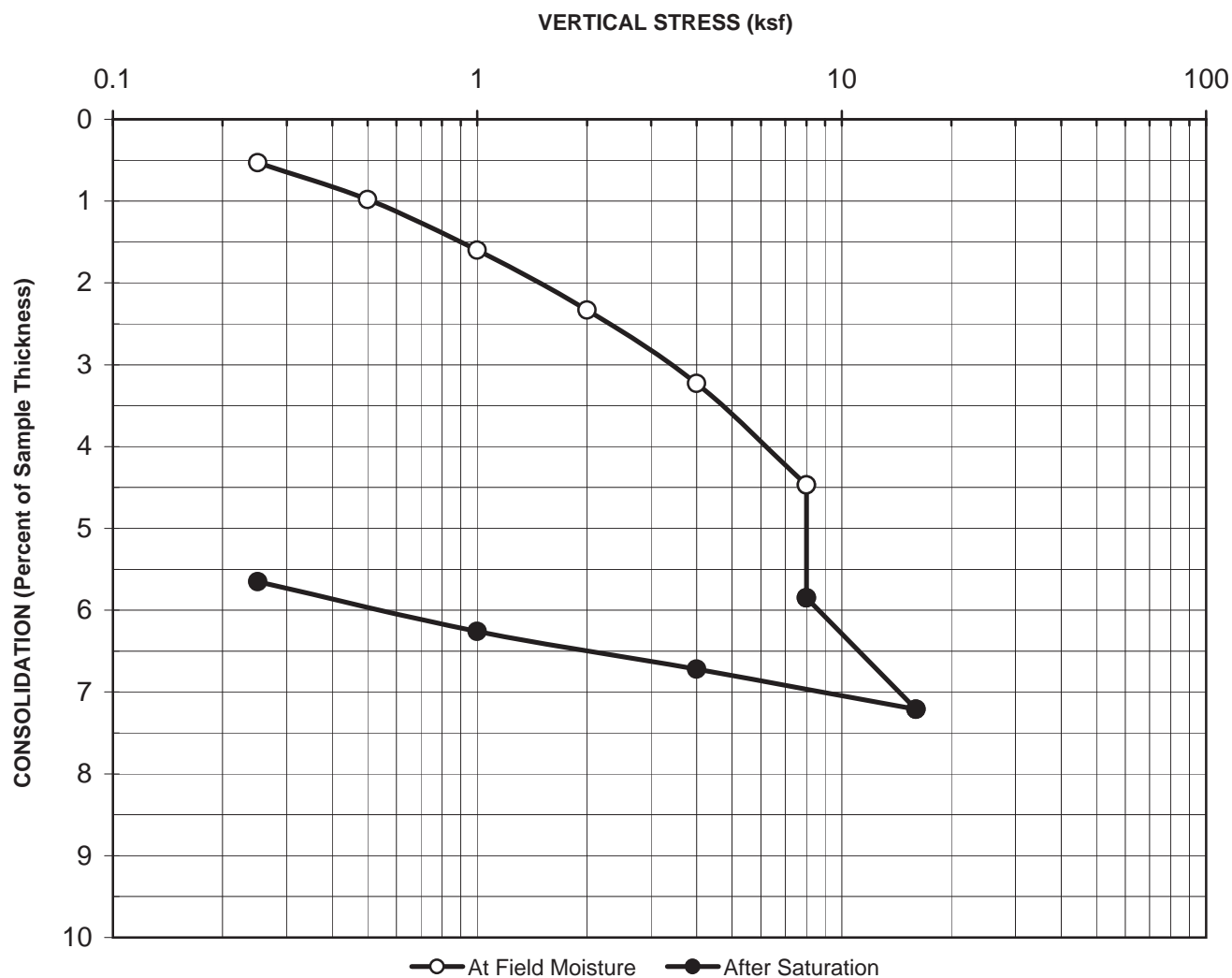
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-411Initial Dry Unit Weight (pcf): 109.6Sample No.: 9Initial Moisture Content (%): 15.4Depth (feet): 84.5Final Moisture Content (%): 17.6Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Silty SandInitial Void Ratio: 0.54Remarks: Collapse= 0.05% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041

**AP Engineering and Testing, Inc.**

DBE | MBE | SBE

2607 Pomona Boulevard | Pomona, CA 91768

t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : G-411Initial Dry Unit Weight (pcf): 103.5Sample No.: 14Initial Moisture Content (%): 21.5Depth (feet): 99.5Final Moisture Content (%): 24.3Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Clayey SandInitial Void Ratio: 0.63Remarks: Swell = 0.01% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 10/22/2015AP No: 15-1041



Boring No. : G-412

Initial Dry Unit Weight (pcf): 84.3

Sample No.: 19

Initial Moisture Content (%): 7.9

Depth (feet): 68

Final Moisture Content (%): 29.0

Sample Type: Mod Cal

Assumed Specific Gravity: 2.7

Soil Description: Silty Sand

Initial Void Ratio: 1.00

Remarks: Collapse= 1.38% upon inundation

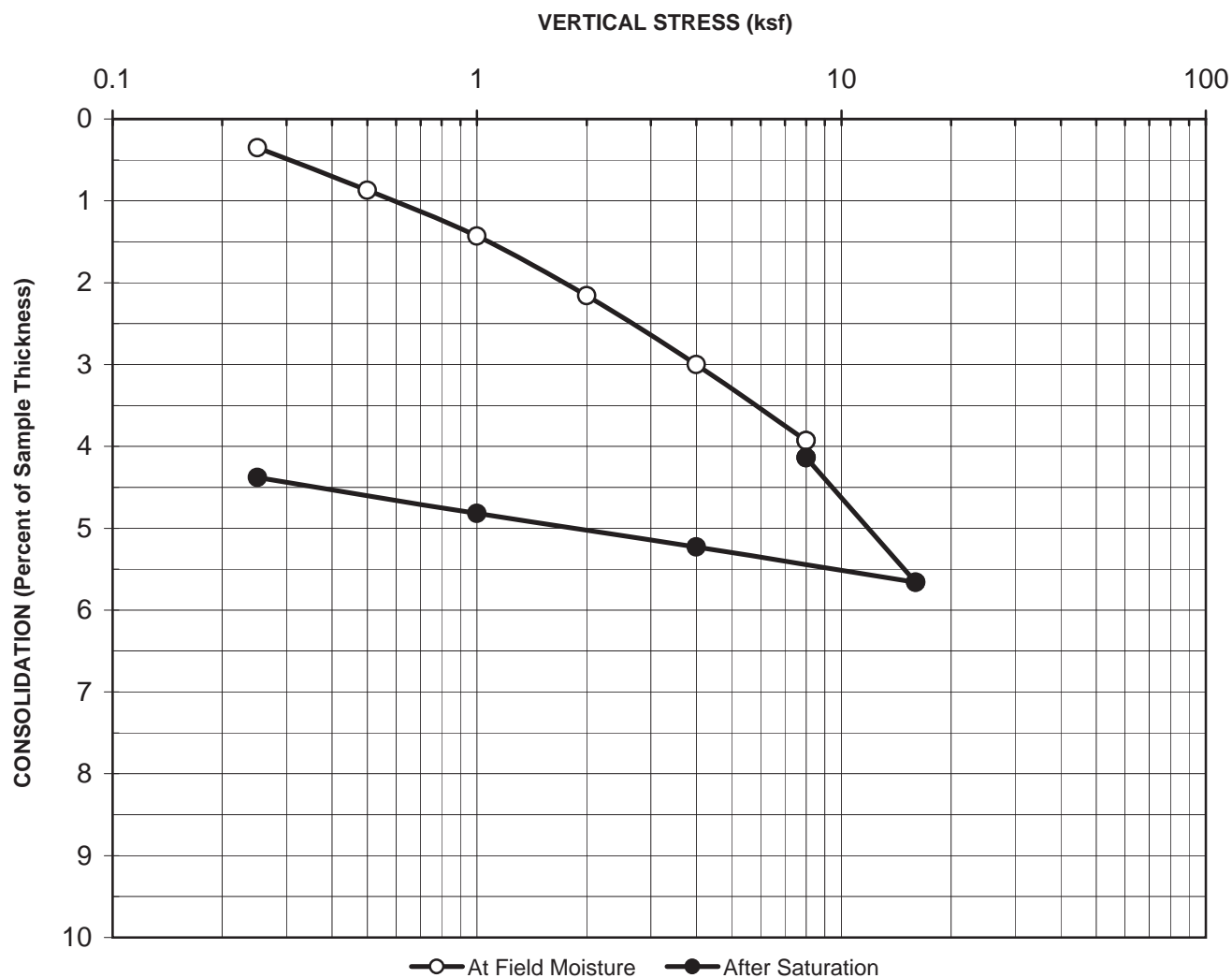
**CONSOLIDATION CURVE
ASTM D 2435**

Project Name: Westside Subway Extension

Project No.: 4953-11-1423

Date: 4/18/2015

AP No: 15-0361



Boring No. : G-412

Initial Dry Unit Weight (pcf): 98.8

Sample No.: 25

Initial Moisture Content (%): 4.1

Depth (feet): 83

Final Moisture Content (%): 19.9

Sample Type: Mod Cal

Assumed Specific Gravity: 2.7

Soil Description: Poorly-Graded Sand w/silt

Initial Void Ratio: 0.71

Remarks: Collapse= 0.21% upon inundation

**CONSOLIDATION CURVE
ASTM D 2435**

Project Name: Westside Subway Extension

Project No.: 4953-11-1423

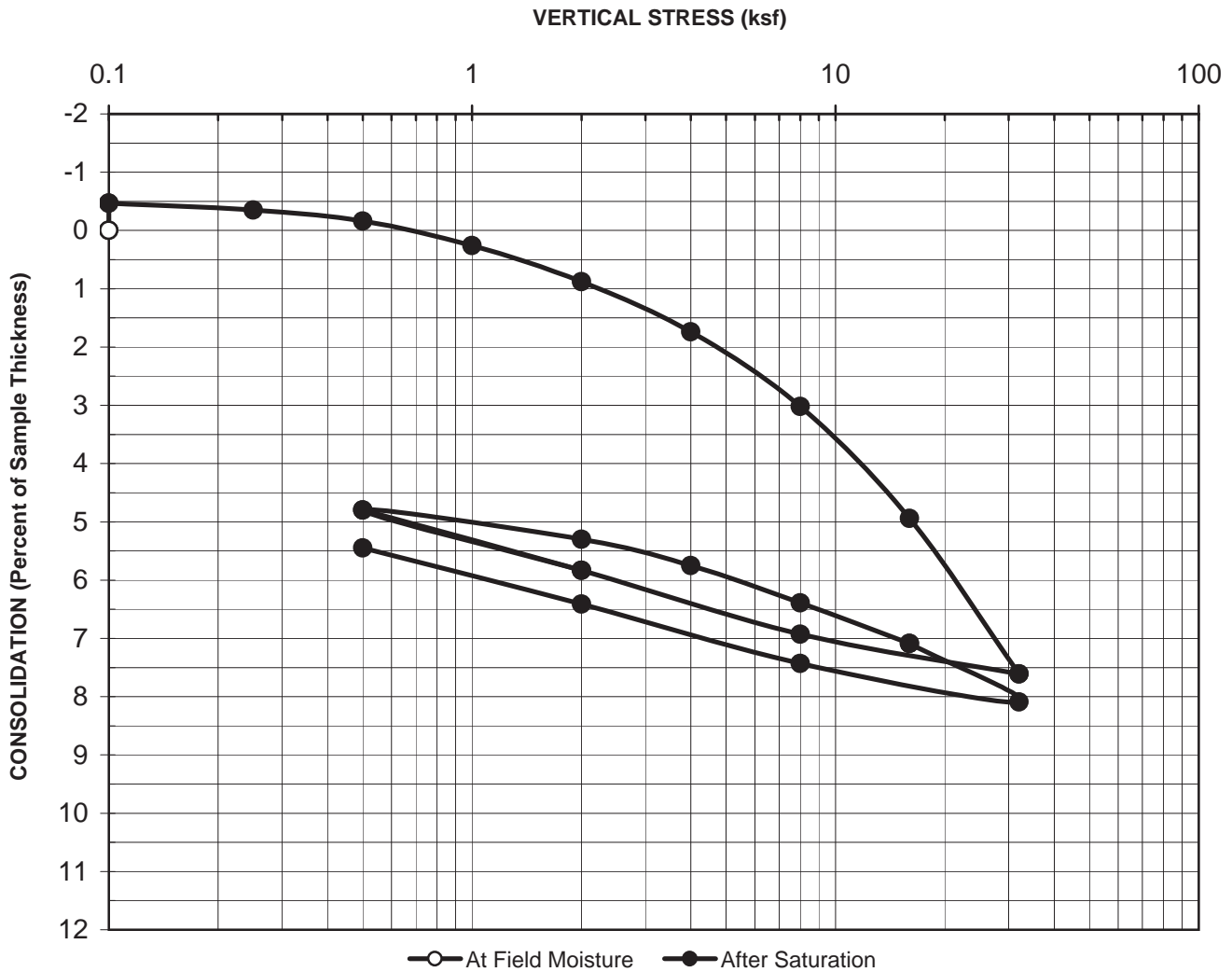
Date: 4/18/2015

AP No: 15-0361

**AP Engineering and Testing, Inc.**

DBE | MBE | SBE

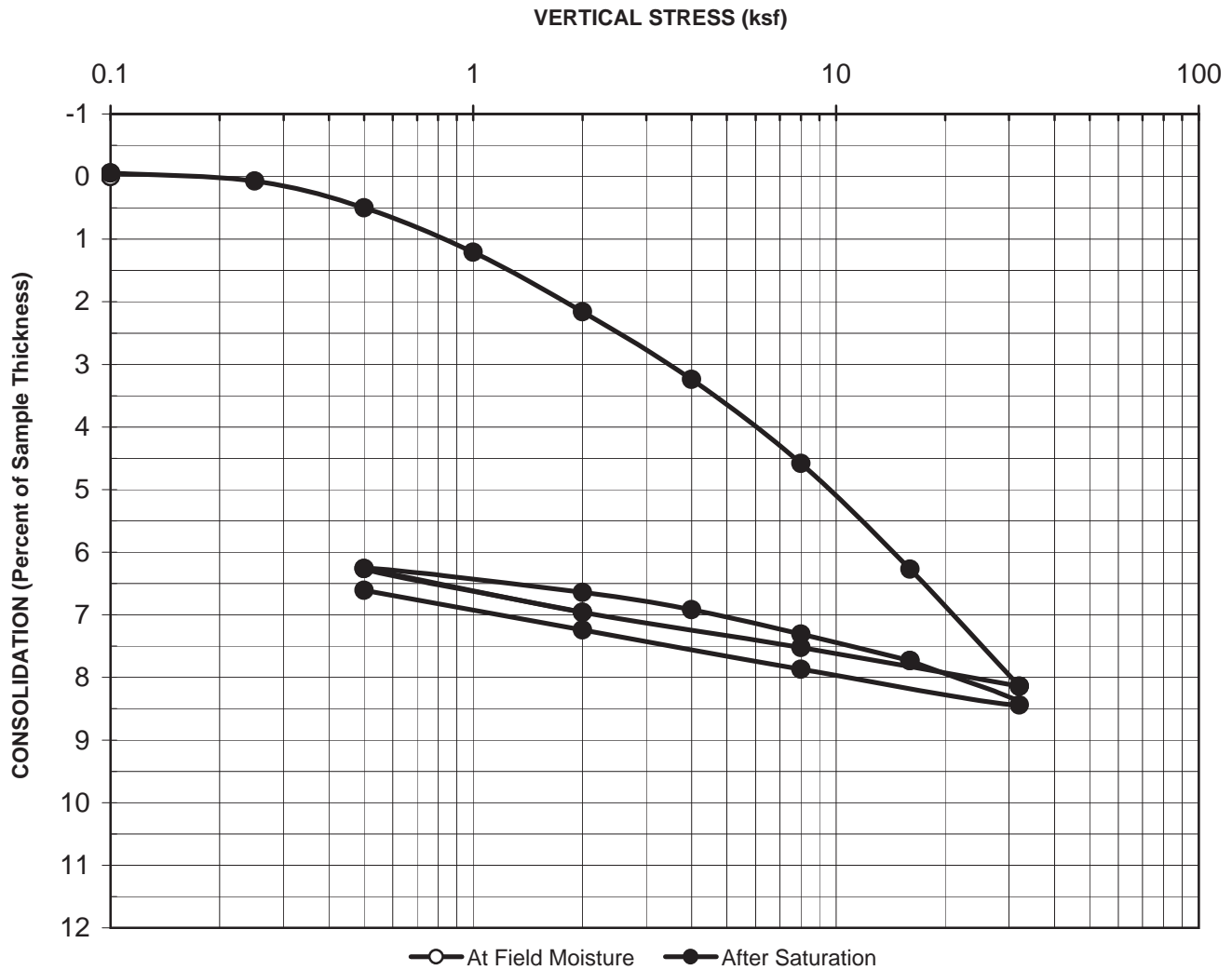
2607 Pomona Boulevard | Pomona, CA 91768

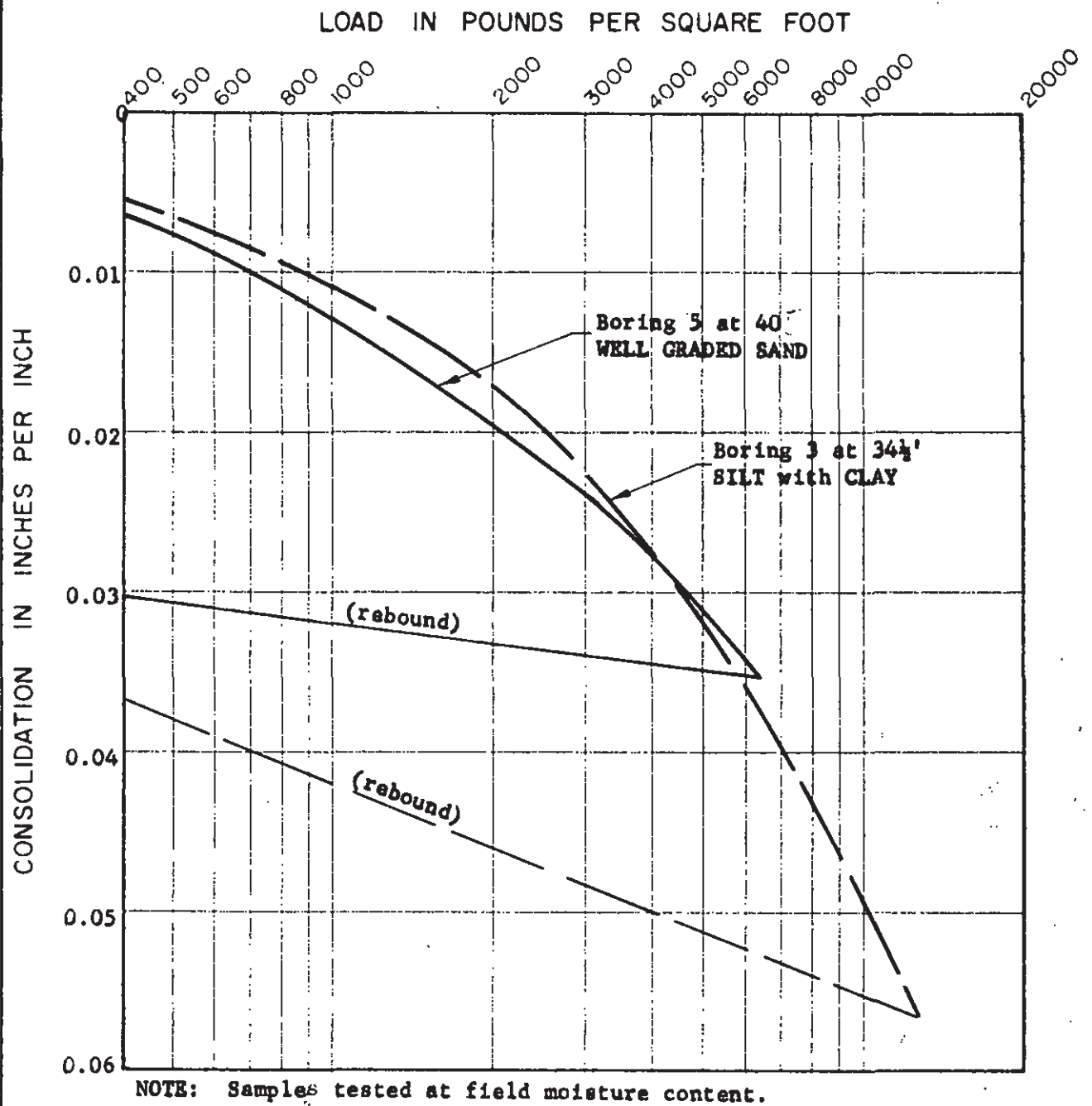
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : M-402Initial Dry Unit Weight (pcf): 109.8Sample No.: 17Initial Moisture Content (%): 17.6Depth (feet): 79.5Final Moisture Content (%): 18.5Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Lean Clay w/sandInitial Void Ratio: 0.53Remarks: Swell = 0.47% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 11/3/2015AP No: 15-1068

**AP Engineering and Testing, Inc.**

DBE|MBE|SBE

2607 Pomona Boulevard | Pomona, CA 91768

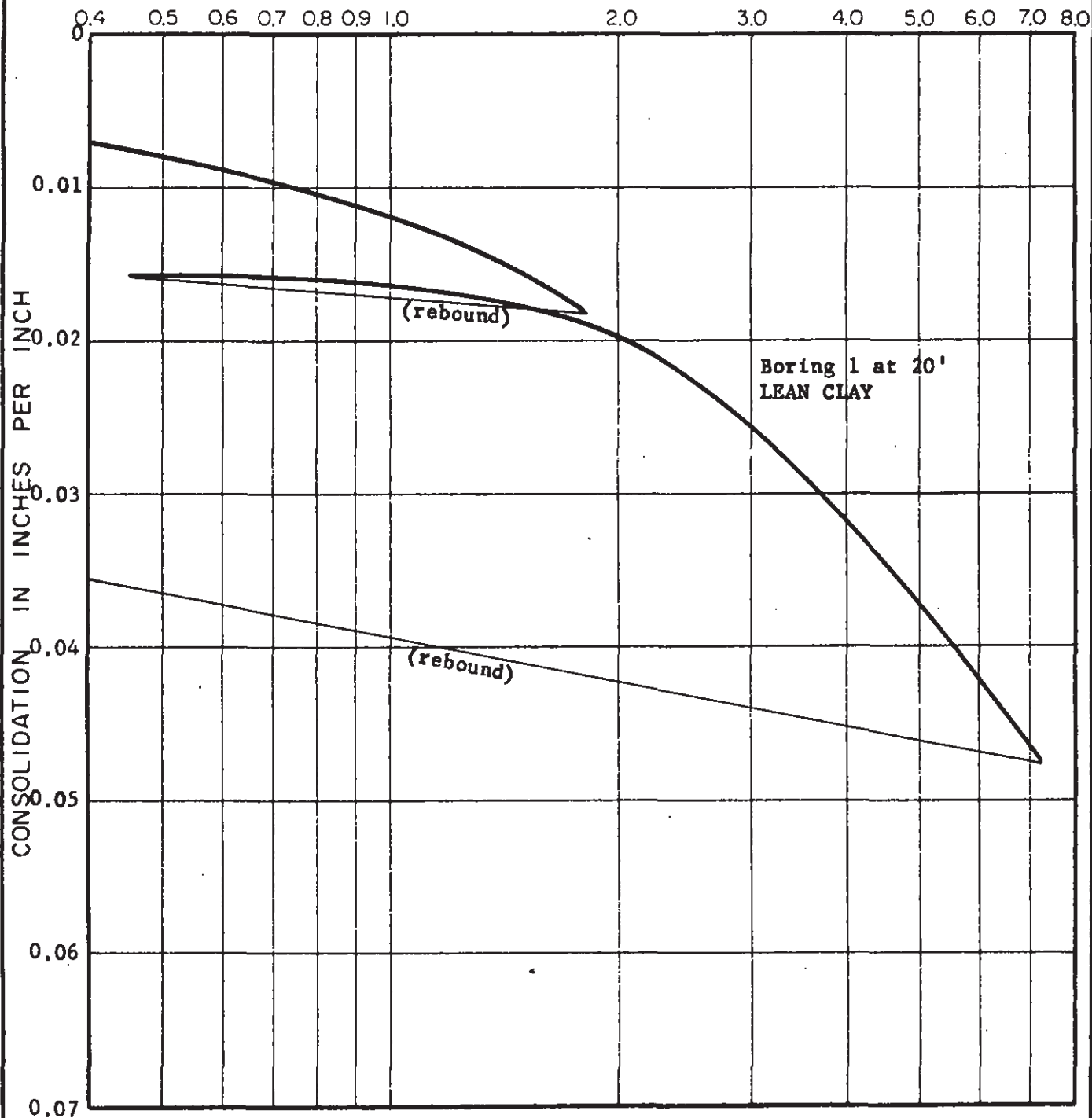
t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.comBoring No. : M-402Initial Dry Unit Weight (pcf): 112.8Sample No.: 29Initial Moisture Content (%): 18.1Depth (feet): 119.5Final Moisture Content (%): 18.5Sample Type: Mod CalAssumed Specific Gravity: 2.7Soil Description: Clayey SandInitial Void Ratio: 0.49Remarks: Swell = 0.06% upon inundation**CONSOLIDATION CURVE
ASTM D 2435**Project Name: Westside Purple Line ExtensionProject No.: 4953-11-1423Date: 11/3/2015AP No: 15-1068



CONSOLIDATION TEST DATA

JOB 61276 DATE 6/27/61 BY [signature]

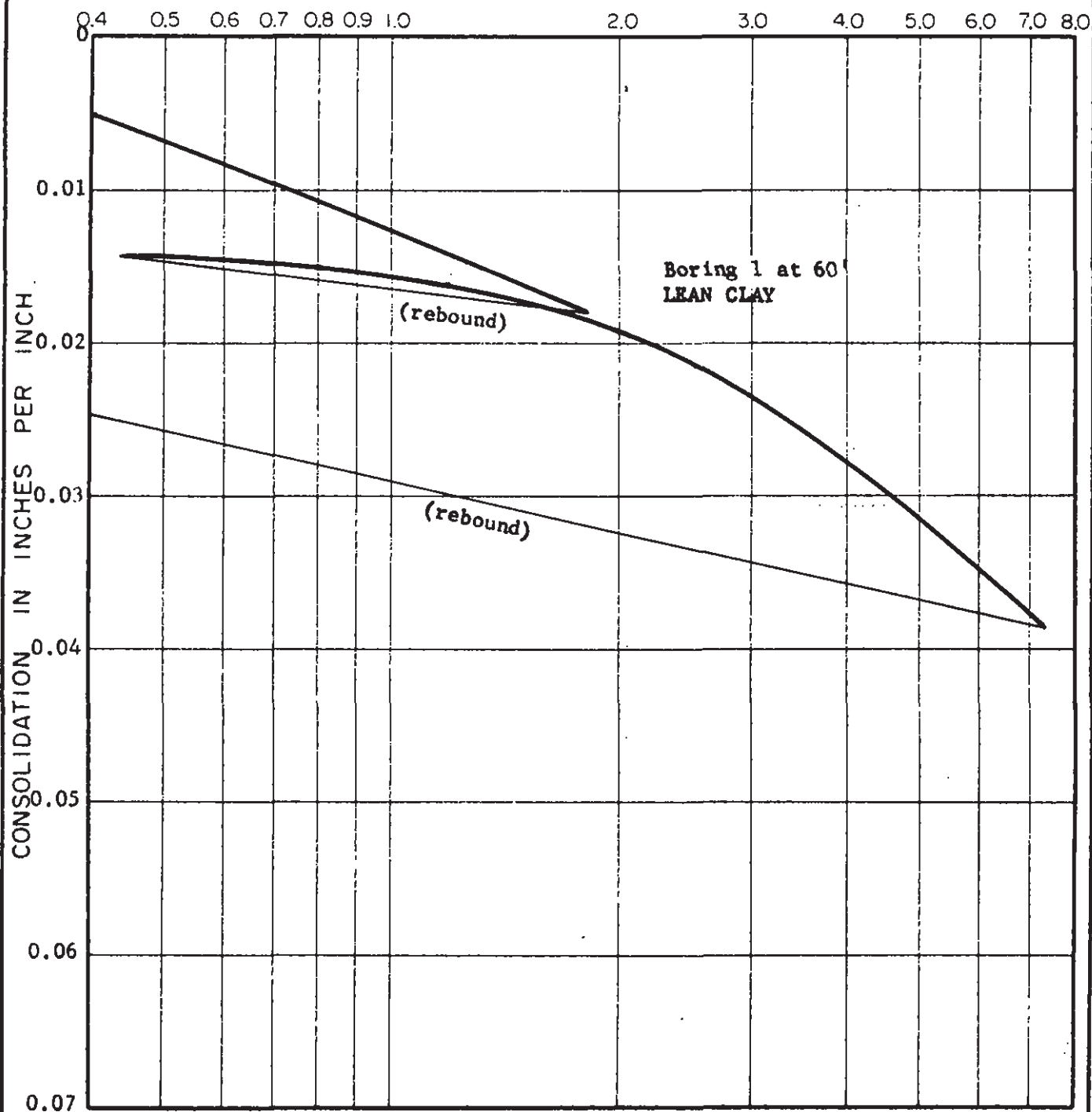
LOAD IN KIPS PER SQUARE FOOT



NOTE: Tested at field moisture content.

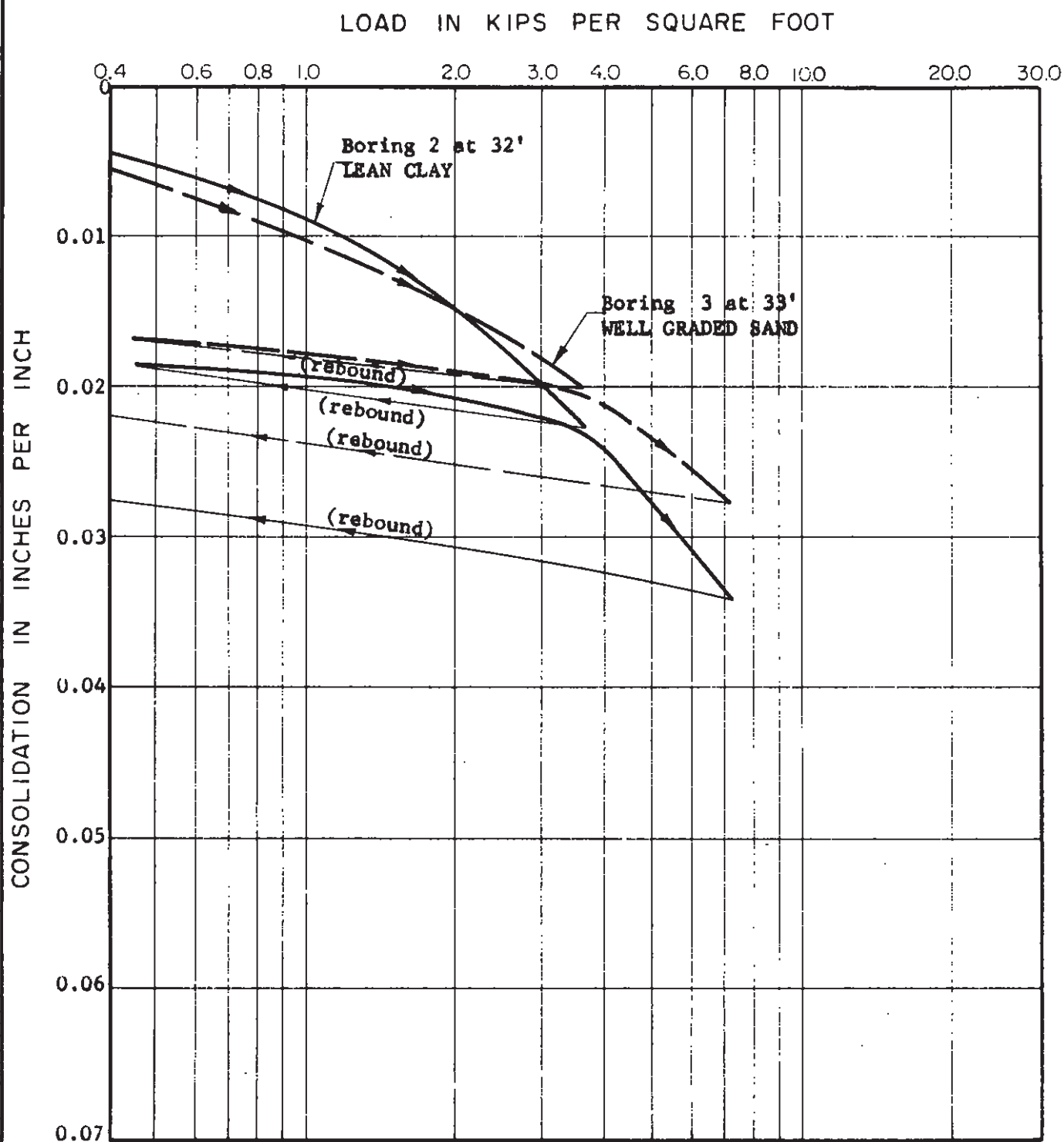
CONSOLIDATION TEST DATA

LOAD IN KIPS PER SQUARE FOOT



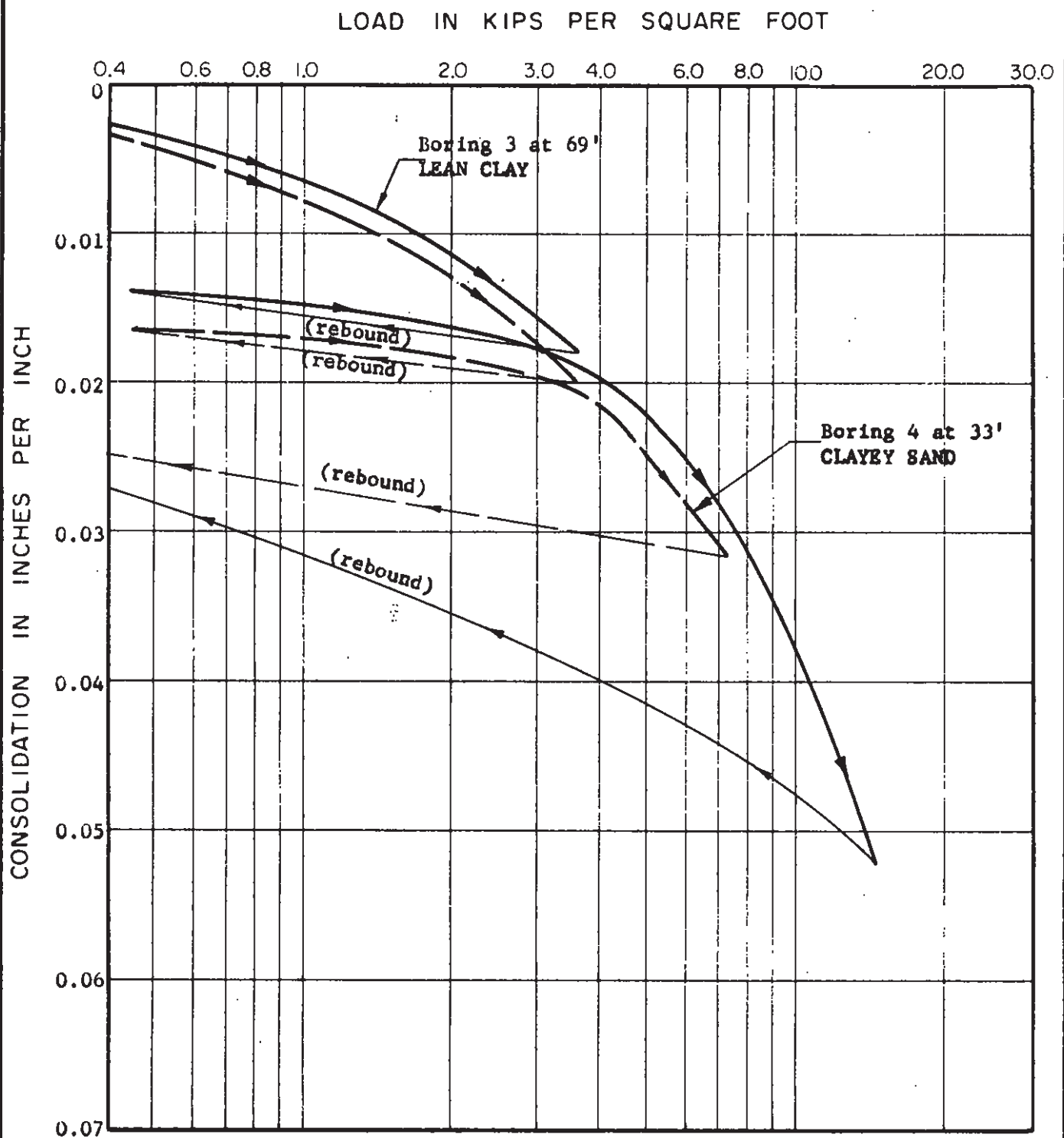
Note: Tested at field moisture content.

CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

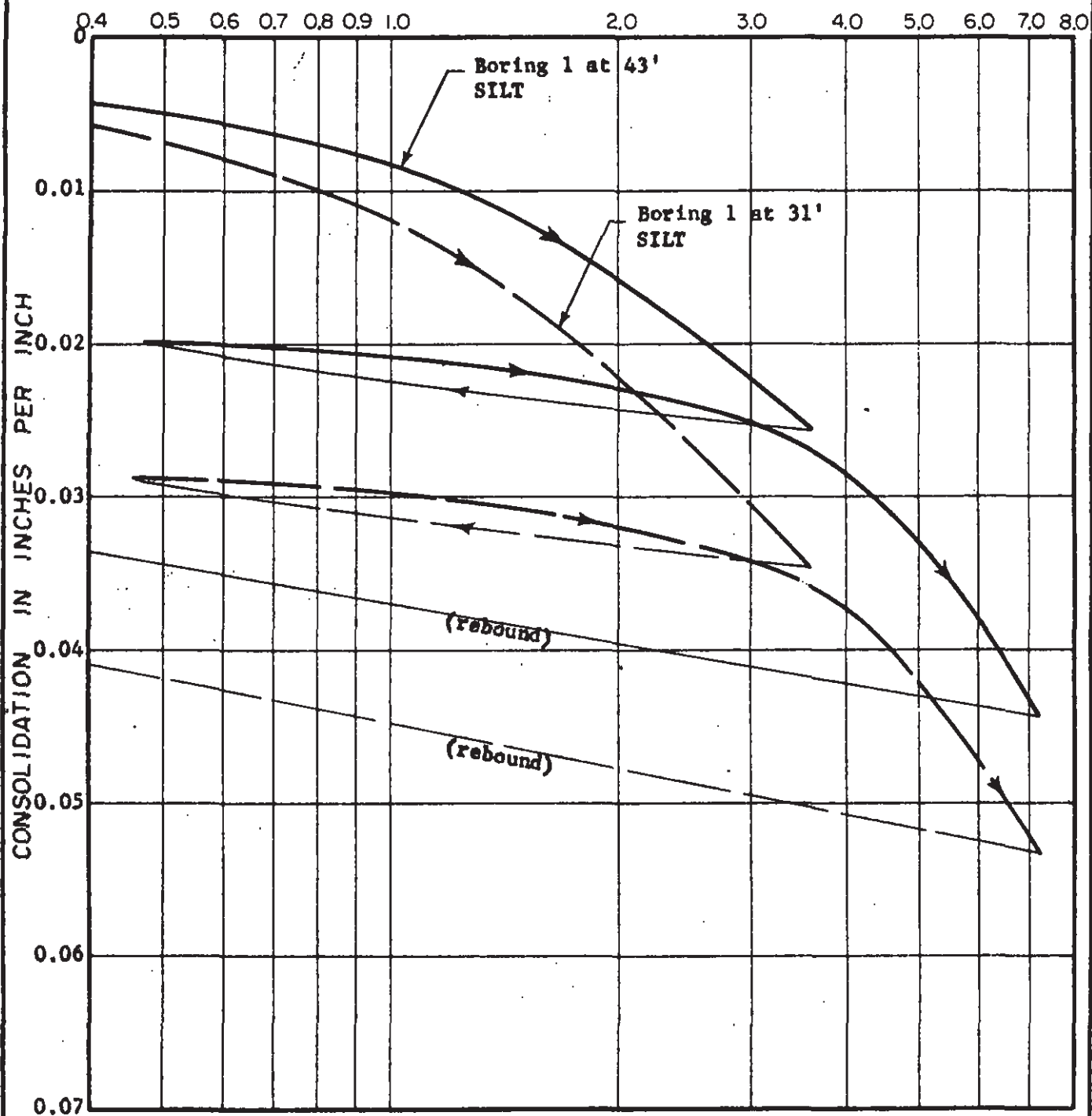
CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

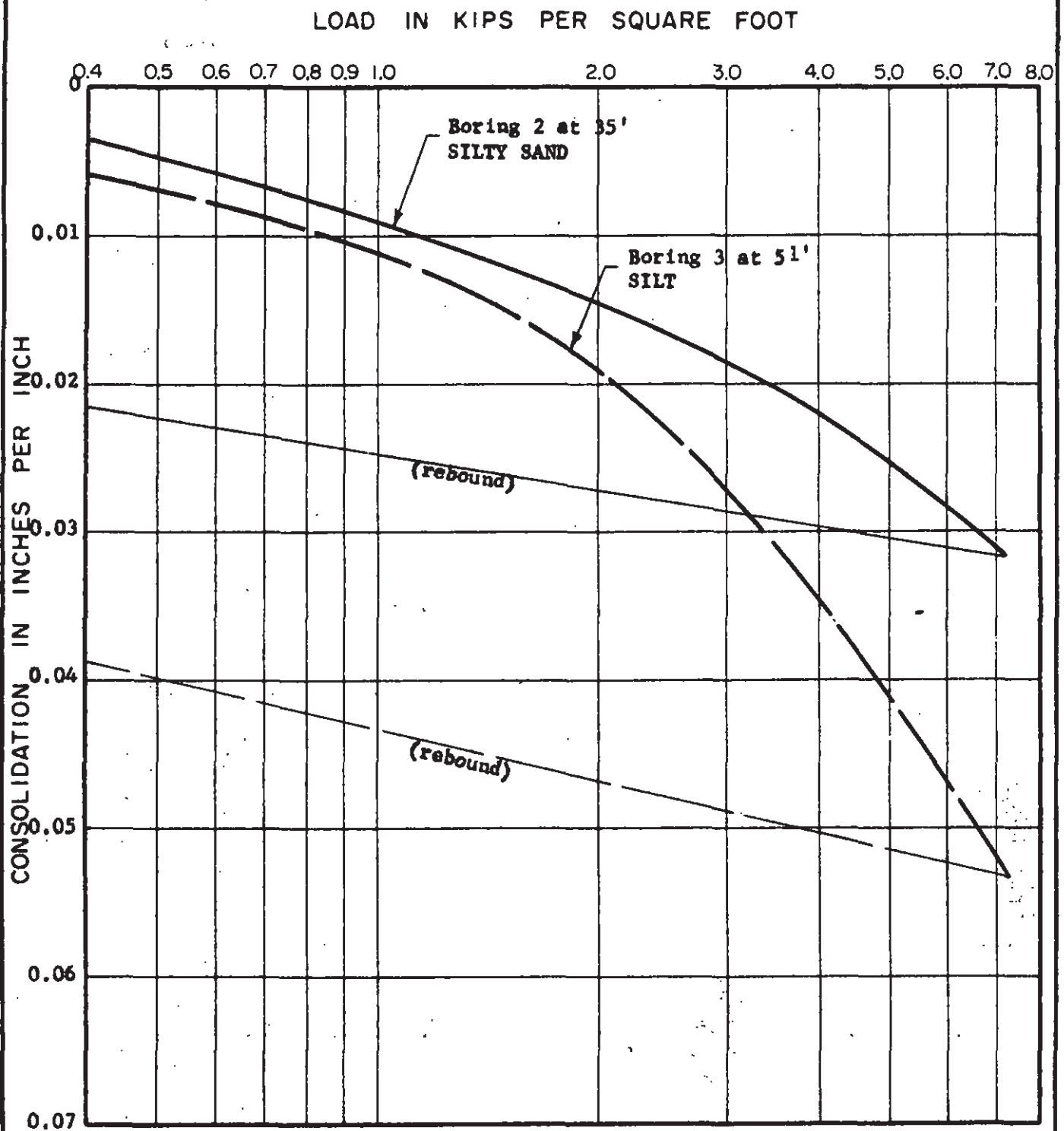
LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

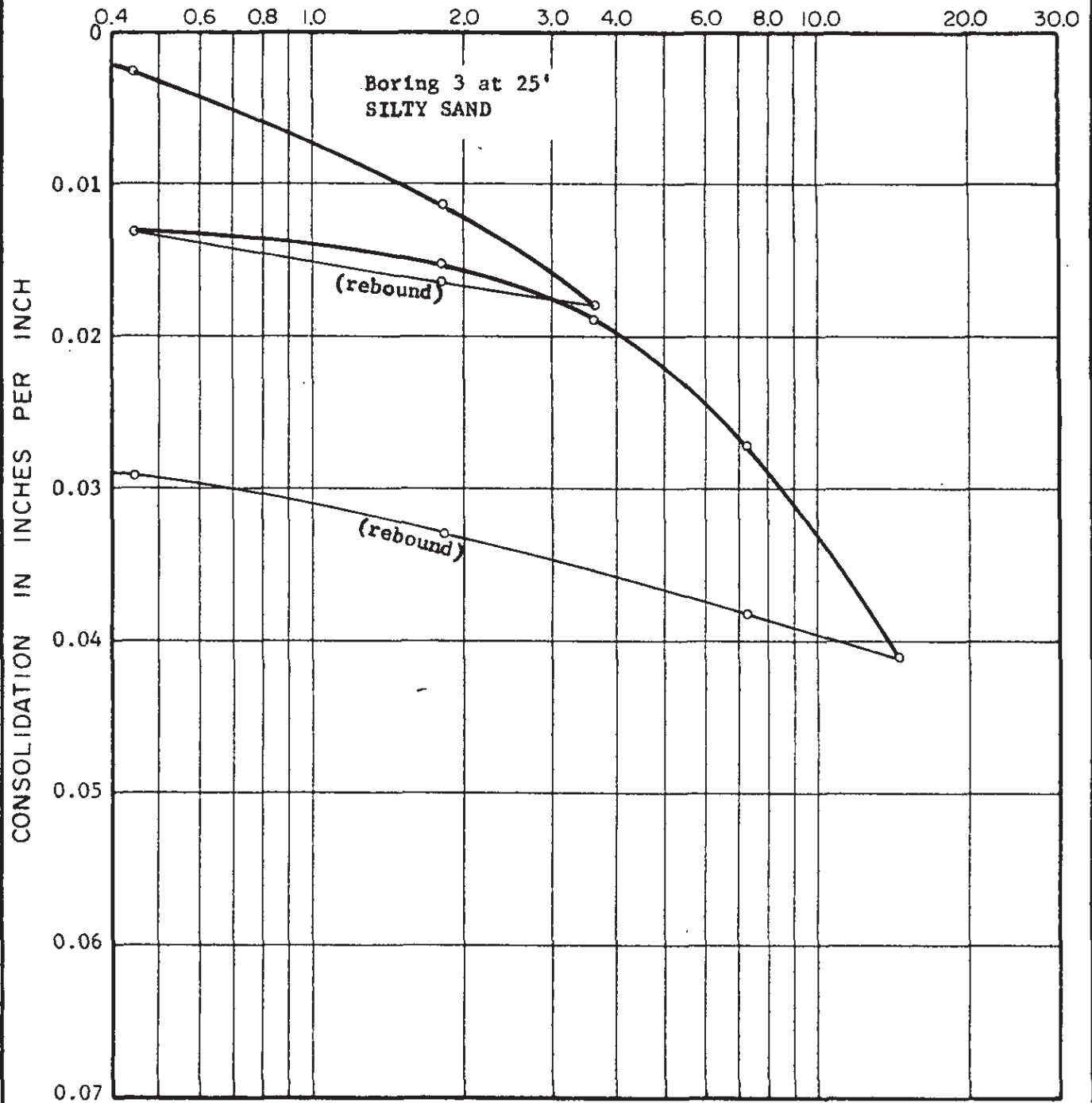
JOB 62464
DATE 8-29-62
BY TJS



NOTE: Samples tested at field moisture content.

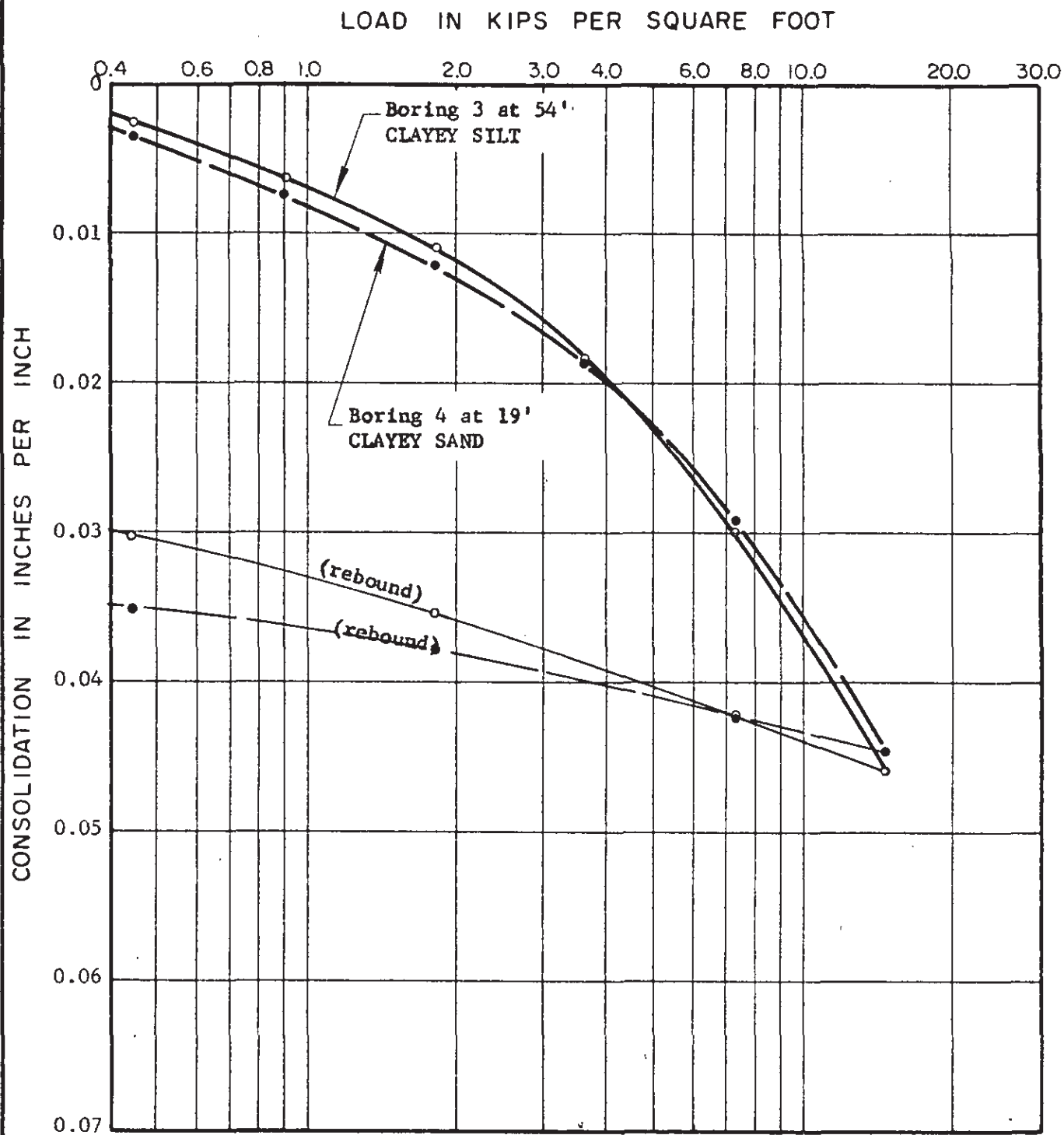
CONSOLIDATION TEST DATA

LOAD IN KIPS PER SQUARE FOOT



NOTE: Sample tested at field moisture content.

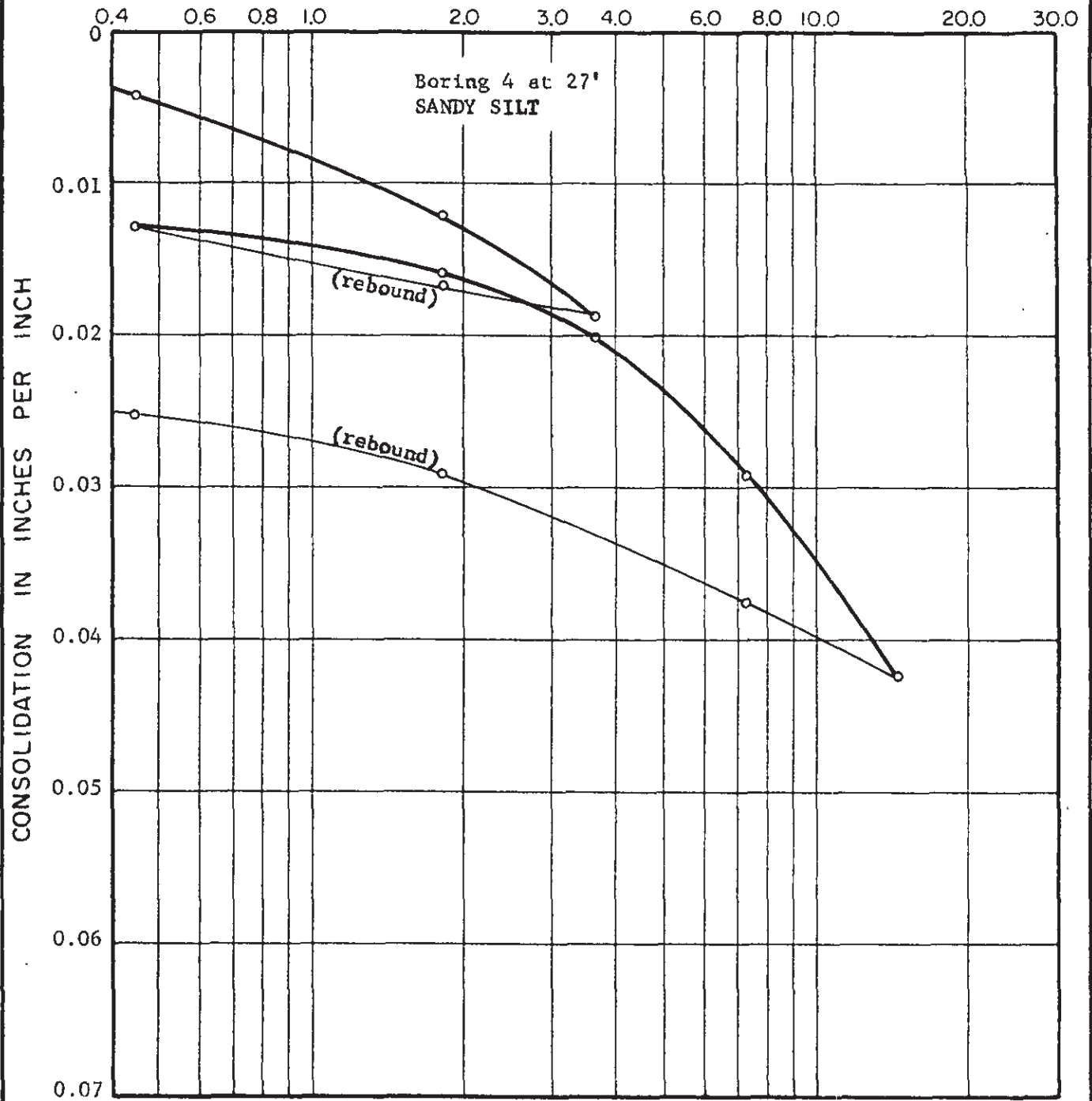
CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

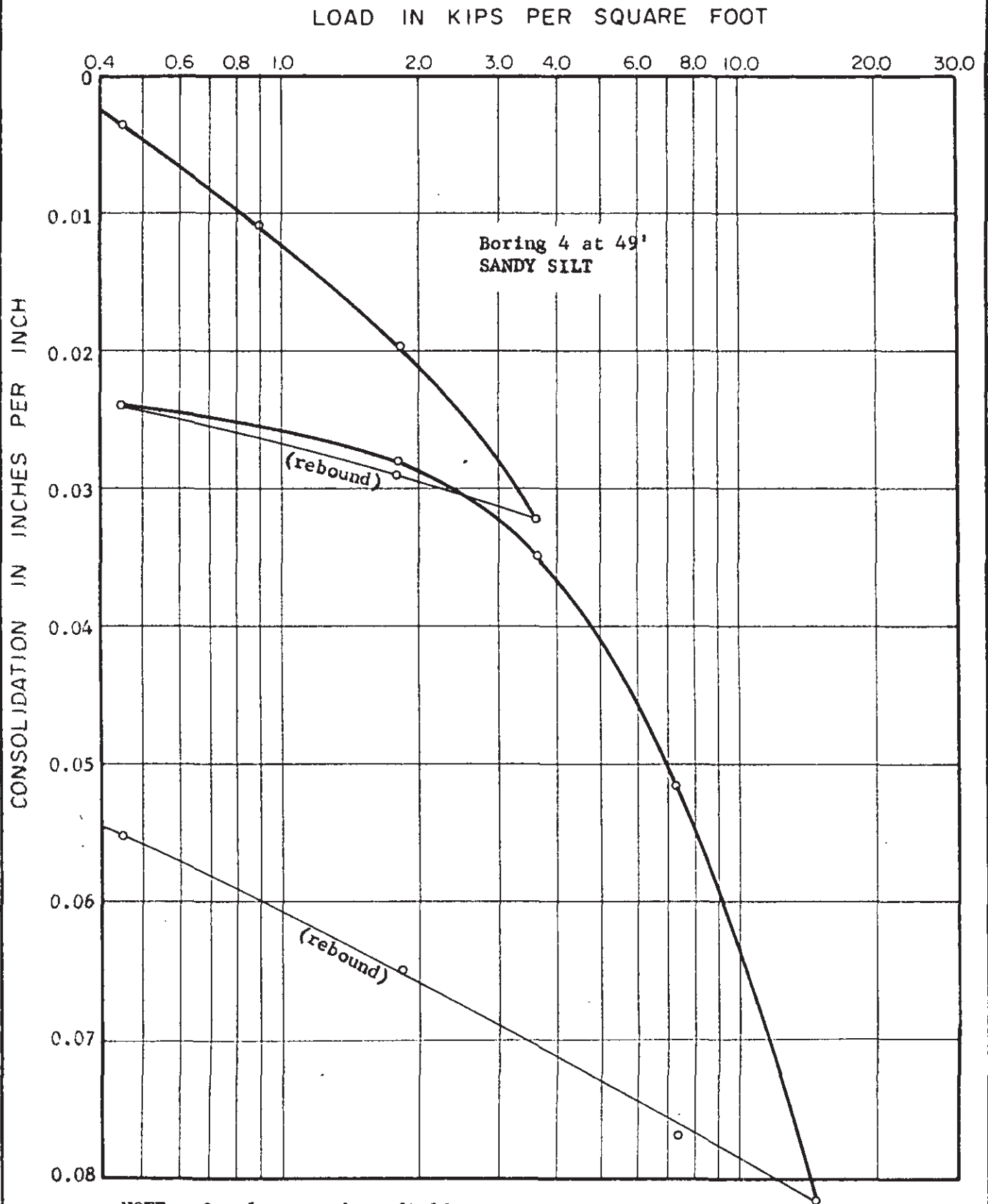
CONSOLIDATION TEST DATA

LOAD IN KIPS PER SQUARE FOOT



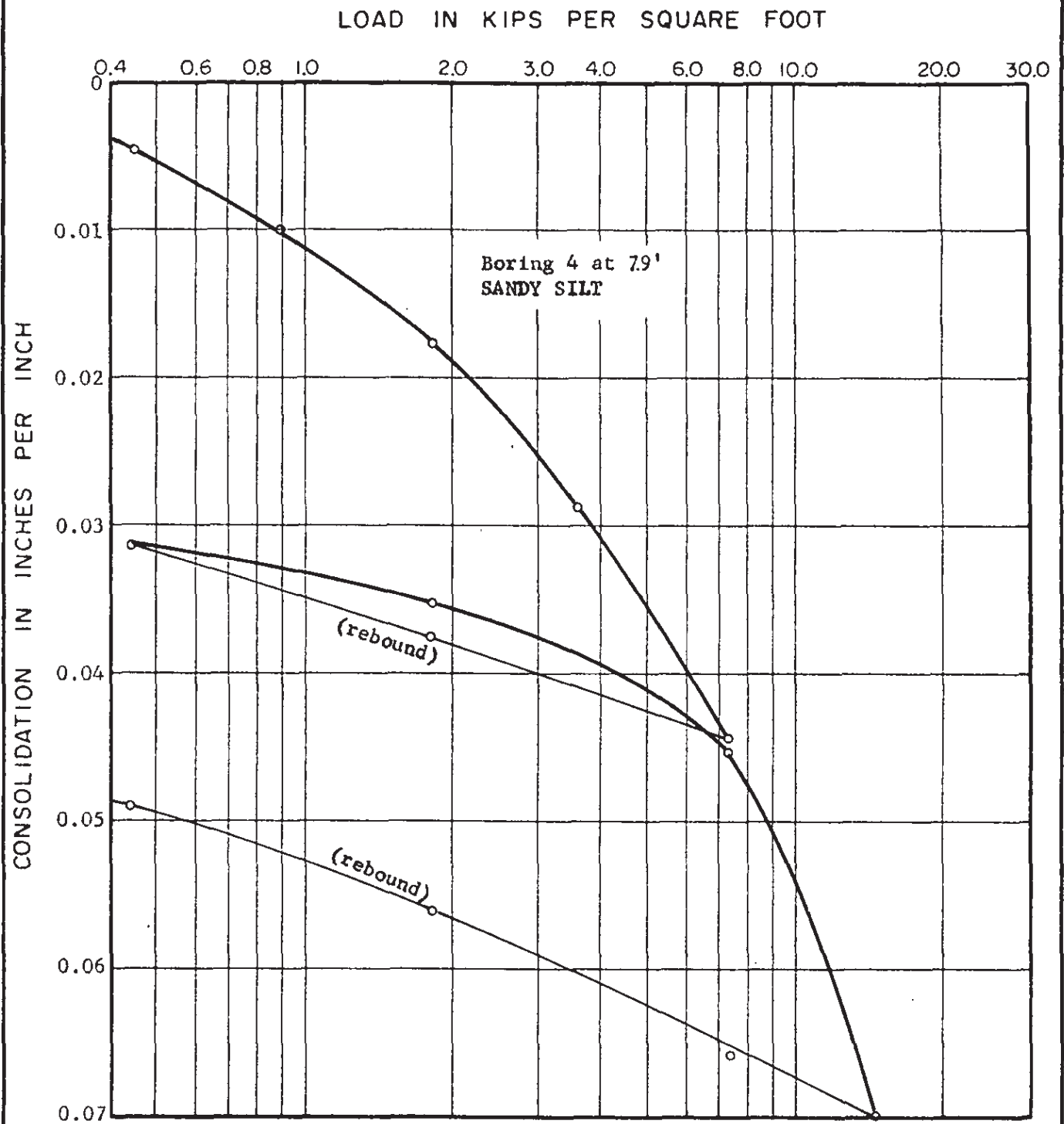
NOTE: Sample tested at field moisture content.

CONSOLIDATION TEST DATA



NOTE: Sample tested at field moisture content.

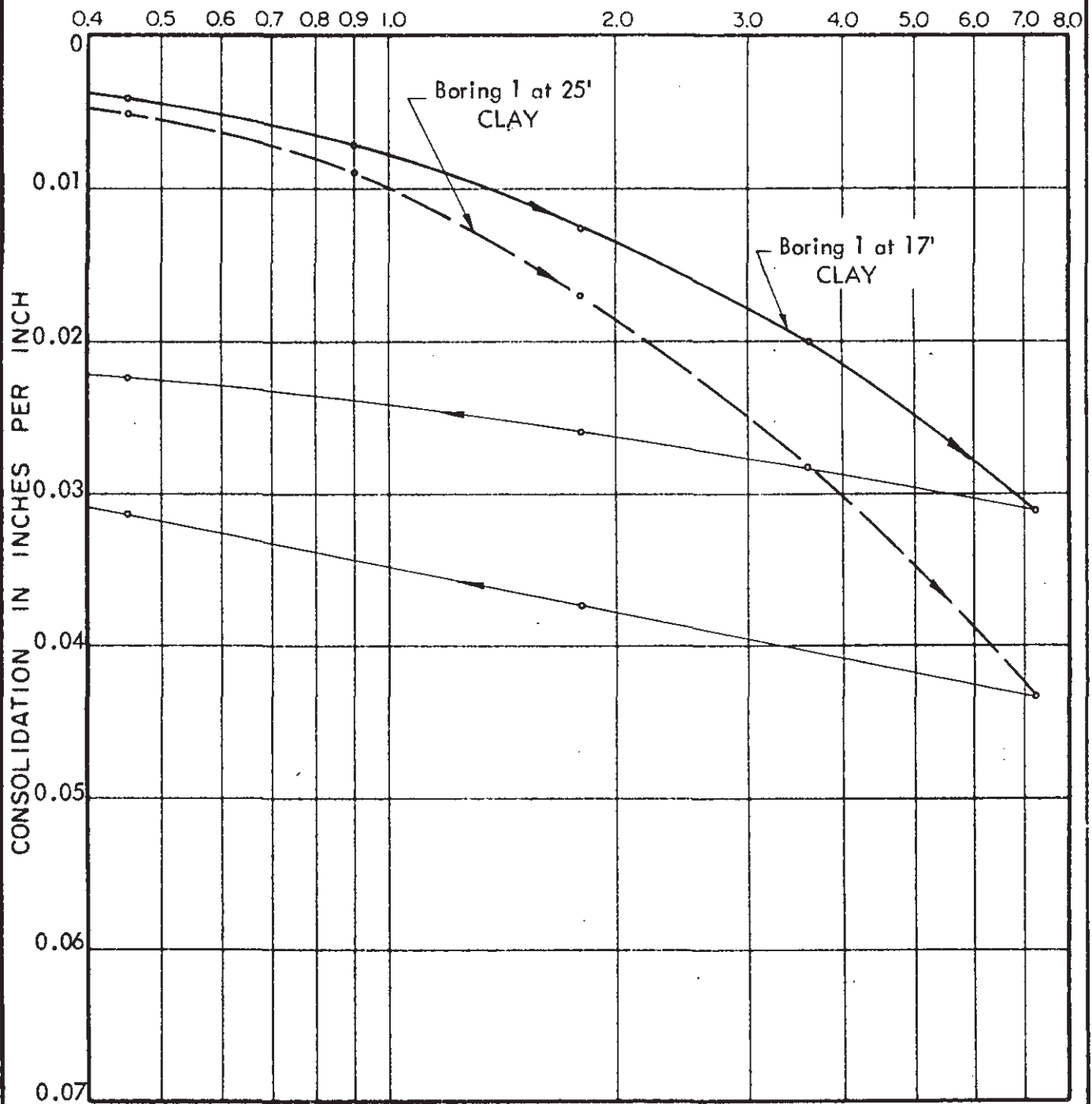
CONSOLIDATION TEST DATA



NOTE: Sample tested at field moisture content.

CONSOLIDATION TEST DATA

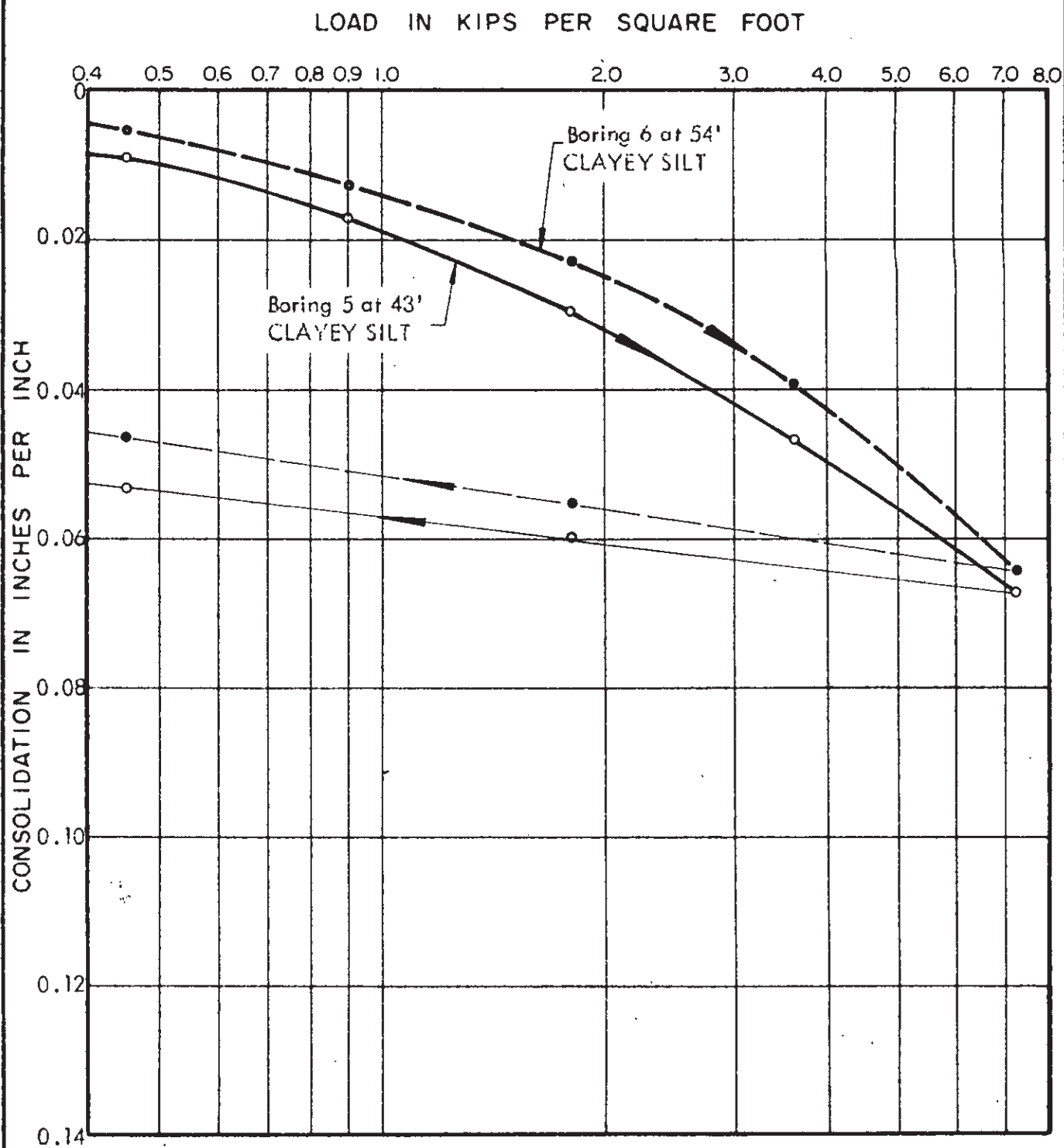
LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content.

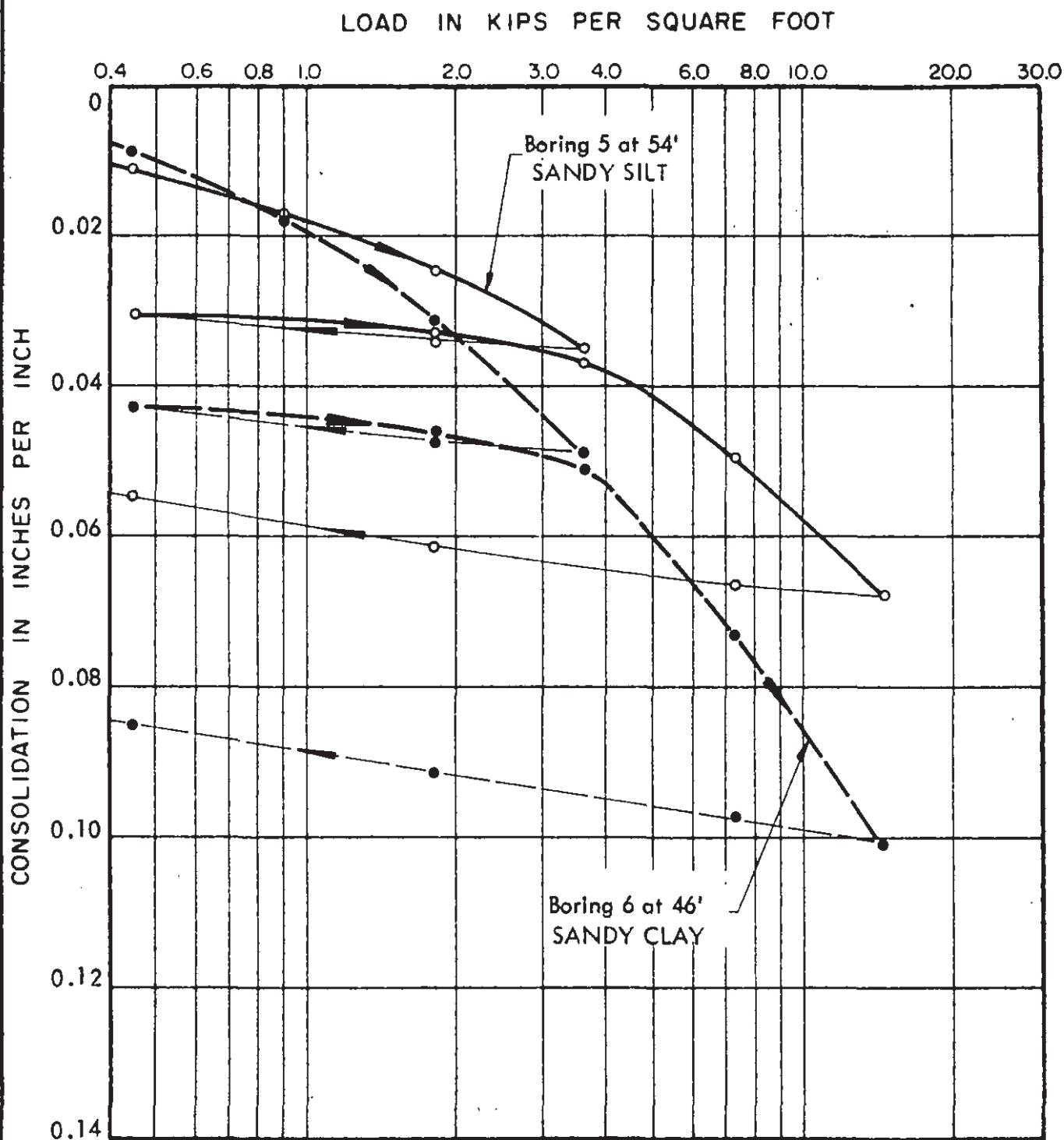
CONSOLIDATION TEST DATA

JOB A-69300 DATE 12/18/62 DR. T. H. O.E. F.M. CHKD. A.L. S.C.



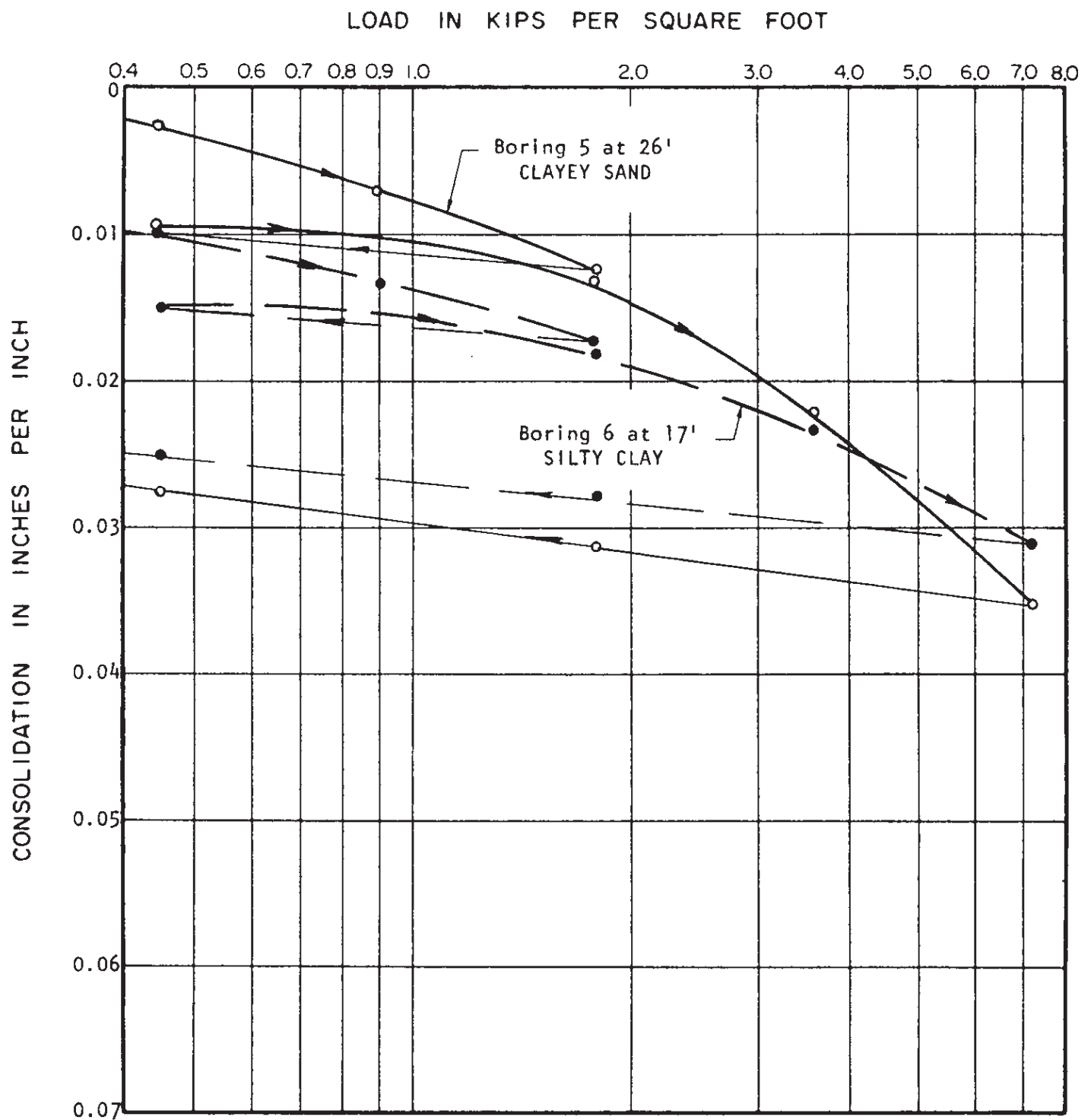
NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

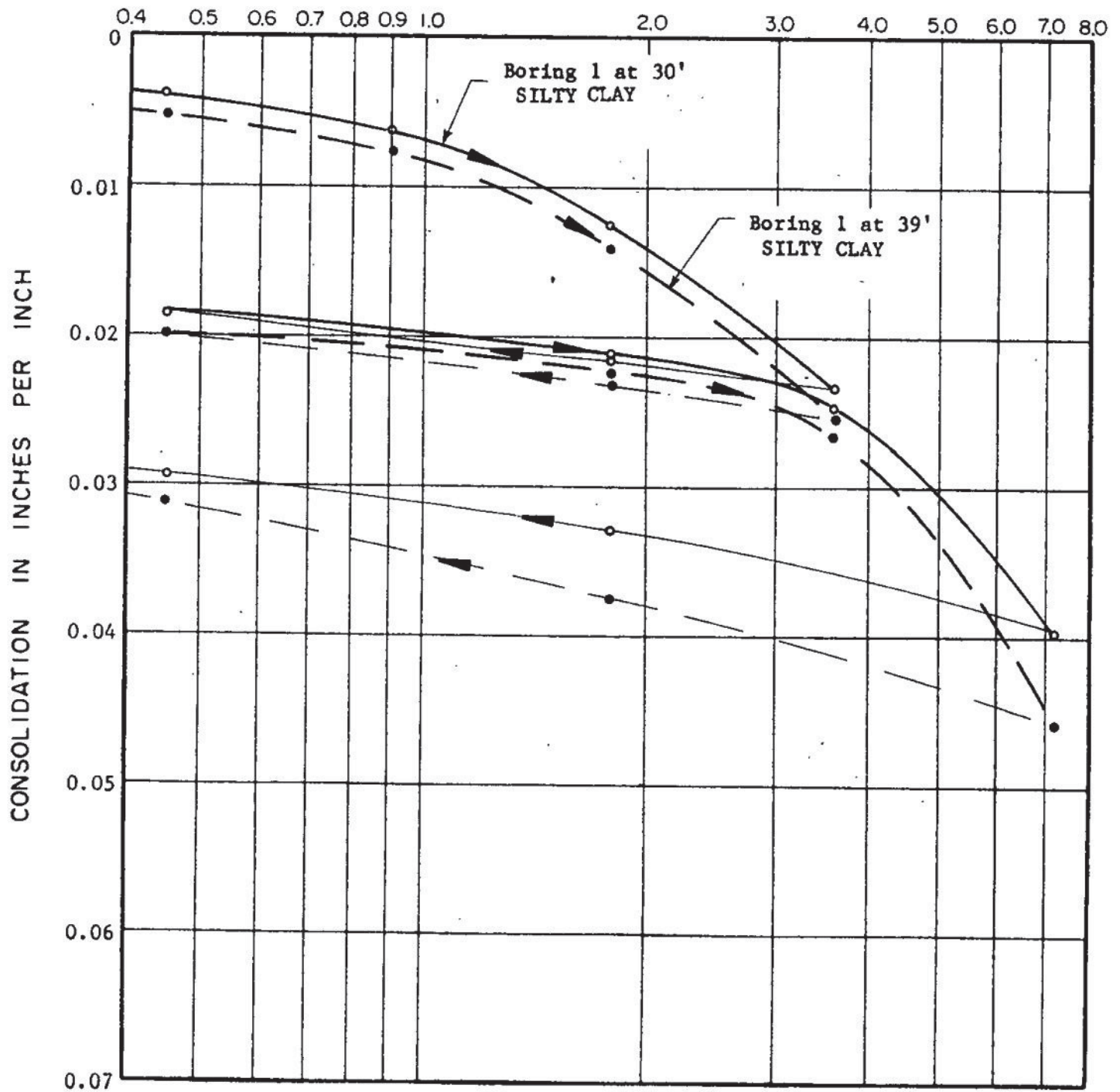
CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

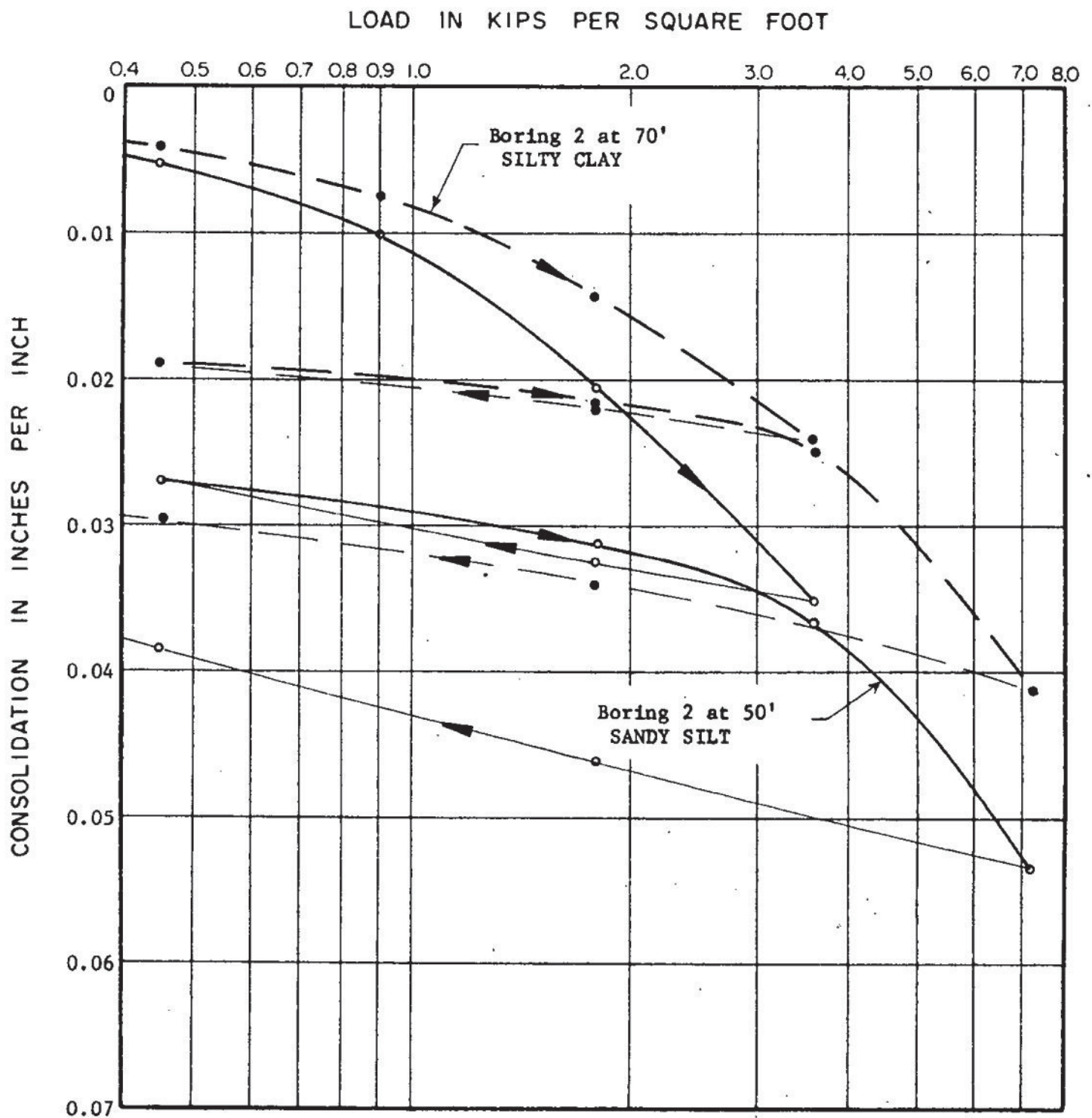
LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content..

