BORING LOG NO. 10-B15

CLIENT: **USACE, Galveston District Galveston, Texas**	PROJECT: **Galveston Channel Deepening, TO-0010**
BORING LOCATION: **N: 13687588.2 E: 3316861.14**	SITE: **San Jacinto Placement Area Galveston, Texas**

Approx. Surface Elevation: 11.7 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, moist, very soft	1	CH	ST	17		0.0	0.1	51								
		2															
		3		ST	19		0.0	0.2			96	30	66	99			
	7.7 / 4.0	4															
	FILL: ELASTIC SILT bluish gray, plastic, very soft	5	MH	ST	19		0.0	0.15	48								
		6															
		7		ST	14		0.0	0.1	65	58							
		8															
		9		ST	13		0.0	0.05			111	59	52	97			
	1.7 / 10.0	10															
	FILL: FAT CLAY bluish gray, plastic, very soft	11	CH	ST	21		0.0	0.1	99								
		12															
		13		ST	20		0.0	0.05	94	45							
		14															
		15		SS	15	0			91								
		16															
	-5.3 / 17.0	17															
	POORLY GRADED SAND w/ SILT bluish gray, w/ shell, fine, slight cohesion, medium dense to dense	18	SP-SM	SS	15	27			46								
		19		SS	15	46			26					7			
	-8.3 / 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 6 feet; wet rotary thereafter.**

WATER LEVEL OBSERVATIONS			
∇ **5 ft**	WS	▼ **2.5 ft**	at 5 min
▼ **2 ft**	at 10 min	▼ **1.5 ft**	at 15 min

