BORING LOG NO. 09-B77

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13826317 E: 3260455	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 14.0 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	FILL: SANDY FAT CLAY dark gray, brown, reddish yellow, stiff, very high plasticity, moist, with sand pockets (12.0 – 2.0)	1	CH	ST	9		1.5		34	88	71	24	47	64			
		2															
	FILL: FAT CLAY reddish brown, dark gray, brown and yellowish brown, medium stiff to hard, very high plasticity, moist - with shell 2 to 4 feet	3	CH	ST	9		1.5		31								
		4															
		5		ST	10		3.25		28	98	76	24	52	95			
		6															
		7		ST	9		2.0		34								
		8															
		9		ST	11		1.25		33								
		10															
		11		ST	8		1.75		34								
		12															
		13		ST	18		1.5		42	83	87	25	62				
		14															
		15		ST	12		1.75		37								
		16															
		17		ST	10		1.75		32								
		18															
	-6.0 - with silt pockets 19 to 20 feet (20.0)	19		ST	15		1.0		38								
	FAT CLAY black and dark gray, very soft to very stiff, very high plasticity, moist	20															
		21	CH	ST	19		0.25	0.4	43	76	74	21	53	100			
		22															
		23		ST	10		0.25		46								
		24															
		25		ST	16		0.25		55								
		26															
		27		ST	16		0.25	0.3	48								
		28															
		29		ST	9		0.0	0.2	47								
		30															
		31		ST	22		0.25	0.25	49	71	83	22	61	93			
		32															
		33		ST	4		0.25	0.25	47								
		34															

Continued Next Page

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: **Dry augered to 26 feet; wet rotary thereafter.**

WATER LEVEL OBSERVATIONS			
▽ 26 ft	WD	▼ 26 ft	at 5 min
▼ 26 ft	at 10 min	▼ 25.5 ft	at 15 min

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DATE DRILLED	Page 1 of 2
3/30/2010	09-B77
PROJECT NUMBER 92105186-A	EXHIBIT A-

BORING LOG NO. 09-B77

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
BORING LOCATION:	N: 13826317 E: 3260455	SITE:	Cedar Bayou PA6 Baytown, Texas

Approx. Surface Elevation: 14.0 feet

Graphic Log	DESCRIPTION	DEPTH, FEET	USCS SYMBOL	TYPE	RECOVERY, IN	SPT, BLOWS/FT	CALIBRATED HAND PENETROM., TSF	TORVANE, TSF	MOISTURE CONTENT, %	DRY DENSITY, PCF	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	MINUS #200 SIEVE, %	COMPRESSIVE STRENGTH, TSF	FAILURE STRAIN, %	CONFINING PRESSURE, PSI
	FAT CLAY black and dark gray, very soft to very stiff, very high plasticity, moist	35		ST	16		0.0	0.15	31								
		36															
		37		ST	15		0.0	0.25	33								
		38															
		39		ST	20		0.5	0.25	34								
	-26.0 40.0	40															
	LEAN CLAY gray and dark gray, very soft to soft, medium plasticity, moist	41	CL	ST	22		0.25	0.2	27								
		42															
		43		ST	4		0.5	0.2	29								
		44															
		45		ST	22		0.25	0.25	27	97	41	17	24				
	-32.0 46.0	46															
	FAT CLAY w/ SAND dark bluish gray, very soft to medium stiff, high plasticity, moist, with sand seams, pockets and layers	47	CH	ST	15		0.25	0.2	32								
		48															
		49		ST	19		0.25		38								
		50															
		51		ST	20		0.5		37	87	55	18	37	83			
		52															
		53		ST	12		1.0		47								
	-40.0 54.0	54															
	LEAN CLAY dark greenish gray, stiff, medium plasticity, moist	55	CL	ST	20		1.25		22								
		56															
		57		ST	7		1.25		27	101	36	17	19	93			
		58															
		59		ST	18		1.75		25								
	-46.0 60.0	60															
	FAT CLAY dark bluish gray, very stiff to hard, high plasticity, moist	61	CH	ST	11		2.25		28								
		62															
		63		ST	16		1.5		29	96	57	21	36				
		64															
	-51.0 65.0	65		ST	8		1.25		27								
	Boring terminated at 65 feet.																

STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: Dry augered to 26 feet; wet rotary thereafter.

WATER LEVEL OBSERVATIONS			
▽ 26 ft	WD	▼ 26 ft	at 5 min
▼ 26 ft	at 10 min	▼ 25.5 ft	at 15 min

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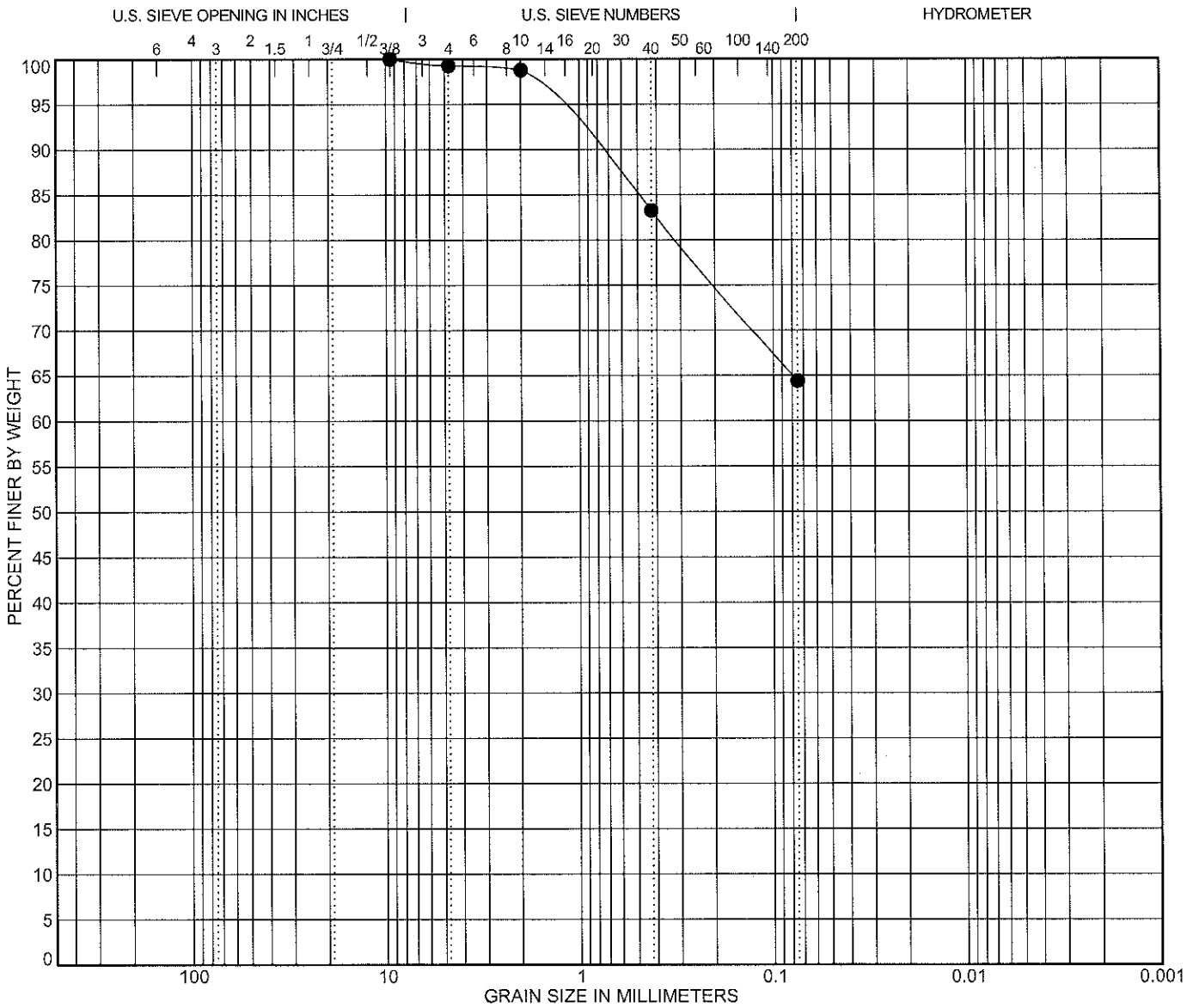
DATE DRILLED	Page 2 of 2
3/30/2010	09-B77
PROJECT NUMBER 92105186-A	EXHIBIT A-



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 09-B77	0.0	**SANDY FAT CLAY(CH)**	**71**	**24**	**47**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● 09-B77	0.0	**100**	**99.3**	**98.8**	**83.3**		**64.4**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 09-B77	0.0	**9.5**				**0.7**	**34.9**	**64.4**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
Baytown, Texas
Project Number 92105186-A

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Terracon Consultants, Inc.
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Houston, Texas 77043
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Fax: 713-690-8787

