BORING LOG NO. 10-B13

CLIENT:	USACE, Galveston District Galveston, Texas	PROJECT:	Galveston Channel Deepening, TO-0010
BORING LOCATION:	N: 13688575.66 E: 3316659.83	SITE:	San Jacinto Placement Area Galveston, Texas

Approx. Surface Elevation: 13.5 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: FAT CLAY brownish gray, with sand pockets. medium stiff to stiff		1	CH	ST	8		1.75				75	29	46	99			
			2															
			3		ST	14		0.5		48								
			4															
			5		ST	17		1.0				98	31	67	96			
	7.5	6.0	6															
	FILL: CLAYEY SAND dark gray, fine, wet, some cohesion, very loose		7	SC	SS	11	0			34								
			8															
			9		SS	12	0			28					21			
	3.5	10.0	10															
	FILL: FAT CLAY dark bluish gray, very soft		11	CH	SS	19	0			56								
			12															
			13		SS	24	0			53		96	32	64				
			14															
			15		SS	8	0			62								
			16															
			17		SS	16	0			63								
	-4.6	18.0	18															
	POORLY GRADED SAND w/ SILT bluish gray, with shell, fine, slightly cohesive, very dense		19	SP-SM	SS	14	53			25								
	-6.6	20.0	20															

Boring terminated at 20 feet.

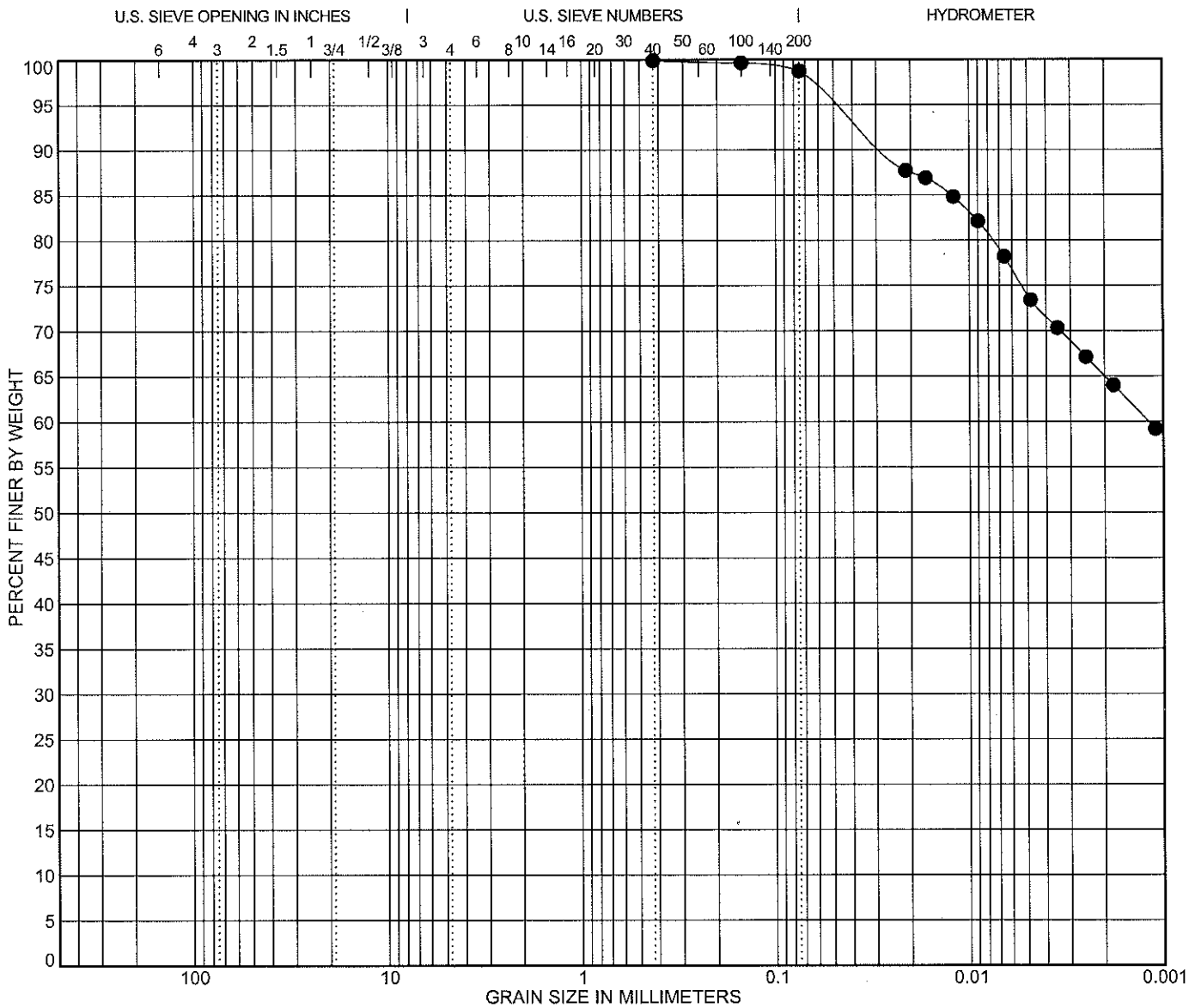
STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES. IN SITU, THE TRANSITION BETWEEN STRATA MAY BE MORE GRADUAL.