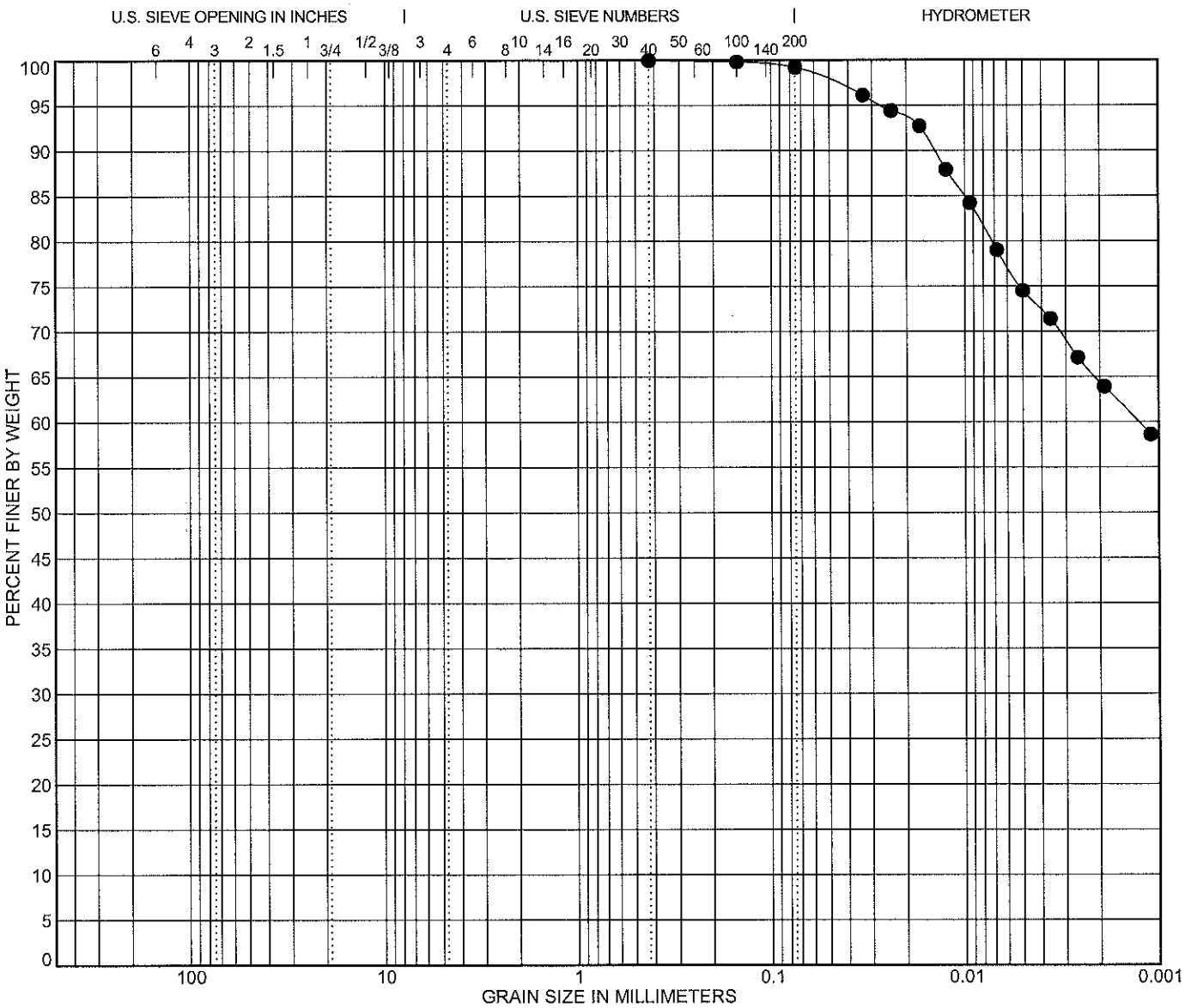
Terracon

DATE DRILLED 4/14/2010

PROJECT NUMBER 92105154

10-B15

EXHIBIT A-15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **10-B15**	**2.0**	**FAT CLAY(CH)**	**96**	**30**	**66**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **10-B15**	**2.0**				**99.9**	**99.8**	**99.2**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **10-B15**	**2.0**	**0.425**				**0.0**	**0.8**	**34.8**	**64.4**