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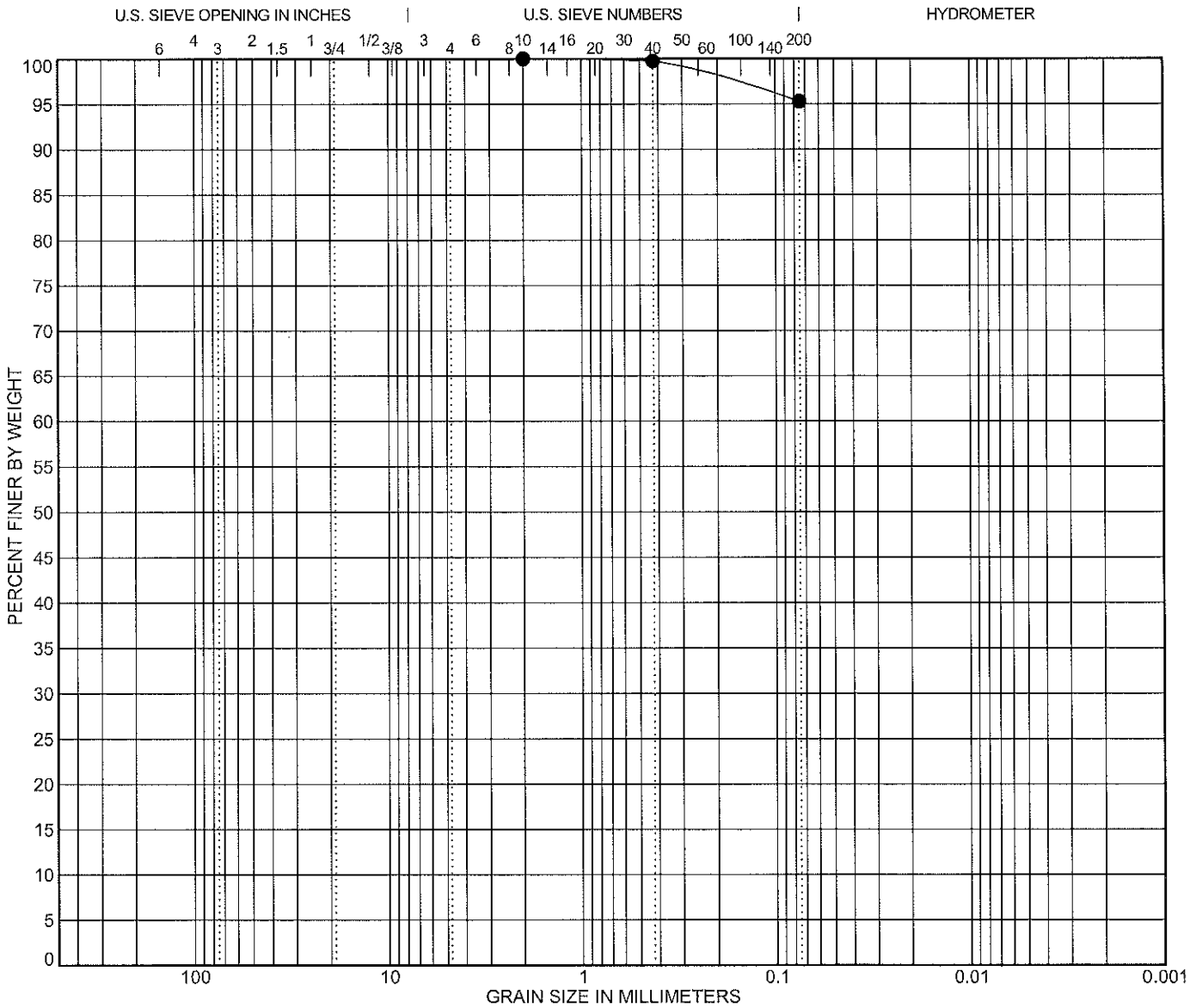

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B77**	**4.0**	**FAT CLAY(CH)**	**76**	**24**	**52**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B77**	**4.0**			**100**	**99.7**		**95.3**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B77**	**4.0**	**2**				**0.0**	**4.7**	**95.3**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
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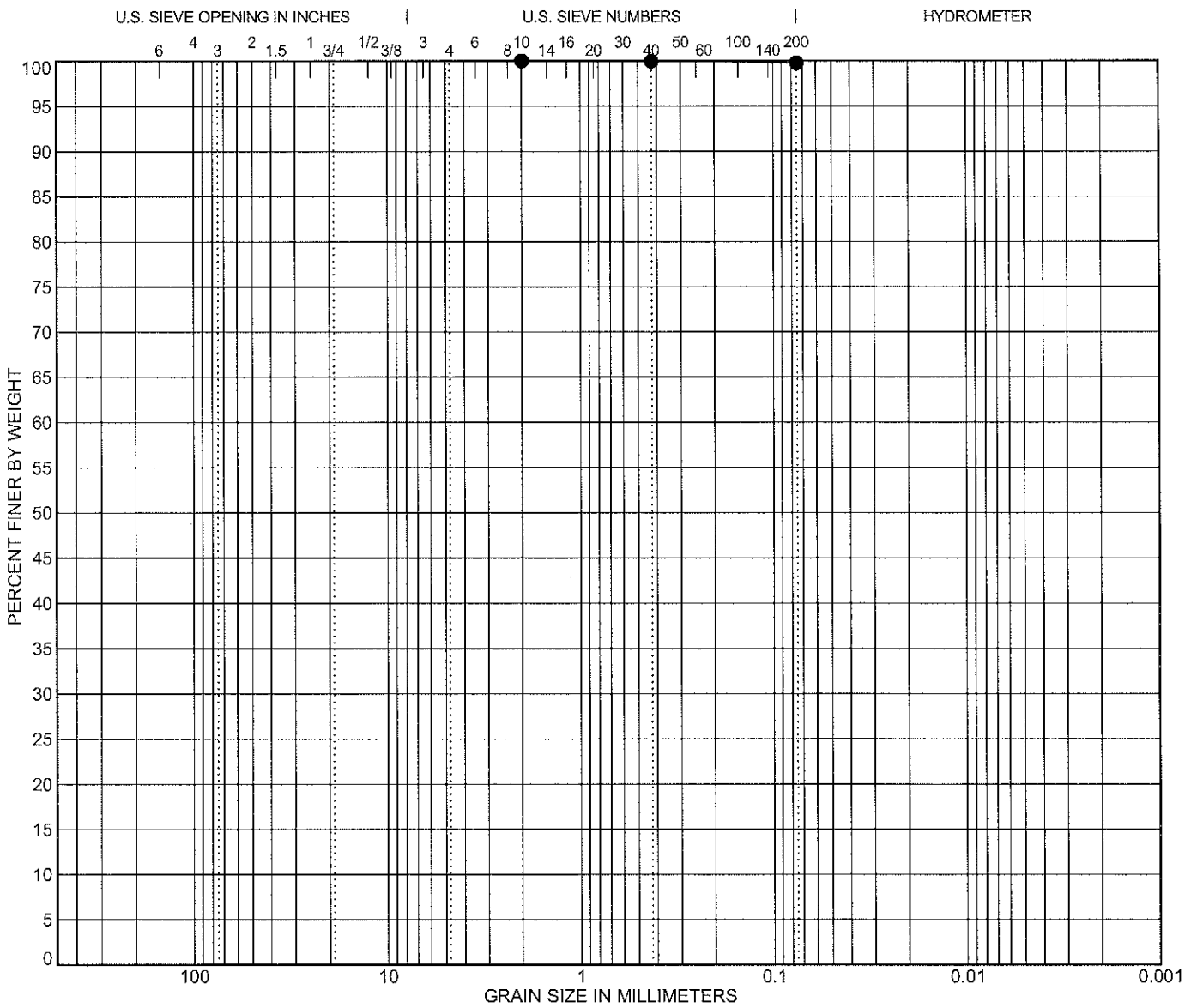

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B77**	**20.0**	**FAT CLAY(CH)**	**74**	**21**	**53**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B77**	**20.0**			**100**	**100**		**99.8**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B77**	**20.0**	**2**				**0.0**	**0.2**	**99.8**	

GRAIN SIZE DISTRIBUTION

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Baytown, Texas
Project Number 92105186-A

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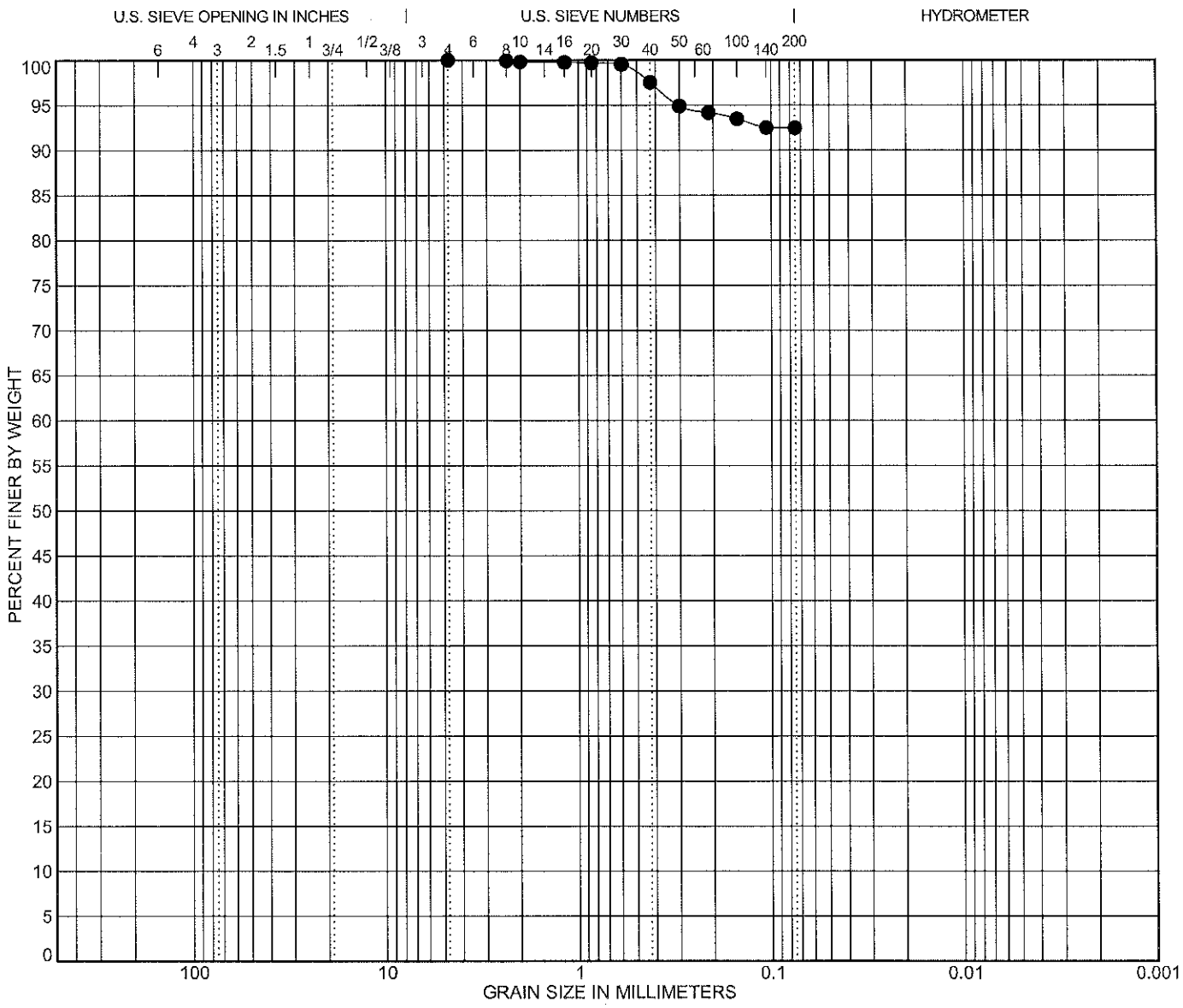

