SUMMARY OF LABORATORY TESTS

Project No. 08.18.920

Client: United States Army Corps of Engineers

Project: Galveston Channel and San Jacinto PA
Contract No. DACW64-03-D-0008, Task Order No. 0080

Boring No.	Sample No.	Depth (ft)	Torvane Shear Test (tsf)	Soil Description	USCS	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plastic Limit	Plast. Index	Finer than #200 Sieve (%)	Uc/UU. Compr. (tsf)	Failure Strain (%)	Conf. Pres. (psi)	Failure Type
	5	8-10		Gray FAT CLAY	CH	44.0	76.6								
	6	10-12	0.23	Gray FAT CLAY with SAND	CH	43.7	75.1	78	24	54	79.0				
	7	12-14		Gray FAT CLAY	CH	39.4	79.9								
	8	14-16		Gray SANDY FAT CLAY	CH	29.7	83.4	84	24	60	64.1	0.60	4.4		Slickensided
	9	16-18		Gray FAT CLAY	CH	44.2	71.2								
	10	18-20		Gray SANDY LEAN CLAY	CL	40.3	79.3								
	11	20-22		Gray LEAN CLAY; organics	CL	52.1	71.0					0.50	6.3		Vertical shear
	12	22-24		Gray LEAN CLAY	CL	30.2	96.9	43	21	22	93.7				
	13	24-26		Gray SILTY SAND	SM	33.7									
	14	26-28		Gray FAT CLAY	CH	36.0	75.8								
	15	28-30		Gray FAT CLAY	CH	45.8	75.0								
07-227															
	1	0-2		Gray FAT CLAY	CH	48.8	67.3								
	2	2-4		Gray FAT CLAY	CH	55.5	67.2	88	24	64	92.7				
	3	4-6		Gray FAT CLAY	CH	56.2	67.9								
	4	6-8		Gray FAT CLAY	CH	83.5	49.8								
	5	8-10		Gray FAT CLAY	CH	79.8	51.5	113	41	72	94.0				
	6	10-12		Gray FAT CLAY	CH	46.6	70.3	64	22	42		0.24	5.0		Slickensided
	7	12-14	0.18	Gray FAT CLAY	CH	107.1	41.2	116	33	83	99.5				
	8	14-15		Gray FAT CLAY	CH	88.5	54.8								
	9	15-16		Gray SILTY SAND	SM										
	10	16-17.5		Gray poorly graded SAND with SILT	SP-SM						5.5				
	11	18.5-20		Gray and tan poorly graded SAND with SILT	SP-SM						7.7				
07-228															
	1	0-2		Gray FAT CLAY	CH	32.0	78.8								
	2	2-4		Gray FAT CLAY	CH	53.0	68.1	87	25	62	98.9	0.43	3.1		60 degree
	3	4-6		Gray FAT CLAY	CH	48.2	71.3					0.48	3.9		Slickensided
	4	6-8		Gray FAT CLAY	CH	66.6	58.8								
	5	8-10		Gray FAT CLAY	CH	65.1	61.8	75	23	52	100.0	0.22	4.6	7.5	Bulge
	6	10-11.5		Tan and gray poorly graded SAND with SILT	SP-SM						7.0				
	7	15-16.5		Tan and gray poorly graded SAND; shells	SP						4.0				
	8	18.5-20		Gray poorly graded SAND with SILT; shells	SP-SM						6.6				
07-229															
	1	0-2		Gray FAT CLAY	CH	39.8	77.1								
	2	2-4		Gray FAT CLAY	CH	51.0	65.7								
	3	4-6		Gray FAT CLAY	CH	50.2	71.4	114	29	85	95.1	0.44	3.0		Slickensided
	4	6-8		Gray and tan poorly graded SAND with SILT; shells	SP-SM						11.9				