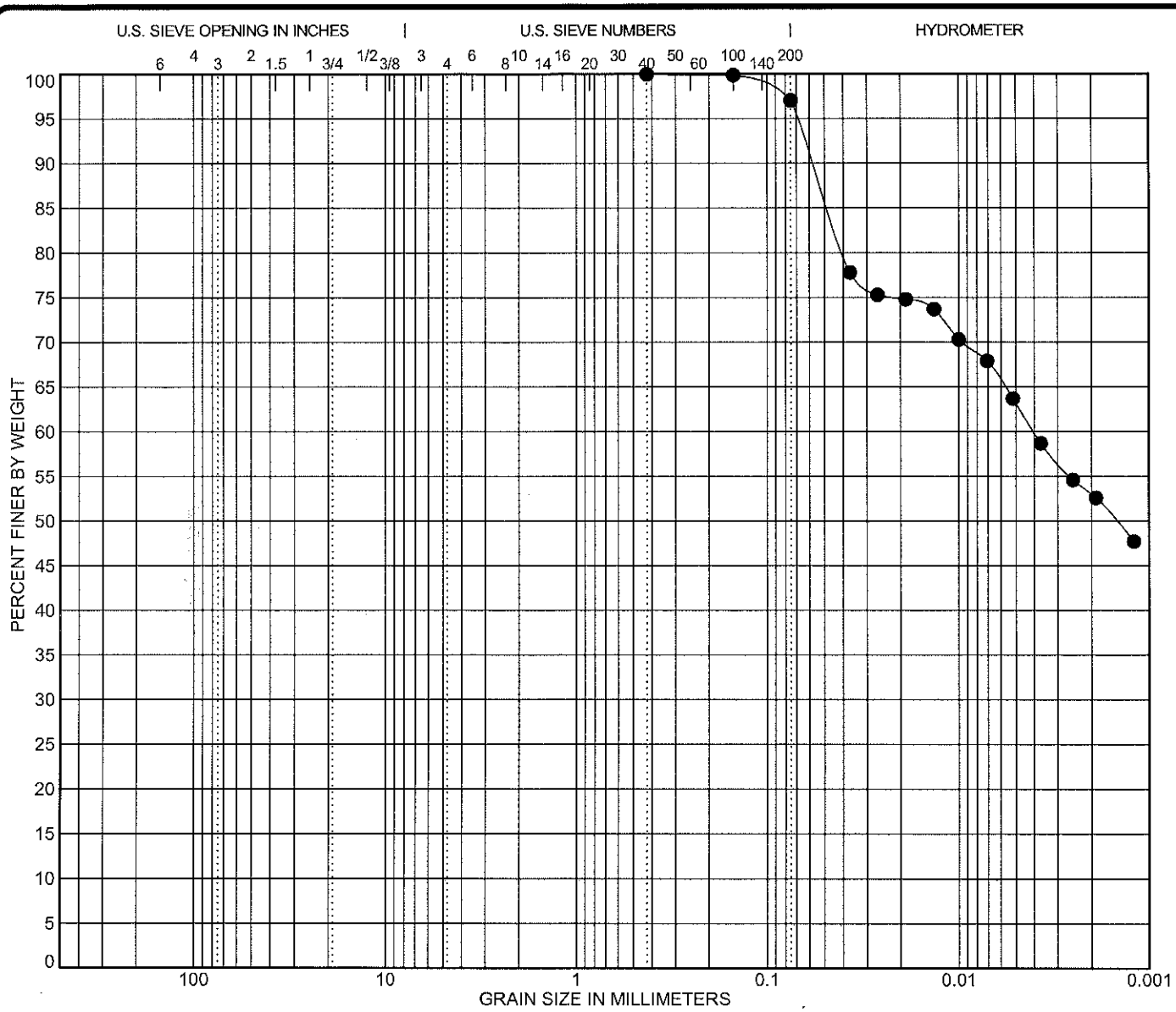
GRAIN SIZE DISTRIBUTION

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-B15, 2.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **10-B15**	**8.0**	**ELASTIC SILT(MH)**	**111**	**59**	**52**		

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **10-B15**	**8.0**				**100**	**99.9**	**97**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **10-B15**	