CONSOLIDATION TEST DATA

JOB A-80025 DATE 2-18-80 DR *ew* E. *AK* W.P. *YK* CHKO *YK*

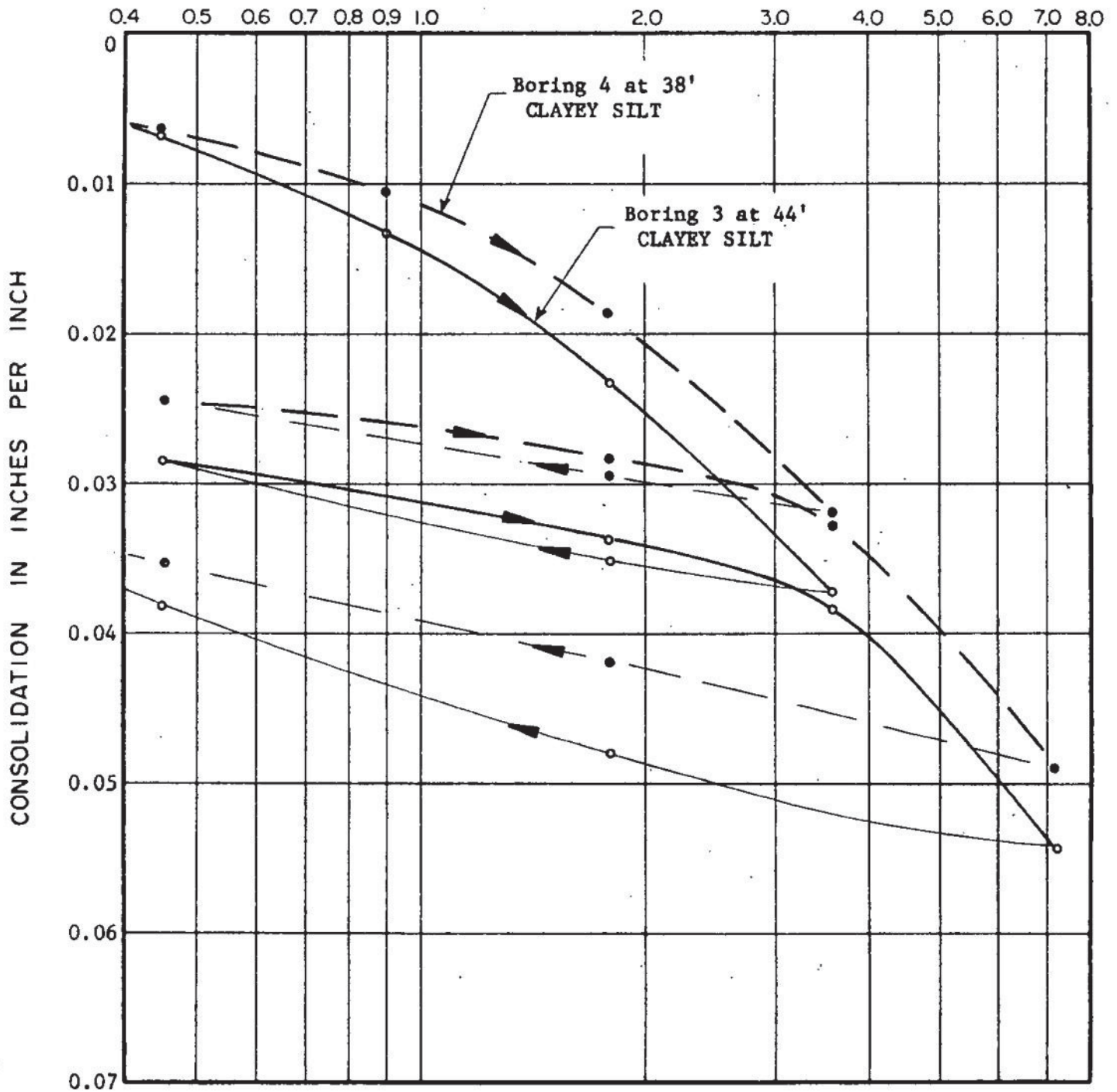


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

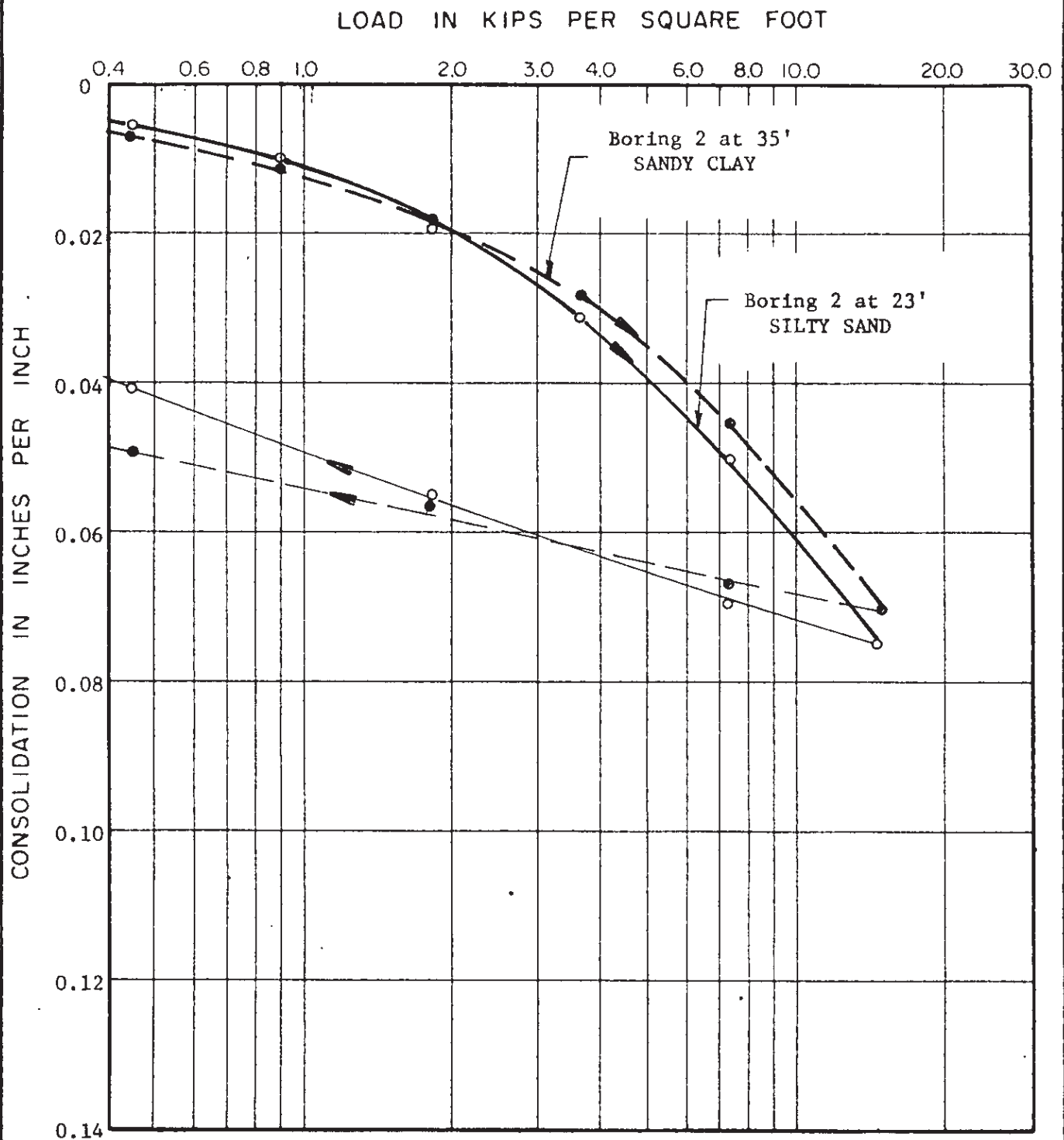
JOB: A-80025 DATE: 2-18-60 DR: ORS DE: BK W.P. FT CHKO YK

LOAD IN KIPS PER SQUARE FOOT

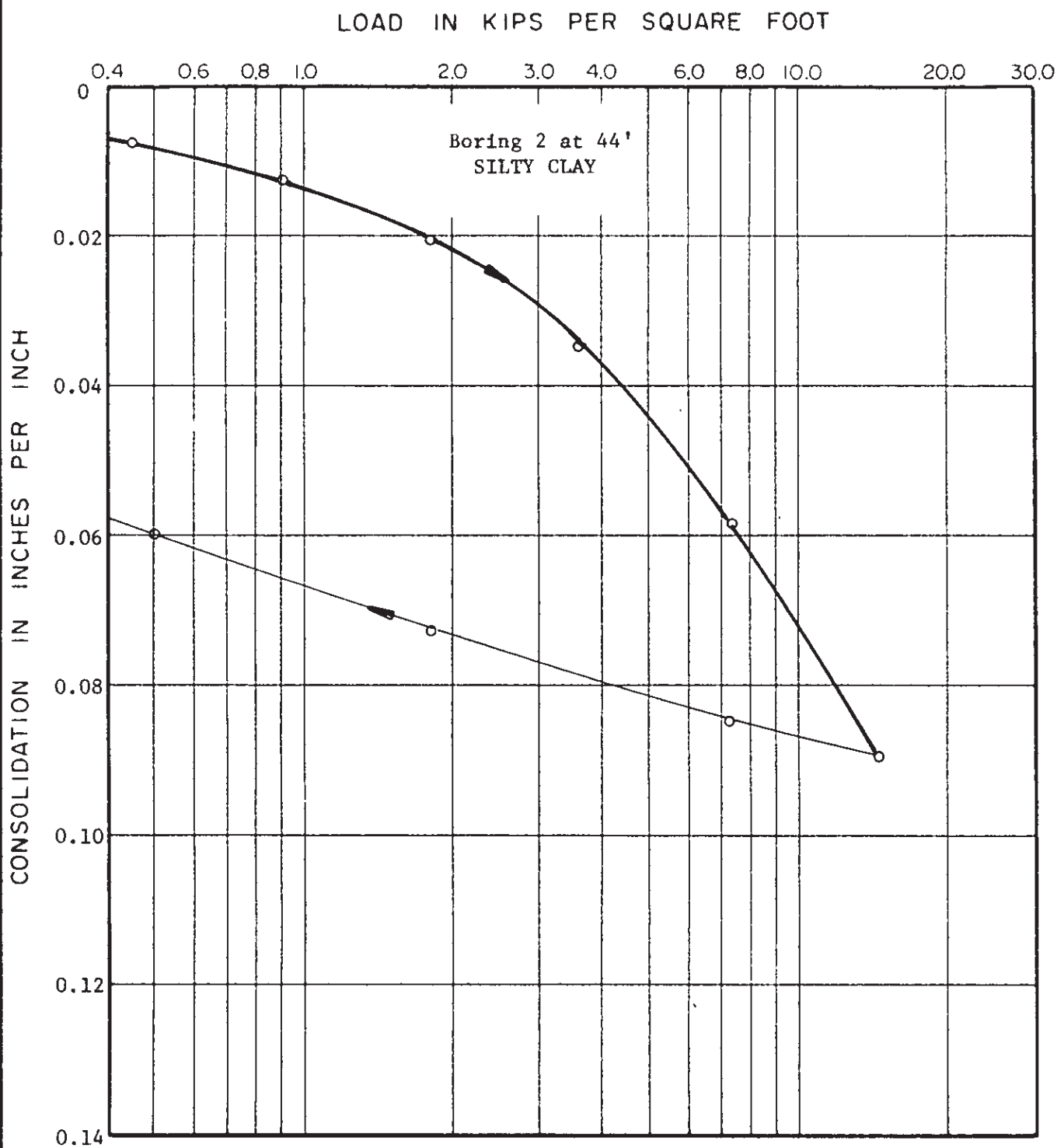


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

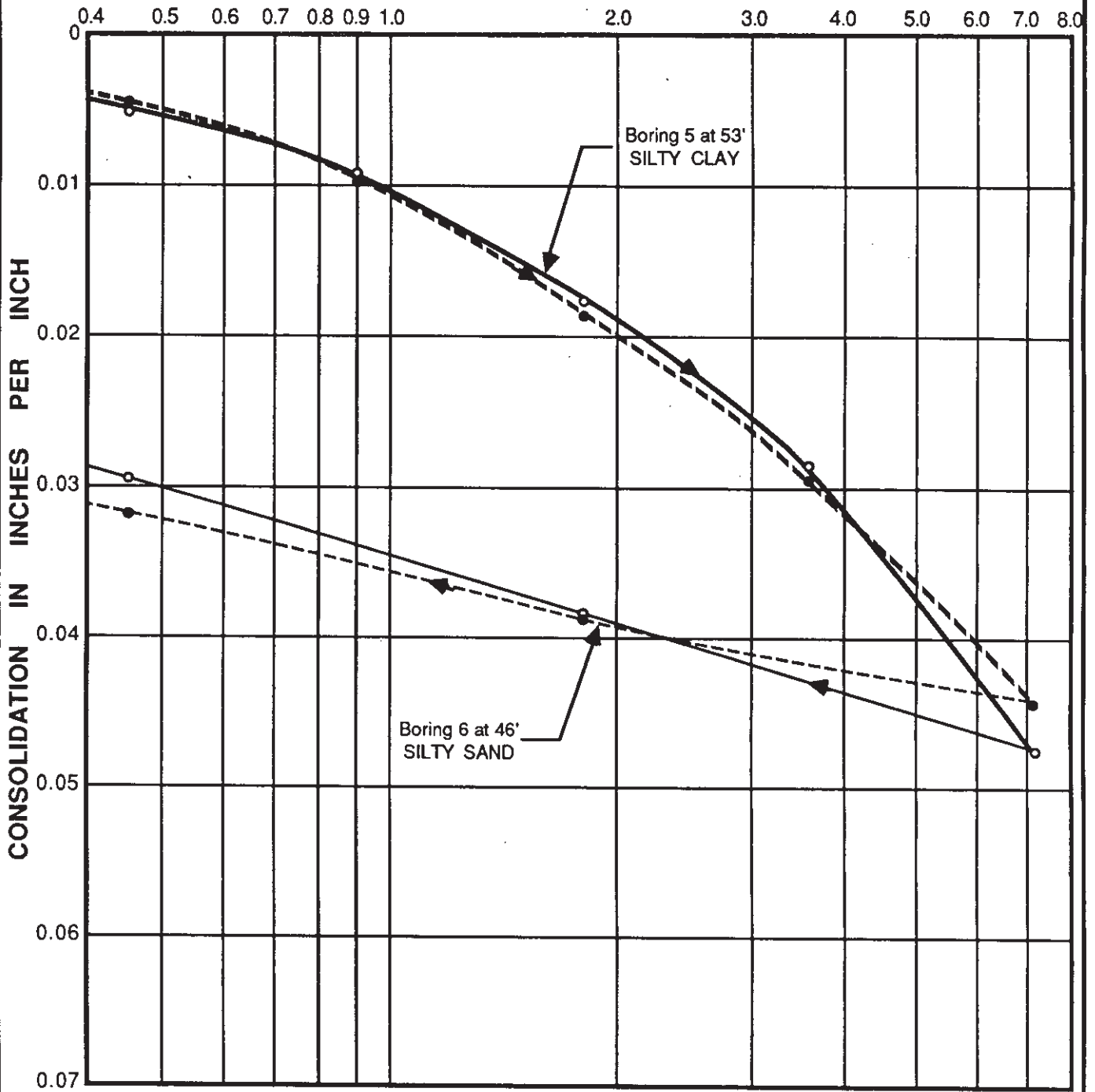


CONSOLIDATION TEST DATA



CONSOLIDATION TEST DATA

LOAD IN KIPS PER SQUARE FOOT



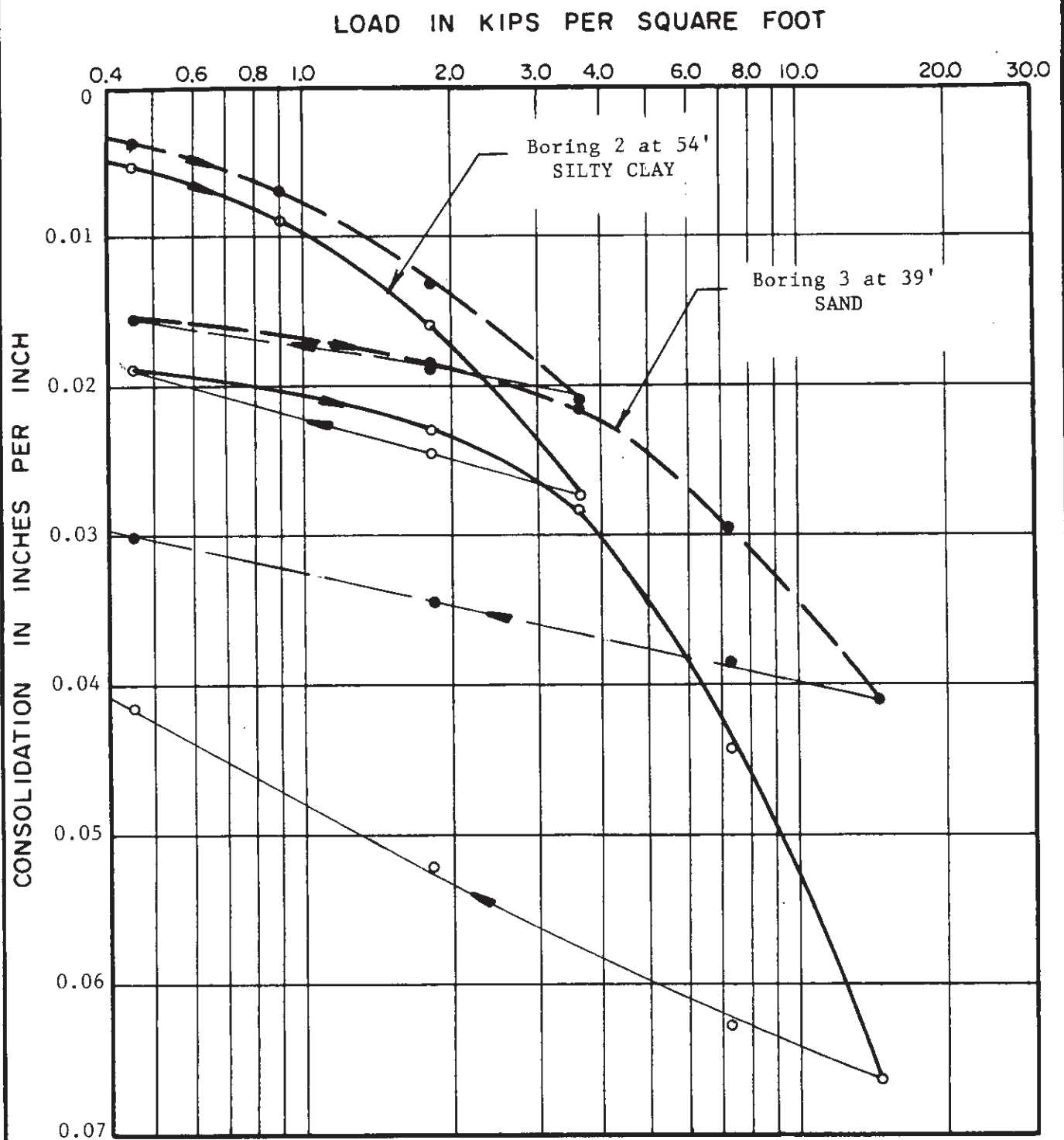
NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LeROY CRANDALL AND ASSOCIATES

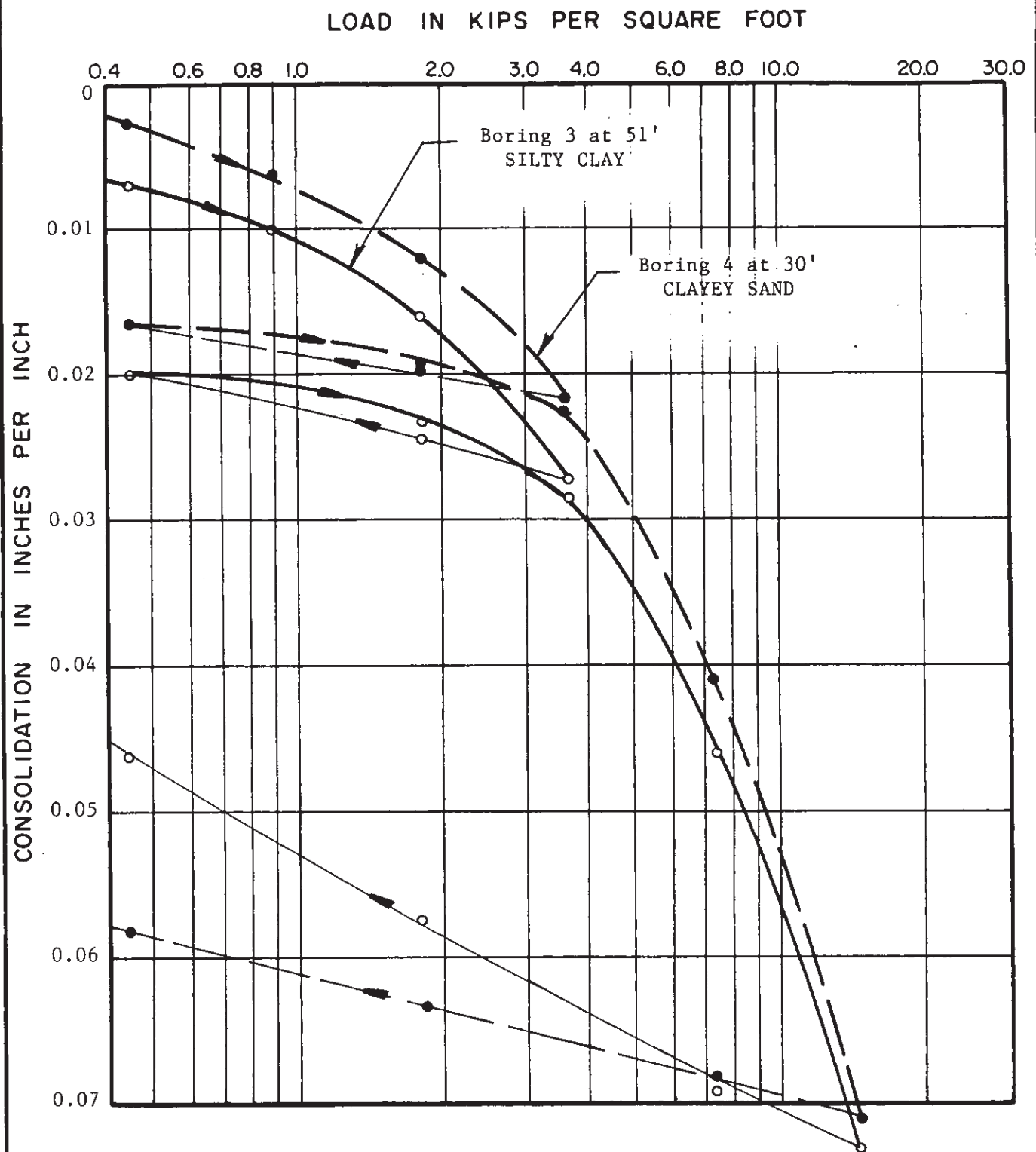
PLATE 5

Figure D-3.4.22



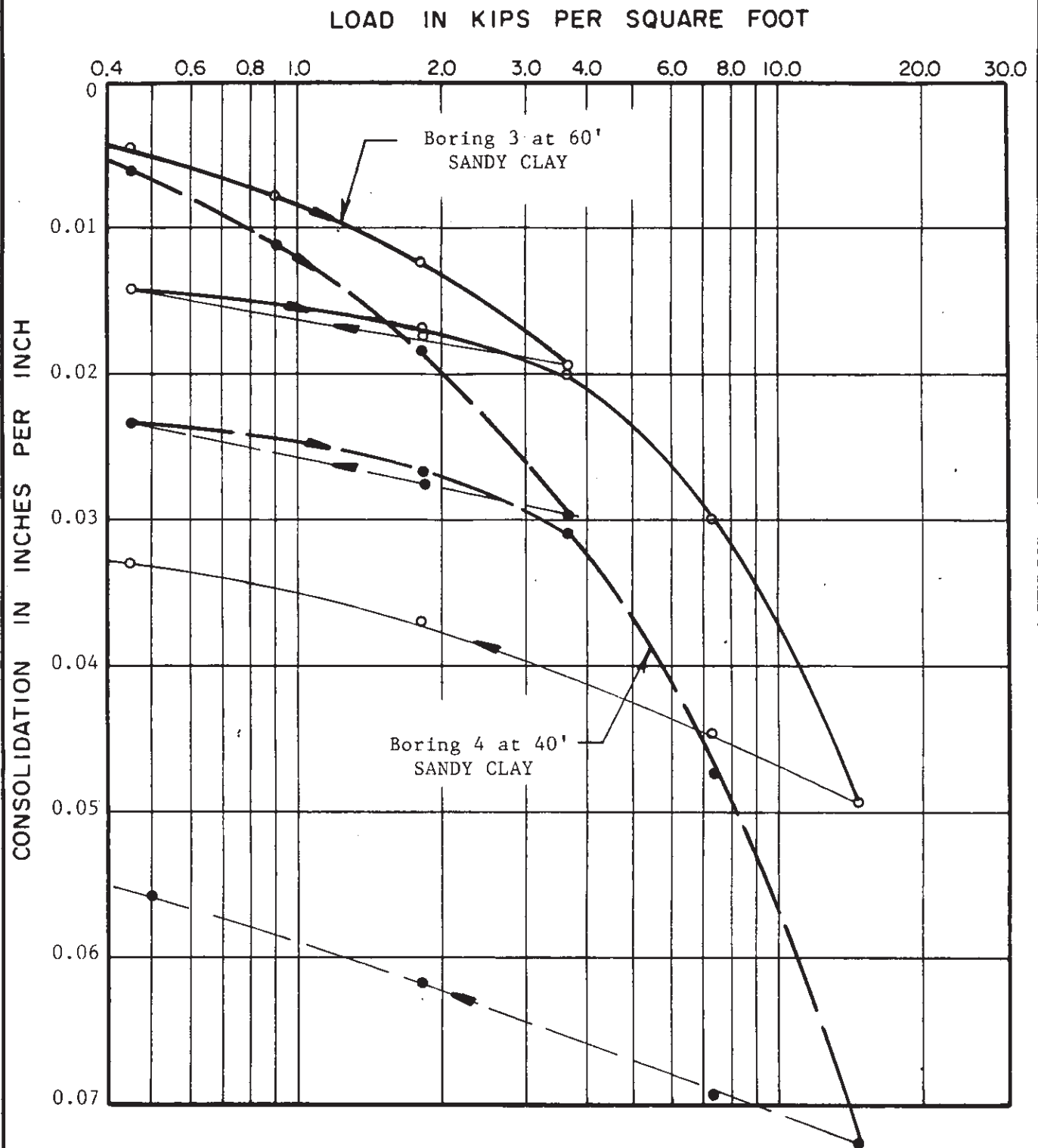
NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA



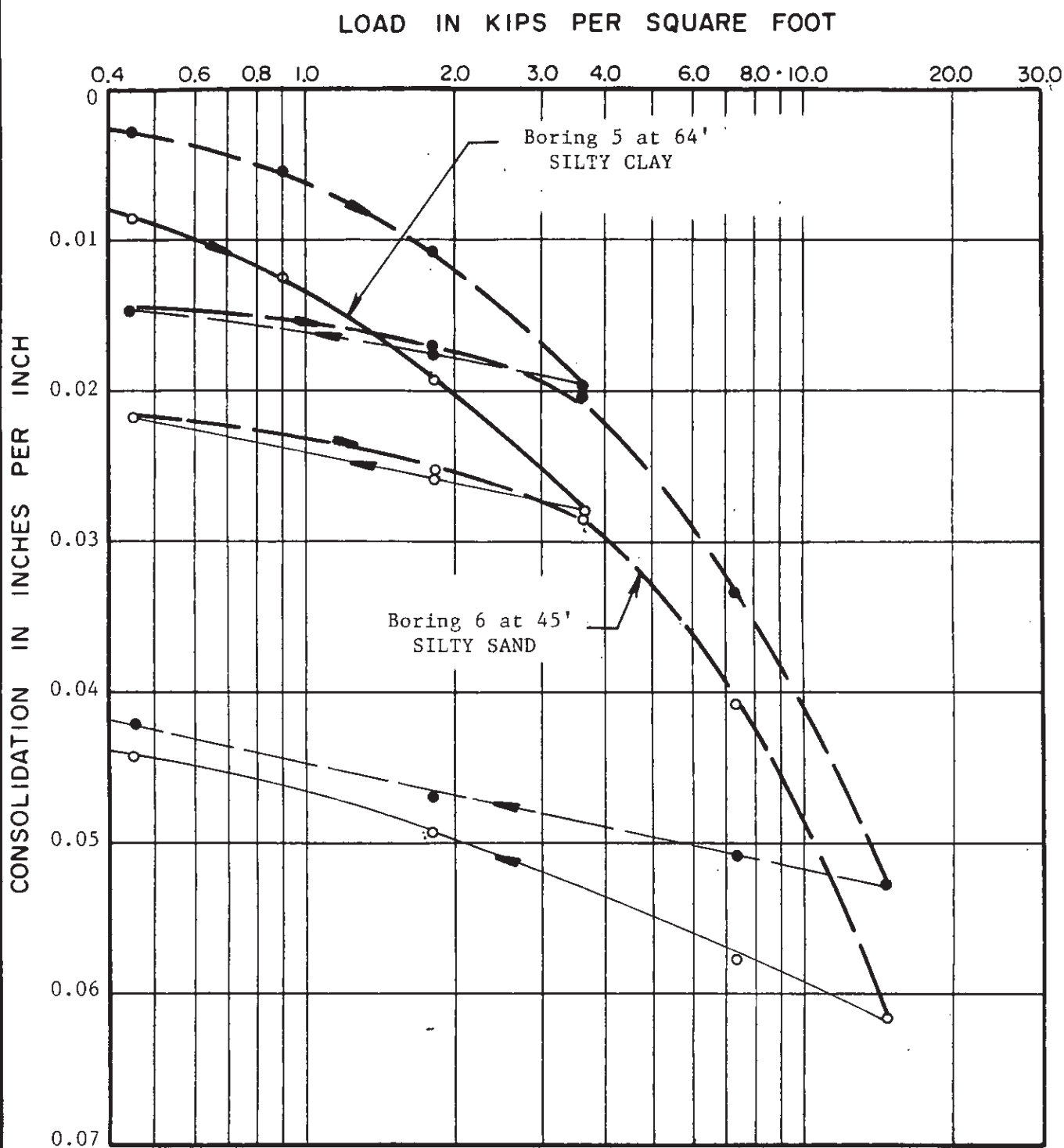
NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

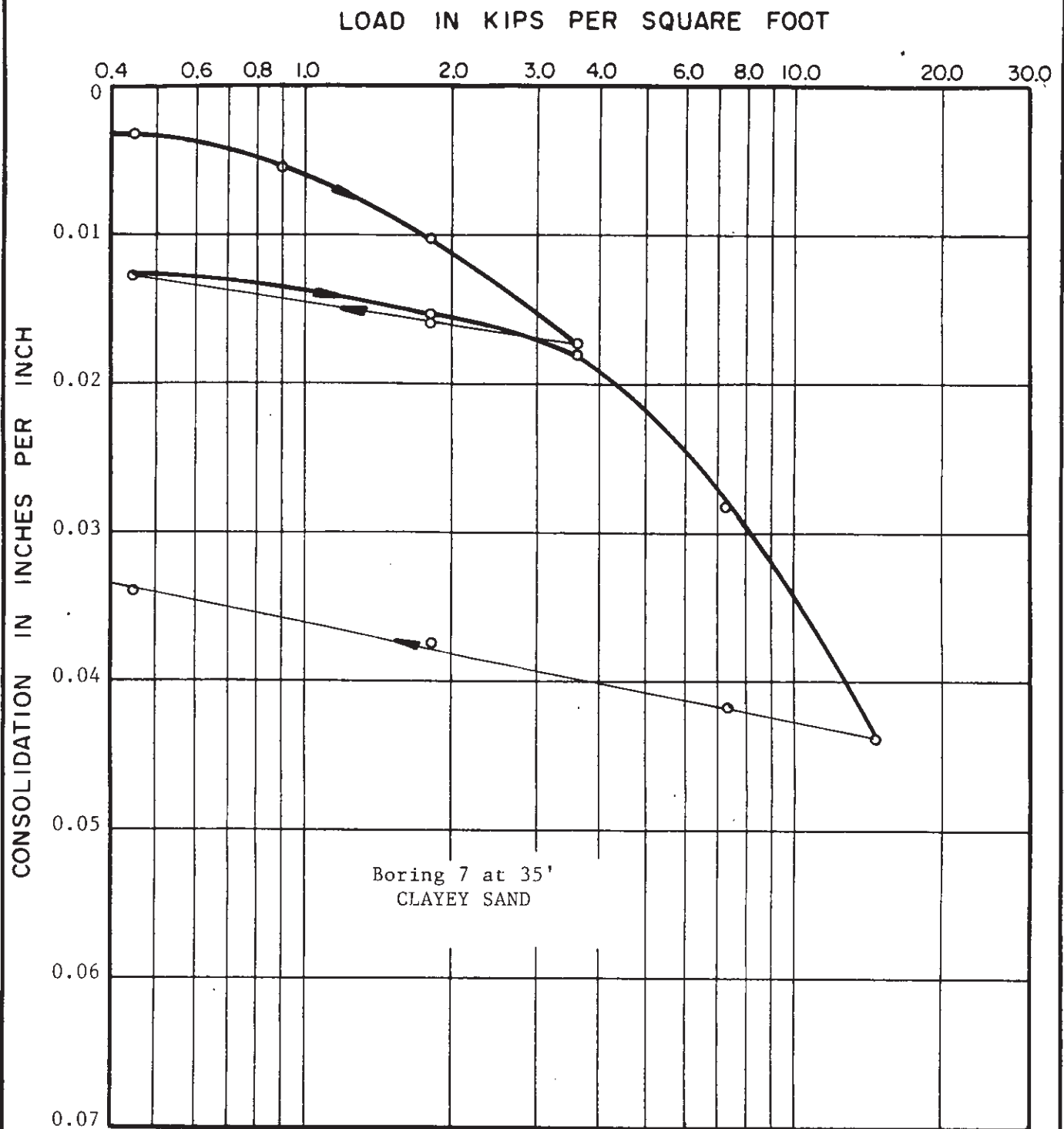
CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

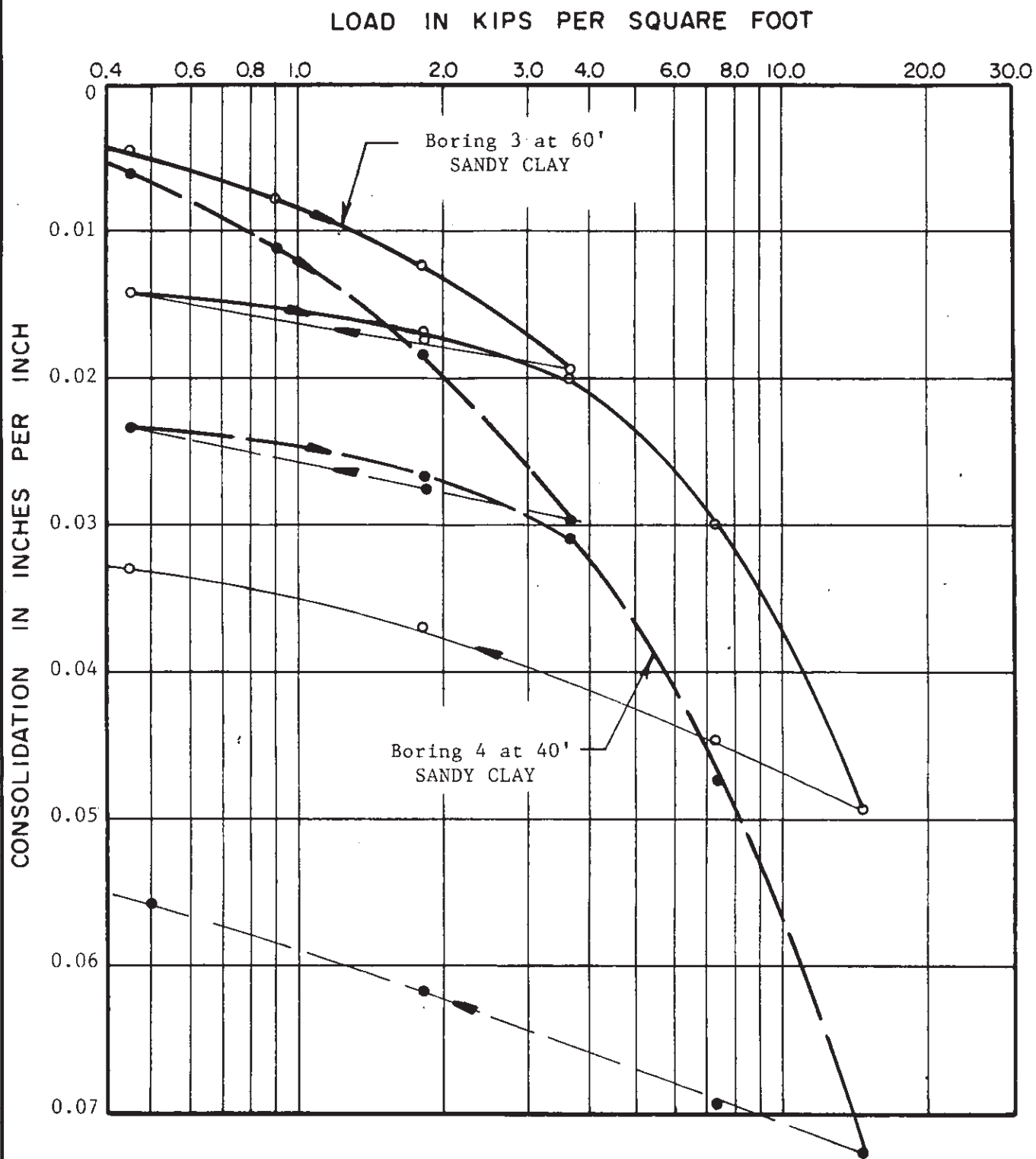
CONSOLIDATION TEST DATA

JOB ADE-86397 DATE 12/29/86 DR. JOHN S. CHKD. H.A. O.E.



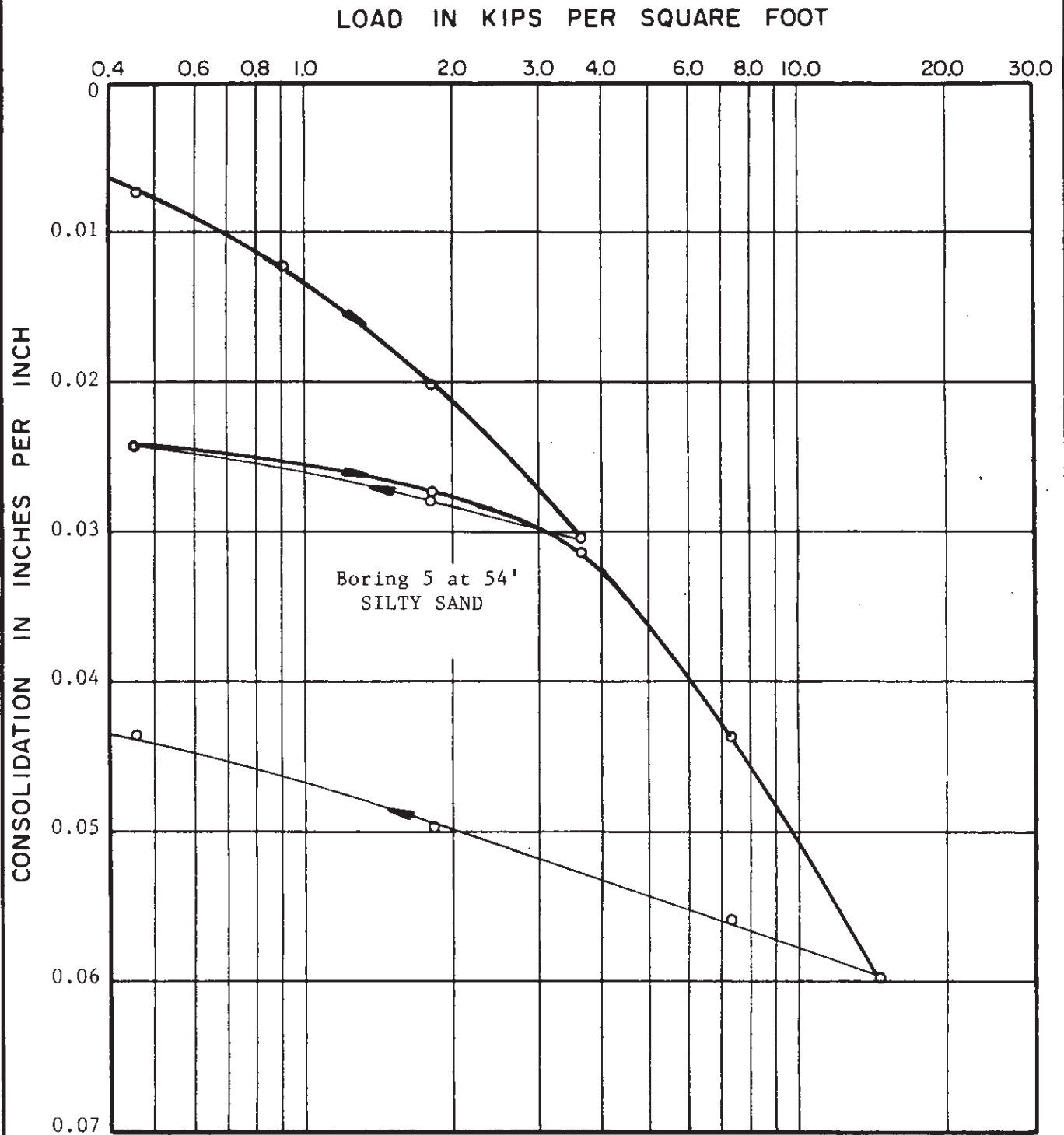
NOTE: Sample tested at field moisture content.

CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

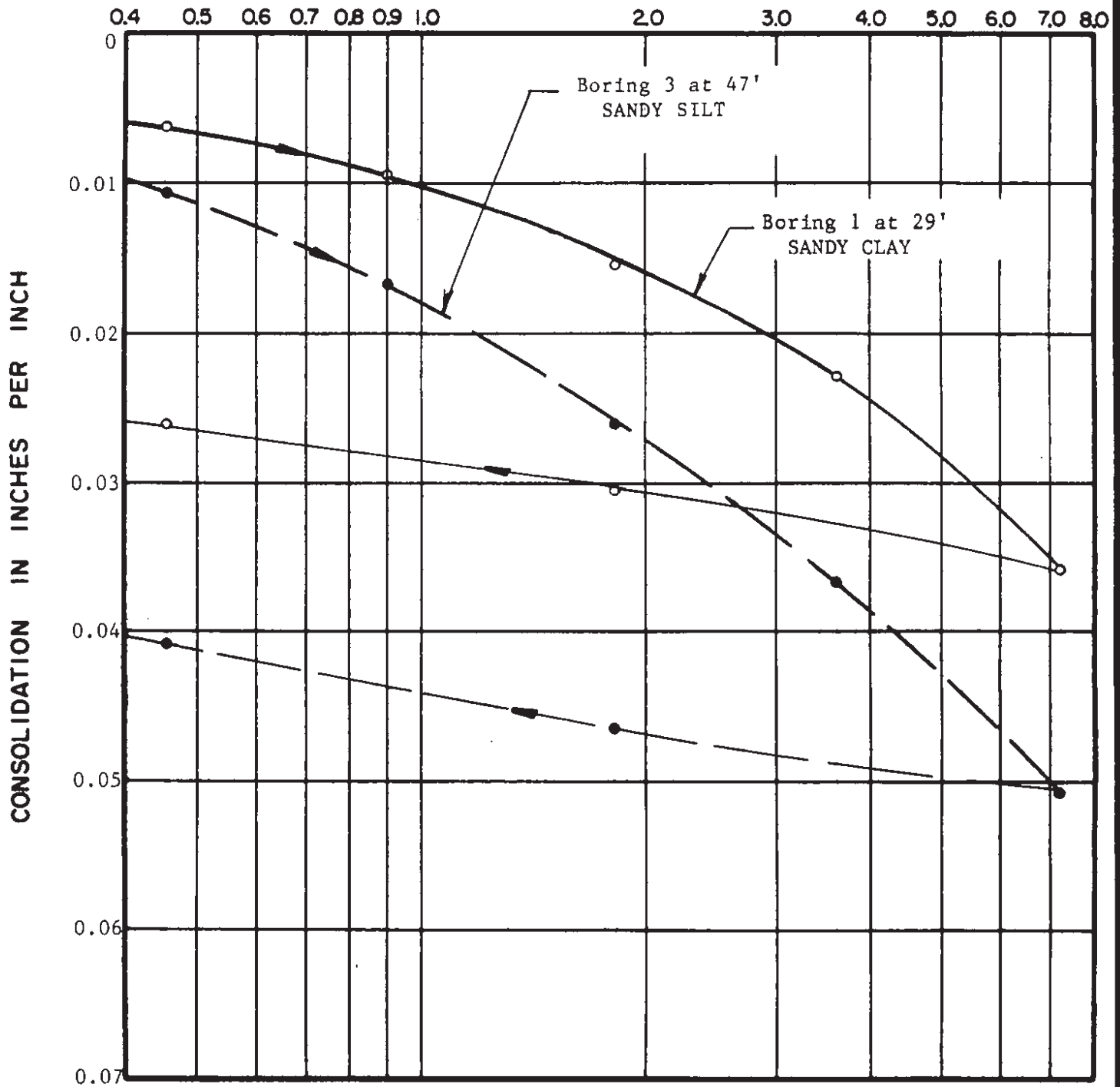
CONSOLIDATION TEST DATA



NOTE: Sample tested at field moisture content.

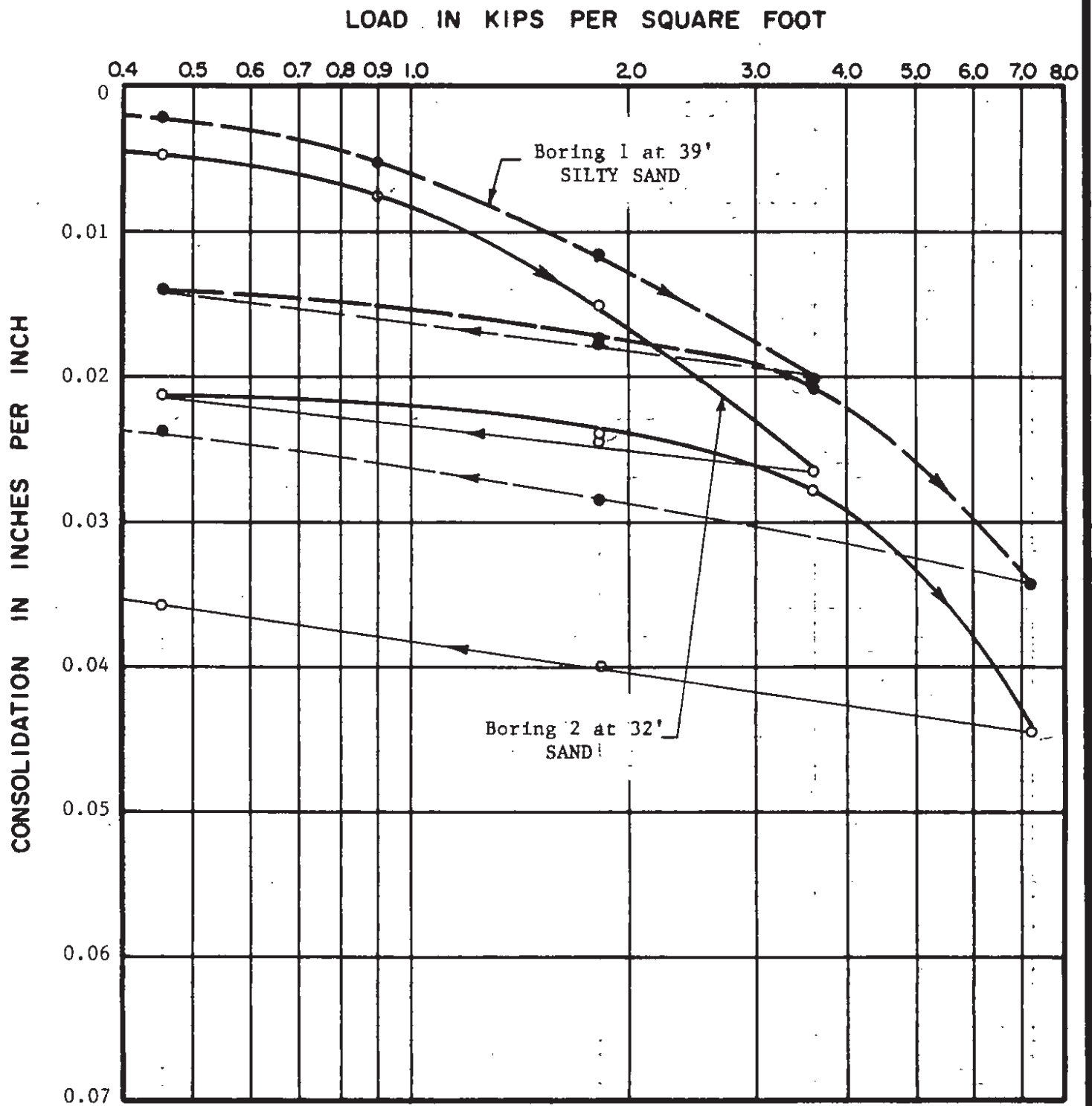
CONSOLIDATION TEST DATA

LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content.

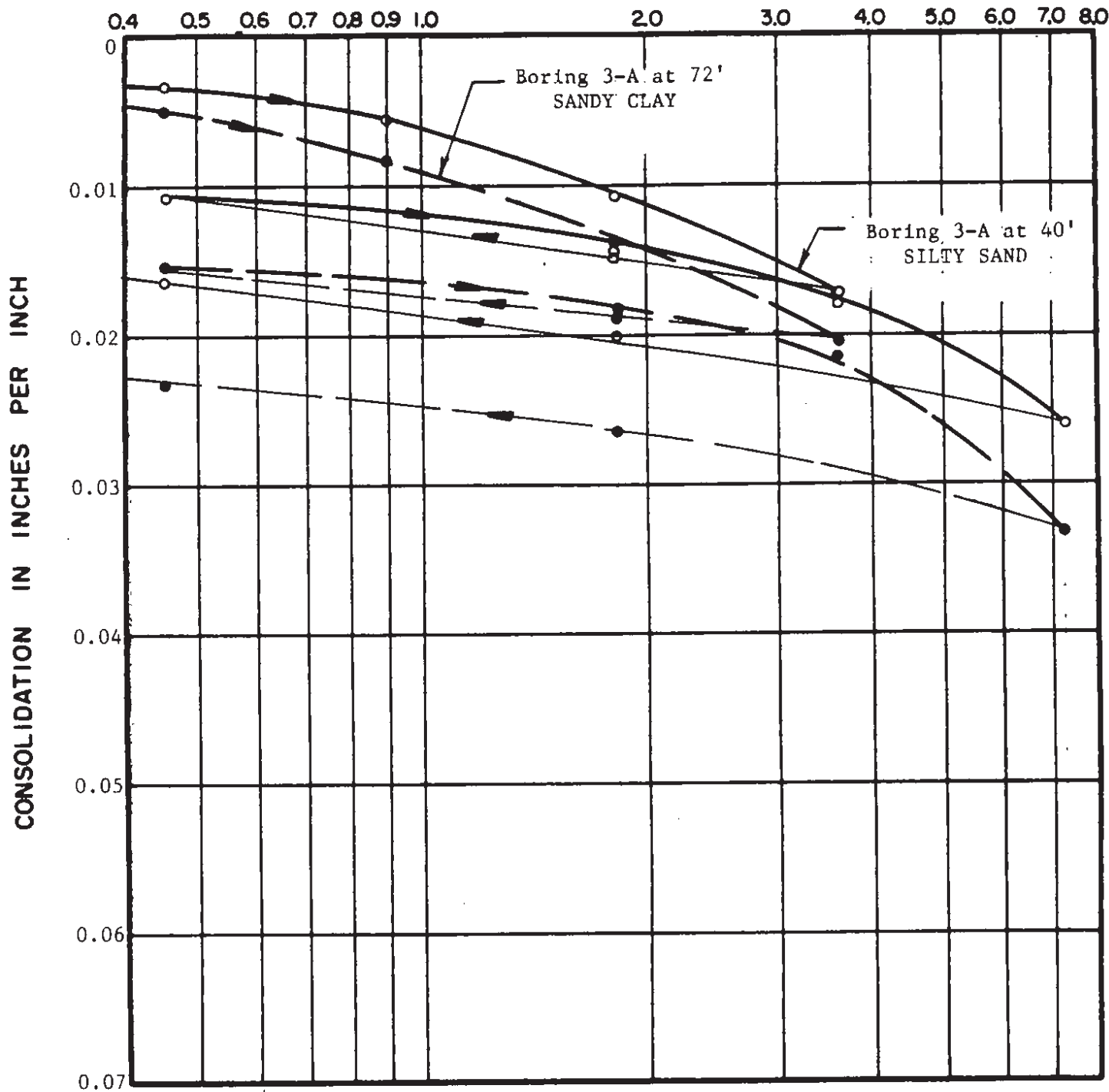
CONSOLIDATION TEST DATA



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

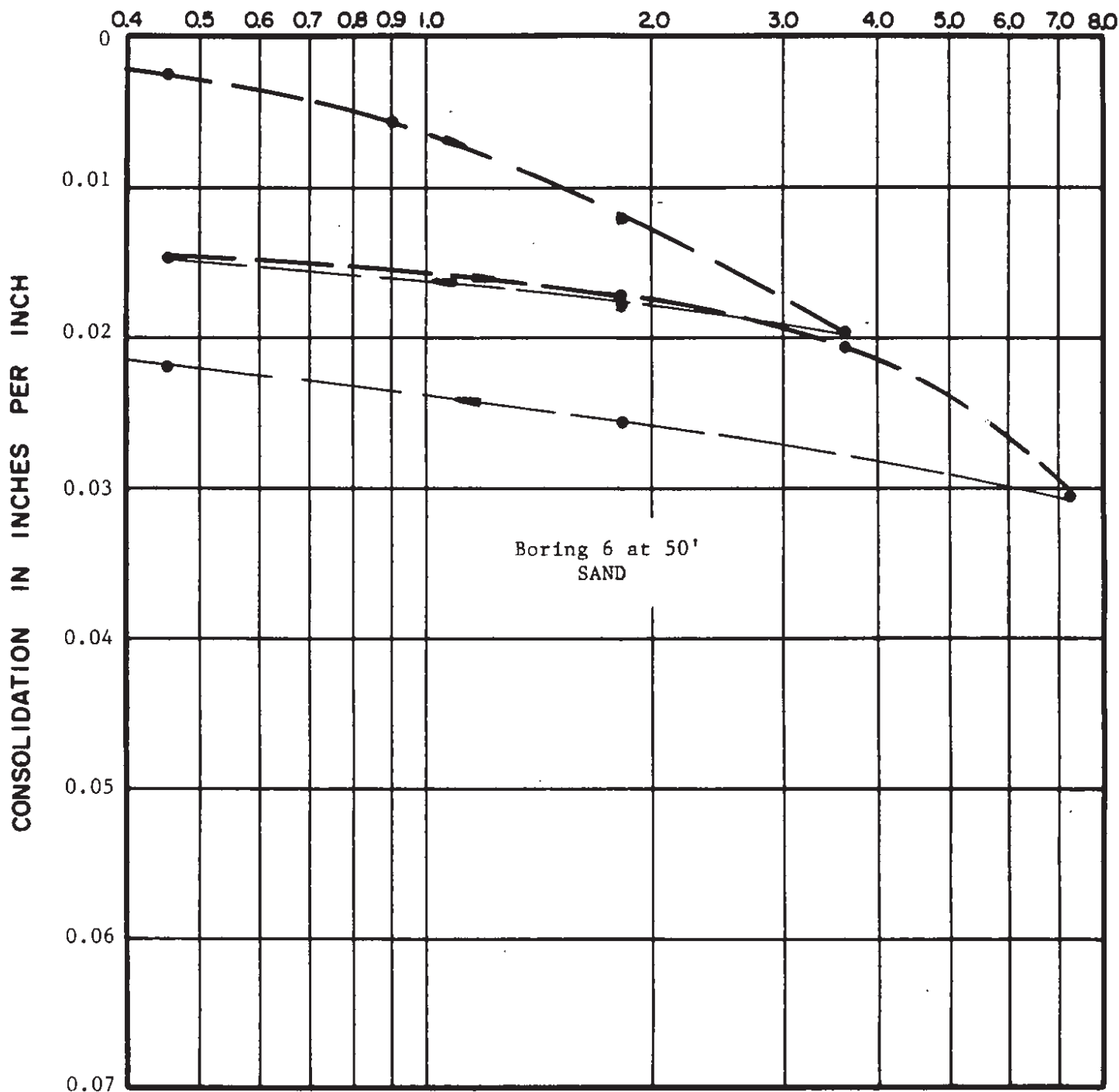
LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

LOAD IN KIPS PER SQUARE FOOT



NOTE: Sample tested at field moisture content.

CONSOLIDATION TEST DATA

JOB AEF-87428 DATE 1/12/88 DR. JOHN O.E. MS W.P. LP CHKD

Y₂

MS CHKD

O.E.

pb

W.P.

pb

DR.

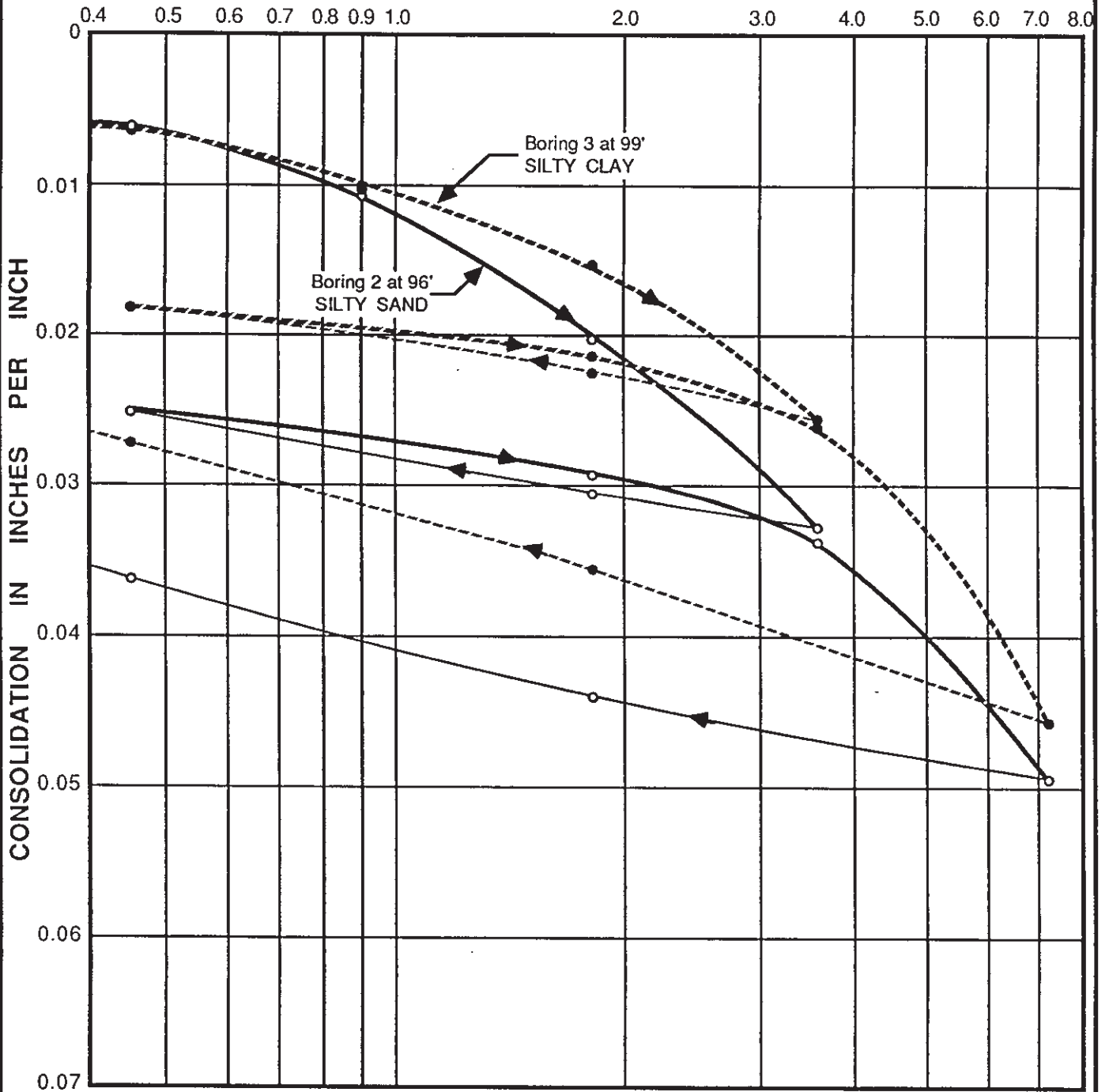
10/2/90

DATE

L89380.ADEB

JOB

LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content.

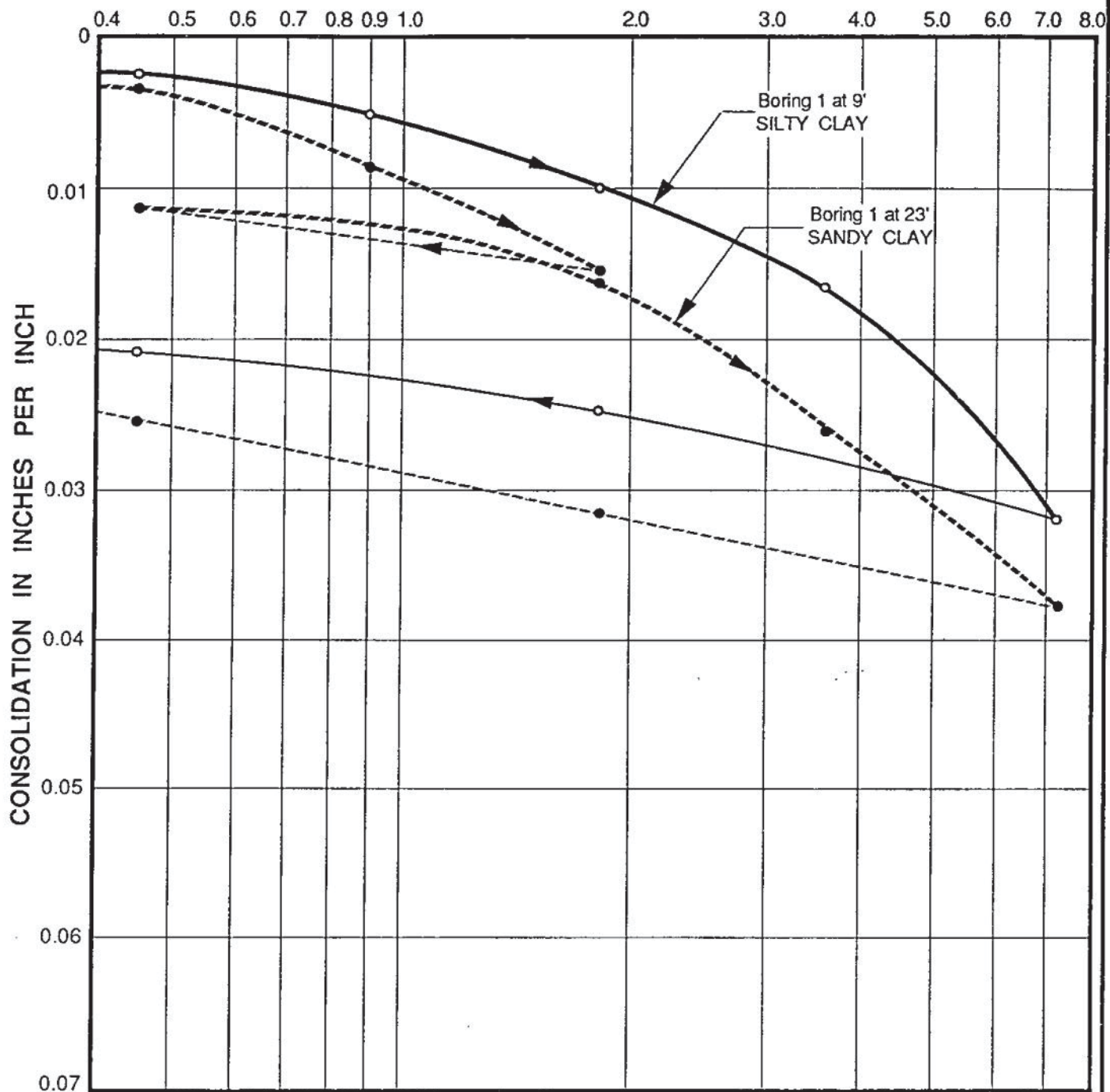
CONSOLIDATION TEST DATA

LeROY CRANDALL AND ASSOCIATES

PLATE A - 4.2

Figure D-3.4.34

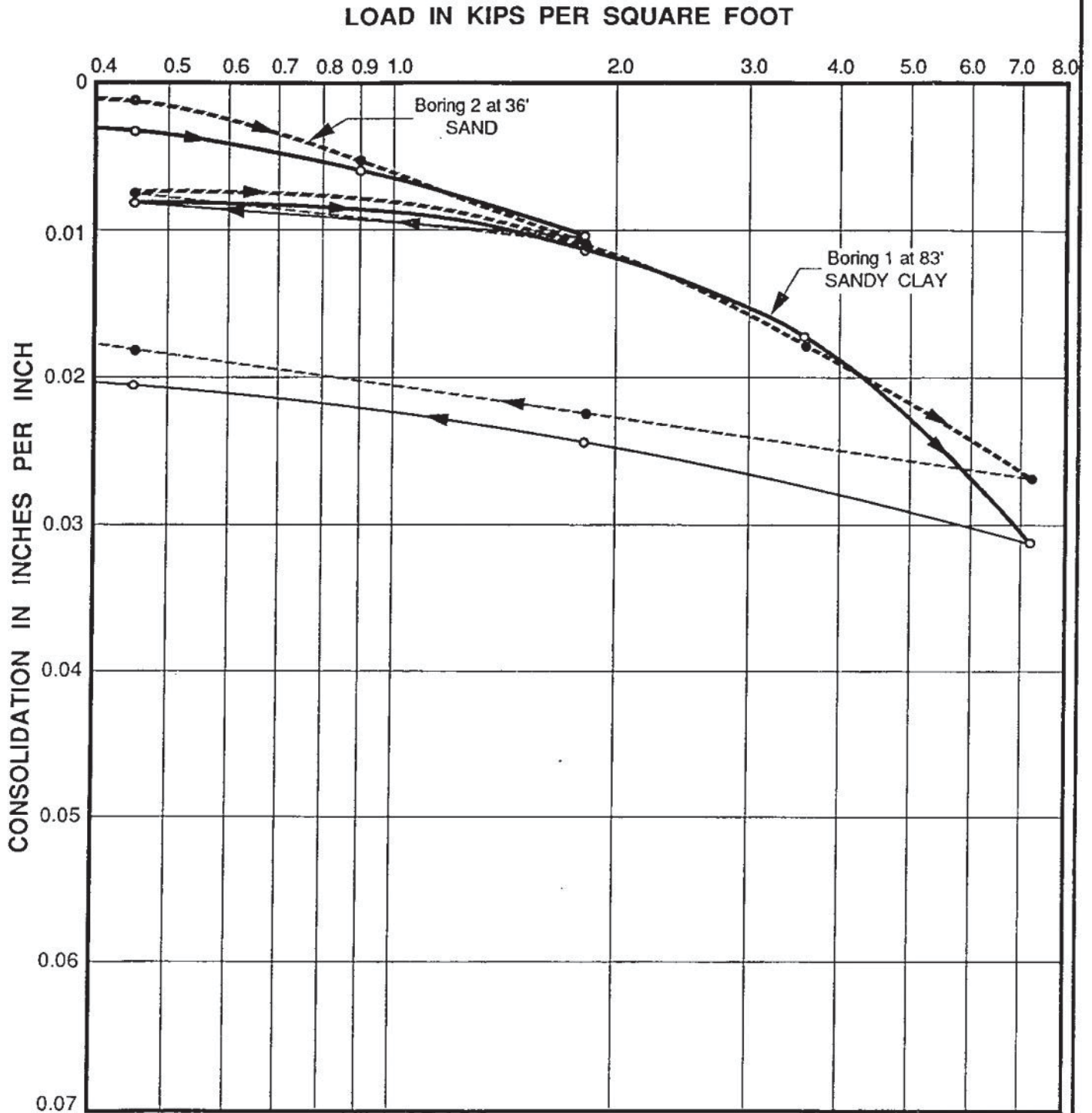
LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA



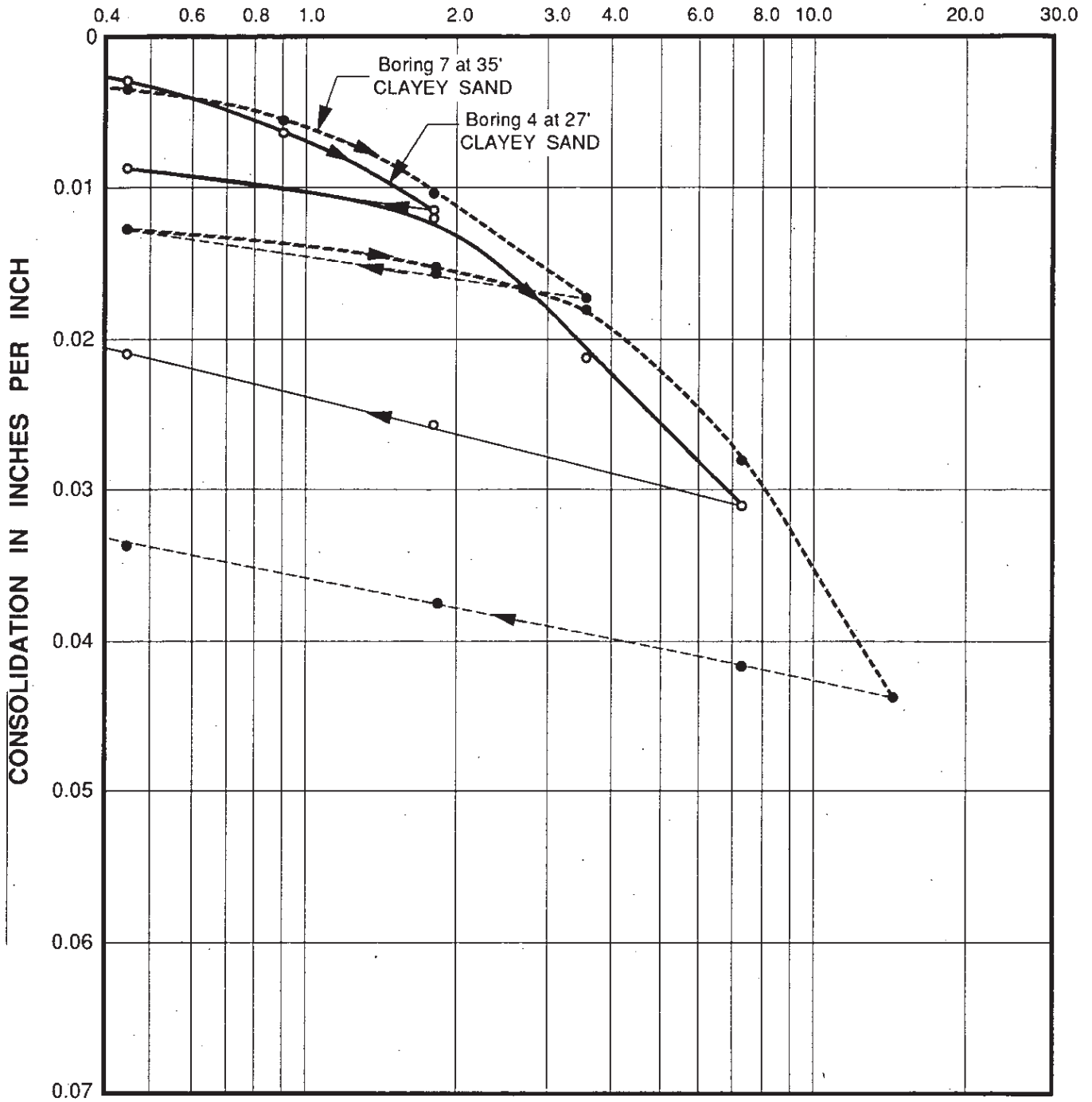


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA



LOAD IN KIPS PER SQUARE FOOT

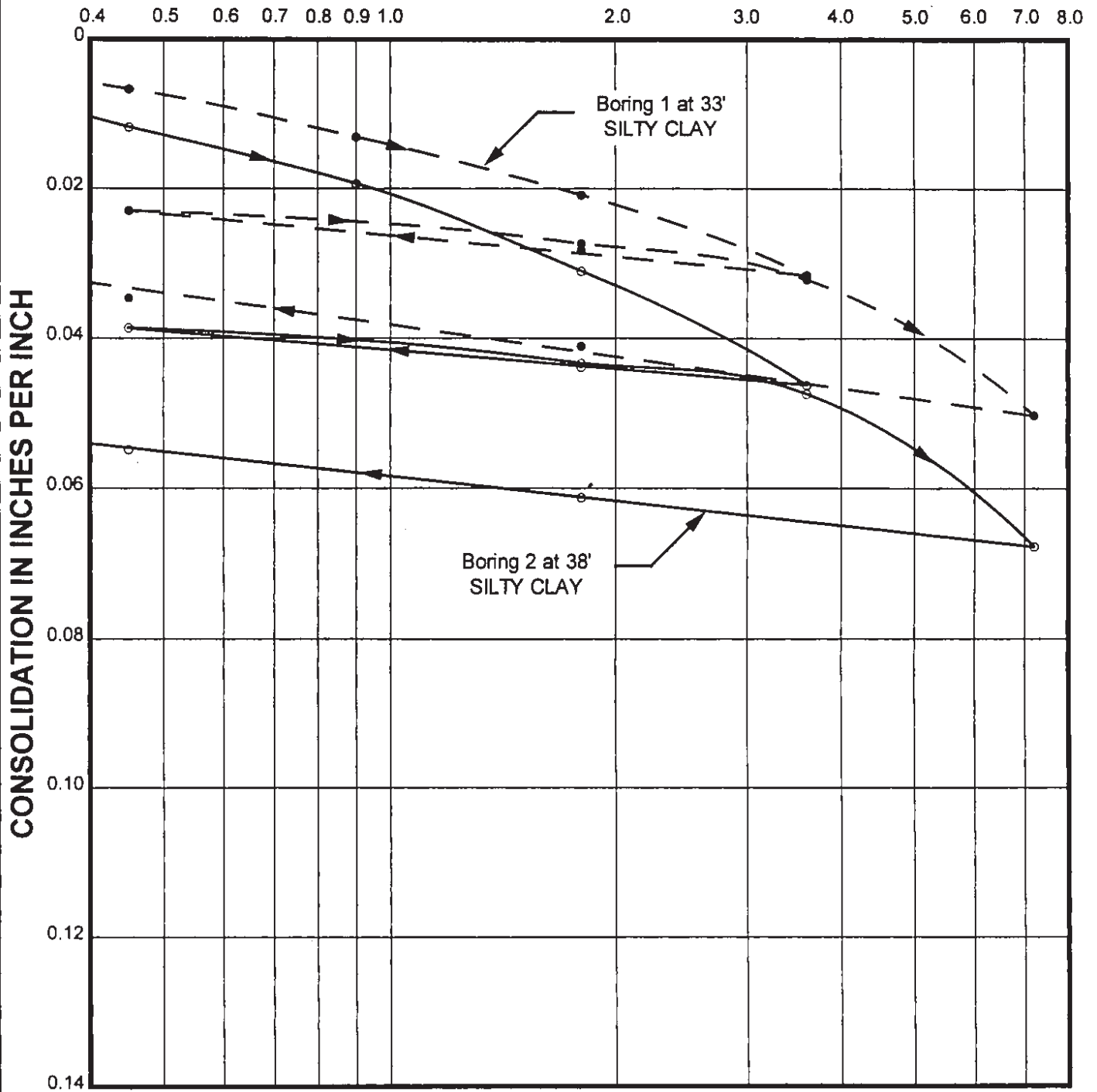


CONSOLIDATION TEST DATA

LAW/CRANDALL, INC.

FIGURE A-4.4

LOAD IN KIPS PER SQUARE FOOT

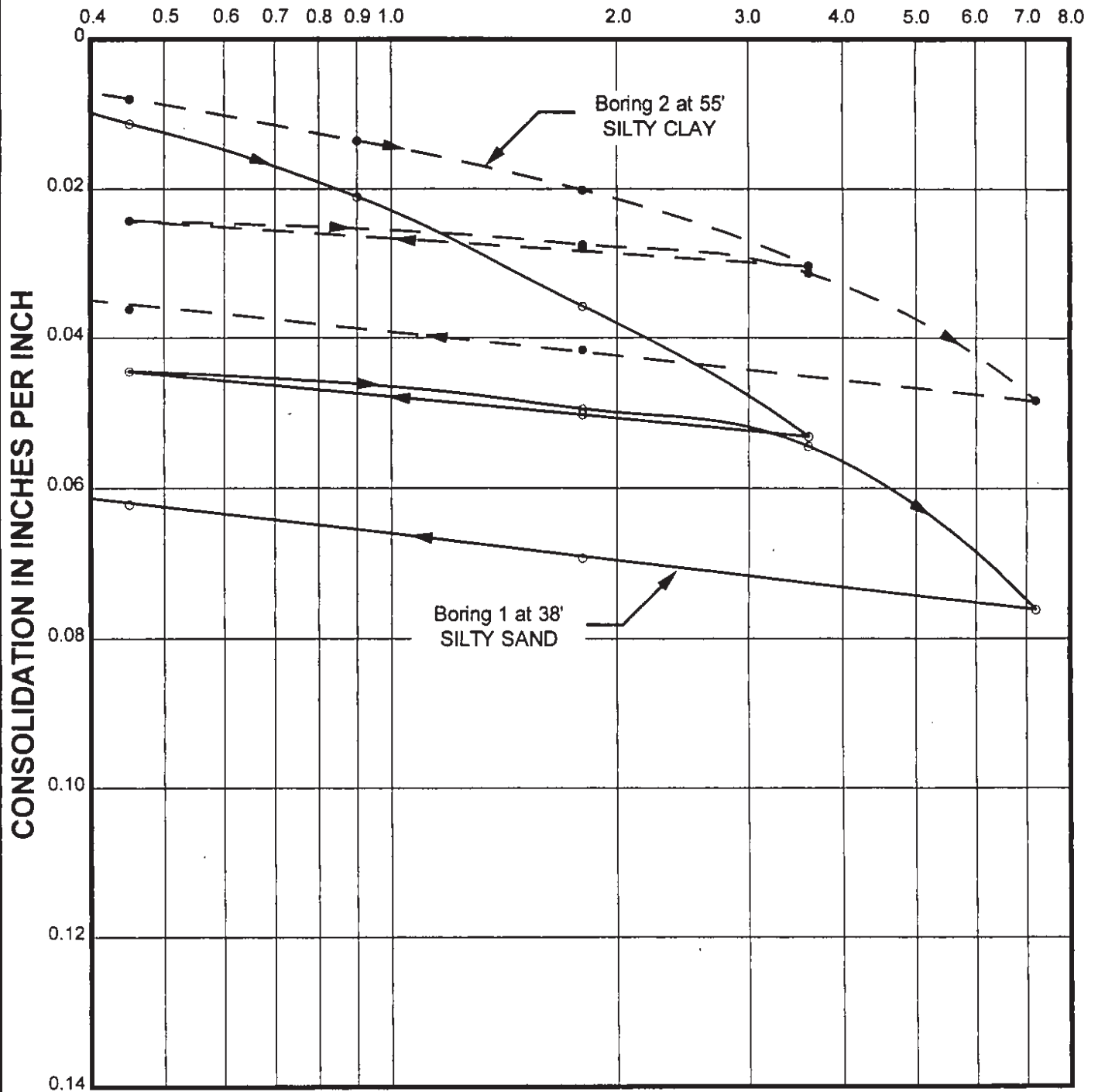


NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

JOB 70131-1-0132 DATE 5/7/01 DR MM OE CJZ CHKD CASC

LOAD IN KIPS PER SQUARE FOOT



NOTE: Samples tested at field moisture content.