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B77**	**30.0**	**FAT CLAY(CH)**	**83**	**22**	**61**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B77**	**30.0**		**100**	**99.8**	**97.5**	**93.5**	**92.5**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B77**	**30.0**	**4.75**				**0.0**	**7.5**	**92.5**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
Baytown, Texas
Project Number 92105186-A

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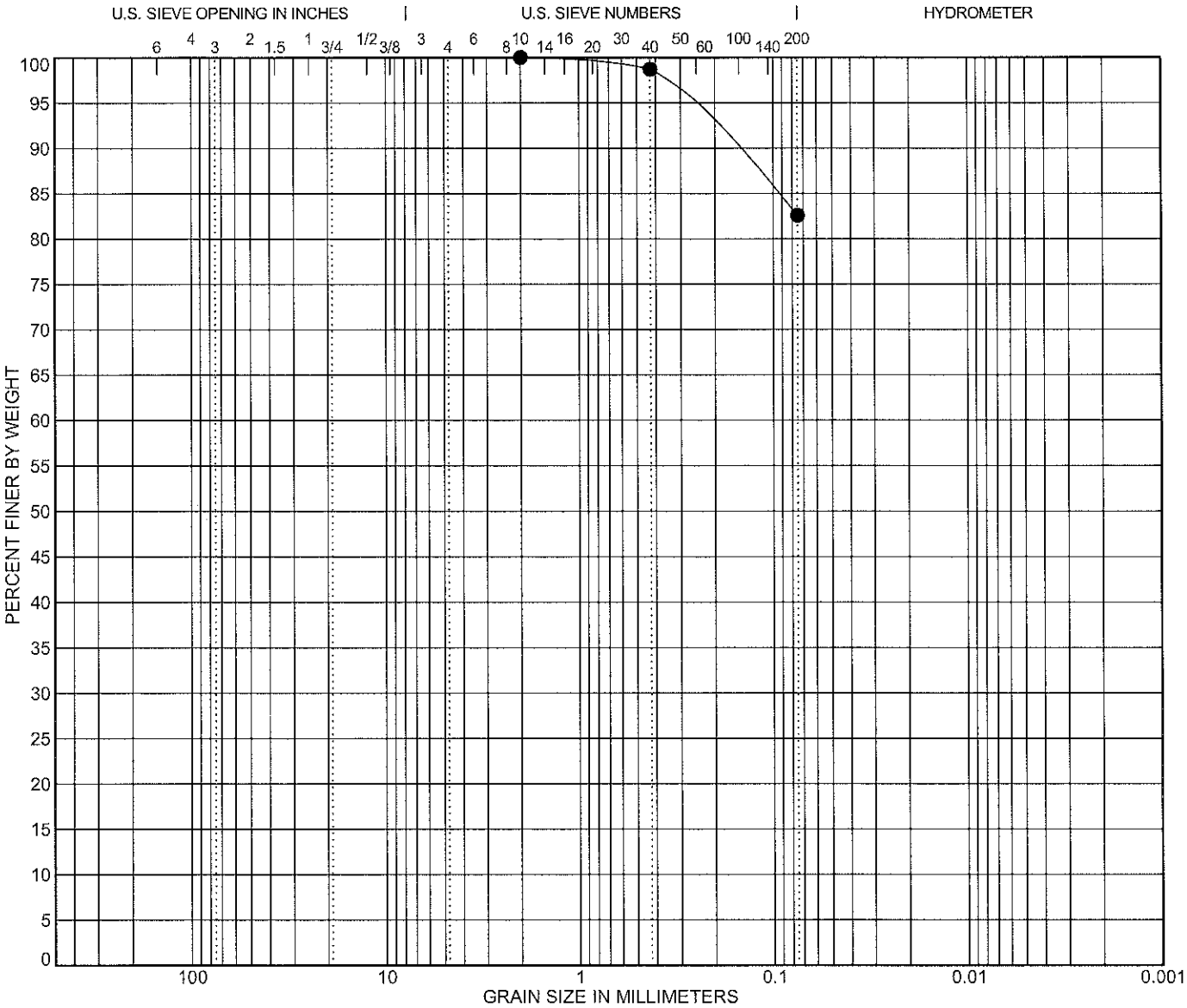

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**09-B77**	**50.0**	**FAT CLAY with SAND(CH)**	**55**	**18**	**37**		

Percent Passing the Indicated Sieve

	Specimen Identification		3/8"	#4	#10	#40	#100	#200
●	**09-B77**	**50.0**			**100**	**98.7**		**82.6**

	Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**09-B77**	**50.0**	**2**				**0.0**	**17.4**	**82.6**	

GRAIN SIZE DISTRIBUTION

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Baytown, Texas
Project Number 92105186-A

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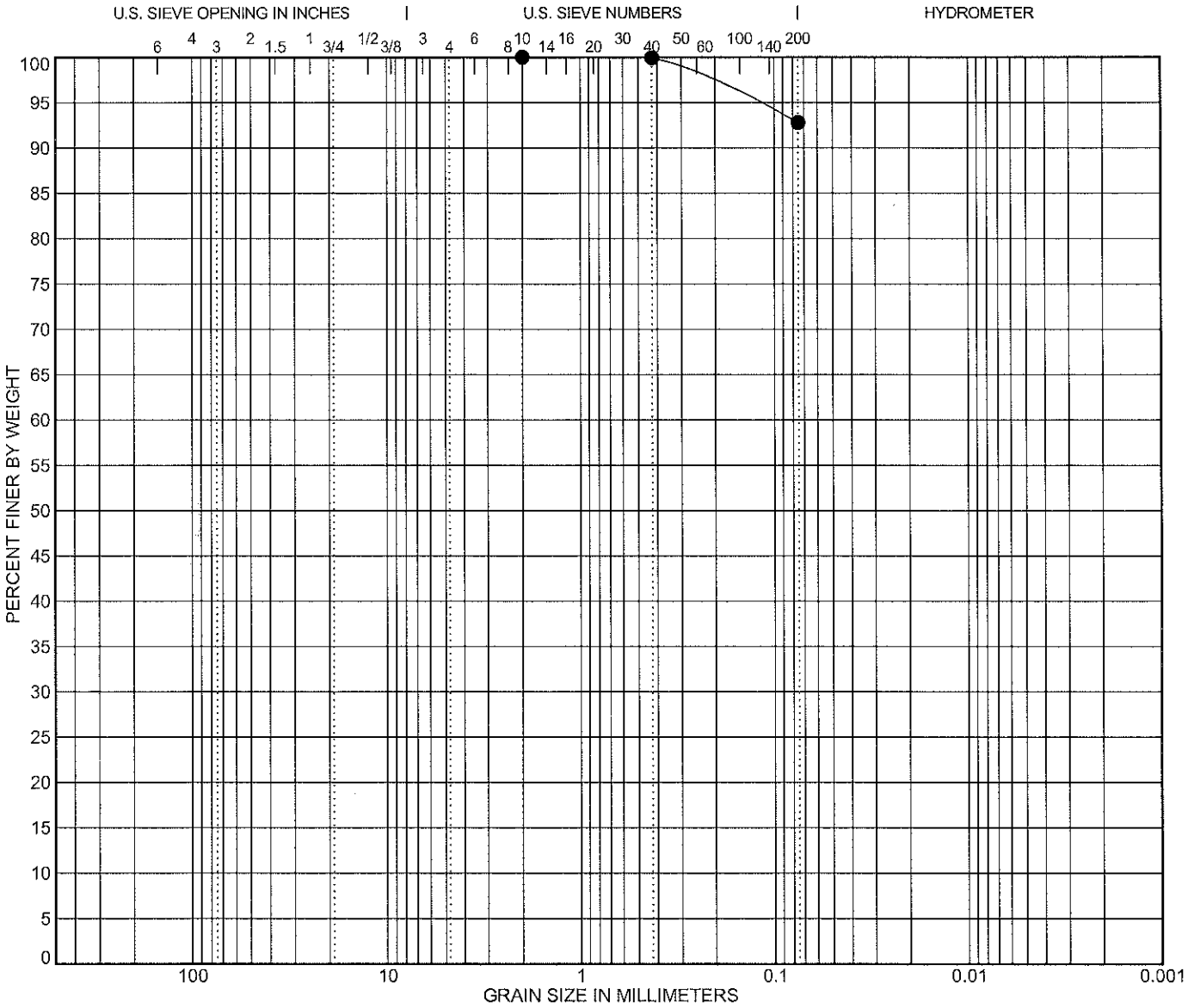