**8.0**	**0.425**	**0.001**			**0.0**	**2.9**	**44.0**	**53.0**

GRAIN SIZE DISTRIBUTION

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

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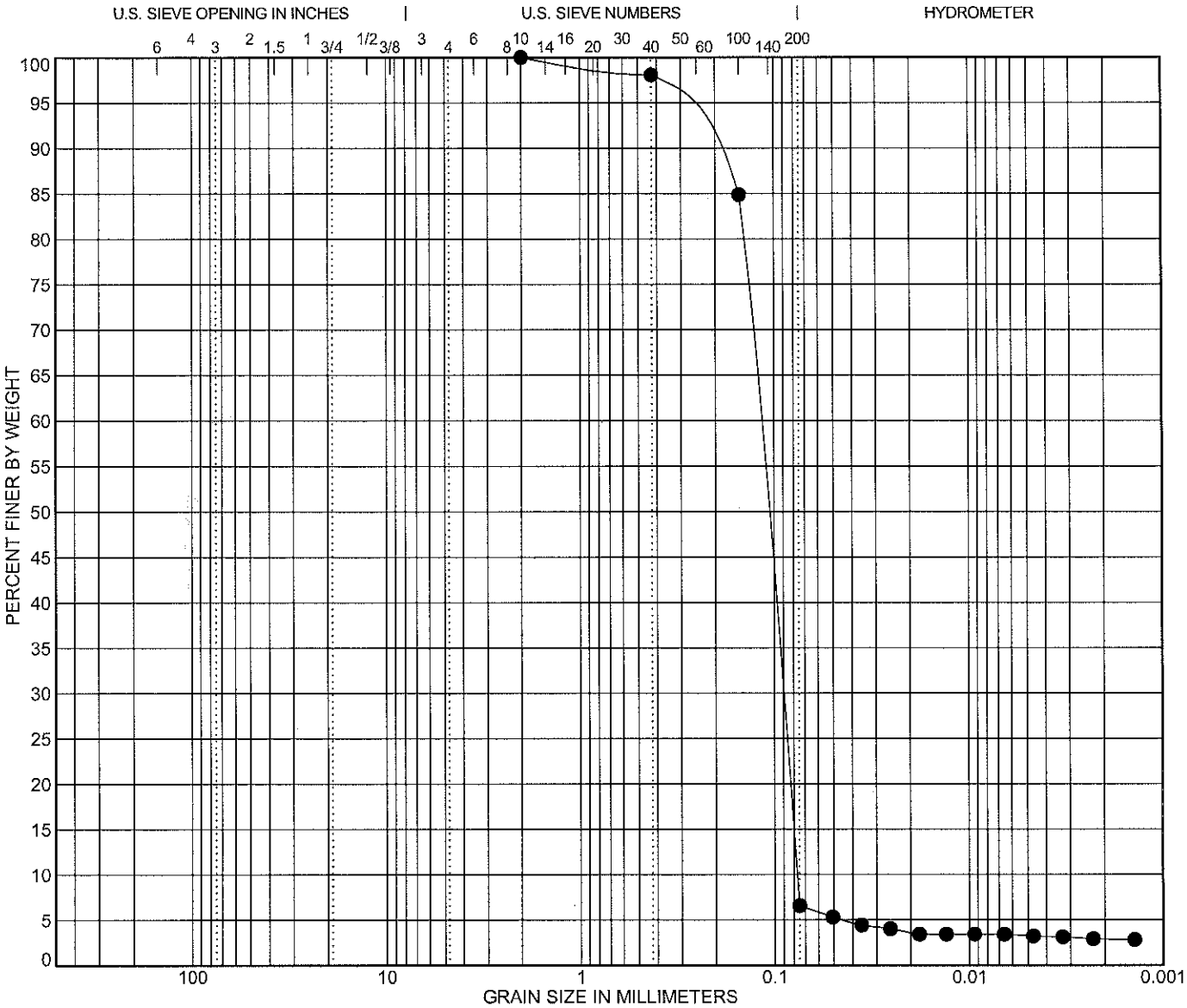
Terracon Consultants, Inc.
11555 Clay Road, Suite 100
Houston, Texas 77043
Telephone: 713-690-8989
Fax: 713-690-8787