CONSOLIDATION TEST DATA

JOB 70131-1-0132 DATE 5/7/01 DR MM OE C.JZ CHKD CASE

BORING NUMBER
AND SAMPLE DEPTH:

G-133 at 41½'

SOIL TYPE:

LEAN CLAY

SURCHARGE PRESSURE:
(lbs./sq. ft.)

1800

PERCENT HYDROCONSOLIDATION:
(%)

0.03

Prepared/Date: LH 09/29/11
Checked/Date: LT 10/2/11

MTA Westside Subway Extension
Los Angeles, California



HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.1

BORING NUMBER

AND SAMPLE DEPTH:

G-133 at 89½'

G-134 at 35½'

G-134 at 45½'

G-134 at 55½'

SOIL TYPE:

SILTY SAND

SANDY SILT

SILT with SAND

SILT with SAND

SURCHARGE PRESSURE:

1800

1800

1800

1800

(lbs./sq. ft.)

PERCENT HYDROCONSOLIDATION:

0.09

0.06

0.05

0.02

(%)

Prepared/Date: LH 09/29/11

Checked/Date: LT 10/2/11

MTA Westside Subway Extension
Los Angeles, California



HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.2

BORING NUMBER
AND SAMPLE DEPTH:

G-134 at 95½'

G-135 at 101½'

G-139 at 45½'

G-139 at 95½'

SOIL TYPE:

SILTY SAND

SILTY SAND

WELL GRADED SAND
with SILT and GRAVEL

SILTY SAND

SURCHARGE PRESSURE:
(lbs./sq. ft.)

1800

1800

2000

2000

PERCENT HYDROCONSOLIDATION:
(%)

0.03

0.02

0.06

0.17

Prepared/Date: LH 09/29/11
Checked/Date: LT 10/2/11

MTA Westside Subway Extension
Los Angeles, California



HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.3

BORING NUMBER
AND SAMPLE DEPTH:

G-140 at 56½'

G-140 at 74½'

G-140 at 86½'

G-140 at 98½'

SOIL TYPE:

SANDY SILT

CLAYEY SAND

POORLY GRADED SAND
with GRAVEL

SILTY SAND

SURCHARGE PRESSURE:
(lbs./sq.ft.)

1800

1800

1800

1800

PERCENT HYDROCONSOLIDATION: 0.11
(%)

0.08

0.01

-0.09

Prepared/Date: LH 09/29/11
Checked/Date: LT 10/2/11

MTA Westside Subway Extension
Los Angeles, California



HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.4

BORING NUMBER

AND SAMPLE DEPTH:

G-141 at 50½'

G-142 at 35½'

G-147 at 85½'

G-148 at 85½'

SOIL TYPE:

SANDY SILT

POORLY GRADED
SAND

SILTY SAND

SILTY SAND

SURCHARGE PRESSURE:

(lbs./sq. ft.)

1800

1800

1800

2000

PERCENT HYDROCONSOLIDATION: 0.05
(%)

Canceled

0.11

0.12

Prepared/Date: LH 09/29/11
Checked/Date: LT 10/2/11

MTA Westside Subway Extension
Los Angeles, California



HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.5

BORING NUMBER
AND SAMPLE DEPTH:

G-148 at 105½'

G-149 at 63½'

G-149 at 73½'

G-149 at 83½'

SOIL TYPE:

SANDY LEAN
CLAY

SILTY SAND

SILTY SAND

SANDY LEAN
CLAY

SURCHARGE PRESSURE:
(lbs./sq.ft.)

2000

1800

1800

1800

PERCENT HYDROCONSOLIDATION:
(%)

0.11

0.06

0.03

0.02

Prepared/Date: LH 09/29/11
Checked/Date: LT 10/2/11

MTA Westside Subway Extension
Los Angeles, California



HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.6

BORING NUMBER AND SAMPLE DEPTH:	G-150 at 70½'	G-150 at 100½'	G-152 at 48½'	G-152 at 68½'
SOIL TYPE:	SILTY SAND	SILTY SAND with GRAVEL	WELL GRADED SAND with GRAVEL	SANDY LEAN CLAY
SURCHARGE PRESSURE: (lbs./sq. ft.)	1800	1800	1800	1800
PERCENT HYDROCONSOLIDATION: (%)	0.04	0.05	0.35	0.01

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HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.7

BORING NUMBER
AND SAMPLE DEPTH:

G-161 at 55½'

G-161 at 85½'

G-162 at 20½'

G-164 at 39½'

SOIL TYPE:

POORLY GRADED
SAND

SANDY LEAN
CLAY

SANDY LEAN
CLAY

SILTY SAND
with GRAVEL

SURCHARGE PRESSURE:
(lbs./sq. ft.)

1800

1800

1800

1800

PERCENT HYDROCONSOLIDATION:
(%)

0.20

-0.03

0.07

0.02

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HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.8

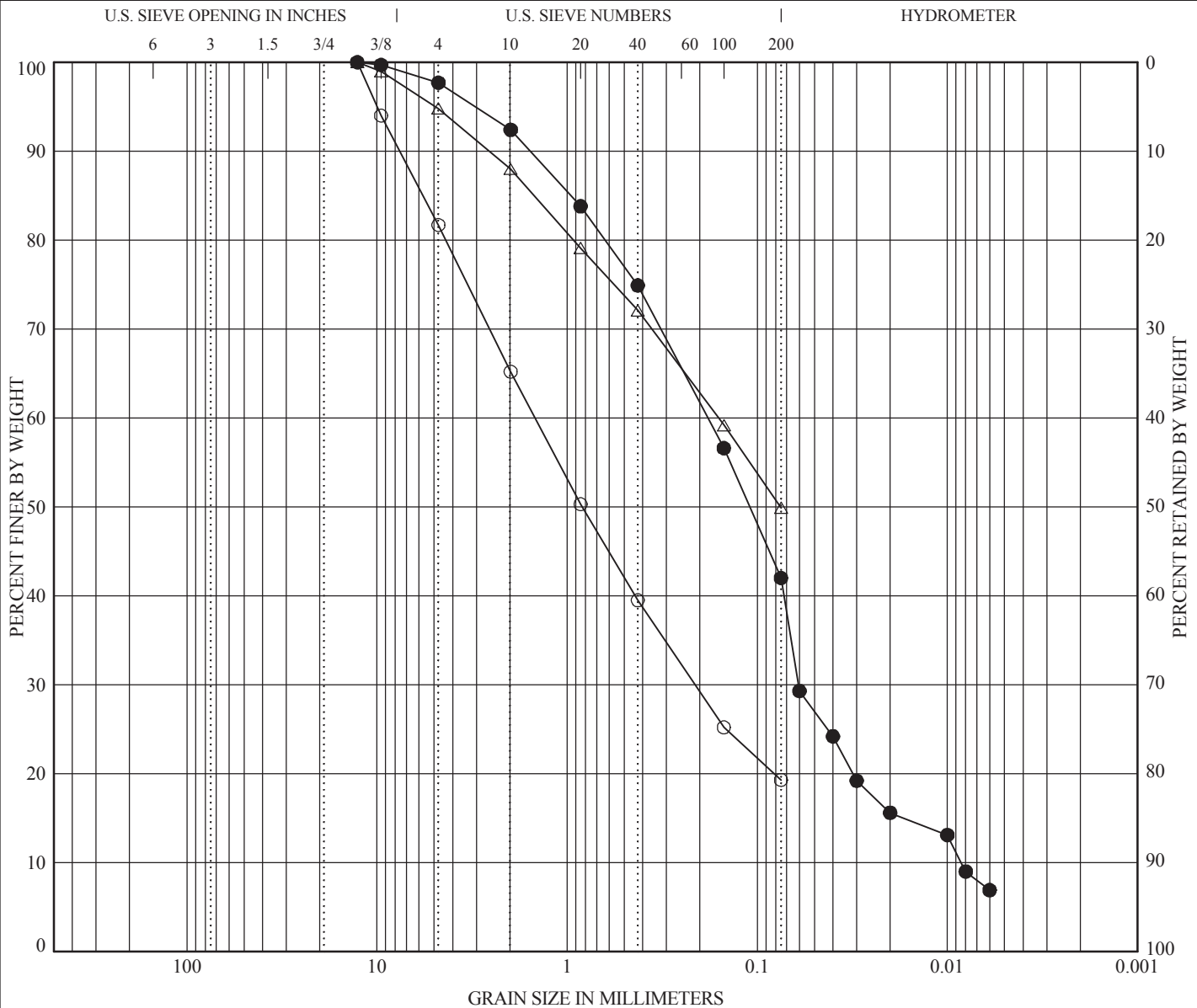
BORING NUMBER AND SAMPLE DEPTH:	G-164 at 48½'	G-164 at 60½'	G-164 at 72½'	G-168 at 77½'
SOIL TYPE:	POORLY GRADED GRAVEL with SILT and SAND	SILTY SAND	POORLY GRADED SAND	POORLY GRADED SAND
SURCHARGE PRESSURE: (lbs./sq. ft.)	1800	1800	1800	2000
PERCENT HYDROCONSOLIDATION: (%)	0.07	0.14	0.06	0.14

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Checked/Date: LT 10/2/11

MTA Westside Subway Extension
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HYDROCONSOLIDATION TEST DATA
Project No.: 4953-10-1561
Figure D-4.9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-10	35.5	CLAYEY SAND (SC)	--	--	--	--	--
●	G-10	50.5	CLAYEY SAND (SC)	28	19	9	2.4	21.5
△	G-10	55.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-10	35.5	12.70	1.474	0.213	--	18.3	62.4	19.3
●	G-10	50.5	12.70	0.182	0.061	0.008	2.3	55.7	42.0
△	G-10	55.5	12.70	0.160	--	--	5.2	44.9	49.9

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

Prepared/Date: JF 6/29/2011
Checked/Date: HP 12/2/2011

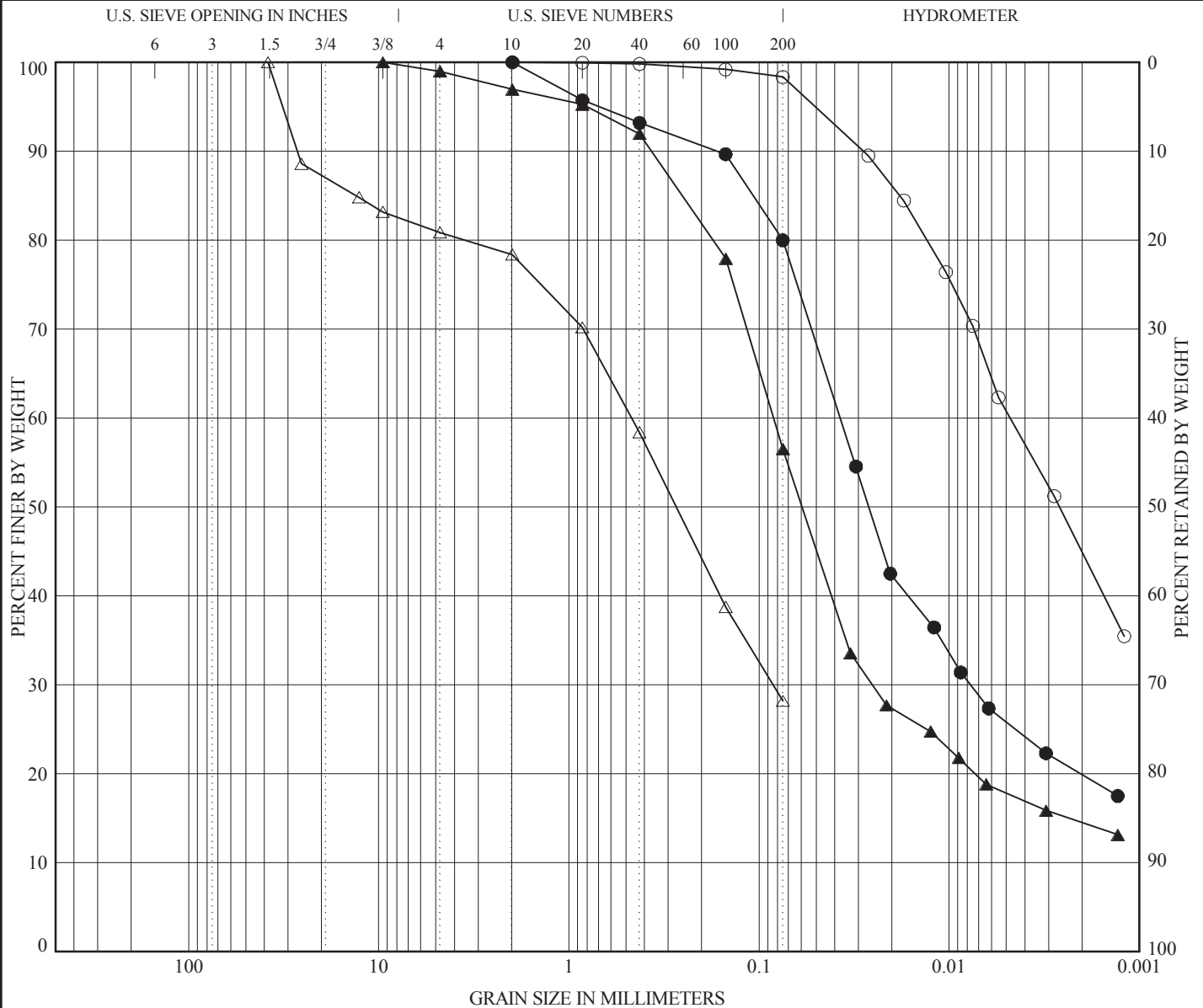
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561



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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-133	50.5	ELASTIC SILT (MH)	65	33	32	--	--
●	G-133	59.5	SILT with SAND (ML)	--	--	--	--	--
△	G-133	68.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
▲	G-133	74.5	SANDY SILT (ML)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-133	50.5	1.98	0.005	--	--	0.0	1.7	98.3
●	G-133	59.5	1.98	0.037	0.008	--	0.0	20.0	80.0
△	G-133	68.5	38.10	0.467	0.085	--	19.1	52.7	28.2
▲	G-133	74.5	9.52	0.084	0.025	--	1.0	42.5	56.5

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

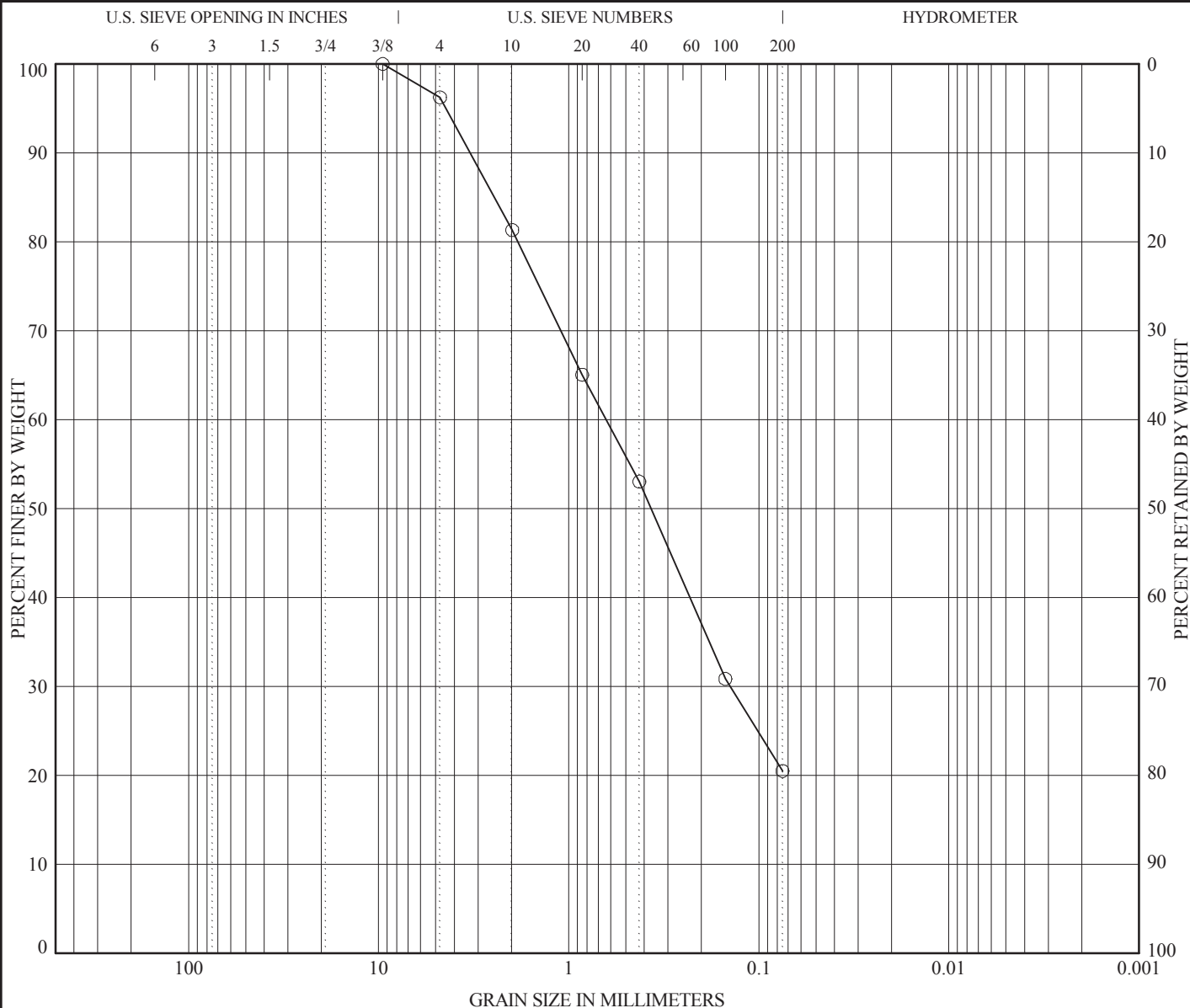
Prepared/Date: JF 6/28/2011
Checked/Date: LT 8/15/2011

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.1

AMECFW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-133	83.5	CLAYEY SAND (SC)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-133	83.5	9.52	0.635	0.142	--	3.8	75.7	20.5

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

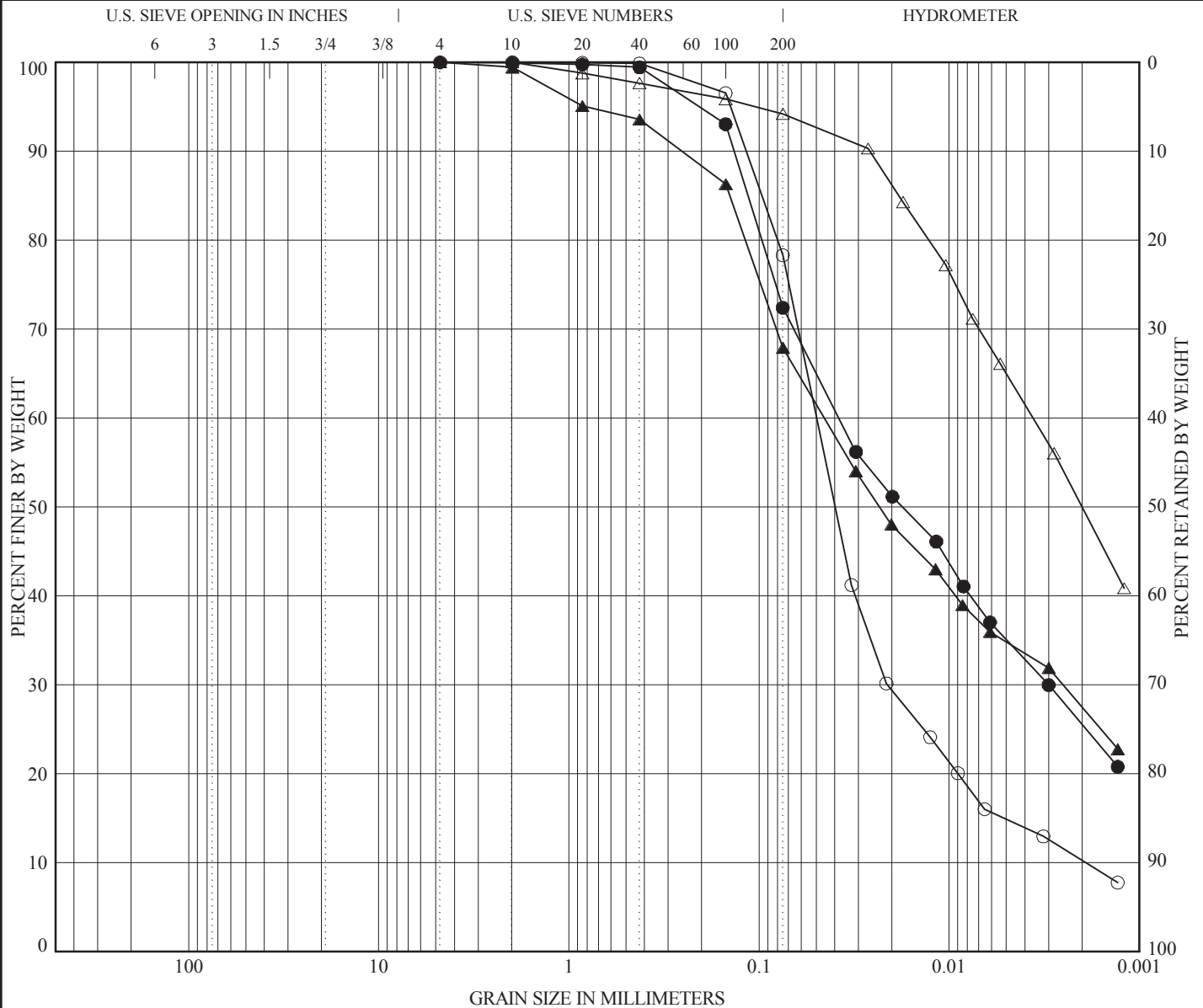
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Figure: D-5.2.2

AMEC FW GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-134	45.5	SILT with SAND (ML)	--	--	--	4.7	25.9
●	G-134	55.5	SILT with SAND (ML)	--	--	--	--	--
△	G-134	60.5	LEAN CLAY (CL)	--	--	--	--	--
▲	G-134	76.5	SANDY LEAN CLAY (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-134	45.5	1.98	0.050	0.021	0.002	0.0	21.7	78.3
●	G-134	55.5	4.75	0.038	0.003	--	0.0	27.6	72.4
△	G-134	60.5	1.98	0.004	--	--	0.0	5.8	94.2
▲	G-134	76.5	4.75	0.045	0.003	--	0.0	32.1	67.9

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

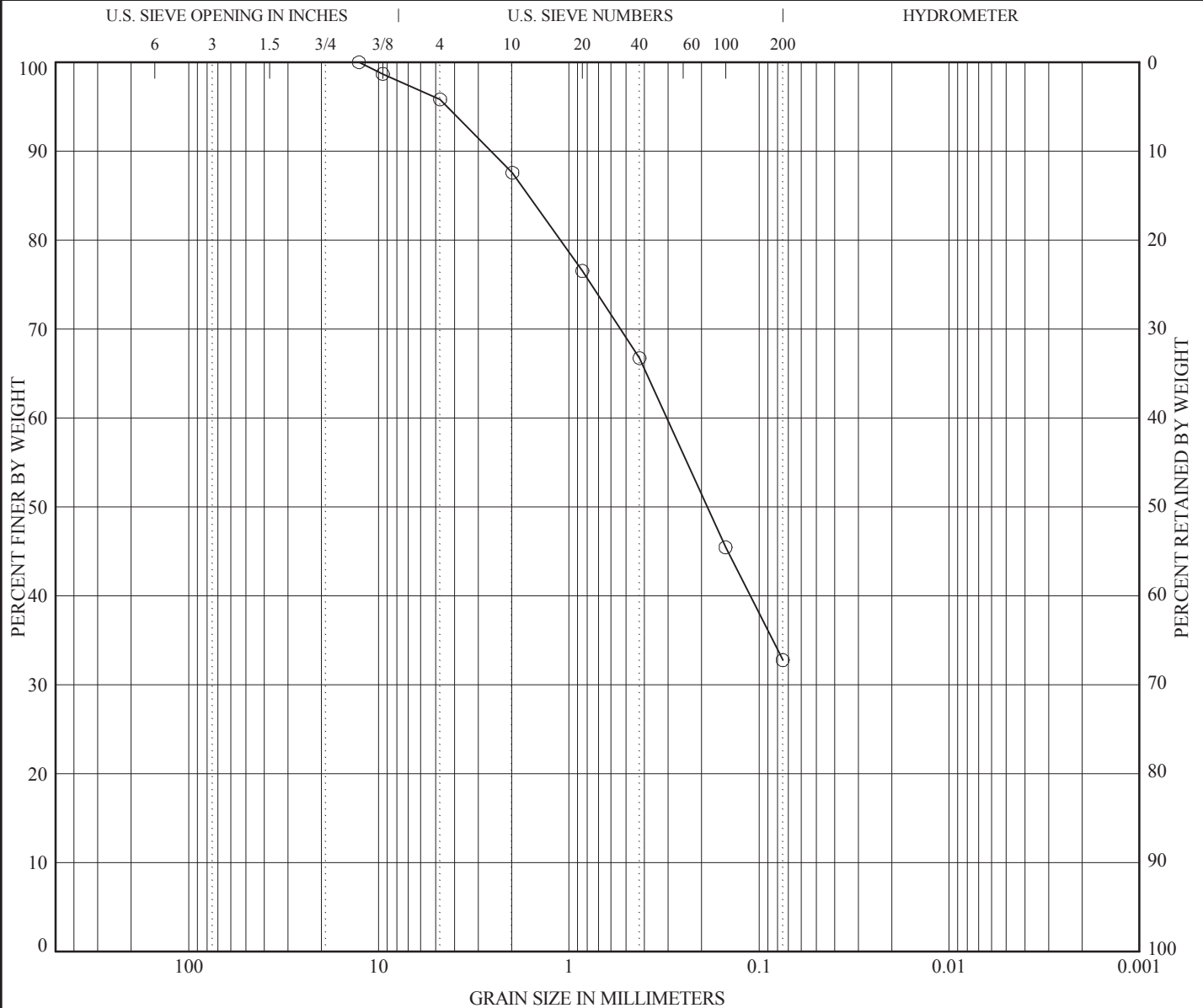
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Figure: D-5.2.3

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-134	95.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-134	95.5	12.70	0.306	--	--	4.2	63.0	32.8

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

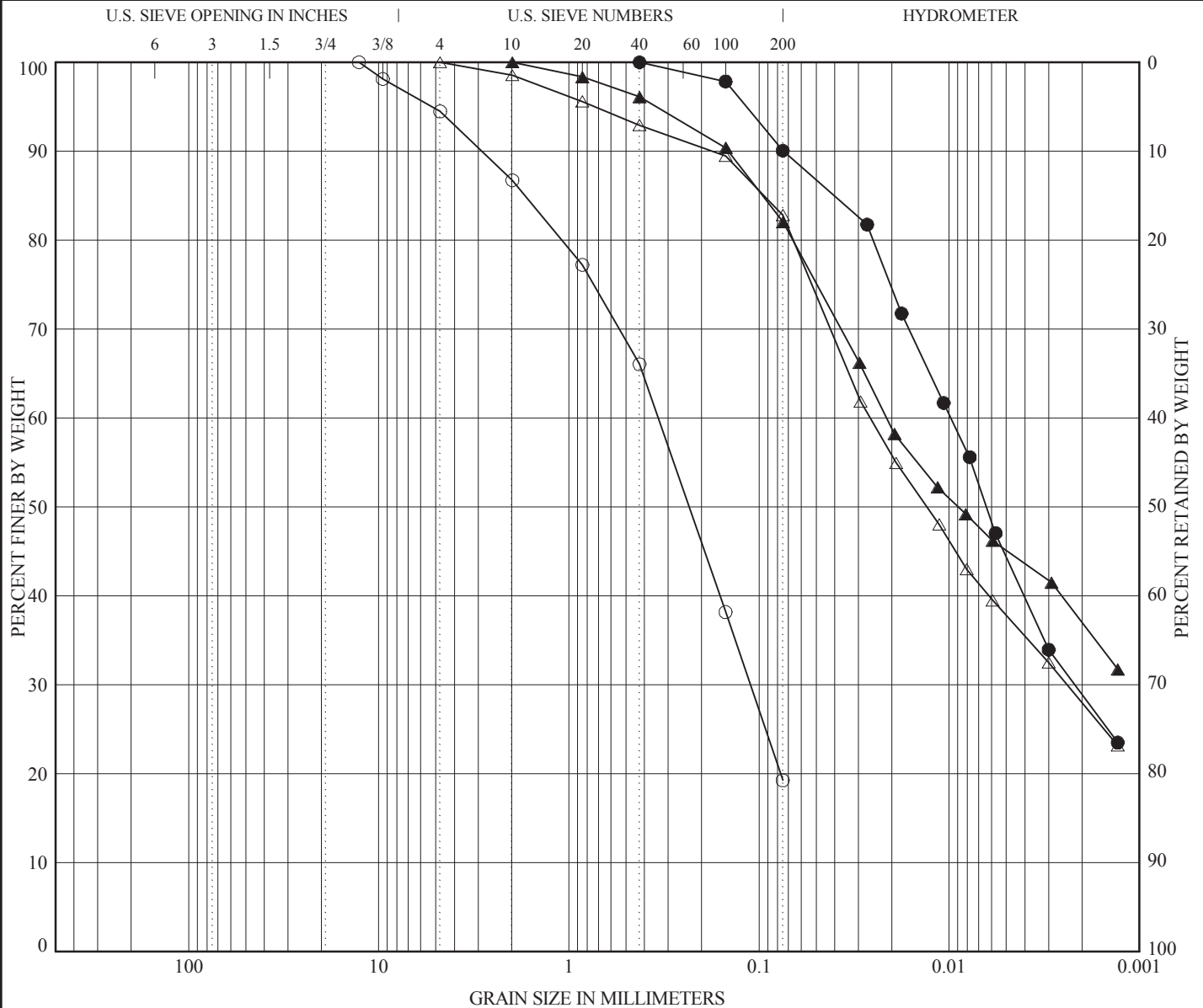
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Figure: D-5.2.4

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-135	19.5	CLAYEY SAND (SC)	--	--	--	--	--
●	G-135	56.0	ELASTIC SILT (MH)	54	30	24	--	--
△	G-135	65.5	FAT CLAY with SAND (CH)	57	29	28	--	--
▲	G-135	74.0	FAT CLAY with SAND (CH)	51	17	34	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-135	19.5	12.70	0.339	0.111	--	5.5	75.2	19.2
●	G-135	56.0	0.43	0.010	0.002	--	0.0	9.9	90.1
△	G-135	65.5	4.75	0.026	0.002	--	0.0	17.2	82.8
▲	G-135	74.0	1.98	0.021	--	--	0.0	18.0	82.0

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

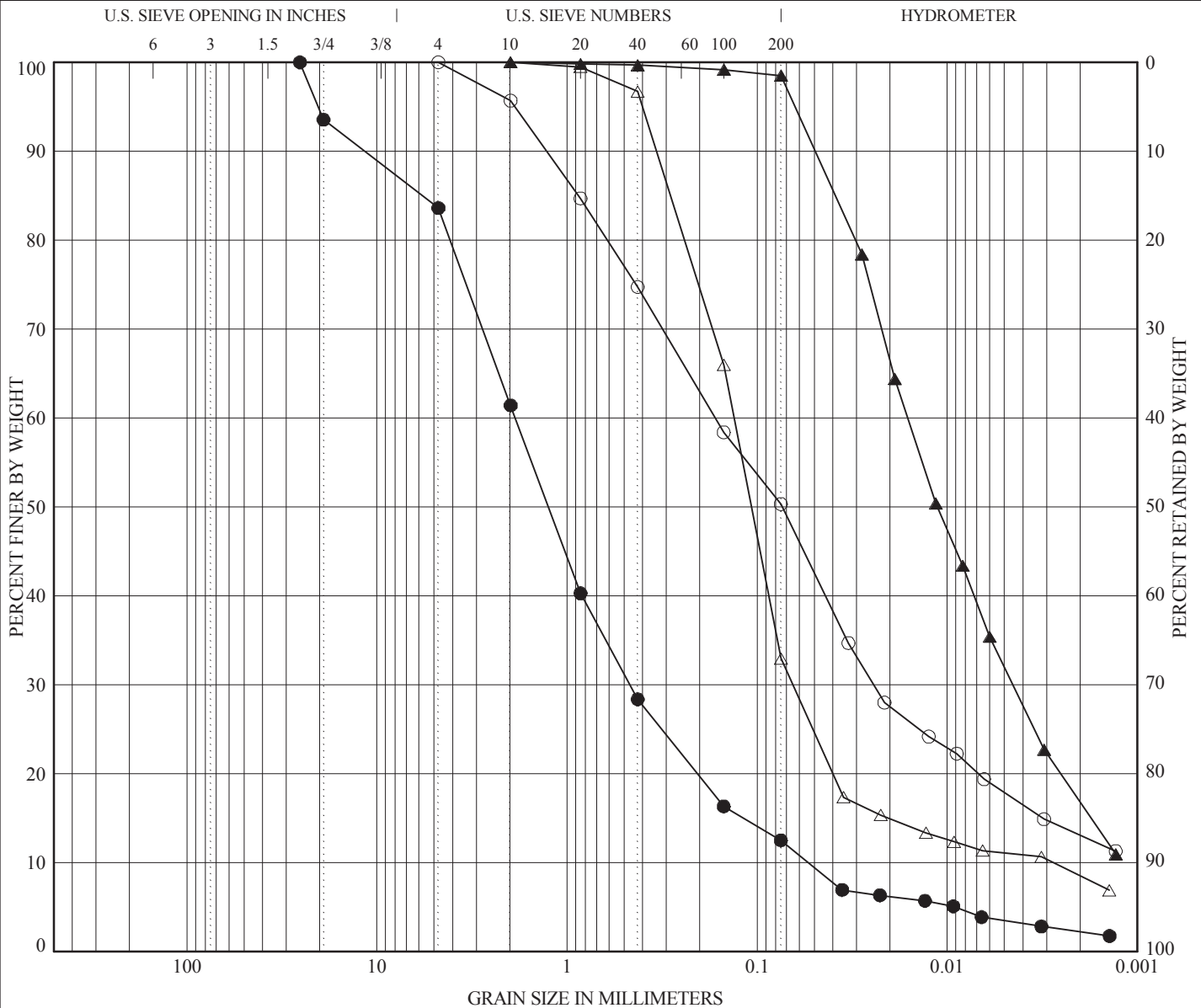
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Figure: D-5.2.5

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-135	83.5	SANDY LEAN CLAY (CL)	37	21	16	--	--
●	G-135	92.0	SILTY SAND with GRAVEL (SM)	--	--	--	2.2	34.8
△	G-135	98.0	SILTY SAND (SM)	--	--	--	11.5	47.7
▲	G-135	110.0	ELASTIC SILT (MH)	66	36	30	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-135	83.5	4.75	0.166	0.024	--	0.0	49.7	50.3
●	G-135	92.0	25.40	1.870	0.467	0.054	16.4	71.1	12.5
△	G-135	98.0	1.98	0.132	0.065	0.003	0.0	67.1	32.9
▲	G-135	110.0	1.98	0.016	0.005	--	0.0	1.5	98.5

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

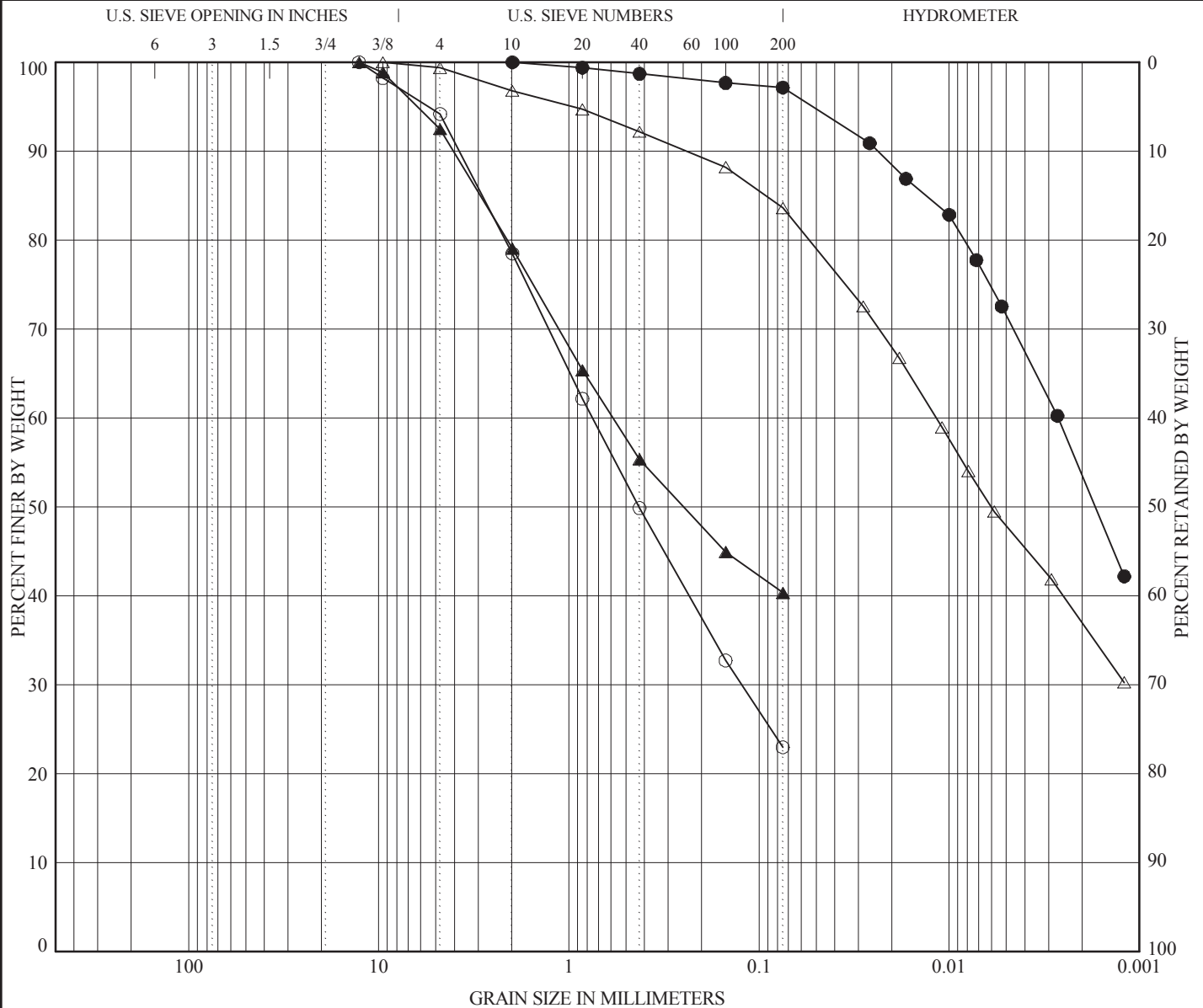
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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.2.6

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-136	35.5	CLAYEY SAND (SC)	--	--	--	--	--
●	G-136	65.5	FAT CLAY (CH)	71	24	47	--	--
△	G-136	75.5	LEAN CLAY with SAND (CL)	43	15	28	--	--
▲	G-136	90.5	CLAYEY SAND (SC)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-136	35.5	12.70	0.753	0.124	--	5.8	71.2	23.0
●	G-136	65.5	1.98	0.003	--	--	0.0	2.8	97.2
△	G-136	75.5	9.52	0.012	--	--	0.6	15.8	83.6
▲	G-136	90.5	12.70	0.586	--	--	7.5	52.1	40.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

Prepared/Date: WL 8/8/2011
Checked/Date: LT 9/12/2011

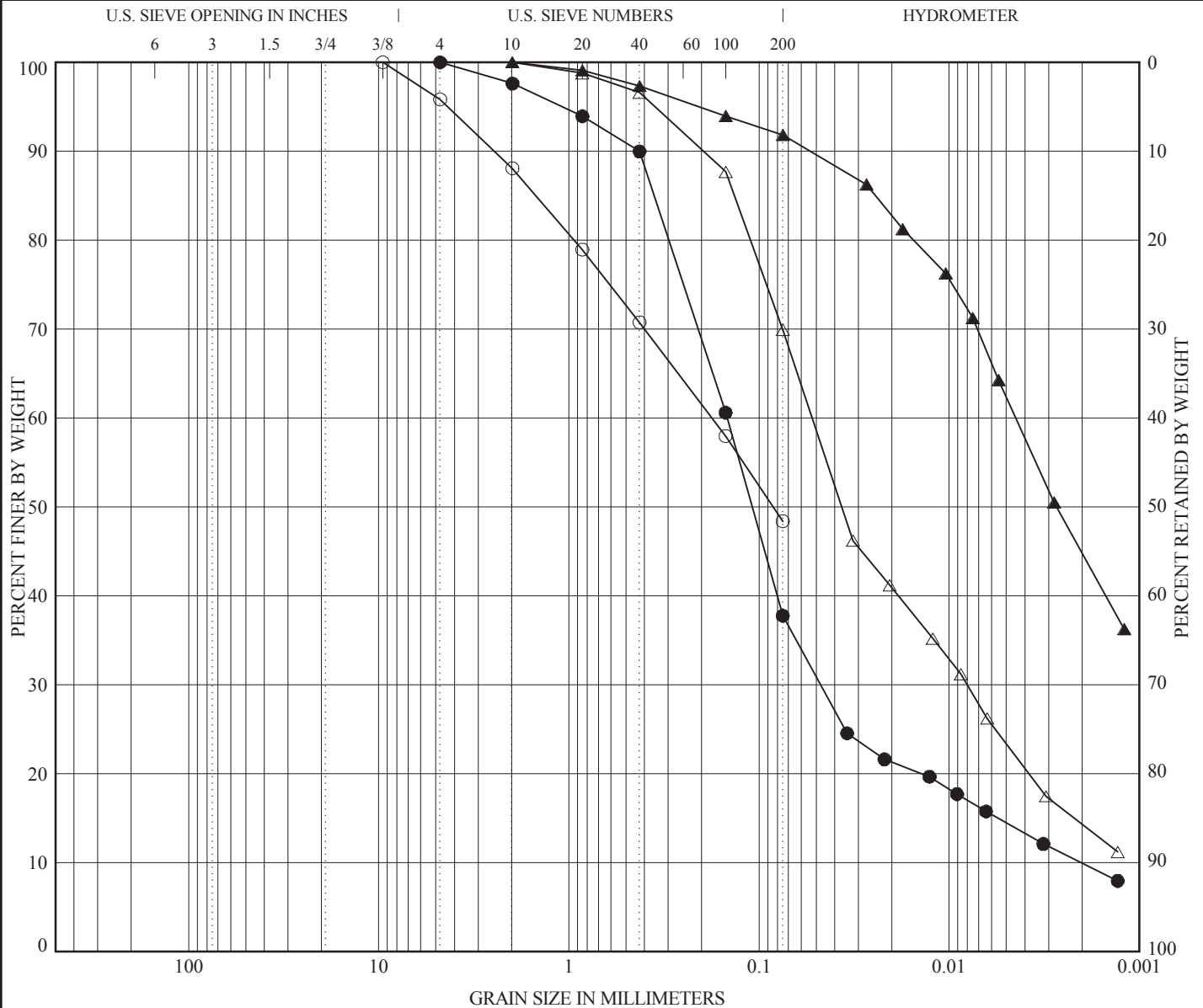
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Figure: D-5.2.7

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Figure: D-5.2.8

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-137	49.0	CLAYEY SAND (SC)	32	17	15	--	--
●	G-137	58.5	SILTY SAND (SM)	--	--	--	7.5	72.7
△	G-137	64.5	SANDY FAT CLAY (CH)	57	28	29	--	--
▲	G-137	70.5	FAT CLAY (CH)	69	21	48	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-137	49.0	9.52	0.177	--	--	4.2	47.4	48.4
●	G-137	58.5	4.75	0.147	0.047	0.002	0.0	62.2	37.8
△	G-137	64.5	1.98	0.053	0.008	--	0.0	30.1	69.9
▲	G-137	70.5	1.98	0.004	--	--	0.0	8.2	91.8

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

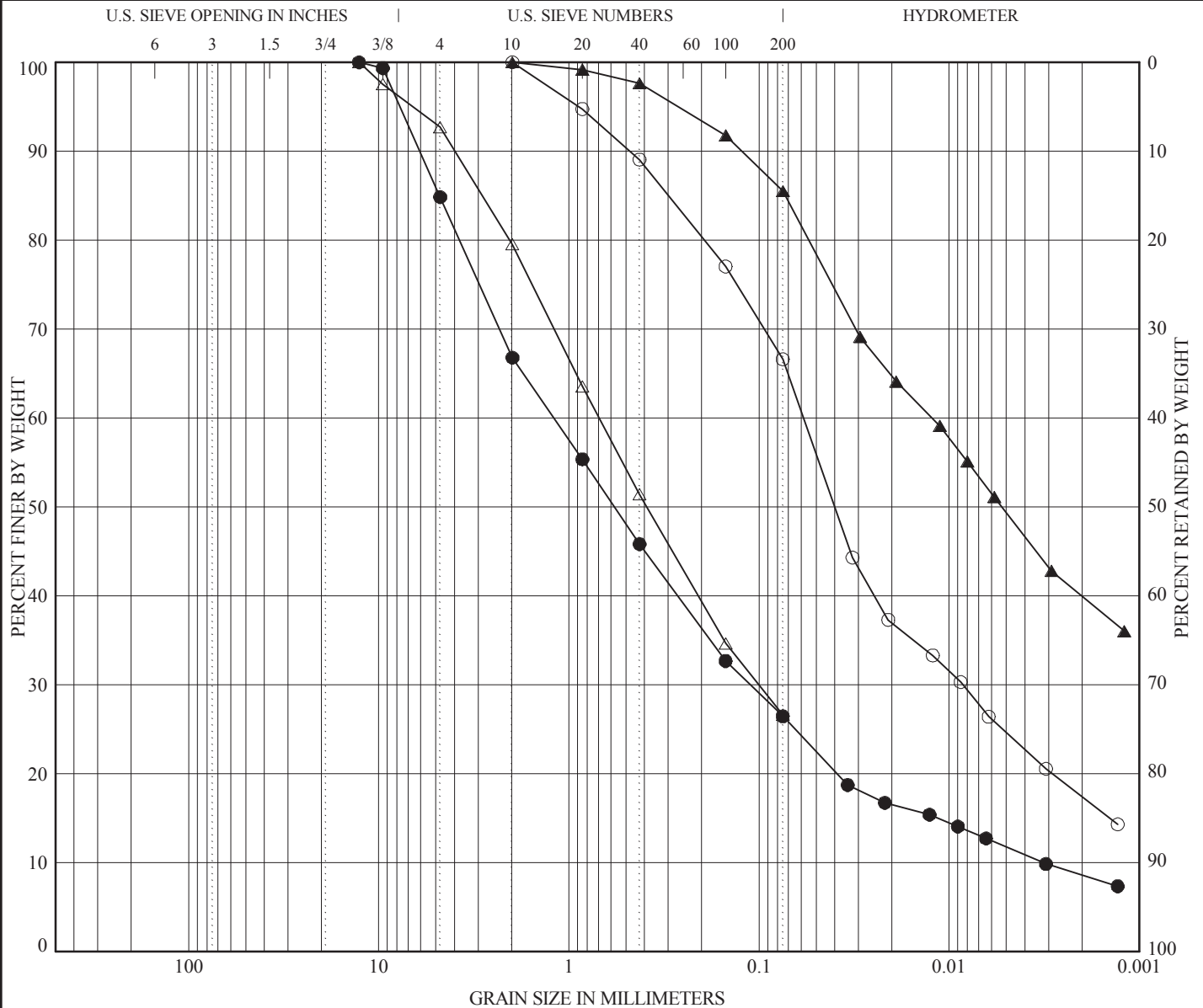
Prepared/Date: YN 9/9/2011
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Figure: D-5.2.9

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-137	82.5	SANDY LEAN CLAY (CL)	32	17	15	--	--
●	G-137	91.0	CLAYEY SAND with GRAVEL (SC)	29	19	10	3.2	372.5
△	G-137	94.5	SILTY SAND (SM)	--	--	--	--	--
▲	G-137	100.5	FAT CLAY (CH)	58	19	39	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-137	82.5	1.98	0.058	0.008	--	0.0	33.4	66.6
●	G-137	91.0	12.70	1.198	0.111	0.003	15.2	58.4	26.5
△	G-137	94.5	12.70	0.694	0.100	--	7.3	66.1	26.6
▲	G-137	100.5	1.98	0.012	--	--	0.0	14.5	85.5

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

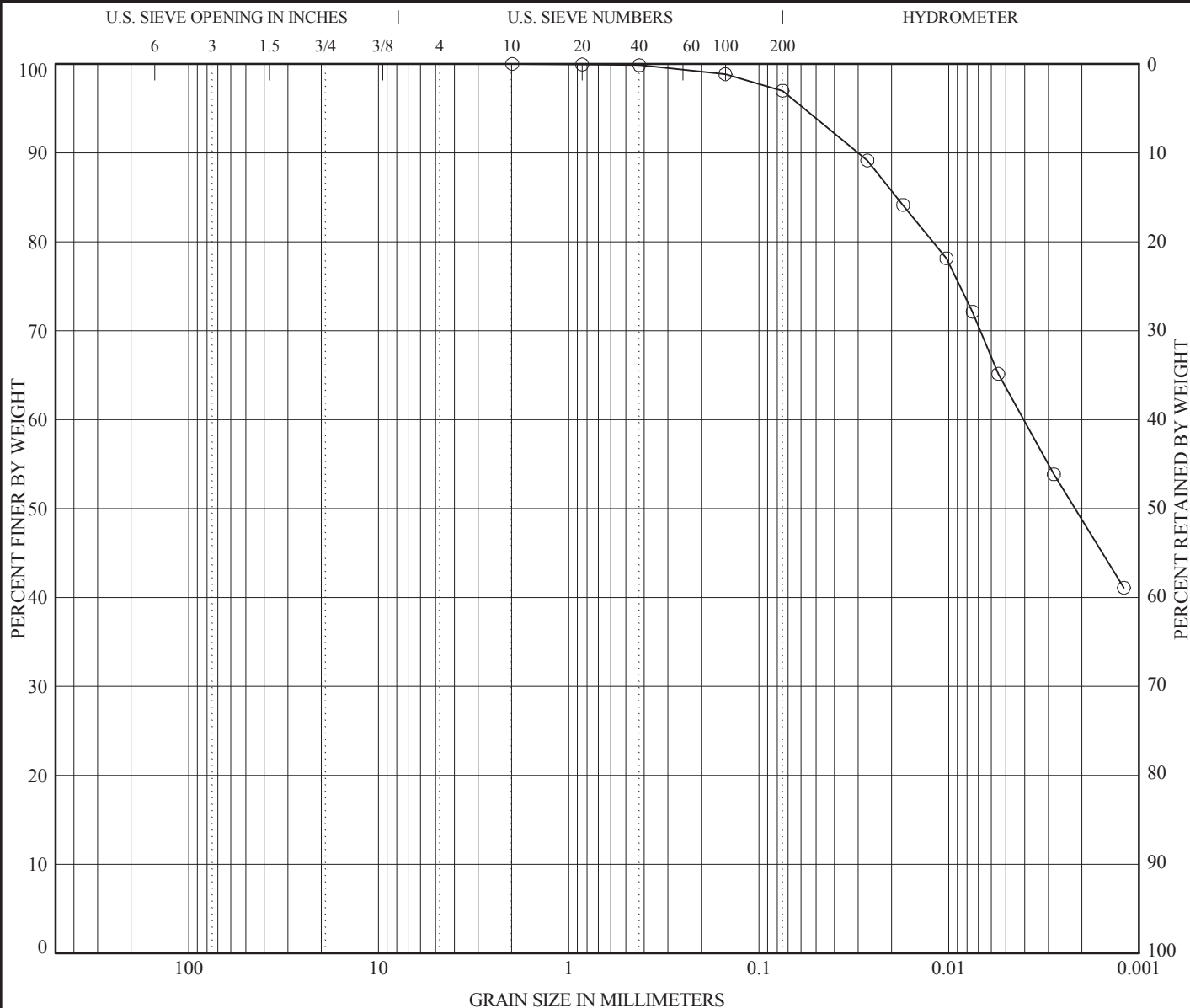
Prepared/Date: YN 9/9/2011
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Figure: D-5.2.10

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-137	109.0	FAT CLAY (CH)	84	27	57	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-137	109.0	1.98	0.004	--	--	0.0	3.0	97.0

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

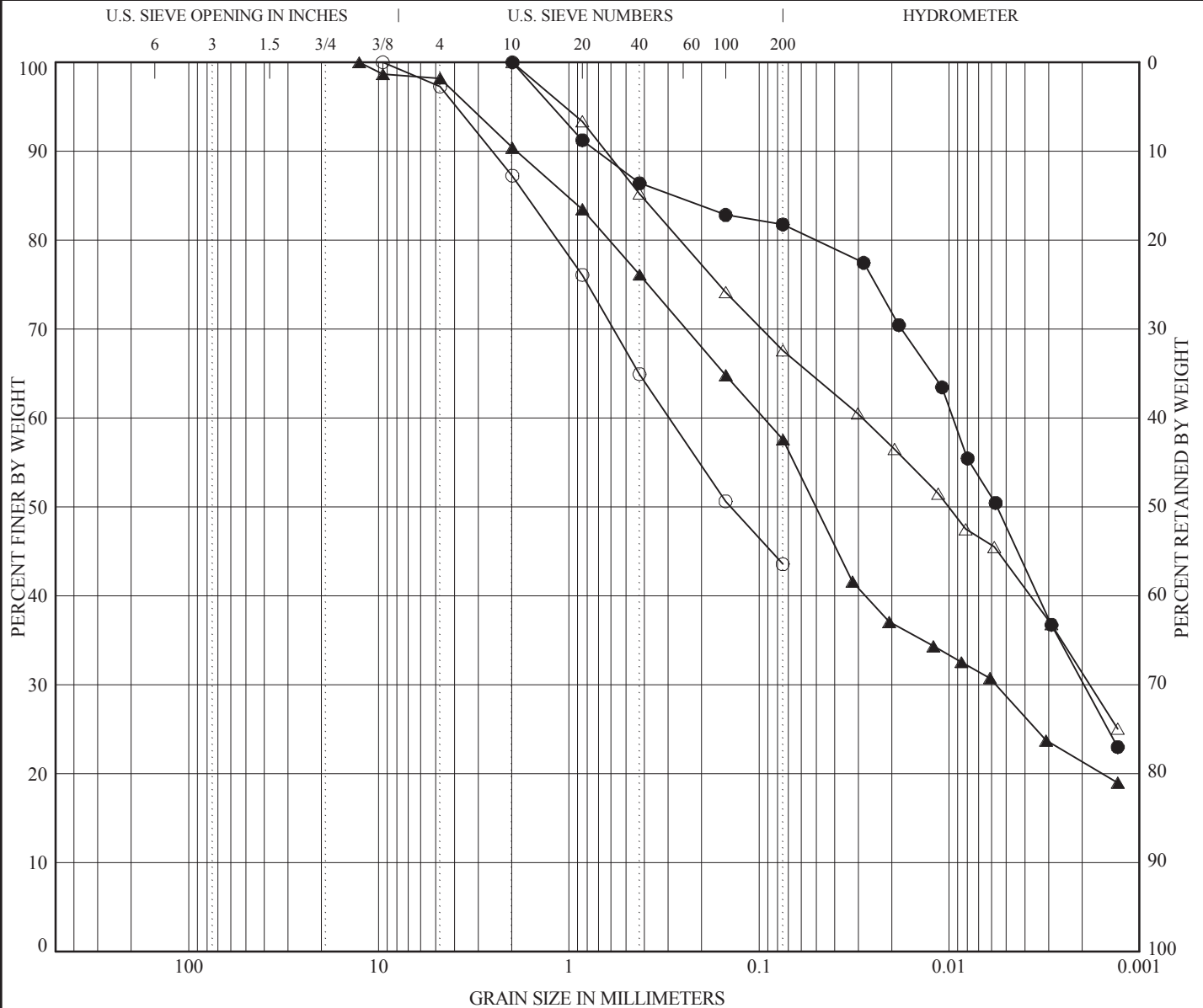
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Figure: D-5.2.11

AMECFW_GRAIN SIZE_L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-138	30.5	CLAYEY SAND (SC)	33	16	17	--	--
●	G-138	65.5	FAT CLAY with SAND (CH)	63	22	41	--	--
△	G-138	75.5	SANDY LEAN CLAY (CL)	47	21	26	--	--
▲	G-138	85.5	SANDY LEAN CLAY (CL)	36	13	23	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-138	30.5	9.52	0.297	--	--	2.7	53.7	43.6
●	G-138	65.5	1.98	0.010	0.002	--	0.0	18.2	81.8
△	G-138	75.5	1.98	0.029	0.002	--	0.0	32.4	67.6
▲	G-138	85.5	12.70	0.095	0.006	--	1.8	40.6	57.6

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

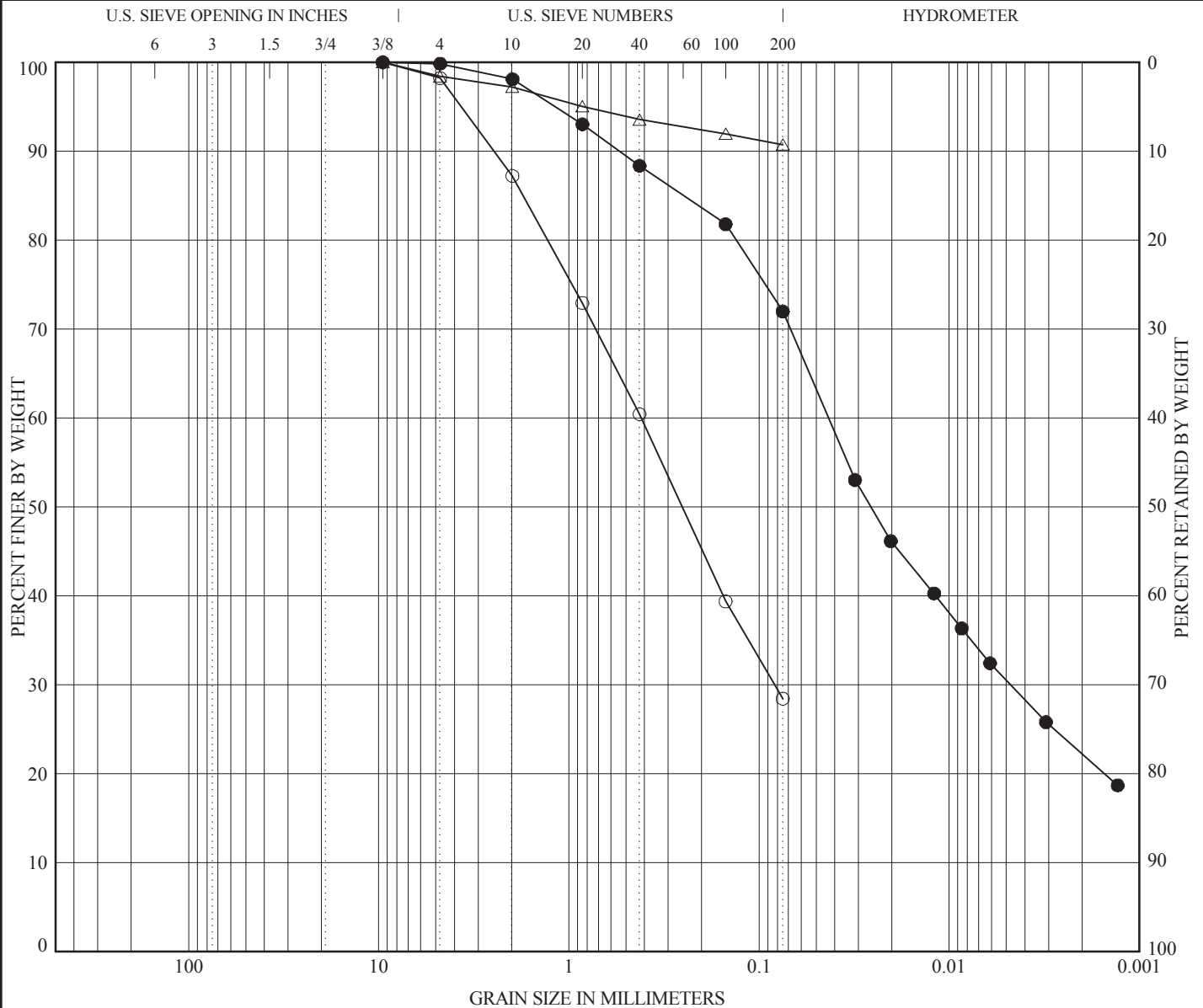
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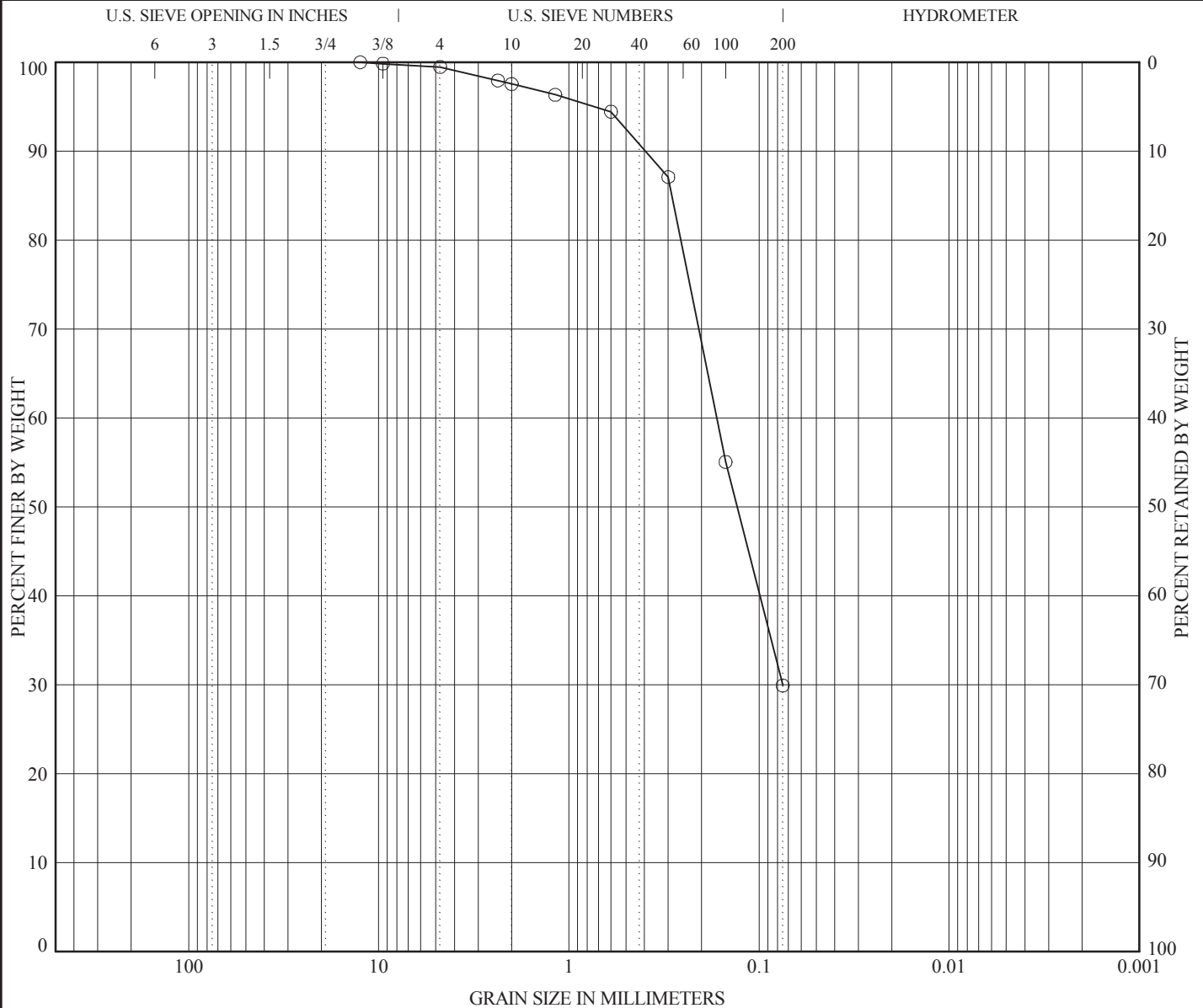


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Project No.: 4953-10-1561
Figure: D-5.2.12

AMEC.FW GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



AMECFW_GRAIN SIZE_L:70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-139	95.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-139	95.5	12.50	0.167	0.075	--	0.5	69.6	29.9

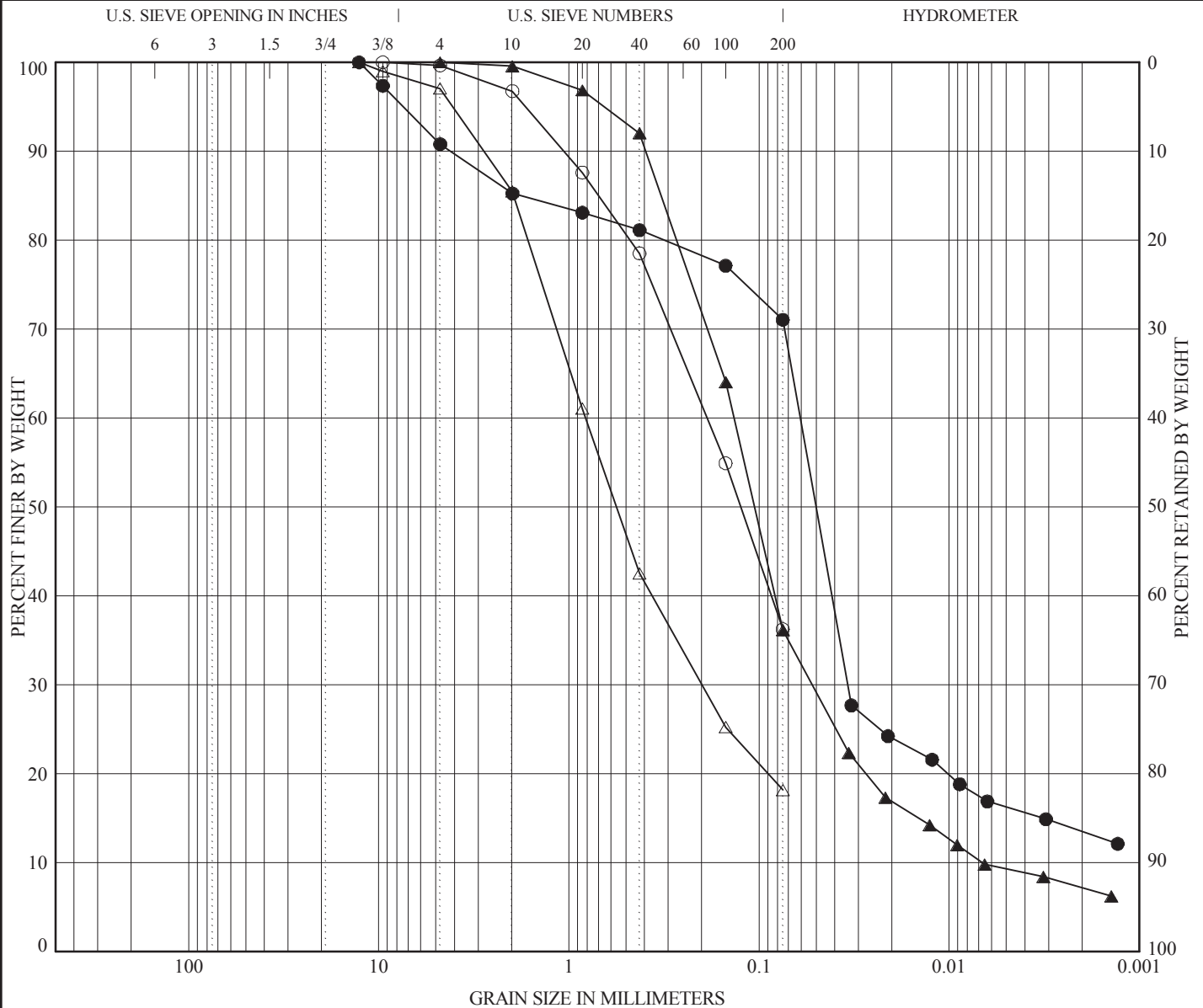
Laboratory Test Method: ASTM D 422
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.
Prepared/Date: YN 8/10/2011
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Figure: D-5.2.15

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-140	50.5	SILTY SAND (SM)	--	--	--	--	--
●	G-140	68.5	LEAN CLAY with SAND (CL)	32	20	12	--	--
△	G-140	77.5	SILTY SAND (SM)	--	--	--	--	--
▲	G-140	80.5	SILTY SAND (SM)	NP	NP	NP	3.0	20.2

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-140	50.5	9.52	0.188	--	--	0.4	63.4	36.2
●	G-140	68.5	12.70	0.061	0.034	--	9.2	19.8	71.0
△	G-140	77.5	12.70	0.817	0.200	--	2.9	78.9	18.2
▲	G-140	80.5	4.75	0.136	0.053	0.007	0.0	63.9	36.1

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

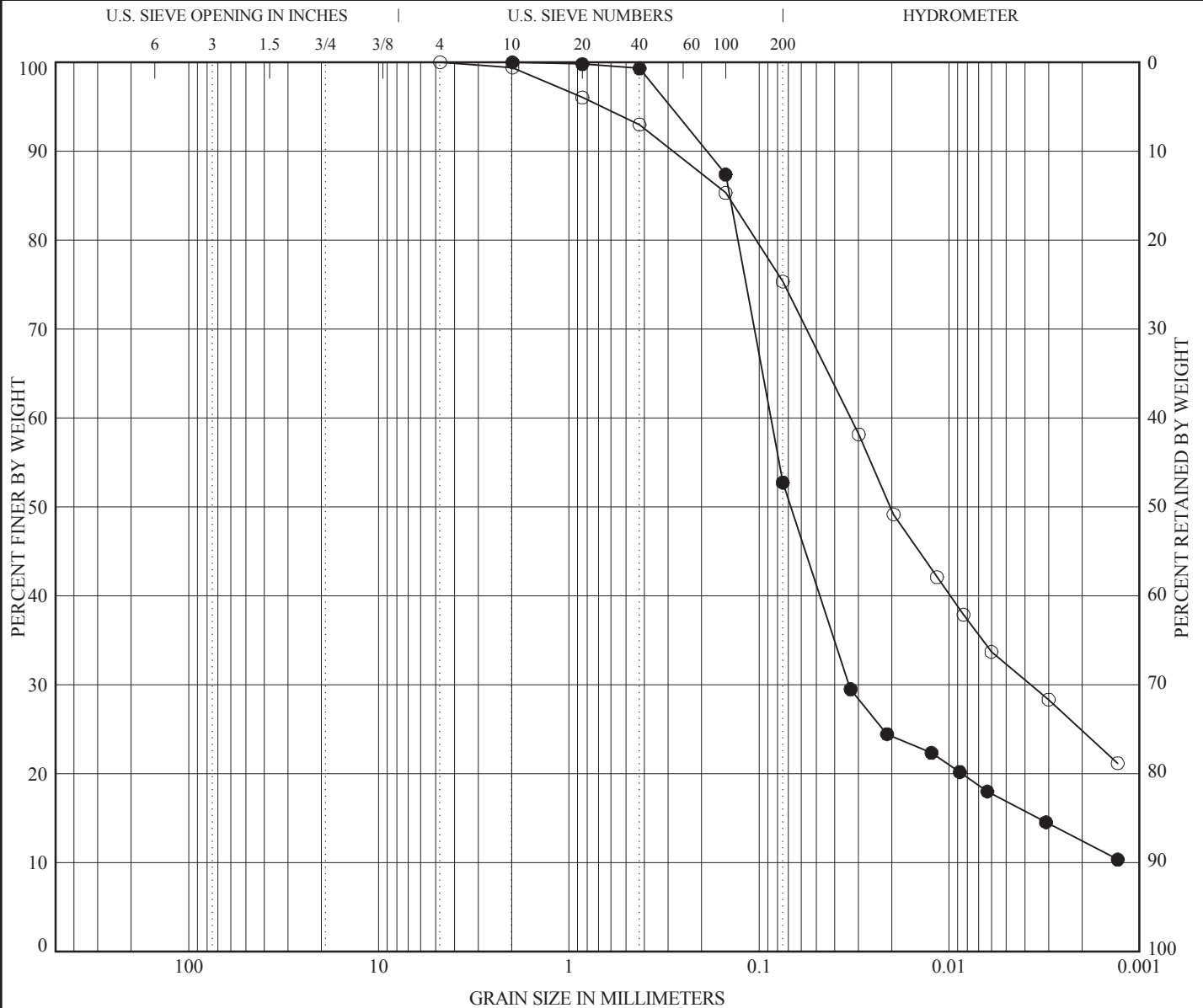
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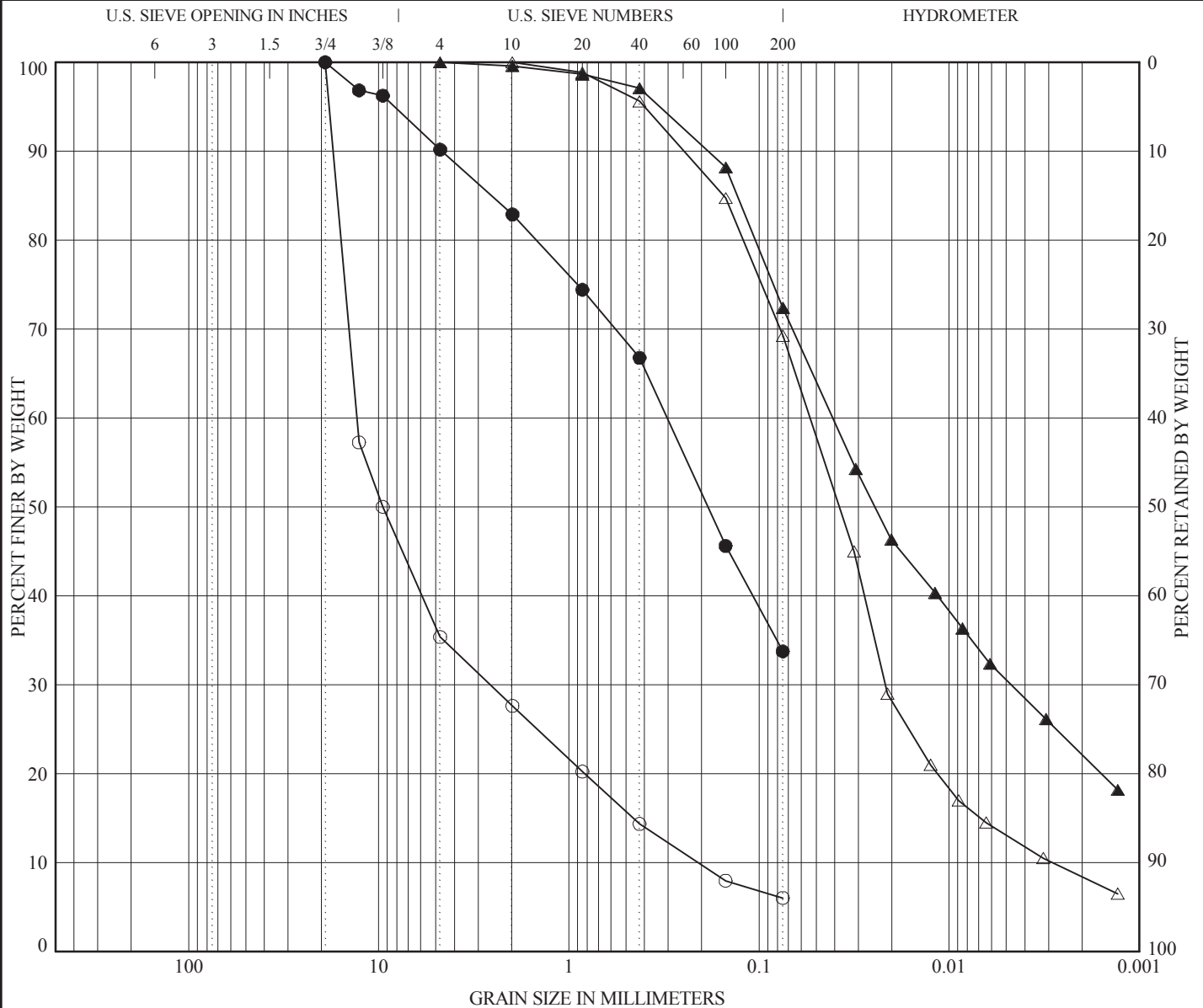


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Figure: D-5.2.16

AMEC FW GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-141	20.5	WELL GRADED GRAVEL with SILT and SAND (GW-GM)	--	--	--	2.5	62.3
●	G-141	45.5	SILTY SAND (SM)	--	--	--	--	--
△	G-141	50.5	SANDY SILT (ML)	--	--	--	3.0	18.9
▲	G-141	60.5	LEAN CLAY with SAND (CL)	38	23	15	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-141	20.5	19.10	13.038	2.591	0.209	64.6	29.3	6.0
●	G-141	45.5	19.10	0.305	--	--	9.8	56.4	33.8
△	G-141	50.5	1.98	0.054	0.022	0.003	0.0	30.7	69.3
▲	G-141	60.5	4.75	0.041	0.005	--	0.0	27.6	72.4

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

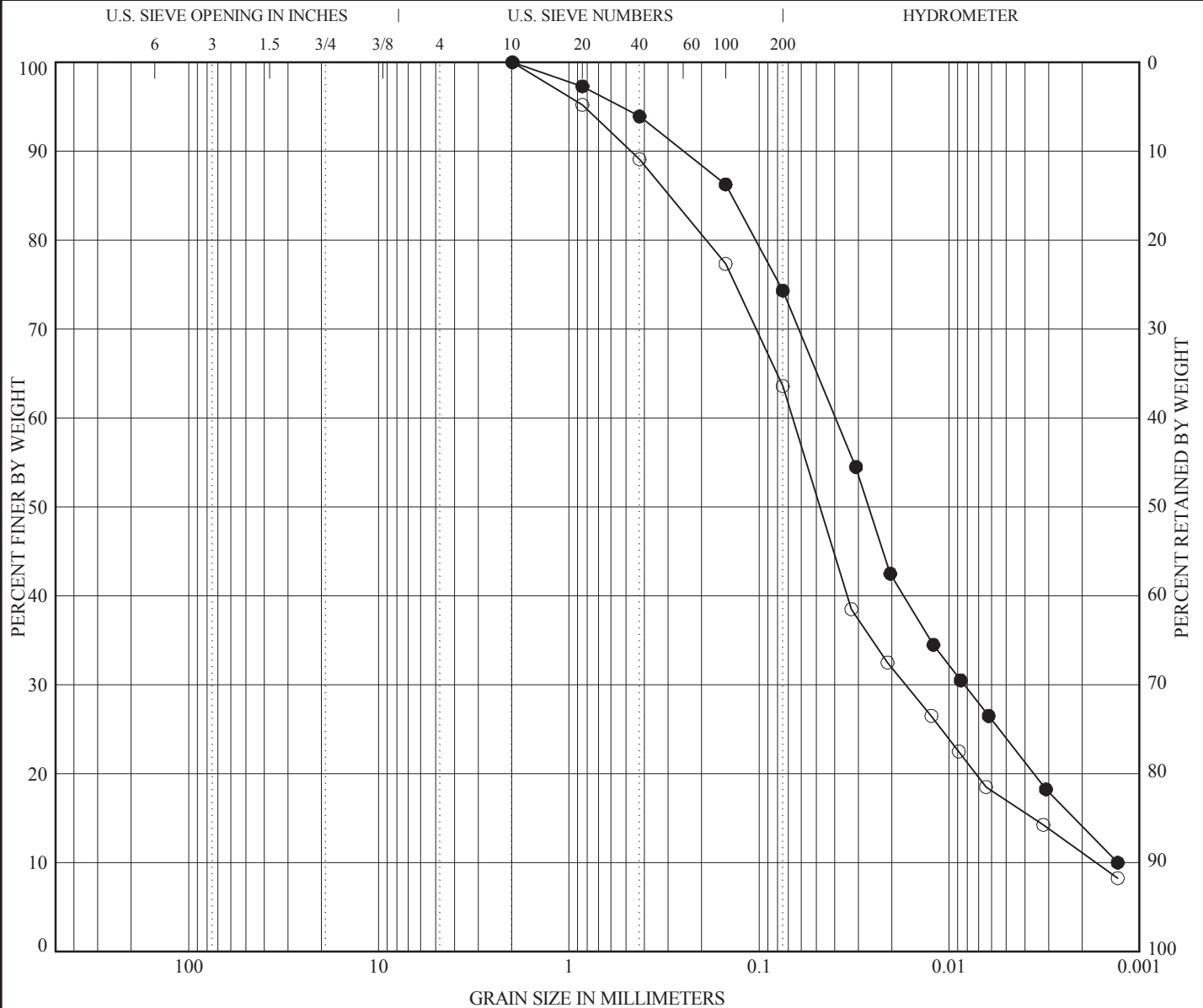
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Figure: D-5.2.18

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-141	70.5	SANDY LEAN CLAY (CL)	35	22	13	2.5	39.4
●	G-141	80.5	LEAN CLAY with SAND (CL)	37	20	17	1.4	30.4

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-141	70.5	1.98	0.067	0.017	0.002	0.0	36.4	63.6
●	G-141	80.5	1.98	0.040	0.008	0.001	0.0	25.7	74.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