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **09-B77**	**56.0**	**LEAN CLAY(CL)**	**36**	**17**	**19**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **09-B77**	**56.0**			**100**	**99.9**		**92.8**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **09-B77**	**56.0**	**2**				**0.0**	**7.2**	**92.8**	

GRAIN SIZE DISTRIBUTION

TO-0012 Pipeline Dredging, Cedar Bayou & Anahuac Channel, Volume I
Baytown, Texas
Project Number 92105186-A

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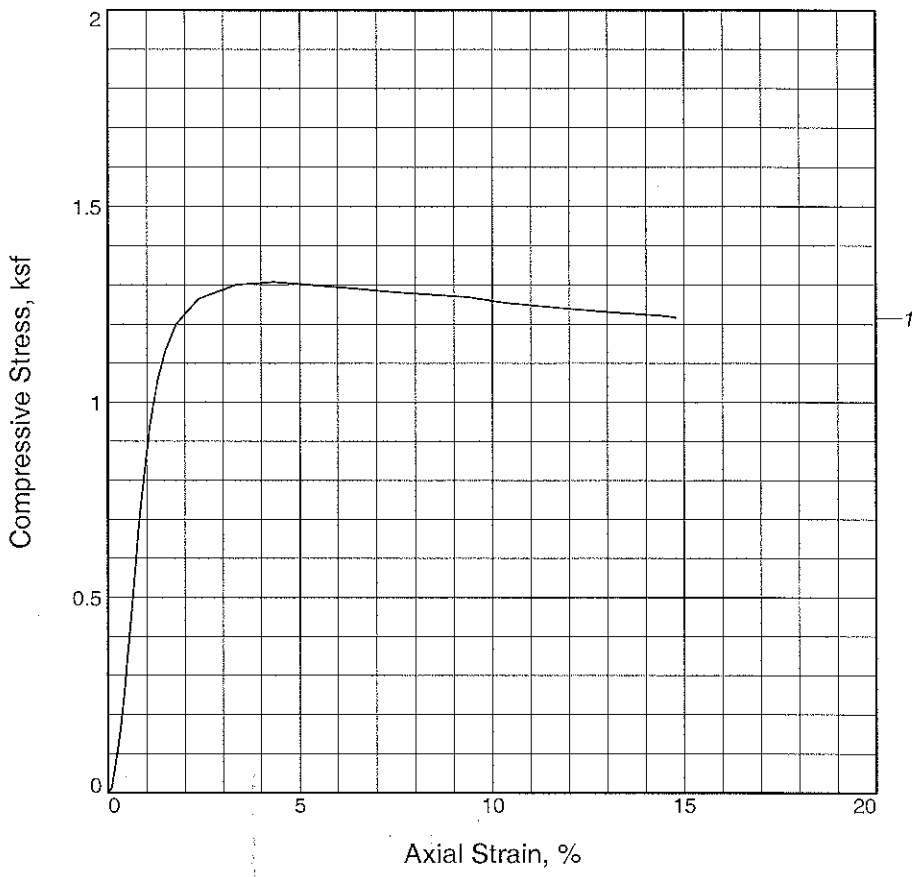
UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	1.308			
Undrained shear strength, ksf	0.654			
Failure strain, %	4.3			
Strain rate, in./min.	0.055			
Water content, %	43.3			
Wet density, pcf	108.4			
Dry density, pcf	75.7			
Saturation, %	93.8			
Void ratio	1.2686			
Specimen diameter, in.	2.781			
Specimen height, in.	5.590			
Height/diameter ratio	2.01			

Description: Gray Clay

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 92105186-B

Date Sampled:

Remarks:
ASTM D2166

Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16. Contract no. W912HY-09-D-0021, Task Order No. 0012

Location: 09-B77

Sample Number: 11 **Depth:** 20-22 ft.

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Houston, TX

UNCONFINED COMPRESSION TEST

11/5/2010

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186-B
Location: 09-B77
Depth: 20-22 ft. **Sample Number:** 11
Description: Gray Clay
Remarks: ASTM D2166
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	174.610
Moisture content: Dry soil+tare, gms.	137.140
Moisture content: Tare, gms.	50.580
Moisture, %	43.3
Moist specimen weight, gms.	966.66
Diameter, in.	2.781
Area, in.^{2}	6.076
Height, in.	5.590
Wet density, pcf	108.4
Dry density, pcf	75.7
Void ratio	1.2686
Saturation, %	93.8

Test Readings for Specimen No. 1

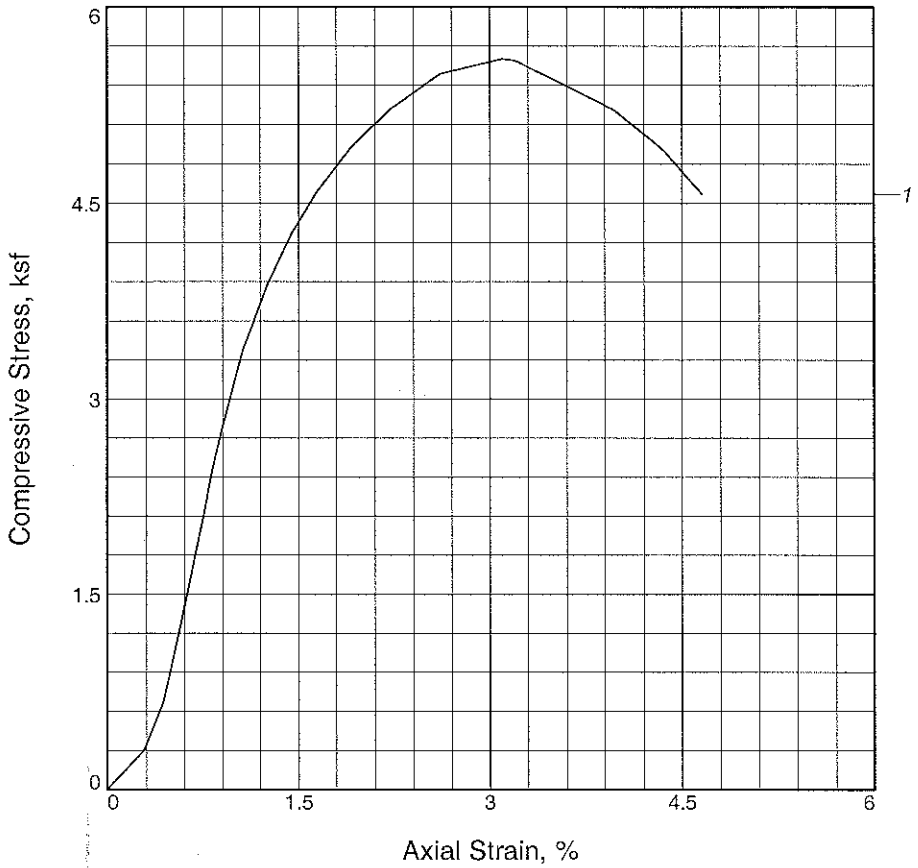
Strain rate, in./min. = 0.055
Unconfined compressive strength = 1.308 ksf **at reading no.** 18

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0050	0.510	0.5	0.1	0.012
2	0.0110	3.230	3.2	0.2	0.076
3	0.0176	7.066	7.1	0.3	0.167
4	0.0232	11.030	11.0	0.4	0.260
5	0.0270	14.282	14.3	0.5	0.337
6	0.0313	17.875	17.9	0.6	0.421
7	0.0355	21.508	21.5	0.6	0.507
8	0.0398	25.111	25.1	0.7	0.591
9	0.0436	28.626	28.6	0.8	0.673
10	0.0478	31.906	31.9	0.9	0.750
11	0.0521	34.944	34.9	0.9	0.821
12	0.0601	40.077	40.1	1.1	0.940
13	0.0715	45.055	45.1	1.3	1.054
14	0.0823	48.346	48.3	1.5	1.129
15	0.0989	51.540	51.5	1.8	1.200

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1320	54.651	54.7	2.4	1.265
17	0.1869	56.742	56.7	3.3	1.300
18	0.2422	57.669	57.7	4.3	1.308
19	0.3027	57.935	57.9	5.4	1.299
20	0.3576	58.208	58.2	6.4	1.291
21	0.4124	58.418	58.4	7.4	1.282
22	0.4677	58.754	58.8	8.4	1.276
23	0.5226	59.073	59.1	9.3	1.269
24	0.5779	59.045	59.0	10.3	1.255
25	0.6327	59.247	59.2	11.3	1.245
26	0.6880	59.481	59.5	12.3	1.236
27	0.7429	59.795	59.8	13.3	1.229
28	0.7982	60.174	60.2	14.3	1.223
29	0.8256	60.286	60.3	14.8	1.218
30	0.8256	60.205	60.2	14.8	1.216

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	5.602			
Undrained shear strength, ksf	2.801			
Failure strain, %	3.1			
Strain rate, in./min.	0.055			
Water content, %	29.2			
Wet density, pcf	123.6			
Dry density, pcf	95.7			
Saturation, %	101.1			
Void ratio	0.7939			
Specimen diameter, in.	2.738			
Specimen height, in.	5.678			
Height/diameter ratio	2.07			

Description: Gray Fat Clay

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 92105186-B

Date Sampled:

Remarks:
ASTM D2166

Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16. Contract no. W912HY-09-D-0021, Task Order No. 0012

Location: 09-B-77

Sample Number: 32 **Depth:** 62-64 ft.