SPECIMEN ID
10-B15, 8.0



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
● **10-B15**	**18.5**					**0.92**	**1.56**

Percent Passing the Indicated Sieve

Specimen Identification		3/8"	#4	#10	#40	#100	#200
● **10-B15**	**18.5**			**100**	**98.1**	**84.9**	**6.6**

Specimen Identification		D100	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **10-B15**	**18.5**	**2**	**0.11**	**0.092**	**0.077**	**0.0**	**93.4**	**3.7**	**2.9**

GRAIN SIZE DISTRIBUTION

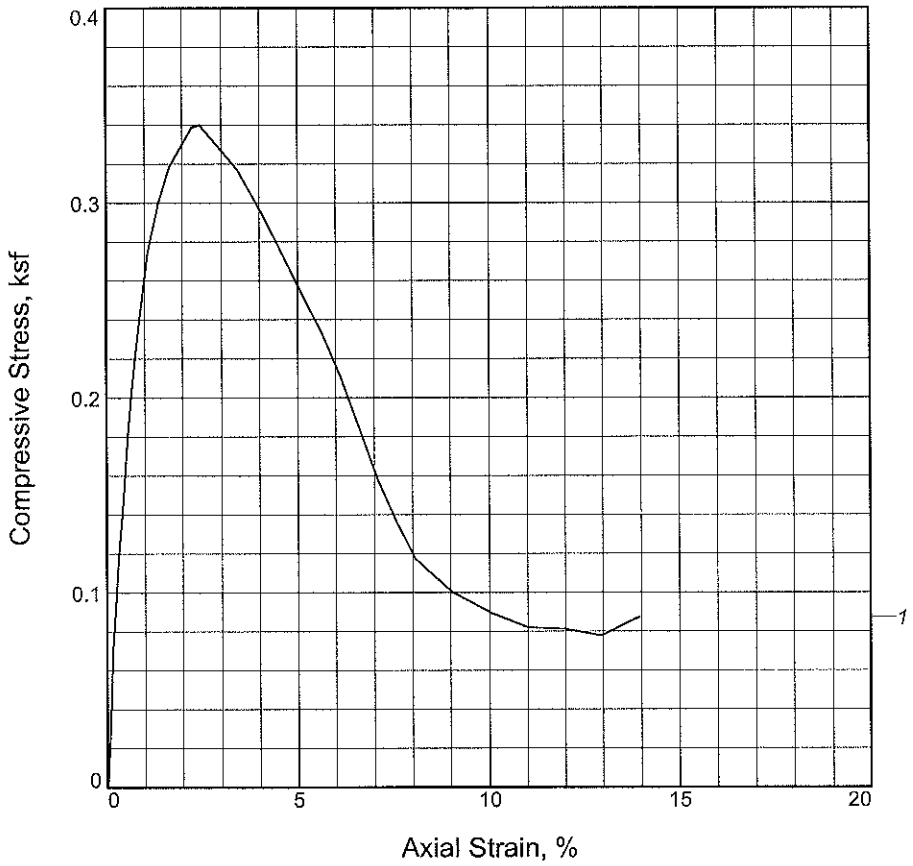
Galveston Channel Deepening,
TO-0010
Galveston, Texas
Project Number 92105154