REMARKS: **Dry auger to 8 feet; wet rotary thereafter.**

WATER LEVEL OBSERVATIONS			
6 ft	WS	5.5 ft	at 5 min
4.6 ft	at 10 min	4.5 ft	at 15 min

Terracon

DATE DRILLED	Page 1 of 1
4/13/2010	10-B13
PROJECT NUMBER 92105154	EXHIBIT A-13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **10-B13**	**0.0**	**FAT CLAY(CH)**	**75**	**29**	**46**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **10-B13**	**0.0**				**99.9**	**99.6**	**98.7**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **10-B13**	**0.0**	**0.425**				**0.0**	**1.2**	**33.7**	**65.0**

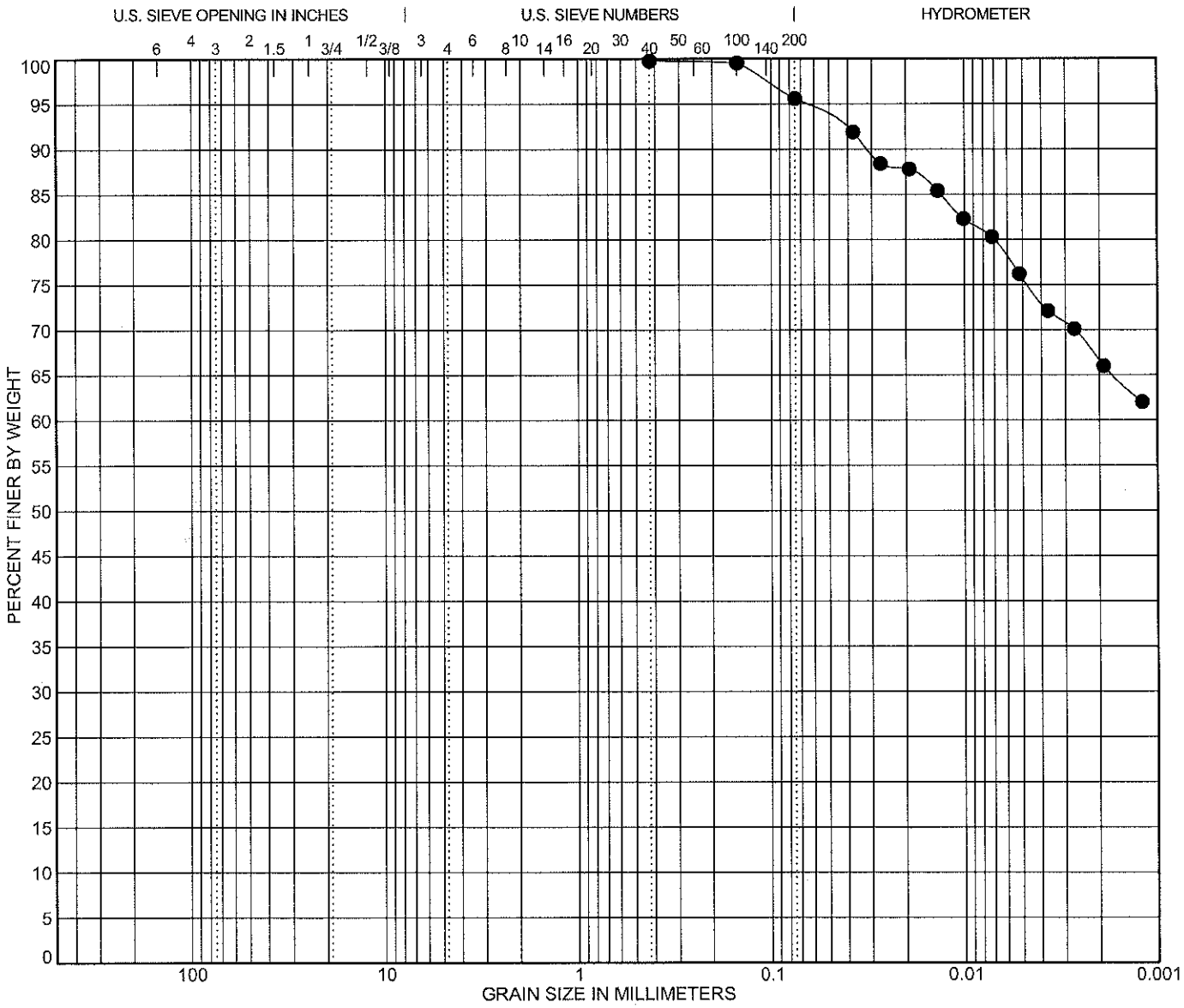
GRAIN SIZE DISTRIBUTION

Galveston Channel Deepening,
TO-0010
Galveston, Texas
Project Number 92105154

Terracon

Terracon Consultants, Inc.