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Houston, TX

UNCONFINED COMPRESSION TEST

11/5/2010

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186-B
Location: 09-B-77
Depth: 62-64 ft. **Sample Number:** 32
Description: Gray Fat Clay
Remarks: ASTM D2166
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**

Parameters for Specimen No. 1

Specimen Parameter	Initial
Moisture content: Moist soil+tare, gms.	183.140
Moisture content: Dry soil+tare, gms.	153.100
Moisture content: Tare, gms.	50.190
Moisture, %	29.2
Moist specimen weight, gms.	1084.96
Diameter, in.	2.738
Area, in.^{2}	5.888
Height, in.	5.678
Wet density, pcf	123.6
Dry density, pcf	95.7
Void ratio	0.7939
Saturation, %	101.1

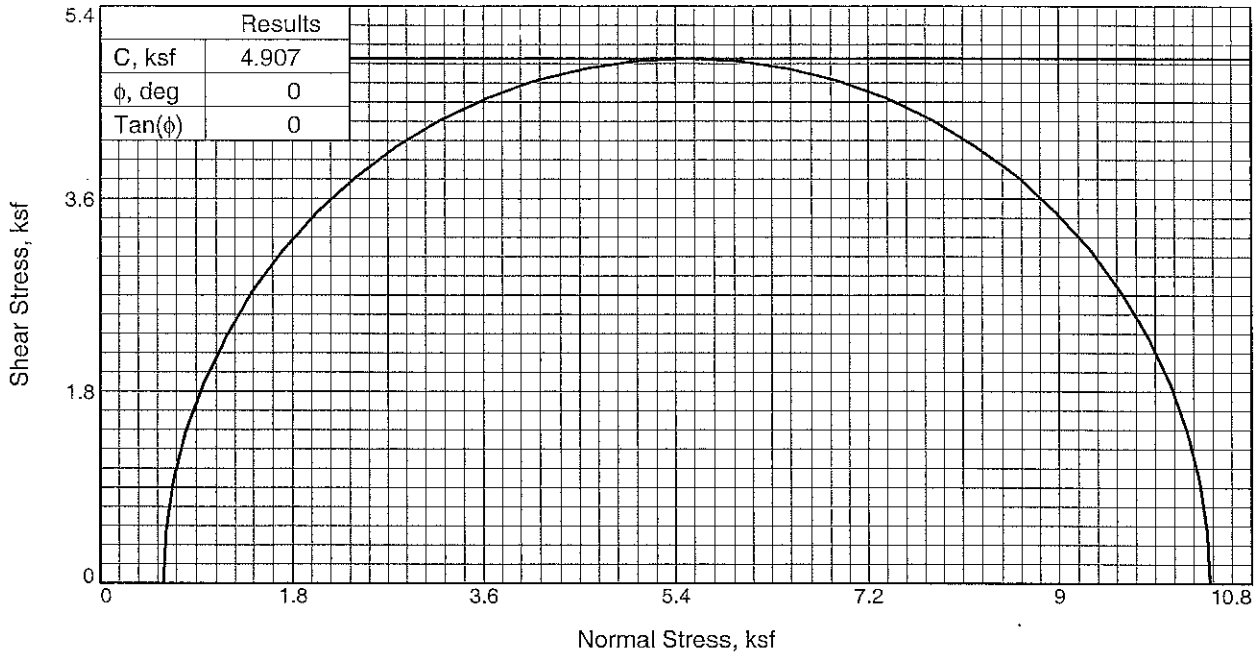
Test Readings for Specimen No. 1

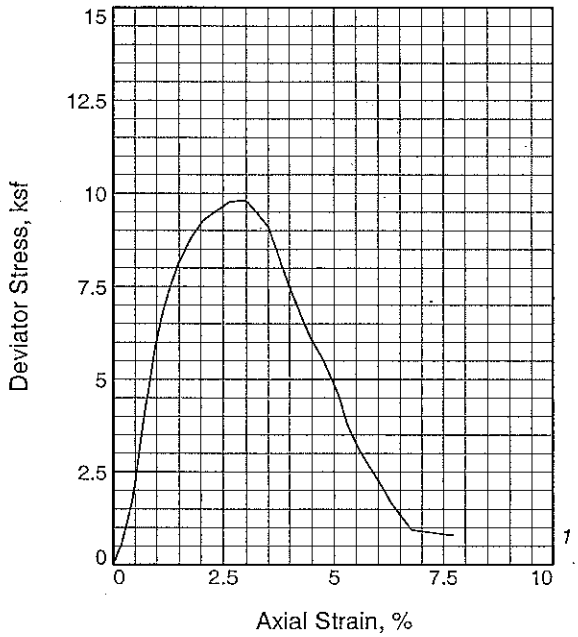
Strain rate, in./min. = 0.055
Unconfined compressive strength = 5.602 ksf **at reading no.** 17

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0001	0.060	0.1	0.0	0.001
2	0.0161	12.453	12.5	0.3	0.304
3	0.0246	27.468	27.5	0.4	0.669
4	0.0298	43.385	43.4	0.5	1.056
5	0.0341	57.882	57.9	0.6	1.407
6	0.0383	72.645	72.6	0.7	1.765
7	0.0426	87.009	87.0	0.7	2.112
8	0.0464	101.026	101.0	0.8	2.451
9	0.0506	113.893	113.9	0.9	2.761
10	0.0601	139.242	139.2	1.1	3.369
11	0.0714	160.852	160.9	1.3	3.885
12	0.0823	177.402	177.4	1.4	4.276
13	0.0932	190.649	190.6	1.6	4.586
14	0.1097	206.127	206.1	1.9	4.944
15	0.1263	218.484	218.5	2.2	5.225

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1485	230.450	230.4	2.6	5.489
17	0.1759	236.383	236.4	3.1	5.602
18	0.1816	236.051	236.1	3.2	5.588
19	0.2256	221.842	221.8	4.0	5.210
20	0.2478	209.197	209.2	4.4	4.893
21	0.2644	196.041	196.0	4.7	4.571





Sample No.		1
Initial	Water Content, %	28.1
	Dry Density, pcf	97.8
	Saturation, %	102.2
	Void Ratio	0.7554
	Diameter, in.	2.717
	Height, in.	5.763
At Test	Water Content, %	27.5
	Dry Density, pcf	97.8
	Saturation, %	100.0
	Void Ratio	0.7554
	Diameter, in.	2.717
	Height, in.	5.763
Strain rate, in./min.		0.055
Back Pressure, psi		0.000
Cell Pressure, psi		4.140
Fail. Stress, ksf		9.81
Ult. Stress, ksf		
σ_1 Failure, ksf		10.41
σ_3 Failure, ksf		0.60

Type of Test:
Unconsolidated Undrained

Sample Type:

Description:

Assumed Specific Gravity= 2.75

Remarks:

Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012

Location: 09-B77

Sample Number: 3 **Depth:** 4-6 ft.

Proj. No.: 92105186-B **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

11/5/2010
11:57 AM

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186-B
Location: 09-B77
Depth: 4-6 ft. **Sample Number:** 3
Description:
Remarks:
Type of Sample:
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Parameters for Specimen No. 1

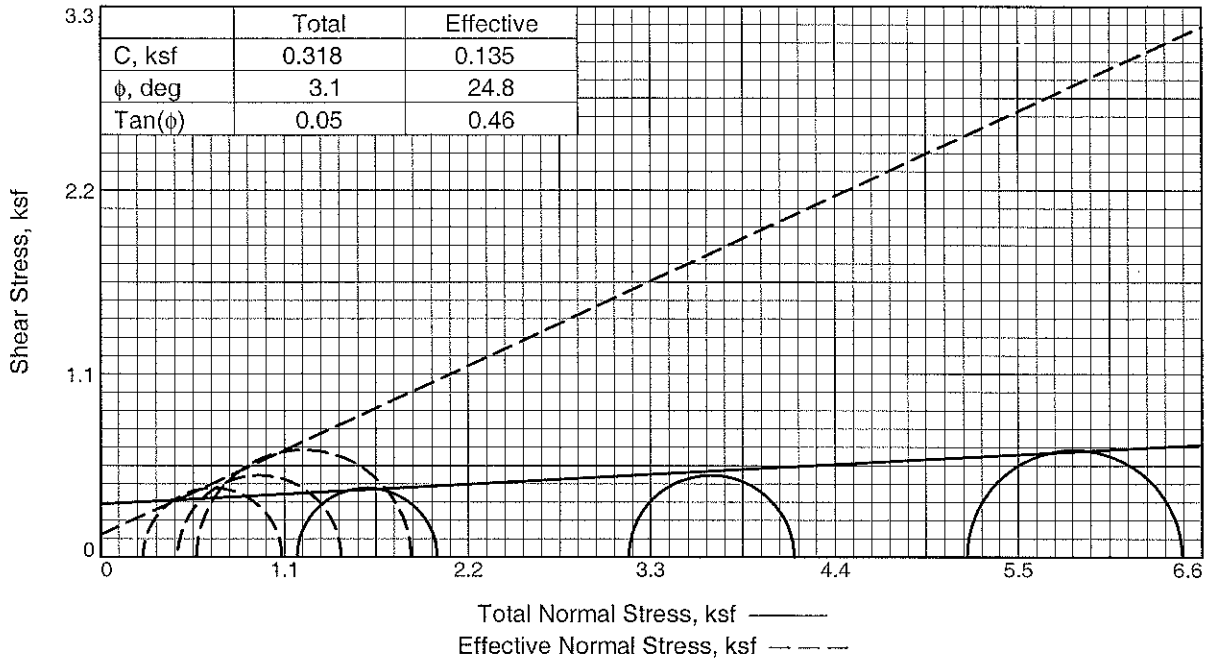
Specimen Parameter	Initial	Saturated	Final
Moisture content: Moist soil+tare, gms.	174.060		174.060
Moisture content: Dry soil+tare, gms.	146.870		146.870
Moisture content: Tare, gms.	50.040		50.040
Moisture, %	28.1	27.5	28.1
Moist specimen weight, gms.	1098.65		
Diameter, in.	2.717	2.717	
Area, in.^{2}	5.798	5.798	
Height, in.	5.763	5.763	
Net decrease in height, in.		0.000	
Wet density, pcf	125.3	124.7	
Dry density, pcf	97.8	97.8	
Void ratio	0.7554	0.7554	
Saturation, %	102.2	100.0	