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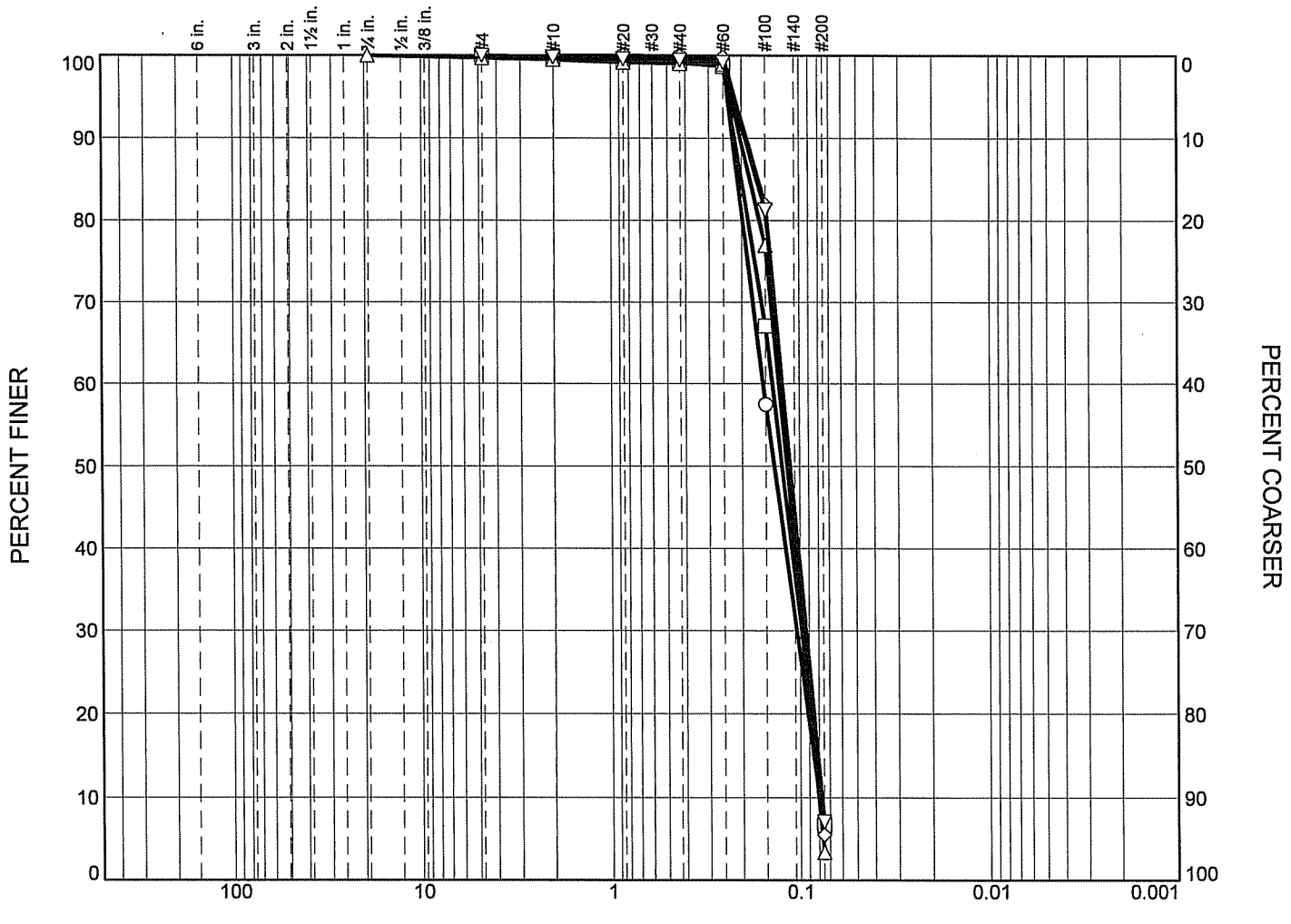
Particle Size Analysis - ASTM D 422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	93.9	6.0	
□	0.0	0.0	0.0	0.2	0.6	92.5	6.7	
△	0.0	0.0	0.3	0.2	0.5	95.6	3.4	
◇	0.0	0.0	0.0	0.0	0.1	94.4	5.5	
▽	0.0	0.0	0.0	0.2	0.4	92.4	7.0	