11555 Clay Road, Suite 100
Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

SPECIMEN ID
10-B13, 0.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **10-B13**	**4.0**	**FAT CLAY(CH)**	**98**	**31**	**67**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **10-B13**	**4.0**				**99.8**	**99.5**	**95.6**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **10-B13**	**4.0**	**0.425**				**0.0**	**4.2**	**29.0**	**66.6**

GRAIN SIZE DISTRIBUTION

Galveston Channel Deepening,
TO-0010
Galveston, Texas
Project Number 92105154

Terracon

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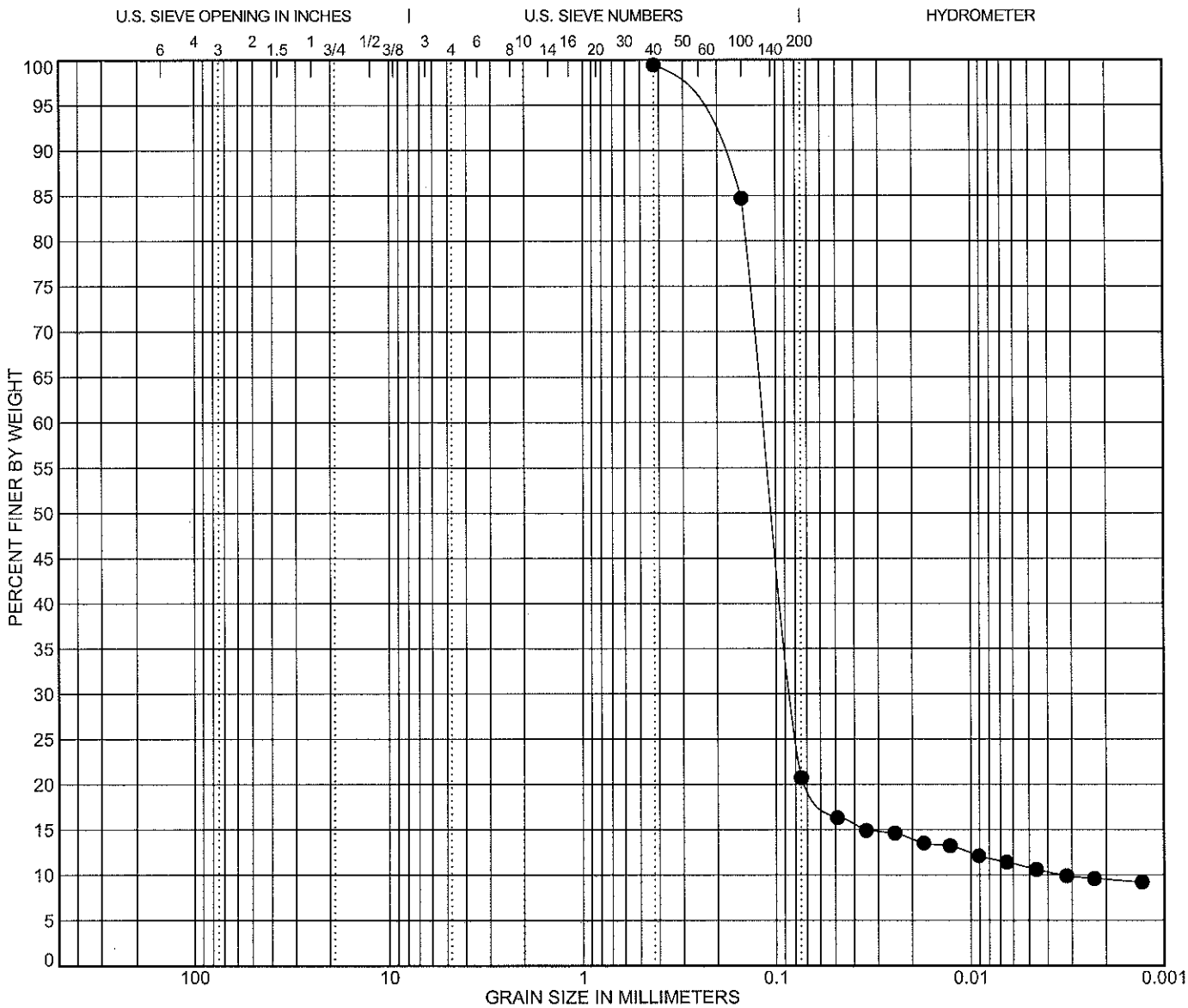
11555 Clay Road, Suite 100
Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