Test Readings for Specimen No. 1

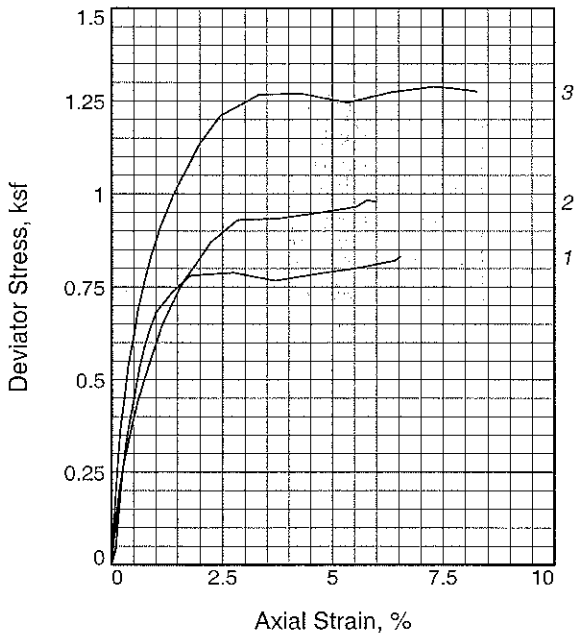
Cell pressure = 4.140 psi (0.596 ksf)
Back pressure = 0.000 psi (0.000 ksf)
Strain rate, in./min. = 0.055
Fail. Stress = 9.815 ksf **at reading no.** 18

Triaxial Readings for Specimen No.

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Princ. Stress ksf	Major Princ. Stress ksf	1:3 Ratio	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	0.596	0.596	1.00	0.596	0.000
1	0.0000	-0.107	-0.1	0.0	-0.003	0.596	0.594	1.00	0.595	-0.001
2	0.0102	22.625	22.6	0.2	0.561	0.596	1.157	1.94	0.877	0.280
3	0.0171	43.251	43.3	0.3	1.071	0.596	1.667	2.80	1.132	0.536
4	0.0244	67.756	67.8	0.4	1.676	0.596	2.272	3.81	1.434	0.838
5	0.0286	88.599	88.6	0.5	2.190	0.596	2.786	4.67	1.691	1.095
6	0.0327	113.378	113.4	0.6	2.800	0.596	3.396	5.70	1.996	1.400
7	0.0374	141.060	141.1	0.6	3.481	0.596	4.077	6.84	2.337	1.740
8	0.0415	165.319	165.3	0.7	4.076	0.596	4.673	7.84	2.634	2.038
9	0.0462	189.514	189.5	0.8	4.669	0.596	5.265	8.83	2.931	2.335
10	0.0503	211.725	211.7	0.9	5.213	0.596	5.809	9.74	3.202	2.606
11	0.0544	232.865	232.9	0.9	5.729	0.596	6.325	10.61	3.461	2.864
12	0.0632	268.937	268.9	1.1	6.606	0.596	7.202	12.08	3.899	3.303
13	0.0743	304.026	304.0	1.3	7.454	0.596	8.050	13.50	4.323	3.727
14	0.0854	331.468	331.5	1.5	8.111	0.596	8.707	14.60	4.651	4.055
15	0.1017	360.444	360.4	1.8	8.794	0.596	9.390	15.75	4.993	4.397
16	0.1187	381.344	381.3	2.1	9.276	0.596	9.872	16.56	5.234	4.638
17	0.1520	403.954	404.0	2.6	9.768	0.596	10.364	17.39	5.480	4.884
18	0.1683	407.063	407.1	2.9	9.815	0.596	10.411	17.46	5.504	4.907
19	0.1742	406.116	406.1	3.0	9.782	0.596	10.378	17.41	5.487	4.891
20	0.2017	380.060	380.1	3.5	9.109	0.596	9.705	16.28	5.151	4.555
21	0.2127	355.105	355.1	3.7	8.494	0.596	9.090	15.25	4.843	4.247
22	0.2238	330.278	330.3	3.9	7.884	0.596	8.481	14.23	4.538	3.942
23	0.2349	304.959	305.0	4.1	7.265	0.596	7.862	13.19	4.229	3.633
24	0.2460	280.875	280.9	4.3	6.678	0.596	7.274	12.20	3.935	3.339
25	0.2570	258.462	258.5	4.5	6.133	0.596	6.729	11.29	3.663	3.067
26	0.2740	232.834	232.8	4.8	5.508	0.596	6.104	10.24	3.350	2.754
27	0.2933	194.964	195.0	5.1	4.596	0.596	5.192	8.71	2.894	2.298
28	0.3067	157.615	157.6	5.3	3.706	0.596	4.302	7.22	2.449	1.853
29	0.3208	131.923	131.9	5.6	3.094	0.596	3.690	6.19	2.143	1.547
30	0.3482	93.624	93.6	6.0	2.185	0.596	2.781	4.66	1.689	1.092
31	0.3621	72.139	72.1	6.3	1.679	0.596	2.275	3.82	1.436	0.840
32	0.3896	40.507	40.5	6.8	0.938	0.596	1.534	2.57	1.065	0.469
33	0.4445	34.387	34.4	7.7	0.788	0.596	1.384	2.32	0.990	0.394



	Total	Effective
C, ksf	0.318	0.135
ϕ, deg	3.1	24.8
Tan(ϕ)	0.05	0.46



Sample No.		1	2	3
Initial	Water Content, %	49.0	49.0	49.0
	Dry Density, pcf	71.5	71.5	71.5
	Saturation, %	96.3	96.3	96.3
	Void Ratio	1.3997	1.3997	1.3997
	Diameter, in.	2.697	2.697	2.697
	Height, in.	5.694	5.694	5.694
At Test	Water Content, %	49.5	49.5	49.5
	Dry Density, pcf	71.5	71.5	71.5
	Saturation, %	97.3	97.3	97.3
	Void Ratio	1.3997	1.3997	1.3997
	Diameter, in.	2.697	2.697	2.697
	Height, in.	5.694	5.694	5.694
Strain rate, in./min.		0.001	0.001	0.001
Back Pressure, psi		50.000	50.000	50.000
Cell Pressure, psi		58.180	72.000	86.050
Fail. Stress, ksf		0.831	0.984	1.289
Excess Pore Pr., ksf		0.925	2.713	4.622
Ult. Stress, ksf				
Excess Pore Pr., ksf				
$\bar{\sigma}_1$ Failure, ksf		1.084	1.439	1.858
$\bar{\sigma}_3$ Failure, ksf		0.253	0.455	0.569

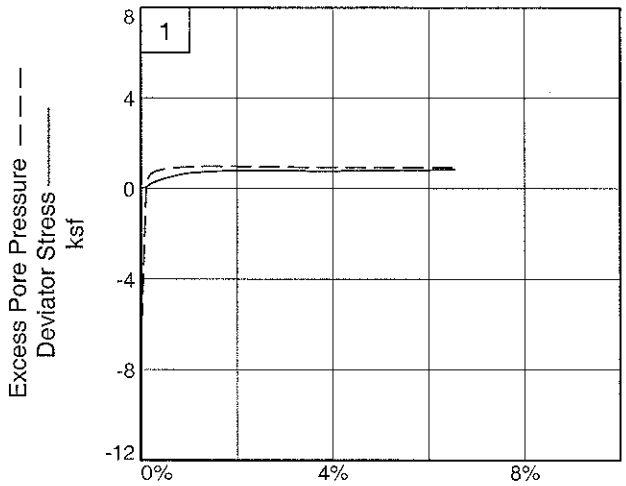
Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Dark gray Fat Clay

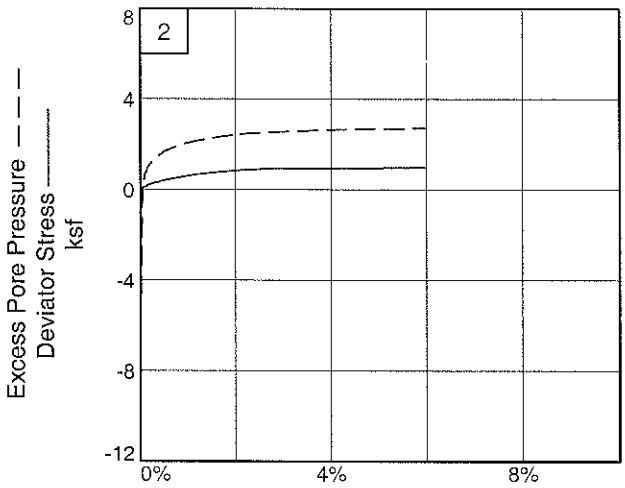
LL= 83 **PL=** 22 **PI=** 61
Assumed Specific Gravity= 2.75
Remarks: ASTM D4767
Specific gravity assumed
Percent pass #200 sieve = 98.1