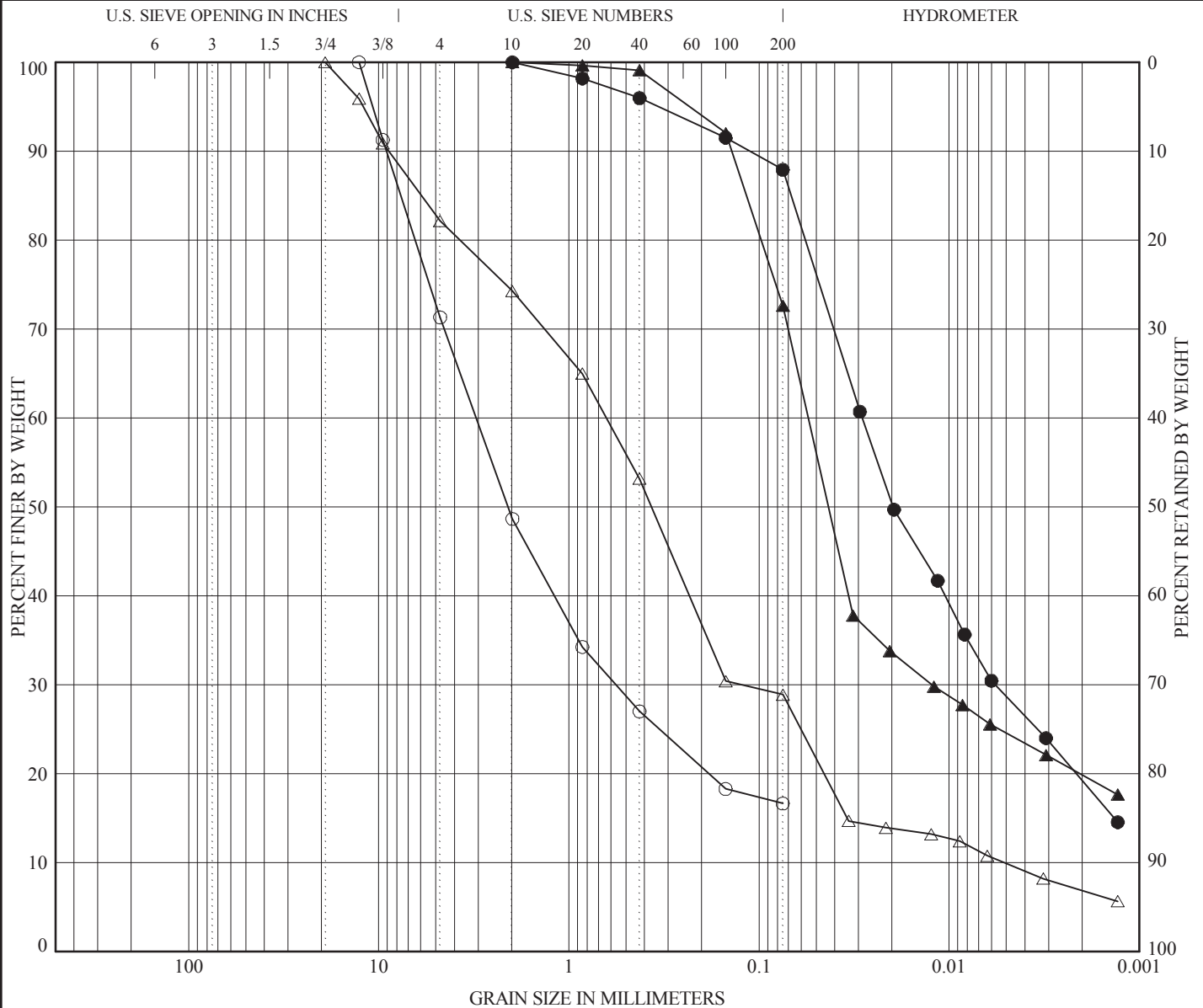
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Figure: D-5.2.19

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-142	30.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
●	G-142	45.5	ELASTIC SILT (MH)	54	31	23	--	--
△	G-142	55.5	SILTY SAND with GRAVEL (SM)	NP	NP	NP	4.8	123.6
▲	G-142	65.5	LEAN CLAY with SAND (CL)	48	26	22	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-142	30.5	12.70	3.069	0.566	--	28.7	54.7	16.6
●	G-142	45.5	1.98	0.029	0.006	--	0.0	12.1	87.9
△	G-142	55.5	19.10	0.635	0.125	0.005	17.8	53.3	28.9
▲	G-142	65.5	1.98	0.055	0.012	--	0.0	27.4	72.6

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

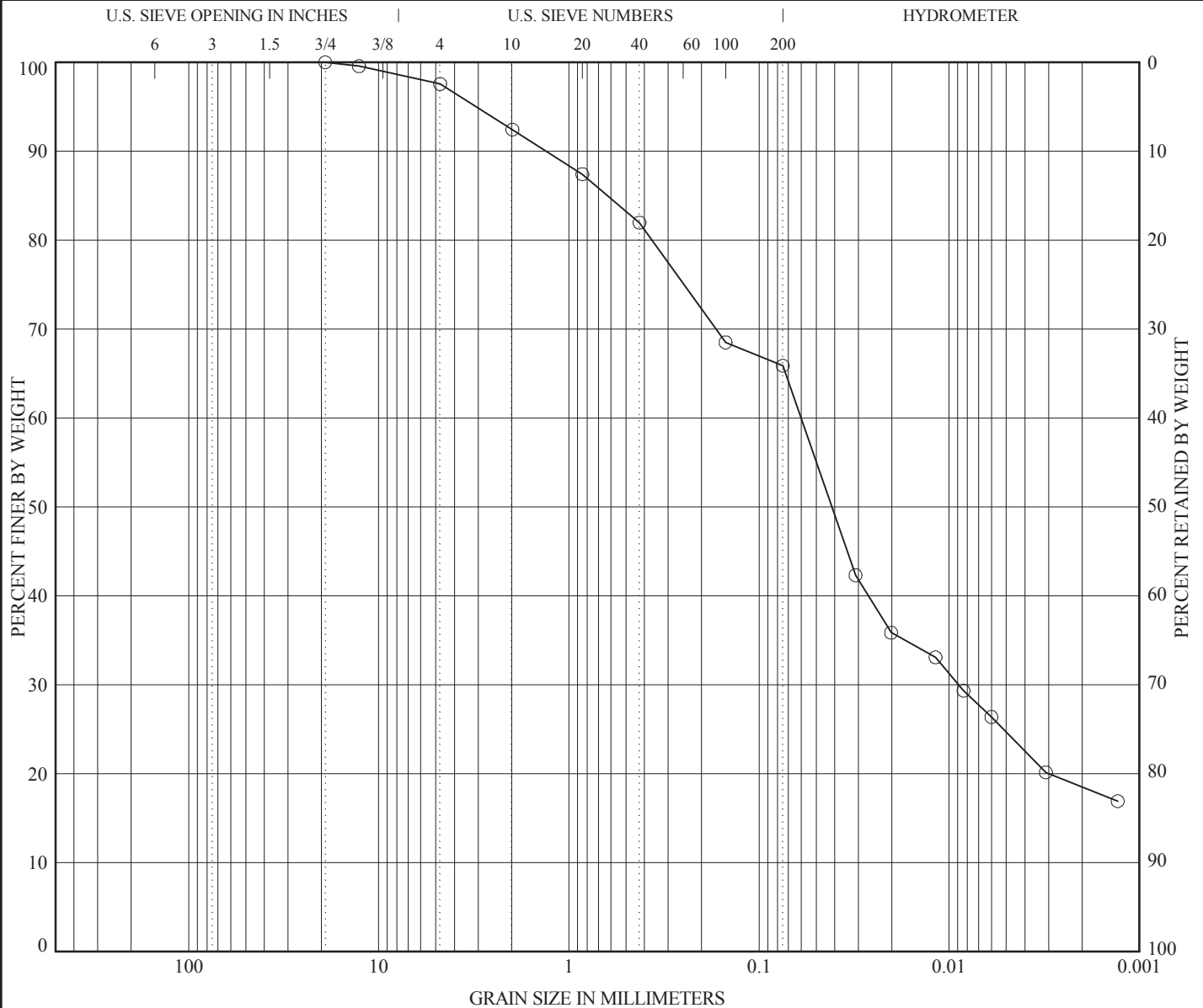
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Figure: D-5.2.20

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-142	80.5	SANDY LEAN CLAY (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-142	80.5	19.10	0.060	0.009	--	2.4	31.7	65.9

Laboratory Test Method: ASTM D 422
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

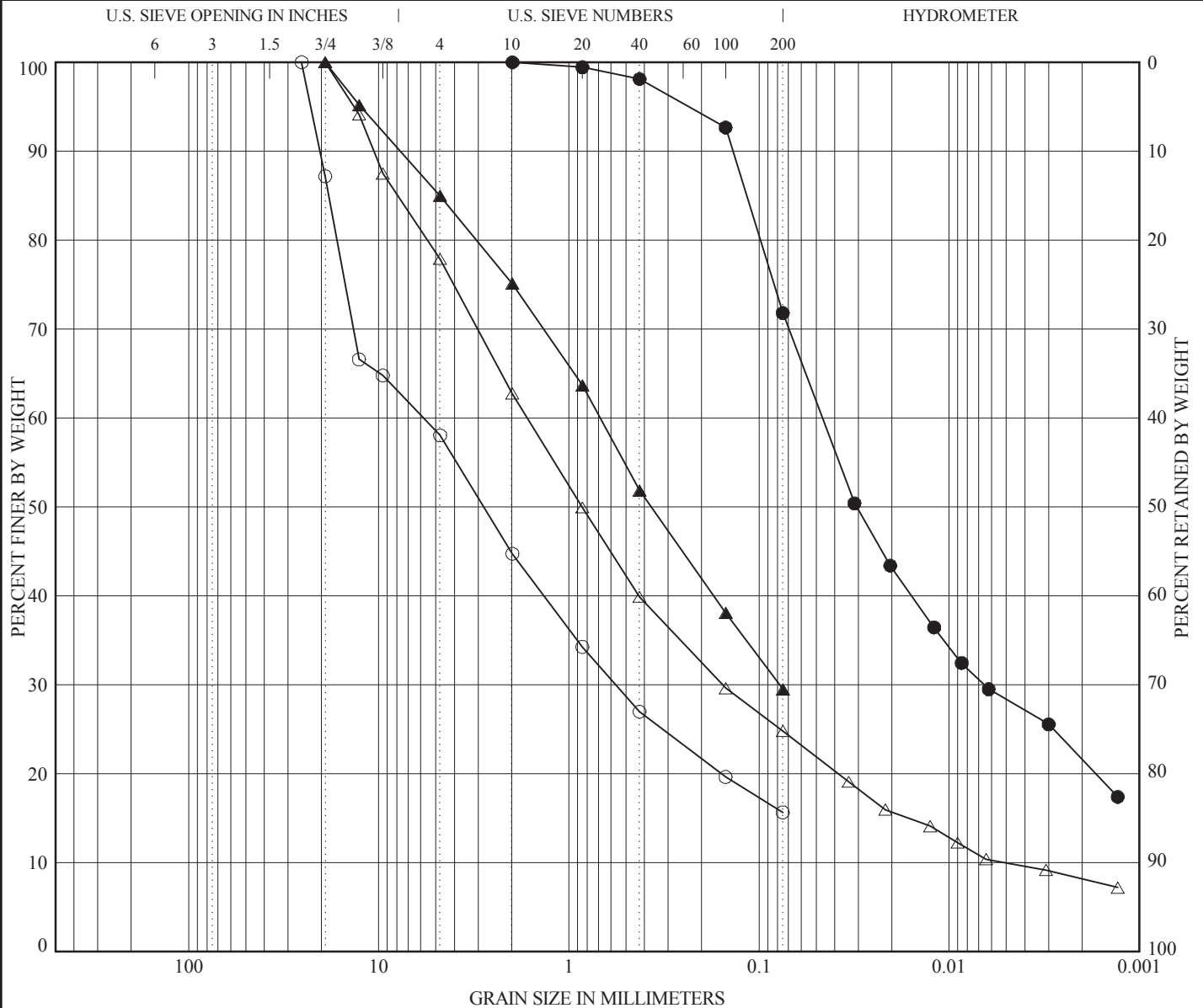
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Project No.: 4953-10-1561
Figure: D-5.2.21

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-143	35.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
●	G-143	55.5	LEAN CLAY with SAND (CL)	38	22	16	--	--
△	G-143	65.5	CLAYEY SAND with GRAVEL (SC)	39	23	16	2.9	325.7
▲	G-143	70.5	CLAYEY SAND with GRAVEL (SC)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-143	35.5	25.40	5.815	0.567	--	42.0	42.4	15.7
●	G-143	55.5	1.98	0.046	0.007	--	0.0	28.2	71.8
△	G-143	65.5	19.10	1.651	0.156	0.005	22.1	53.1	24.8
▲	G-143	70.5	19.10	0.685	0.078	--	15.0	55.5	29.5

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

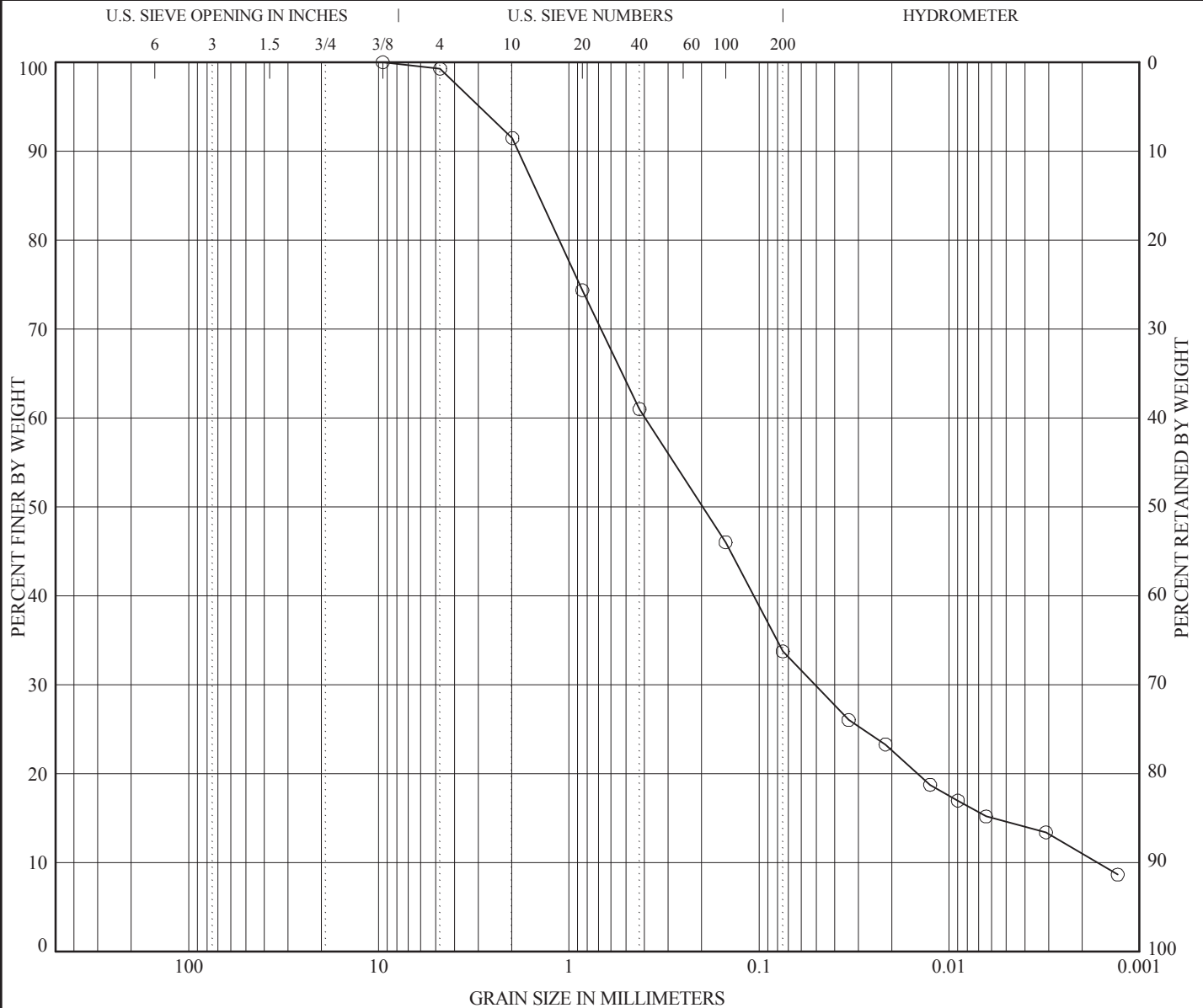
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Figure: D-5.2.22

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-143	85.5	SILTY SAND (SM)	NP	NP	NP	3.9	238.2

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-143	85.5	9.52	0.396	0.051	0.002	0.7	65.5	33.7

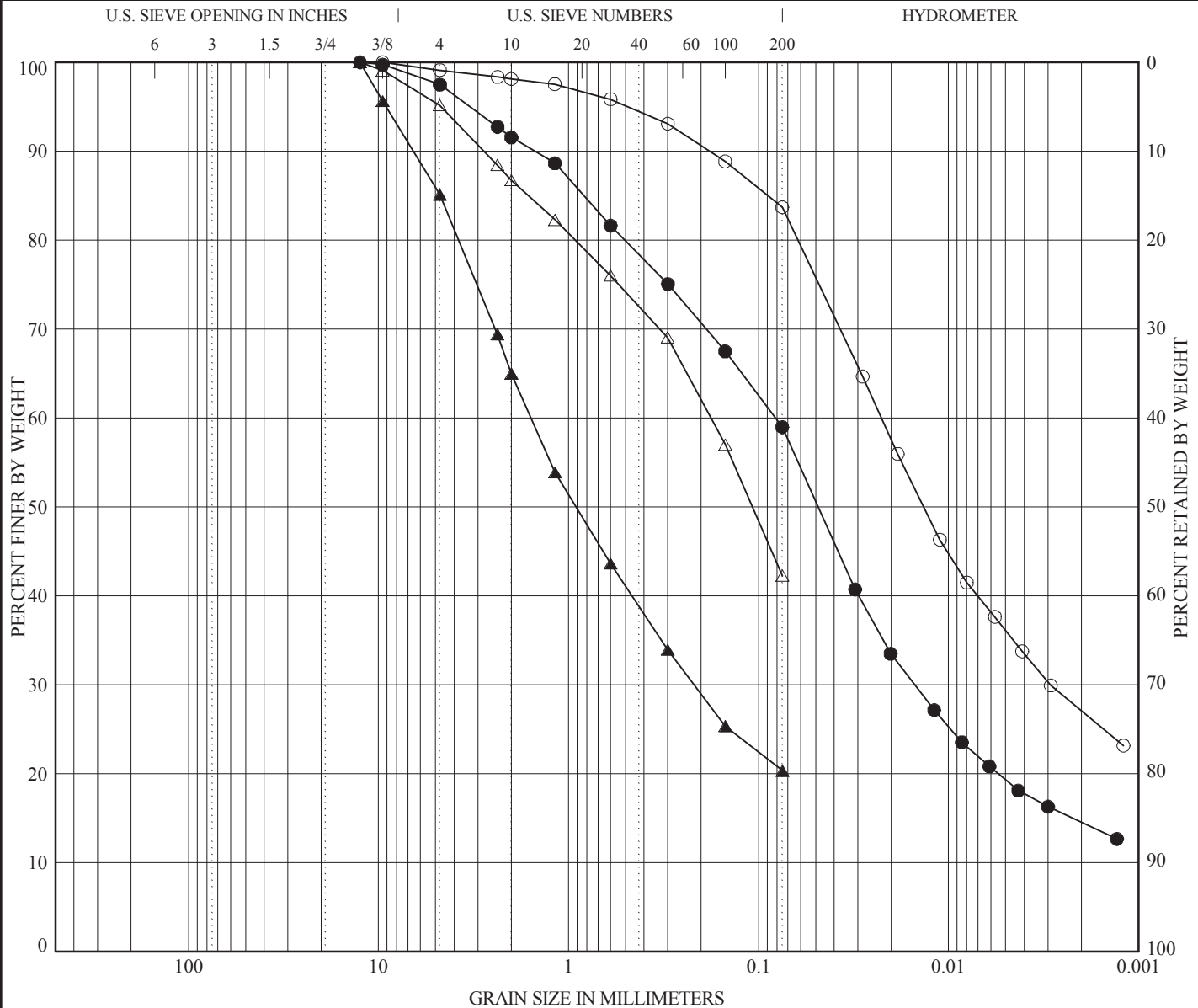
Laboratory Test Method: ASTM D 422
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.
Prepared/Date: LH/YN 9/28/11
Checked/Date: LT/HP 9/15/11

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Figure: D-5.2.23

AMEC FW GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-145	10.5	LEAN CLAY with SAND (CL)	47	17	30	--	--
●	G-145	25.5	SANDY LEAN CLAY (CL)	33	15	18	--	--
△	G-145	35.5	SILTY SAND (SM)	--	--	--	--	--
▲	G-145	41.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-145	10.5	9.50	0.023	0.003	--	0.9	15.4	83.7
●	G-145	25.5	12.50	0.081	0.015	--	2.5	38.5	59.0
△	G-145	35.5	12.50	0.178	--	--	4.8	52.9	42.3
▲	G-145	41.5	12.50	1.578	0.218	--	14.9	64.8	20.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

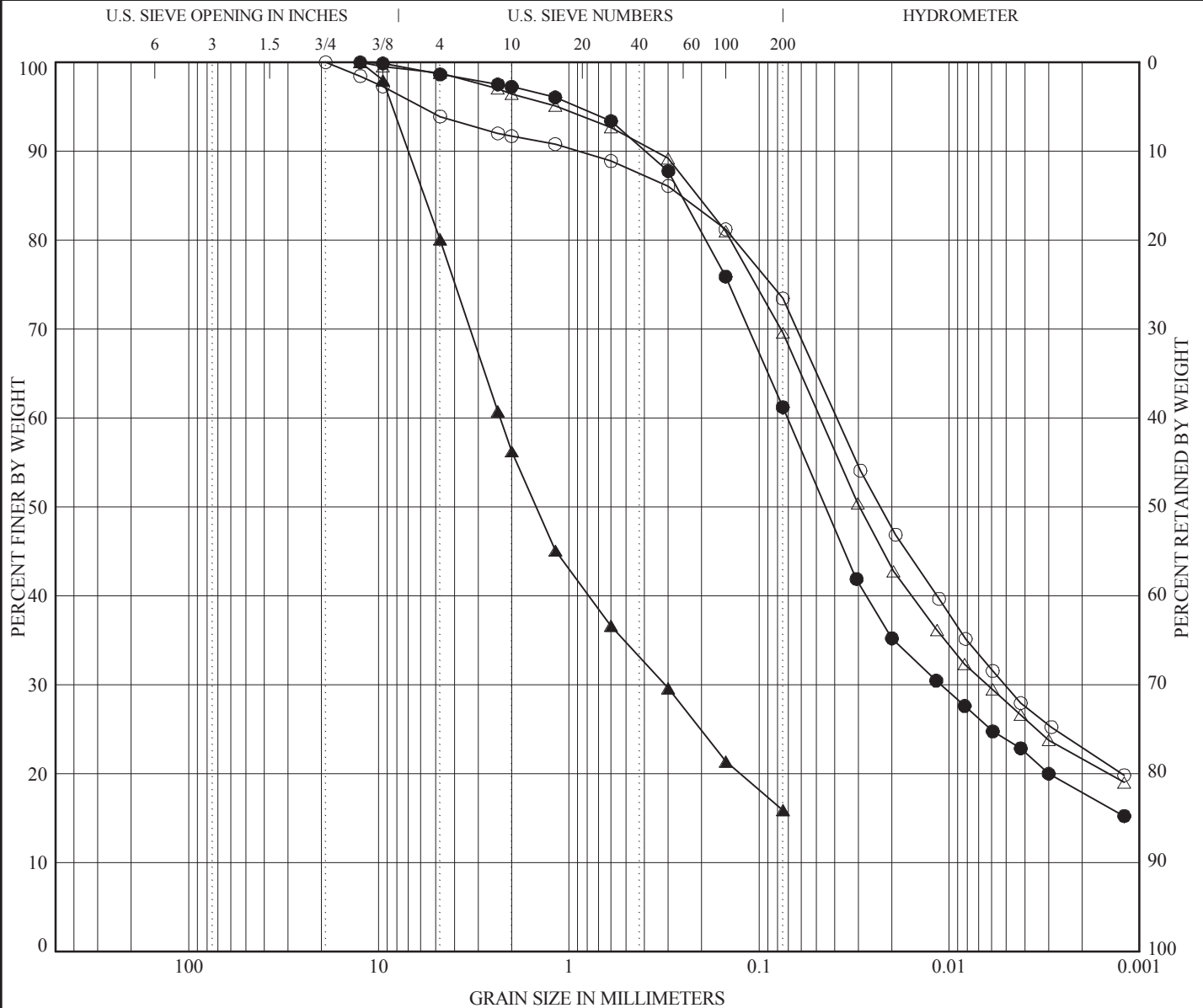
Prepared/Date: YN 8/9/2011
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PARTICLE SIZE DISTRIBUTION
 Project No.: 4953-10-1561
 Figure: D-5.2.24

AMEC FW GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-145	51.5	LEAN CLAY with SAND (CL)	39	15	24	--	--
●	G-145	65.5	SANDY LEAN CLAY (CL)	30	15	15	--	--
△	G-145	71.5	SANDY LEAN CLAY (CL)	39	15	24	--	--
▲	G-145	80.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-145	51.5	19.00	0.039	0.005	--	6.1	20.5	73.4
●	G-145	65.5	12.50	0.071	0.011	--	1.4	37.4	61.2
△	G-145	71.5	12.50	0.048	0.006	--	1.2	29.2	69.6
▲	G-145	80.5	12.50	2.294	0.312	--	19.9	64.2	15.9

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

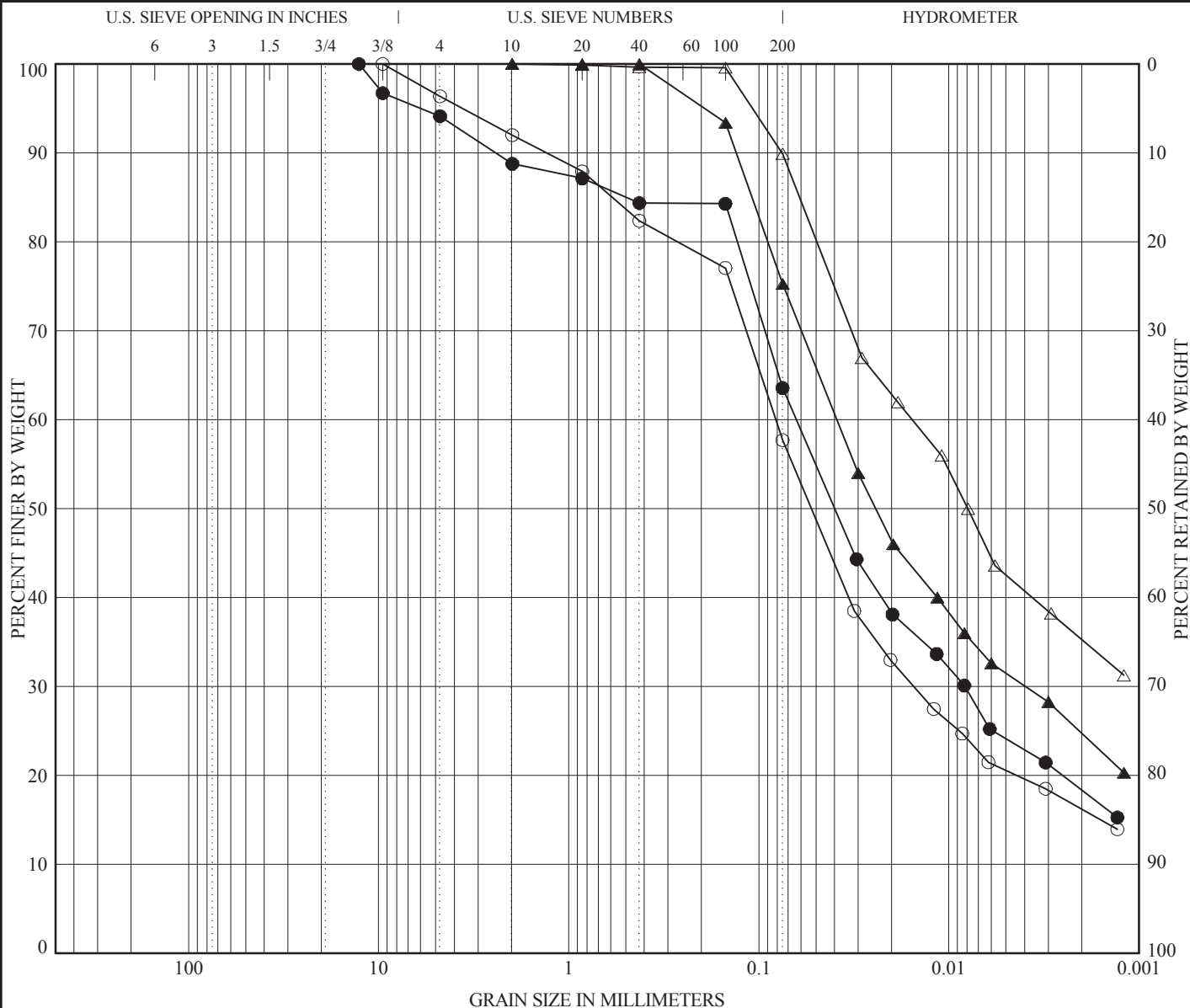
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Figure: D-5.2.25

PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.26



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-146	48.5	SANDY SILT (ML)	--	--	--	--	--
●	G-146	57.5	SANDY LEAN CLAY (CL)	33	18	15	--	--
△	G-146	69.5	LEAN CLAY (CL)	42	18	24	--	--
▲	G-146	81.5	LEAN CLAY with SAND (CL)	43	22	21	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-146	48.5	9.52	0.081	0.015	--	3.6	38.7	57.7
●	G-146	57.5	12.70	0.064	0.008	--	5.9	30.6	63.6
△	G-146	69.5	1.98	0.016	--	--	0.0	10.1	89.9
▲	G-146	81.5	1.98	0.039	0.004	--	0.0	24.7	75.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

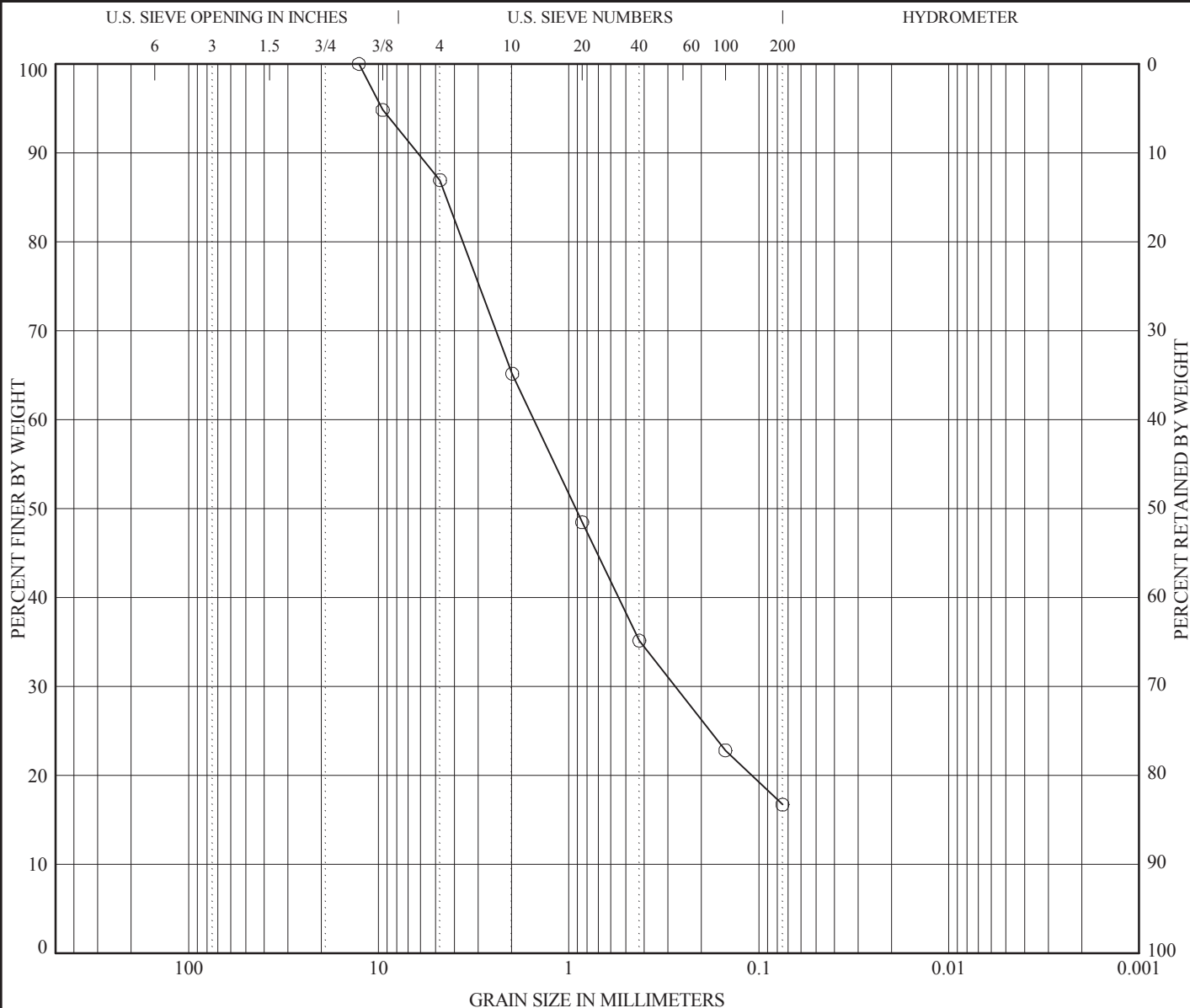
Prepared/Date: YN 9/1/2011
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PARTICLE SIZE DISTRIBUTION
 Project No.: 4953-10-1561
 Figure: D-5.2.27

AMECFW_GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-146	90.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-146	90.5	12.70	1.524	0.275	--	13.1	70.2	16.7

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

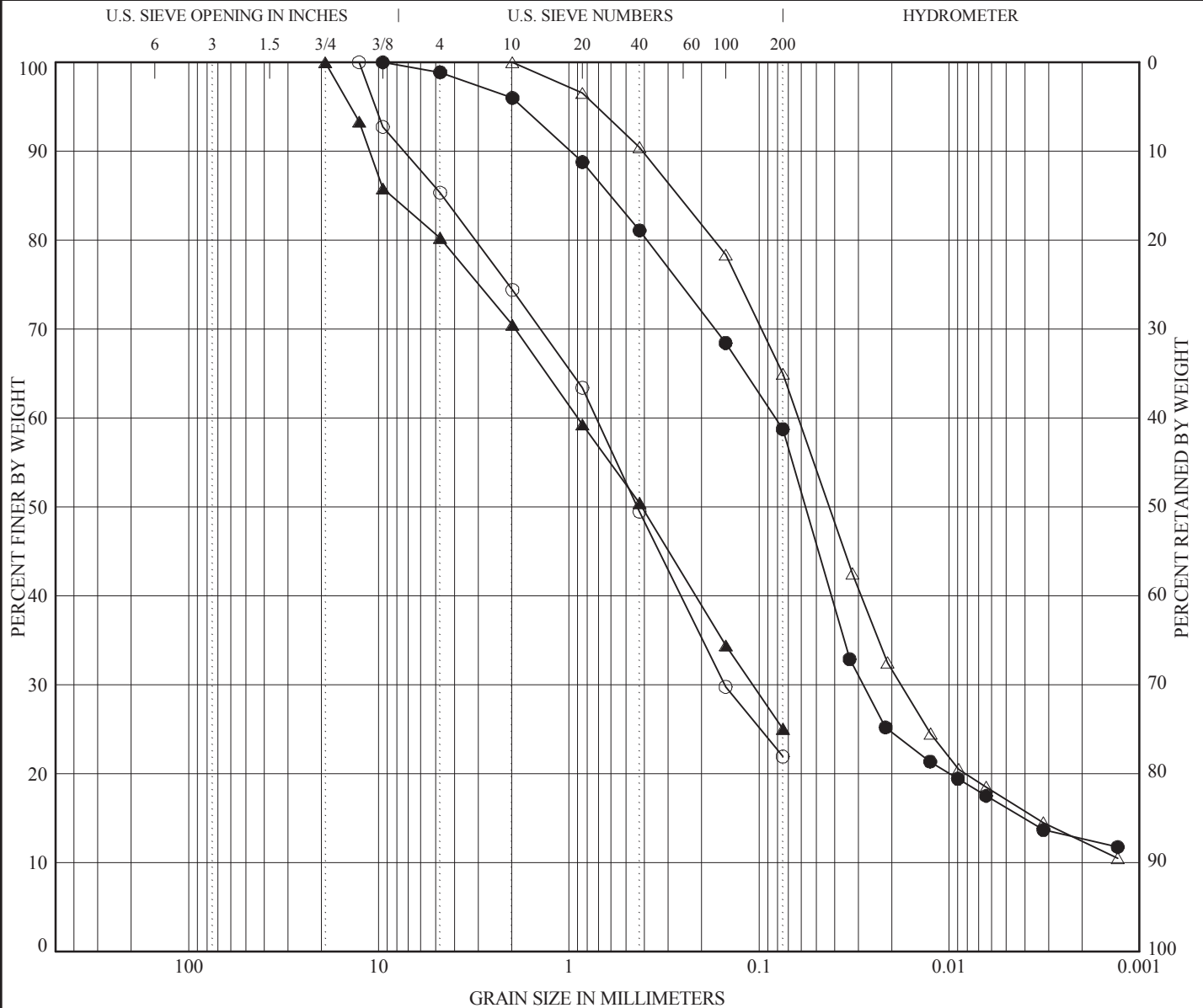
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.28

AMECFW_GRAIN SIZE_L:70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-147	70.5	SILTY SAND (SM)	--	--	--	--	--
●	G-147	75.5	SANDY LEAN CLAY (CL)	38	16	22	--	--
△	G-147	80.5	SANDY LEAN CLAY (CL)	31	18	13	--	--
▲	G-147	90.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-147	70.5	12.70	0.718	0.152	--	14.7	63.4	21.9
●	G-147	75.5	9.52	0.082	0.028	--	1.1	40.1	58.7
△	G-147	80.5	1.98	0.062	0.018	--	0.0	35.0	65.0
▲	G-147	90.5	19.10	0.898	0.108	--	19.7	55.2	25.1

Laboratory Test Method: ASTM D 422

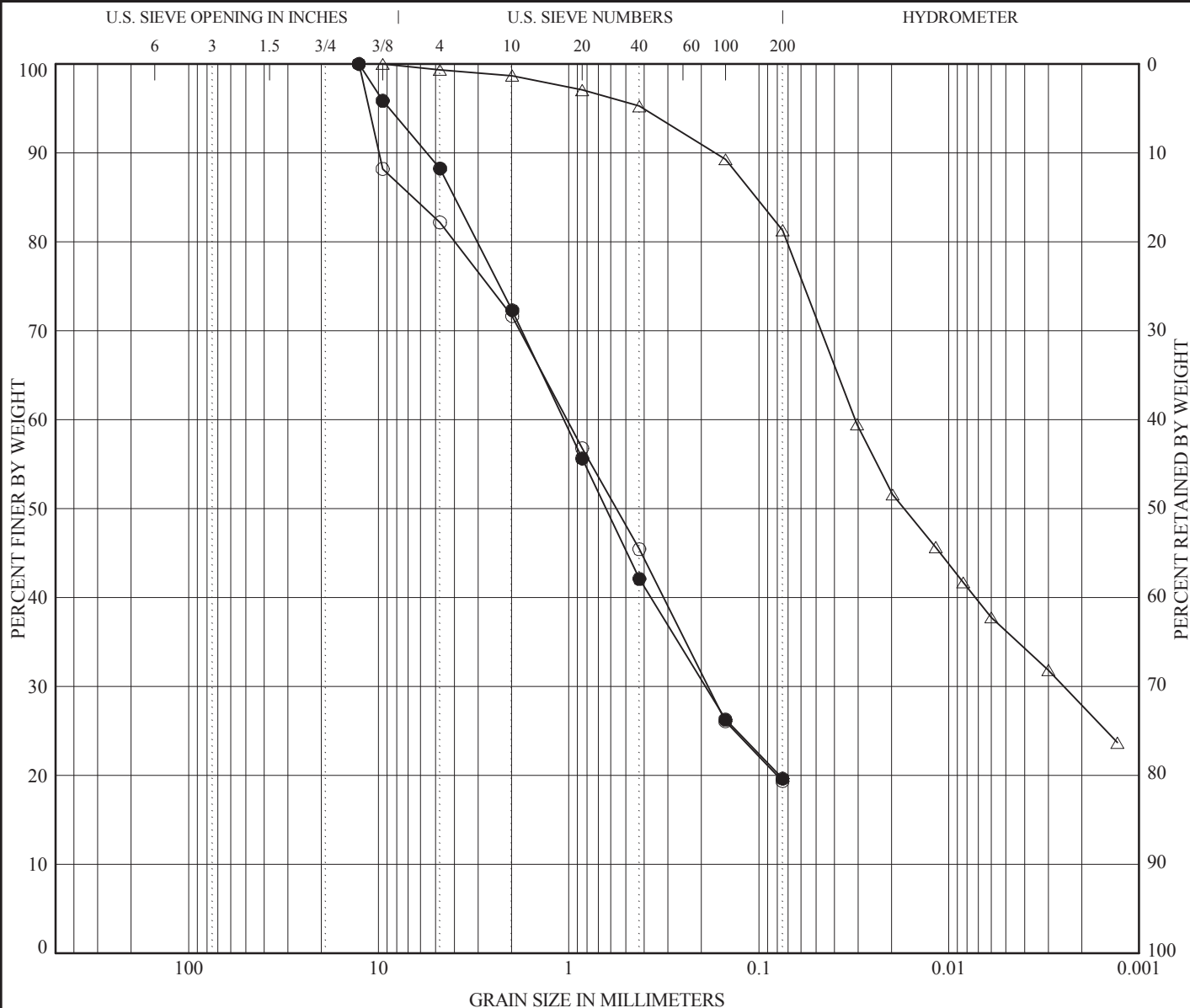
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.29



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-147	95.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
●	G-147	100.5	SILTY SAND (SM)	--	--	--	--	--
△	G-147	115.5	SILT with SAND (ML)	48	28	20	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-147	95.5	12.70	1.020	0.185	--	17.8	62.8	19.4
●	G-147	100.5	12.70	1.060	0.192	--	11.7	68.6	19.6
△	G-147	115.5	9.52	0.031	0.002	--	0.7	18.0	81.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

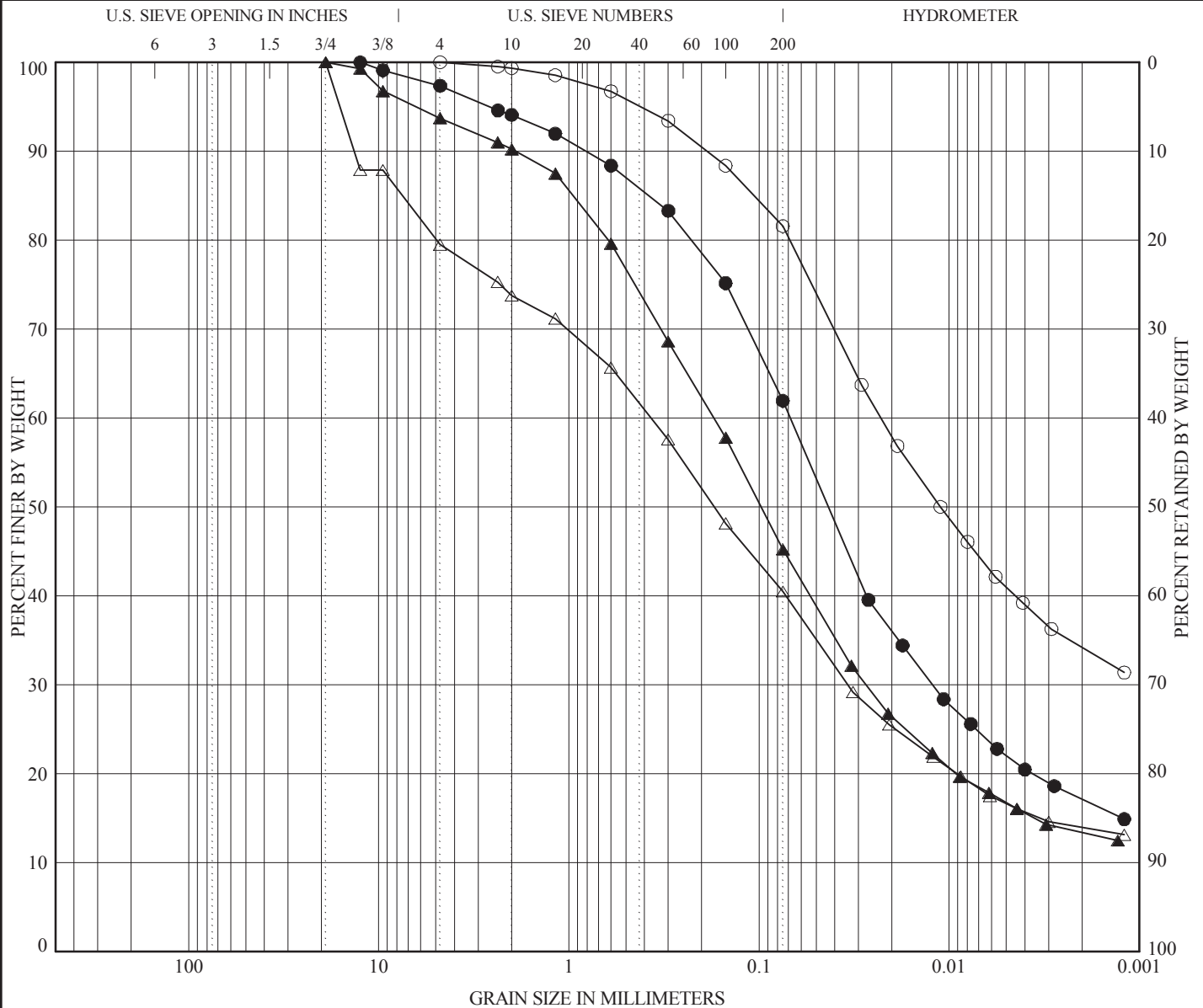
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PARTICLE SIZE DISTRIBUTION
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 Figure: D-5.2.30

AMECFW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-148	20.5	LEAN CLAY with SAND (CL)	39	16	23	--	--
●	G-148	35.5	SANDY SILT (ML)	--	--	--	--	--
△	G-148	45.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
▲	G-148	70.5	CLAYEY SAND (SC)	31	22	9	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-148	20.5	4.75	0.023	--	--	0.0	18.4	81.6
●	G-148	35.5	12.50	0.069	0.012	--	2.6	35.4	61.9
△	G-148	45.5	19.00	0.369	0.034	--	20.5	39.0	40.5
▲	G-148	70.5	19.00	0.173	0.027	--	6.3	48.5	45.2

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

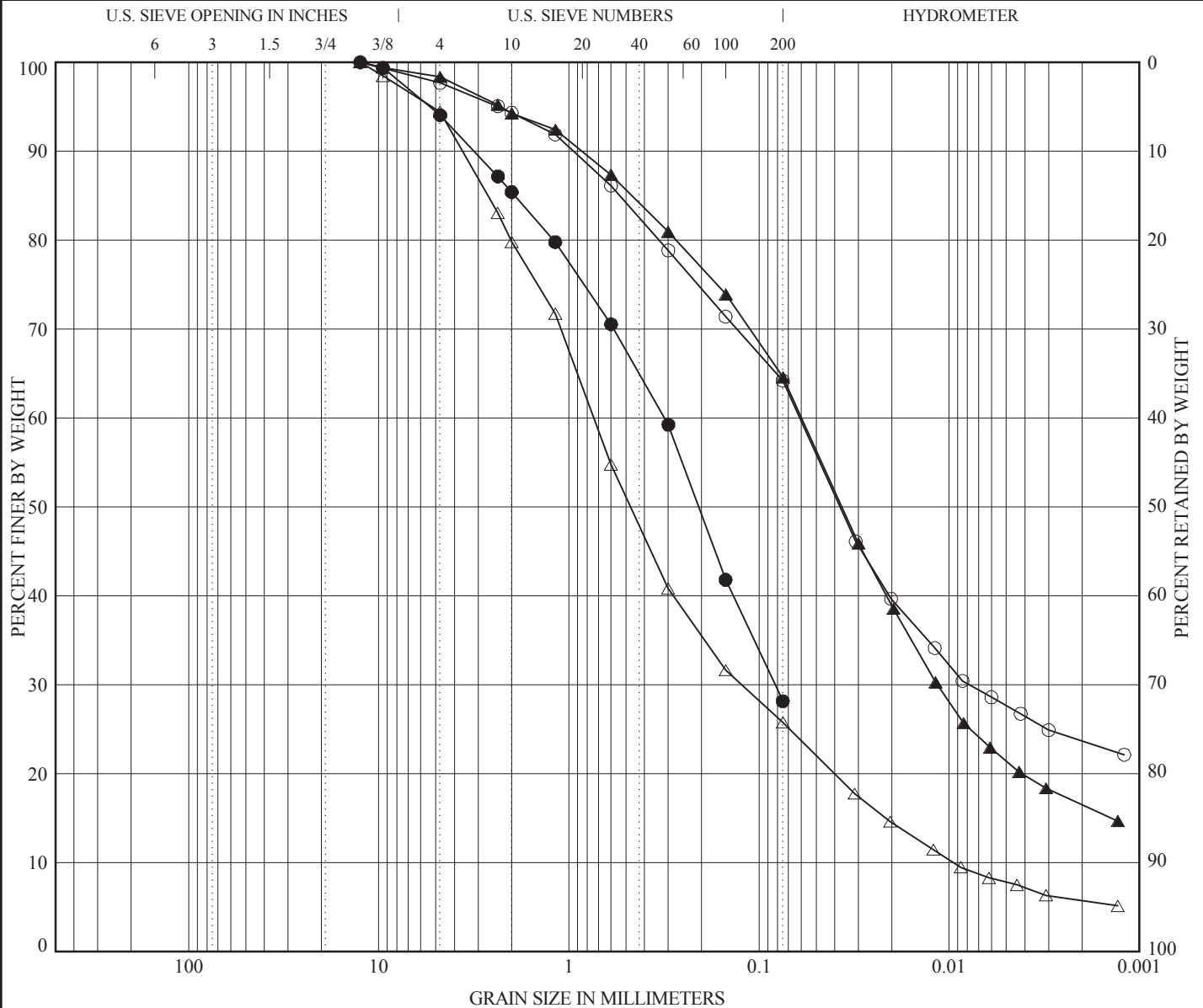
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.31

AMECFW_GRAIN SIZE_L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-148	75.5	SANDY LEAN CLAY (CL)	32	17	15	--	--
●	G-148	85.5	SILTY SAND (SM)	--	--	--	--	--
△	G-148	95.5	SILTY SAND (SM)	NP	NP	NP	2.2	77.8
▲	G-148	100.5	SANDY LEAN CLAY (CL)	37	22	15	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-148	75.5	12.50	0.061	0.008	--	2.3	33.5	64.2
●	G-148	85.5	12.50	0.314	0.082	--	5.9	65.9	28.2
△	G-148	95.5	12.50	0.739	0.124	0.010	5.6	68.7	25.8
▲	G-148	100.5	12.50	0.060	0.012	--	1.6	33.8	64.6

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

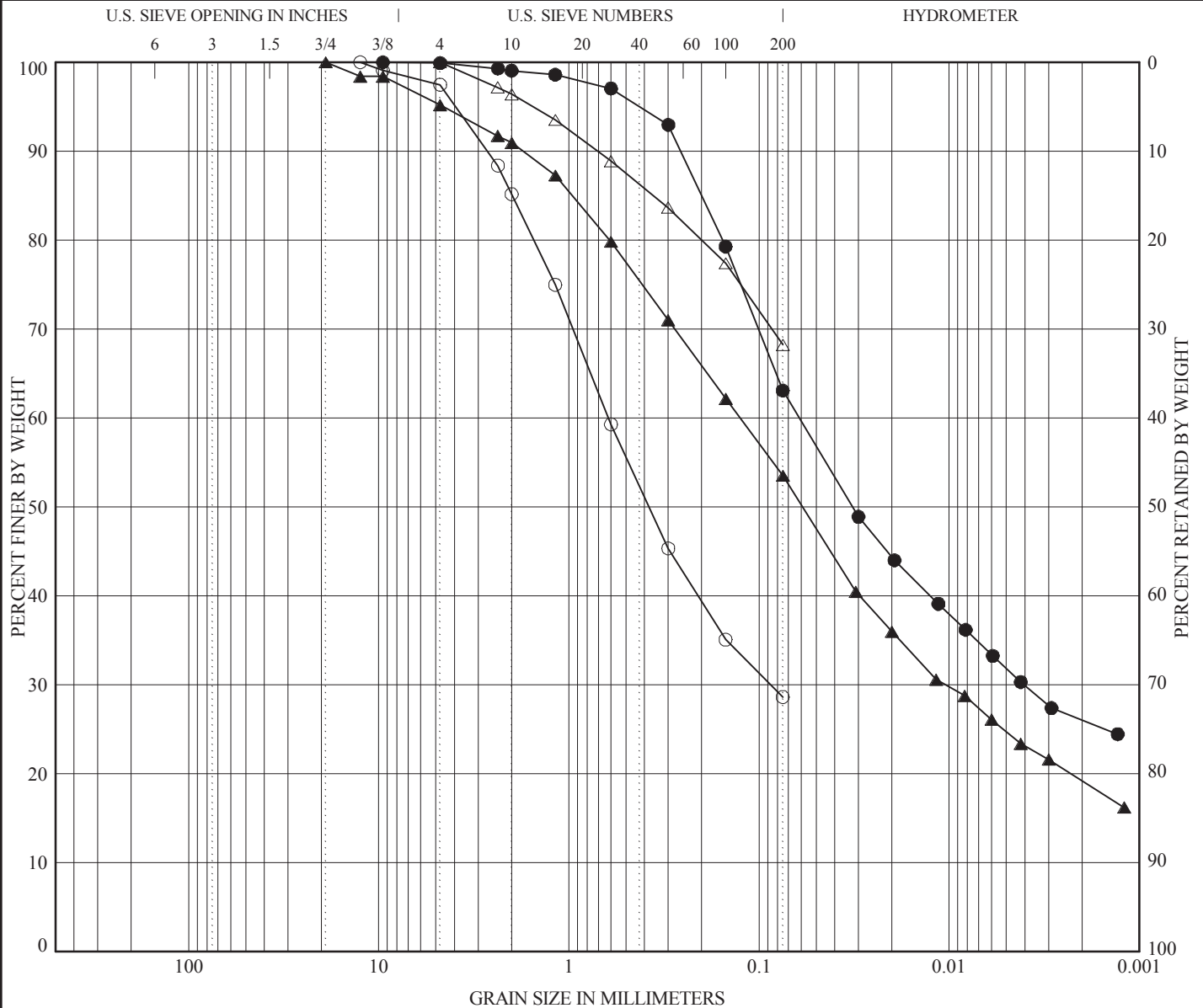
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Project No.: 4953-10-1561
Figure: D-5.2.32

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-148	105.5	SANDY LEAN CLAY (CL)	--	--	--	--	--
●	G-148	115.5	SANDY LEAN CLAY (CL)	44	16	28	--	--
△	G-148	125.5	SANDY SILT (ML)	--	--	--	--	--
▲	G-148	140.5	SANDY LEAN CLAY (CL)	38	14	24	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-148	105.5	12.50	0.619	0.087	--	2.5	68.9	28.6
●	G-148	115.5	9.50	0.061	0.004	--	0.1	36.8	63.1
△	G-148	125.5	4.75	--	--	--	0.0	31.8	68.2
▲	G-148	140.5	19.00	0.126	0.010	--	4.8	41.7	53.5

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

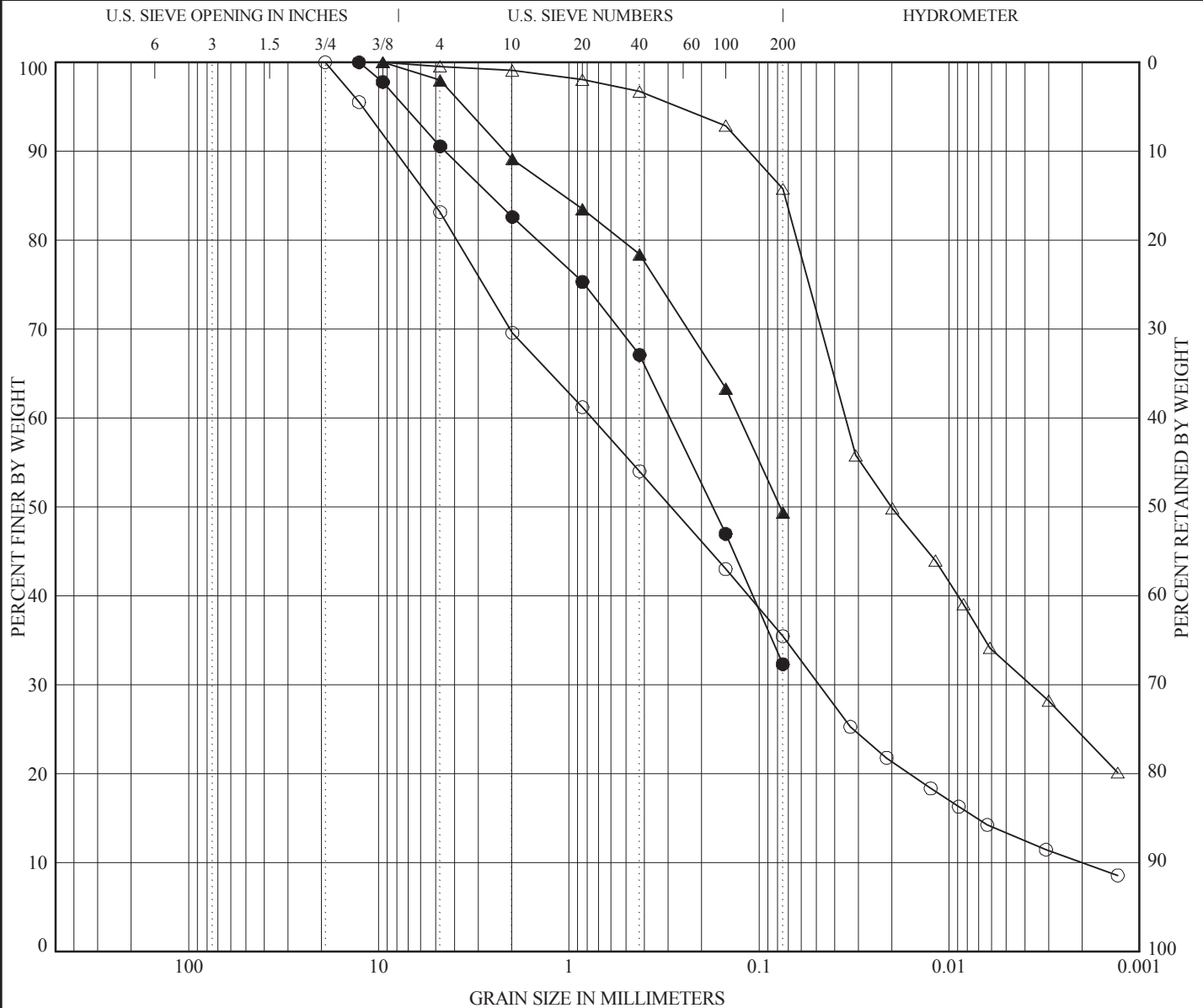
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.33

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-149	58.0	SILTY SAND with GRAVEL (SM)	--	--	--	1.5	377.5
●	G-149	63.0	SILTY SAND (SM)	--	--	--	--	--
△	G-149	65.5	LEAN CLAY (CL)	46	24	22	--	--
▲	G-149	73.0	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-149	58.0	19.10	0.757	0.048	0.002	16.8	47.7	35.5
●	G-149	63.0	12.70	0.294	--	--	9.4	58.2	32.3
△	G-149	65.5	9.52	0.035	0.004	--	0.5	13.8	85.8
▲	G-149	73.0	9.52	0.127	--	--	2.0	48.6	49.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

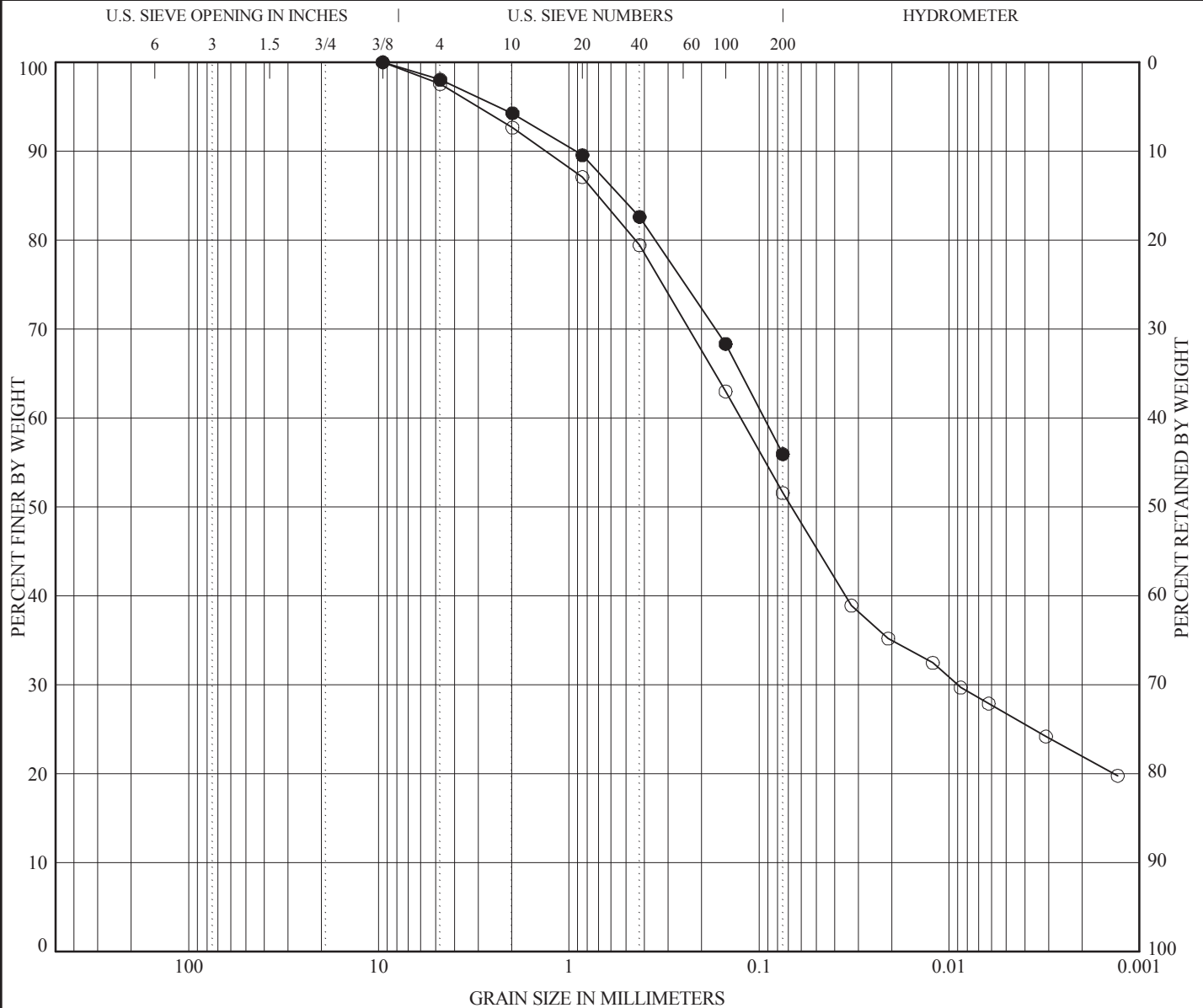
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.34

AMECFW_GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-149	80.5	SANDY LEAN CLAY (CL)	--	--	--	--	--
●	G-149	83.0	SANDY LEAN CLAY (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-149	80.5	9.52	0.125	0.009	--	2.5	46.0	51.6
●	G-149	83.0	9.52	0.094	--	--	2.0	42.1	55.9

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

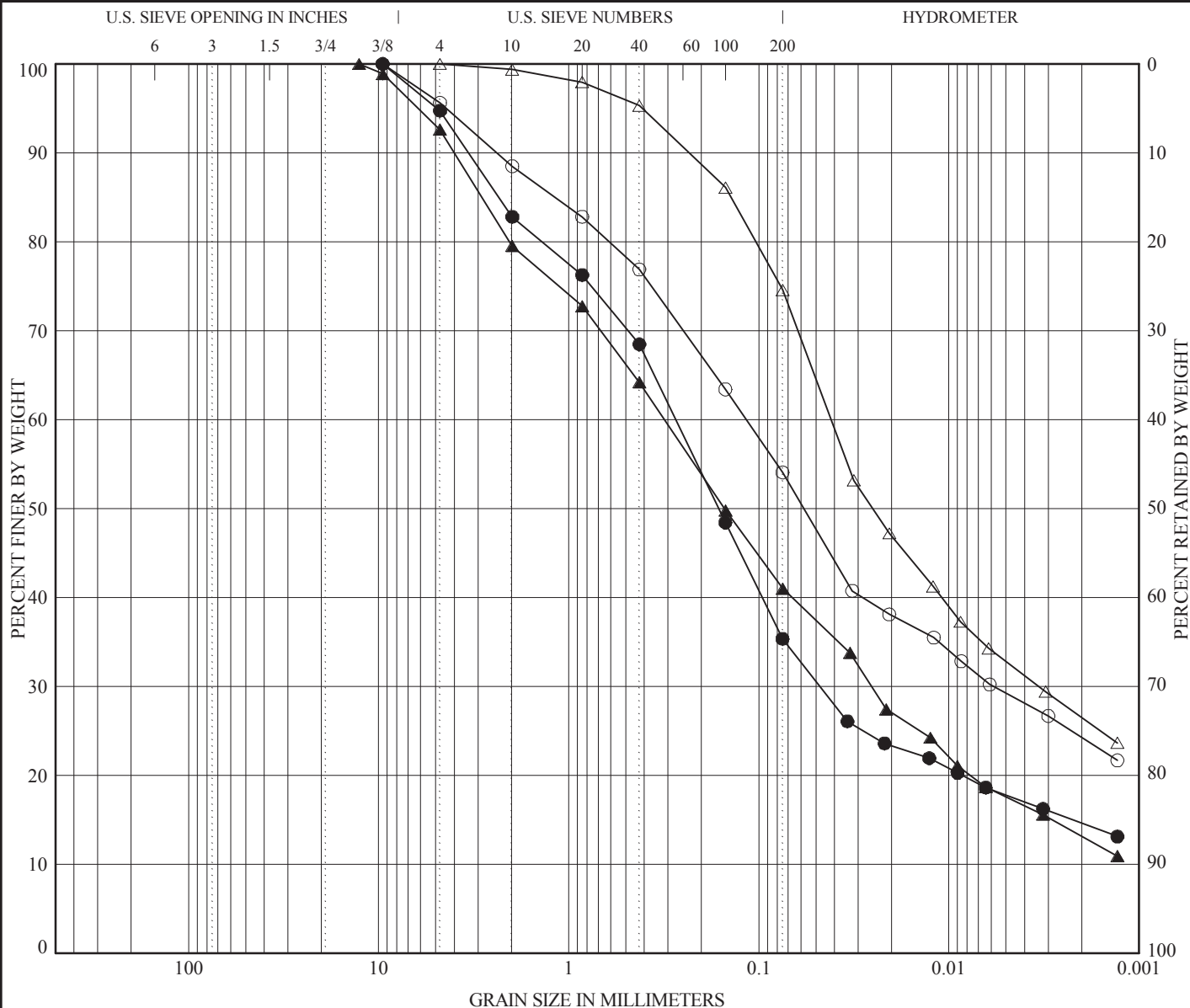
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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.2.35

AMECFW_GRAIN SIZE_L:\70131 GEOTECH\GINT\W\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-150	25.5	SANDY LEAN CLAY (CL)	--	--	--	--	--
●	G-150	40.5	CLAYEY SAND (SC)	--	--	--	--	--
△	G-150	50.5	LEAN CLAY with SAND (CL)	43	21	22	--	--
▲	G-150	60.5	CLAYEY SAND (SC)	37	20	17	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-150	25.5	9.52	0.116	0.006	--	4.4	41.6	54.1
●	G-150	40.5	9.52	0.273	0.048	--	5.2	59.4	35.4
△	G-150	50.5	4.75	0.042	0.003	--	0.0	25.4	74.6
▲	G-150	60.5	12.70	0.314	0.025	--	7.4	51.6	41.0

Laboratory Test Method: ASTM D 422

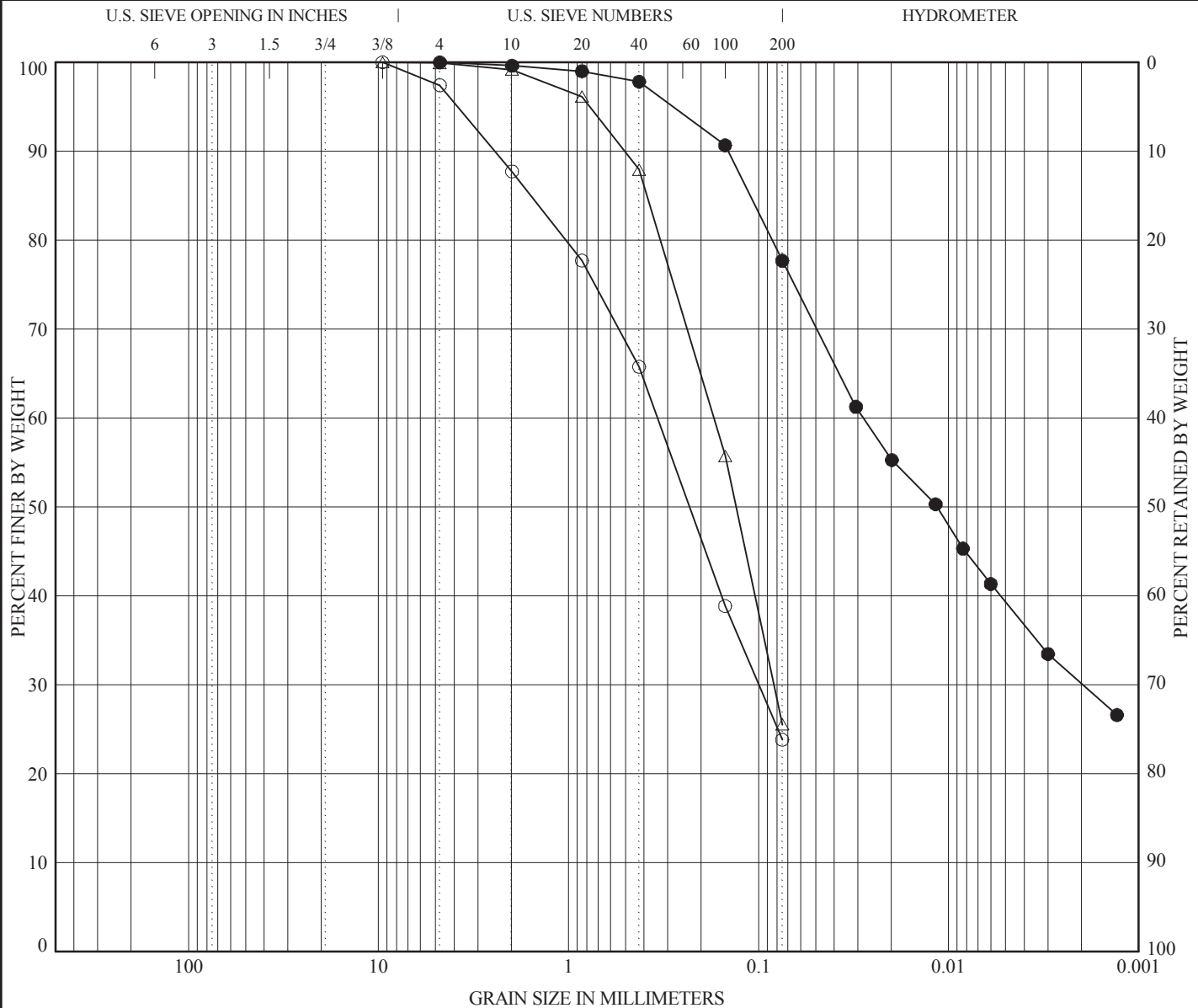
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.36



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-150	70.5	SILTY SAND (SM)	--	--	--	--	--
●	G-150	75.5	FAT CLAY with SAND (CH)	54	27	27	--	--
△	G-150	90.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-150	70.5	9.52	0.340	0.100	--	2.6	73.6	23.8
●	G-150	75.5	4.75	0.028	0.002	--	0.0	22.3	77.7
△	G-150	90.5	9.52	0.172	0.083	--	0.1	74.4	25.5

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

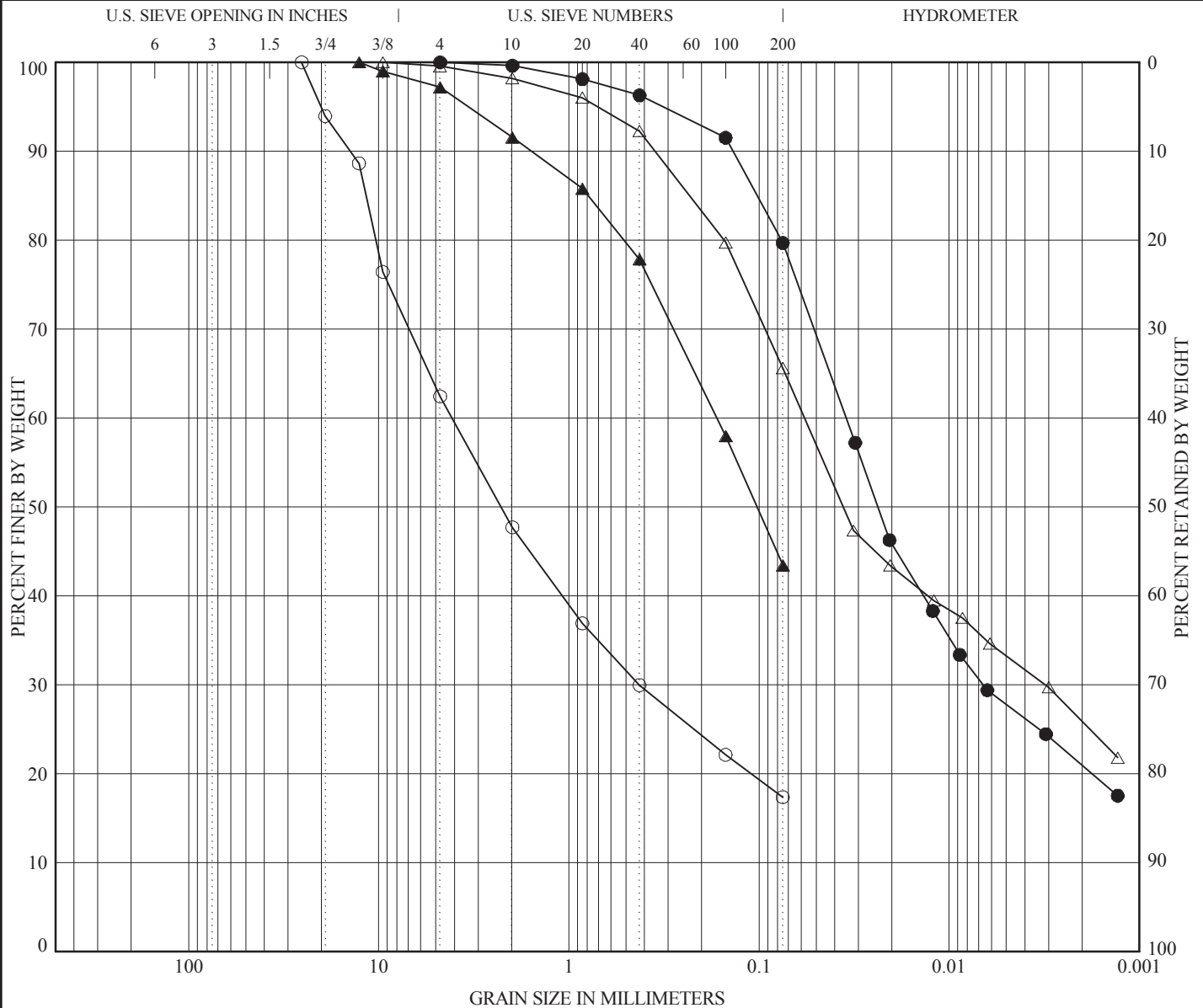
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PARTICLE SIZE DISTRIBUTION
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 Figure: D-5.2.37

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-161	50.5	SILTY SAND with GRAVEL (SM)	31	23	8	--	--
●	G-161	75.5	LEAN CLAY with SAND (CL)	39	23	16	--	--
△	G-161	85.5	SANDY LEAN CLAY (CL)	34	18	16	--	--
▲	G-161	95.5	CLAYEY SAND (SC)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-161	50.5	25.40	4.111	0.427	--	37.6	45.1	17.4
●	G-161	75.5	4.75	0.035	0.007	--	0.0	20.3	79.7
△	G-161	85.5	9.52	0.058	0.003	--	0.4	34.0	65.6
▲	G-161	95.5	12.70	0.167	--	--	2.8	53.7	43.4

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

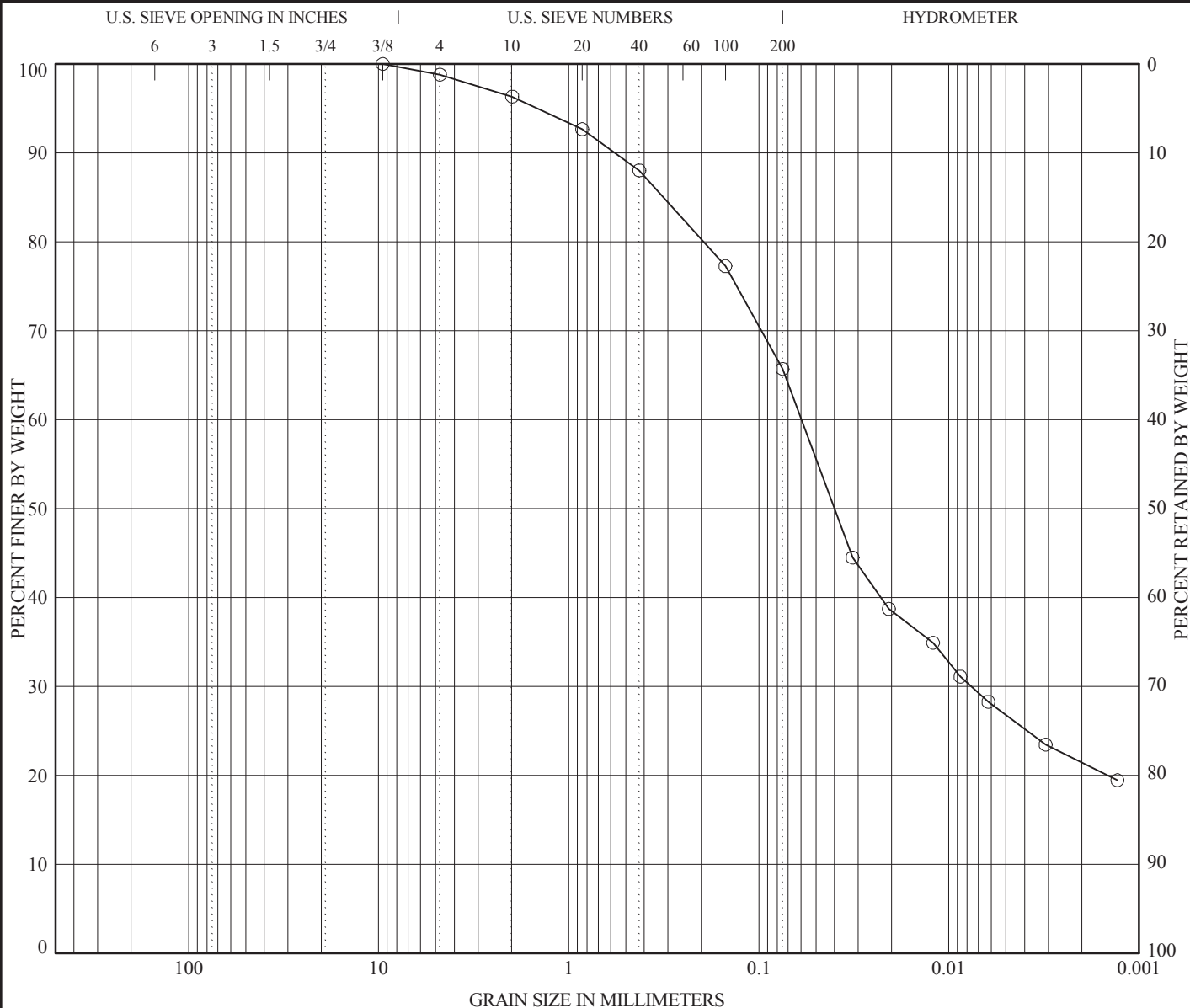
Prepared/Date: JF 6/14/2011
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.38

AMECFW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-161	100.5	SANDY LEAN CLAY (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-161	100.5	9.52	0.060	0.008	--	1.2	33.1	65.7

Laboratory Test Method: ASTM D 422

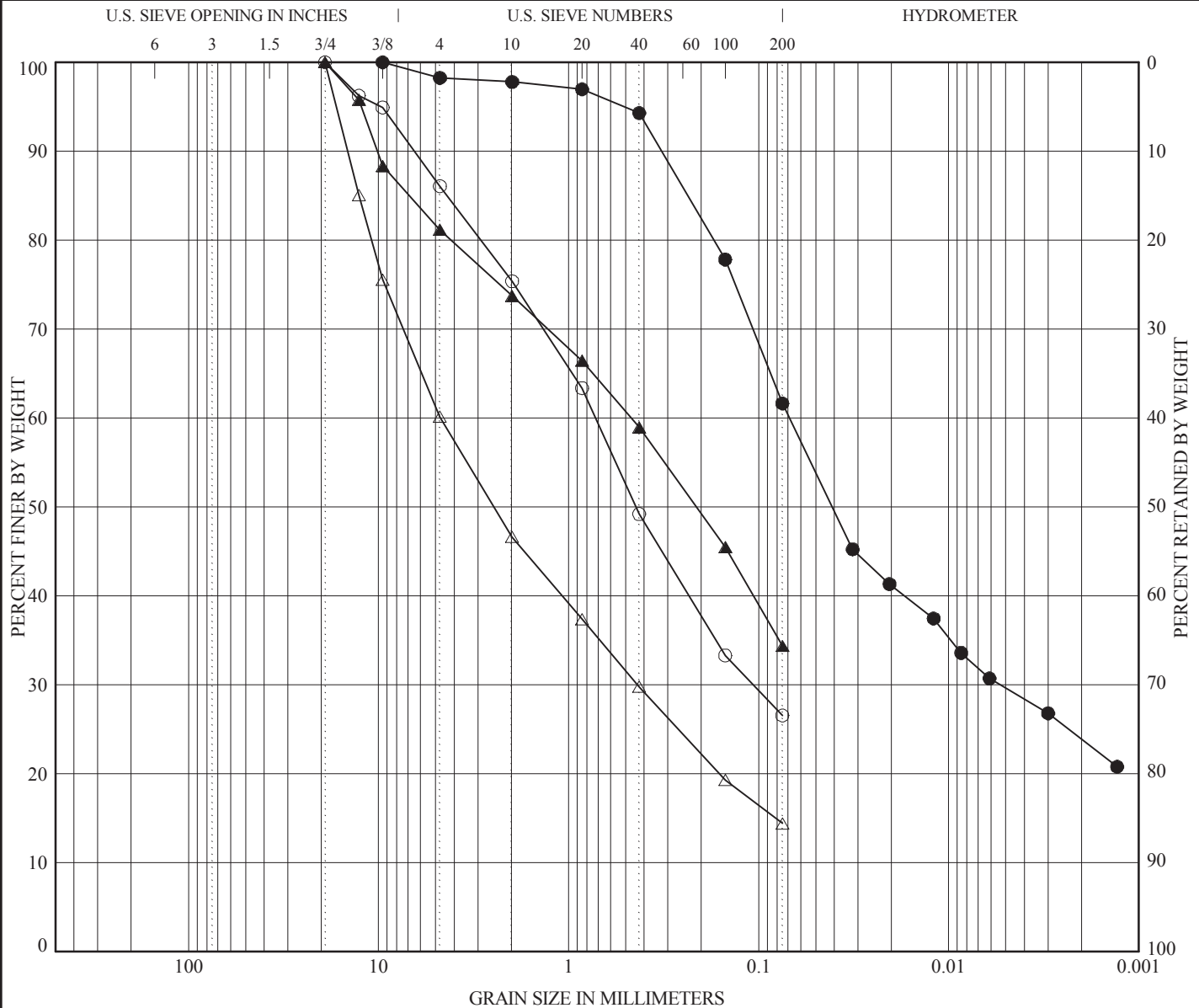
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.39