SPECIMEN ID
10-B13, 4.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● 10-B13	8.5					17.78	34.06

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● 10-B13	8.5				99.4	84.7	20.7

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 10-B13	8.5	0.425	0.103	0.083	0.003	0.0	78.7	11.2	9.5

GRAIN SIZE DISTRIBUTION

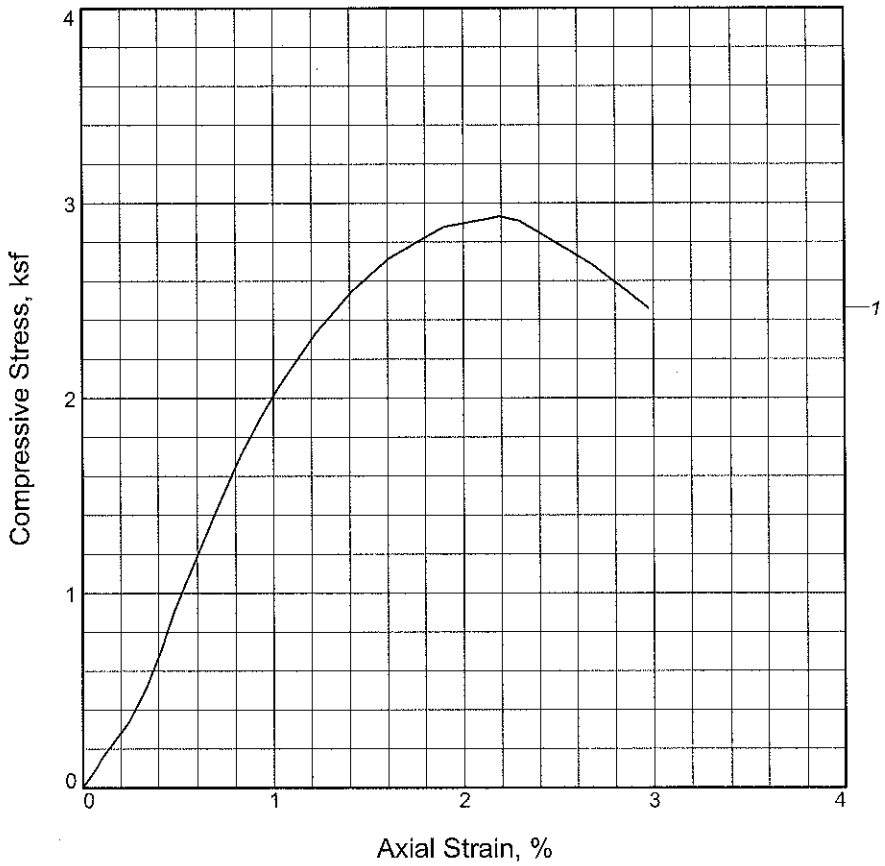
Galveston Channel Deepening,
TO-0010
Galveston, Texas
Project Number 92105154

Terracon

Terracon Consultants, Inc.
11555 Clay Road, Suite 100
Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