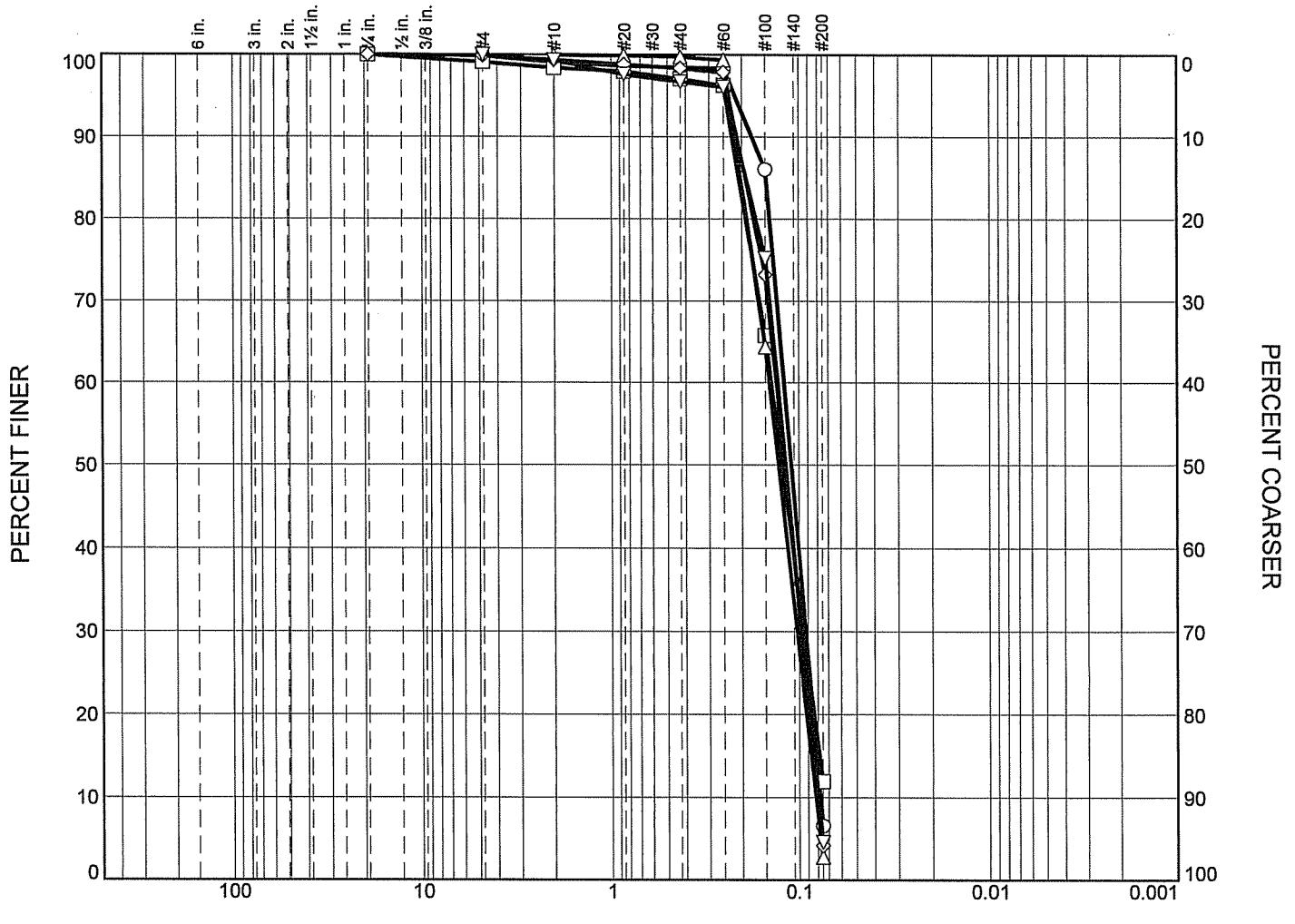
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	07-223	3	7-8.5	Gray poorly graded SAND with SILT	SP-SM
□	07-223	5	17-18.5	Gray and tan poorly graded SAND with SILT	SP-SM
△	07-225	11	20-21.5	Gray poorly graded SAND; shells	SP
◇	07-227	10	16-17.5	Gray and tan poorly graded SAND with SILT	SP-SM
▽	07-228	6	10-11.5	Tan and gray poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.
Houston, Texas

Client: United States Army Corps of Engineers
Project: Galveston Channel and San Jacinto PA
Contract No. DACW64-03-D-0008, Task Order No. 0080
Project No.: 08.18.920 **Figure**