Terracon

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

SPECIMEN ID
10-B15, 18.5

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	0.340			
Undrained shear strength, ksf	0.170			
Failure strain, %	2.4			
Strain rate, in./min.	0.055			
Water content, %	55.1			
Wet density, pcf	106.3			
Dry density, pcf	68.6			
Saturation, %	100.7			
Void ratio	1.5043			
Specimen diameter, in.	2.767			
Specimen height, in.	5.933			
Height/diameter ratio	2.14			

Description: Brown and light gray Fat Clay

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-B15

Sample Number: 2 **Depth:** 2-4 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-B15
Depth: 2-4 ft. **Sample Number:** 2
Description: Brown and light 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.	168.890
Moisture content: Dry soil+tare, gms.	126.170
Moisture content: Tare, gms.	48.640
Moisture, %	55.1
Moist specimen weight, gms.	995.75
Diameter, in.	2.767
Area, in.^{2}	6.013
Height, in.	5.933
Wet density, pcf	106.3
Dry density, pcf	68.6
Void ratio	1.5043
Saturation, %	100.7

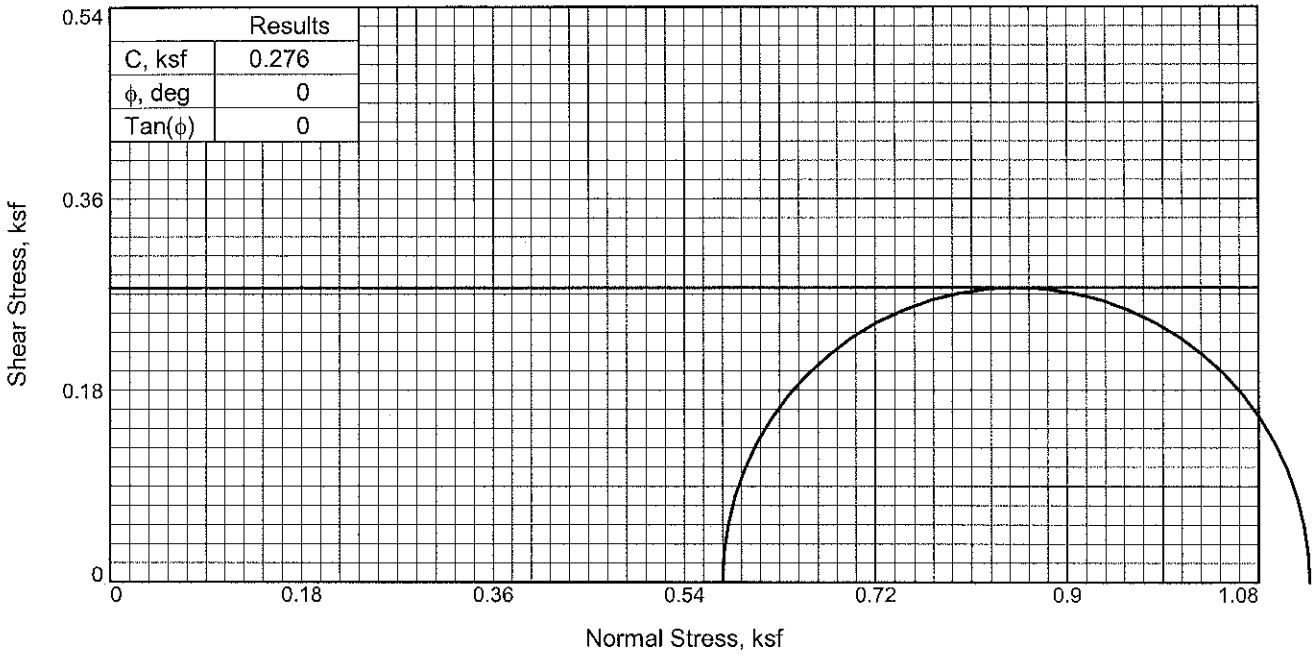
Test Readings for Specimen No. 1

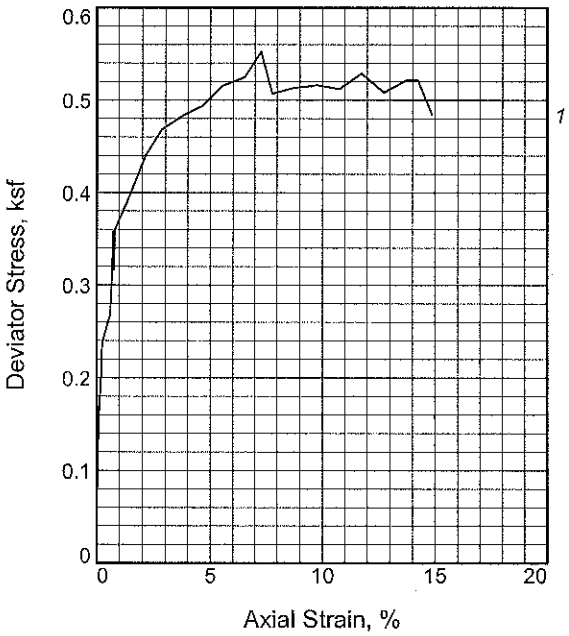
Strain rate, in./min. = 0.055
Unconfined compressive strength = 0.340 ksf **at reading no.** 17

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
0	0.0000	0.000	0.0	0.0	0.000
1	0.0012	0.040	0.0	0.0	0.001
2	0.0042	0.868	0.9	0.1	0.021
3	0.0072	1.901	1.9	0.1	0.045
4	0.0097	2.990	3.0	0.2	0.071
5	0.0142	3.899	3.9	0.2	0.093
6	0.0187	4.943	4.9	0.3	0.118
7	0.0247	5.893	5.9	0.4	0.141
8	0.0292	6.780	6.8	0.5	0.162
9	0.0337	7.686	7.7	0.6	0.183
10	0.0396	8.629	8.6	0.7	0.205
11	0.0451	9.366	9.4	0.8	0.223
12	0.0511	10.165	10.2	0.9	0.241
13	0.0641	11.605	11.6	1.1	0.275
14	0.0815	12.705	12.7	1.4	0.300
15	0.0990	13.530	13.5	1.7	0.319

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf
16	0.1339	14.478	14.5	2.3	0.339
17	0.1453	14.555	14.6	2.4	0.340
18	0.1513	14.469	14.5	2.6	0.338
19	0.2036	13.713	13.7	3.4	0.317
20	0.2380	12.909	12.9	4.0	0.297
21	0.2674	12.131	12.1	4.5	0.277
22	0.3048	11.115	11.1	5.1	0.252
23	0.3337	10.334	10.3	5.6	0.234
24	0.3632	9.384	9.4	6.1	0.211
25	0.3921	8.248	8.2	6.6	0.184
26	0.4210	7.098	7.1	7.1	0.158
27	0.4499	6.159	6.2	7.6	0.136
28	0.4788	5.335	5.3	8.1	0.117
29	0.5371	4.598	4.6	9.1	0.100
30	0.5950	4.157	4.2	10.0	0.090
31	0.6528	3.854	3.9	11.0	0.082
32	0.7111	3.854	3.9	12.0	0.081
33	0.7689	3.734	3.7	13.0	0.078
34	0.8272	4.238	4.2	13.9	0.087





Sample No.		1
Initial	Water Content, %	45.5
	Dry Density, pcf	74.3
	Saturation, %	95.5
	Void Ratio	1.3096
	Diameter, in.	2.777
	Height, in.	5.950
At Test	Water Content, %	45.5
	Dry Density, pcf	74.3
	Saturation, %	95.5
	Void Ratio	1.3096
	Diameter, in.	2.777
	Height, in.	5.950
Strain rate, in./min.		0.055
Back Pressure, psi		0.000
Cell Pressure, psi		4.000
Fail. Stress, ksf		0.552
Ult. Stress, ksf		
σ_1 Failure, ksf		1.128
σ_3 Failure, ksf		0.576