SPECIMEN ID
10-B13, 8.5

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	2.933			
Undrained shear strength, ksf	1.466			
Failure strain, %	2.2			
Strain rate, in./min.	0.055			
Water content, %	35.2			
Wet density, pcf	105.1			
Dry density, pcf	77.7			
Saturation, %	80.0			
Void ratio	1.2081			
Specimen diameter, in.	2.851			
Specimen height, in.	5.944			
Height/diameter ratio	2.08			

Description: Gray Fat Clay w/sand pockets

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

Project No.: 92105154

Date Sampled:

Remarks:
ASTM D2166

Client: USACE

Project: Galveston Channel Deepening San Jacinto Placement Area
Contract #W912HY-09-D-0021, Task Order #0010

Location: 10-B13

Sample Number: 1 **Depth:** 0-2 ft.

UNCONFINED COMPRESSION TEST
Terracon, Inc.
Houston, TX

UNCONFINED COMPRESSION TEST

7/21/2010

Date:
Client: USACE
Project: Galveston Channel Deepening San Jacinto Placement Area
Contract #W912HY-09-D-0021, Task Order #0010
Project No.: 92105154
Location: 10-B13
Depth: 0-2 ft. **Sample Number:** 1
Description: Gray Fat Clay w/sand pockets
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.	153.070
Moisture content: Dry soil+tare, gms.	126.110
Moisture content: Tare, gms.	49.430
Moisture, %	35.2
Moist specimen weight, gms.	1046.70
Diameter, in.	2.851
Area, in.^{2}	6.384
Height, in.	5.944
Wet density, pcf	105.1
Dry density, pcf	77.7
Void ratio	1.2081
Saturation, %	80.0