Particle Size Analysis - ASTM D 422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.8	0.6	91.9	6.6	
□	0.0	0.0	0.9	0.7	1.3	85.2	11.9	
△					0.1	97.1	2.7	
◇	0.0	0.0	0.1	0.5	1.0	94.3	4.1	
▽	0.0	0.0	0.0	0.6	2.7	92.2	4.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	07-228	8	18.5-20	Gray poorly graded SAND with SILT; shells	SP-SM
□	07-229	4	6-8	Gray and tan poorly graded SAND with SILT; shells	SP-SM
△	07-229	6	13-14.5	Tan and gray poorly graded SAND	SP
◇	07-229	9	25-26.5	Gray and tan poorly graded SAND; shells	SP
▽	07-229	11	35-36.5	Gray poorly graded SAND	SP

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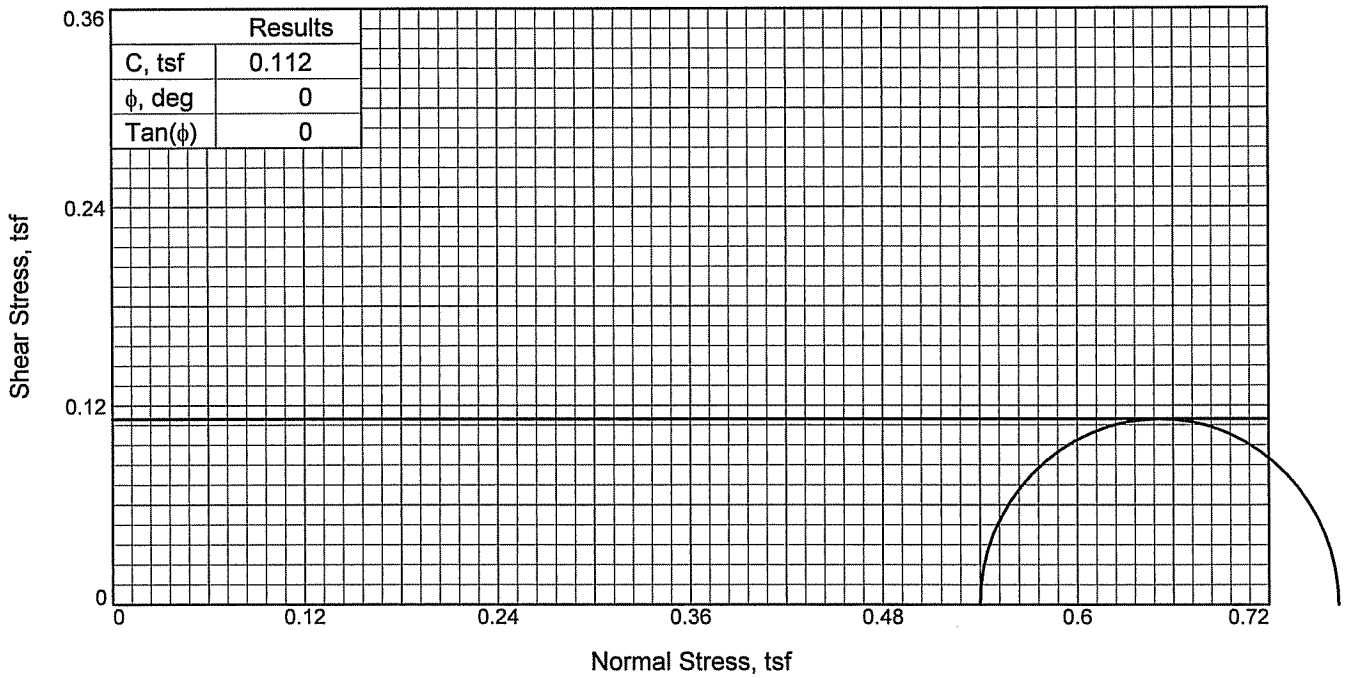
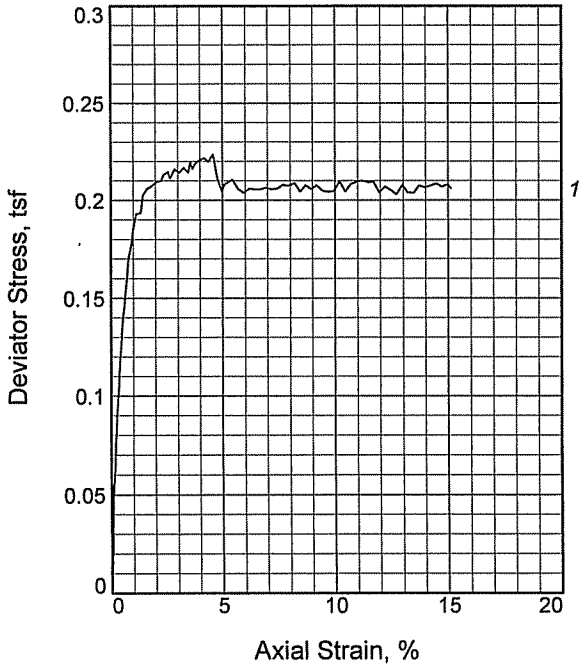