Type of Test:
Unconsolidated Undrained
Sample Type: undisturbed
Description: Dark gray Fat Clay

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-B15
Sample Number: 5 **Depth:** 8-10 ft.
Proj. No.: 92105154 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Terracon, Inc.
Houston, TX

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

7/20/2010
2:41 PM

Date:
Client: USACE
Project: Galveston Channel Deepening San Jacinto Placement Area
Contract #W912HY-09-D-0021, Task Order #0010
Project No.: 92105154
Location: 10-B15
Depth: 8-10 ft. **Sample Number:** 5
Description: Dark gray Fat Clay
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.	156.520	156.520
Moisture content: Dry soil+tare, gms.	125.870	125.870
Moisture content: Tare, gms.	58.490	58.490
Moisture, %	45.5	45.5
Moist specimen weight, gms.	1023.02	
Diameter, in.	2.777	
Area, in.^{2}	6.057	
Height, in.	5.950	
Wet density, pcf	108.1	
Dry density, pcf	74.3	
Void ratio	1.3096	
Saturation, %	95.5	

Test Readings for Specimen No. 1

Cell pressure = 4.000 psi (0.576 ksf)
Back pressure = 0.000 psi (0.000 ksf)
Strain rate, in./min. = 0.055
Fail. Stress = 0.552 ksf **at reading no.** 19

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	0.000	0.0	0.0	0.000	0.576	0.576	1.00	0.576	0.000
1	0.0000	1.140	1.1	0.0	0.027	0.576	0.603	1.05	0.590	0.014
2	0.0016	3.001	3.0	0.0	0.071	0.576	0.647	1.12	0.612	0.036
3	0.0041	5.347	5.3	0.1	0.127	0.576	0.703	1.22	0.640	0.064
4	0.0061	6.785	6.8	0.1	0.161	0.576	0.737	1.28	0.657	0.081
5	0.0119	8.541	8.5	0.2	0.203	0.576	0.779	1.35	0.677	0.101
6	0.0150	10.005	10.0	0.3	0.237	0.576	0.813	1.41	0.695	0.119
7	0.0370	11.375	11.4	0.6	0.269	0.576	0.845	1.47	0.710	0.134
8	0.0402	12.671	12.7	0.7	0.299	0.576	0.875	1.52	0.726	0.150
9	0.0446	15.153	15.2	0.8	0.358	0.576	0.934	1.62	0.755	0.179
10	0.0465	13.427	13.4	0.8	0.317	0.576	0.893	1.55	0.734	0.158
11	0.0477	15.206	15.2	0.8	0.359	0.576	0.935	1.62	0.755	0.179
12	0.0799	16.618	16.6	1.3	0.390	0.576	0.966	1.68	0.771	0.195
13	0.1276	18.933	18.9	2.1	0.440	0.576	1.016	1.76	0.796	0.220
14	0.1690	20.269	20.3	2.8	0.468	0.576	1.044	1.81	0.810	0.234
15	0.2229	21.090	21.1	3.7	0.483	0.576	1.059	1.84	0.817	0.241
16	0.2763	21.778	21.8	4.6	0.494	0.576	1.070	1.86	0.823	0.247
17	0.3296	22.957	23.0	5.5	0.516	0.576	1.092	1.90	0.834	0.258
18	0.3886	23.620	23.6	6.5	0.525	0.576	1.101	1.91	0.838	0.262
19	0.4332	25.052	25.1	7.3	0.552	0.576	1.128	1.96	0.852	0.276
20	0.4627	23.117	23.1	7.8	0.507	0.576	1.083	1.88	0.829	0.253
21	0.5217	23.673	23.7	8.8	0.513	0.576	1.089	1.89	0.833	0.257
22	0.5807	24.059	24.1	9.8	0.516	0.576	1.092	1.90	0.834	0.258
23	0.6398	24.139	24.1	10.8	0.512	0.576	1.088	1.89	0.832	0.256
24	0.6990	25.209	25.2	11.7	0.529	0.576	1.105	1.92	0.840	0.264
25	0.7580	24.503	24.5	12.7	0.508	0.576	1.084	1.88	0.830	0.254
26	0.8171	25.438	25.4	13.7	0.522	0.576	1.098	1.91	0.837	0.261
27	0.8466	25.594	25.6	14.2	0.522	0.576	1.098	1.91	0.837	0.261
28	0.8855	23.939	23.9	14.9	0.484	0.576	1.060	1.84	0.818	0.242