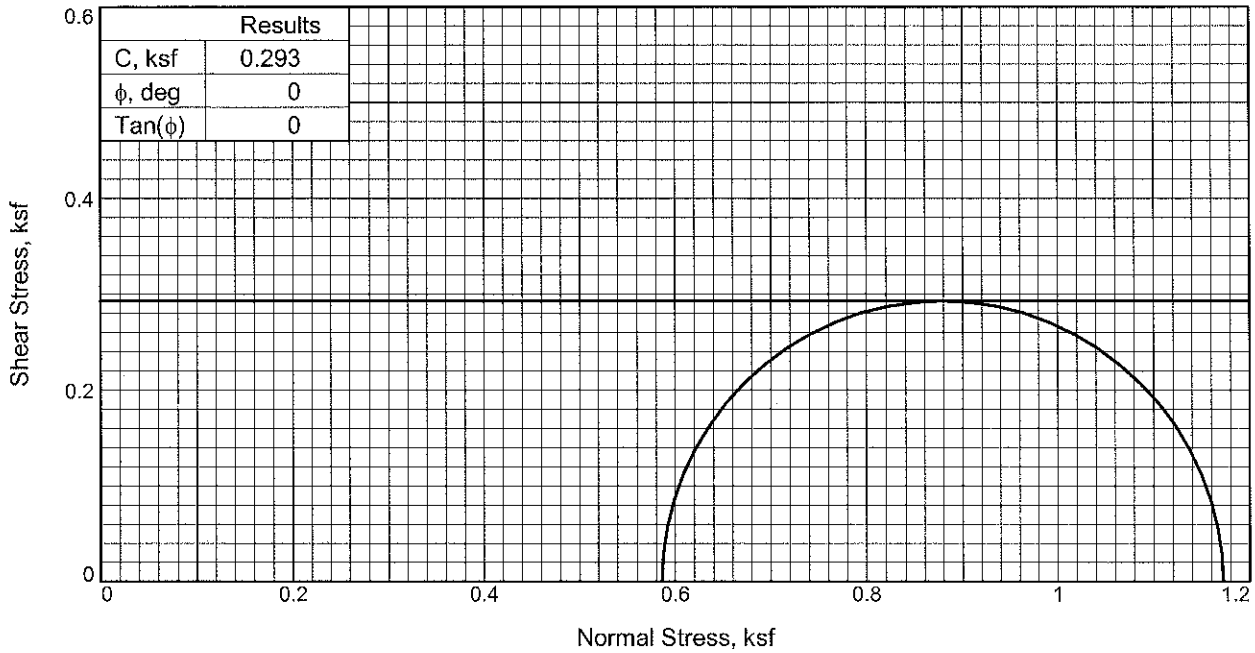
Test Readings for Specimen No. 1

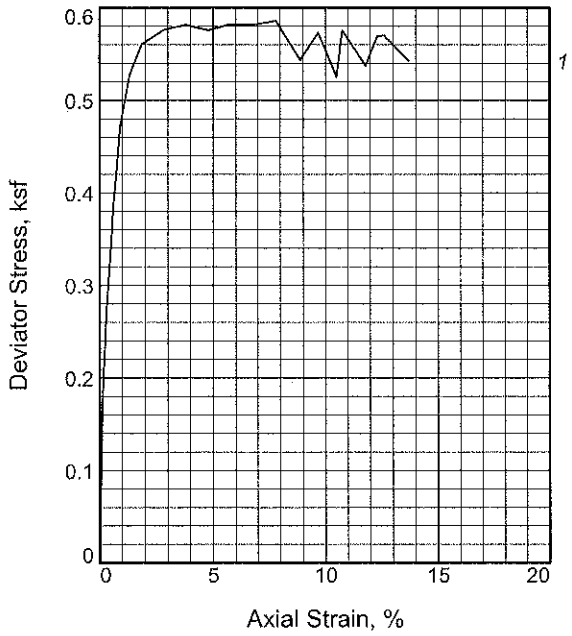
Strain rate, in./min. = 0.055
Unconfined compressive strength = 2.933 ksf **at reading no.** 18

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0145	0.000	0.0	0.0	0.000
1	0.0150	0.522	0.5	0.0	0.012
2	0.0188	4.500	4.5	0.1	0.101
3	0.0204	6.509	6.5	0.1	0.147
4	0.0288	14.982	15.0	0.2	0.337
5	0.0348	23.362	23.4	0.3	0.525
6	0.0393	31.799	31.8	0.4	0.714
7	0.0433	40.626	40.6	0.5	0.912
8	0.0478	48.888	48.9	0.6	1.097
9	0.0523	56.760	56.8	0.6	1.272
10	0.0566	64.506	64.5	0.7	1.445
11	0.0636	76.235	76.2	0.8	1.705
12	0.0696	84.612	84.6	0.9	1.891
13	0.0756	92.123	92.1	1.0	2.057
14	0.0871	104.675	104.7	1.2	2.332
15	0.0985	114.581	114.6	1.4	2.548

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1100	122.444	122.4	1.6	2.718
17	0.1274	130.154	130.2	1.9	2.880
18	0.1449	132.935	132.9	2.2	2.933
19	0.1509	132.079	132.1	2.3	2.911
20	0.1738	122.347	122.3	2.7	2.686
21	0.1913	112.500	112.5	3.0	2.462





Sample No.		1
Initial	Water Content, %	59.9
	Dry Density, pcf	66.5
	Saturation, %	104.1
	Void Ratio	1.5822
	Diameter, in.	2.799
	Height, in.	5.536
At Test	Water Content, %	59.9
	Dry Density, pcf	66.5
	Saturation, %	104.1
	Void Ratio	1.5822
	Diameter, in.	2.799
	Height, in.	5.536
Strain rate, in./min.		1.000
Back Pressure, psi		0.000
Cell Pressure, psi		4.070
Fail. Stress, ksf		0.586
Ult. Stress, ksf		
σ_1 Failure, ksf		1.172
σ_3 Failure, ksf		0.586

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray Fat Clay w/sand seams

Assumed Specific Gravity= 2.75

Remarks: ASTM D2850

Client: USACE

Project: Galveston Channel Deepening San Jacinto Placement Area
Contract #W912HY-09-D-0021, Task Order #0010

Location: 10-B13

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

Proj. No.: 92105154 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

7/21/2010
9:33 AM

Date:
Client: USACE
Project: Galveston Channel Deepening San Jacinto Placement Area
Contract #W912HY-09-D-0021, Task Order #0010
Project No.: 92105154
Location: 10-B13
Depth: 4-6 ft. **Sample Number:** 3
Description: Gray Fat Clay w/sand seams
Remarks: ASTM D2850
Type of Sample: Undisturbed
Assumed Specific Gravity=2.75 **LL=** **PL=** **PI=**
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	165.570	165.570
Moisture content: Dry soil+tare, gms.	122.010	122.010
Moisture content: Tare, gms.	49.250	49.250
Moisture, %	59.9	59.9
Moist specimen weight, gms.	950.39	
Diameter, in.	2.799	
Area, in.^{2}	6.153	
Height, in.	5.536	
Wet density, pcf	106.3	
Dry density, pcf	66.5	
Void ratio	1.5822	
Saturation, %	104.1	