Sample No.		1
Initial	Water Content, %	65.1
	Dry Density, pcf	61.8
	Saturation, %	98.7
	Void Ratio	1.8811
	Diameter, in.	2.83
	Height, in.	5.99
At Test	Water Content, %	72.8
	Dry Density, pcf	61.8
	Saturation, %	110.3
	Void Ratio	1.8811
	Diameter, in.	2.83
	Height, in.	5.99
Strain rate, %/min.		1.00
Back Pressure, tsf		0.00
Cell Pressure, tsf		0.54
Fail. Stress, tsf		0.22
Ult. Stress, tsf		
σ_1 Failure, tsf		0.76
σ_3 Failure, tsf		0.54

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray FAT CLAY

LL= 75 **PL=** 23 **PI=** 52

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D 2850
Torvane; tsf: 0.225
Failure type: Bulge

Client: United States Army Corps of Engineers

Project: Galveston Channel and San Jacinto PA
Contract No. DACW64-03-D-0008, Task Order No. 0080

Source of Sample: 07-228 **Depth:** 8-10

Sample Number: 5

Proj. No.: 08.18.920 **Date Sampled:** 7/31/08

TRIAXIAL SHEAR TEST REPORT

Tolunay-Wong Engineers, Inc.

TRIAXIAL COMPRESSION TEST

Unconsolidated Undrained

8/8/2008
11:38 AM

Date: 7/31/08
Client: United States Army Corps of Engineers
Project: Galveston Channel and San Jacinto PA Contract No. DACW64-03-D-0008, Task Order No. 0080
Project No.: 08.18.920
Location: 07-228
Depth: 8-10 **Sample Number:** 5
Description: Gray FAT CLAY
Remarks:

Test method: ASTM D 2850
Torvane; tsf: 0.225
Failure type: Bulge

Type of Sample: Undisturbed
Assumed Specific Gravity=2.85 **LL=**75 **PL=**23 **PI=**52
Test Method: ASTM D 2850

Parameters for Specimen No. 1

Specimen Parameter	Initial	Final
Moisture content: Moist soil+tare, gms.	143.830	127.530
Moisture content: Dry soil+tare, gms.	99.620	87.100
Moisture content: Tare, gms.	31.730	31.550
Moisture, %	65.1	72.8
Moist specimen weight, gms.	1004.4	
Diameter, in.	2.83	
Area, in.^{2}	6.27	
Height, in.	5.99	
Wet Density, pcf	102.0	
Dry density, pcf	61.8	
Void ratio	1.8811	
Saturation, %	98.7	

Test Readings for Specimen No. 1

Membrane modulus = .130 kN/cm^2
Membrane thickness = .031 cm
Cell pressure = 7.50 psi (0.540 tsf)
Back pressure = 0.00 psi (0.000 tsf)
Strain rate, %/min. = 1.00
Fail. Stress = 0.223 tsf **at reading no.** 45