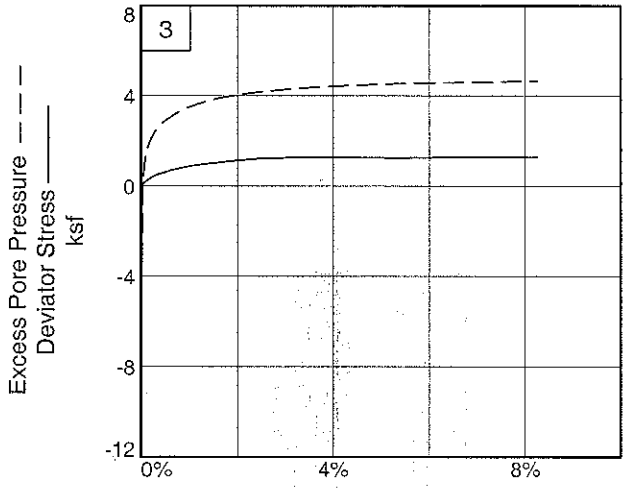
Client: USACE

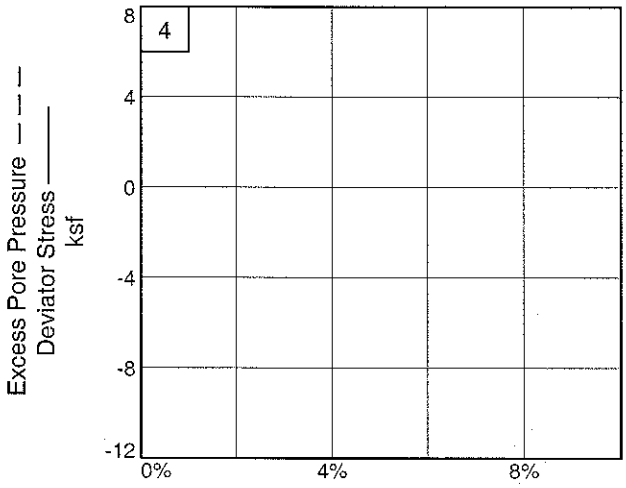
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Location: 09-B77
Sample Number: 16 **Depth:** 30-32 ft.
Proj. No.: 92105186 **Date Sampled:**

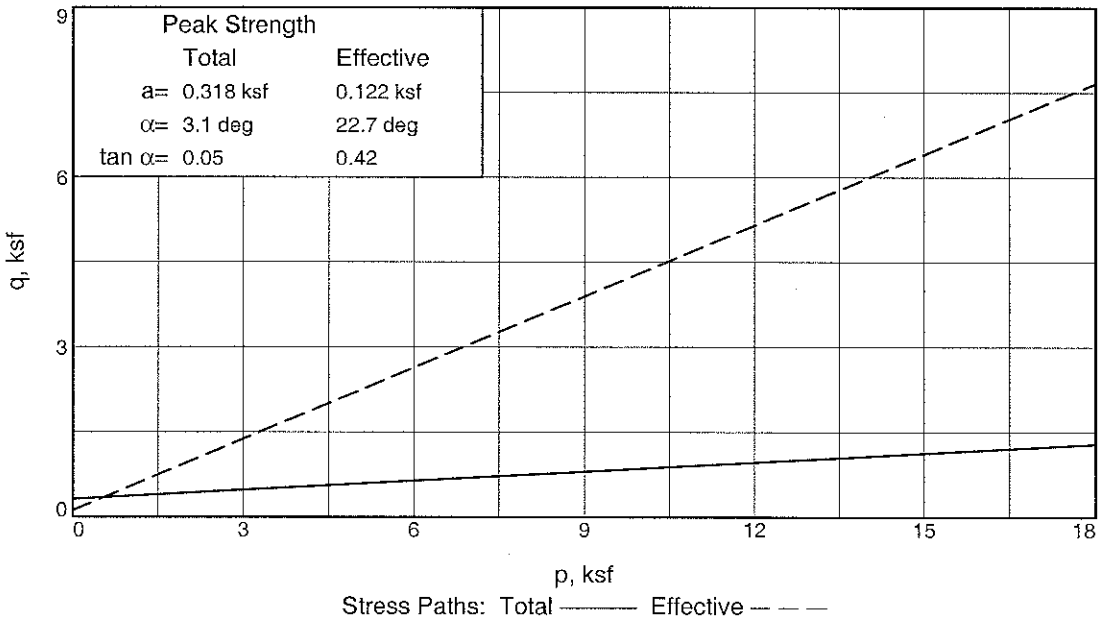
TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX











Client: USACE

Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.

Location: 09-B77 **Depth:** 30-32 ft. **Sample Number:** 16

Project No.: 92105186

Terracon, Inc.

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

11/23/2010
12:10 PM

Date:
Client: USACE
Project: Pipeline Dredging, Cedar Bayou and Anahuac Channel, PA 16.
Contract no. W912HY-09-D-0021, Task Order No. 0012
Project No.: 92105186
Location: 09-B77
Depth: 30-32 ft. **Sample Number:** 16
Description: Dark gray Fat Clay
Remarks: ASTM D4767
Specific gravity assumed
Percent pass #200 sieve = 98.1
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=**83 **PL=**22 **PI=**61
Test Method: ASTM D 4767 Method A

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	171.620			151.520
Moisture content: Dry soil+tare, gms.	131.400			117.690
Moisture content: Tare, gms.	49.350			49.410
Moisture, %	49.0	49.5	49.5	49.5
Moist specimen weight, gms.	910.31			
Diameter, in.	2.697	2.697	2.697	
Area, in.^{2}	5.713	5.713	5.713	
Height, in.	5.694	5.694	5.694	
Net decrease in height, in.		0.000	0.000	
Net decrease in water volume, cc.			0.000	
Wet density, pcf	106.6	107.0	107.0	
Dry density, pcf	71.5	71.5	71.5	
Void ratio	1.3997	1.3997	1.3997	
Saturation, %	96.3	97.3	97.3	

Test Readings for Specimen No. 1

Consolidation cell pressure = 58.180 psi (8.378 ksf)
Consolidation back pressure = 50.000 psi (7.200 ksf)
Consolidation effective confining stress = 1.178 ksf
Strain rate, in./min. = 0.001
Fail. Stress = 0.831 ksf **at reading no.** 21

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	8.378	8.378	1.00	0.000	8.378	0.000
1	0.0059	1.785	1.8	0.1	0.045	1.157	1.201	1.04	50.149	1.179	0.022
2	0.0074	3.785	3.8	0.1	0.095	0.838	0.933	1.11	52.360	0.886	0.048
3	0.0104	6.259	6.3	0.2	0.157	0.600	0.758	1.26	54.011	0.679	0.079
4	0.0119	8.249	8.2	0.2	0.207	0.544	0.751	1.38	54.405	0.647	0.104
5	0.0149	10.233	10.2	0.3	0.257	0.468	0.725	1.55	54.928	0.597	0.129
6	0.0179	12.449	12.4	0.3	0.313	0.417	0.730	1.75	55.282	0.574	0.156
7	0.0224	14.869	14.9	0.4	0.373	0.366	0.739	2.02	55.638	0.553	0.187
8	0.0269	16.920	16.9	0.5	0.424	0.329	0.754	2.29	55.894	0.541	0.212
9	0.0314	19.103	19.1	0.6	0.479	0.300	0.779	2.60	56.098	0.539	0.239
10	0.0359	21.198	21.2	0.6	0.531	0.279	0.810	2.90	56.244	0.544	0.265
11	0.0419	23.465	23.5	0.7	0.587	0.255	0.842	3.30	56.407	0.549	0.294
12	0.0494	25.496	25.5	0.9	0.637	0.236	0.873	3.70	56.541	0.555	0.319
13	0.0569	27.291	27.3	1.0	0.681	0.225	0.907	4.02	56.614	0.566	0.341
14	0.0779	29.578	29.6	1.4	0.735	0.206	0.941	4.57	56.750	0.574	0.368
15	0.1019	31.521	31.5	1.8	0.780	0.206	0.986	4.79	56.748	0.596	0.390
16	0.1559	32.146	32.1	2.7	0.788	0.226	1.014	4.49	56.613	0.620	0.394
17	0.2099	31.589	31.6	3.7	0.767	0.237	1.004	4.24	56.536	0.620	0.383
18	0.2639	32.670	32.7	4.6	0.785	0.243	1.028	4.23	56.494	0.635	0.393
19	0.3209	33.714	33.7	5.6	0.802	0.250	1.052	4.20	56.442	0.651	0.401
20	0.3659	34.823	34.8	6.4	0.821	0.251	1.072	4.27	56.438	0.662	0.411
21	0.3716	35.289	35.3	6.5	0.831	0.253	1.084	4.29	56.424	0.669	0.416

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	171.620			151.520
Moisture content: Dry soil+tare, gms.	131.400			117.690
Moisture content: Tare, gms.	49.350			49.410
Moisture, %	49.0	49.5	49.5	49.5
Moist specimen weight, gms.	910.31			
Diameter, in.	2.697	2.697	2.697	
Area, in.^{2}	5.713	5.713	5.713	
Height, in.	5.694	5.694	5.694	
Net decrease in height, in.		0.000	0.000	
Net decrease in water volume, cc.			0.000	
Wet density, pcf	106.6	107.0	107.0	
Dry density, pcf	71.5	71.5	71.5	
Void ratio	1.3997	1.3997	1.3997	
Saturation, %	96.3	97.3	97.3	