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	Strenght tests																				
								% by weight passing sieve					Soil Particle Content								Direct Shear Test					Unconfined Compression				UU Triaxial Test				CU Triaxial Test						
		PP	TV	SPTn	LL	PL	PI	4	10	40	100	200	gravel	sand	silt	clay	sieve 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	
10-B15	0-2	0.00	0.10															CH**	51																						
	2-4	0.00	0.20		96	30	66	100	100	100	100	99	0	1	35	64		CH								0.17	55	69	CH**												
	4-6	0.00	0.15															MH**	48																						
	6-8	0.00	0.10															MH**	65	58																					
	8-10	0.00	0.05		111	59	52	100	100	100	100	97	0	3	44	53		MH												0.28	46	74	CH**							
	10-12	0.00	0.10															CH**	99																						
	12-14	0.00	0.05															CH**	94	45																					
	14.5-16			0														CH**	91																						
	16.5-18			27														SP-SM**	46																						
	18.5-20			46				100	100	98	85	7	0	93	4	3		SP-SM*	26																						
10-B16	0-2	1.00			87	31	56											CH*	38	81																					
	2-4	0.00	0.15		83	30	53	100	100	100	100	98	0	2	42	56		CH								0.44	38	81	CH**												
	4-6	0.00	0.10															CH**	45																						
	6-8	0.00	0.15															CH**	81	55																					
	8-10	0.00	0.10		60	22	38	100	100	100	99	90	0	10	40	50		CH	44																						
	10-12	0.00	0.15		86	29	57	100	100	100	99	88	0	12	33	55		CH	49	74																					
	12-14	0.00	0.25															CH**	46																						
	14.5-16			0														CH**	62																						
	16.5-18			40				100	100	100	91	6	0	94	4	2		SP-SM*	28																						
	18.5-20			26														SP-SM**	24																						
10-B17	0-2	0.50			101	33	68											CH*	56	67																					
	2-4	0.00	0.20															CH**	56																						
	4-6	0.00	0.20		81	27	54											CH*												0.28	76	54	CH**							
	6-8	0.00	0.15															CH**	83																						
	8-10	0.00	0.10															CH**	87																						
	10-12	0.00	0.10		123	35	88	100	100	100	100	100	0	0	21	79		CH	93	47																					
	12-14	0.00	0.10															CH**	62																						
	14.5-16			0														CH**	50																						
	16.5-18			22				100	100	100	93	5	0	95			5	SP-SM*	26																						
	18.5-20			10														SP-SM**	34																						
10-B18	0-2	0.00	0.20															CH**	57																						
	2-4	0.00	0.20		97	28	69	100	100	100	99	82	0	18	31	51		CH																							
	4-6	0.00	0.25		96	29	67	100	100	100	100	98	0	2	28	70		CH	92	52																					
	6-8	0.00	0.10															CH**	95																						
	8-10	0.00	0.05		75	24	51	100	100	100	100	94	0	6	29	65		CH	78							0.09	78	55	CH**												
	10-12	0.00	0.05															CH**	101																						
	12-14	0.00	0.05		114	33	81											CH*	88	51																					
	14.5-16			0														CH**	85																						
	16.5-18			0	109	29	80											CH*	80																						
	18.5-20			0														CH**	80																						
10-B19	0-2	0.75			103	35	68	100	100	100	100	97	0	3	30	67		CH	45																						
	2-4	0.00	0.15		100	29	71	100	100	100	100	96	0	4	31	65		CH												0.42	47	73	CH**							
	4-6	0.00	0.30															CH**	53																						
	6-8	0.00	0.15															CH**	45	73																					
	8-10	0.00	0.10		80	26	54	100	100	100	100	99	0	1	38	61		CH																0.26	3	0.14	21	67	60	CH**
	10-12	0.00	1.00															CH**	54																						
	12.5-14			7														CH**	32																						
	14.5-16			0				100	100	99	95	57	0	43	20	37		CH*	44																						
	16.5-18			31														SP-SM**	26																						