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-162	55.5	CLAYEY SAND (SC)	--	--	--	--	--
●	G-162	60.5	SANDY LEAN CLAY (CL)	--	--	--	--	--
△	G-162	70.5	CLAYEY SAND with GRAVEL (SC)	--	--	--	--	--
▲	G-162	87.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	29	22	7	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-162	55.5	19.10	0.721	0.107	--	13.9	59.5	26.5
●	G-162	60.5	9.52	0.069	0.005	--	1.7	36.6	61.6
△	G-162	70.5	19.10	4.707	0.434	--	39.9	45.7	14.4
▲	G-162	87.5	19.10	0.469	--	--	18.8	46.8	34.4

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

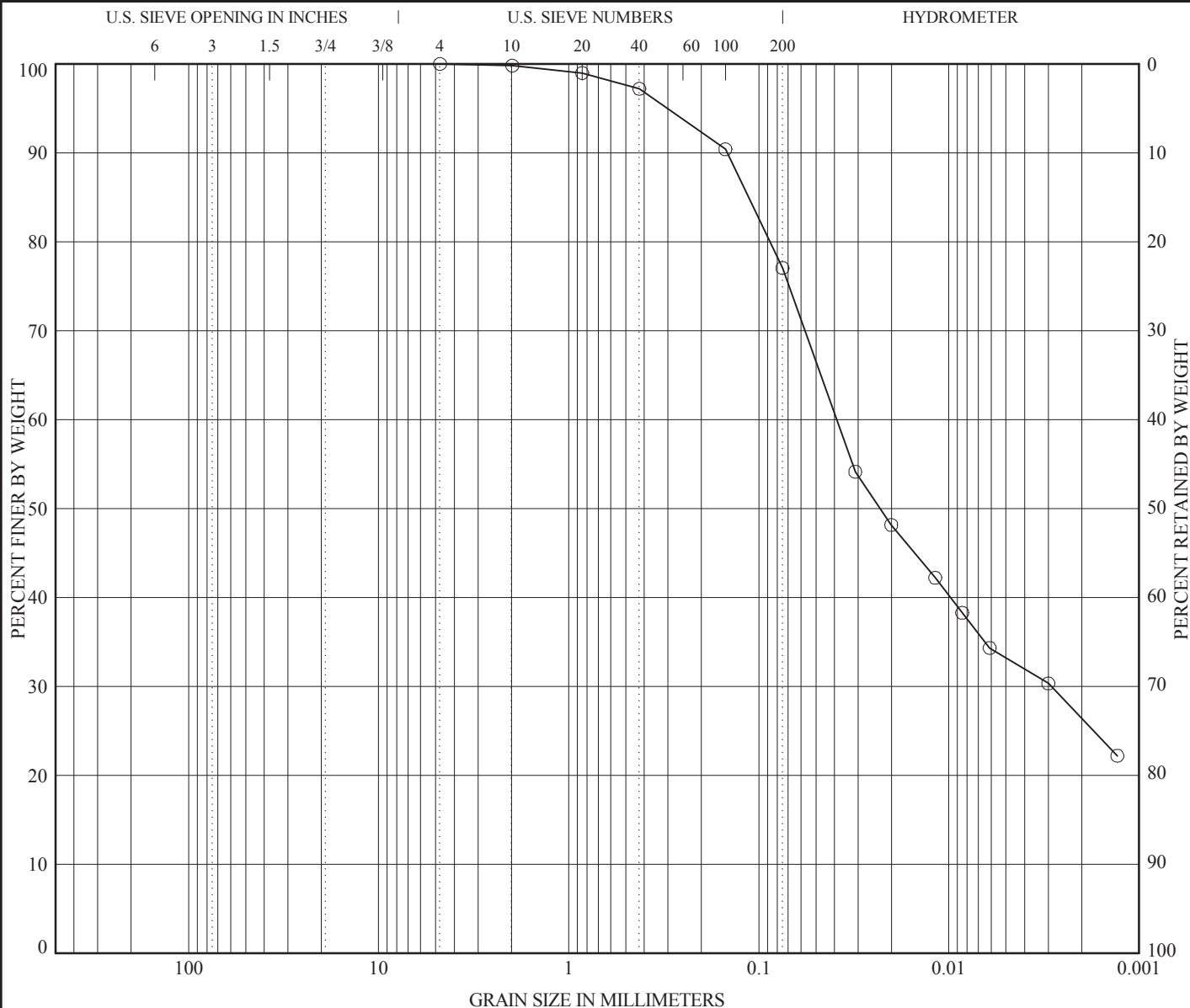
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PARTICLE SIZE DISTRIBUTION
 Project No.: 4953-10-1561
 Figure: D-5.2.40

AMECFW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-162	93.5	FAT CLAY with SAND (CH)	56	26	30	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-162	93.5	4.75	0.039	0.003	--	0.0	22.9	77.1

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

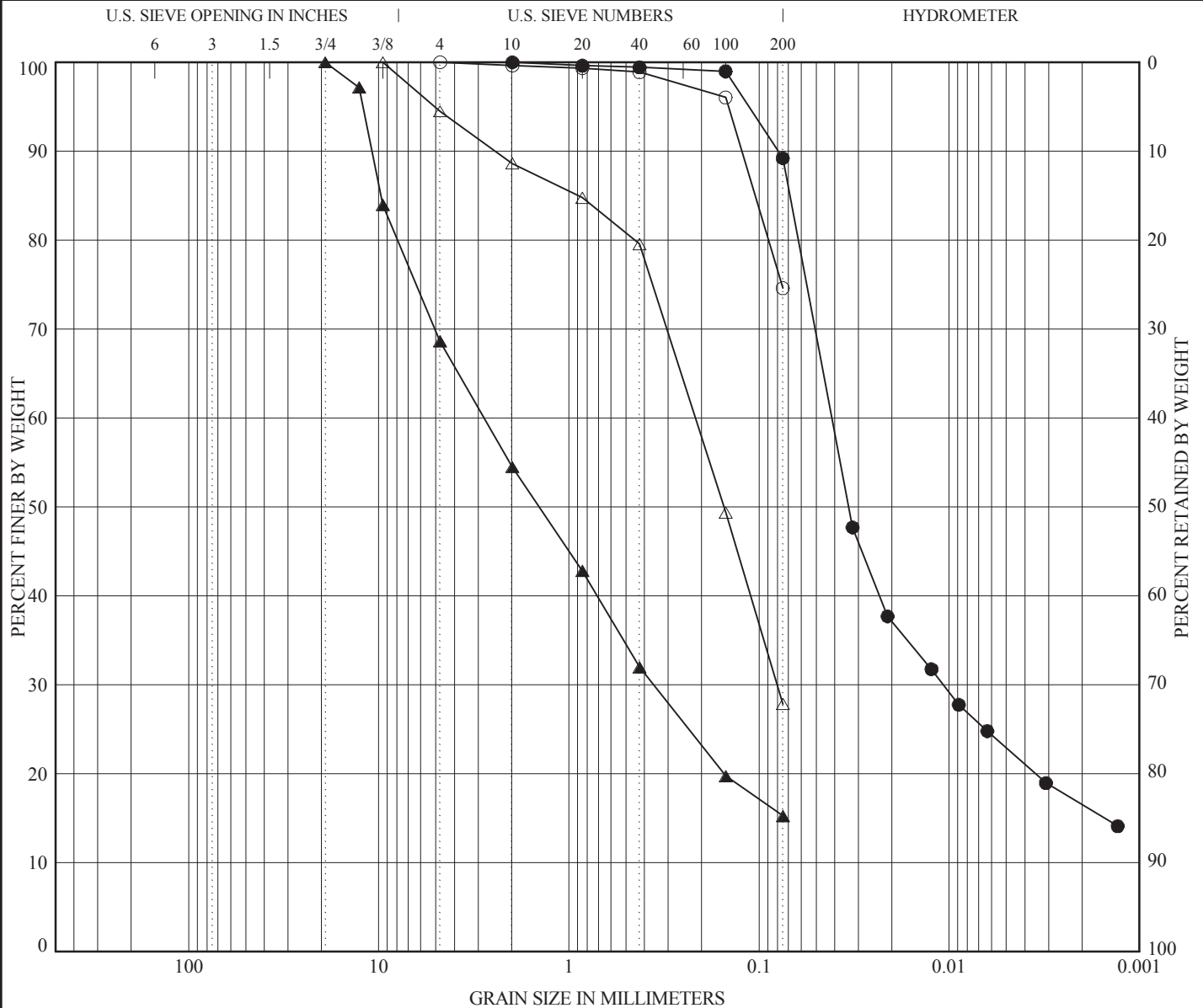
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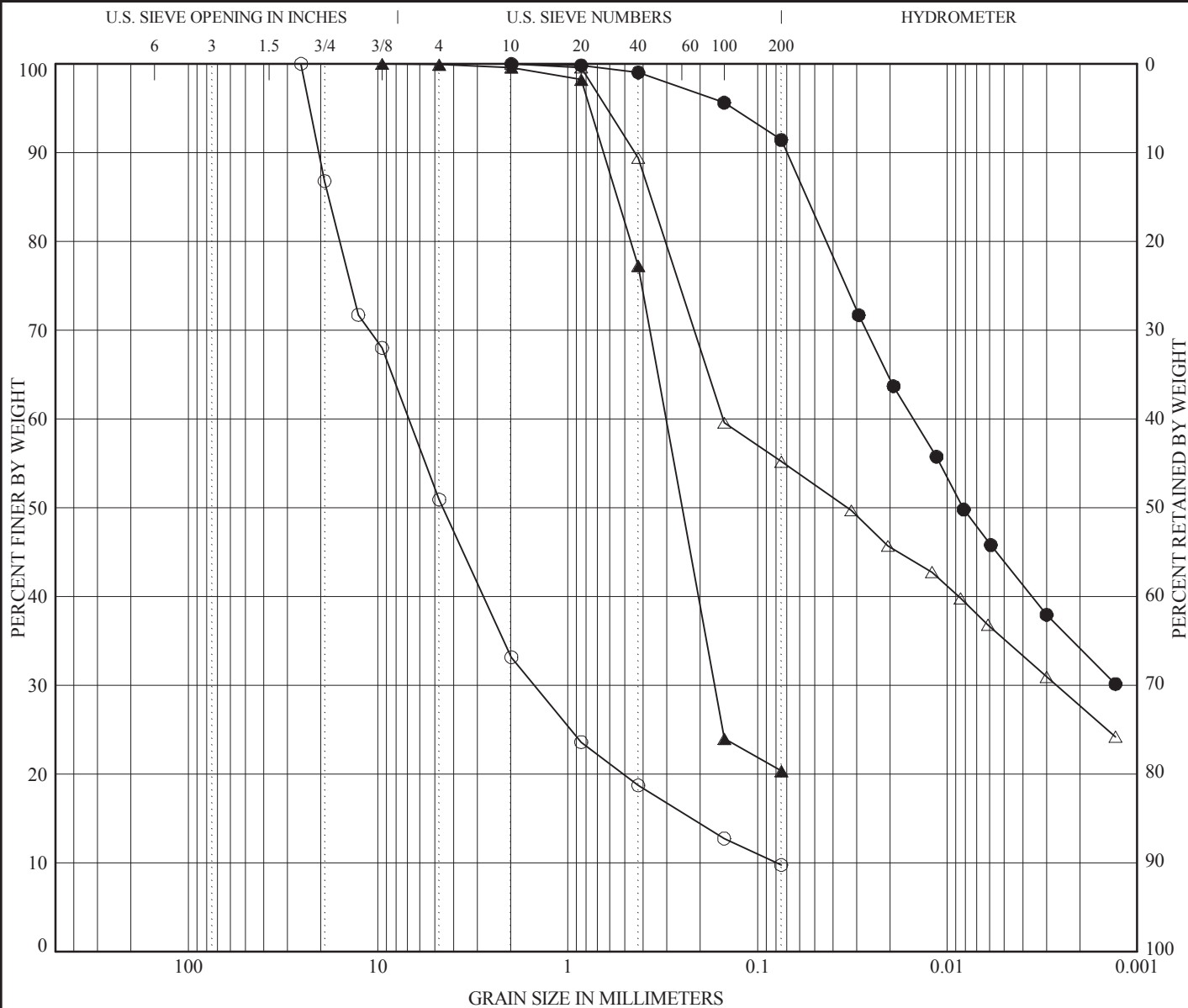


PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.41

AMEC FW GRAIN SIZE L:\70131 GEOTECH\GINT\W\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



AMEC FW GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561 METRO_ WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-164	48.5	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	--	--	--	4.1	86.5
●	G-164	51.5	FAT CLAY (CH)	50	27	23	--	--
△	G-164	57.5	SANDY FAT CLAY (CH)	--	--	--	--	--
▲	G-164	60.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-164	48.5	25.40	6.874	1.497	0.079	49.1	41.2	9.8
●	G-164	51.5	1.98	0.015	--	--	0.0	8.6	91.4
△	G-164	57.5	1.98	0.152	0.003	--	0.0	44.8	55.2
▲	G-164	60.5	9.52	0.303	0.169	--	0.1	79.6	20.4

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

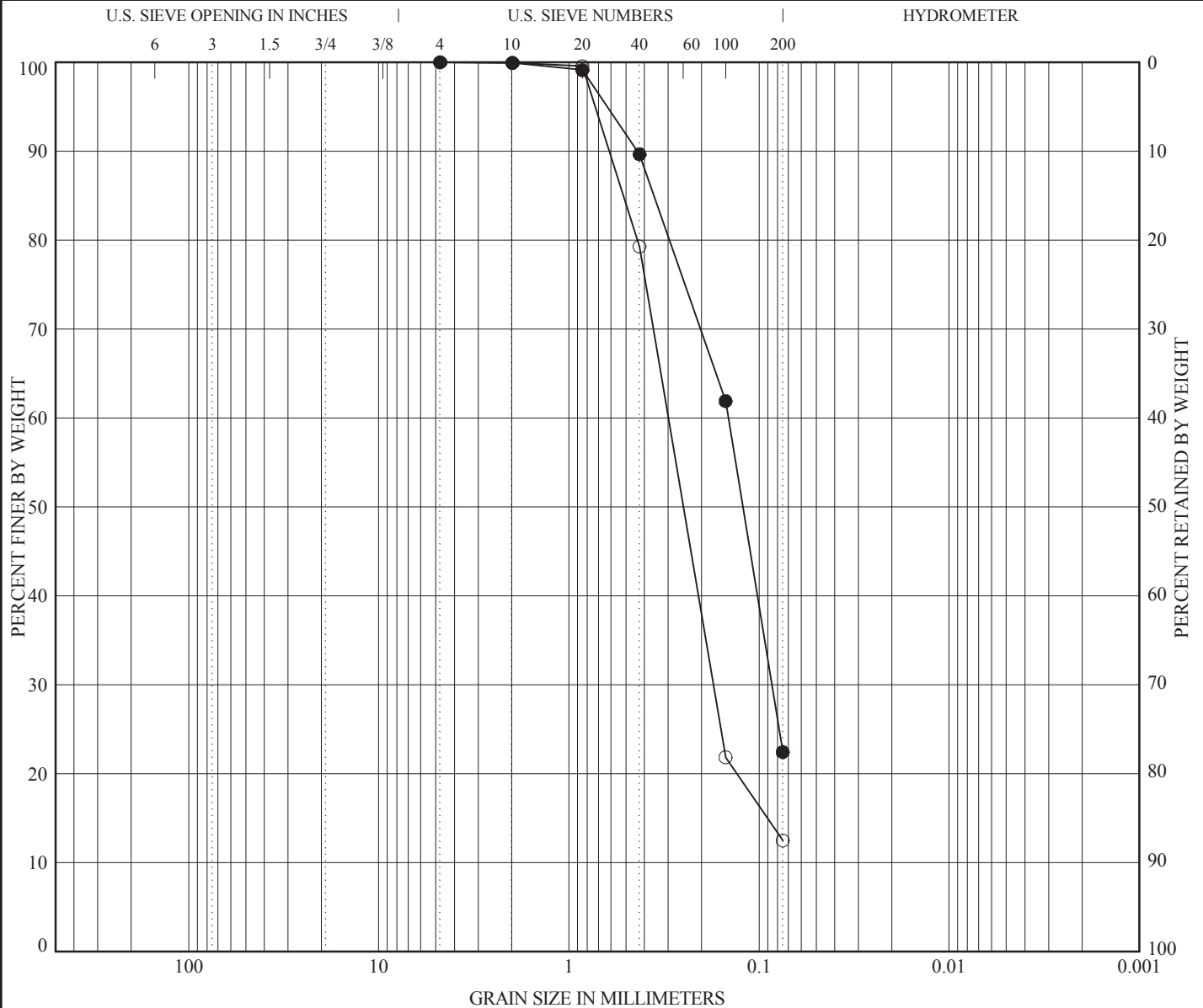
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.43

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-164	69.5	SILTY SAND (SM)	--	--	--	1.6	4.8
●	G-164	90.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-164	69.5	4.75	0.300	0.174	--	0.0	87.5	12.5
●	G-164	90.5	4.75	0.145	0.086	--	0.0	77.6	22.4

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

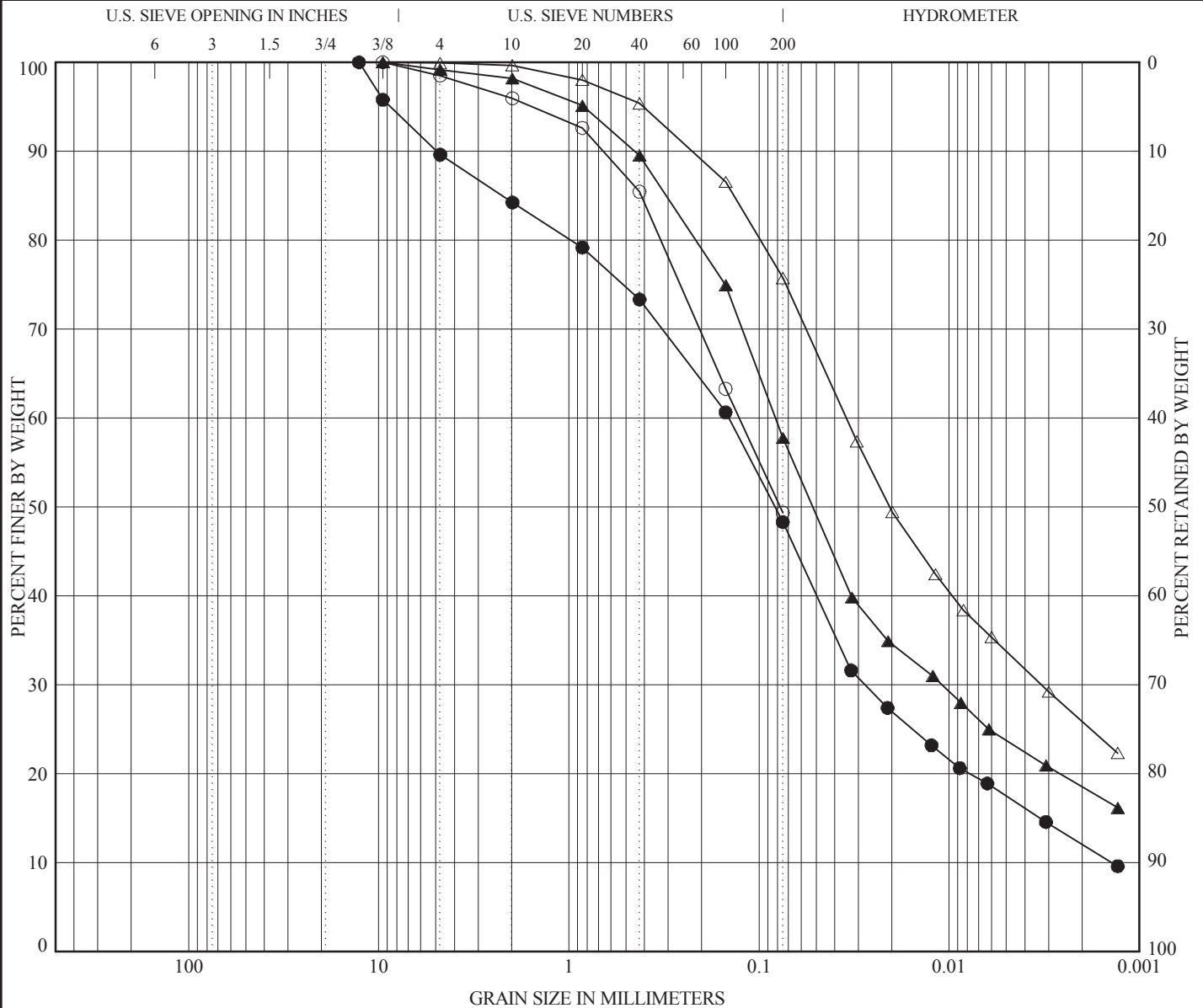
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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.2.44

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G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-165	16.5	CLAYEY SAND (SC)	--	--	--	--	--
●	G-165	25.5	CLAYEY SAND (SC)	39	20	19	3.8	103.7
△	G-165	43.5	LEAN CLAY with SAND (CL)	--	--	--	--	--
▲	G-165	55.5	SANDY LEAN CLAY (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-165	16.5	9.52	0.127	--	--	1.5	49.1	49.4
●	G-165	25.5	12.70	0.145	0.028	0.001	10.4	41.3	48.3
△	G-165	43.5	9.52	0.035	0.003	--	0.1	24.2	75.7
▲	G-165	55.5	9.52	0.082	0.011	--	0.8	41.4	57.8

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

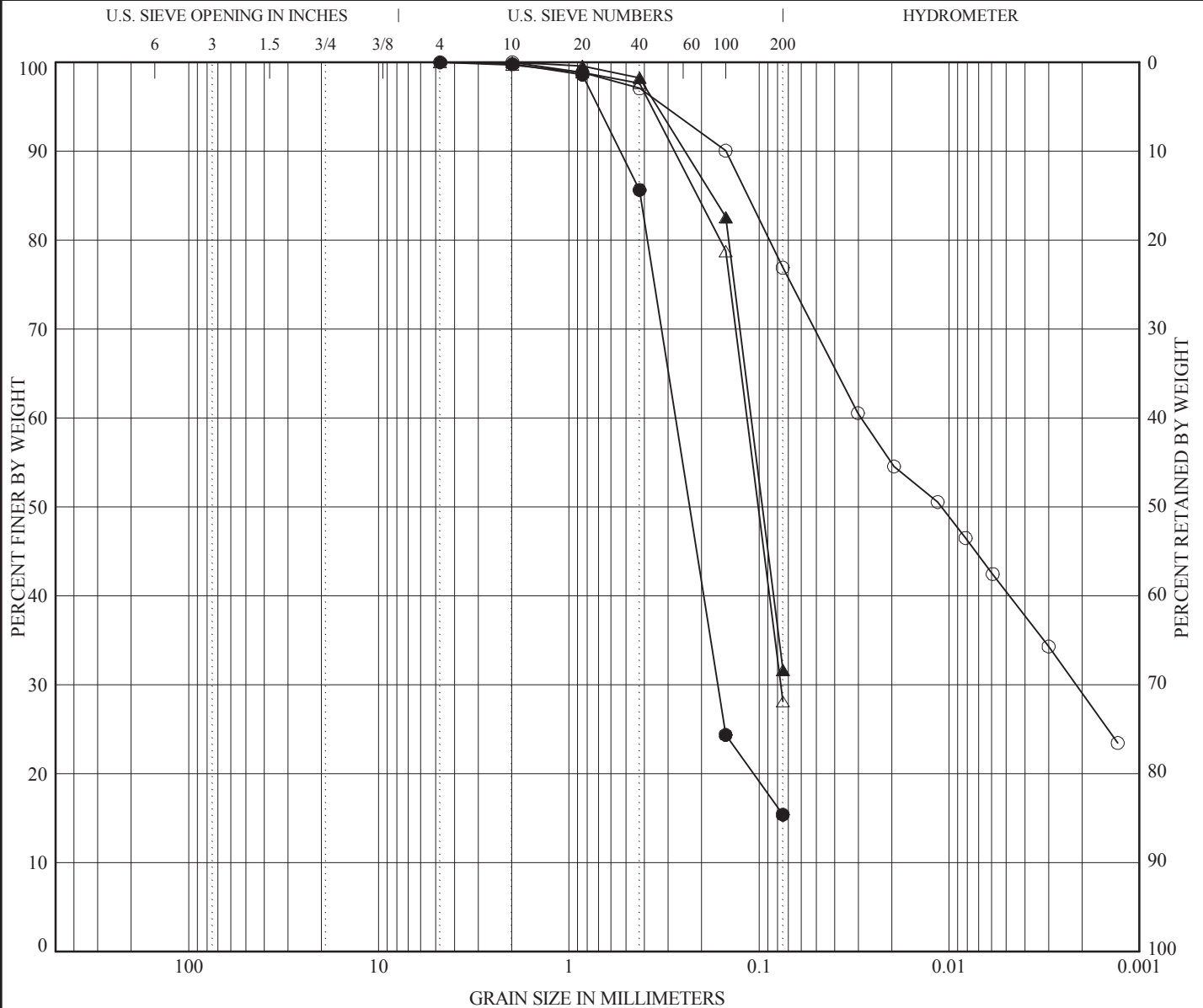
Prepared/Date: JF 6/14/2011
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.45

AMECFW_GRAIN SIZE_L:70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-165	67.5	LEAN CLAY with SAND (CL)	42	25	17	--	--
●	G-165	79.5	SILTY SAND (SM)	--	--	--	--	--
△	G-165	91.5	SILTY SAND (SM)	--	--	--	--	--
▲	G-165	103.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-165	67.5	1.98	0.029	0.002	--	0.0	23.1	76.9
●	G-165	79.5	4.75	0.275	0.165	--	0.0	84.6	15.4
△	G-165	91.5	4.75	0.116	0.077	--	0.0	71.9	28.1
▲	G-165	103.5	1.98	0.110	--	--	0.0	68.3	31.7

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

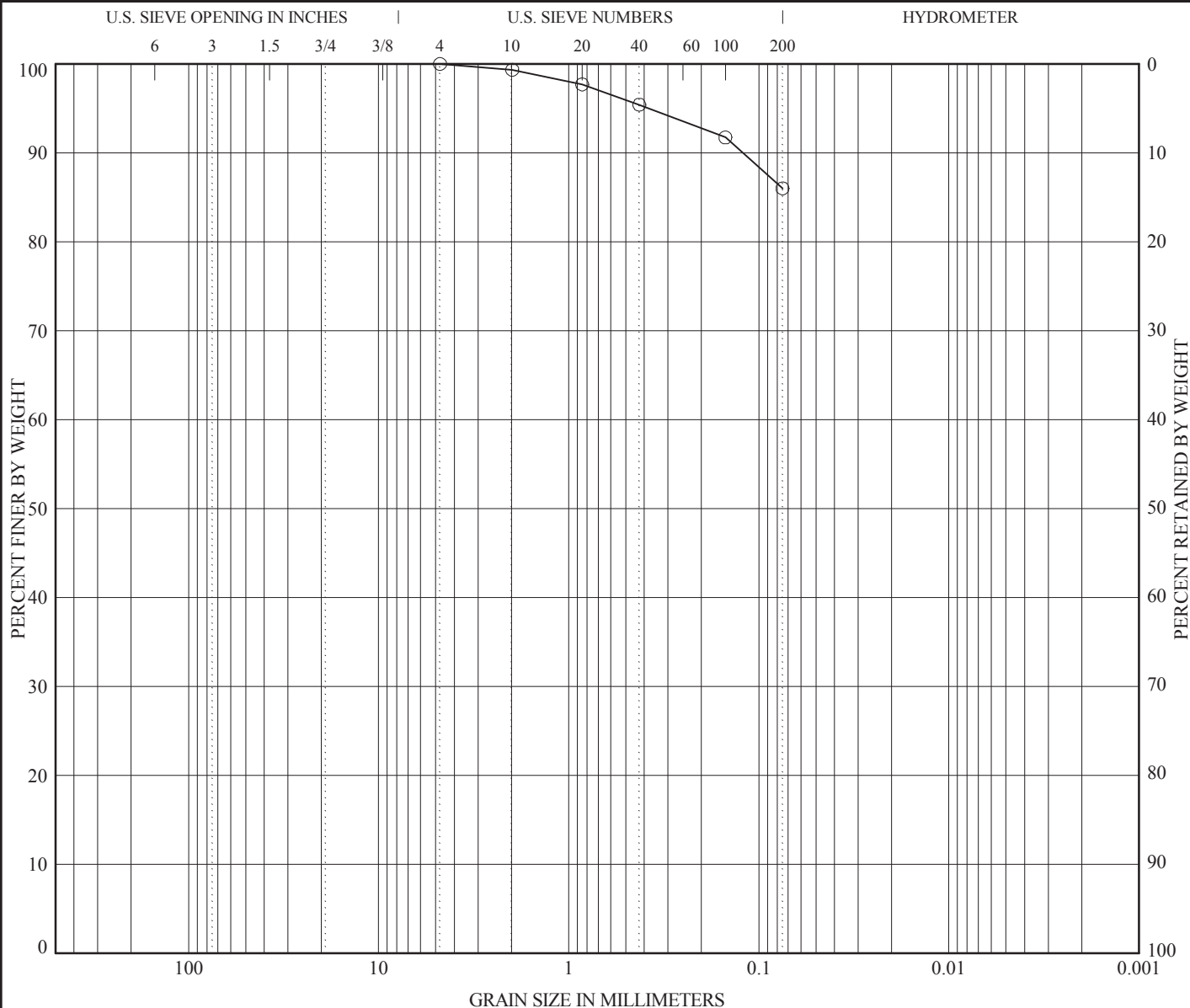
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.46

AMECFW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-165	120.5	ELASTIC SILT (MH)	51	30	21	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-165	120.5	4.75	--	--	--	0.0	14.0	86.0

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

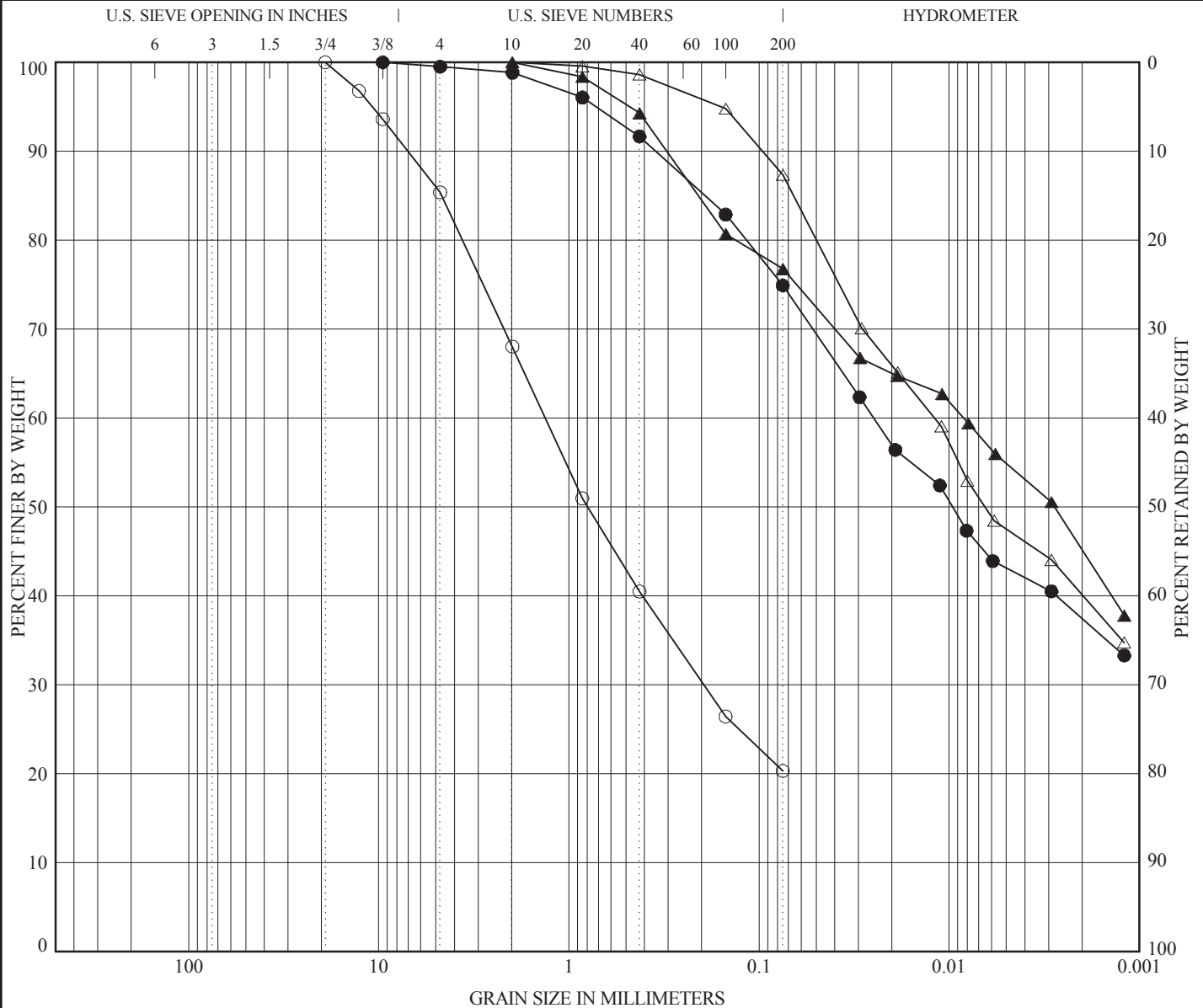
Prepared/Date: JF 6/14/2011
Checked/Date: JAG 6/27/2011

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Project No.: 4953-10-1561
Figure: D-5.2.47

AMEC.FW_GRAIN SIZE L:\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-166A/B	13.5	SILTY SAND (SM)	--	--	--	--	--
●	G-166A/B	25.5	LEAN CLAY with SAND (CL)	--	--	--	--	--
△	G-166A/B	52.5	LEAN CLAY (CL)	46	18	28	--	--
▲	G-166A/B	62.5	FAT CLAY with SAND (CH)	55	28	27	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-166A/B	13.5	19.10	1.330	0.195	--	14.6	65.1	20.3
●	G-166A/B	25.5	9.52	0.025	--	--	0.5	24.6	74.9
△	G-166A/B	52.5	1.98	0.012	--	--	0.0	12.7	87.3
▲	G-166A/B	62.5	1.98	0.008	--	--	0.0	23.2	76.8

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

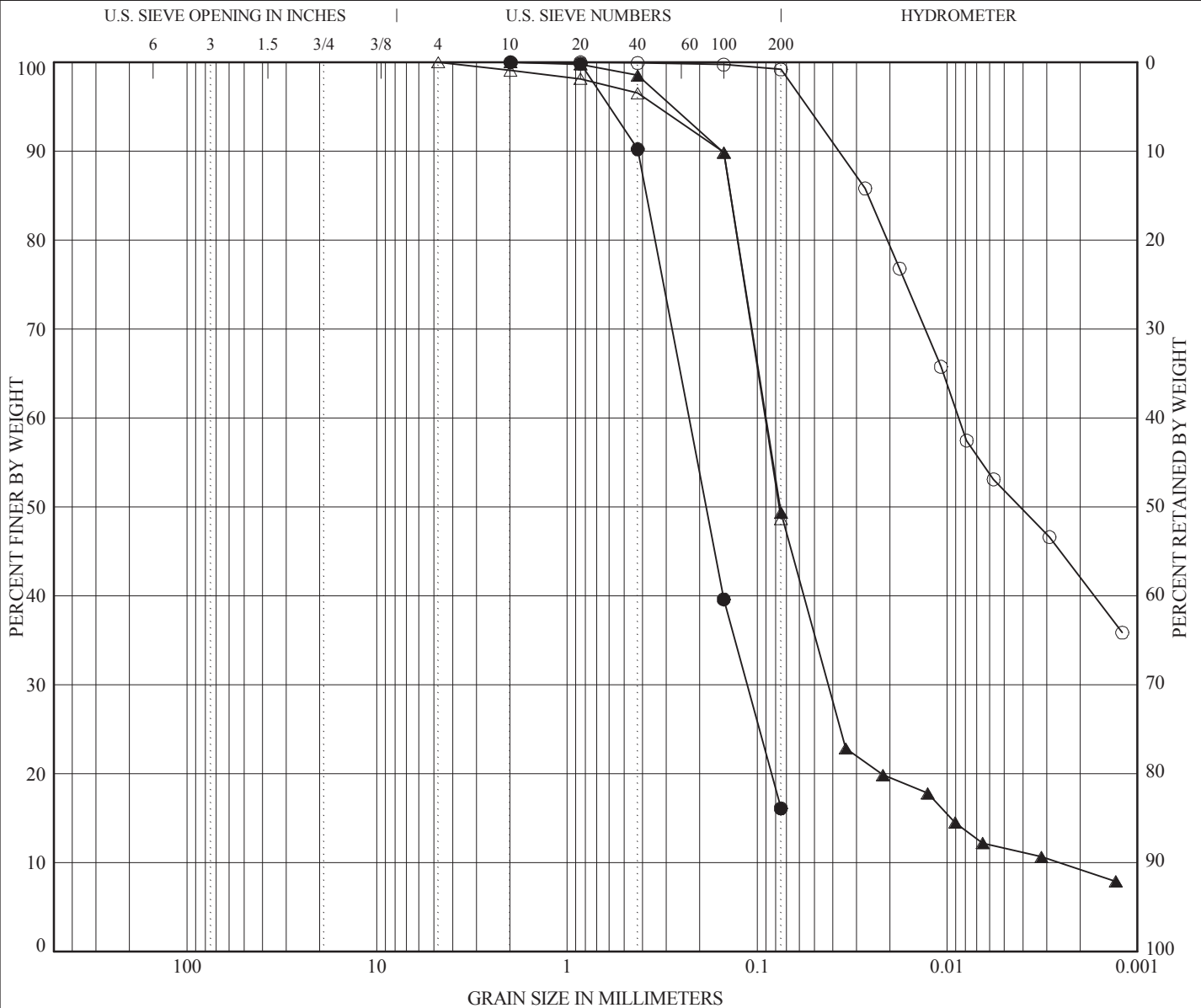
Prepared/Date: JF 7/17/2011
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.48

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\ROTARY WASH GINT LOGS\4953-10-1561 (ROTARY WASH).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-166A/B	68.5	ELASTIC SILT (MH)	82	43	39	--	--
●	G-166A/B	85.0	SILTY SAND (SM)	--	--	--	--	--
△	G-166A/B	100.5	SILTY SAND (SM)	--	--	--	--	--
▲	G-166A/B	105.5	SILTY SAND (SM)	NP	NP	NP	7.6	34.8

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-166A/B	68.5	1.98	0.009	--	--	0.0	0.8	99.2
●	G-166A/B	85.0	1.98	0.228	0.113	--	0.0	83.9	16.1
△	G-166A/B	100.5	4.75	0.091	--	--	0.0	51.4	48.6
▲	G-166A/B	105.5	1.98	0.090	0.042	0.003	0.0	50.7	49.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

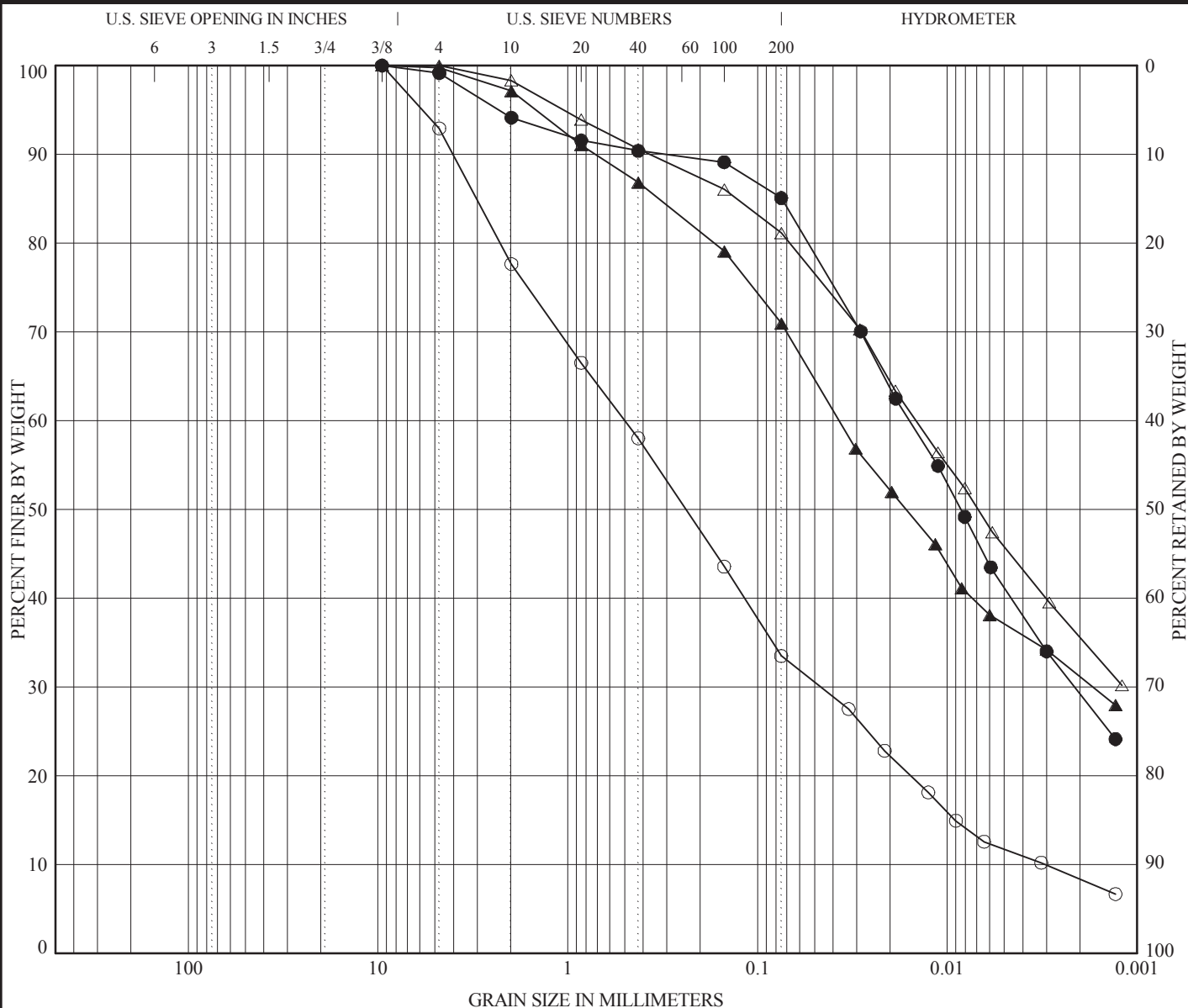
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.49

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\SONIC CORE GINT LOGS\4953-10-1561 (SONIC CORE).GPI 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-108	52.5-53.5	SILTY SAND (SM)	--	--	--	1.4	164.5
●	S-108	63-64	ELASTIC SILT (MH)	55	33	22	--	--
△	S-108	72.5-73.5	ELASTIC SILT with SAND (MH)	63	35	28	--	--
▲	S-108	78-79	FAT CLAY with SAND (CH)	50	27	23	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-108	52.5-53.5	9.52	0.500	0.047	0.003	7.1	59.4	33.5
●	S-108	63-64	9.52	0.016	0.002	--	0.9	14.1	85.1
△	S-108	72.5-73.5	4.75	0.015	--	--	0.0	18.9	81.1
▲	S-108	78-79	9.52	0.037	0.002	--	0.2	28.8	71.0

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

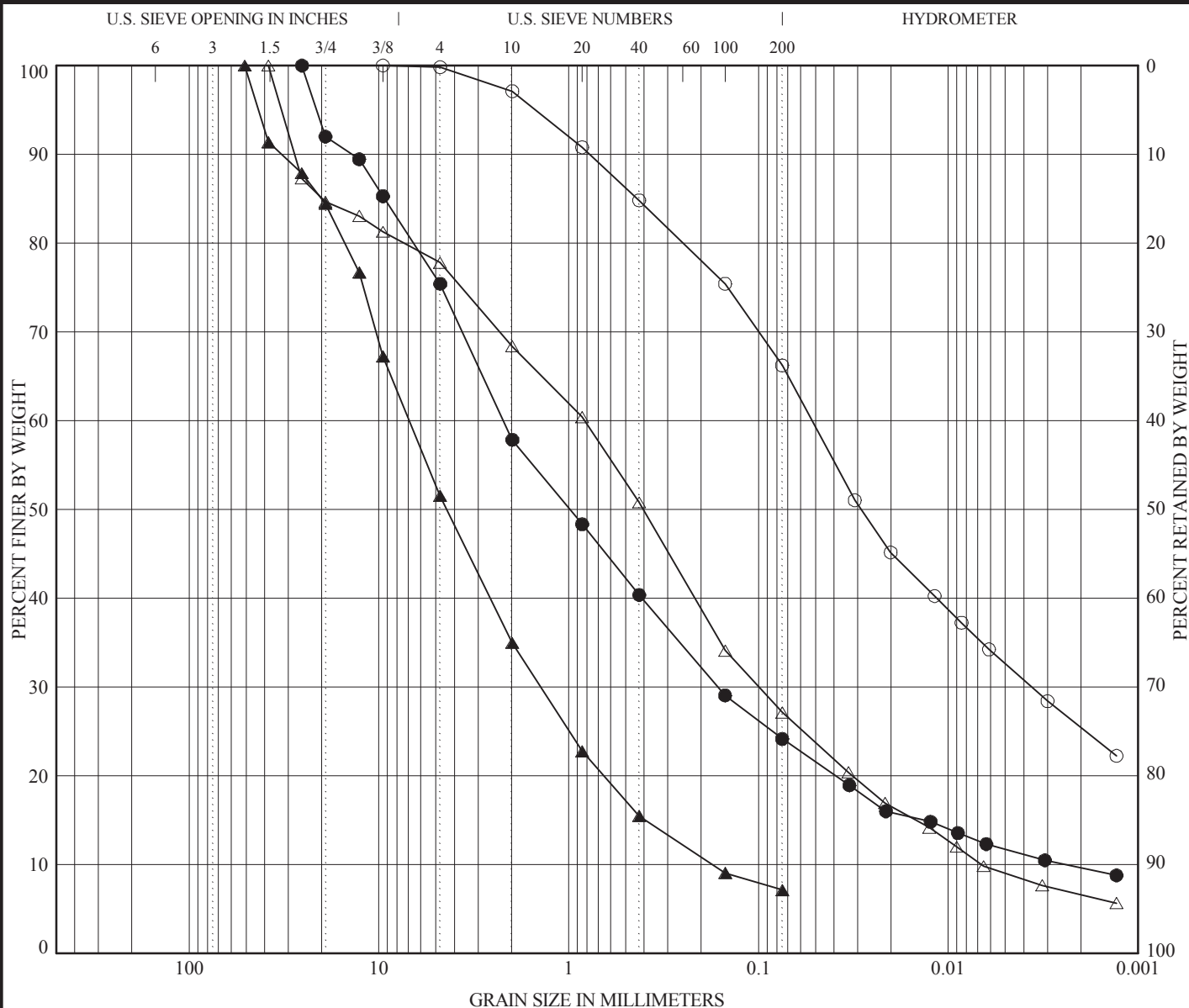
Prepared/Date: DR 6/23/2011
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.51

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\SONIC CORE GINT LOGS\4953-10-1561 (SONIC CORE).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-108	82-83	SANDY LEAN CLAY (CL)	47	24	23	--	--
●	S-108	86-87	CLAYEY SAND with GRAVEL (SC)	--	--	--	5.0	913.0
△	S-108	91-92	SILTY SAND with GRAVEL (SM)	NP	NP	NP	1.8	123.6
▲	S-108	93-94	WELL GRADED GRAVEL with SILT (GW-GM)	--	--	--	1.6	39.5

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-108	82-83	9.52	0.052	0.004	--	0.2	33.6	66.2
●	S-108	86-87	25.40	2.204	0.164	0.002	24.6	51.3	24.2
△	S-108	91-92	38.10	0.826	0.100	0.007	22.2	50.7	27.1
▲	S-108	93-94	50.80	6.912	1.404	0.175	48.5	44.4	7.1

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

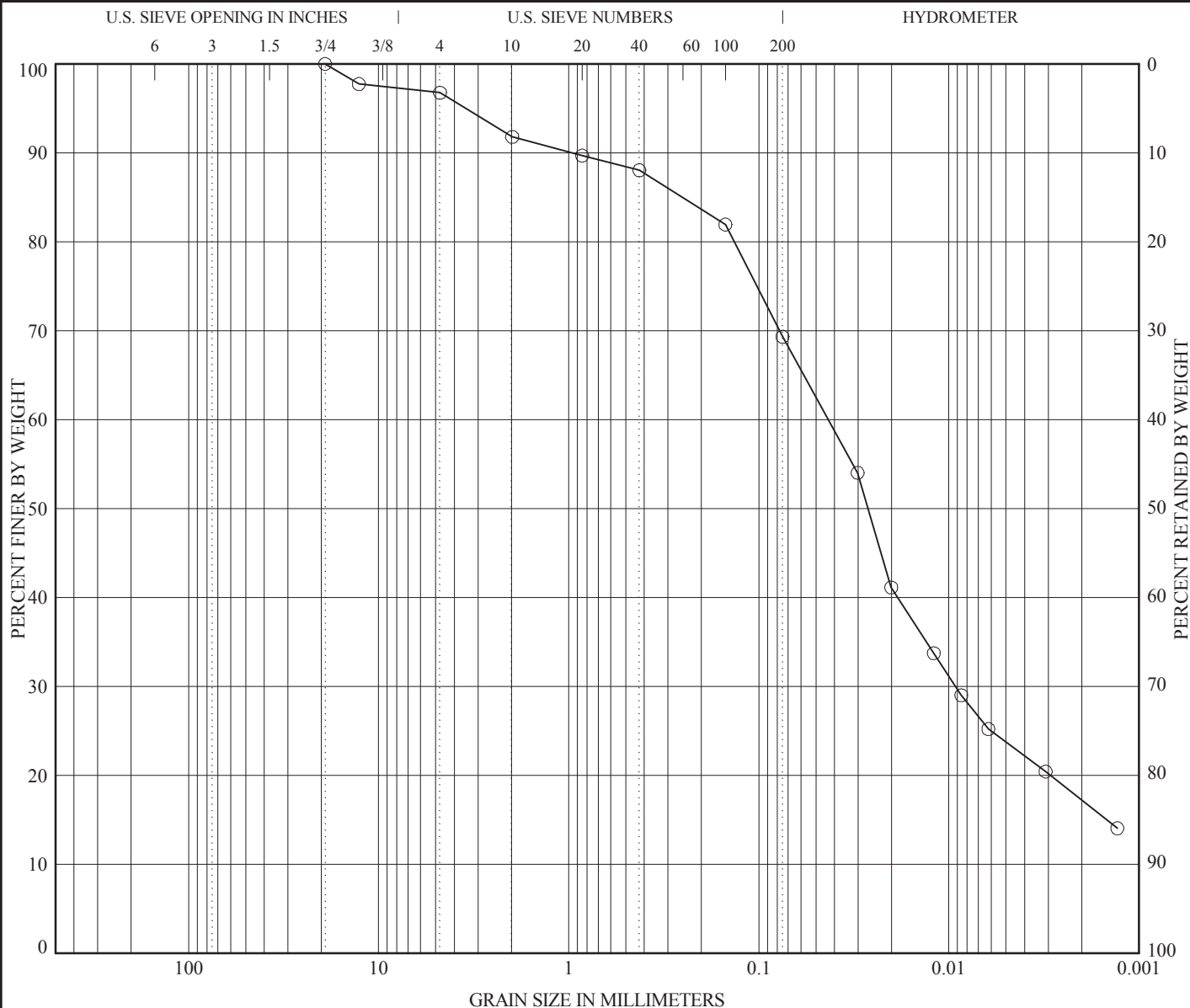
Prepared/Date: DR 6/23/2011
Checked/Date: LT 6/29/2011

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.52

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\SONIC CORE GINT LOGS\4953-10-1561 (SONIC CORE).GPI 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-108	97-98	SANDY SILT (ML)	NP	NP	NP	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-108	97-98	19.10	0.043	0.009	--	3.2	27.4	69.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

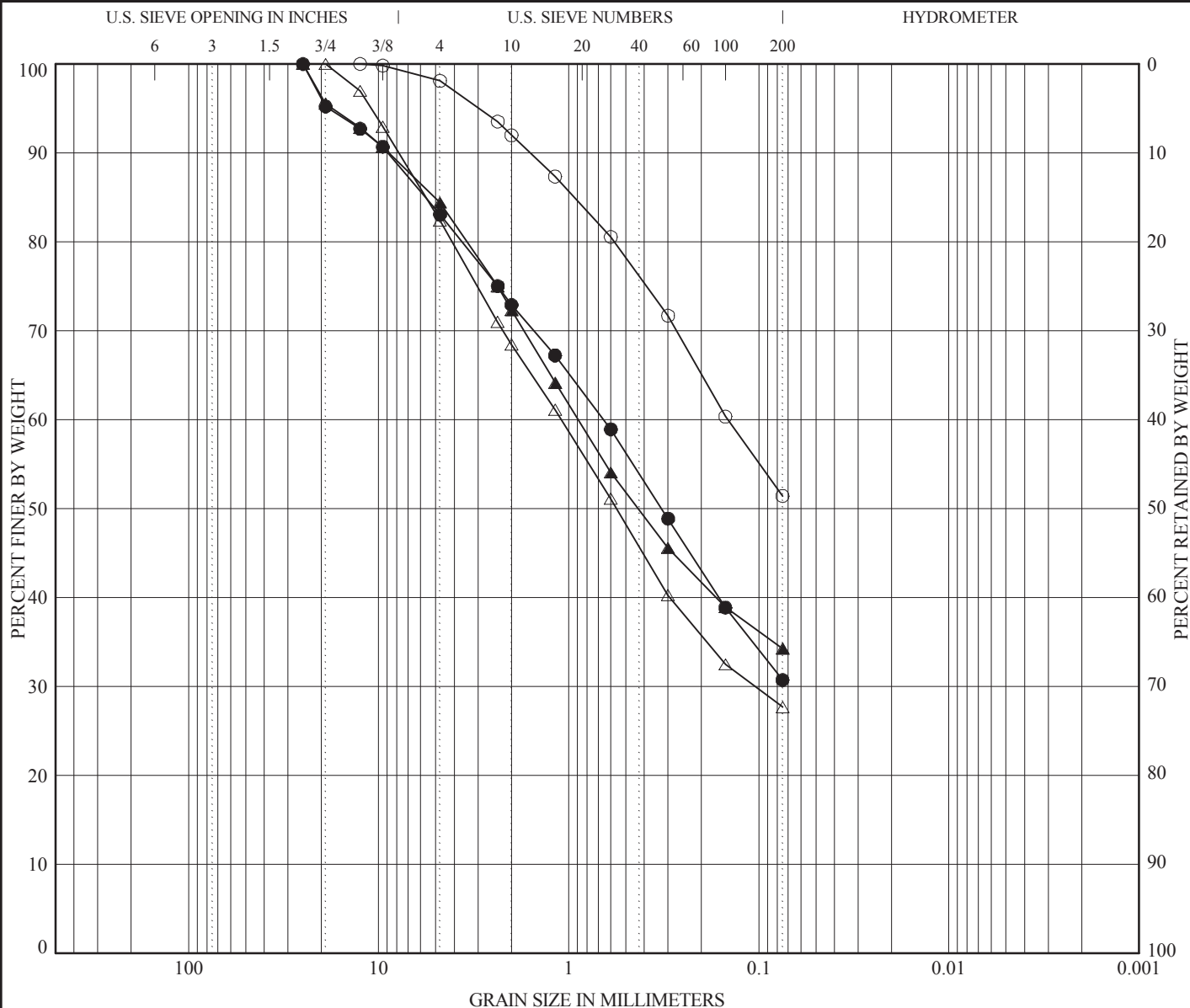
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.53

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\SONIC CORE GINT LOGS\4953-10-1561 (SONIC CORE).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-109	22-23	SANDY LEAN CLAY (CL)	31	13	18	--	--
●	S-109	33-34	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
△	S-109	41-42	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
▲	S-109	45-46	SILTY SAND with GRAVEL (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-109	22-23	12.50	0.146	--	--	1.9	46.7	51.4
●	S-109	33-34	25.00	0.655	--	--	16.9	52.3	30.7
△	S-109	41-42	19.00	1.095	0.105	--	17.6	54.7	27.7
▲	S-109	45-46	25.00	0.893	--	--	15.6	50.2	34.3

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

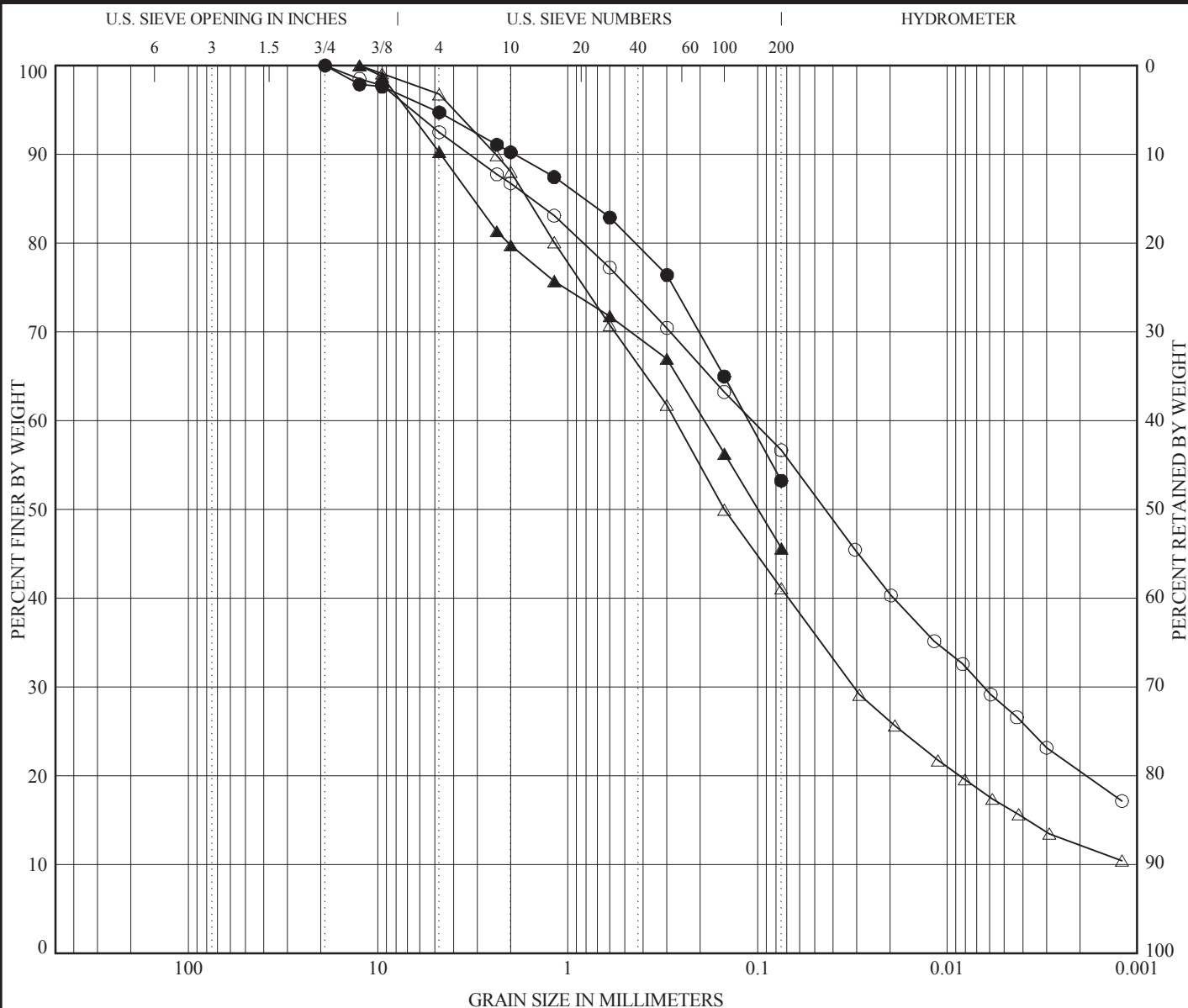
Prepared/Date: YN 7/16/2011
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.54

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-109	56-57	SANDY LEAN CLAY (CL)	38	14	24	--	--
●	S-109	62-63	SANDY LEAN CLAY (CL)	35	17	18	--	--
△	S-109	77-78	CLAYEY SAND (SC)	30	16	14	--	--
▲	S-109	86-87	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-109	56-57	19.00	0.107	0.006	--	7.5	35.8	56.7
●	S-109	62-63	19.00	0.112	--	--	5.3	41.5	53.2
△	S-109	77-78	12.50	0.271	0.031	--	3.2	55.6	41.1
▲	S-109	86-87	12.50	0.191	--	--	9.8	44.6	45.6

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

Prepared/Date: YN 7/16/2011

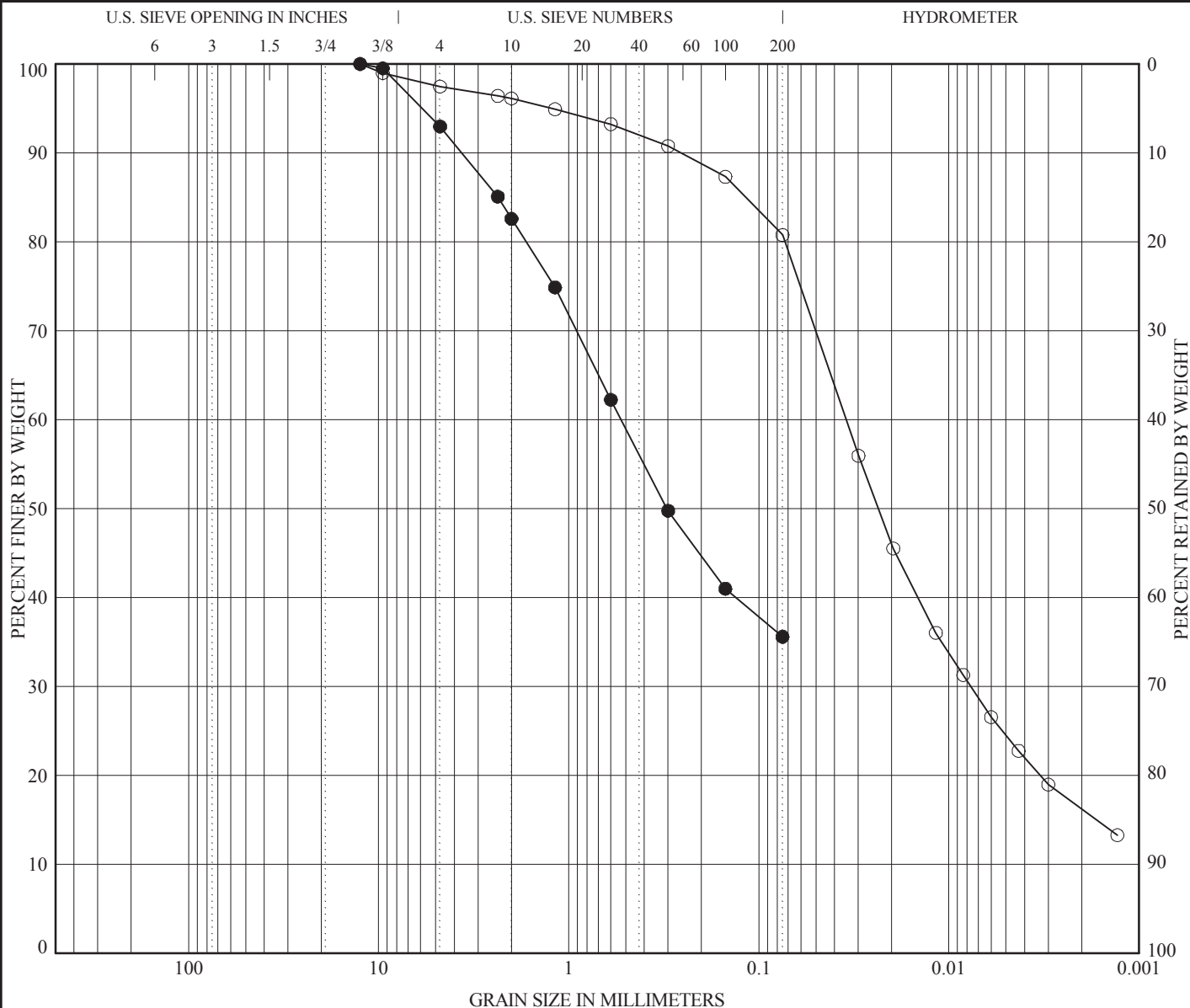
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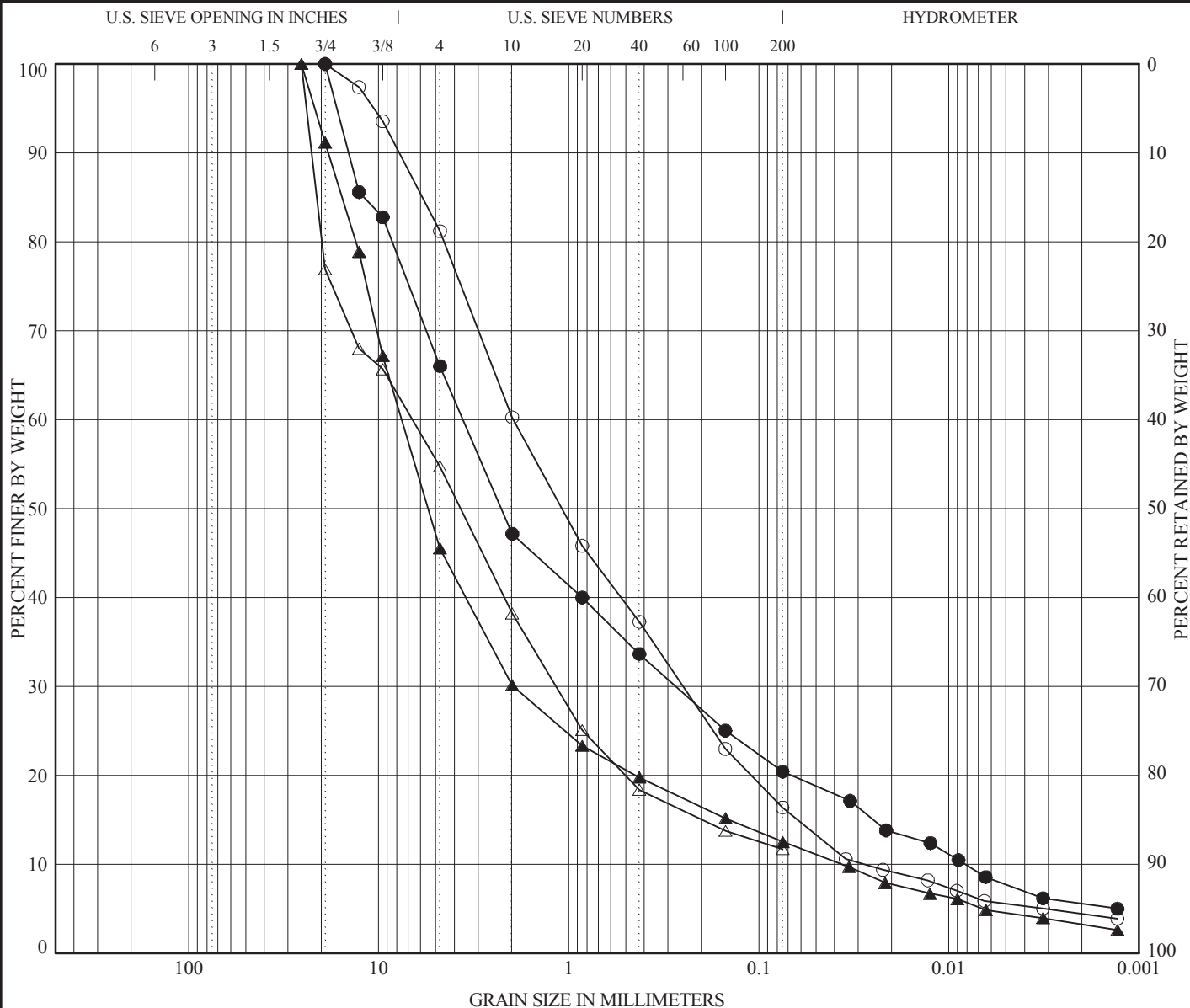
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.55

AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
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AMEC\FW_GRAIN SIZE_L\70131 GEOTECH\GINT\LIBRARY AMEC\JUNE2012 GLB
G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\SONIC CORE GINT LOGS\4953-10-1561 (SONIC CORE).GPI 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-111	38-39	SILTY SAND with GRAVEL (SM)	--	--	--	1.1	69.6
●	S-111	41-42	SILTY SAND with GRAVEL (SM)	--	--	--	2.5	438.3
△	S-111	45-46	POORLY GRADED GRAVEL with CLAY and SAND (GP-GC)	36	19	17	4.9	157.6
▲	S-111	49-50	SILTY, CLAYEY GRAVEL with SAND (GC-GM)	--	--	--	13.8	208.4

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-111	38-39	19.10	1.951	0.250	0.028	18.8	64.8	16.4
●	S-111	41-42	19.10	3.592	0.273	0.008	34.0	45.6	20.4
△	S-111	45-46	25.40	6.635	1.166	--	45.2	43.0	11.7
▲	S-111	49-50	25.40	7.562	1.944	0.036	54.5	33.0	12.5

Laboratory Test Method: ASTM D 422

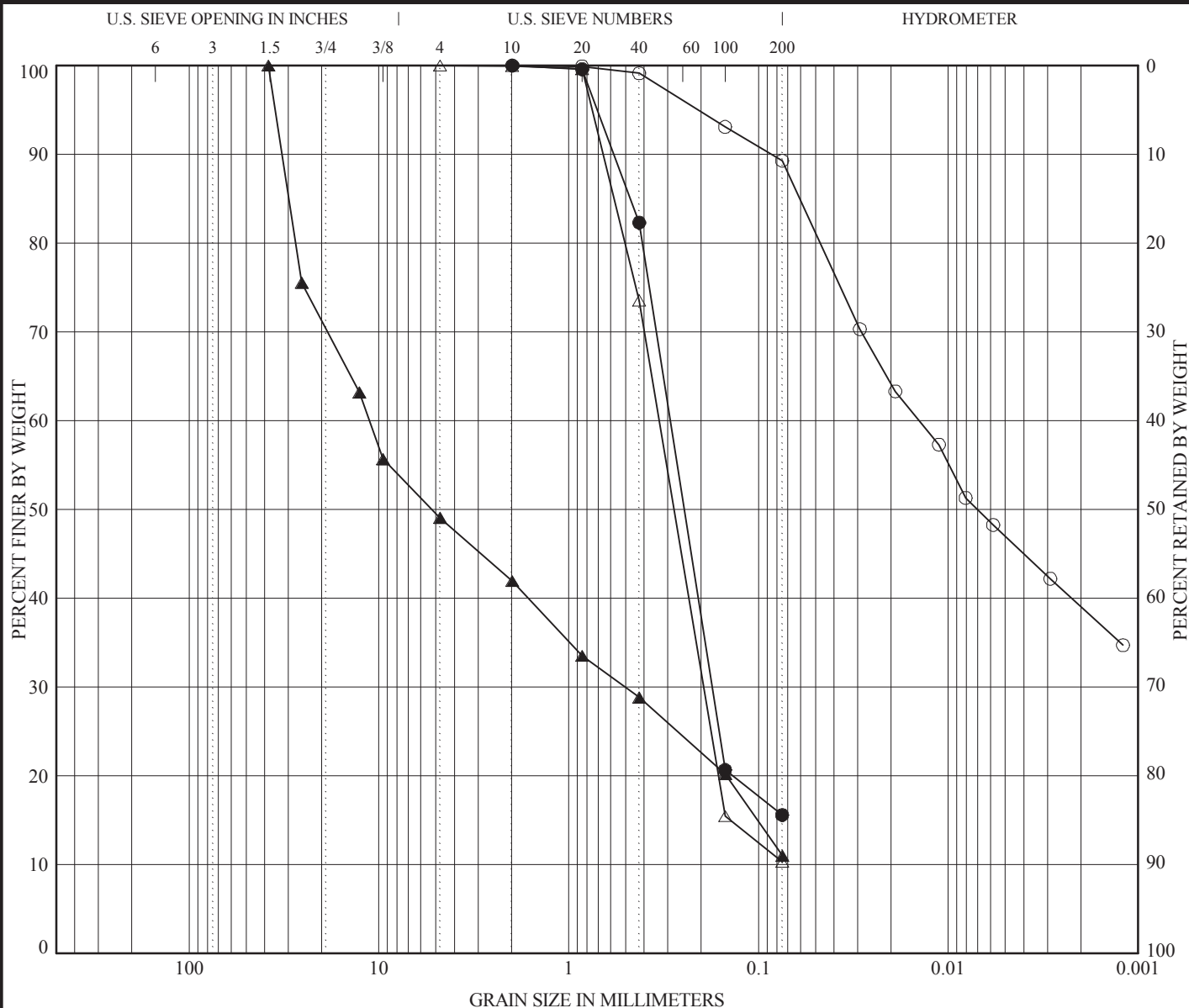
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.57



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-111	52-53	LEAN CLAY (CL)	47	26	21	--	--
●	S-111	59-60	SILTY SAND (SM)	--	--	--	--	--
△	S-111	70-71	POORLY GRADED SAND with SILT (SP-SM)	--	--	--	1.6	4.6
▲	S-111	78.5-79.5	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	--	--	--	0.3	161.8

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-111	52-53	1.98	0.014	--	--	0.0	10.7	89.3
●	S-111	59-60	1.98	0.292	0.176	--	0.0	84.4	15.6
△	S-111	70-71	4.75	0.333	0.195	--	0.0	89.7	10.3
▲	S-111	78.5-79.5	38.10	11.238	0.505	--	51.0	38.0	11.0

Laboratory Test Method: ASTM D 422

*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

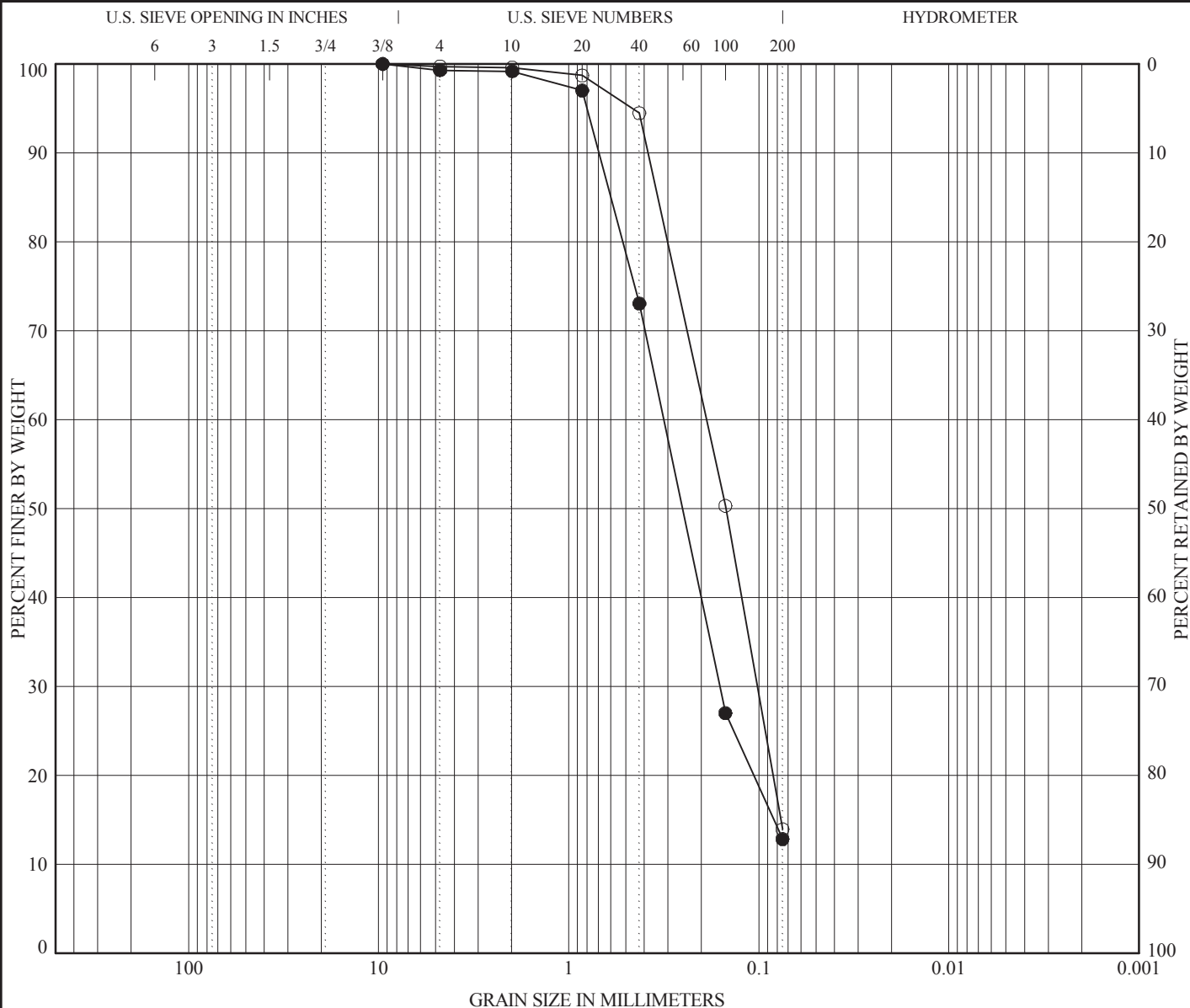
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.58

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G:\PROJECT_DIRECTORIES\4953\2010\101561_METRO_WESTSIDE_EXTENSION\6.2.3.1 GEOTECHNICAL DESIGN\3.2 ALL FIELD NOTES\GINT LOG\SONIC CORE GINT LOGS\4953-10-1561 (SONIC CORE).GPJ 7/16/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	S-111	83-84	SILTY SAND (SM)	--	--	--	--	--
●	S-111	88-89	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	S-111	83-84	9.52	0.189	0.102	--	0.3	85.8	13.9
●	S-111	88-89	9.52	0.316	0.161	--	0.7	86.5	12.8

Laboratory Test Method: ASTM D 422

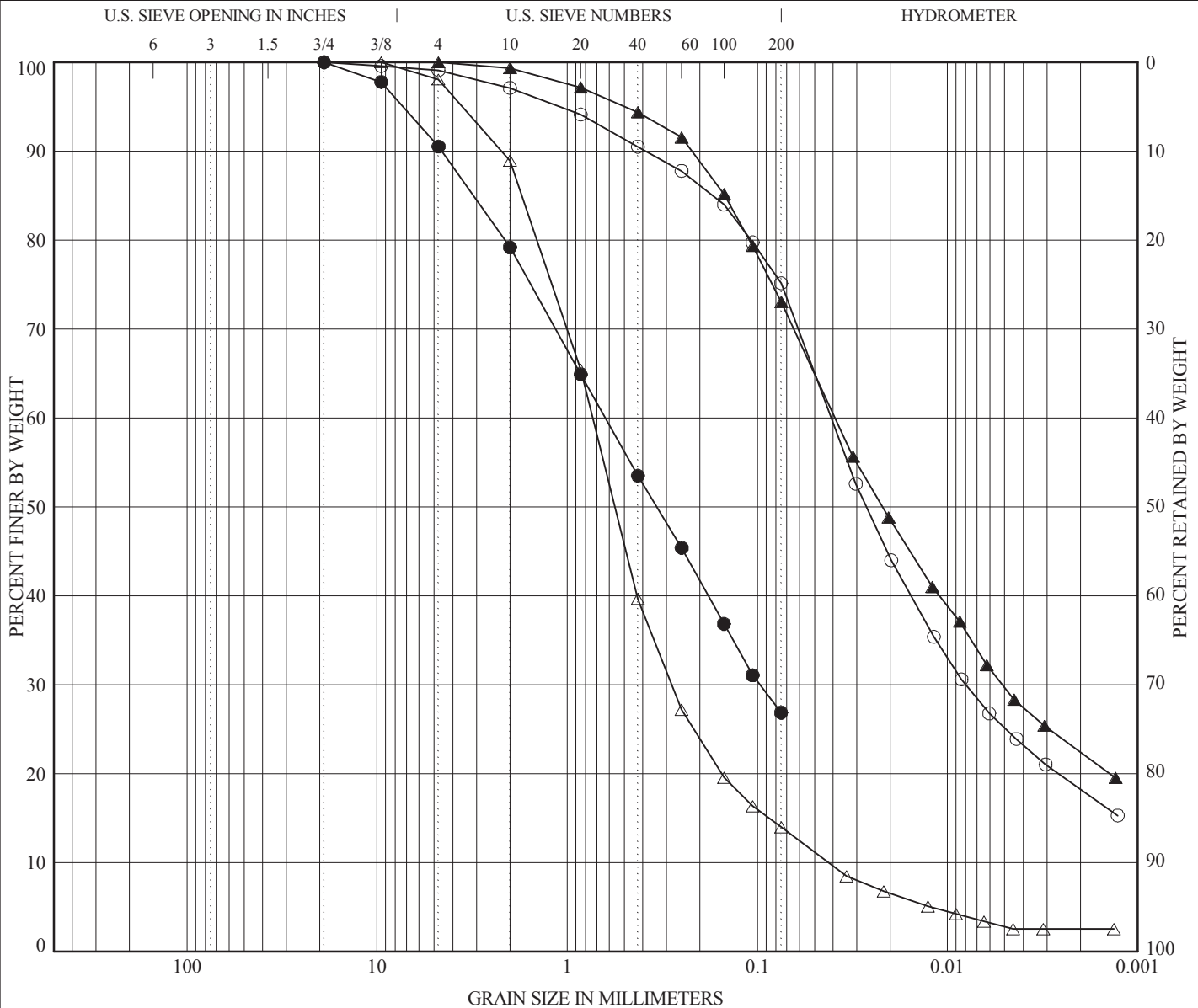
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-10-1561
Figure: D-5.2.59