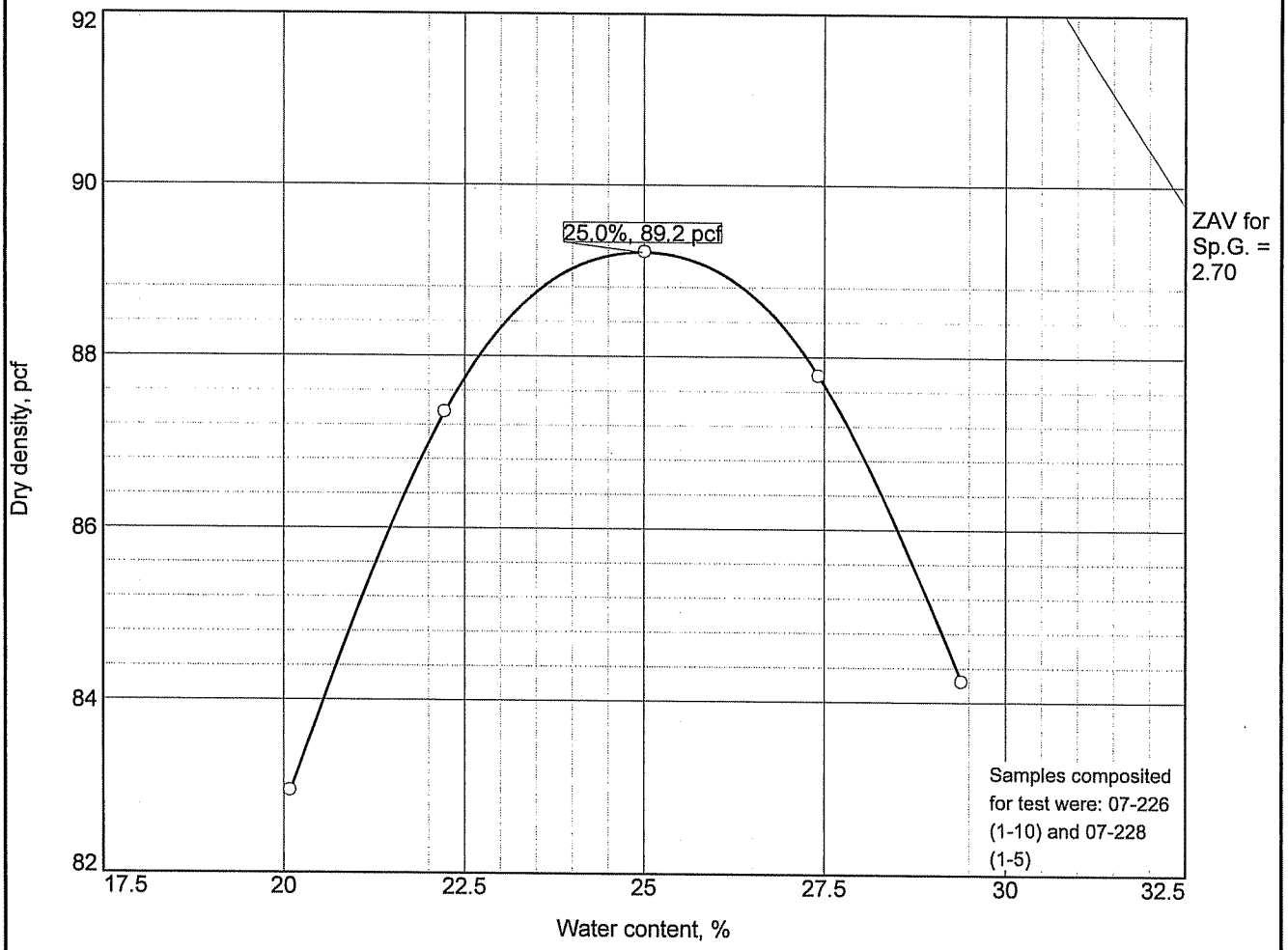
Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Princ. Stress tsf	Major Princ. Stress tsf	1:3 Ratio	P tsf	Q tsf
0	0.0300	0.000	0.0	0.0	0.000	0.540	0.540	1.00	0.540	0.000
1	0.0358	4.643	4.6	0.1	0.053	0.540	0.593	1.10	0.567	0.027
2	0.0374	4.959	5.0	0.1	0.057	0.540	0.597	1.11	0.568	0.028
3	0.0386	5.366	5.4	0.1	0.062	0.540	0.602	1.11	0.571	0.031
4	0.0406	5.756	5.8	0.2	0.066	0.540	0.606	1.12	0.573	0.033
5	0.0418	6.600	6.6	0.2	0.076	0.540	0.616	1.14	0.578	0.038
6	0.0438	7.094	7.1	0.2	0.081	0.540	0.621	1.15	0.581	0.041
7	0.0450	7.705	7.7	0.3	0.088	0.540	0.628	1.16	0.584	0.044
8	0.0470	8.210	8.2	0.3	0.094	0.540	0.634	1.17	0.587	0.047
9	0.0502	8.916	8.9	0.3	0.102	0.540	0.642	1.19	0.591	0.051
10	0.0514	9.713	9.7	0.4	0.111	0.540	0.651	1.21	0.596	0.056
11	0.0547	10.354	10.4	0.4	0.118	0.540	0.658	1.22	0.599	0.059
12	0.0559	10.806	10.8	0.4	0.124	0.540	0.664	1.23	0.602	0.062
13	0.0580	11.087	11.1	0.5	0.127	0.540	0.667	1.23	0.603	0.063
14	0.0593	11.740	11.7	0.5	0.134	0.540	0.674	1.25	0.607	0.067
15	0.0625	12.319	12.3	0.5	0.141	0.540	0.681	1.26	0.610	0.070
16	0.0658	12.847	12.8	0.6	0.147	0.540	0.687	1.27	0.613	0.073
17	0.0683	13.345	13.3	0.6	0.152	0.540	0.692	1.28	0.616	0.076
18	0.0735	14.211	14.2	0.7	0.162	0.540	0.702	1.30	0.621	0.081
19	0.0767	14.864	14.9	0.8	0.169	0.540	0.709	1.31	0.625	0.085
20	0.0799	15.159	15.2	0.8	0.173	0.540	0.713	1.32	0.626	0.086
21	0.0844	15.474	15.5	0.9	0.176	0.540	0.716	1.33	0.628	0.088