Test Readings for Specimen No. 1

Cell pressure = 4.070 psi (0.586 ksf)
Back pressure = 0.000 psi (0.000 ksf)
Strain rate, in./min. = 1.000
Fail. Stress = 0.586 ksf **at reading no.** 18

Test Readings for Specimen No. 1

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	0.082	0.0	0.0	0.000	0.586	0.586	1.00	0.586	0.000
1	0.0015	2.909	2.8	0.0	0.066	0.586	0.652	1.11	0.619	0.033
2	0.0047	4.838	4.8	0.1	0.111	0.586	0.697	1.19	0.642	0.056
3	0.0060	6.442	6.4	0.1	0.149	0.586	0.735	1.25	0.660	0.074
4	0.0091	8.375	8.3	0.2	0.194	0.586	0.780	1.33	0.683	0.097
5	0.0141	10.245	10.2	0.3	0.237	0.586	0.823	1.40	0.705	0.119
6	0.0166	11.691	11.6	0.3	0.271	0.586	0.857	1.46	0.722	0.135
7	0.0291	15.199	15.1	0.5	0.352	0.586	0.938	1.60	0.762	0.176
8	0.0336	16.640	16.6	0.6	0.385	0.586	0.971	1.66	0.779	0.193
9	0.0413	18.191	18.1	0.7	0.421	0.586	1.007	1.72	0.796	0.210
10	0.0502	20.342	20.3	0.9	0.470	0.586	1.056	1.80	0.821	0.235
11	0.0733	22.948	22.9	1.3	0.528	0.586	1.114	1.90	0.850	0.264
12	0.1028	24.494	24.4	1.9	0.561	0.586	1.147	1.96	0.866	0.280
13	0.1563	25.416	25.3	2.8	0.576	0.586	1.162	1.98	0.874	0.288
14	0.2104	25.927	25.8	3.8	0.582	0.586	1.168	1.99	0.877	0.291
15	0.2636	25.927	25.8	4.8	0.576	0.586	1.162	1.98	0.874	0.288
16	0.3143	26.439	26.4	5.7	0.582	0.586	1.168	1.99	0.877	0.291
17	0.3733	26.738	26.7	6.7	0.582	0.586	1.168	1.99	0.877	0.291
18	0.4325	27.239	27.2	7.8	0.586	0.586	1.172	2.00	0.879	0.293
19	0.4915	25.578	25.5	8.9	0.544	0.586	1.130	1.93	0.858	0.272
20	0.5354	27.191	27.1	9.7	0.573	0.586	1.159	1.98	0.873	0.287
21	0.5800	25.175	25.1	10.5	0.526	0.586	1.112	1.90	0.849	0.263
22	0.5944	27.640	27.6	10.7	0.576	0.586	1.162	1.98	0.874	0.288
23	0.6535	26.129	26.0	11.8	0.538	0.586	1.124	1.92	0.855	0.269
24	0.6830	27.844	27.8	12.3	0.570	0.586	1.156	1.97	0.871	0.285
25	0.6981	27.955	27.9	12.6	0.570	0.586	1.156	1.97	0.871	0.285
26	0.7571	26.952	26.9	13.7	0.543	0.586	1.129	1.93	0.858	0.271

SUMMARY TABLE OF LABORATORY TEST DATA

Project name: TO-0010 Galveston Channel Deepening | **Client: USACE, Galveston District** | **Terracon Project # : 92105154**