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	E-126A/M-404	35.5	LEAN CLAY WITH SAND (CL)	37	17	20	--	--
●	E-126A/M-404	40.5	SILTY SAND (SM)	--	--	--	--	--
△	E-126A/M-404	45.5	WELL GRADED SAND WITH SILT (SW-SM)	--	--	--	2.6	17.4
▲	E-126A/M-404	55.5	LEAN CLAY WITH SAND (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	E-126A/M-404	35.5	19.00	0.041	0.008	--	0.9	24.0	75.1
●	E-126A/M-404	40.5	19.00	0.630	0.097	--	9.5	63.7	26.9
△	E-126A/M-404	45.5	9.50	0.734	0.282	0.042	1.9	84.1	14.0
▲	E-126A/M-404	55.5	4.75	0.039	0.005	--	0.0	26.9	73.1

Laboratory Test Method: ASTM D 422

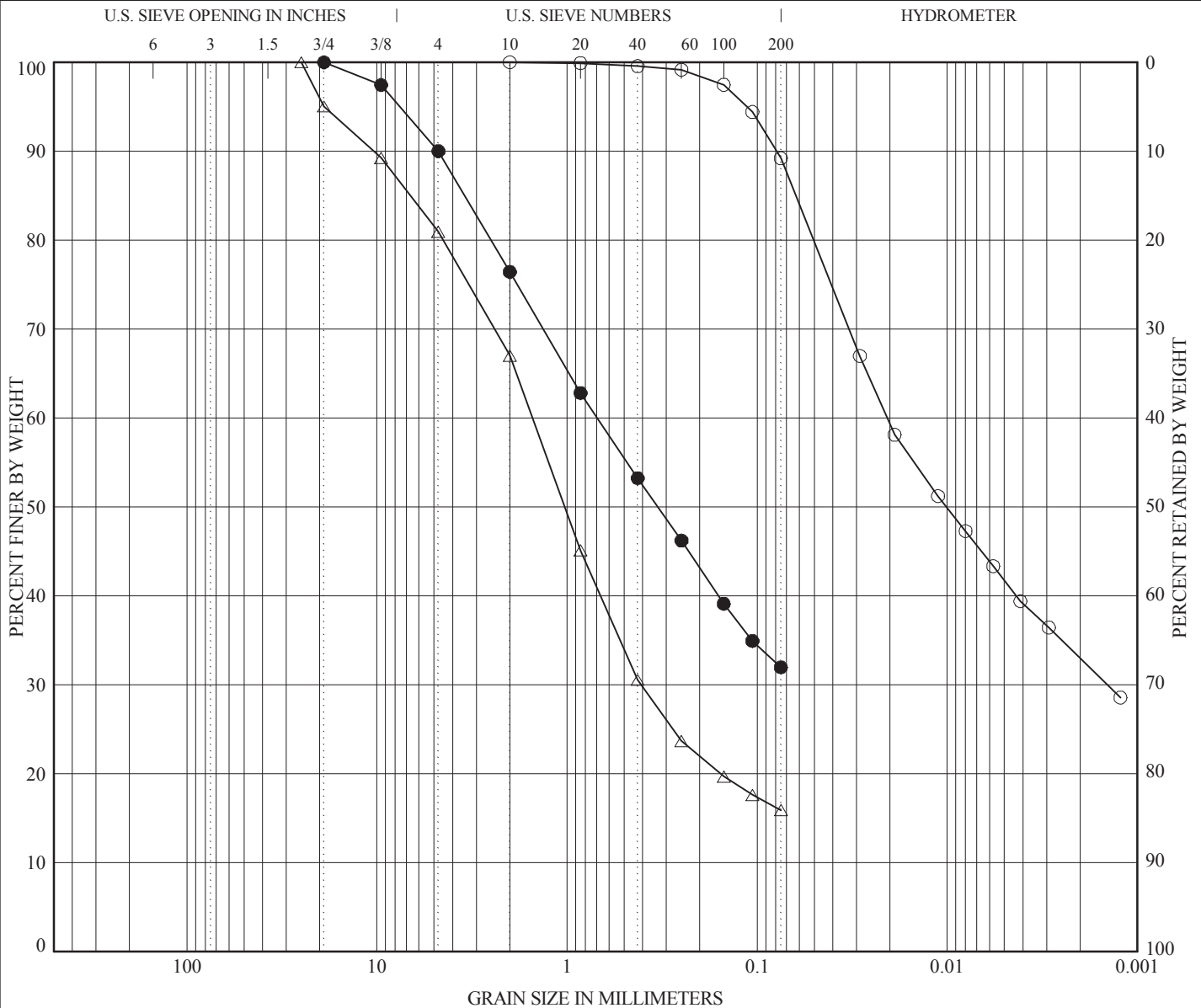
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
 Project No.: 4953-11-1423
 Figure: D-5.3.1.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	E-126A/M-404	65.5	LEAN CLAY (CL)	49	16	33	--	--
●	E-126A/M-404	75.5	SILTY CLAYEY SAND (SC-SM)	--	--	--	--	--
△	E-126A/M-404	85.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	E-126A/M-404	65.5	2.00	0.021	0.001	--	0.0	10.8	89.2
●	E-126A/M-404	75.5	19.00	0.693	--	--	10.0	58.1	32.0
△	E-126A/M-404	85.5	25.00	1.521	0.407	--	19.0	65.0	15.9

Laboratory Test Method: ASTM D 422

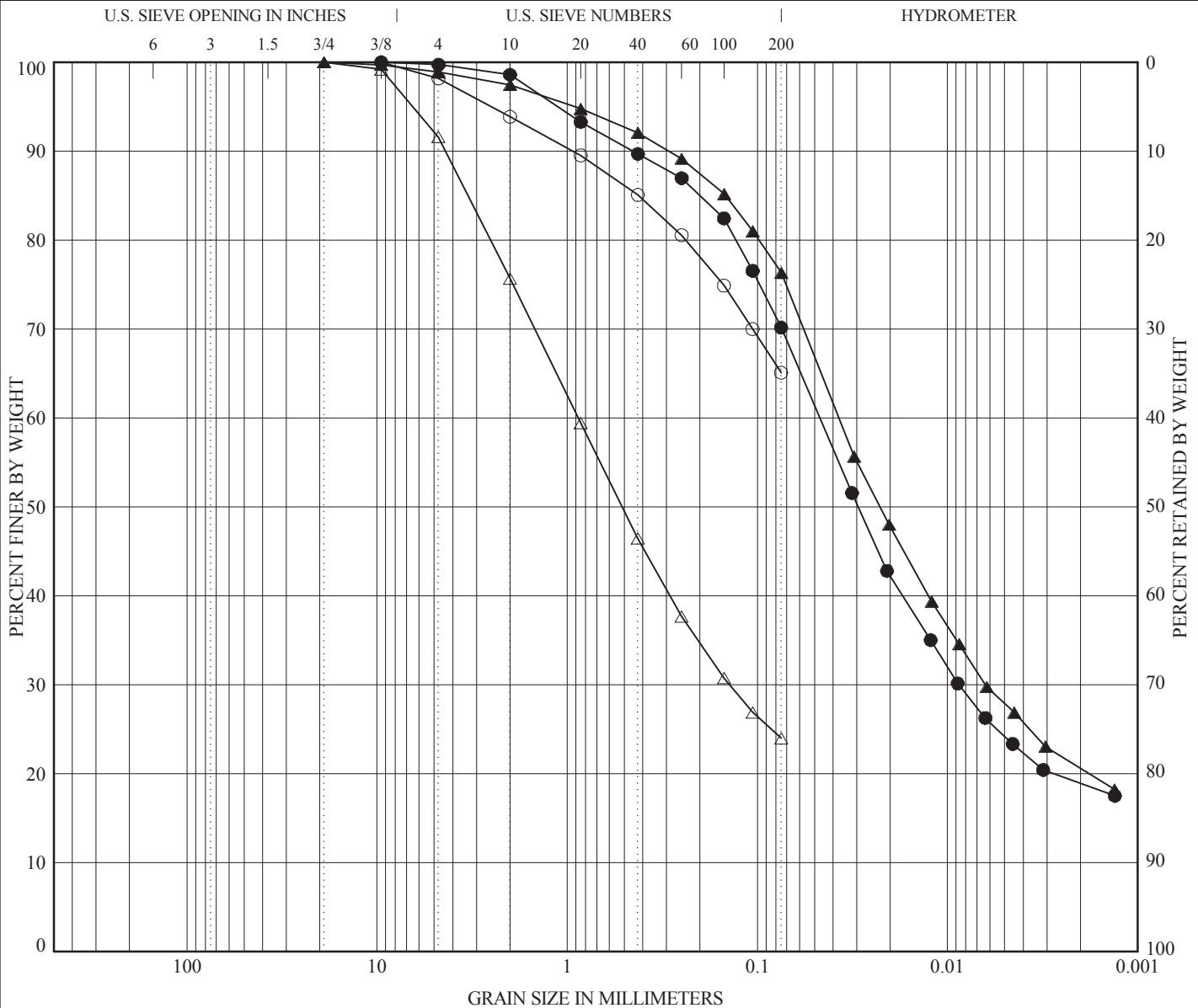
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.1.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	E-126B/M-405	15.5	SANDY LEAN CLAY (CL)	34	16	18	--	--
●	E-126B/M-405	30.5	SANDY LEAN CLAY (CL)	35	15	20	--	--
△	E-126B/M-405	45.5	SILTY SAND (SM)	--	--	--	--	--
▲	E-126B/M-405	55.5	LEAN CLAY WITH SAND (CL)	33	15	18	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	E-126B/M-405	15.5	9.50	--	--	--	1.8	33.1	65.1
●	E-126B/M-405	30.5	9.50	0.047	0.009	--	0.3	29.6	70.2
△	E-126B/M-405	45.5	19.00	0.876	0.140	--	8.4	67.6	24.0
▲	E-126B/M-405	55.5	19.00	0.037	0.006	--	1.1	22.5	76.3

Laboratory Test Method: ASTM D 422

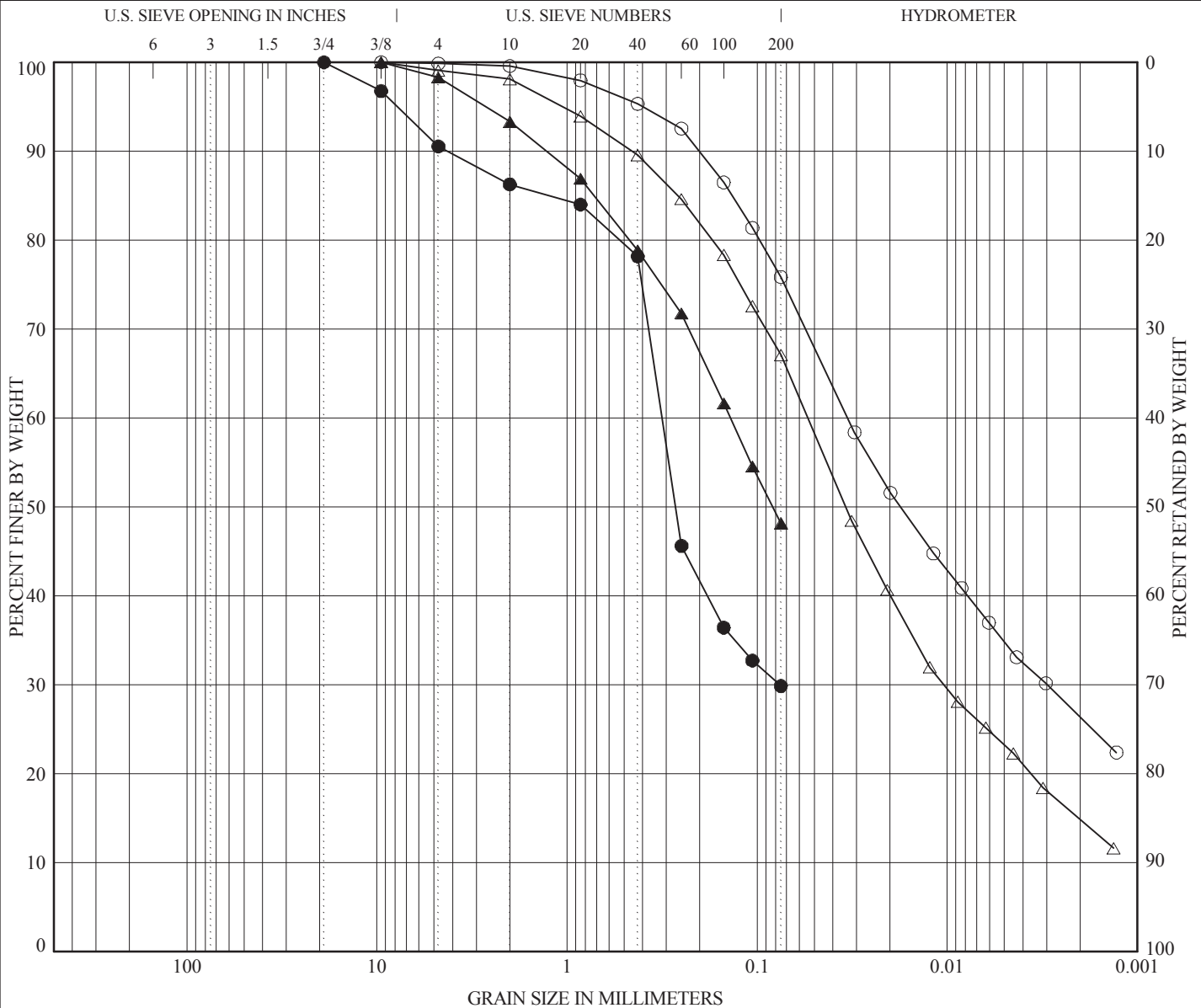
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.2.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	E-126B/M-405	75.5	LEAN CLAY WITH SAND (CL)	39	15	24	--	--
●	E-126B/M-405	85.5	SILTY SAND (SM)	--	--	--	--	--
△	E-126B/M-405	115.5	SANDY LEAN CLAY (CL)	36	14	22	--	--
▲	E-126B/M-405	125.5	SILTY SAND (SM)	--	--	--	--	--

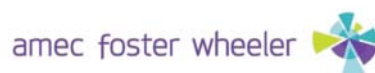
SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	E-126B/M-405	75.5	9.50	0.033	0.003	--	0.2	24.0	75.8
●	E-126B/M-405	85.5	19.00	0.316	0.076	--	9.5	60.7	29.9
△	E-126B/M-405	115.5	9.50	0.054	0.010	--	0.9	32.0	67.1
▲	E-126B/M-405	125.5	9.50	0.138	--	--	1.7	50.2	48.1

Laboratory Test Method: ASTM D 422

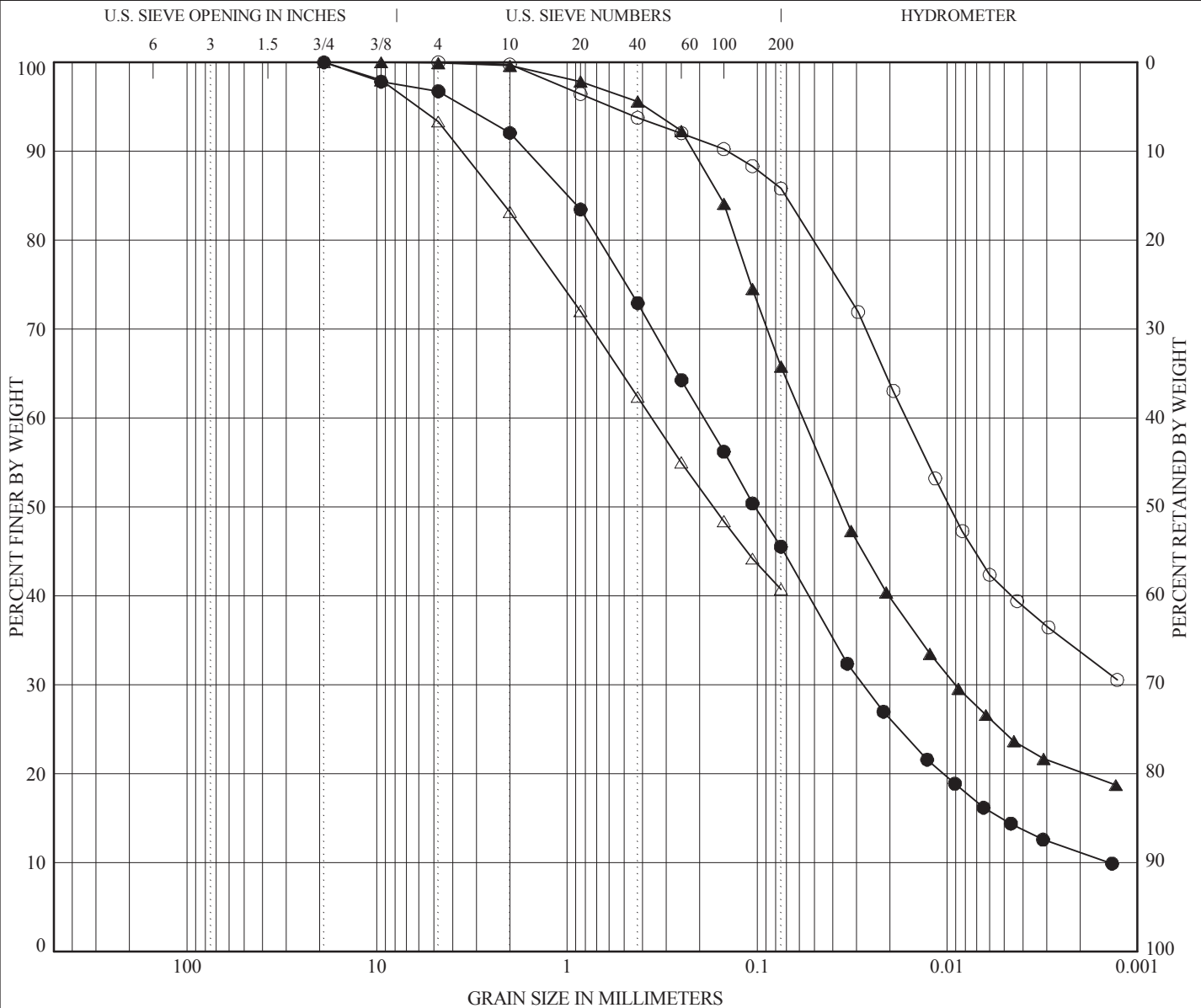
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.2.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-405/M-403	75.5	FAT CLAY (CH)	52	17	35	--	--
●	G-405/M-403	83.5	CLAYEY SAND (SC)	28	15	13	2.9	135.9
△	G-405/M-403	89.5	CLAYEY SAND (SC)	--	--	--	--	--
▲	G-405/M-403	92.5	SANDY LEAN CLAY (CL)	38	14	24	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-405/M-403	75.5	4.75	0.016	--	--	0.0	14.2	85.8
●	G-405/M-403	83.5	19.00	0.191	0.028	0.001	3.3	51.2	45.5
△	G-405/M-403	89.5	19.00	0.359	--	--	6.7	52.6	40.7
▲	G-405/M-403	92.5	9.50	0.058	0.009	--	0.1	34.2	65.8

Laboratory Test Method: ASTM D 422

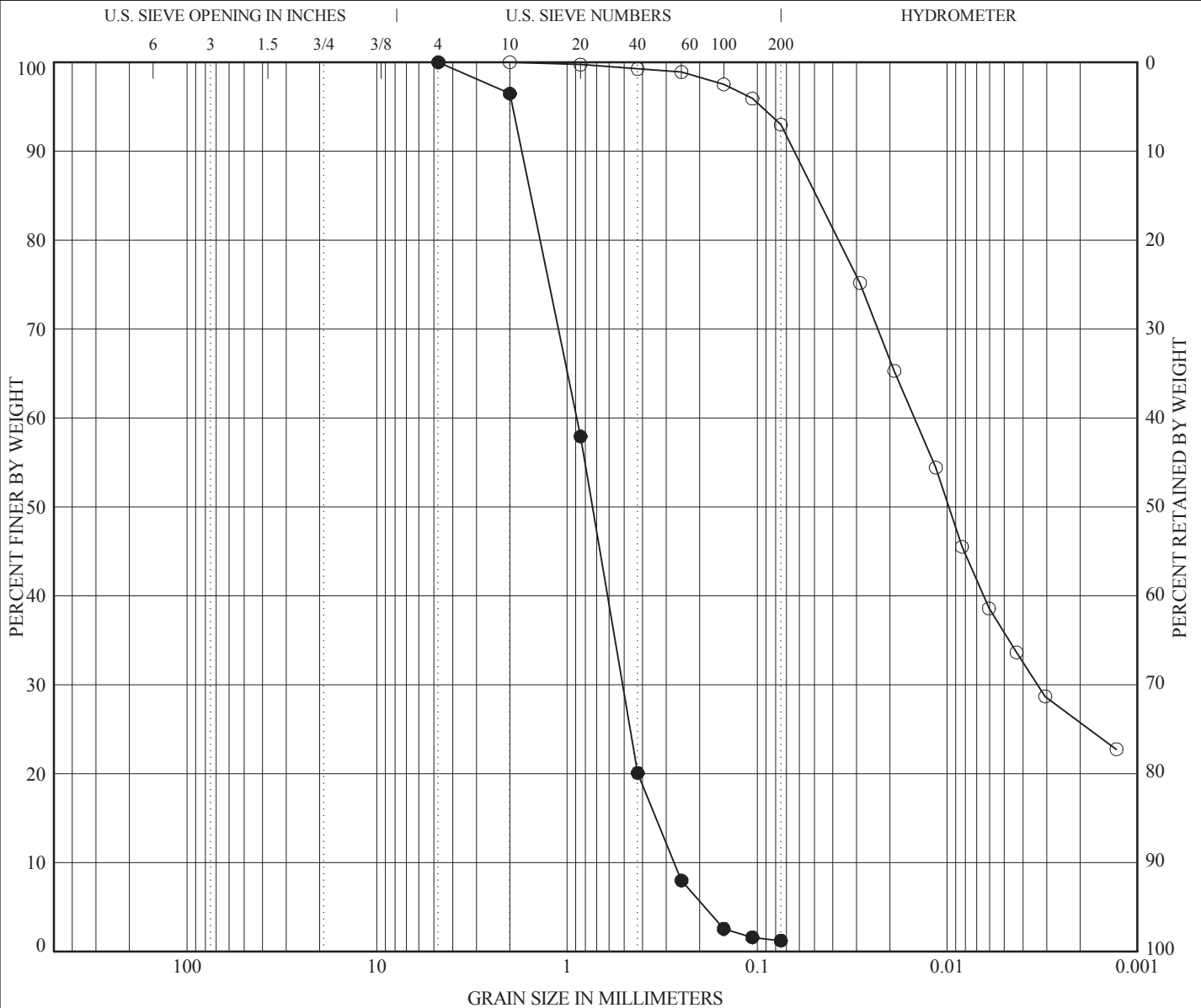
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.3.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-405/M-403	110.5	LEAN CLAY with SAND (CL)	48	19	29	--	--
●	G-405/M-403	113.5	POORLY GRADED SAND (SP)	--	--	--	1.1	3.3

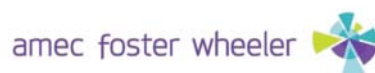
SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-405/M-403	110.5	4.75	0.015	0.003	--	0.0	7.0	93.0
●	G-405/M-403	113.5	4.75	0.890	0.510	0.273	0.0	98.8	1.2

Laboratory Test Method: ASTM D 422

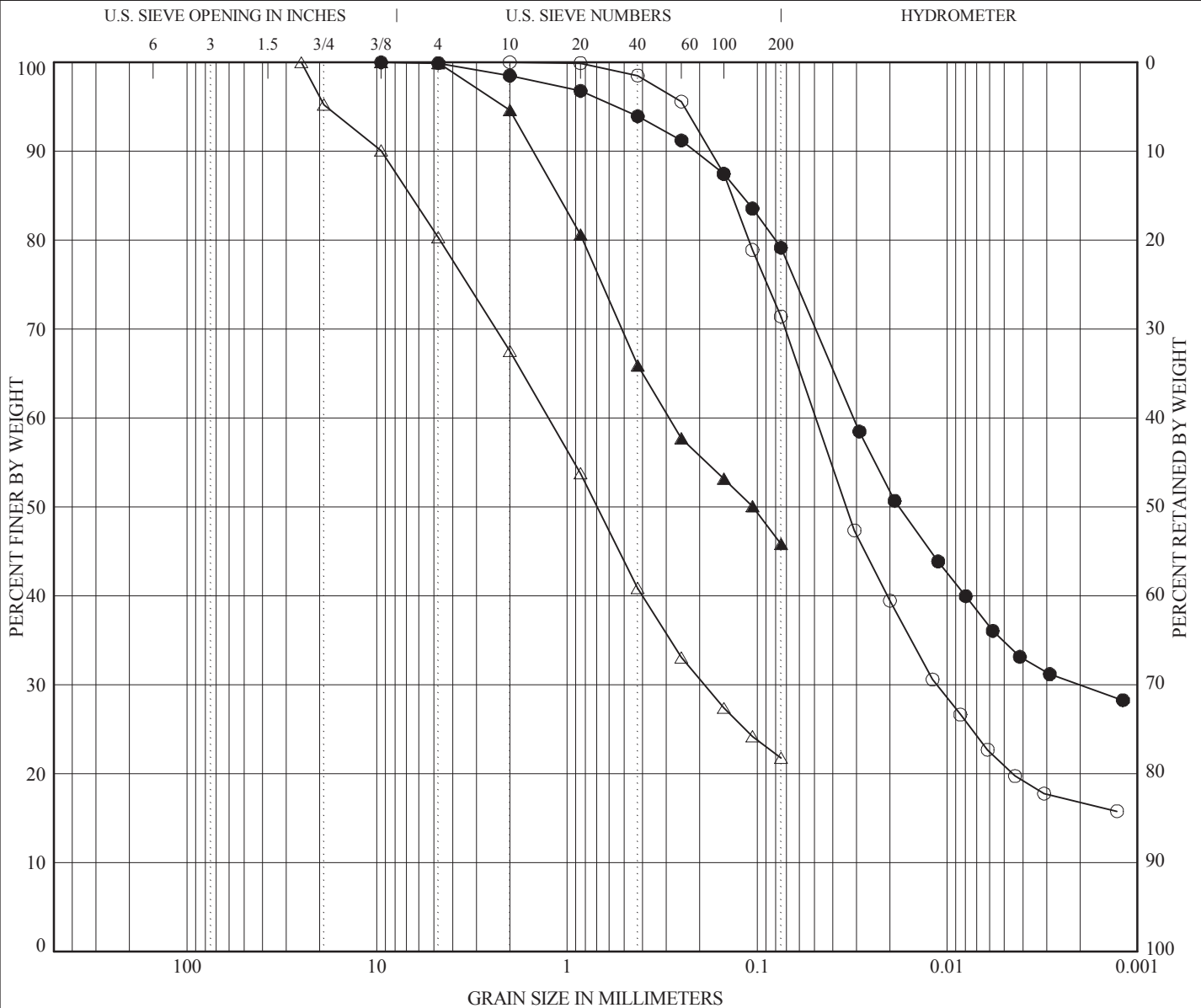
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.3.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-406	55.5	SANDY SILT (ML)	31	17	14	--	--
●	G-406	65.5	LEAN CLAY WITH SAND (CL)	41	13	28	--	--
△	G-406	78.0	SILTY SAND WITH GRAVEL (SM)	--	--	--	--	--
▲	G-406	88.0	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-406	55.5	2.00	0.049	0.011	--	0.0	28.6	71.4
●	G-406	65.5	9.50	0.031	0.002	--	0.1	20.8	79.1
△	G-406	78.0	25.00	1.251	0.190	--	19.7	58.5	21.8
▲	G-406	88.0	9.50	0.290	--	--	0.1	54.1	45.8

Laboratory Test Method: ASTM D 422

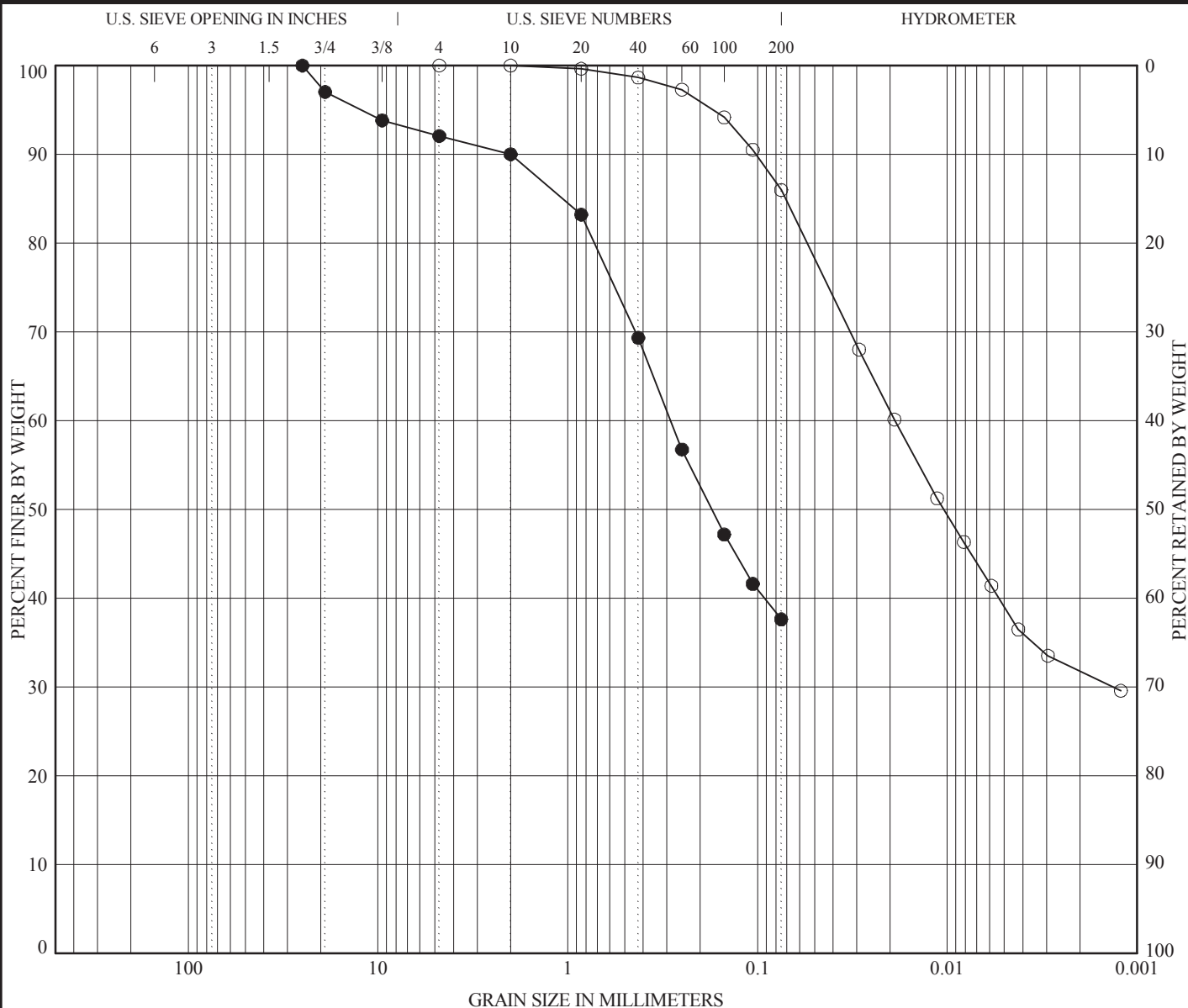
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.3.4.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-406	93.0	LEAN CLAY (CL)	49	14	35	--	--
●	G-406	100.5	SILTY SAND (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-406	93.0	4.75	0.019	0.001	--	0.0	14.0	86.0
●	G-406	100.5	25.00	0.287	--	--	7.9	54.4	37.6

Laboratory Test Method: ASTM D 422

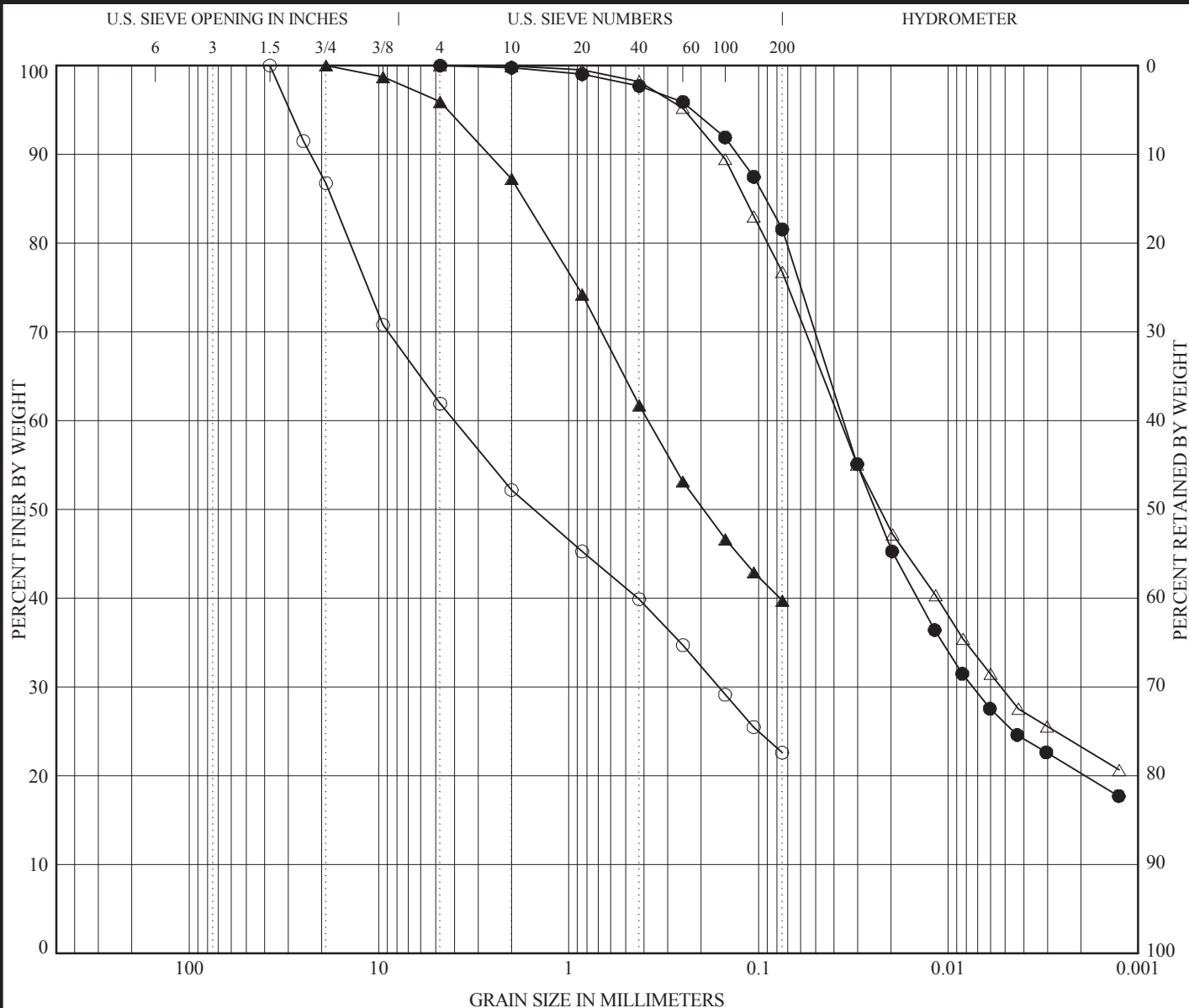
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.3.4.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-407	35.5	SILTY SAND WITH GRAVEL (SM)	--	--	--	--	--
●	G-407	47.5	LEAN CLAY WITH SAND (CL)	35	16	19	--	--
△	G-407	53.5	LEAN CLAY WITH SAND (CL)	38	15	23	--	--
▲	G-407	62.5	CLAYEY SAND (SC)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-407	35.5	37.50	4.007	0.162	--	38.1	39.3	22.6
●	G-407	47.5	4.75	0.036	0.007	--	0.0	18.5	81.5
△	G-407	53.5	4.75	0.037	0.005	--	0.0	23.3	76.7
▲	G-407	62.5	19.00	0.382	--	--	4.1	56.2	39.7

Laboratory Test Method: ASTM D 422

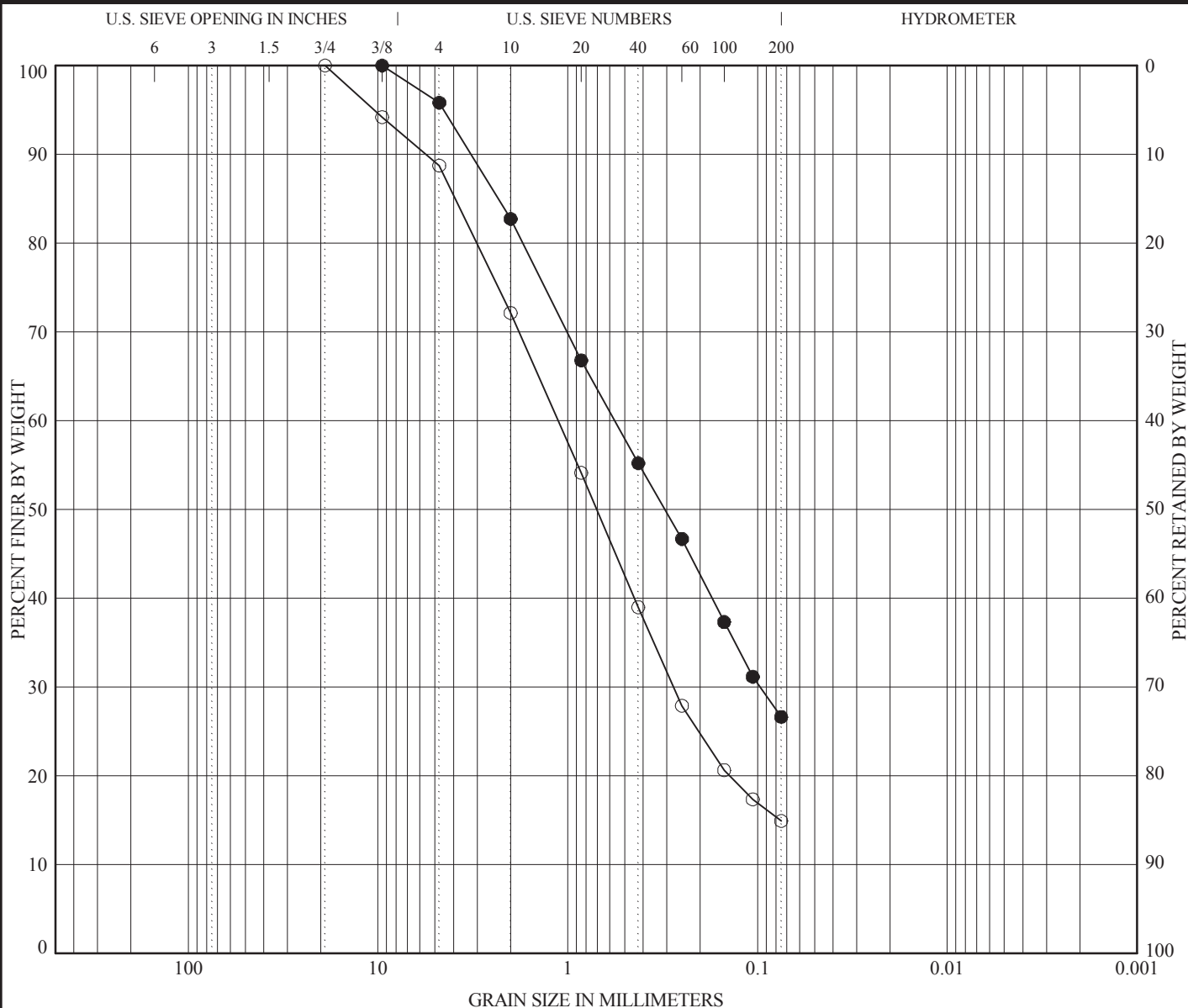
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
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 Figure: D-5.3.5.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-407	74.5	SILTY SAND (SM)	--	--	--	--	--
●	G-407	80.5	CLAYEY SAND with GRAVEL (SC)	--	--	--	--	--

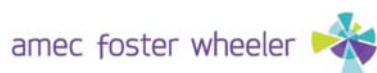
SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-407	74.5	19.00	1.124	0.277	--	11.3	73.8	14.9
●	G-407	80.5	9.50	0.566	0.097	--	4.2	69.2	26.6

Laboratory Test Method: ASTM D 422

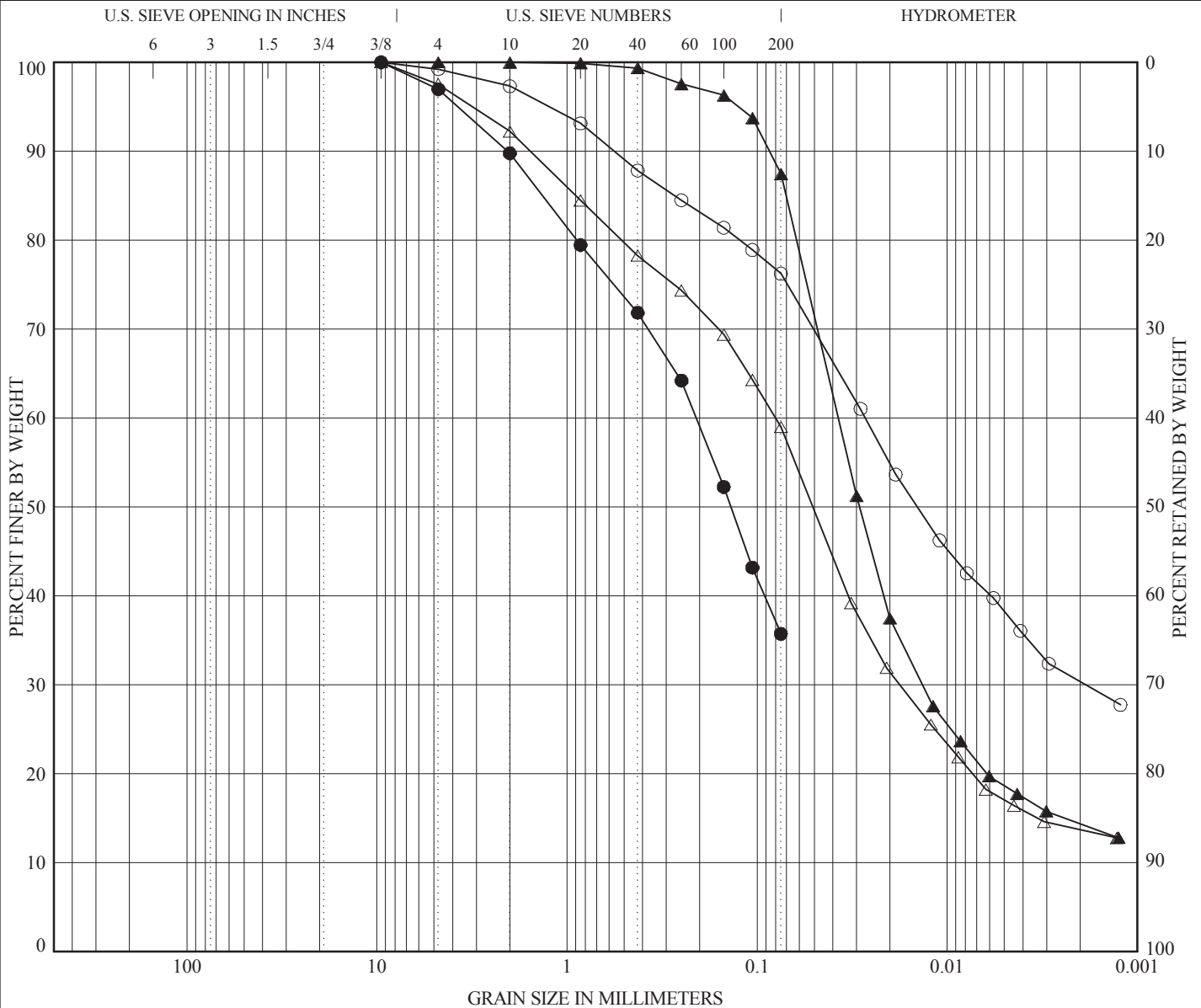
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.3.5.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-408/P-306	15.5	LEAN CLAY WITH SAND (CL)	47	15	32	--	--
●	G-408/P-306	40.5	SILTY SAND (SM)	--	--	--	--	--
△	G-408/P-306	45.5	SANDY LEAN CLAY (CL)	--	--	--	--	--
▲	G-408/P-306	55.5	SILT (ML)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-408/P-306	15.5	9.50	0.027	0.002	--	0.8	23.0	76.2
●	G-408/P-306	40.5	9.50	0.209	--	--	3.0	61.2	35.7
△	G-408/P-306	45.5	9.50	0.080	0.018	--	2.5	38.6	59.0
▲	G-408/P-306	55.5	4.75	0.038	0.014	--	0.0	12.6	87.4

Laboratory Test Method: ASTM D 422

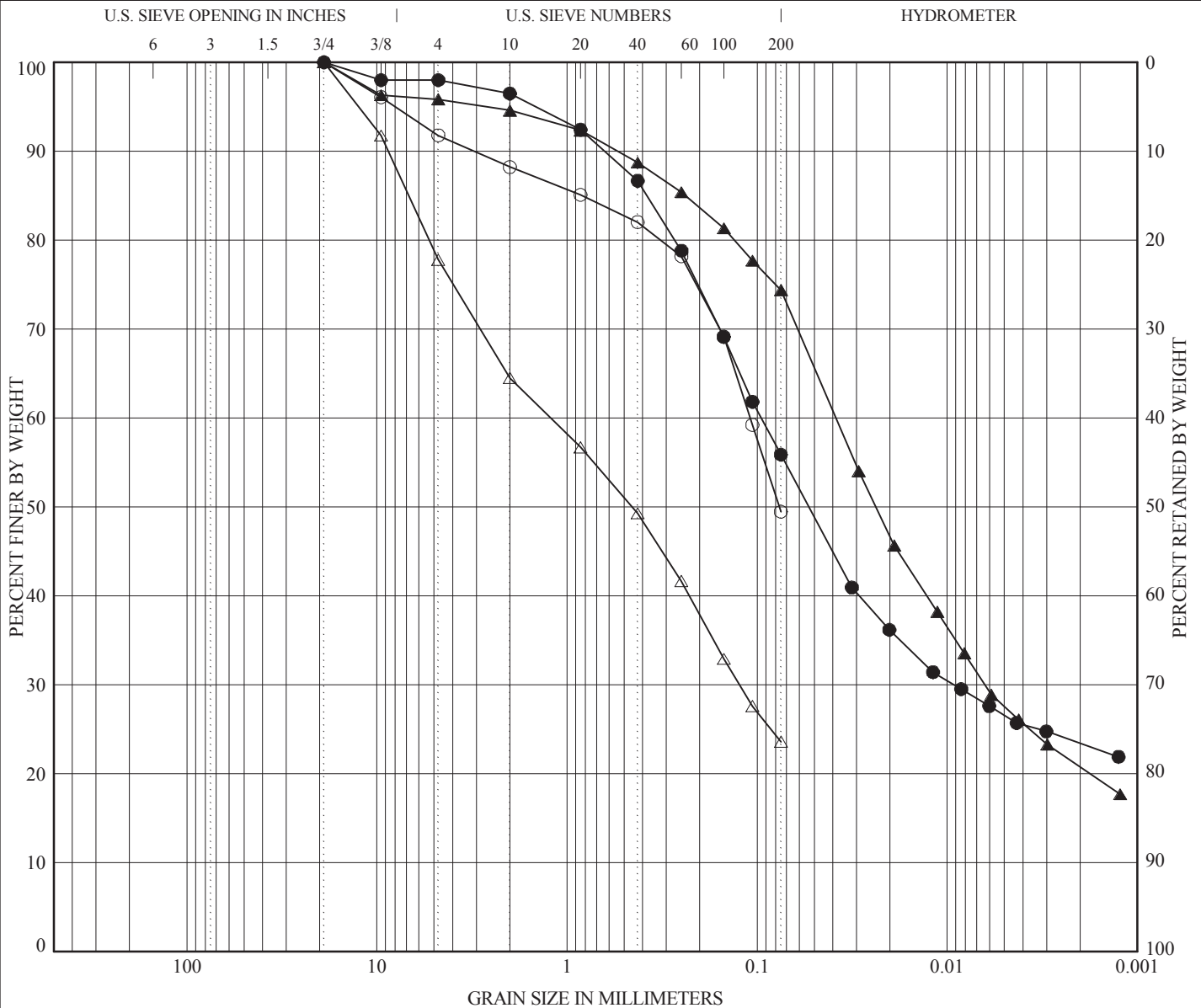
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.6.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-408/P-306	60.5	SILTY SAND (SM)	--	--	--	--	--
●	G-408/P-306	75.5	SANDY LEAN CLAY (CL)	34	13	21	--	--
△	G-408/P-306	105.5	SILTY SAND WITH GRAVEL (SM)	--	--	--	--	--
▲	G-408/P-306	110.5	LEAN CLAY WITH SAND (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-408/P-306	60.5	19.00	0.109	--	--	8.2	42.3	49.5
●	G-408/P-306	75.5	19.00	0.095	0.009	--	2.0	42.1	55.9
△	G-408/P-306	105.5	19.00	1.219	0.124	--	22.2	54.2	23.6
▲	G-408/P-306	110.5	19.00	0.039	0.006	--	4.2	21.4	74.4

Laboratory Test Method: ASTM D 422

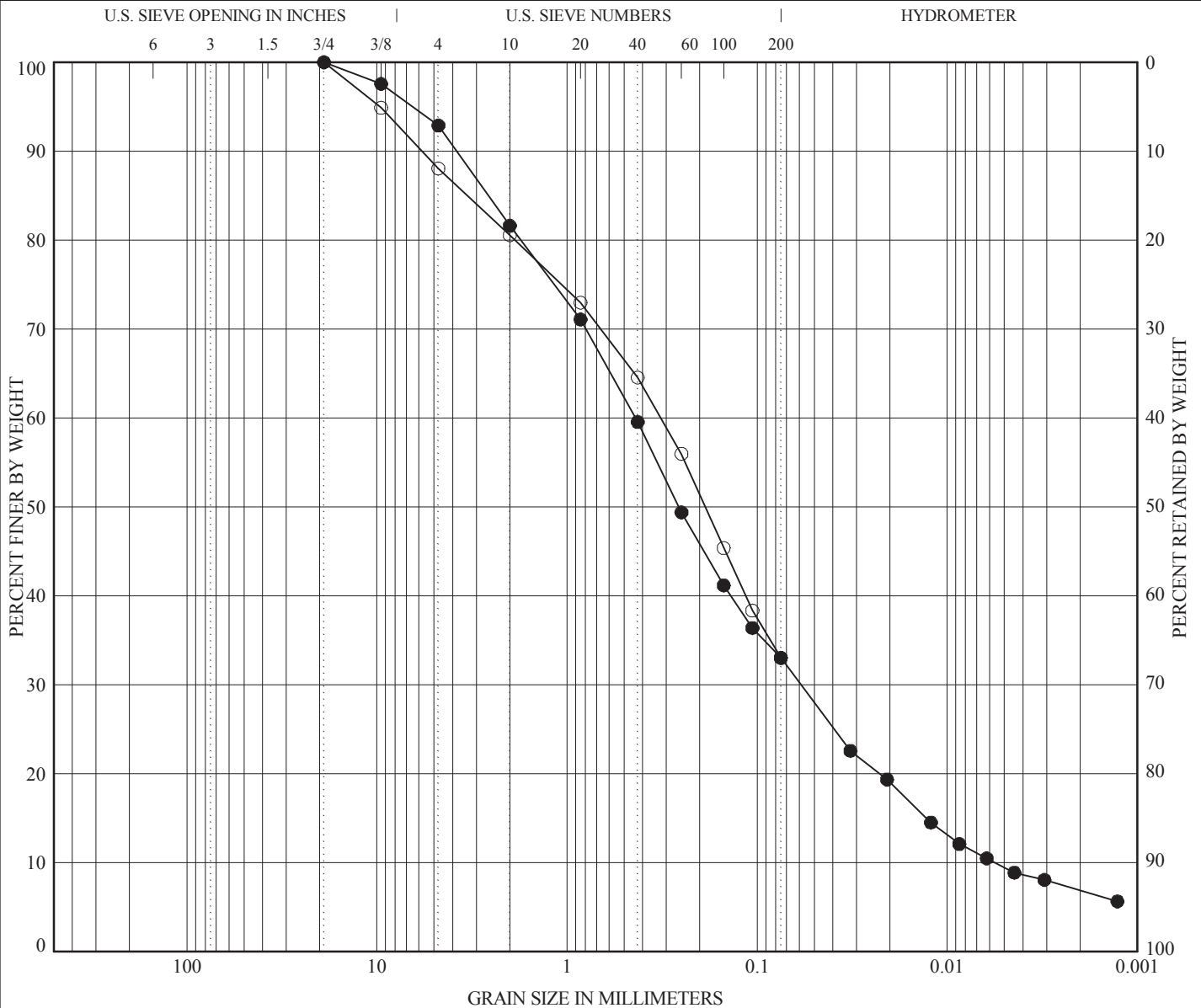
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.6.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-408/P-306	120.5	SILTY SAND (SM)	--	--	--	--	--
●	G-408/P-306	140.5	SILTY SAND (SM)	--	--	--	1.4	77.8

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-408/P-306	120.5	19.00	0.321	--	--	11.9	55.0	33.0
●	G-408/P-306	140.5	19.00	0.437	0.059	0.006	7.1	59.9	33.0

Laboratory Test Method: ASTM D 422

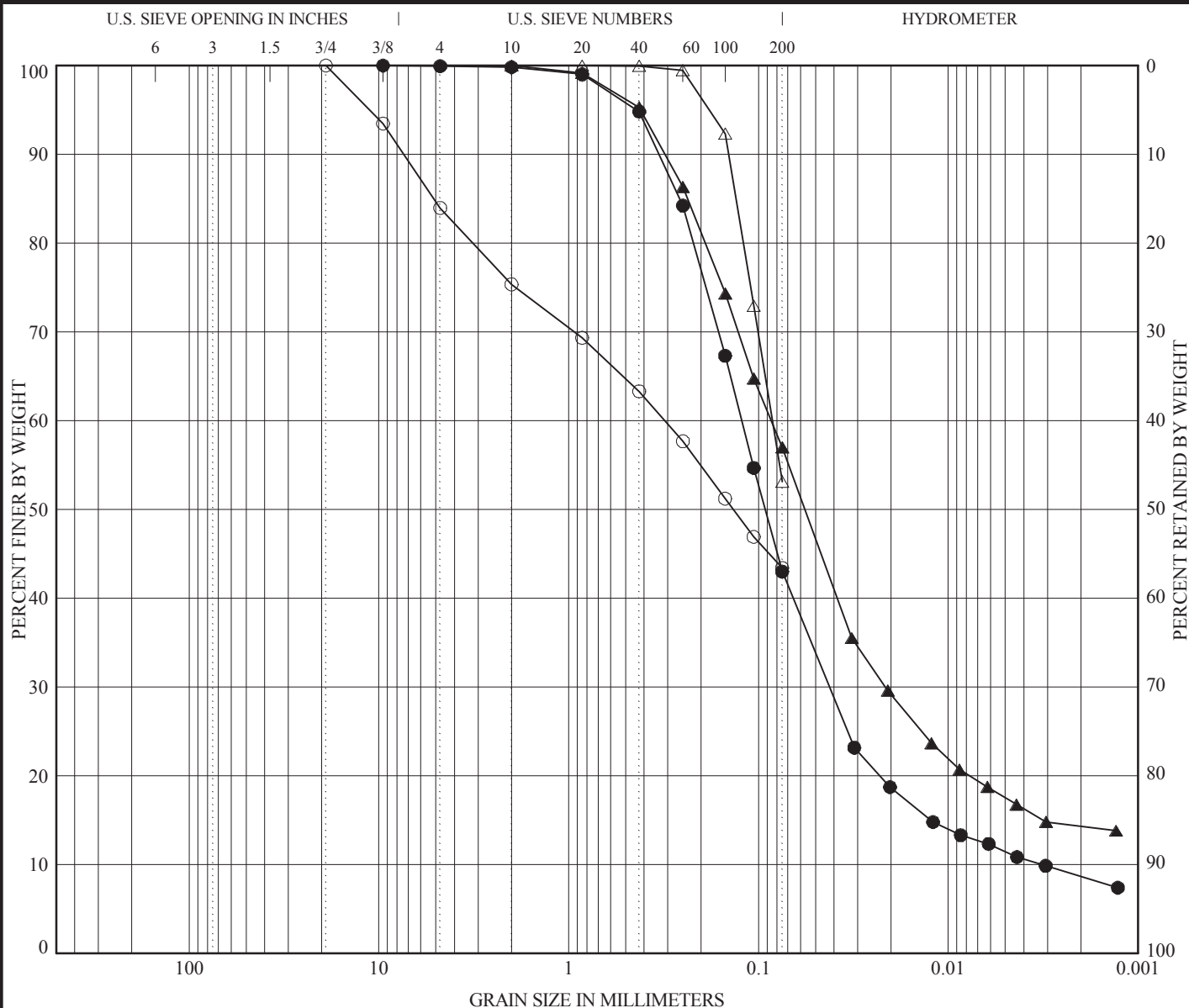
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.6.c



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-409	90.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--
●	G-409	105.5	SILTY SAND (SM)	NP	NP	NP	4.5	38.0
△	G-409	117.5	SILTY SAND (SM)	--	--	--	--	--
▲	G-409	120.5	SANDY LEAN CLAY (CL)	28	15	13	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-409	90.5	19.00	0.311	--	--	16.0	40.6	43.4
●	G-409	105.5	9.50	0.123	0.042	0.003	0.1	56.9	43.0
△	G-409	117.5	0.85	0.085	--	--	0.0	46.9	53.1
▲	G-409	120.5	2.00	0.086	0.021	--	0.0	43.0	57.0

Laboratory Test Method: ASTM D 422

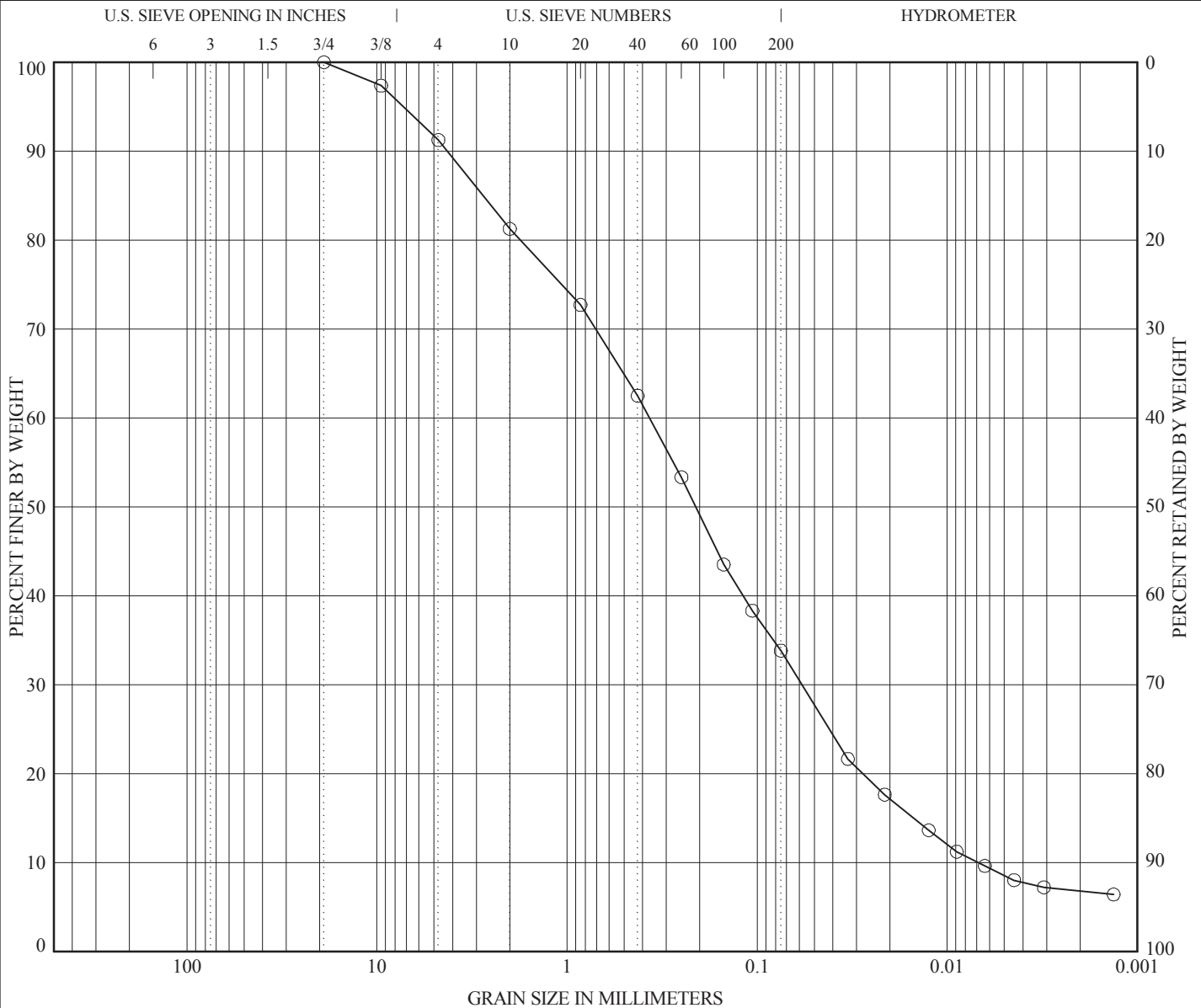
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.7.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-409	130.5	CLAYEY SAND (SC)	28	16	12	1.3	53.5

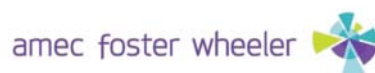
SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-409	130.5	19.00	0.368	0.058	0.007	8.7	57.4	33.8

Laboratory Test Method: ASTM D 422

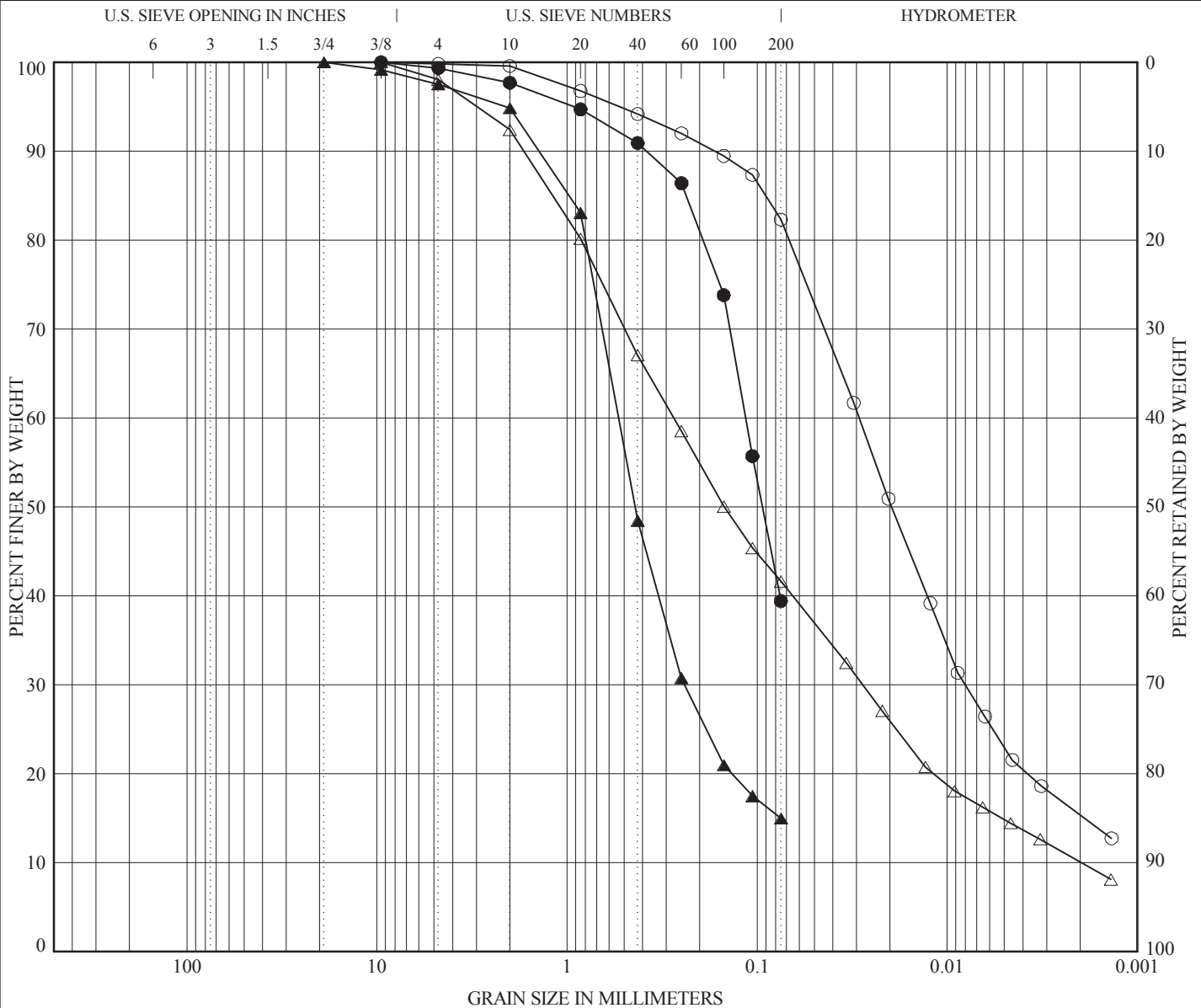
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.7.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-410/M-406	110.5	LEAN CLAY with SAND (CL)	39	19	20	--	--
●	G-410/M-406	113.5		--	--	--	--	--
△	G-410/M-406	116.5		--	--	--	1.4	139.1
▲	G-410/M-406	123.5		--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-410/M-406	110.5	9.50	0.029	0.008	--	0.2	17.5	82.3
●	G-410/M-406	113.5	9.50	0.115	--	--	0.7	59.9	39.4
△	G-410/M-406	116.5	9.50	0.274	0.028	0.002	2.0	56.4	41.6
▲	G-410/M-406	123.5	19.00	0.536	0.240	--	2.5	82.6	15.0

Laboratory Test Method: ASTM D 422

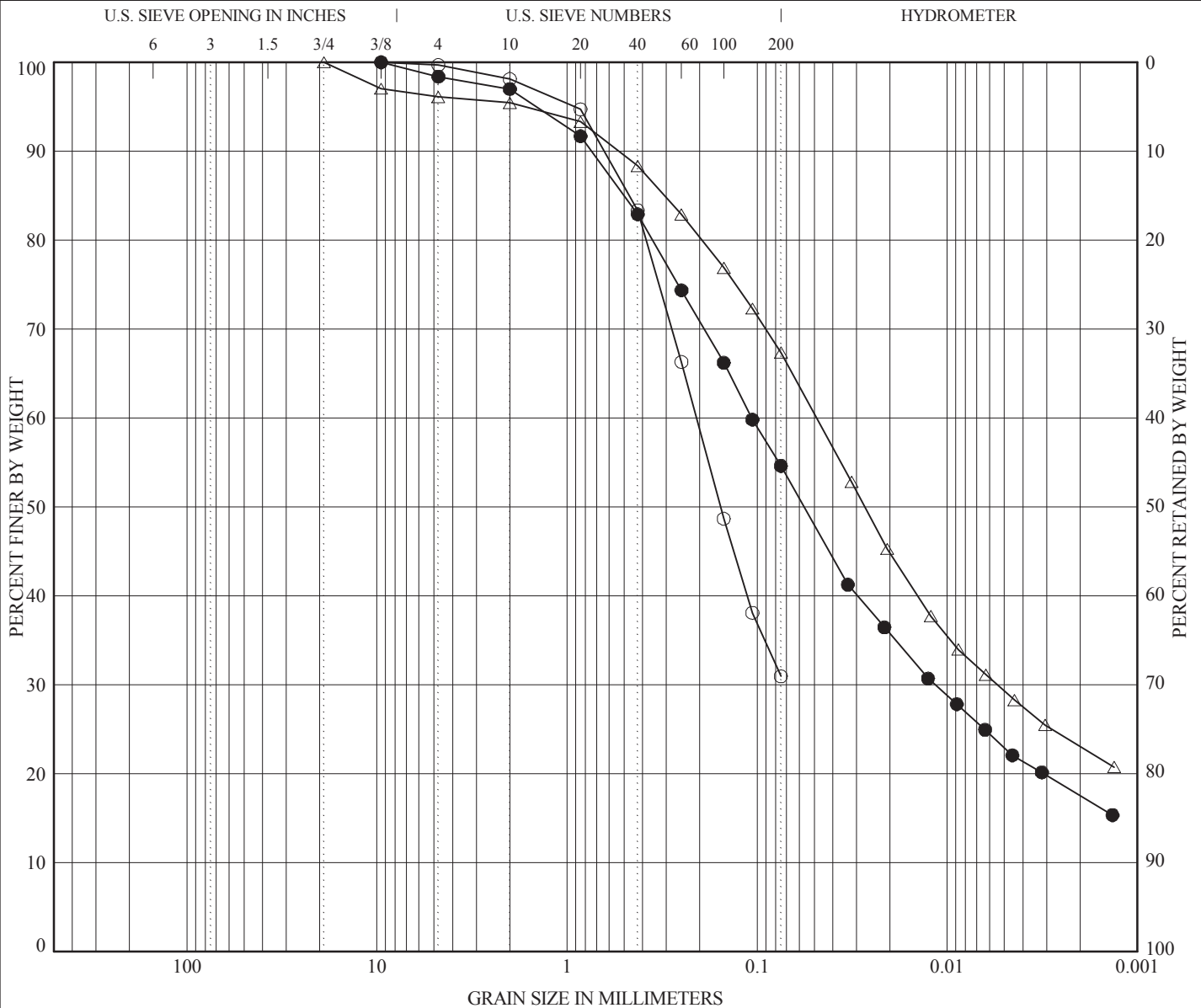
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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.8.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-410/M-406	130.5		--	--	--	--	--
●	G-410/M-406	139.5	SANDY LEAN CLAY (CL)	35	14	21	--	--
△	G-410/M-406	149.5	SANDY LEAN CLAY (CL)	45	15	30	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-410/M-406	130.5	9.50	0.208	--	--	0.3	68.7	30.9
●	G-410/M-406	139.5	9.50	0.107	0.012	--	1.6	43.8	54.6
△	G-410/M-406	149.5	19.00	0.049	0.005	--	3.9	28.7	67.4

Laboratory Test Method: ASTM D 422

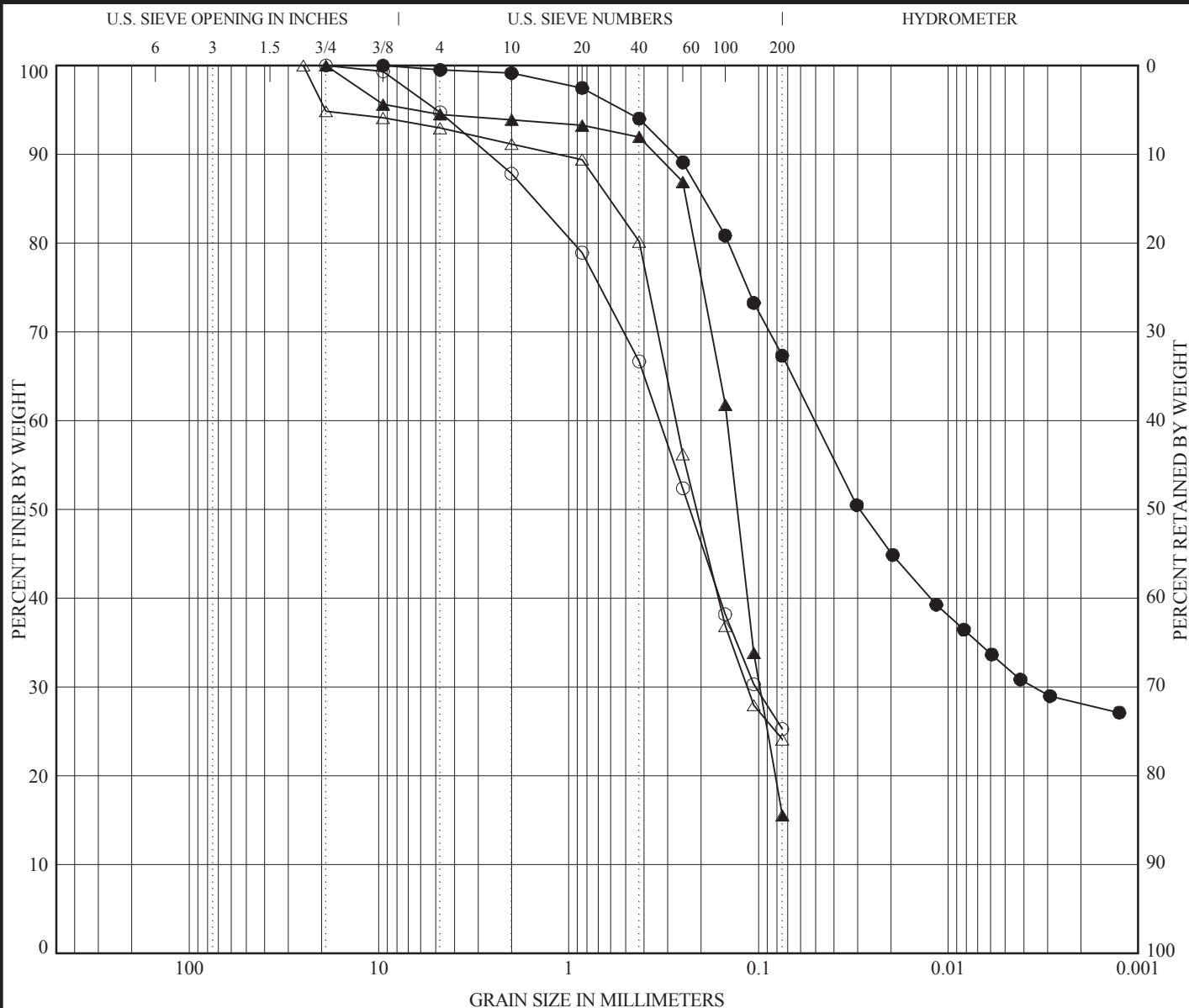
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

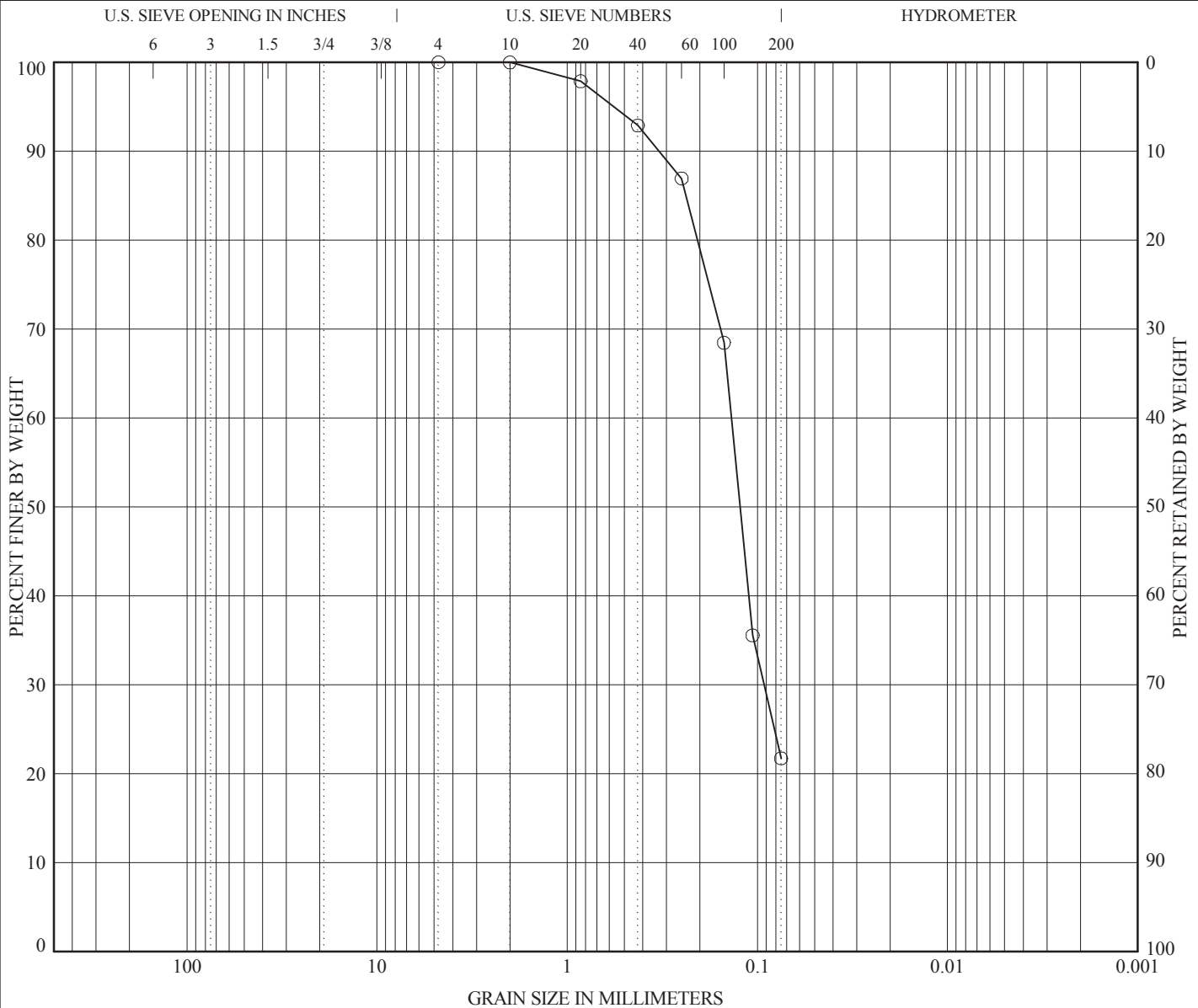
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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.3.8.b



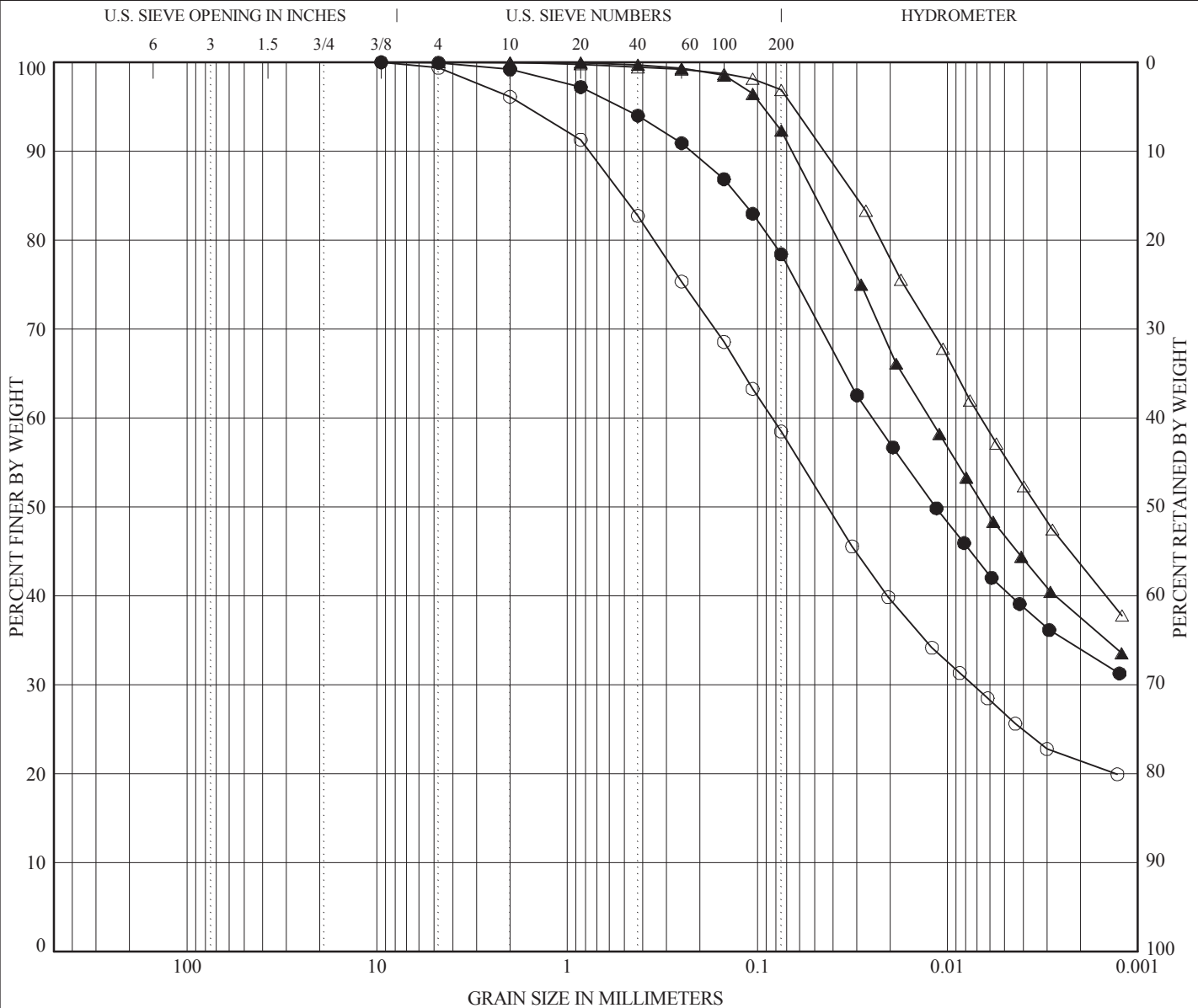


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-411	109.5		--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-411	109.5	4.75	0.137	0.092	--	0.0	78.3	21.7