22	0.0877	15.907	15.9	1.0	0.181	0.540	0.721	1.34	0.630	0.090
23	0.0890	16.242	16.2	1.0	0.185	0.540	0.725	1.34	0.632	0.092
24	0.0922	16.553	16.6	1.0	0.188	0.540	0.728	1.35	0.634	0.094
25	0.0981	16.975	17.0	1.1	0.193	0.540	0.733	1.36	0.636	0.096
26	0.1104	17.085	17.1	1.3	0.194	0.540	0.734	1.36	0.637	0.097
27	0.1168	17.887	17.9	1.4	0.202	0.540	0.742	1.37	0.641	0.101
28	0.1283	18.227	18.2	1.6	0.206	0.540	0.746	1.38	0.643	0.103
29	0.1406	18.370	18.4	1.8	0.207	0.540	0.747	1.38	0.644	0.104
30	0.1527	18.623	18.6	2.1	0.210	0.540	0.750	1.39	0.645	0.105
31	0.1649	18.680	18.7	2.3	0.210	0.540	0.750	1.39	0.645	0.105
32	0.1713	18.980	19.0	2.4	0.213	0.540	0.753	1.39	0.646	0.106
33	0.1834	19.150	19.1	2.6	0.214	0.540	0.754	1.40	0.647	0.107
34	0.1892	18.895	18.9	2.7	0.211	0.540	0.751	1.39	0.646	0.106
35	0.2014	19.353	19.4	2.9	0.216	0.540	0.756	1.40	0.648	0.108
36	0.2137	19.230	19.2	3.1	0.214	0.540	0.754	1.40	0.647	0.107
37	0.2258	19.489	19.5	3.3	0.217	0.540	0.757	1.40	0.648	0.108
38	0.2379	19.326	19.3	3.5	0.214	0.540	0.754	1.40	0.647	0.107
39	0.2437	19.812	19.8	3.6	0.219	0.540	0.759	1.41	0.650	0.110
40	0.2495	19.524	19.5	3.7	0.216	0.540	0.756	1.40	0.648	0.108
41	0.2560	19.774	19.8	3.8	0.219	0.540	0.759	1.40	0.649	0.109
42	0.2681	19.983	20.0	4.0	0.220	0.540	0.760	1.41	0.650	0.110
43	0.2803	20.128	20.1	4.2	0.222	0.540	0.762	1.41	0.651	0.111
44	0.2918	20.010	20.0	4.4	0.220	0.540	0.760	1.41	0.650	0.110
45	0.3041	20.378	20.4	4.6	0.223	0.540	0.763	1.41	0.652	0.112
46	0.3163	20.295	20.3	4.8	0.211	0.540	0.751	1.39	0.645	0.105