Boring	Depth	Field tests			Atterberg Limits			Grain size Analysis										USCS Symbol	Wc	γd
		PP	TV	SPTn	LL	PL	PI	% by weight passing sieve					Soil Particle Content							
								4	10	40	100	200	gravel	sand	silt	clay	sieve 200			
	ft	tsf	tsf	bl/ft	%	%	%	%	%	%	%	%	%	%	%	%	%		%	pcf
10-B11	2-4	0.00																SC**	19	
	4-6	0.50			90	28	62											CH*	45	
	6-8	0.00	0.05		84	27	57	100	100	100	99	89	0	11	33	56		CH	57	67
	8-10	0.00	0.10															CH**	62	
	10-12	0.00	0.20		96	31	65	100	100	100	100	96	0	4	27	69		CH	47	
	12-14	0.00	0.25															CH**	74	60
	14-16	0.00	0.15		90	29	61	100	100	100	97	69	0	31	14	55		CH	52	
	16-18	0.00	0.10		121	32	89	100	100	100	100	97	0	3	20	77		CH	79	55
	18.5-20			41				100	100	98	87	7	0	93	4	3		SP-SM*	18	
	20.5-22			52														SP-SM**	25	
	22.5-24			29														SP-SC**	37	
	24.5-26			13														SP-SC**	31	
	26.5-28			15														SP-SC**	27	
	28-5-30			18														SP-SC**	28	
10-B12	0-2	1.25																SC**	31	
	2-4	0.75			36	16	20	100	100	99	79	32	0	68	10	22		SC	26	94
	4-6	0.00	0.15															SC**	21	
	6.5-8			15														SC**	24	
	8.5-10			8				100	100	99	77	14	0	86	8	6		SC*	24	
	10.5-12			9														SC**	38	
	12.5-14			2														SC**	33	
	14.5-16			0														CH**	61	
	16.5-18			0														CH**	62	
	18.5-20			26				100	100	97	93	44	0	56	12	32		SC*	50	
	20.5-22			17														SC**	31	
	22.5-24			39														SC**	79	
	24.5-26			49														SC**	25	
	26.5-28			60				100	100	99	88	13	0	87	11	2		SC*	24	
	28.5-30			9														SC**	28	
10-B13	0-2	1.75			75	29	46	100	100	100	100	99	0	1	34	65		CH		
	2-4	0.50																CH**	48	
	4-6	1.00			98	31	67	100	100	100	100	96	0	4	29	67		CH		
	6.5-8			0														SC**	34	
	8.5-10			0				100	100	99	85	21	0	79	11	10		SC*	28	
	10.5-12			0														CH**	56	
	12.5-14			0	96	32	64											CH*	53	
	14.5-16			0														CH**	62	
	16.5-18			0														CH**	63	
	18.5-20			53														SP-SM**	25	
10-B14	0-2	1.00			97	34	63	100	100	100	100	100	0	0	20	80		CH	47	
	2-4	0.50	0.30		100	35	65	100	100	100	100	96	0	4	30	66		CH		
	4-6	0.00	0.25															CH**	53	
	6-8	0.00	0.20															CH**	71	
	8-10	0.00	0.10		96	32	64	100	100	100	100	100	0	0	23	77		CH	73	55
	10-12	0.00	0.25		33	26	7	100	100	100	100	99	0	1	44	56		ML	42	80
	12.5-14			0														ML**	64	
	14.5-16			38														SP-SM**	28	
	16.5-18			35				100	100	100	88	11	0	90	5	5		SP-SM*	28	
	18.5-20			50														SP-SM**	32	

Boring	Depth	Strenght tests: Direct Shear Test					Unconfined Compression				UU Triaxial Test				CU Triaxial Test						
		C	φ	Wc	γd	Symbol	C	Wc	γd	Symbol	C	Wc	γd	Symbol	C	φ	c'	φ'	Wc	γd	Symbol
	ft	ksf	°	%	pcf		ksf	%	pcf		ksf	%	pcf		ksf	°	ksf	°	%	pcf	
10-B11	2-4																				
	4-6																				
	6-8																				
	8-10																				
	10-12						0.48	47	70	CH**											
	12-14																				
	14-16																				
	16-18																				
	18.5-20																				
	20.5-22																				
	22.5-24																				
	24.5-26																				
	26.5-28																				
	28-5-30																				
10-B12	0-2																				
	2-4						0.44	26	94	CL**											
	4-6																				
	6.5-8																				
	8.5-10																				
	10.5-12																				
	12.5-14																				
	14.5-16																				
	16.5-18																				
	18.5-20																				
	20.5-22																				
	22.5-24																				
	24.5-26																				
	26.5-28																				
	28.5-30																				
10-B13	0-2						1.47	35	78	CH**											
	2-4																				
	4-6										0.29	60	67	CH**							
	6.5-8																				
	8.5-10																				
	10.5-12																				
	12.5-14																				
	14.5-16																				
	16.5-18																				
	18.5-20																				
10-B14	0-2																				
	2-4						0.53	48	72	CH**											
	4-6																				
	6-8																				
	8-10																				
	10-12																				
	12.5-14																				
	14.5-16																				
	16.5-18																				
	18.5-20																				