Test Readings for Specimen No. 2

Consolidation cell pressure = 72.000 psi (10.368 ksf)

Consolidation back pressure = 50.000 psi (7.200 ksf)

Consolidation effective confining stress = 3.168 ksf

Strain rate, in./min. = 0.001

Fail. Stress = 0.984 ksf **at reading no.** 19

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	10.368	10.368	1.00	0.000	10.368	0.000
1	0.0026	2.336	2.3	0.0	0.059	3.168	3.226	1.02	50.003	3.197	0.029
2	0.0054	4.502	4.5	0.1	0.113	2.500	2.614	1.05	54.636	2.557	0.057
3	0.0097	7.810	7.8	0.2	0.197	2.139	2.335	1.09	57.149	2.237	0.098
4	0.0154	10.702	10.7	0.3	0.269	1.881	2.150	1.14	58.935	2.016	0.135
5	0.0211	12.781	12.8	0.4	0.321	1.702	2.023	1.19	60.180	1.863	0.160
6	0.0267	15.122	15.1	0.5	0.379	1.544	1.923	1.25	61.281	1.733	0.190
7	0.0339	17.609	17.6	0.6	0.441	1.407	1.848	1.31	62.231	1.627	0.221
8	0.0424	20.073	20.1	0.7	0.502	1.281	1.783	1.39	63.107	1.532	0.251
9	0.0524	22.722	22.7	0.9	0.567	1.160	1.727	1.49	63.947	1.443	0.284
10	0.0652	26.003	26.0	1.1	0.648	1.036	1.684	1.63	64.804	1.360	0.324
11	0.0766	28.112	28.1	1.3	0.699	0.955	1.654	1.73	65.370	1.304	0.350
12	0.0936	30.927	30.9	1.6	0.767	0.855	1.621	1.90	66.065	1.238	0.383
13	0.1107	33.076	33.1	1.9	0.818	0.777	1.595	2.05	66.604	1.186	0.409
14	0.1278	35.346	35.3	2.2	0.871	0.701	1.572	2.24	67.129	1.137	0.435
15	0.1619	37.996	38.0	2.8	0.930	0.626	1.556	2.49	67.653	1.091	0.465
16	0.2132	38.506	38.5	3.7	0.934	0.550	1.484	2.70	68.181	1.017	0.467
17	0.2644	39.469	39.5	4.6	0.949	0.488	1.437	2.94	68.608	0.963	0.474
18	0.3156	40.550	40.6	5.5	0.965	0.470	1.435	3.05	68.737	0.953	0.483
19	0.3298	41.436	41.4	5.8	0.984	0.455	1.439	3.16	68.839	0.947	0.492
20	0.3393	41.344	41.3	6.0	0.980	0.451	1.431	3.17	68.868	0.941	0.490

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	171.620			151.520
Moisture content: Dry soil+tare, gms.	131.400			117.690
Moisture content: Tare, gms.	49.350			49.410
Moisture, %	49.0	49.5	49.5	49.5
Moist specimen weight, gms.	910.31			
Diameter, in.	2.697	2.697	2.697	
Area, in.^{2}	5.713	5.713	5.713	
Height, in.	5.694	5.694	5.694	
Net decrease in height, in.		0.000	0.000	
Net decrease in water volume, cc.			0.000	
Wet density, pcf	106.6	107.0	107.0	
Dry density, pcf	71.5	71.5	71.5	
Void ratio	1.3997	1.3997	1.3997	
Saturation, %	96.3	97.3	97.3	

Test Readings for Specimen No. 3

Consolidation cell pressure = 86.050 psi (12.391 ksf)

Consolidation back pressure = 50.000 psi (7.200 ksf)

Consolidation effective confining stress = 5.191 ksf

Strain rate, in./min. = 0.001

Fail. Stress = 1.289 ksf **at reading no.** 20

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	0.000	0.0	0.0	0.000	12.391	12.391	1.00	0.000	12.391	0.000
1	0.0020	2.934	2.9	0.0	0.074	5.022	5.096	1.01	51.172	5.059	0.037
2	0.0047	7.083	7.1	0.1	0.178	3.929	4.107	1.05	58.767	4.018	0.089
3	0.0075	10.192	10.2	0.1	0.257	3.492	3.748	1.07	61.802	3.620	0.128
4	0.0116	14.707	14.7	0.2	0.370	3.086	3.456	1.12	64.620	3.271	0.185
5	0.0171	18.305	18.3	0.3	0.460	2.741	3.201	1.17	67.013	2.971	0.230
6	0.0212	21.333	21.3	0.4	0.536	2.548	3.084	1.21	68.353	2.816	0.268
7	0.0281	24.341	24.3	0.5	0.611	2.291	2.902	1.27	70.140	2.596	0.305
8	0.0336	27.389	27.4	0.6	0.686	2.132	2.818	1.32	71.244	2.475	0.343
9	0.0419	30.497	30.5	0.7	0.763	1.936	2.699	1.39	72.609	2.317	0.382
10	0.0515	33.606	33.6	0.9	0.839	1.755	2.595	1.48	73.862	2.175	0.420
11	0.0625	36.533	36.5	1.1	0.911	1.601	2.512	1.57	74.933	2.056	0.455
12	0.0790	39.973	40.0	1.4	0.994	1.409	2.403	1.71	76.264	1.906	0.497
13	0.0955	42.743	42.7	1.7	1.059	1.266	2.325	1.84	77.261	1.795	0.530
14	0.1120	45.717	45.7	2.0	1.130	1.150	2.280	1.98	78.065	1.715	0.565
15	0.1395	49.231	49.2	2.4	1.211	1.014	2.224	2.19	79.009	1.619	0.605
16	0.1890	52.016	52.0	3.3	1.268	0.847	2.114	2.50	80.169	1.481	0.634
17	0.2440	52.648	52.6	4.3	1.270	0.729	1.999	2.74	80.986	1.364	0.635
18	0.3045	52.202	52.2	5.3	1.245	0.649	1.895	2.92	81.543	1.272	0.623
19	0.3595	53.932	53.9	6.3	1.274	0.597	1.871	3.13	81.904	1.234	0.637
20	0.4145	55.145	55.1	7.3	1.289	0.569	1.858	3.27	82.099	1.213	0.644
21	0.4420	55.189	55.2	7.8	1.283	0.551	1.834	3.33	82.226	1.192	0.642
22	0.4695	55.175	55.2	8.2	1.276	0.537	1.813	3.38	82.323	1.175	0.638

Project name: TO-0012 Pipeline Dredging, Volume I, Cedar Bayou PA 6 | Client: USACE, Galveston District | Terracon Project # : 92105186-A

Boring	Depth	Field tests			Atterberg Limits			Grain Size Analysis														USCS Symbol (ASTM 2487)	Wc	γd	Strength tests																						
								Percent Pasing Sieve																	Direct Shear Test					Unconfined Compression				UU Triaxial Test				CU Triaxial Test						
		PP	TV	SPTn	LL	PL	PI	3/4"	3/8"	4	8	10	16	20	30	40	50	70	100	140	200				C	φ	Wc	γd	Symbol	C	Wc	γd	Symbol	C	Wc	γd	Symbol	C	φ	c'	φ'	Wc	γd	Symbol
	ft	tsf	tsf	bl/ft	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%		%	pcf	ksf	°	%	pcf		ksf	%	pcf		ksf	%	pcf		ksf	°	ksf	°	%	pcf	
09-B77	0-2	1.50			71	24	47			100		99			83						64	CH	34	88																					
	2-4	1.50																				CH**	31																						
	4-6	3.25			76	24	52					100			100						95	CH	28											4.9	28	98	CH**							
	6-8	2.00																				CH**	34																						
	8-10	1.25																				CH**	33																						
	10-12	1.75																				CH**	34																						
	12-14	1.50			87	25	62															CH*	42	83																					
	14-16	1.75																				CH**	37																						
	16-18	1.75																				CH**	32																						
	18-20	1.00																				CH**	38																						
	20-22	0.25	0.40		74	21	53					100			100						100	CH	43							0.7	43	76	CH**											
	22-24	0.25																				CH**	46																						
	24-26	0.25																				CH**	55																						
	26-28	0.25	0.30																			CH**	49																						
	28-30	0.00	0.20																			CH**	47																						
	30-32	0.25	0.25		83	22	61			100		100			100						98	CH	49															0.3	3	0.1	25	49	72	CH**
	32-34	0.25	0.25																			CH**	47																						
	34-36	0.00	0.15																			CH**	31																						
	36-38	0.00	0.25																			CH**	33																						
	38-40	0.50	0.25																			CH**	34																						
	40-42	0.25	0.20																			CL**	27																						
	42-44	0.50	0.20																			CL**	29																						
	44-46	0.25	0.25		41	17	24															CL*	27	97																					
	46-48	0.25	0.20																			CH**	32																						
	48-50	0.25																				CH**	38																						
	50-52	0.50			55	18	37					100				99					83	CH	37	87																					
	52-54	1.00																				CH**	47																						
	54-56	1.25																				CL**	22																						
	56-58	1.25			36	17	19					100				100					93	CL	27	101																					
	58-60	1.75																				CL**	25																						
	60-62	2.25																				CH**	28																						
	62-64	1.50			57	21	36															CH*	29							2.8	29	96	CH**											
	64-66	1.25																				CH**	27																						