Laboratory Test Method: ASTM D 422
 *As determined by ASTM D 4318; see attached Atterberg Limits Test Results.
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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-412/M-407/E-132A	10.5	SANDY LEAN CLAY (CL)	--	--	--	--	--
●	G-412/M-407/E-132A	15.5	SANDY LEAN CLAY (CL)	43	12	31	--	--
△	G-412/M-407/E-132A	25.5	FAT CLAY (CH)	71	18	53	--	--
▲	G-412/M-407/E-132A	43.0	FAT CLAY (CH)	60	17	43	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-412/M-407/E-132A	10.5	9.50	0.084	0.007	--	0.6	40.9	58.5
●	G-412/M-407/E-132A	15.5	9.50	0.025	--	--	0.1	21.5	78.4
△	G-412/M-407/E-132A	25.5	2.00	0.007	--	--	0.0	3.1	96.9
▲	G-412/M-407/E-132A	43.0	4.75	0.012	--	--	0.0	7.7	92.3

Laboratory Test Method: ASTM D 422

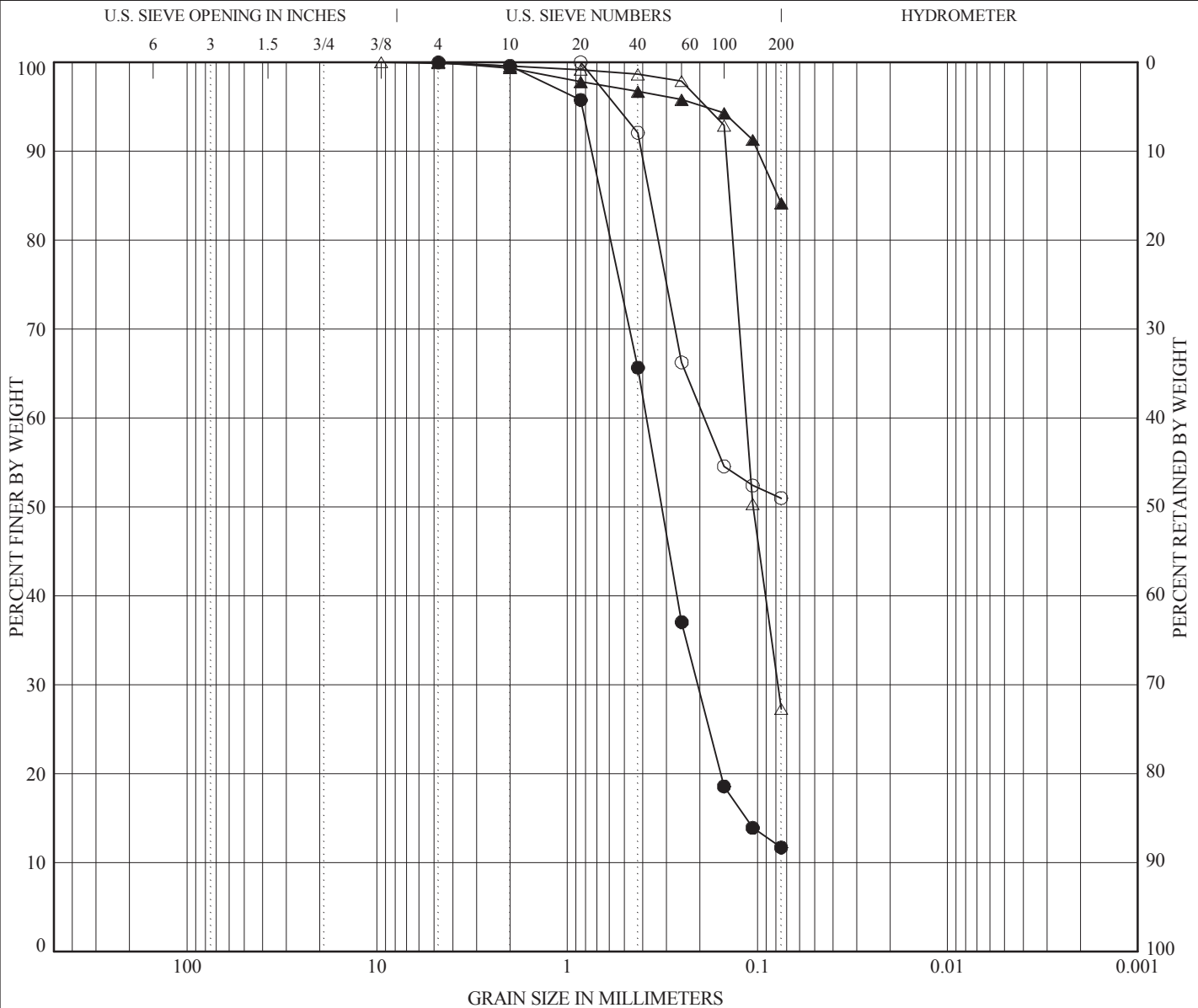
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PARTICLE SIZE DISTRIBUTION
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Figure: D-5.3.10.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-412/M-407/E-132A	48.0	SANDY LEAN CLAY (CL)	34	8	26	--	--
●	G-412/M-407/E-132A	58.0	WELL GRADED SAND with SILT (SW-SM)	--	--	--	1.9	6.7
△	G-412/M-407/E-132A	68.0	SILTY SAND (SM)	--	--	--	--	--
▲	G-412/M-407/E-132A	75.5	SILT with SAND (ML)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-412/M-407/E-132A	48.0	0.85	0.190	--	--	0.0	49.0	51.0
●	G-412/M-407/E-132A	58.0	4.75	0.383	0.206	--	0.0	88.3	11.7
△	G-412/M-407/E-132A	68.0	9.50	0.115	0.078	--	0.1	72.6	27.3
▲	G-412/M-407/E-132A	75.5	4.75	--	--	--	0.0	15.9	84.1

Laboratory Test Method: ASTM D 422

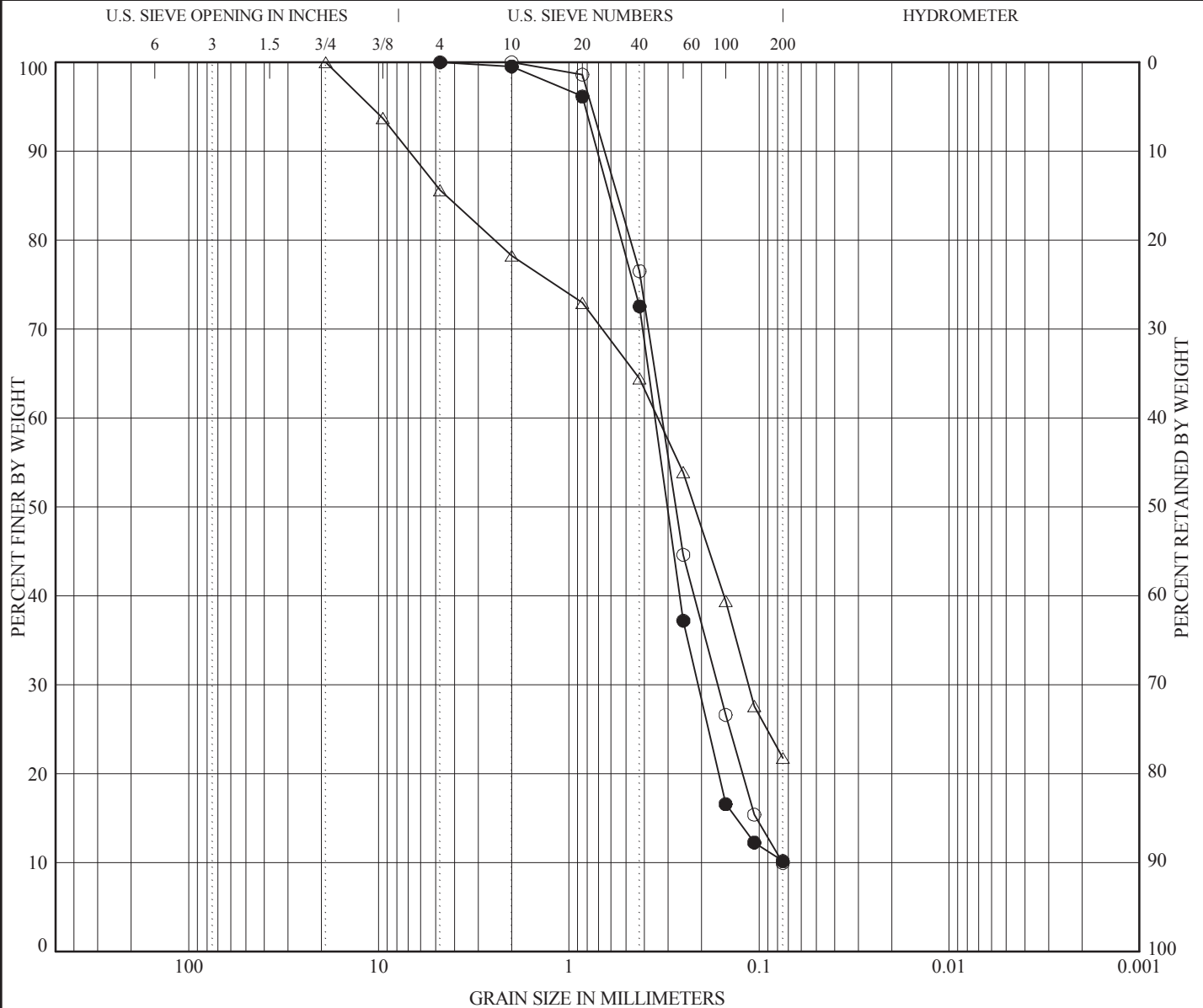
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.10.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	G-412/M-407/E-132A	83.0	POORLY GRADED SAND with SILT (SP-SM)	--	--	--	1.1	4.3
●	G-412/M-407/E-132A	90.5	POORLY GRADED SAND with SILT (SP-SM)	--	--	--	1.7	4.8
△	G-412/M-407/E-132A	95.0	SILTY SAND (SM)	--	--	--	--	--

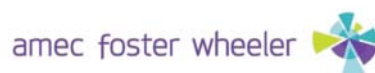
SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	G-412/M-407/E-132A	83.0	2.00	0.323	0.165	0.075	0.0	90.1	9.9
●	G-412/M-407/E-132A	90.5	4.75	0.352	0.209	--	0.0	89.8	10.2
△	G-412/M-407/E-132A	95.0	19.00	0.340	0.114	--	14.4	63.9	21.8

Laboratory Test Method: ASTM D 422

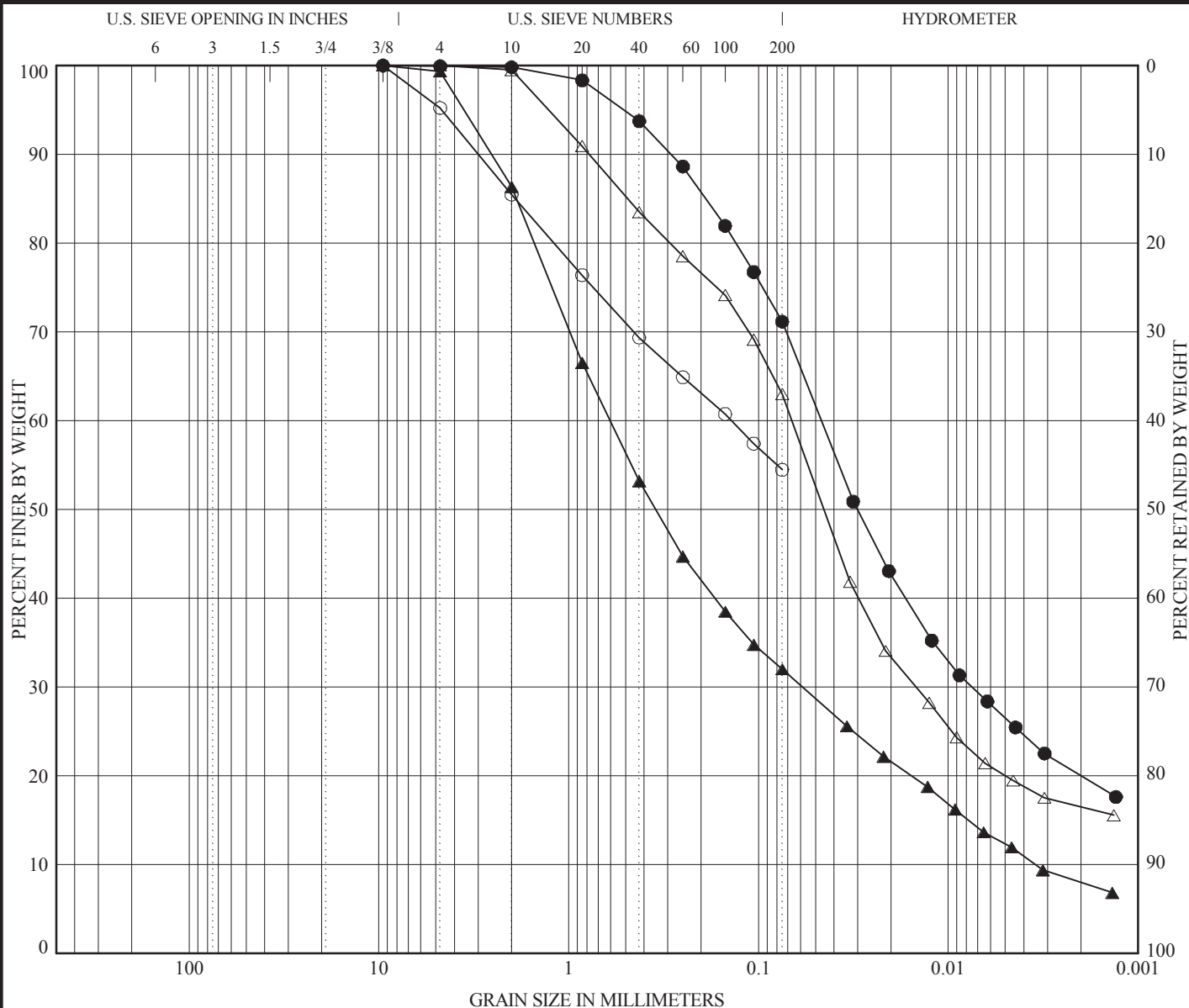
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.10.c



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	M-402	70.5	SANDY LEAN CLAY (CH)	--	--	--	--	--
●	M-402	79.5	LEAN CLAY with SAND (CL)	32	12	20	--	--
△	M-402	85.5	SANDY LEAN CLAY (CL)	32	15	17	--	--
▲	M-402	97.5	CLAYEY SAND (SC)	38	16	22	1.6	173.6

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	M-402	70.5	9.50	0.139	--	--	4.8	40.8	54.5
●	M-402	79.5	9.50	0.047	0.008	--	0.1	28.8	71.2
△	M-402	85.5	4.75	0.067	0.015	--	0.0	37.0	63.0
▲	M-402	97.5	9.50	0.605	0.059	0.003	0.7	67.3	32.0

Laboratory Test Method: ASTM D 422

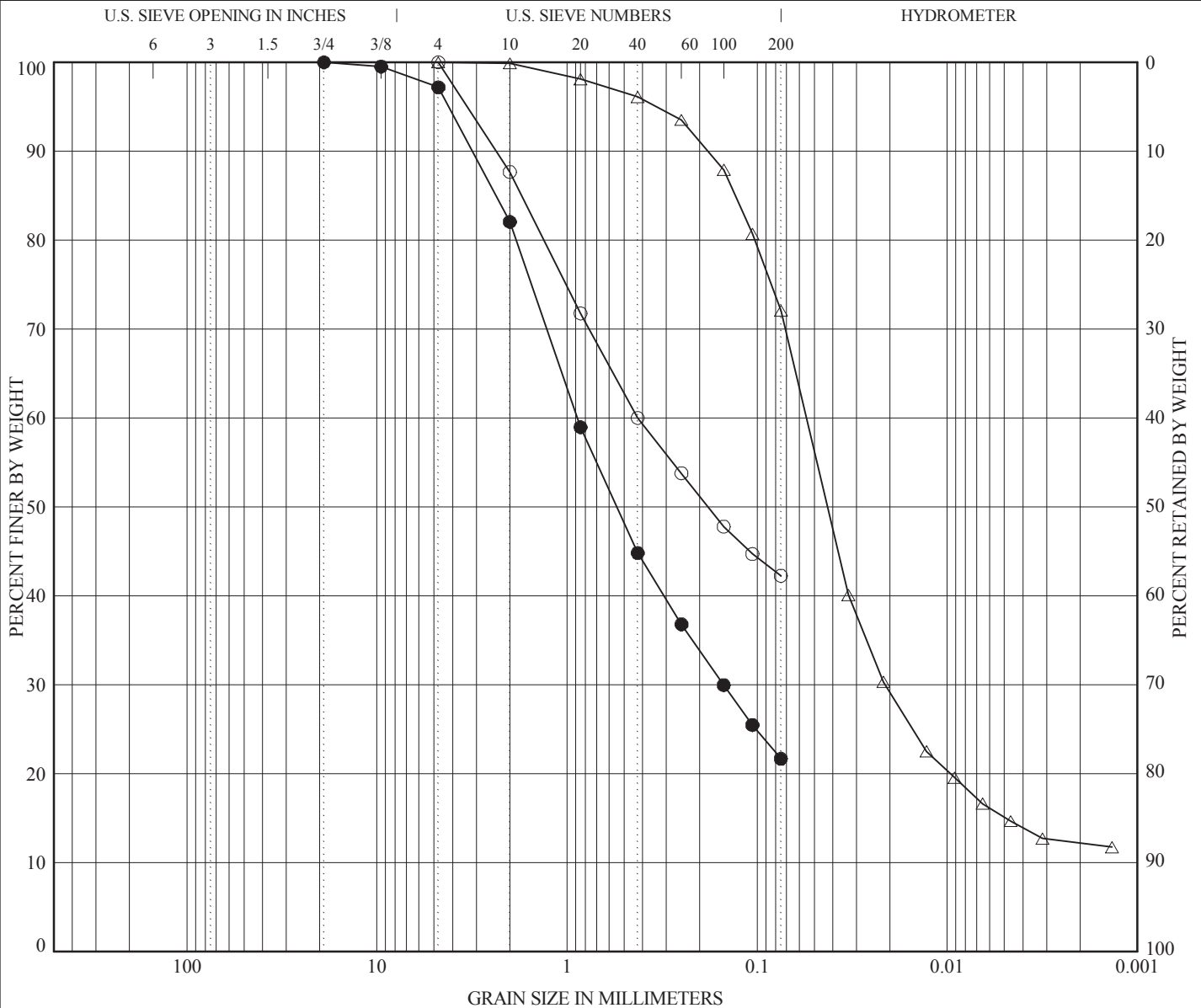
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
 Project No.: 4953-11-1423
 Figure: D-5.3.11.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	M-402	100.5	CLAYEY SAND (SC)	--	--	--	--	--
●	M-402	109.5	SILTY SAND (SM)	--	--	--	--	--
△	M-402	114.5	LEAN CLAY with SAND (CL)	31	20	11	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	M-402	100.5	4.75	0.425	--	--	0.0	57.7	42.3
●	M-402	109.5	19.00	0.883	0.150	--	2.8	75.5	21.7
△	M-402	114.5	4.75	0.055	0.021	--	0.0	27.9	72.1

Laboratory Test Method: ASTM D 422

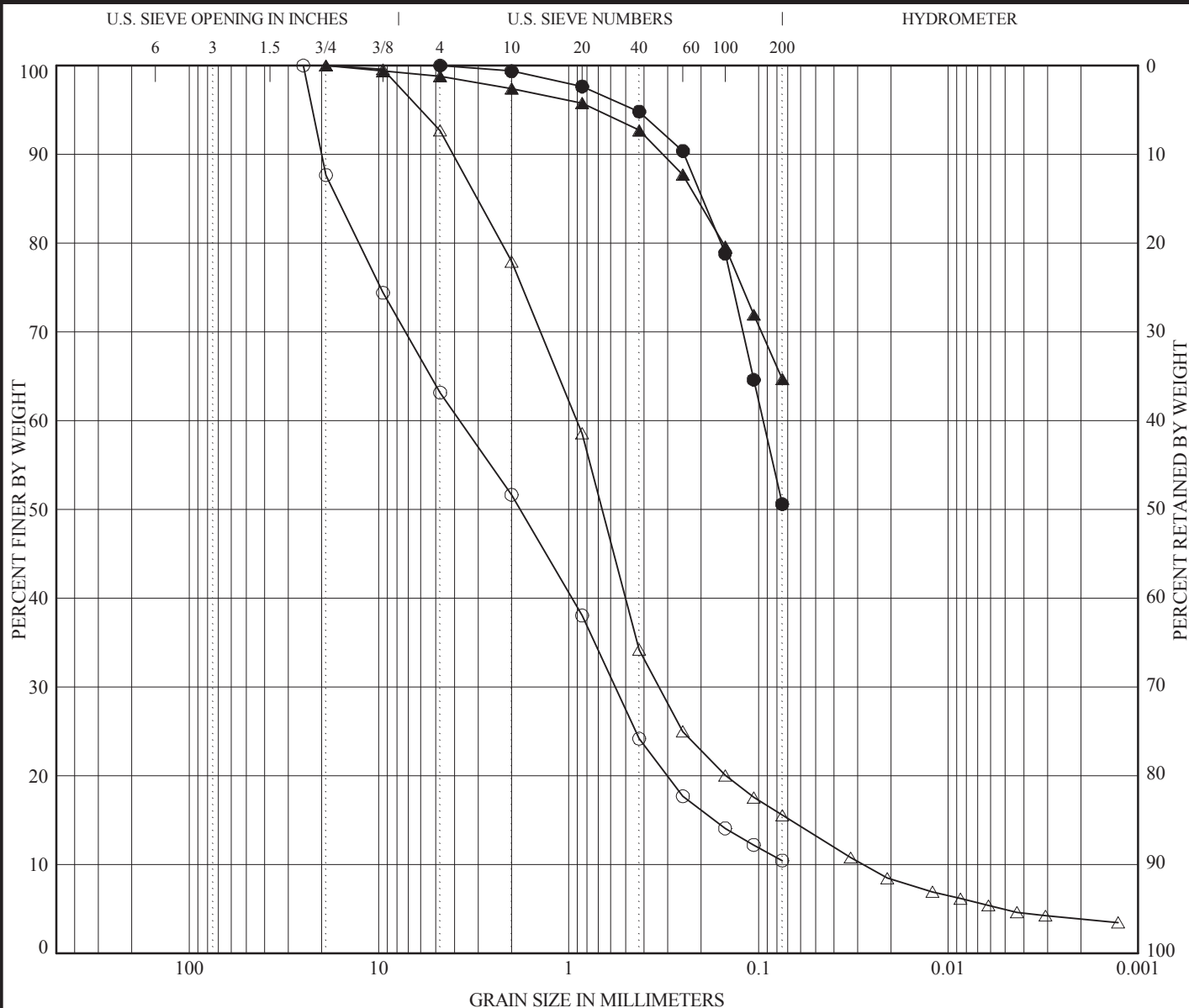
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.11.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	OB-307	30.5	POORLY GRADED SAND WITH SILT (SP-SM)	--	--	--	1.3	54.6
●	OB-307	42.5	SANDY SILT (ML)	--	--	--	--	--
△	OB-307	48.5	POORLY GRADED SAND WITH SILT (SP-SM)	--	--	--	4.4	32.3
▲	OB-307	63.5	LEAN CLAY WITH SAND (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	OB-307	30.5	25.00	3.746	0.569	--	36.8	52.7	10.5
●	OB-307	42.5	4.75	0.095	--	--	0.0	49.4	50.6
△	OB-307	48.5	19.00	0.905	0.334	0.028	7.3	77.1	15.6
▲	OB-307	63.5	19.00	--	--	--	1.2	34.1	64.7

Laboratory Test Method: ASTM D 422

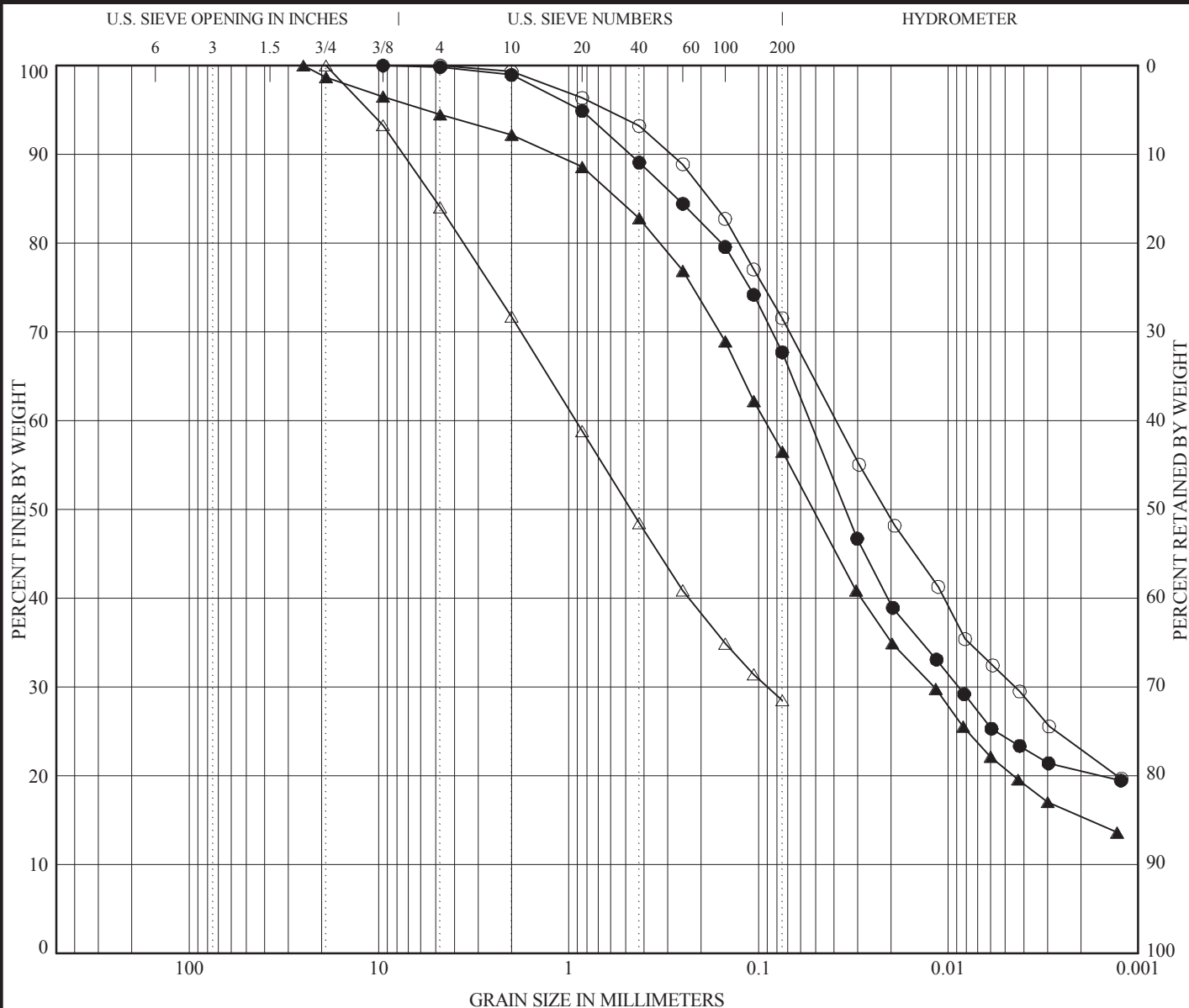
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.12.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	OB-307	66.5	LEAN CLAY WITH SAND (CL)	--	--	--	--	--
●	OB-307	87.5	SANDY FAT CLAY (CH)	--	--	--	--	--
△	OB-307	93.5	CLAYEY SAND WITH GRAVEL (SC)	--	--	--	--	--
▲	OB-307	111.5	SANDY LEAN CLAY (CL)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	OB-307	66.5	4.75	0.039	0.004	--	0.0	28.5	71.5
●	OB-307	87.5	9.50	0.054	0.009	--	0.2	32.1	67.7
△	OB-307	93.5	19.00	0.918	0.090	--	16.0	55.6	28.5
▲	OB-307	111.5	25.00	0.093	0.012	--	5.5	38.0	56.5

Laboratory Test Method: ASTM D 422

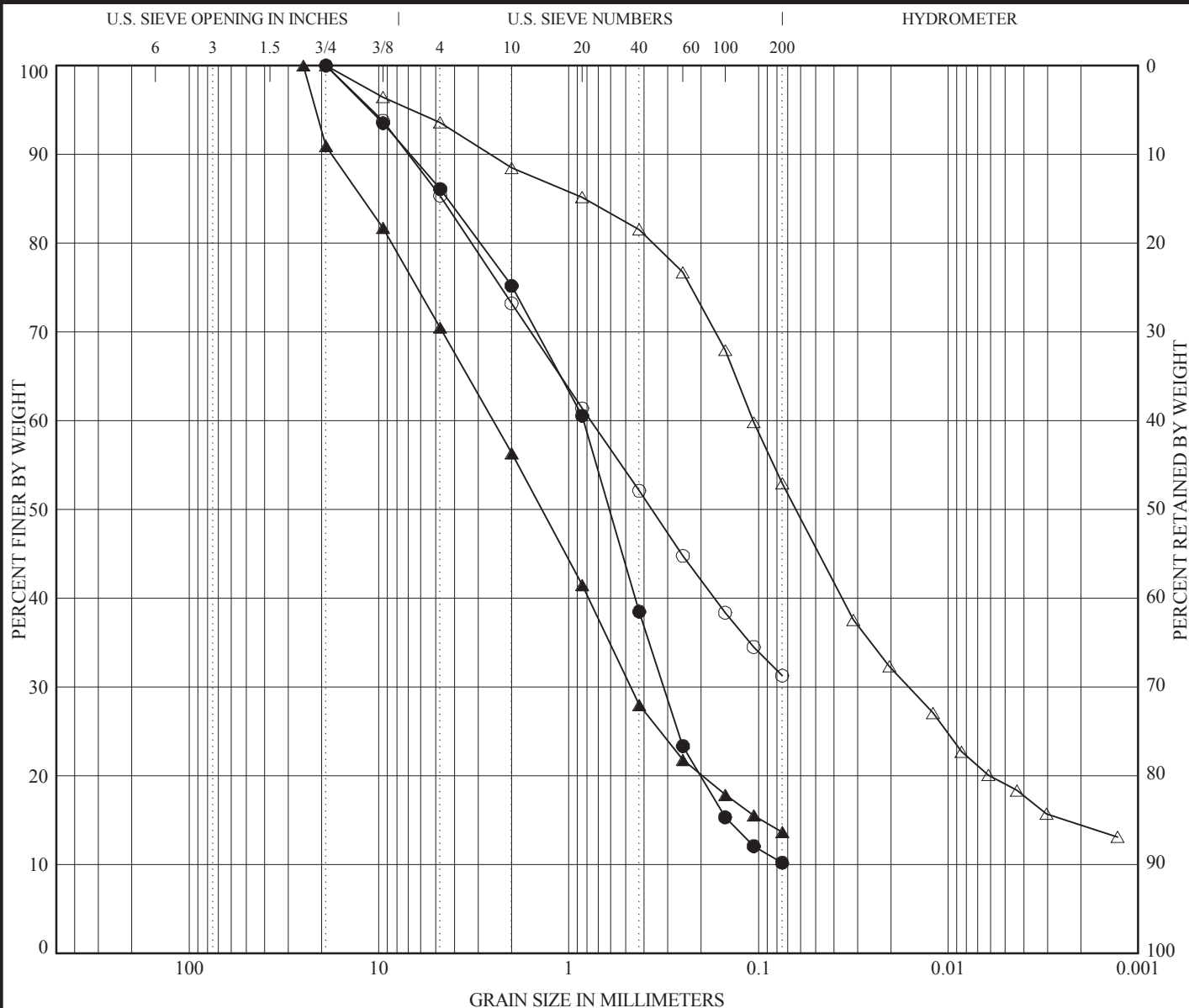
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.12.b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	OB-308	25.5	CLAYEY SAND with GRAVEL (SC)	--	--	--	--	--
●	OB-308	40.5	WELL GRADED SAND with SILT (SW-SM)	--	--	--	1.7	11.6
△	OB-308	65.5	SANDY LEAN CLAY (CL)	32	14	18	--	--
▲	OB-308	90.5	SILTY SAND with GRAVEL (SM)	--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	OB-308	25.5	19.00	0.767	--	--	14.7	54.1	31.3
●	OB-308	40.5	19.00	0.835	0.316	--	13.9	75.9	10.2
△	OB-308	65.5	19.00	0.107	0.016	--	6.4	40.7	52.9
▲	OB-308	90.5	25.00	2.500	0.472	--	29.5	56.8	13.6

Laboratory Test Method: ASTM D 422

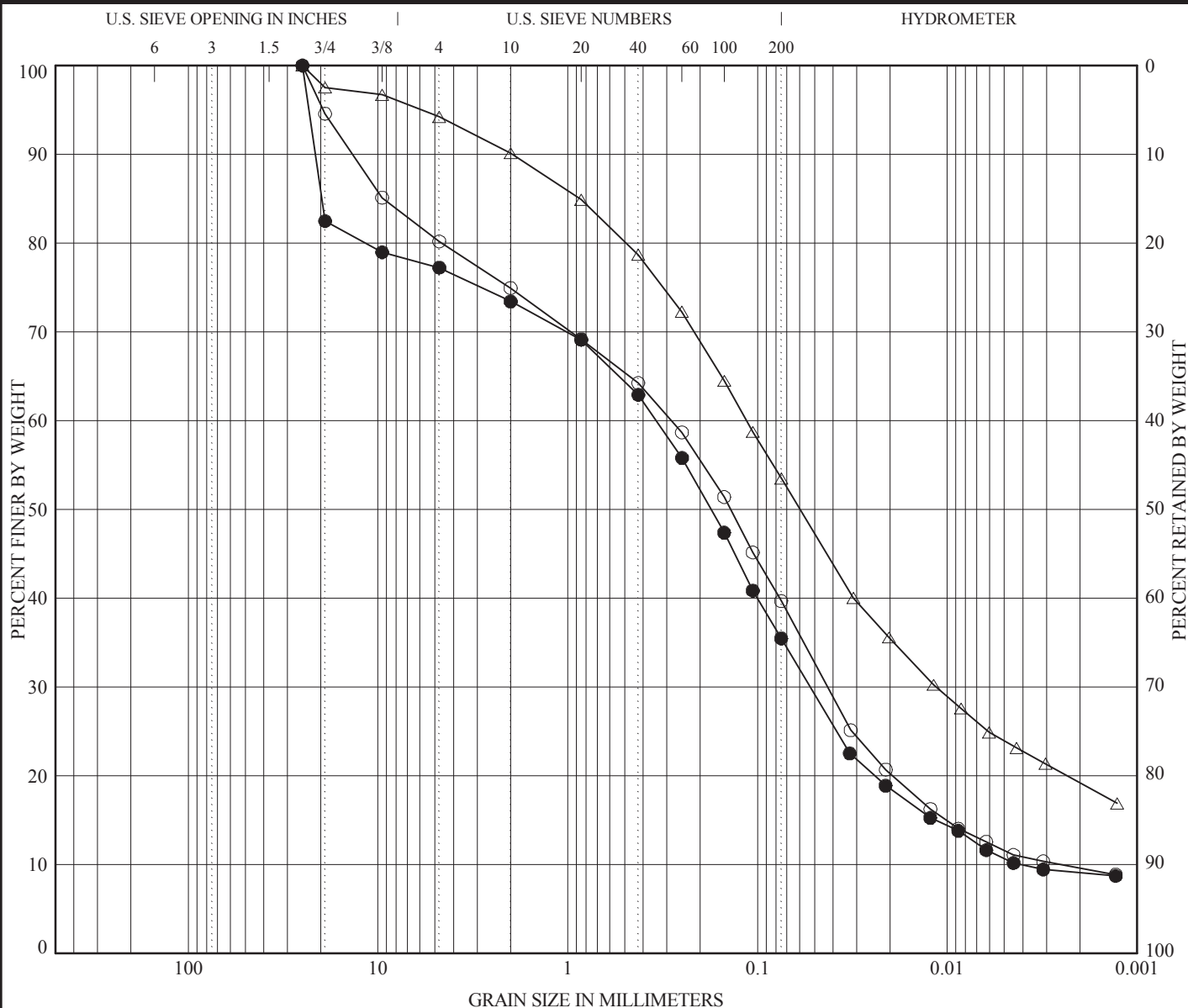
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.13.a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

SYMBOL	BORING	DEPTH (ft)	CLASSIFICATION	LL (%)*	PL (%)*	PI (%)*	C _c	C _u
○	OB-308	95.5	CLAYEY SAND with GRAVEL (SC)	--	--	--	2.5	111.5
●	OB-308	105.5	CLAYEY SAND with GRAVEL (SC)	26	16	10	2.0	83.2
△	OB-308	120.5		--	--	--	--	--

SYMBOL	BORING	DEPTH (ft)	D ₁₀₀ (mm)	D ₆₀ (mm)	D ₃₀ (mm)	D ₁₀ (mm)	% Gravel	% Sand	% Silt or % Clay
○	OB-308	95.5	25.00	0.284	0.043	0.003	19.8	40.5	39.7
●	OB-308	105.5	25.00	0.342	0.053	0.004	22.8	41.8	35.5
△	OB-308	120.5	25.00	0.114	0.011	--	5.8	40.7	53.5

Laboratory Test Method: ASTM D 422

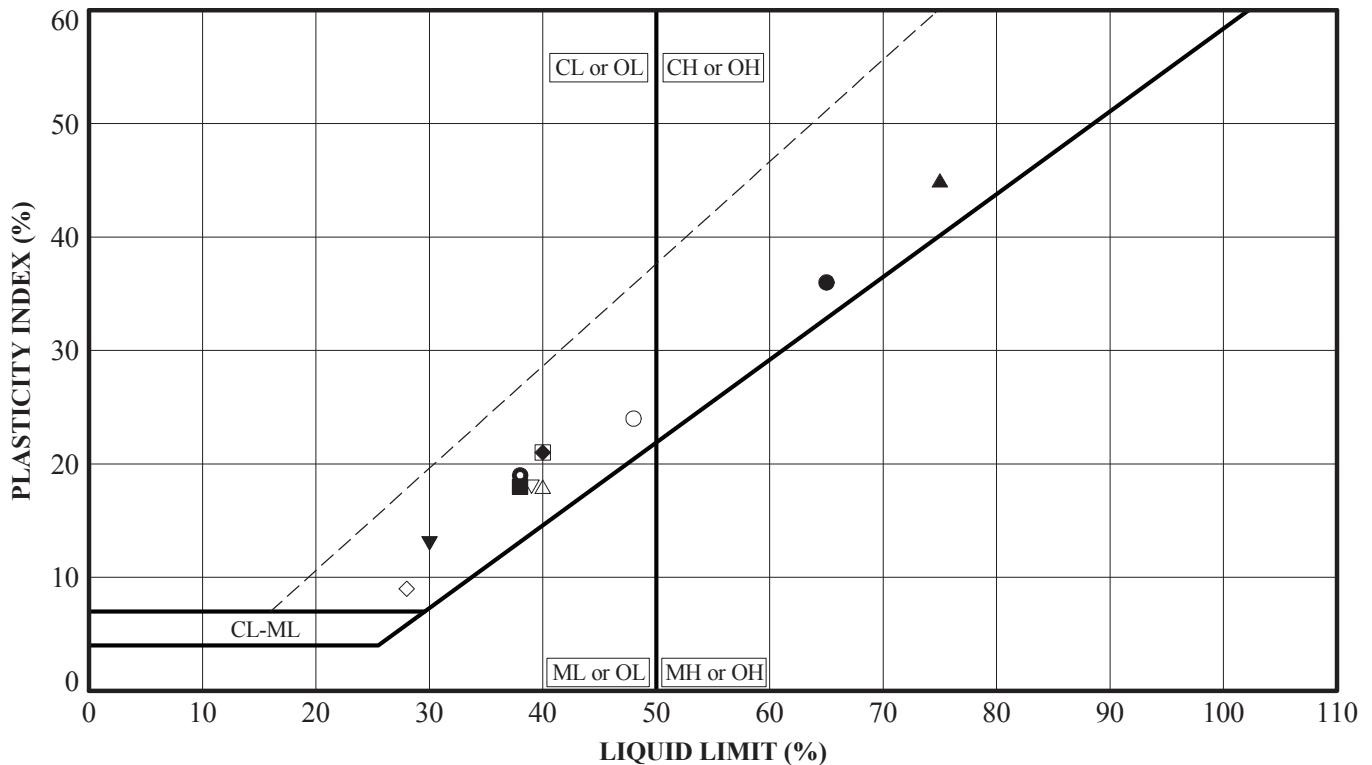
*As determined by ASTM D 4318; see attached Atterberg Limits Test Results.

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Checked/Date: FW/HP 12/17/2015

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PARTICLE SIZE DISTRIBUTION
Project No.: 4953-11-1423
Figure: D-5.3.13.b

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Laboratory Test Method: ASTM D 4318

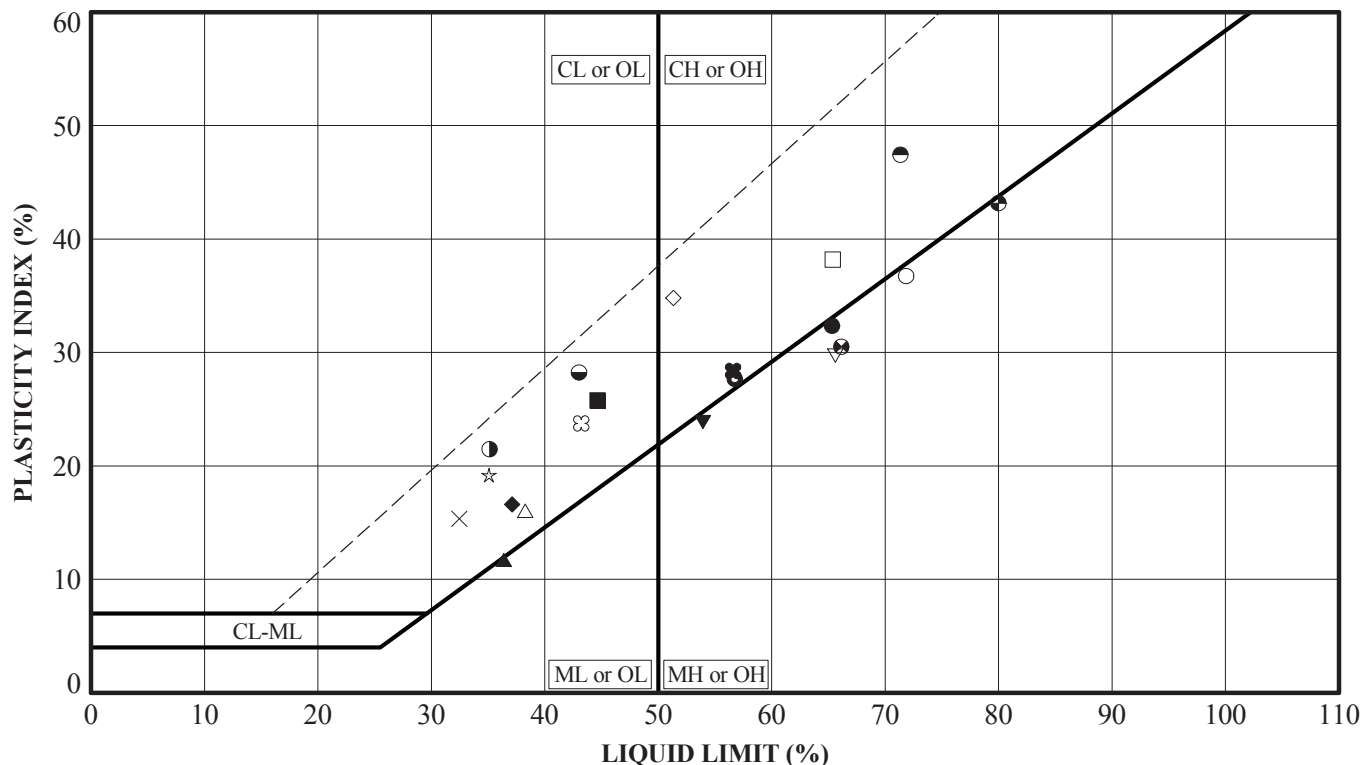
"NP" indicates Non-Plastic

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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.1



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-133	47.5	72	35	37	ELASTIC SILT (MH)
●	G-133	50.5	65	33	32	ELASTIC SILT (MH)
△	G-133	65.5	38	22	16	SANDY LEAN CLAY (CL)
▲	G-133	77.5	36	25	11	SANDY SILT (ML)
□	G-135	9.5	65	27	38	SANDY FAT CLAY (CH)
■	G-135	39.5	45	19	26	LEAN CLAY with SAND (CL)
▽	G-135	50.0	66	36	30	ELASTIC SILT (MH)
▼	G-135	56.0	54	30	24	ELASTIC SILT (MH)
⊙	G-135	65.5	57	29	28	FAT CLAY with SAND (CH)
◇	G-135	74.0	51	17	34	FAT CLAY with SAND (CH)
◆	G-135	83.5	37	21	16	SANDY LEAN CLAY (CL)
⊗	G-135	110.0	66	36	30	ELASTIC SILT (MH)
⊕	G-135	119.0	80	37	43	ELASTIC SILT (MH)
☆	G-136	25.5	35	16	19	LEAN CLAY (CL)
⊗	G-136	55.5	43	19	24	LEAN CLAY (CL)
⊙	G-136	65.5	71	24	47	FAT CLAY (CH)
⊕	G-136	75.5	43	15	28	LEAN CLAY with SAND (CL)
⊙	G-136	85.5	35	14	21	LEAN CLAY (CL)
×	G-137	49.0	32	17	15	CLAYEY SAND (SC)
⊗	G-137	64.5	57	28	29	SANDY FAT CLAY (CH)

Laboratory Test Method: ASTM D 4318

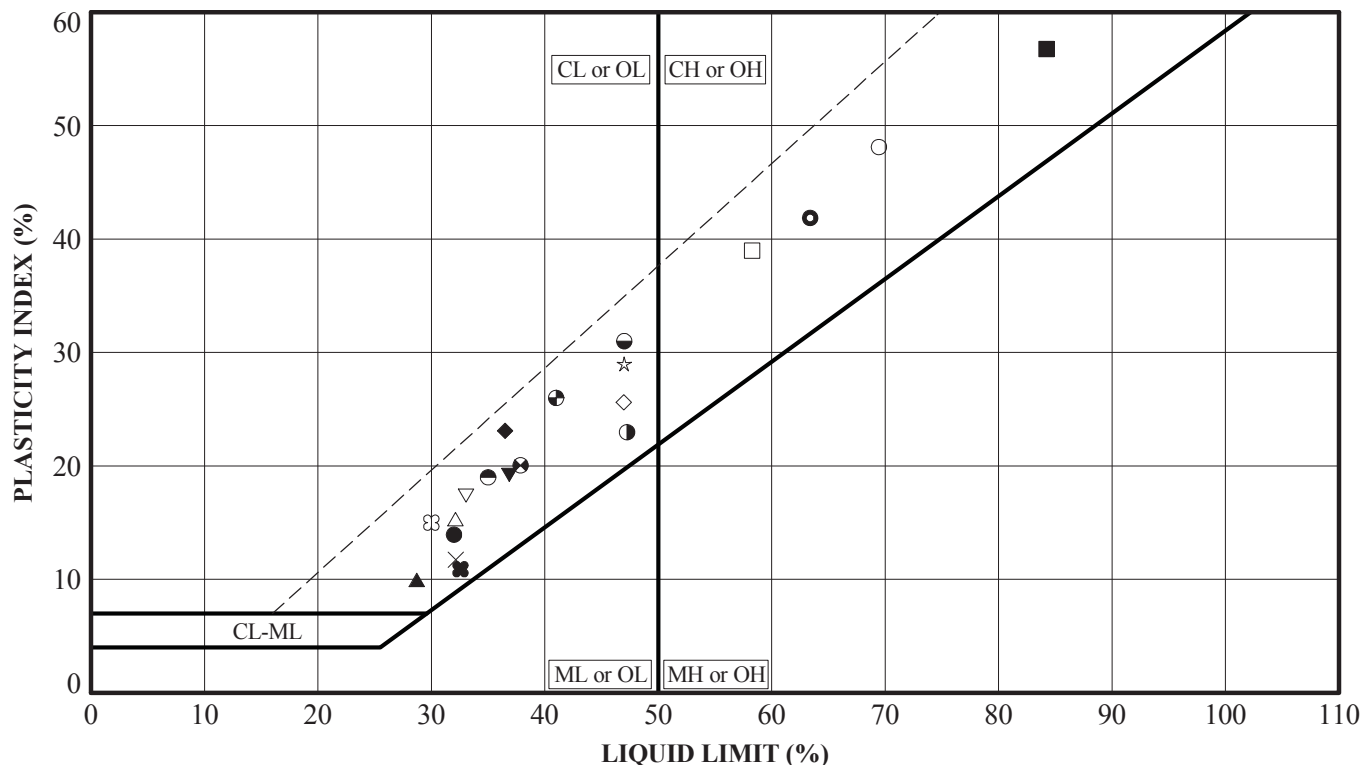
"NP" indicates Non-Plastic

Prepared/Date: JF 6/28/2011
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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.2.1



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-137	70.5	69	21	48	FAT CLAY (CH)
●	G-137	76.5	32	18	14	SANDY LEAN CLAY (CL)
△	G-137	82.5	32	17	15	SANDY LEAN CLAY (CL)
▲	G-137	91.0	29	19	10	CLAYEY SAND with GRAVEL (SC)
□	G-137	100.5	58	19	39	FAT CLAY (CH)
■	G-137	109.0	84	27	57	FAT CLAY (CH)
▽	G-138	30.5	33	16	17	CLAYEY SAND (SC)
▼	G-138	55.5	37	18	19	SANDY LEAN CLAY (CL)
⊙	G-138	65.5	63	22	41	FAT CLAY with SAND (CH)
◇	G-138	75.5	47	21	26	SANDY LEAN CLAY (CL)
◆	G-138	85.5	36	13	23	SANDY LEAN CLAY (CL)
⊗	G-138	100.5	38	18	20	LEAN CLAY with SAND (CL)
⊕	G-139	55.5	41	15	26	LEAN CLAY (CL)
☆	G-139	65.5	47	18	29	LEAN CLAY (CL)
⊗	G-139	75.5	30	15	15	CLAYEY SAND (SC)
⊕	G-139	85.5	35	16	19	CLAYEY SAND (SC)
⊗	G-139	100.5	47	16	31	LEAN CLAY (CL)
⊕	G-140	62.5	47	24	23	LEAN CLAY with SAND (CL)
×	G-140	68.5	32	20	12	LEAN CLAY with SAND (CL)
⊗	G-140	74.5	33	22	11	CLAYEY SAND (SC)

Laboratory Test Method: ASTM D 4318

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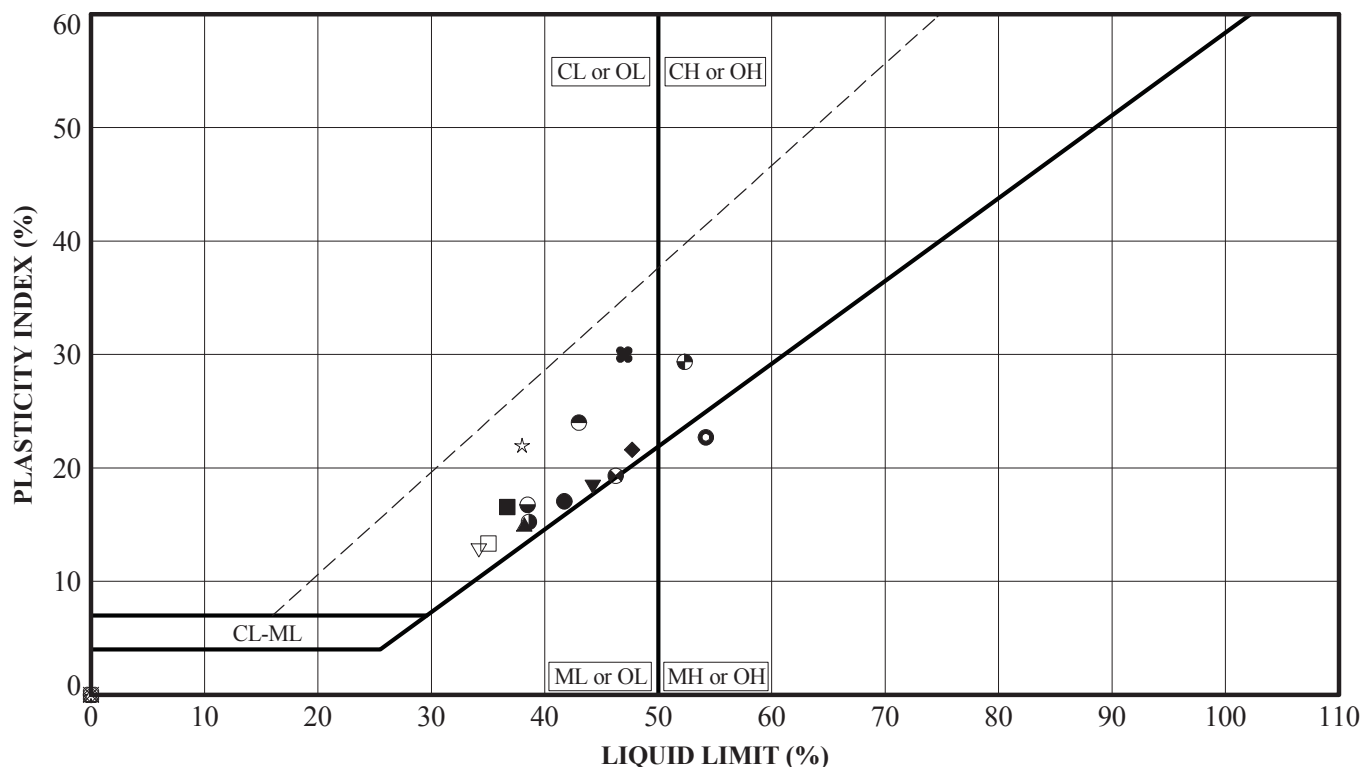
Prepared/Date: YN 9/9/2011

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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.2.2



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-140	80.5	NP	NP	NP	SILTY SAND (SM)
●	G-140	89.5	42	25	17	LEAN CLAY with SAND (CL)
△	G-140	95.5	NP	NP	NP	SANDY SILT (ML)
▲	G-141	60.5	38	23	15	LEAN CLAY with SAND (CL)
□	G-141	70.5	35	22	13	SANDY LEAN CLAY (CL)
■	G-141	80.5	37	20	17	LEAN CLAY with SAND (CL)
▽	G-141	85.5	34	21	13	LEAN CLAY with SAND (CL)
▼	G-142	40.5	44	26	18	LEAN CLAY (CL)
⦿	G-142	45.5	54	31	23	ELASTIC SILT (MH)
◇	G-142	55.5	NP	NP	NP	SILTY SAND with GRAVEL (SM)
◆	G-142	65.5	48	26	22	LEAN CLAY with SAND (CL)
⊗	G-142	95.5	46	27	19	SANDY CLAY (CL)
⊕	G-143	5.5	52	23	29	FAT CLAY (CH)
☆	G-143	15.5	38	16	22	CLAYEY SAND (SC)
⊗	G-143	25.5	NP	NP	NP	SILTY SAND (SM)
⊖	G-143	45.5	43	19	24	LEAN CLAY (CL)
⊙	G-143	55.5	38	22	16	LEAN CLAY with SAND (CL)
⦿	G-143	65.5	39	23	16	CLAYEY SAND with GRAVEL (SC)
×	G-143	85.5	NP	NP	NP	SILTY SAND (SM)
⦿	G-145	10.5	47	17	30	LEAN CLAY with SAND (CL)

Laboratory Test Method: ASTM D 4318

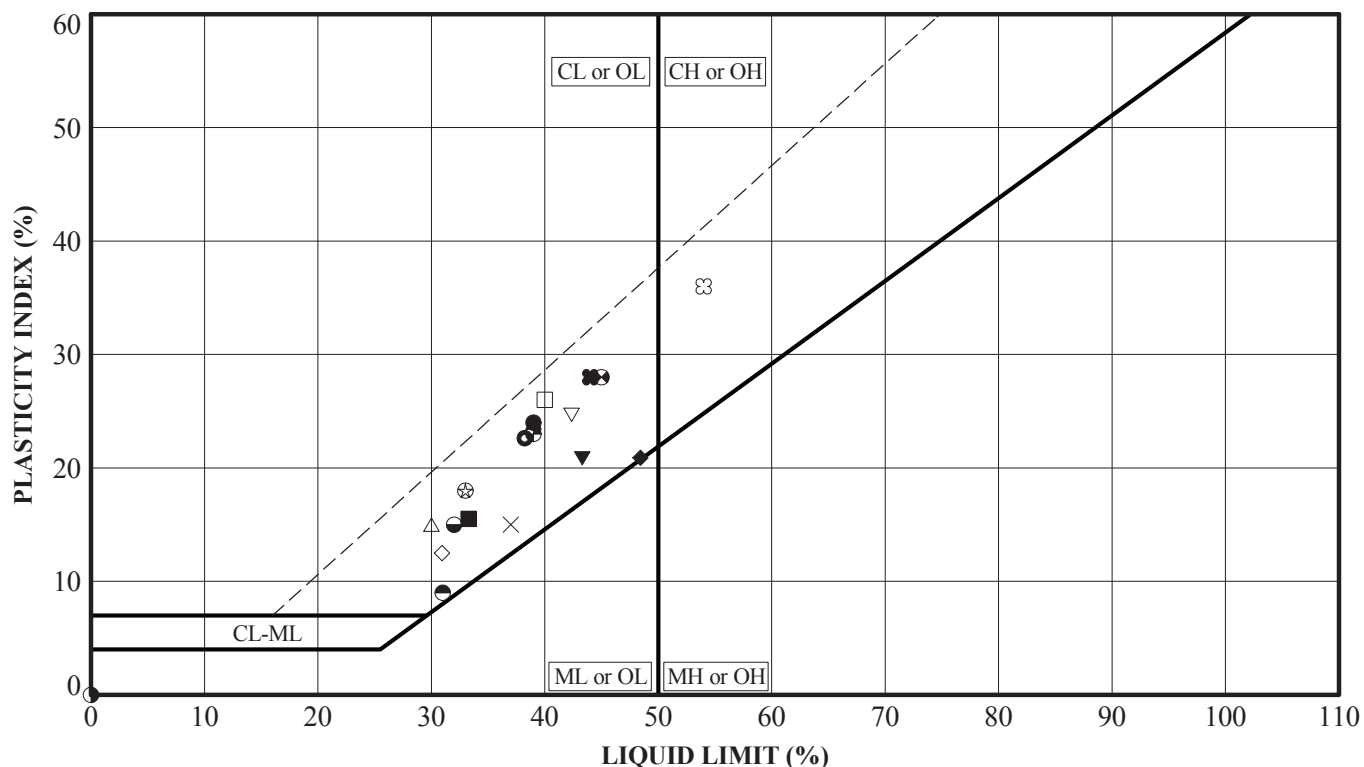
"NP" indicates Non-Plastic

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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.2.3



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-145	25.5	33	15	18	SANDY LEAN CLAY (CL)
●	G-145	51.5	39	15	24	LEAN CLAY with SAND (CL)
△	G-145	65.5	30	15	15	SANDY LEAN CLAY (CL)
▲	G-145	71.5	39	15	24	SANDY LEAN CLAY (CL)
□	G-145	110.5	40	14	26	LEAN CLAY with SAND (CL)
■	G-146	57.5	33	18	15	SANDY LEAN CLAY (CL)
▽	G-146	69.5	42	18	24	LEAN CLAY (CL)
▼	G-146	81.5	43	22	21	LEAN CLAY with SAND (CL)
⦿	G-147	75.5	38	16	22	SANDY LEAN CLAY (CL)
◇	G-147	80.5	31	18	13	SANDY LEAN CLAY (CL)
◆	G-147	115.5	48	28	20	SILT with SAND (ML)
⊗	G-148	10.5	45	17	28	LEAN CLAY (CL)
⊕	G-148	20.5	39	16	23	LEAN CLAY with SAND (CL)
☆	G-148	40.5	33	15	18	LEAN CLAY (CL)
☼	G-148	60.5	54	18	36	FAT CLAY (CH)
☾	G-148	70.5	31	22	9	CLAYEY SAND (SC)
☾	G-148	75.5	32	17	15	SANDY LEAN CLAY (CL)
☾	G-148	95.5	NP	NP	NP	SILTY SAND (SM)
×	G-148	100.5	37	22	15	SANDY LEAN CLAY (CL)
⛔	G-148	115.5	44	16	28	SANDY LEAN CLAY (CL)

Laboratory Test Method: ASTM D 4318

"NP" indicates Non-Plastic

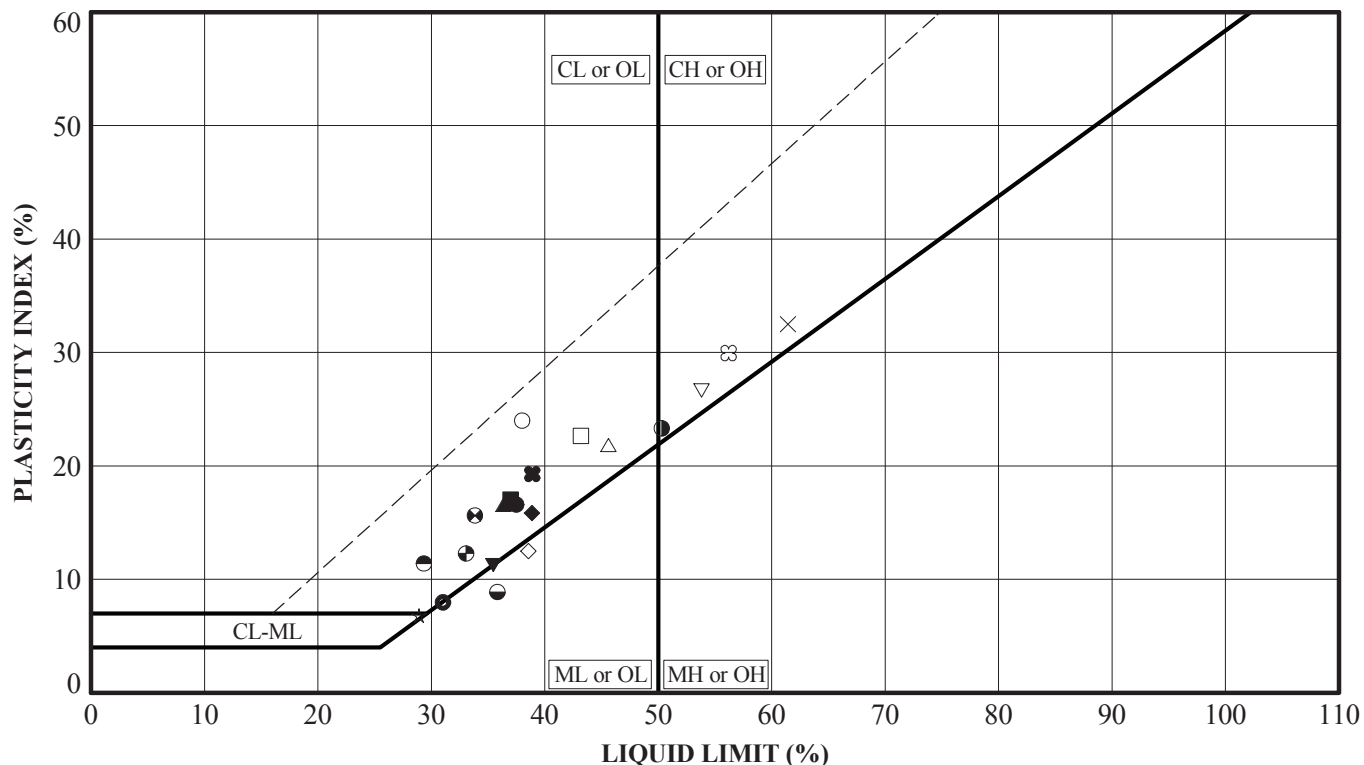
Prepared/Date: YN 8/9/2011

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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.2.4



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-148	140.5	38	14	24	SANDY LEAN CLAY (CL)
●	G-149	55.5	37	21	16	LEAN CLAY (CL)
△	G-149	65.5	46	24	22	LEAN CLAY (CL)
▲	G-149	75.5	36	20	16	LEAN CLAY (CL)
□	G-150	50.5	43	21	22	LEAN CLAY with SAND (CL)
■	G-150	60.5	37	20	17	CLAYEY SAND (SC)
▽	G-150	75.5	54	27	27	FAT CLAY with SAND (CH)
▼	G-161	25.5	35	24	11	LEAN CLAY with SAND (CL)
⊙	G-161	50.5	31	23	8	SILTY SAND with GRAVEL (SM)
◇	G-161	60.5	39	26	13	SILT (ML)
◆	G-161	75.5	39	23	16	LEAN CLAY with SAND (CL)
⊗	G-161	85.5	34	18	16	SANDY LEAN CLAY (CL)
⊕	G-162	20.5	33	21	12	SANDY LEAN CLAY (CL)
☆	G-162	87.5	29	22	7	SILTY, CLAYEY SAND with GRAVEL (SC-SM)
⊗	G-162	93.5	56	26	30	FAT CLAY with SAND (CH)
⊖	G-164	15.5	29	18	11	SANDY LEAN CLAY (CL)
⊗	G-164	33.5	36	27	9	SILT (ML)
⊙	G-164	51.5	50	27	23	FAT CLAY (CH)
×	G-164	54.5	61	29	32	FAT CLAY (CH)
⊗	G-165	25.5	39	20	19	CLAYEY SAND (SC)

Laboratory Test Method: ASTM D 4318

"NP" indicates Non-Plastic

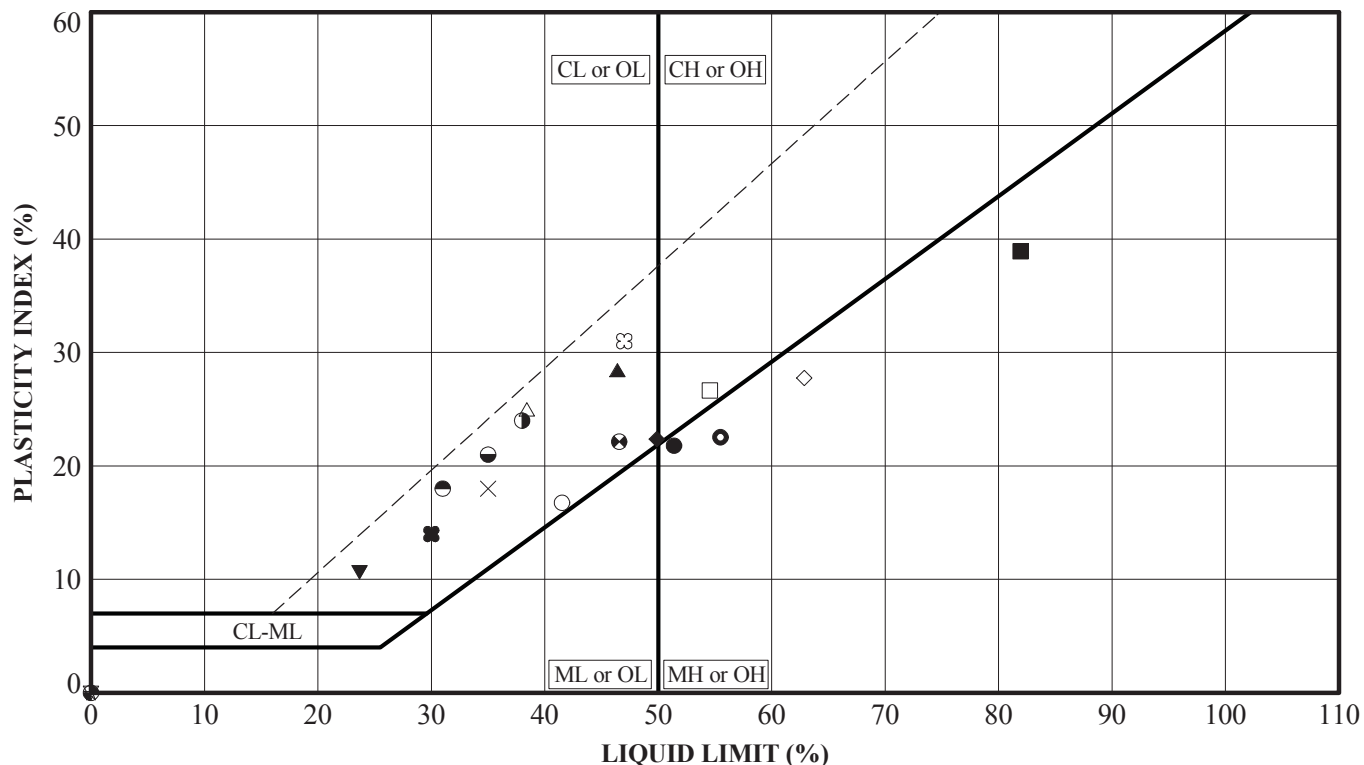
Prepared/Date: YN 8/10/2011

Checked/Date: LT 9/26/2011

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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.2.5



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-165	67.5	42	25	17	LEAN CLAY with SAND (CL)
●	G-165	120.5	51	30	21	ELASTIC SILT (MH)
△	G-166A/B	31.5	38	13	25	SANDY LEAN CLAY (CL)
▲	G-166A/B	52.5	46	18	28	LEAN CLAY (CL)
□	G-166A/B	62.5	55	28	27	FAT CLAY with SAND (CH)
■	G-166A/B	68.5	82	43	39	ELASTIC SILT (MH)
▽	G-166A/B	105.5	NP	NP	NP	SILTY SAND (SM)
▼	G-166A/B	115.5	24	13	11	CLAYEY SAND (SC)
⊙	S-108	63-64	55	33	22	ELASTIC SILT (MH)
◇	S-108	72.5-73.5	63	35	28	ELASTIC SILT with SAND (MH)
◆	S-108	78-79	50	27	23	FAT CLAY with SAND (CH)
⊗	S-108	82-83	47	24	23	SANDY LEAN CLAY (CL)
⊕	S-108	91-92	NP	NP	NP	SILTY SAND with GRAVEL (SM)
☆	S-108	97-98	NP	NP	NP	SANDY SILT (ML)
⊗	S-109	10-11	47	16	31	LEAN CLAY (CL)
⊕	S-109	22-23	31	13	18	SANDY LEAN CLAY (CL)
⊖	S-109	51-52	35	14	21	LEAN CLAY with SAND (CL)
⊙	S-109	56-57	38	14	24	SANDY LEAN CLAY (CL)
×	S-109	62-63	35	17	18	SANDY LEAN CLAY (CL)
⊗	S-109	77-78	30	16	14	CLAYEY SAND (SC)

Laboratory Test Method: ASTM D 4318

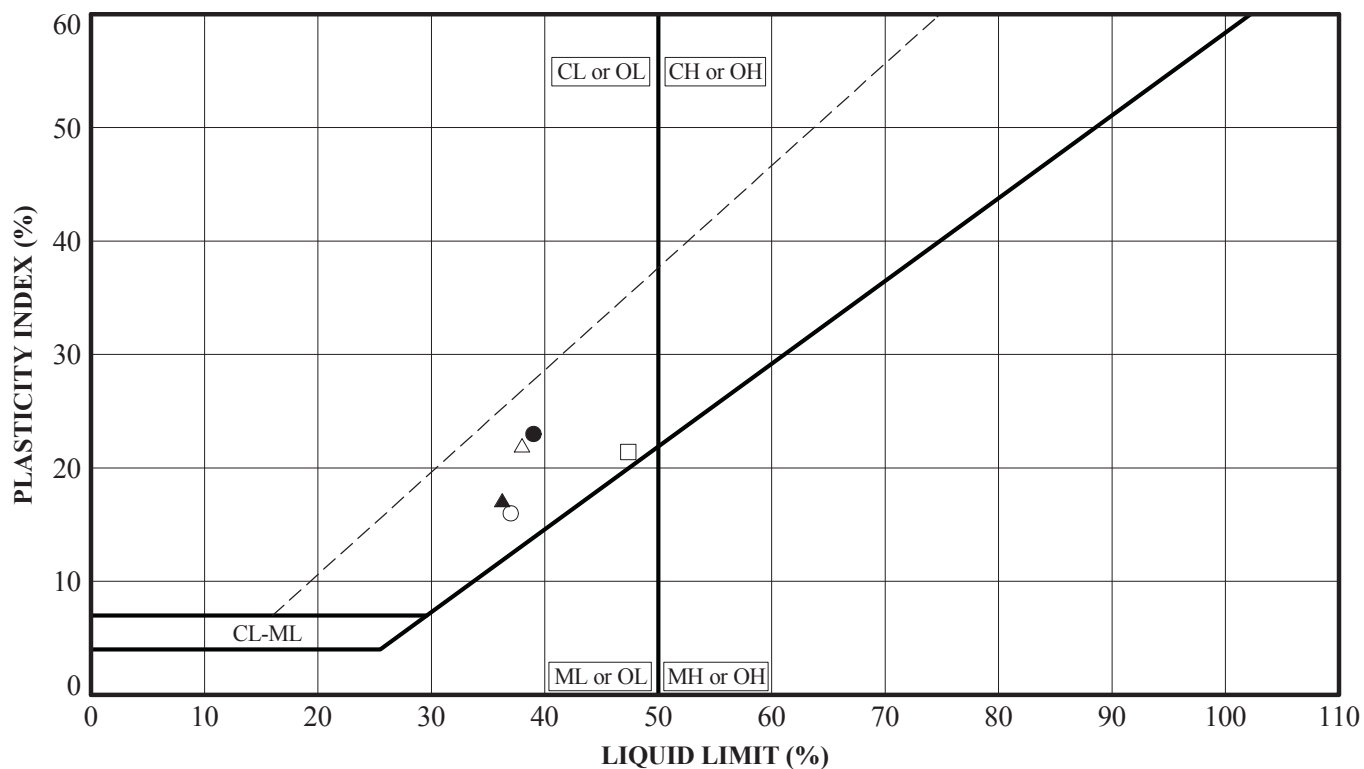
"NP" indicates Non-Plastic

Prepared/Date: JF 6/14/2011
Checked/Date: JAG 6/27/2011

MTA Westside Subway Extension
Los Angeles, California



ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.2.6

[illegible]

Laboratory Test Method: ASTM D 4318

"NP" indicates Non-Plastic

Prepared/Date: YN 7/16/2011

Checked/Date: LT 9/30/2011

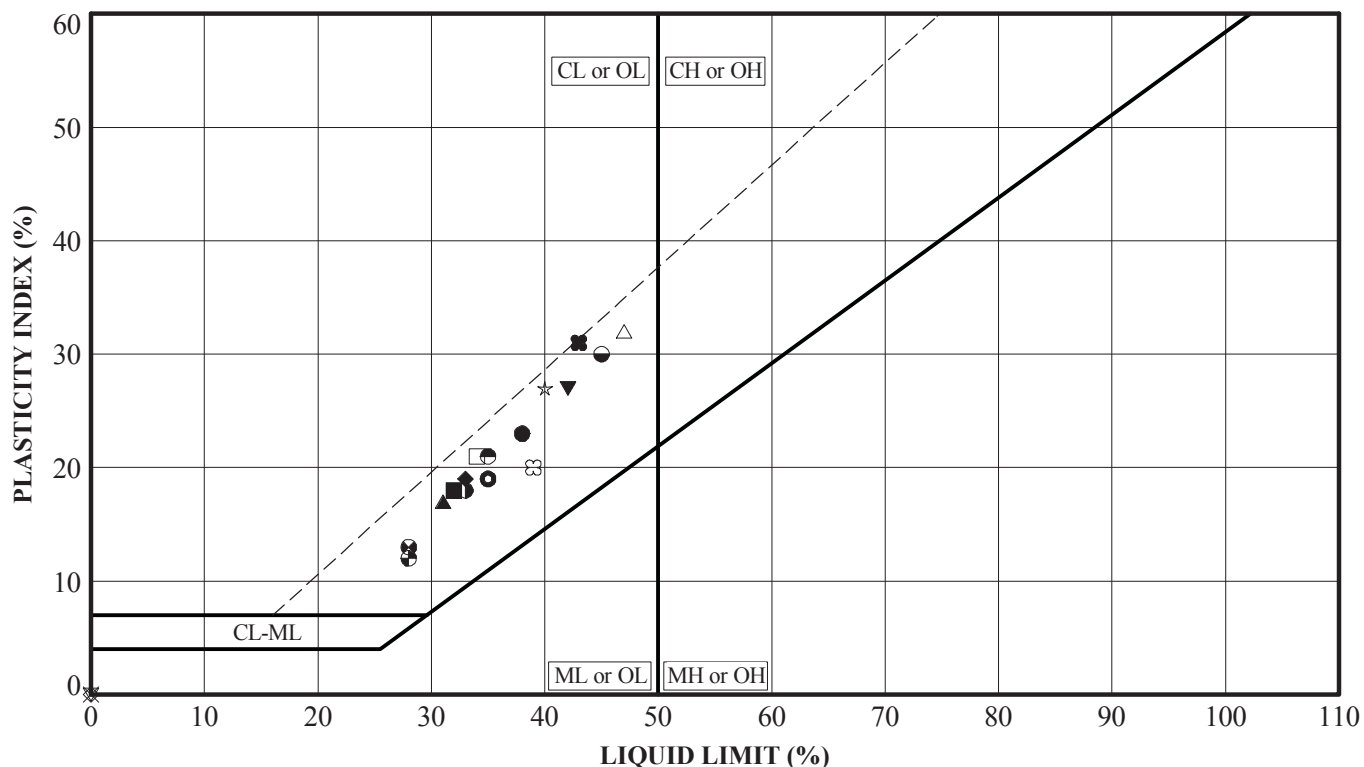
MTA Westside Subway Extension
Los Angeles, California



ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-10-1561
Figure: D-6.2.7

SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	E-126A/M-404	35.5	37	17	20	LEAN CLAY WITH SAND (CL)
●	E-126A/M-404	65.5	49	16	33	LEAN CLAY (CL)
△	E-126A/M-404	100.5	27	14	13	CLAYEY SAND (SC)
▲	E-126A/M-404	125.5	33	14	19	SANDY LEAN CLAY (CL)
□	E-126B/M-405	15.5	34	16	18	SANDY LEAN CLAY (CL)
■	E-126B/M-405	30.5	35	15	20	SANDY LEAN CLAY (CL)
▽	E-126B/M-405	55.5	33	15	18	LEAN CLAY WITH SAND (CL)
▼	E-126B/M-405	75.5	39	15	24	LEAN CLAY WITH SAND (CL)
⦿	E-126B/M-405	115.5	36	14	22	SANDY LEAN CLAY (CL)
◇	G-405/M-403	75.5	52	17	35	FAT CLAY (CH)
◆	G-405/M-403	83.5	28	15	13	CLAYEY SAND (SC)
⊕	G-405/M-403	92.5	38	14	24	SANDY LEAN CLAY (CL)
⊕	G-405/M-403	104.5	33	25	8	SILT WITH SAND (ML)
☆	G-405/M-403	110.5	48	19	29	LEAN CLAY with SAND (CL)
⊗	G-406	55.5	31	17	14	SANDY SILT (ML)
⊖	G-406	65.5	41	13	28	LEAN CLAY WITH SAND (CL)
⦿	G-406	85.5	33	16	17	SANDY LEAN CLAY (CL)
●	G-406	93.0	49	14	35	LEAN CLAY (CL)
×	G-406	105.5	NP	NP	NP	CLAYEY SAND (SC)
⦿	G-407	41.5	37	17	20	LEAN CLAY with SAND (CL)

Prepared/Date: KC/SK 12/17/2015
Checked/Date: FW/HP 12/17/2015



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-407	47.5	35	16	19	LEAN CLAY WITH SAND (CL)
●	G-407	53.5	38	15	23	LEAN CLAY WITH SAND (CL)
△	G-408/P-306	15.5	47	15	32	LEAN CLAY WITH SAND (CL)
▲	G-408/P-306	25.5	31	14	17	SANDY LEAN CLAY (CL)
□	G-408/P-306	75.5	34	13	21	SANDY LEAN CLAY (CL)
■	G-408/P-306	95.5	32	14	18	SANDY LEAN CLAY WITH GRAVEL (CL)
▽	G-408/P-306	115.5	NP	NP	NP	SILTY SAND with GRAVEL (SM)
▼	G-409	40.5	42	15	27	LEAN CLAY WITH SAND (CL)
◉	G-409	75.5	35	16	19	LEAN CLAY (CL)
◇	G-409	105.5	NP	NP	NP	SILTY SAND (SM)
◆	G-409	114.5	33	14	19	LEAN CLAY with SAND (CL)
⊕	G-409	120.5	28	15	13	SANDY LEAN CLAY (CL)
⊙	G-409	130.5	28	16	12	CLAYEY SAND (SC)
☆	G-409	140.5	40	13	27	LEAN CLAY WITH SAND (CL)
⊗	G-410/M-406	110.5	39	19	20	LEAN CLAY with SAND (CL)
⊖	G-410/M-406	139.5	35	14	21	SANDY LEAN CLAY (CL)
⊕	G-410/M-406	149.5	45	15	30	SANDY LEAN CLAY (CL)
⊙	G-410/M-406	164.5	33	15	18	LEAN CLAY with SAND (CL)
×	G-411	79.5	NP	NP	NP	SILT WITH SAND (ML)
⊗	G-412/M-407/E-132A	55.5	43	12	31	SANDY LEAN CLAY (CL)

Laboratory Test Method: ASTM D 4318

"NP" indicates Non-Plastic

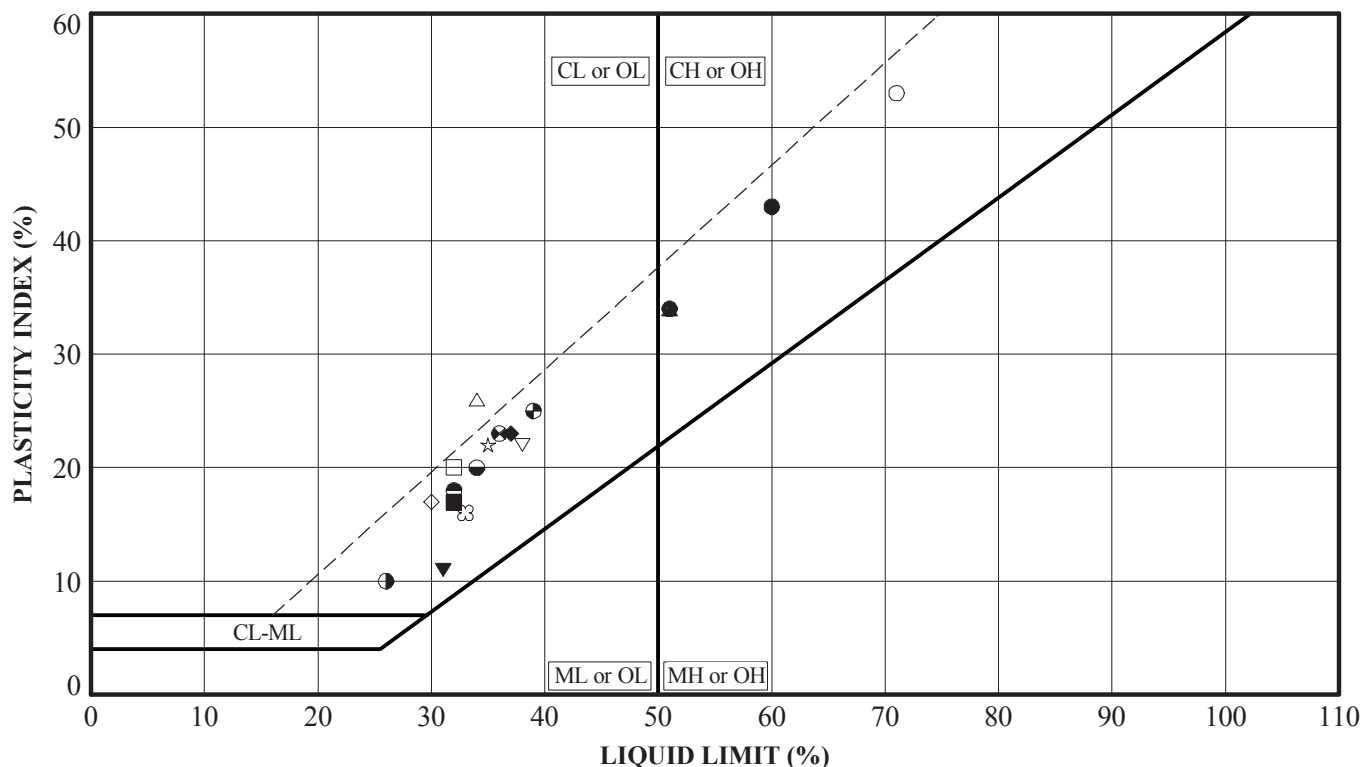
Prepared/Date: KC/SK 12/17/2015

Checked/Date: FW/HP 12/17/2015

MTA Westside Subway Extension
Los Angeles, California

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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-11-1423
Figure: D-6.3.2



SYMBOL	BORING	DEPTH (ft)	LL (%)	PL (%)	PI (%)	CLASSIFICATION
○	G-412/M-407/E-132	25.5	71	18	53	FAT CLAY (CH)
●	G-412/M-407/E-132	43.0	60	17	43	FAT CLAY (CH)
△	G-412/M-407/E-132	48.0	34	8	26	SANDY LEAN CLAY (CL)
▲	M-402	60.5	51	17	34	FAT CLAY (CH)
□	M-402	79.5	32	12	20	LEAN CLAY with SAND (CL)
■	M-402	85.5	32	15	17	SANDY LEAN CLAY (CL)
▽	M-402	97.5	38	16	22	CLAYEY SAND (SC)
▼	M-402	114.5	31	20	11	LEAN CLAY with SAND (CL)
◐	OB-307	6.5	51	17	34	SANDY FAT CLAY (CH)
◇	OB-307	24.5	30	13	17	SANDY LEAN CLAY (CL)
◆	OB-307	54.5	37	14	23	LEAN CLAY (CL)
⊗	OB-307	75.5	36	13	23	LEAN CLAY (CL)
◐	OB-307	90.5	39	14	25	SANDY LEAN CLAY (CL)
☆	OB-308	6.5	35	13	22	CLAYEY SAND (SC)
⊗	OB-308	30.0	33	17	16	LEAN CLAY with SAND (CL)
◐	OB-308	65.5	32	14	18	SANDY LEAN CLAY (CL)
◐	OB-308	80.0	34	14	20	LEAN CLAY (CL)
◐	OB-308	105.5	26	16	10	CLAYEY SAND with GRAVEL (SC)

Laboratory Test Method: ASTM D 4318

"NP" indicates Non-Plastic

Prepared/Date: KC/SK 12/17/2015

Checked/Date: FW/HP 12/17/2015

MTA Westside Subway Extension
Los Angeles, California

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ATTERBERG LIMITS TEST RESULTS
Project No.: 4953-11-1423
Figure: D-6.3.3

Table 1 - Laboratory Tests on Soil Samples

Sample ID		G-8 @ 20'	G-8 @ 30'	G-9 @ 30'	G-9 @ 60'	G-10 @ 35'
MACTEC						
Westside Extension						
Your #4953-09-0472, SA #09-0628SCSP						
13-Aug-09						
Resistivity	Units					
as-received	ohm-cm	1,440	1,840	1,600	1,200	5,680
saturated	ohm-cm	1,000	1,560	1,500	1,200	2,960
pH		7.7	8.0	7.8	8.0	8.1
Electrical						
Conductivity	mS/cm	0.28	0.25	0.24	0.23	0.08
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	95	78	120	103	43
magnesium	Mg ²⁺ mg/kg	42	31	30	34	13
sodium	Na ¹⁺ mg/kg	179	195	140	120	73
potassium	K ¹⁺ mg/kg	26	10	19	36	5.8
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	708	515	616	549	76
flouride	F ¹⁻ mg/kg	15	18	6.8	4.6	2.8
chloride	Cl ¹⁻ mg/kg	16	27	21	34	12
sulfate	SO ₄ ²⁻ mg/kg	58	93	61	69	97
phosphate	PO ₄ ³⁻ mg/kg	ND	ND	2.3	1.5	2.6
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	ND	ND	1.0	1.7	ND
nitrate	NO ₃ ¹⁻ mg/kg	ND	1.0	ND	0.5	ND
sulfide	S ²⁻ qual	na	na	na	na	na
Redox	mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

Sample ID		<p><i>MACTEC</i> <i>Westside Extension</i> <i>Your #4953-09-0472, SA #09-0628SCSP</i> <i>13-Aug-09</i></p>				
		G-10 @ 65'	G-11 @ 20'	G-11 @ 70'	G-12 @ 50'	G-13 @ 40'
Resistivity	Units					
as-received	ohm-cm	5,400	6,800	1,080	3,320	760
saturated	ohm-cm	1,260	1,520	1,020	1,048	760
pH		8.0	7.7	7.8	7.7	7.4
Electrical						
Conductivity	mS/cm	0.23	0.08	0.12	0.09	0.12
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	100	43	60	50	53
magnesium	Mg ²⁺ mg/kg	30	12	19	16	16
sodium	Na ¹⁺ mg/kg	116	79	69	62	92
potassium	K ¹⁺ mg/kg	31	8.2	24	17	20
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	555	189	189	159	140
flouride	F ¹⁻ mg/kg	6.5	1.9	1.5	1.7	1.5
chloride	Cl ¹⁻ mg/kg	6.2	3.4	18	15	33
sulfate	SO ₄ ²⁻ mg/kg	46	37	79	56	108
phosphate	PO ₄ ³⁻ mg/kg	3.3	4.7	ND	ND	5.6
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	1.8	0.8	2.0	0.7	1.0
nitrate	NO ₃ ¹⁻ mg/kg	2.1	1.4	1.6	1.3	5.9
sulfide	S ²⁻ qual	na	na	na	na	na
Redox	mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Sample(s)

MACTEC Engineering & Consulting, Inc.
Westside Extension
Your #4953-10-1561, HDR|Schiff #11-0482LAB
25-May-11

Sample ID			G-133 @ 50' CL	G-133 @ 62' CL	G-133 @ 74' Sandy ML / SM	G-134 @ 60' CL / CL-CH	G-134 @ 76' CL / CL-CH
Resistivity							
	Units						
as-received	ohm-cm		2,840	2,080	1,280	1,160	4,000
saturated	ohm-cm		960	1,760	1,080	800	1,840
pH			7.7	8.0	8.0	8.0	8.1
Electrical							
Conductivity	mS/cm		0.22	0.19	0.24	0.24	0.13
Chemical Analyses							
Cations							
calcium	Ca ²⁺	mg/kg	62	75	103	94	72
magnesium	Mg ²⁺	mg/kg	26	21	24	27	16
sodium	Na ¹⁺	mg/kg	127	96	99	111	61
potassium	K ¹⁺	mg/kg	27	19	35	41	5.7
Anions							
carbonate	CO ₃ ²⁻	mg/kg	ND	ND	ND	ND	12
bicarbonate	HCO ₃ ¹⁻	mg/kg	458	360	360	515	183
fluoride	F ¹⁻	mg/kg	3.6	2.9	3.8	8.8	5.3
chloride	Cl ¹⁻	mg/kg	56	65	37	60	31
sulfate	SO ₄ ²⁻	mg/kg	48	33	186	53	31
phosphate	PO ₄ ³⁻	mg/kg	ND	1.0	ND	ND	ND
Other Tests							
ammonium	NH ₄ ¹⁺	mg/kg	2.9	2.0	2.2	3.4	ND
nitrate	NO ₃ ¹⁻	mg/kg	1.0	1.7	1.3	ND	ND
sulfide	S ²⁻	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0699LAB

20-Jul-11

Sample ID		G-135 @ 86' CL	G-135 @ 92' SW	G-144 @ 10.5' CL-ML	G-144 @ 30.5' CL-ML	G-144 @ 50.5' Sandy CL
Resistivity	Units					
as-received	ohm-cm	6,000	11,600	960	1,560	1,480
saturated	ohm-cm	2,800	4,400	960	1,560	1,360
pH		8.1	7.8	7.6	7.6	7.5
Electrical						
Conductivity	mS/cm	0.09	0.08	0.13	0.04	0.06
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	43	42	79	25	28
magnesium	Mg ²⁺ mg/kg	15	12	17	7.5	8.3
sodium	Na ¹⁺ mg/kg	49	43	57	42	48
potassium	K ¹⁺ mg/kg	6.3	7.0	7.7	2.4	4.9
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	195	156	345	79	67
fluoride	F ¹⁻ mg/kg	3.9	2.1	5.6	5.1	4.0
chloride	Cl ¹⁻ mg/kg	13	23	2.0	6.8	13
sulfate	SO ₄ ²⁻ mg/kg	35	62	33	12	56
phosphate	PO ₄ ³⁻ mg/kg	3.1	1.7	3.8	6.3	2.5
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	ND	1.1	ND	ND	ND
nitrate	NO ₃ ¹⁻ mg/kg	ND	1.0	25	13	0.9
sulfide	S ²⁻ qual	Negative	Negative	Negative	Negative	Negative
Redox	mV	22	37	18	63	38

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0647LAB

8-Jul-11

Sample ID			G-125 @ 56' Clayey ML	G-125 @ 68.5' SM	G-125 @ 86' SP	G-136 @ 65' CL/CL-CH	G-136 @ 105' SM
Resistivity							
	Units						
as-received	ohm-cm		1,640	1,280	1,080	1,640	3,920
saturated	ohm-cm		720	1,120	392	960	3,440
pH			7.6	7.8	2.1	7.4	7.8
Electrical							
Conductivity	mS/cm		0.38	0.26	2.40	0.25	0.10
Chemical Analyses							
Cations							
calcium	Ca2+	mg/kg	125	52	1,589	83	43
magnesium	Mg2+	mg/kg	30	13	343	29	12
sodium	Na1+	mg/kg	213	183	24	121	52
potassium	K1+	mg/kg	39	15	5.2	28	7.3
Anions							
carbonate	CO32-	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO31	mg/kg	223	317	ND	390	113
fluoride	F1-	mg/kg	2.7	2.5	22	6.8	1.7
chloride	Cl1-	mg/kg	8.8	15	12	27	23
sulfate	SO42-	mg/kg	667	249	8,074	157	82
phosphate	PO43-	mg/kg	ND	0.5	ND	ND	ND
Other Tests							
ammonium	NH41+	mg/kg	7.2	6.5	4.4	1.6	ND
nitrate	NO31-	mg/kg	0.6	4.2	ND	0.6	2.3
sulfide	S2-	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0750LAB

29-Jul-11

Sample ID			G-116 @ 35' CL-ML	G-137 @ 61' CL	G-137 @ 73' CH	G-137 @ 85' CL	G-137 @ 103' CH
Resistivity							
	Units						
as-received	ohm-cm		960	1,680	1,120	2,560	1,800
saturated	ohm-cm		880	1,680	1,120	1,800	1,440
pH			8.2	8.3	8.5	8.4	8.2
Electrical							
Conductivity	mS/cm		0.27	0.14	0.15	0.13	0.11
Chemical Analyses							
Cations							
calcium	Ca ²⁺	mg/kg	91	71	50	49	41
magnesium	Mg ²⁺	mg/kg	40	22	22	26	23
sodium	Na ¹⁺	mg/kg	121	71	95	81	72
potassium	K ¹⁺	mg/kg	33	10	2.3	7.4	11
Anions							
carbonate	CO ₃ ²⁻	mg/kg	6.0	9.0	30	18	9.0
bicarbonate	HCO ₃ ¹⁻	mg/kg	208	247	247	249	224
fluoride	F ¹⁻	mg/kg	3.5	5.4	7.0	5.3	3.8
chloride	Cl ¹⁻	mg/kg	11	20	16	3.4	2.9
sulfate	SO ₄ ²⁻	mg/kg	377	41	31	22	18
phosphate	PO ₄ ³⁻	mg/kg	ND	4.0	ND	ND	ND
Other Tests							
ammonium	NH ₄ ¹⁺	mg/kg	7.8	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻	mg/kg	1.0	ND	0.5	ND	ND
sulfide	S ²⁻	qual	Trace	Trace	Trace	Negative	Negative
Redox		mV	-33	35	-71	46	58

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples
MACTEC Engineering, Inc.
Westside Extension
Your #4953-10-1561, HDR|Schiff #11-0750LAB
29-Jul-11

Sample ID		G-138 @ 70.5' CL	G-138 @ 80.5' CH
Resistivity			
as-received	ohm-cm	11,200	2,040
saturated	ohm-cm	1,560	1,800
pH		8.3	8.2
Electrical			
Conductivity	mS/cm	0.17	0.13
Chemical Analyses			
Cations			
calcium	Ca ²⁺ mg/kg	55	56
magnesium	Mg ²⁺ mg/kg	20	21
sodium	Na ¹⁺ mg/kg	87	79
potassium	K ¹⁺ mg/kg	24	6.3
Anions			
carbonate	CO ₃ ²⁻ mg/kg	21	15
bicarbonate	HCO ₃ ¹⁻ mg/kg	252	254
fluoride	F ¹⁻ mg/kg	6.4	4.8
chloride	Cl ¹⁻ mg/kg	3.1	3.0
sulfate	SO ₄ ²⁻ mg/kg	8.0	18
phosphate	PO ₄ ³⁻ mg/kg	1.7	2.4
Other Tests			
ammonium	NH ₄ ¹⁺ mg/kg	2.5	ND
nitrate	NO ₃ ¹⁻ mg/kg	0.5	ND
sulfide	S ²⁻ qual	Negative	Trace
Redox	mV	3.6	54

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0674LAB

14-Jul-11

Sample ID		G-114 @ 77.5' SP-SM	G-114 @ 89' ML	G-114 @ 100.5' CL-ML	G-139 @ 60' CL	G-139 @ 70' CL
Resistivity						
	Units					
as-received	ohm-cm	3,200	1,240	880	1,800	2,600
saturated	ohm-cm	1,760	332	248	1,800	1,880
pH		7.9	5.2	5.9	7.6	7.7
Electrical						
Conductivity	mS/cm	0.18	2.35	2.40	0.11	0.13
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	59	730	629	60	61
magnesium	Mg ²⁺ mg/kg	14	571	493	13	16
sodium	Na ¹⁺ mg/kg	81	935	1,427	65	70
potassium	K ¹⁺ mg/kg	21	196	217	6.5	11
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	12	9.0
bicarbonate	HCO ₃ ¹⁻ mg/kg	104	40	58	229	279
fluoride	F ¹⁻ mg/kg	1.0	3.9	0.7	3.0	2.5
chloride	Cl ¹⁻ mg/kg	13	285	625	5.0	3.4
sulfate	SO ₄ ²⁻ mg/kg	256	5,751	5,688	17	14
phosphate	PO ₄ ³⁻ mg/kg	ND	ND	ND	1.5	1.7
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	1.1	742	74	ND	ND
nitrate	NO ₃ ¹⁻ mg/kg	21	ND	3.5	ND	ND
sulfide	S ²⁻ qual	na	na	na	na	na
Redox	mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0674LAB

14-Jul-11

Sample ID			G-139 @ 80' CL	G-189 @ 10' ML	G-189 @ 40' SW	G-189 @ 70' ML	G-189 @ 100' CL
Resistivity							
	Units						
as-received	ohm-cm		1,920	1,760	28,400	2,280	1,720
saturated	ohm-cm		1,920	1,760	4,800	2,280	1,400
pH			7.9	7.6	7.6	7.3	7.2
Electrical							
Conductivity	mS/cm		0.14	0.06	0.04	0.04	0.05
Chemical Analyses							
Cations							
calcium	Ca ²⁺	mg/kg	67	49	20	22	30
magnesium	Mg ²⁺	mg/kg	15	7.8	6.2	5.5	6.8
sodium	Na ¹⁺	mg/kg	70	29	33	32	35
potassium	K ¹⁺	mg/kg	10	3.5	3.2	46	10
Anions							
carbonate	CO ₃ ²⁻	mg/kg	12	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	263	143	70	46	67
fluoride	F ¹⁻	mg/kg	0.9	2.5	2.8	2.5	3.4
chloride	Cl ¹⁻	mg/kg	10	1.7	6.3	11	5.6
sulfate	SO ₄ ²⁻	mg/kg	36	14	19	33	54
phosphate	PO ₄ ³⁻	mg/kg	ND	3.6	4.7	2.0	2.1
Other Tests							
ammonium	NH ₄ ¹⁺	mg/kg	ND	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻	mg/kg	ND	10	22	2.5	2.7
sulfide	S ²⁻	qual	na	na	na	na	na
Redox	mV		na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Sample(s)
MACTEC Engineering & Consulting, Inc.
Westside Extension
Your #4953-10-1561, HDR|Schiff #11-0457LAB
13-May-11

Sample ID	G-118 @ 67'		G-126 @ 65'		G-126 @ 85.5'		G-140 @ 59.5'		G-140 @ 71'	
	Sandy ML/SM with tar		SP-SM/SM		Sandy CL/SC		CL		Sandy CL/SC	
Resistivity	Units									
as-received	ohm-cm	4,400,000		1,680		2,080		1,560		3,400
saturated	ohm-cm	8,000		1,080		800		1,280		2,360
pH		7.4		7.5		7.6		7.9		8.0
Electrical										
Conductivity	mS/cm	0.08		0.34		0.48		0.19		0.18
Chemical Analyses										
Cations										
calcium	Ca ²⁺	mg/kg	70	123		186		92		96
magnesium	Mg ²⁺	mg/kg	4.5	53		76		25		20
sodium	Na ¹⁺	mg/kg	32	123		168		93		68
potassium	K ¹⁺	mg/kg	3.3	19		29		27		25
Anions										
carbonate	CO ₃ ²⁻	mg/kg	ND	ND		ND		ND		ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	ND	113		299		424		323
fluoride	F ¹⁻	mg/kg	ND	1.3		1.6		3.1		0.6
chloride	Cl ¹⁻	mg/kg	22	13		10		26		22
sulfate	SO ₄ ²⁻	mg/kg	161	594		829		87		130
phosphate	PO ₄ ³⁻	mg/kg	ND	ND		ND		ND		ND
Other Tests										
ammonium	NH ₄ ¹⁺	mg/kg	1.6	2.7		10		2.2		1.9
nitrate	NO ₃ ¹⁻	mg/kg	ND	62		1.1		ND		ND
sulfide	S ²⁻	qual	na	na		na		na		Positive
Redox		mV	na	na		na		na		-206

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

AMEC E&I
Westside Extension
Your #4953-10-1561, HDR|Schiff #11-0948LAB
15-Sep-11

Sample ID			G-141 @ 55' CL	G-141 @ 65' CL	G-141 @ 80.5' Sandy CL
Resistivity					
	Units				
as-received	ohm-cm		5,200	1,480	1,760
saturated	ohm-cm		1,280	1,320	1,120
pH			7.4	7.8	8.0
Electrical					
Conductivity	mS/cm		0.11	0.16	0.15
Chemical Analyses					
Cations					
calcium	Ca ²⁺	mg/kg	41	83	56
magnesium	Mg ²⁺	mg/kg	13	20	15
sodium	Na ¹⁺	mg/kg	66	83	78
potassium	K ¹⁺	mg/kg	21	23	29
Anions					
carbonate	CO ₃ ²⁻	mg/kg	ND	6.0	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	110	323	183
fluoride	F ¹⁻	mg/kg	ND	1.1	2.4
chloride	Cl ¹⁻	mg/kg	13	6.0	38
sulfate	SO ₄ ²⁻	mg/kg	132	48	132
phosphate	PO ₄ ³⁻	mg/kg	0.5	ND	ND
Other Tests					
ammonium	NH ₄ ¹⁺	mg/kg	4.5	2.9	3.9
nitrate	NO ₃ ¹⁻	mg/kg	0.5	1.8	ND
sulfide	S ²⁻	qual	Positive	Positive	Positive
Redox		mV	-71	-115	-65

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0647LAB

8-Jul-11

Sample ID			G-142 @ 50.5' CL-ML	G-142 @ 70.5' Gravelly CL	G-143 @ 20.5' CL w/Gravel	G-143 @ 40.5' SP/SW	G-143 @ 80.5' Sandy ML
Resistivity							
	Units						
as-received	ohm-cm		1,320	5,200	6,000	144,000	2,480
saturated	ohm-cm		880	1,520	2,600	4,040	1,600
pH			7.6	7.8	7.6	7.8	7.4
Electrical							
Conductivity	mS/cm		0.24	0.21	0.07	0.08	0.10
Chemical Analyses							
Cations							
calcium	Ca2+	mg/kg	95	102	24	29	43
magnesium	Mg2+	mg/kg	30	25	5.6	9.2	15
sodium	Na1+	mg/kg	91	74	74	53	51
potassium	K1+	mg/kg	39	26	2.6	5.4	6.8
Anions							
carbonate	CO32-	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO31	mg/kg	125	195	67	37	49
fluoride	F1-	mg/kg	1.8	1.5	5.1	2.3	3.3
chloride	Cl1-	mg/kg	15	23	8.4	9.2	21
sulfate	SO42-	mg/kg	405	297	59	104	119
phosphate	PO43-	mg/kg	ND	ND	8.6	1.8	2.6
Other Tests							
ammonium	NH41+	mg/kg	1.8	ND	ND	ND	ND
nitrate	NO31-	mg/kg	2.1	11	41	18	3.3
sulfide	S2-	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0699LAB

20-Jul-11

Sample ID		G-144 @ 60.5' Sandy CL	G-144 @ 80.5' CL	G-144 @ 100.5' SC	G-145 @ 31.5' Sandy CL	G-145 @ 61.5' Sandy CL
Resistivity						
as-received	ohm-cm	1,360	1,720	9,600	1,680	3,040
saturated	ohm-cm	1,360	1,160	2,440	1,680	1,840
pH		7.5	7.5	7.6	7.7	7.8
Electrical						
Conductivity	mS/cm	0.06	0.06	0.05	0.05	0.09
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	33	30	23	24	36
magnesium	Mg ²⁺ mg/kg	10	9.0	6.8	6.3	0.5
sodium	Na ¹⁺ mg/kg	51	44	39	44	67
potassium	K ¹⁺ mg/kg	5.5	4.7	6.2	3.8	6.8
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	67	58	43	95	140
fluoride	F ¹⁻ mg/kg	4.5	5.3	2.0	2.3	3.1
chloride	Cl ¹⁻ mg/kg	15	13	11	8.4	13
sulfate	SO ₄ ²⁻ mg/kg	62	49	46	12	57
phosphate	PO ₄ ³⁻ mg/kg	3.1	ND	2.6	6.3	2.8
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	ND	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻ mg/kg	0.5	2.1	1.5	20	3.2
sulfide	S ²⁻ qual	Negative	Negative	Negative	Negative	Negative
Redox	mV	60	31	56	80	57

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0699LAB

20-Jul-11

Sample ID		G-145 @ 95.5' SM w/gravel	G-145 @ 115.5' Sandy CL	G-148 @ 80.5' Sandy ML/SW	G-148 @ 90.5' SM	G-148 @ 110.5' CL-ML
Resistivity	Units					
as-received	ohm-cm	5,600	1,000	1,680	2,040	1,160
saturated	ohm-cm	2,840	1,000	1,680	1,920	1,160
pH		7.8	8.3	8.0	7.7	7.8
Electrical						
Conductivity	mS/cm	0.06	0.15	0.07	0.07	0.07
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	22	65	28	29	32
magnesium	Mg ²⁺ mg/kg	6.4	15	8.7	9.1	9.2
sodium	Na ¹⁺ mg/kg	42	75	46	44	51
potassium	K ¹⁺ mg/kg	3.8	22	3.8	5.0	7.0
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	58	253	67	52	125
fluoride	F ¹⁻ mg/kg	3.1	5.1	3.2	3.1	4.9
chloride	Cl ¹⁻ mg/kg	15	10	18	17	4.5
sulfate	SO ₄ ²⁻ mg/kg	50	122	65	68	43
phosphate	PO ₄ ³⁻ mg/kg	2.9	2.0	2.9	2.8	5.1
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	ND	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻ mg/kg	1.9	ND	2.9	1.9	0.9
sulfide	S ²⁻ qual	Negative	Negative	Negative	Negative	Negative
Redox	mV	66	28	43	99	47

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

AMEC E&I

Westside Subway Extension

Your #4953-10-1561, HDR|Schiff #11-0699LAB

20-Jul-11

Sample ID		G-144 @ 100.5' SC	G-145 @ 31.5' Sandy CL	G-145 @ 61.5' Sandy CL	G-145 @ 95.5' SM w/gravel	G-145 @ 115.5' Sandy CL
Resistivity						
as-received	ohm-cm	9,600	1,680	3,040	5,600	1,000
saturated	ohm-cm	2,440	1,680	1,840	2,840	1,000
pH		7.6	7.7	7.8	7.8	8.3
Electrical						
Conductivity	mS/cm	0.05	0.05	0.09	0.06	0.15
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	23	24	36	22	65
magnesium	Mg ²⁺ mg/kg	6.8	6.3	0.5	6.4	15
sodium	Na ¹⁺ mg/kg	39	44	67	42	75
potassium	K ¹⁺ mg/kg	6.2	3.8	6.8	3.8	22
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	43	95	140	58	253
fluoride	F ¹⁻ mg/kg	2.0	2.3	3.1	3.1	5.1
chloride	Cl ¹⁻ mg/kg	11	8.4	13	15	10
sulfate	SO ₄ ²⁻ mg/kg	46	12	57	50	122
phosphate	PO ₄ ³⁻ mg/kg	2.6	6.3	2.8	2.9	2.0
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	ND	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻ mg/kg	1.5	20	3.2	1.9	ND
sulfide	S ²⁻ qual	Negative	Negative	Negative	Negative	Negative
Redox	mV	56	80	57	66	28

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0647LAB

8-Jul-11

Sample ID			G-146 @ 66' CL-ML w/Sand	G-146 @ 78.5' Clayey ML	G-166 @ 57' CL/CL-CH	S-103A @ 86-87' ML	S-103A @ 111-112' ML
Resistivity							
	Units						
as-received	ohm-cm		1,280	4,800	1,360	1,360	1,160
saturated	ohm-cm		1,120	1,840	1,040	408	244
pH			7.3	7.0	6.5	6.9	5.0
Electrical							
Conductivity	mS/cm		0.11	0.09	0.09	1.20	2.39
Chemical Analyses							
Cations							
calcium	Ca2+	mg/kg	45	39	32	164	481
magnesium	Mg2+	mg/kg	13	11	10	106	320
sodium	Na1+	mg/kg	69	51	73	827	1,748
potassium	K1+	mg/kg	7.8	13	10	168	321
Anions							
carbonate	CO32-	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO31	mg/kg	79	79	67	201	ND
fluoride	F1-	mg/kg	3.7	3.1	7.4	ND	ND
chloride	Cl1-	mg/kg	19	11	23	349	599
sulfate	SO42-	mg/kg	134	94	79	1,637	5,384
phosphate	PO43-	mg/kg	2.5	2.1	5.6	ND	ND
Other Tests							
ammonium	NH41+	mg/kg	ND	ND	ND	62	107
nitrate	NO31-	mg/kg	2.8	1.1	6.0	0.7	105
sulfide	S2-	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0699LAB

20-Jul-11

Sample ID		G-145 @ 95.5' SM w/gravel	G-145 @ 115.5' Sandy CL	G-148 @ 80.5' Sandy ML/SW	G-148 @ 90.5' SM	G-148 @ 110.5' CL-ML
Resistivity	Units					
as-received	ohm-cm	5,600	1,000	1,680	2,040	1,160
saturated	ohm-cm	2,840	1,000	1,680	1,920	1,160
pH		7.8	8.3	8.0	7.7	7.8
Electrical						
Conductivity	mS/cm	0.06	0.15	0.07	0.07	0.07
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	22	65	28	29	32
magnesium	Mg ²⁺ mg/kg	6.4	15	8.7	9.1	9.2
sodium	Na ¹⁺ mg/kg	42	75	46	44	51
potassium	K ¹⁺ mg/kg	3.8	22	3.8	5.0	7.0
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	58	253	67	52	125
fluoride	F ¹⁻ mg/kg	3.1	5.1	3.2	3.1	4.9
chloride	Cl ¹⁻ mg/kg	15	10	18	17	4.5
sulfate	SO ₄ ²⁻ mg/kg	50	122	65	68	43
phosphate	PO ₄ ³⁻ mg/kg	2.9	2.0	2.9	2.8	5.1
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	ND	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻ mg/kg	1.9	ND	2.9	1.9	0.9
sulfide	S ²⁻ qual	Negative	Negative	Negative	Negative	Negative
Redox	mV	66	28	43	99	47

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

MACTEC Engineering, Inc.

Westside Extension

Your #4953-10-1561, HDR|Schiff #11-0699LAB

20-Jul-11

Sample ID		G-148 @ 120.5' SC	G-200 Alt @ 70.5' Sandy CL	G-200 Alt @ 80.5' SC	G-200 Alt @ 90.5' CL/ML	G-200 Alt @ 100.5' Sandy CL
Resistivity						
	Units					
as-received	ohm-cm	4,800	2,200	3,880	1,760	1,760
saturated	ohm-cm	1,440	2,200	3,400	1,760	640
pH		7.7	8.1	8.1	8.1	8.5
Electrical						
Conductivity	mS/cm	0.11	0.09	0.09	0.18	0.31
Chemical Analyses						
Cations						
calcium	Ca ²⁺ mg/kg	63	67	58	92	156
magnesium	Mg ²⁺ mg/kg	12	11	12	19	37
sodium	Na ¹⁺ mg/kg	69	46	43	70	104
potassium	K ¹⁺ mg/kg	13	5.6	13	24	52
Anions						
carbonate	CO ₃ ²⁻ mg/kg	ND	18	18	12	ND
bicarbonate	HCO ₃ ¹⁻ mg/kg	259	160	160	302	290
fluoride	F ¹⁻ mg/kg	3.6	4.7	2.7	4.8	3.9
chloride	Cl ¹⁻ mg/kg	3.4	6.3	3.8	5.3	4.7
sulfate	SO ₄ ²⁻ mg/kg	66	26	17	65	504
phosphate	PO ₄ ³⁻ mg/kg	2.0	ND	1.9	ND	ND
Other Tests						
ammonium	NH ₄ ¹⁺ mg/kg	ND	ND	ND	ND	0.6
nitrate	NO ₃ ¹⁻ mg/kg	ND	1.8	0.7	0.7	ND
sulfide	S ²⁻ qual	Negative	Negative	Negative	Negative	Positive
Redox	mV	20	28	9	43	-163

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1: soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Sample(s)

MACTEC

Westside Extension

Your #4953-10-1561, SA #11-0229LAB

3-Mar-11

Sample ID			161 @ 70' CL	161 @ 110' CL / CL-CH	162 @ 60' CL with Sand	162 @ 93' CL / CL-CH	164 @ 30' Clayey ML
Resistivity	Units						
as-received	ohm-cm		1,600	1,200	2,200	1,400	1,800
saturated	ohm-cm		1,400	1,120	1,000	1,120	1,720
pH			7.8	7.7	7.7	7.6	7.5
Electrical							
Conductivity	mS/cm		0.08	0.05	0.08	0.06	0.08
Chemical Analyses							
Cations							
calcium	Ca ²⁺	mg/kg	34	25	46	34	25
magnesium	Mg ²⁺	mg/kg	9.4	8.4	11	9.3	5.6
sodium	Na ¹⁺	mg/kg	62	50	50	47	91
potassium	K ¹⁺	mg/kg	6.9	3.1	11	5.8	3.1
Anions							
carbonate	CO ₃ ²⁻	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	116	64	110	82	92
fluoride	F ¹⁻	mg/kg	6.2	6.2	4.6	5.3	1.8
chloride	Cl ¹⁻	mg/kg	9.3	6.3	15	23	29
sulfate	SO ₄ ²⁻	mg/kg	82	36	79	30	62
phosphate	PO ₄ ³⁻	mg/kg	6.1	5.2	0.6	2.4	17
Other Tests							
ammonium	NH ₄ ¹⁺	mg/kg	ND	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻	mg/kg	2.6	1.8	2.8	4.7	0.5
sulfide	S ²⁻	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed


Table 1 - Laboratory Tests on Soil Sample(s)
MACTEC
Westside Extension
Your #4953-10-1561, SA #11-0229LAB
3-Mar-11

Sample ID			164	164	181	181
			@ 54.5'	@ 75'	@ 100'	@ 110'
			CL	SP	CL	ML with Sand
Resistivity		Units				
as-received		ohm-cm	1,080	4,800	1,400	2,680
saturated		ohm-cm	600	3,200	960	2,280
pH			7.4	7.8	7.6	7.5
Electrical						
Conductivity		mS/cm	0.17	0.07	0.06	0.04
Chemical Analyses						
Cations						
calcium	Ca ²⁺	mg/kg	72	21	39	21
magnesium	Mg ²⁺	mg/kg	20	5.1	10	5.5
sodium	Na ¹⁺	mg/kg	87	58	53	42
potassium	K ¹⁺	mg/kg	16	4.6	7.6	5.5
Anions						
carbonate	CO ₃ ²⁻	mg/kg	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	387	64	73	46
fluoride	F ¹⁻	mg/kg	4.7	2.6	7.5	6.0
chloride	Cl ¹⁻	mg/kg	37	20	22	19
sulfate	SO ₄ ²⁻	mg/kg	26	61	21	16
phosphate	PO ₄ ³⁻	mg/kg	ND	4.7	2.0	3.4
Other Tests						
ammonium	NH ₄ ¹⁺	mg/kg	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻	mg/kg	4.2	2.8	5.2	5.4
sulfide	S ²⁻	qual	na	na	na	na
Redox		mV	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Sample(s)
MACTEC Engineering & Consulting, Inc.
Westside Extension
Your #4953-10-1561, HDR|Schiff #11-0482LAB
25-May-11

Sample ID			G-165 @ 67' CL	G-165 @ 109' SC	S-108 @ 63-64' ML/CL	S-108 @ 75.5'-76.5' CL/CH	S-108 @ 82-83' ML/CL
Resistivity							
	Units						
as-received	ohm-cm		1,000	810	1,880	4,000	2,320
saturated	ohm-cm		600	680	1,040	1,560	1,560
pH			7.7	7.8	8.2	8.0	8.0
Electrical							
Conductivity	mS/cm		0.24	0.42	0.18	0.15	0.15
Chemical Analyses							
Cations							
calcium	Ca ²⁺	mg/kg	106	189	73	74	71
magnesium	Mg ²⁺	mg/kg	13	24	19	17	19
sodium	Na ¹⁺	mg/kg	123	172	94	76	76
potassium	K ¹⁺	mg/kg	16	18	20	6.8	6.2
Anions							
carbonate	CO ₃ ²⁻	mg/kg	ND	ND	ND	12	9.0
bicarbonate	HCO ₃ ¹⁻	mg/kg	329	256	381	226	245
fluoride	F ¹⁻	mg/kg	3.6	2.7	7.9	5.6	4.3
chloride	Cl ¹⁻	mg/kg	172	432	48	43	38
sulfate	SO ₄ ²⁻	mg/kg	8.8	53	27	24	14
phosphate	PO ₄ ³⁻	mg/kg	ND	ND	2.0	ND	ND
Other Tests							
ammonium	NH ₄ ¹⁺	mg/kg	ND	0.8	ND	ND	ND
nitrate	NO ₃ ¹⁻	mg/kg	7.4	ND	1.0	ND	ND
sulfide	S ²⁻	qual	na	na	na	na	na
Redox		mV	na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Sample(s)*MACTEC Engineering & Consulting, Inc.**Westside Extension**Your #4953-10-1561, HDR|Schiff #11-0482LAB**25-May-11*

Sample ID S-108
@ 97-98'
CL/SC

Resistivity	Units	
as-received	ohm-cm	2,680
saturated	ohm-cm	1,800

pH	8.0
----	-----

Electrical Conductivity	mS/cm	0.14
-------------------------	-------	------

Chemical Analyses**Cations**

calcium	Ca ²⁺	mg/kg	57
magnesium	Mg ²⁺	mg/kg	18
sodium	Na ¹⁺	mg/kg	79
potassium	K ¹⁺	mg/kg	7.2

Anions

carbonate	CO ₃ ²⁻	mg/kg	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	311
fluoride	F ¹⁻	mg/kg	2.7
chloride	Cl ¹⁻	mg/kg	39
sulfate	SO ₄ ²⁻	mg/kg	11
phosphate	PO ₄ ³⁻	mg/kg	ND

Other Tests

ammonium	NH ₄ ¹⁺	mg/kg	ND
nitrate	NO ₃ ¹⁻	mg/kg	ND
sulfide	S ²⁻	qual	na
Redox	mV		na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Samples

AMEC E&I
Westside Subway Extension
Your #4953-10-1561, HDR|Schiff #11-0633LAB
7-Jul-11

Sample ID			S-109 @ 30-31' CL	S-109 @ 53-54' CL	S-109 @ 65-66' ML	S-109 @ 77-78' ML	S-109 @ 92-93' ML
Resistivity							
	Units						
as-received	ohm-cm		1,480	1,440	1,640	4,200	2,440
saturated	ohm-cm		1,480	1,200	1,160	2,520	2,400
pH			6.7	7.1	7.0	7.2	4.0
Electrical							
Conductivity	mS/cm		0.07	0.06	0.10	0.06	0.08
Chemical Analyses							
Cations							
calcium	Ca ²⁺	mg/kg	24	24	37	27	30.8
magnesium	Mg ²⁺	mg/kg	7.6	7.8	11	7.6	9.2
sodium	Na ¹⁺	mg/kg	64	46	58	41	46
potassium	K ¹⁺	mg/kg	2.4	6.7	6.6	5.6	5.8
Anions							
carbonate	CO ₃ ²⁻	mg/kg	ND	ND	ND	ND	ND
bicarbonate	HCO ₃ ¹⁻	mg/kg	76	73	82	61	70
fluoride	F ¹⁻	mg/kg	4.0	4.3	4.1	4.7	2.6
chloride	Cl ¹⁻	mg/kg	15	8.8	17	12	20
sulfate	SO ₄ ²⁻	mg/kg	53	49	84	56	79
phosphate	PO ₄ ³⁻	mg/kg	2.0	2.7	2.0	2.0	1.6
Other Tests							
ammonium	NH ₄ ¹⁺	mg/kg	ND	ND	ND	ND	ND
nitrate	NO ₃ ¹⁻	mg/kg	ND	1.6	ND	0.8	ND
sulfide	S ²⁻	qual	na	na	na	na	na
Redox	mV		na	na	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

Table 1 - Laboratory Tests on Soil Sample(s)
MACTEC Engineering & Consulting, Inc.
Westside Extension
Your #4953-10-1561, HDR|Schiff #11-0498LAB
31-May-11

Sample ID			S-107 @ 102-103' ML	S-107 @ 121-122' ML	S-111 @ 52-53' CL w/sand	S-111 @ 81-82' SM	G-130 @ 45' Sandy CL
Resistivity							
	Units						
as-received	ohm-cm		3,480	3,400	1,920	5,200	1,280
saturated	ohm-cm		480	800	760	3,280	880
pH			8.0	8.2	7.6	7.9	8.0
Electrical							
Conductivity	mS/cm		0.58	0.29	0.12	0.06	0.39
Chemical Analyses							
Cations							
calcium	Ca ²⁺	mg/kg	244	113	40	19	95
magnesium	Mg ²⁺	mg/kg	102	43	11	5.3	40
sodium	Na ¹⁺	mg/kg	124	80	60	52	248
potassium	K ¹⁺	mg/kg	68	79	6.3	5.1	44
Anions							
carbonate	CO ₃ ²⁻	mg/kg	ND	9.0	ND	ND	12
bicarbonate	HCO ₃ ¹⁻	mg/kg	354	245	92	43	231
fluoride	F ¹⁻	mg/kg	1.1	2.5	4.6	2.1	2.0
chloride	Cl ¹⁻	mg/kg	57	48	45	32	40
sulfate	SO ₄ ²⁻	mg/kg	921	318	39	50	554
phosphate	PO ₄ ³⁻	mg/kg	ND	ND	1.3	3.1	ND
Other Tests							
ammonium	NH ₄ ¹⁺	mg/kg	12	3.3	ND	ND	2.2
nitrate	NO ₃ ¹⁻	mg/kg	1.1	ND	3.4	1.0	ND
sulfide	S ²⁻	qual	na	Trace	na	na	na
Redox		mV	na	-97	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed



SOIL CORROSIVITY EVALUATION
for the
WESTSIDE PURPLE LINE EXTENSION
REACHES 4 AND 5

in
LOS ANGELES, CALIFORNIA

prepared for

AMEC FOSTER WHEELER

6001 Rickenbacker Road

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Project No.: 4953-11-1423

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HDR #264097 REV02

December 18, 2015

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Introduction

The existing subway system is owned and operated by Los Angeles County Metropolitan Transportation Authority (MTA) and provides public transportation throughout the City of Los Angeles, and surrounding areas.

The proposed tunnel configuration for the subway consists of dual 18-foot-10-inch diameter tunnels of the same length and at the same depth, separated horizontally by approximately 20 feet. Tunnels will be constructed in a side-by-side configuration using either a slurry-shield tunnel boring machine (Slurry TBM) or an earth pressure balance tunnel boring machine (EPB TBM).

Tunnel Reach 4 is the portion of the tunnel alignment between the proposed Tail Tracks in Section 1 (just west of the Wilshire/La Cienega Station) and the proposed Wilshire/Rodeo Station. Tunnel Reach 5 is the portion of the tunnel alignment between the proposed Wilshire/Rodeo and Century City Constellation Stations. Based on the current plans dated June 2015, the tunnels in Reaches 4 and 5 are about 1.03 and 1.10 miles long, respectively. The depth to tunnel invert varies from 65 to 110 feet below ground surface (bgs) in Tunnel Reach 4 and from 80 to 135 feet bgs in Tunnel Reach 5. In addition, cross-passages between the tunnels are typically spaced at about 800 feet along the alignment. Excavations of cross-passages are performed using conventional methods.

Ground water was encountered at depths of about 24 to 64.5 feet below ground surface. The tunnel will include pre-cast concrete segments, utility piping (if any), concrete lining for cross passages, and steel lining in contact with soil.

An analysis of soil corrosivity along Reaches 4 and 5 alignments was requested. Laboratory tests on the soil samples provided by AMEC Foster Wheeler (AMEC) have been completed. A total of 40 samples were selected by AMEC for analysis: 32 samples from Reach 4 and Reach 5 were tested by HDR Engineering, Inc. (HDR), 4 samples were originally tested by AP Engineering, Inc. (AP), and an additional 4 samples were tested by AP on October 22, 2015. HDR assumes that the samples selected are representative of the most corrosive soils at the site.

The scope of this study is limited to a determination of soil corrosivity, estimated corrosion rates and Romanoff similitude analysis for metal loss of steel exposed to on-site soils, and general corrosion control recommendations for materials planned for construction. A study of the impact of the DC powered heavy rail system was not detailed as part of the scope work in this project. This report has been revised to include a Romanoff similitude analysis

and provide additional recommendations for materials planned for construction. This report was revised a second time to address additional soil sample test results that became available.

Laboratory Soil Corrosivity Tests

The electrical resistivity of each sample was measured in a soil box per ASTM G187 in its as-received condition and again after saturation with distilled water. Resistivities are at about their lowest value when the soil is saturated. The pH of the saturated samples was measured per CTM 643. A 5:1 water:soil extract from each sample was chemically analyzed for the major soluble salts commonly found in soil per ASTM D4327, ASTM D6919, and Standard Method 2320-B¹. Sulfide and oxidation-reduction (redox) potential were determined on samples from borings G-135, G-137, G-140 and G-141 from Reach 4; G-145 and G-148 from Reach 5 per ASTM G200 and AWWA C105 Appendix A.

Laboratory analysis was performed under various HDR laboratory numbers in 2011: 11-0457LAB, 11-0482LAB, 11-0647LAB, 11-0699LAB, 11-0750LAB, and 11-0948LAB for Reach 4 and 11-0229LAB, 11-0482LAB, 11-0498LAB, 11-0633LAB, 11-0647LAB, and 11-0699LAB for Reach 5. The test results are summarized in the attached Table 1 and Table 2.

Laboratory testing conducted by AP on April 20, 2015, under job #15-0361 was reportedly performed per CTM 643 for resistivity and pH, CTM 417 for sulfate concentration, and CTM 422 for chloride concentration. Additional testing conducted by AP on October 22, 2015, was completed under job #15-1004. The provided test results are shown in the attached Table 3 and 4.

Soil Corrosivity

A major factor in determining soil corrosivity is electrical resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil resistivity.

¹ American Public Health Association (APHA). 2012. *Standard Methods of Water and Wastewater*. 22nd ed. American Public Health Association, American Water Works Association, Water Environment Federation publication. APHA, Washington D.C.

Lower electrical resistivities result from higher moisture and soluble salt contents and indicate corrosive soil.

A correlation between electrical resistivity and corrosivity toward ferrous metals is:²

Soil Resistivity in ohm-centimeters	Corrosivity Category
Greater than 10,000	Mildly Corrosive
2,001 to 10,000	Moderately Corrosive
1,001 to 2,000	Corrosive
0 to 1,000	Severely Corrosive

Other soil characteristics that may influence corrosivity towards metals are pH, soluble salt content, soil types, aeration, anaerobic conditions, and site drainage.

Electrical resistivities were in the mildly corrosive to corrosive categories with as-received moisture. When saturated, the resistivities were in the moderately to severely corrosive categories. Some as-received resistivities were near their saturated values.

Soil pH values varied from 6.5 to 8.4. This range is slightly acidic to moderately alkaline.³ These values do not particularly increase soil corrosivity. Soil with a pH range of 6.5 to 7.5 can support sulfate-reducing bacteria.⁴

The soluble salt content of the samples ranged from low to moderate.

Additional testing results reported boring G-406@110.5 feet as having sulfate salts as the predominant constituent. High concentrations of sulfate, as was measured in this soil sample, can react with components in concrete to cause degradation and reduced strength in a mechanism known as sulfate attack.

Ammonium and nitrate were detected in low concentrations.

Sulfide, which is aggressive to copper and ferrous metals, was found to be present in a qualitative test performed on the samples from borings G-140 and G141 from Reach 4.

² Romanoff, Melvin. *Underground Corrosion*, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, pp. 166–167.

³ Romanoff, Melvin. *Underground Corrosion*, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, p. 8.

⁴ ANSI/AWWA C105 Appendix A

The negative redox potential measured on the samples indicates reducing conditions in which anaerobic, sulfide-producing bacteria are active.

The variation in soil types and soil resistivities of an order of magnitude or more can create differential-aeration corrosion cells that would affect all metals.

Corrosion Loss for Steel Exposed to Soils

Corrosion rates of metals in soils depend on construction details, soil moisture, etc., in addition to soil corrosivity, and are, therefore, difficult to predict. Data for corrosion of ferrous metals in a variety of soils was compiled by Melvin Romanoff of the National Bureau of Standards in a Circular 579 entitled Underground Corrosion. The basic methodology was to identify the representative soil characteristics most likely to be encountered at the project site and then use the data presented in Circular 579 to calculate the corrosion rates based upon the similitude between the soils documented and the soils anticipated at the site.

It is assumed for this evaluation that the steel tunnel lining will not come into contact with concrete. The pH differential created by the steel in partial contact with both soil and concrete would significantly increase the corrosion rate of the steel near the concrete/soil boundary that is not accounted for in this analysis.

Based on the laboratory results on 32 soil samples, Soil 2 listed in Table 6 of Romanoff's Circular 579 was selected as the soil of similar composition for bare steel. Based on Soil 2, a factor of safety of 2.0 and single-sided corrosion, a uniform corrosion rate of approximately 1.36 mils per year (mpy) was estimated for bare steel lining exposed to site soils.

Uniform corrosion is not the only type of corrosion that can occur on buried metals. Localized corrosion in the form of pitting can also occur. This localized attack is an exacerbated form of corrosion. In the case of steel lining, pitting corrosion would be such that perforation of the steel lining could occur. Pitting rates were investigated using similitude analysis of the tested soil samples. Based on soil 2, a factor of safety of 2.0, a single-sided pitting corrosion rate of approximately 6.60 mpy was estimated for bare steel lining exposed to site soils.

Conclusions

This soil is classified as severely corrosive to ferrous metals, severe for sulfate attack on concrete, and could subject metal to microbial induced corrosion.

It is estimated that the uniform and pitting corrosion rates for bare steel exposed to on-site soils is approximately 1.36 mpy and 6.60 mpy, respectively.

A study of the impact of the DC powered heavy rail system was not detailed as part of the scope work in this project. Such a study should be pursued.

Due to the nature and magnitude of the project and the long design service life requirements, tolerance for corrosion on all project components is low. Based on the need for high reliability and the corrosivity considerations discussed above, it is clear that corrosion protection must be provided for the components exposed to the environment discussed with consideration given to the level of risk and practicality.

Corrosion Control Recommendations

The life of buried materials depends on thickness, strength, loads, construction details, soil moisture, etc., in addition to soil corrosivity, and is, therefore, difficult to predict. Of more practical value are corrosion control methods that will increase the life of materials that would be subject to significant corrosion.

The following recommendations are based on the soil conditions discussed in the Soil Corrosivity section above. Unless otherwise indicated, these recommendations apply to the entire site or alignment.

DC Stray Current

A study of the impact of the DC powered heavy rail system was not detailed as part of the scope work in this project. It is recommended that the client pursue such a study in order to take the necessary precautions to avoid the deleterious effects known to result from DC stray current.

Tunnel

Prestressed Concrete Segments

1. Protect concrete structures and pipe from sulfate attack in soil with a severe sulfate concentration, 0.20 to 2.0 percent. Use ASTM C150 Type V cement, a maximum

water/cement ratio of 0.45, and minimum strength of 4,500 psi per applicable code.
5,6,7

2. Standard concrete cover over the reinforcing steel may be used for prestressed concrete segments in contact with these soils due to the low chloride concentration¹¹ found onsite.
3. Due to the high ground water table encountered along the alignment, cyclical or continual wetting may be an issue. Any contact between prestressed concrete segments and ground water should be prevented. Contact can be prevented with an impermeable waterproofing system.

Pre-Cast Concrete Segments

1. It is assumed that pre-cast concrete segments will contain about 8 sacks of ASTM C150 Type V cement per cubic yard of concrete, a water/cement ratio not exceeding 0.45, and a minimum of 2 inches of concrete cover. No further corrosion control measures are required for such segments.
2. Any contact between pre-cast concrete segments and ground water should be prevented. Contact can be prevented with an impermeable waterproofing system.

Cast-in-Place Concrete (Lining for Cross Passages)

1. Protect concrete structures and pipe from sulfate attack in soil with a severe sulfate concentration, 0.20 to 2.0 percent. Use ASTM C150 Type V cement, a maximum water/cement ratio of 0.45, and minimum strength of 4,500 psi per applicable code.
12,13,14

⁵ 2012 International Building Code (IBC) Section 1904.3

⁶ 2012 International Residential Code (IRC) which refers to American Concrete Institute (ACI) 318 Table 19.3.2.1

⁷ 2013 California Building Code (CBC) which refers to American Concrete Institute (ACI) 318 Table 19.3.2.1

¹¹ AWWA Manual M9, Concrete Pressure Pipe

¹² 2012 International Building Code (IBC) Section 1904.3

¹³ 2012 International Residential Code (IRC) which refers to American Concrete Institute (ACI) 318 Table 19.3.2.1

¹⁴ 2013 California Building Code (CBC) which refers to American Concrete Institute (ACI) 318 Table 19.3.2.1

2. Standard concrete cover over reinforcing steel may be used for cast-in-place concrete lining in contact with these soils due to the low chloride concentration¹⁸ found onsite.
3. Due to the high ground water table encountered at this site, cyclical or continual wetting may be an issue. Any contact between cast-in-place concrete lining and ground water should be prevented. Contact can be prevented with an impermeable waterproofing system.

Steel Lining (Seismic Zones)

1. Steel is most susceptible to corrosion in disturbed soil where oxygen is available. Choose one of the following corrosion control alternatives.

ALTERNATIVE 1: DIELECTRICALLY COAT STEEL LINING

Coat the steel lining with epoxy or polyurethane intended for underground use. Abrasive blast and apply to 25-mil thickness per the coating manufacturer's recommendations. Provide shop and field NACE CIP Level 3 coating inspection.

ALTERNATIVE 2: CONCRETE-ENCASE STEEL LINING

Provide full concrete encasement of the steel lining such that there is no soil contact of the steel. Avoid partial concrete encasement to eliminate the formation of unfavorable pH concentration cells. If partial concrete encasement is unavoidable, then provide a dielectric coating per alternative 1 prior to concrete encasement.

ALTERNATIVE 3: CORROSION ALLOWANCE FOR BARE STEEL LINING

Provide a corrosion allowance of 6.6 mils (0.0066 inches) per year for the duration of the projected tunnel service life.

High-Density Polyethylene (HDPE) Liners and Rubber Gaskets

1. Avoid gouges, scratches, rock impingements and other stress concentrations.
2. Ensure that welded joints are fully-fused.

¹⁸ Design Manual 303: Concrete Cylinder Pipe. Ameron. p.65

3. Protect the materials from long-term exposure to sunlight, elevated temperatures, and strong oxidants.
4. Perform additional exposure tests if the materials will be exposed to any soil that contains transition metals, such as those potentially from mining operation spoils.

Utilities (if any)

Steel Pipe

Implement *all* the following measures.

1. Underground steel pipe with rubber gasketed, mechanical, grooved end, or other nonconductive type joints should be bonded for electrical continuity. For pipe diameters less than 18 inches use two joint bonds. For pipe diameters greater than or equal to 18 inches use three joint bonds. Electrical continuity is necessary for corrosion monitoring and cathodic protection.
2. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
 - a. Two- or four-wire test stations at each end of the pipeline depending on how the pipe terminates.
 - b. Four-wire test stations at all buried insulating joints.
 - c. Four-wire test stations at each end of all casings.
 - d. Two-wire test stations at other locations as necessary so the interval between test stations does not exceed 1,200 feet.

Where 4-wire test stations are required, use wires of difference size or insulation color for identification. Each wire should be independently welded or pin-brazed to the pipe.

3. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically isolate each buried steel pipeline per NACE SP0286 from:
 - a. Pumping plants.

- b. Reservoirs.
- c. Flow meters.
- d. Motorized operated valves.
- e. Dissimilar metals.
- f. Dissimilarly coated piping (cement-mortar vs. dielectric).
- g. Above ground steel pipe.
- h. All existing piping.

Insulated joints should be placed above grade or in vaults where possible. Wrap all buried insulators with wax tape per AWWA C217.

- 4. Prevent contact between the steel pipe and concrete and/or reinforcing steel, such as at wall penetrations and thrust blocks, with such items as plastic sleeves, rubber seals, or 20 mil plastic tape.
- 5. Apply a suitable dielectric coating intended for underground use such as:
 - a. Polyurethane per AWWA C222 *or*
 - b. Extruded polyethylene per AWWA C215 *or*
 - c. A tape coating system per AWWA C214 *or*
 - d. Hot applied coal tar enamel per AWWA C203 *or*
 - e. Fusion bonded epoxy per AWWA C213.
- 6. Buried steel and iron pipe, fittings, and valves in appurtenances, such as air valves and blowoffs, should be coated with a material listed above or with coal-tar epoxy, wax tape, moldable sealant, or equivalent. If copper is used, electrically insulate it from the steel with an insulating joint or with a dielectric union and protect as described below.
- 7. Apply cathodic protection to steel piping as per NACE SP0169.
- 8. To ensure that corrosion control is properly designed, preliminary construction drawings should be reviewed by a qualified corrosion engineer.

9. After the pipeline is backfilled, but before the construction contract is completed, the pipeline should be tested to ensure that the joint bonds are intact and test stations properly installed. Also, native pipe-to-soil potentials should be measured and recorded. These data will be useful in determining if pipeline conditions change in the future.

Iron Pipe

Implement *all* the following measures:

1. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically isolate each buried iron pipeline per NACE SP0286 from:
 - a. Pumping systems.
 - b. Flow meters.
 - c. Motorized operated valves.
 - d. Dissimilar metals.
 - e. Dissimilarly coated piping (cement-mortar vs. dielectric).
 - f. Above ground iron pipe.
 - g. All existing piping.

Insulated joints should be placed above grade or in vaults where possible. Wrap all buried insulators with wax tape per AWWA C217.

2. Bond all nonconductive type joints for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection. For pipe diameters less than 18 inches use two joint bonds. For pipe diameters greater than or equal to 18 inches use three joint bonds. Electrical continuity is necessary for corrosion monitoring and cathodic protection.
3. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
 - a. Two- or four-wire test stations at each end of the pipeline depending on how the pipe terminates.

- b. Four-wire test stations at all buried insulating joints.
- c. Four-wire test stations at each end of all casings.
- d. Two-wire test stations at other locations as necessary so the interval between test stations does not exceed 1,200 feet.

Where 4-wire test stations are required, use wires of difference size or insulation color for identification. Each wire should be independently welded or pin-brazed to the pipe.

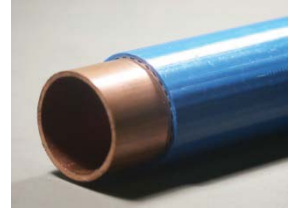
- 4. Use iron pipe, fittings, and valves in appurtenances to the extent possible to avoid creating dissimilar metal corrosion cells. Steel appurtenances such as bolts should be coated with wax tape per AWWA C217. If copper is used, electrically isolate it from the iron and protect as described below.
- 5. Prevent contact between iron and concrete including reinforcing steel, using such items as plastic sleeves, rubber seals, two layers of 8 mil thick polyethylene plastic, or 20 mil plastic tape.
- 6. Conditions on-site have the potential to create a uniquely severe environment, as defined by AWWA C105 Appendix A. In these rare circumstances, a coating system, including polyethylene encasement, is NOT advisable.
- 7. Apply cathodic protection to cast and ductile iron piping as per NACE SP0169.

Copper Pipe

Implement *all* the following measures:

- 1. Electrically insulate underground copper pipe from dissimilar metals and from above ground copper pipe with insulating devices per NACE SP0286.
- 2. Electrically insulate cold water piping from hot water piping systems.
- 3. Protect buried copper tubing by one of the following measures:
 - a. Prevention of soil contact. Soil contact may be prevented by placing the tubing above ground or encasing the tubing using PVC pipe with solvent-welded joints.

- b. Installation of a factory-coated copper pipe with a minimum 25-mil thickness such as Kamco's Aqua Shield™, Mueller's Streamline Protec™, or equal. The coating must be continuous with no cuts or defects.
- c. Installation of 12-mil polyethylene pipe wrapping tape with butyl rubber mastic over a suitable primer. Protect wrapped copper tubing by applying cathodic protection per NACE SP0169.



Plastic and Vitrified Clay Pipe

- 1. No special precautions are required for plastic and vitrified clay piping placed underground from a corrosion viewpoint.
- 2. Protect all metallic fittings and valves with wax tape per AWWA C217 or epoxy.

All Pipe

- 1. On all pipes, appurtenances, and fittings not protected by cathodic protection or encased in concrete, coat pipe specials such as valves, bolts, flange joints, joint harnesses, and flexible couplings with wax tape per AWWA C217 after assembly.
- 2. Where metallic pipelines penetrate concrete structures such as building floors, vault walls, and thrust blocks use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.

Closure

The analysis and recommendations presented in this report are based upon data obtained from the laboratory samples. This report does not reflect variations that may occur across the site or due to the modifying effects of construction. If variations appear, HDR should be notified immediately so that further evaluation and supplemental recommendations can be provided.

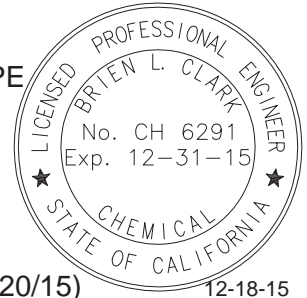
HDR's services have been performed with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended.

Please call if you have any questions.

Respectfully Submitted,
HDR Engineering, Inc.

Jose Peña

Brien L. Clark, PE



Enc: Table 1 – Summary of Laboratory Tests on Soil Samples (Reach 4)
Table 2 – Summary of Laboratory Tests on Soil Samples (Reach 5)
Table 3 – AP Engineering & Testing, Inc. Corrosion Test Results (4/20/15)
Table 4 – AP Engineering & Testing, Inc. Corrosion Test Results (10/22/15)

264097-SCS_Rpt_Reach4&5_JP_LQ_Rev02_JP_BC.docx



Table 1 - Summary of Laboratory Tests on Soil Samples

*AMEC Foster Wheeler
Westside Purple Line Extension - Reach 4
AMEC #4953-11-1423; HDR #264097*

Sample ID	Resistivity		pH	EC ^a (mS-cm)	Chemical Analysis (mg/kg) ^b												Qual. Sulfide ^c	Redox ^d (mV)
	As-received (ohm-cm)	Saturated (ohm-cm)			Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	SO ₄	PO ₄	NH ₄	NO ₃		
G-140 @ 71'	3,400	2,360	8.0	0.18	96	20	68	25	ND ^e	323	0.6	22	130	ND	1.9	ND	Positive	-206
G-133 @ 74'	1,280	1,080	8.0	0.24	103	24	99	35	ND	360	3.8	37	186	ND	2.2	1.3	na ^f	na
G-134 @ 76'	4,000	1,840	8.1	0.13	72	16	61	5.7	12	183	5.3	31	31	ND	ND	ND	na	na
S-108 @ 82-83'	2,320	1,560	8.0	0.15	71	19	76	6.2	9.0	245	4.3	38	14	ND	ND	ND	na	na
S-108 @ 97-98'	2,680	1,800	8.0	0.14	57	18	79	7.2	ND	311	2.7	39	11	ND	ND	ND	na	na
G-136 @ 105'	3,920	3,440	7.8	0.10	43	12	52	7.3	ND	113	1.7	23	82	ND	ND	2.3	na	na
G-142 @ 50.5'	1,320	880	7.6	0.24	95	30	91	39	ND	125	1.8	15	405	ND	1.8	2.1	na	na
G-142 @ 70.5'	5,200	1,520	7.8	0.21	102	25	74	26	ND	195	1.5	23	297	ND	ND	11	na	na
G-143 @ 40.5'	144,000	4,040	7.8	0.08	29	9.2	53	5.4	ND	37	2.3	9.2	104	1.8	ND	18	na	na
G-139 @ 80'	1,920	1,920	7.9	0.14	67	15	70	10	12	263	0.9	9.6	36	ND	ND	ND	na	na
G-135 @ 86'	6,000	2,800	8.1	0.09	43	15	49	6.3	ND	195	3.9	13	35	3.1	ND	ND	Negative	22
G-135 @ 92'	11,600	4,400	7.8	0.08	42	12	43	7.0	ND	156	2.1	23	62	1.7	1.1	1.0	Negative	37
G-137 @ 85'	2,560	1,800	8.4	0.13	49	26	81	7.4	18	249	5.3	3.4	22	ND	ND	ND	Negative	46
G-137 @ 103'	1,800	1,440	8.2	0.11	41	23	72	11	9.0	224	3.8	2.9	18	ND	ND	ND	Negative	58
G-141 @ 65'	1,480	1,320	7.8	0.16	83	20	83	23	6.0	323	1.1	6.0	48	ND	2.9	1.8	Positive	-115
G-141 @ 80.5'	1,760	1,120	8.0	0.15	56	15	78	29	ND	183	2.4	38	132	ND	3.9	ND	Positive	-65

^a Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

^b milligrams per kilogram (parts per million) of dry soil.

^c qualitative sulfide

^d oxidation-reduction potential in millivolts

^e not detected

^f not analyzed

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Table 2 - Summary of Laboratory Tests on Soil Samples

*AMEC Foster Wheeler
Westside Purple Line Extension - Reach 5
AMEC #4953-11-1423; HDR #264097*

Sample ID	Resistivity		pH	EC ^a (mS-cm)	Chemical Analysis (mg/kg) ^b												Qual. Sulfide ^c	Redox ^d (mV)
	As-received (ohm-cm)	Saturated (ohm-cm)			Ca	Mg	Na	K	CO ₃	HCO ₃	F	Cl	SO ₄	PO ₄	NH ₄	NO ₃		
G-161 @ 110'	1,200	1,120	7.7	0.05	25	8.4	50	3.1	ND ^e	64	6.2	6.3	36	5.2	ND	1.8	na ^f	na
G-162 @ 93'	1,400	1,120	7.6	0.06	34	9.3	47	5.8	ND	82	5.3	23	30	2.4	ND	4.7	na	na
G-164 @ 54.5'	1,080	600	7.4	0.17	72	20	87	16	ND	387	4.7	37	26	ND	ND	4.2	na	na
G-164 @ 75'	4,800	3,200	7.8	0.07	21	5.1	58	4.6	ND	64	2.6	20	61	4.7	ND	2.8	na	na
G-165 @ 67'	1,000	600	7.7	0.24	106	13	123	16	ND	329	3.6	172	8.8	ND	ND	7.4	na	na
G-146 @ 66'	1,280	1,120	7.3	0.11	45	13	69	7.8	ND	79	3.7	19	134	2.5	ND	2.8	na	na
G-146 @ 78.5'	4,800	1,840	7.0	0.09	39	11	51	13	ND	79	3.1	11	94	2.1	ND	1.1	na	na
G-166 @ 57'	1,360	1,040	6.5	0.09	32	9.6	73	10	ND	67	7.4	23	79	5.6	ND	6.0	na	na
G-145 @ 61.5'	3,040	1,840	7.8	0.09	36	0.5	67	6.8	ND	140	3.1	13	57	2.8	ND	3.2	Negative	57
G-148 @ 110.5'	1,160	1,160	7.8	0.07	32	9.2	51	7.0	ND	125	4.9	4.5	43	5.1	ND	0.9	Negative	47
G-148 @ 120.5'	4,800	1,440	7.7	0.11	63	12	69	13	ND	259	3.6	3.4	66	2.0	ND	ND	Negative	20
S-111 @ 52-53'	1,920	760	7.6	0.12	40	11	60	6.3	ND	92	4.6	45	39	1.3	ND	3.4	na	na
S-111 @ 81-82'	5,200	3,280	7.9	0.06	19	5.3	52	5.1	ND	43	2.1	32	50	3.1	ND	1.0	na	na
S-109 @ 53-54'	1,440	1,200	7.1	0.06	24	7.8	46	6.7	ND	73	4.3	8.8	49	2.7	ND	1.6	na	na
S-109 @ 65-66'	1,640	1,160	7.0	0.10	37	11	58	6.6	ND	82	4.1	17	84	2.0	ND	ND	na	na
S-109 @ 77-78'	4,200	2,520	7.2	0.06	27	7.6	41	5.6	ND	61	4.7	12	56	2.0	ND	0.8	na	na

^a Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.

^b milligrams per kilogram (parts per million) of dry soil.

^c qualitative sulfide

^d oxidation-reduction potential in millivolts

^e not detected

^f not analyzed

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Table 3



AP Engineering & Testing, Inc.

CORROSION TEST RESULTS

Client Name: AMEC Foster Wheeler
 Project Name: Westside Subway Extension
 Project No.: 4953-11-1423

AP Job No.: 15-0361
 Date: 04/20/15

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-412	14	55	SM	9638	7.7	33	25
G-412	19	68	SM	4270	7.8	143	81
G-412	22 & 23	75-78	ML	2754	7.8	45	42
G-412	24 & 25	80-83	SM	7208	8.0	53	52

NOTES: Resistivity Test and pH: California Test Method 643
 Sulfate Content : California Test Method 417
 Chloride Content : California Test Method 422
 ND = Not Detectable
 NA = Not Sufficient Sample
 NR = Not Requested

Table 4



AP Engineering and Testing, Inc.

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CORROSION TEST RESULTS

Client Name: AMEC Foster Wheeler

AP Job No.: 15-1004

Project Name: Westside Purple Line Extension

Date: 10/22/15

Project No.: 4953-11-1423

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-406	13	65.5	CL	1193	8.0	56	34
G-406	16	78	SM	2886	7.9	181	40
G-406	22	93	CL	1051	7.8	415	56
G-406	26	110.5	CL	476	6.4	3228	56

NOTES: Resistivity Test and pH: California Test Method 643
 Sulfate Content : California Test Method 417
 Chloride Content : California Test Method 422
 ND = Not Detectable
 NA = Not Sufficient Sample
 NR = Not Requested

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t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com**CORROSION TEST RESULTS**Client Name: AMEC Foster WheelerAP Job No.: 15-1041Project Name: Westside Purple Line ExtensionDate: 10/27/15Project No.: 4953-11-1423

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
E-126A	5	25.5	CL	1554	7.6	36	54
E-126A	7	35.5	CL	1286	8.2	45	180
E-126A	11	55.5	CL	1467	7.5	56	66
E-126A	13	65.5	CL	811	7.7	44	90

NOTES: Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

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t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com**CORROSION TEST RESULTS**Client Name: AMEC Foster WheelerAP Job No.: 15-1068Project Name: Westside Purple Line ExtensionDate: 11/10/15Project No.: 4953-11-1423

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-405	15	75.5	CH	932	8.0	28	59
G-405	18	86	CL	1314	7.7	46	65
G-405	25-26	107-110.5	CL	1238	7.9	32	68

NOTES: Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

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Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-406	13	65.5	CL	1193	8.0	56	34
G-406	16	78	SM	2886	7.9	181	40
G-406	22	93	CL	1051	7.8	415	56
G-406	26	110.5	CL	476	6.4	3228	56

NOTES: Resistivity Test and pH: California Test Method 643
 Sulfate Content : California Test Method 417
 Chloride Content : California Test Method 422
 ND = Not Detectable
 NA = Not Sufficient Sample
 NR = Not Requested

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Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-407	10	44	CL	2730	7.5	40	35
G-407	14	56	CL	1001	7.7	47	35
G-407	17	65	SC	1130	7.3	145	41

NOTES: Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
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Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-409	24	114	CL	1461	7.6	87	36
G-409	26	120	CL	1924	8.0	86	23
G-409	28	130	SC	1176	7.6	80	29
G-409	30	139.5	SC	4051	7.8	86	56

NOTES: Resistivity Test and pH: California Test Method 643
 Sulfate Content : California Test Method 417
 Chloride Content : California Test Method 422
 ND = Not Detectable
 NA = Not Sufficient Sample
 NR = Not Requested

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t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com**CORROSION TEST RESULTS**Client Name: AMEC Foster WheelerAP Job No.: 15-1163Project Name: Westside Purple Line ExtensionDate: 12/07/15Project No.: 4953-11-1423

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-410	22	106	CL	1774	7.3	58	210
G-410	25	116	SC	2447	8.2	50	180
G-410	27	123.5	SM	5508	7.5	57	240
G-410	33	144	CL	1107	7.8	49	243

NOTES: Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

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Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-411	7	76.5	CL	1262	7.8	47	42
G-411	8	79	ML	2778	7.6	39	39
G-411	12	93.5	SM	2214	7.5	40	34
G-411	16	109.5	SM	2558	7.6	44	29

NOTES: Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested



AP Engineering & Testing, Inc.

CORROSION TEST RESULTS

Client Name: AMEC Foster Wheeler
Project Name: Westside Subway Extension
Project No.: 4953-11-1423

AP Job No.: 15-0361
Date: 04/20/15

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
G-412	14	55	SM	9638	7.7	33	25
G-412	19	68	SM	4270	7.8	143	81
G-412	22 & 23	75-78	ML	2754	7.8	45	42
G-412	24 & 25	80-83	SM	7208	8.0	53	52

NOTES: Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

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Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
M-402	14	70	CL	1949	7.6	29	58
M-402	16	76	CL	1540	7.8	39	62
M-402	24	100	SC	2062	7.8	70	111
M-402	28	114	CL	1635	7.6	110	119

NOTES: Resistivity Test and pH: California Test Method 643
 Sulfate Content : California Test Method 417
 Chloride Content : California Test Method 422
 ND = Not Detectable
 NA = Not Sufficient Sample
 NR = Not Requested

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)

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**Geotechnical Engineering Center
Department of Civil, Architectural
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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_ MACTEC_001_001

Test Date	7/8/11-7/18/11
Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Summary

Boring No.	Test Depth (ft)	AVS
S-101	60-61	31
S-102	67-68	22.5
S-104	59.5-60.5	14.5
S-104	81-82	35
S-107	57-57.9	23.5
S-108	91-92	13.5
S-109	80-81	11.5
S-110	40.5-41.5	10
S-110	44-45	5
S-111	65-66	27.5
S-114	67-68	38
S-115	89-90 (GM)	5.5
S-115	89-90	8

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Figure D-8.1.1

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)



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Department of Civil, Architectural
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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_MACTEC_001_001
Sample ID.	
Boring No.	S-108
Depth Interval	91-92 ft
Sample received	7/8/2011
Test date	7/18/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	N/A
Soil type description	SC/SM

Test no.	Test 1	Test 2	AVS
Weight loss in mg	15	12	13.5

Photograph of the test sample



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Figure D-8.1.2

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)



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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_MACTEC_001_001
Sample ID.	
Boring No.	S-109
Depth Interval	80-81 ft
Sample received	7/8/2011
Test date	7/17/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	N/A
Soil type description	SC/CL

Test no.	Test 1	Test 2	AVS
Weight loss in mg	13	10	11.5

Photograph of the test sample



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Figure D-8.1.3

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)



The University of Texas at Austin

Geotechnical Engineering Center
Department of Civil, Architectural
and Environmental Engineering

Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_MACTEC_001_001
Sample ID.	
Boring No.	S-111
Depth Interval	65-66 ft
Sample received	7/8/2011
Test date	7/17/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	N/A
Soil type description	SP

Test no.	Test 1	Test 2	AVS
Weight loss in mg	28	27	27.5

Photograph of the test sample



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Figure D-8.1.4

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)

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**Geotechnical Engineering Center
Department of Civil, Architectural
and Environmental Engineering**

Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_ MACTEC_001_003

Test Date	8/19/11-8/23/11
Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Summary

Boring No.	Test Depth (ft)	AVS
S-101	42.6-43.6	20
S-101	53-54	38
S-102	64-65	25.5
S-102	71-72	31.5
S-103A	96-97	2.5
S-103A	101-102	1.5
S-105	96-97	6.5
S-106	52-53	22
S-108	69-70	2.5
S-108	82-83	5
S-108	86-87	8
S-110	71-71.8	7
S-110	81-82	4.5
S-111	59-60	25.5
S-111	78.5-79.5	16
S-116	76-77	2
S-116	91-92	5.5
S-117	64-65	27
S-118	89-90	4

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Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)

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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_MACTEC_001_003
Sample ID.	
Boring No.	S-108
Depth Interval	69-70 ft
Sample received	8/19/2011
Test date	8/23/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	
Soil type description	CL/CH

Test no.	Test 1	Test 2	AVS
Weight loss in mg	3	2	2.5

Photograph of the test sample

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Figure D-8.1.6

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)



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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_MACTEC_001_003
Sample ID.	
Boring No.	S-108
Depth Interval	82-83 ft
Sample received	8/19/2011
Test date	8/23/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	
Soil type description	ML/CL

Test no.	Test 1	Test 2	AVS
Weight loss in mg	5	5	5

Photograph of the test sample



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Figure D-8.1.7

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)



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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_MACTEC_001_003
Sample ID.	
Boring No.	S-108
Depth Interval	86-87 ft
Sample received	8/19/2011
Test date	8/23/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	
Soil type description	GC

Test no.	Test 1	Test 2	AVS
Weight loss in mg	8	8	8

Photograph of the test sample



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Figure D-8.1.8

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)



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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_ MACTEC_001_003
Sample ID.	
Boring No.	S-111
Depth Interval	59-60 ft
Sample received	8/19/2011
Test date	8/23/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	
Soil type description	SP

Test no.	Test 1	Test 2	AVS
Weight loss in mg	26	25	25.5

Photograph of the test sample



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Figure D-8.1.9

Soil Abrasion Test

(SAT: NTNU's new soil abrasion test, Tunnels & Tunnelling International, May 2006, 43-45)

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Department of Civil, Architectural
and Environmental Engineering**

Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, California
UT reference	2011_MACTEC_001_003
Sample ID.	
Boring No.	S-111
Depth Interval	78.5-79.5 ft
Sample received	8/19/2011
Test date	8/23/2011

Tested by	Moo Yeon Kim
Checked by	Mahdi Heidari
Steel test piece condition	Ground and polished by bench grinder
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Geologic unit	
Soil type description	SM

Test no.	Test 1	Test 2	AVS
Weight loss in mg	15	17	16

Photograph of the test sample

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Figure D-8.1.10

Abrasion Value Steel Test

(SAT: NTNU's new soil abrasion test,
Tunnels & Tunnelling International,
May 2006, 43-45)

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Department of Civil, Architectural
and Environmental Engineering****Summary of Abrasion Value Steel Test Results**

Boring Name	Depth (ft)	Test 1	Test 2	AVERAGE
S-107	64.0-65.0	6.3	5.4	5.9
S-109	68.0-69.0	2.1	1.0	1.6
S-114	61.0-62.0	8.8	7.6	8.2
S-115	68.0-69.0	4.5	3.5	4.0
S-104	73.0-74.0	27.8	29.9	28.9
S-104	64.5-65.5	28.8	28.0	28.4
S-107	48.0-49.0	10.4	8.4	9.4
S-115	62.0-63.0	10.4	10.5	10.5
S-109	61.0-62.0	4.1	3.0	3.6
S-114	53.0-54.0	8.5	7.4	8.0

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Abrasion Value Steel Test

(SAT: NTNU's new soil abrasion test,
Tunnels & Tunnelling International,
May 2006, 43-45)

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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, CA
UT reference	2011_ MACTEC_001_004
Sample ID.	S-109@ 68.5
Boring No.	S-109
Depth Interval	68.0-69.0

Test Date	09/1/11
Tested by	Mahdi Heidari
Checked by	Fulvio Tonon
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder
Rock type	ML

Test no.	Test 1	Test 2	AVS
Weight loss in mg	2.1	1.0	1.6

Photograph of the tested sample

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Abrasion Value Steel Test

(SAT: NTNU's new soil abrasion test,
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May 2006, 43-45)

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Project Name	Westside Subway Extension
Client project NO.	4953-10-1561
Location	Los Angeles, CA
UT reference	2011_ MACTEC_001_004
Sample ID.	S-109@ 61.5
Boring No.	S-109
Depth Interval	61.0-62.0

Test Date	09/1/11
Tested by	Mahdi Heidari
Checked by	Fulvio Tonon
Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder
Rock type	ML

Test no.	Test 1	Test 2	AVS
Weight loss in mg	4.1	3.0	3.6

Photograph of the tested sample

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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-48
Report No.	2015-48-5
Report Date	11/19/2015
Boring and Depth (ft)	E-126A; (1) 45.5', 50' ft
Soil Type	SW-SM

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 10/27/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
---------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	38	37	37.5

Photograph of the Tested Sample



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-49
Report No.	2015-49-3
Report Date	11/19/2015
Boring and Depth (ft)	G-405; -(1) 98.5' / 101' ft
Soil Type	SW-SM / CL

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 11/6/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
--------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2
Weight Loss (mg)	8	10

AVS
9

Photograph of the Tested Sample



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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-48
Report No.	2015-48-1
Report Date	11/19/2015
Boring and Depth (ft)	G-406; (2) 80', 90' ft
Soil Type	SM/SW/ML

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 10/27/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
---------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	24	26	25

Photograph of the Tested Sample



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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-48
Report No.	2015-48-2
Report Date	11/19/2015
Boring and Depth (ft)	G-407; (1) 71', 77' ft
Soil Type	SM/SW/ML

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 10/27/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
---------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	15	12	13.5

Photograph of the Tested Sample



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-48
Report No.	2015-48-3
Report Date	11/19/2015
Boring and Depth (ft)	G-409; (1) 111.5' ft
Soil Type	SM/CL

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 10/27/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
---------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2
Weight Loss (mg)	26	28

AVS
27

Photograph of the Tested Sample



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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-48
Report No.	2015-48-4
Report Date	11/19/2015
Boring and Depth (ft)	G-409; (1) 135.5' ft
Soil Type	SC/CL

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 10/27/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
---------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	27	25	26

Photograph of the Tested Sample



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-53
Report No.	2015-53-1
Report Date	12/5/2015
Boring and Depth (ft)	G-410; -120' / 126' ft
Soil Type	SC/SW-SM

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 12/2/2015	Date Opened: 12/2/2015	Date Tested: 12/5/2015
--------------------------	------------------------	------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	28	30	29

Photograph of the Tested Sample



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-53
Report No.	2015-53-1
Report Date	12/5/2015
Boring and Depth (ft)	G-410; -135' ft
Soil Type	SM/CL

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 12/2/2015	Date Opened: 12/2/2015	Date Tested: 12/5/2015
--------------------------	------------------------	------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	31	35	33

Photograph of the Tested Sample



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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-48
Report No.	2015-48-6
Report Date	11/19/2015
Boring and Depth (ft)	G-411; (1) 90', 96', 114.5' ft
Soil Type	SP-SM/SM

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 10/27/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
---------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	29	27	28

Photograph of the Tested Sample



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-49
Report No.	2015-49-1
Report Date	11/19/2015
Boring and Depth (ft)	M-402; (1) 88' / 91' ft
Soil Type	CL / SM

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 11/6/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
--------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	12	14	13

Photograph of the Tested Sample



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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Project Name	WSE SECTION 2
Location	LOS ANGELES, CA
Client	METRO
Client's Project No.	4953-11-1423
Registry No.	2015-49
Report No.	2015-49-2
Report Date	11/19/2015
Boring and Depth (ft)	M-402; (1) 103.5' / 106' ft
Soil Type	CL / SP-SM

Sample moisture condition	Dried in ventilated oven at 30°C for 3 days
Steel test piece condition	Ground and polished by bench grinder

Date Received: 11/6/2015	Date Opened: 11/16/2015	Date Tested: 11/19/2015
--------------------------	-------------------------	-------------------------

Test no.	Test 1	Test 2	AVS
Weight Loss (mg)	8	9	8.5

Photograph of the Tested Sample



Tested by: Dr. Fulvio Tonon, P.E., Ph.D.

Checked by: Gloria Tonon-Kozma, P.E.

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