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress tsf	Minor Princ. Stress tsf	Major Princ. Stress tsf	1:3 Ratio	P tsf	Q tsf
47	0.3285	19.796	19.8	5.0	0.204	0.540	0.744	1.38	0.642	0.102
48	0.3342	20.169	20.2	5.1	0.208	0.540	0.748	1.39	0.644	0.104
49	0.3555	20.554	20.6	5.4	0.211	0.540	0.751	1.39	0.645	0.105
50	0.3702	20.229	20.2	5.7	0.206	0.540	0.746	1.38	0.643	0.103
51	0.3855	20.146	20.1	5.9	0.204	0.540	0.744	1.38	0.642	0.102
52	0.4002	20.448	20.4	6.2	0.206	0.540	0.746	1.38	0.643	0.103
53	0.4150	20.518	20.5	6.4	0.205	0.540	0.745	1.38	0.643	0.103
54	0.4304	20.633	20.6	6.7	0.205	0.540	0.745	1.38	0.643	0.103
55	0.4452	20.830	20.8	6.9	0.206	0.540	0.746	1.38	0.643	0.103
56	0.4599	20.857	20.9	7.2	0.206	0.540	0.746	1.38	0.643	0.103
57	0.4754	21.010	21.0	7.4	0.206	0.540	0.746	1.38	0.643	0.103
58	0.4901	21.292	21.3	7.7	0.208	0.540	0.748	1.38	0.644	0.104
59	0.5055	21.371	21.4	7.9	0.207	0.540	0.747	1.38	0.644	0.104
60	0.5202	21.611	21.6	8.2	0.209	0.540	0.749	1.39	0.644	0.104
61	0.5355	21.321	21.3	8.4	0.204	0.540	0.744	1.38	0.642	0.102
62	0.5502	21.729	21.7	8.7	0.208	0.540	0.748	1.38	0.644	0.104
63	0.5656	21.671	21.7	8.9	0.206	0.540	0.746	1.38	0.643	0.103
64	0.5803	21.953	22.0	9.2	0.207	0.540	0.747	1.38	0.644	0.104
65	0.5957	21.813	21.8	9.4	0.205	0.540	0.745	1.38	0.642	0.102
66	0.6104	21.880	21.9	9.7	0.204	0.540	0.744	1.38	0.642	0.102
67	0.6258	22.029	22.0	10.0	0.205	0.540	0.745	1.38	0.642	0.102
68	0.6404	22.629	22.6	10.2	0.210	0.540	0.750	1.39	0.645	0.105
69	0.6558	22.252	22.3	10.5	0.204	0.540	0.744	1.38	0.642	0.102
70	0.6706	22.734	22.7	10.7	0.208	0.540	0.748	1.39	0.644	0.104
71	0.6860	22.988	23.0	11.0	0.209	0.540	0.749	1.39	0.645	0.105
72	0.7007	23.159	23.2	11.2	0.210	0.540	0.750	1.39	0.645	0.105
73	0.7161	23.203	23.2	11.5	0.209	0.540	0.749	1.39	0.645	0.105
74	0.7308	23.352	23.4	11.7	0.209	0.540	0.749	1.39	0.645	0.105
75	0.7462	22.937	22.9	12.0	0.204	0.540	0.744	1.38	0.642	0.102
76	0.7609	23.351	23.4	12.2	0.207	0.540	0.747	1.38	0.643	0.103
77	0.7762	23.295	23.3	12.5	0.205	0.540	0.745	1.38	0.642	0.102
78	0.7910	23.203	23.2	12.7	0.203	0.540	0.743	1.38	0.641	0.101
79	0.8063	23.796	23.8	13.0	0.207	0.540	0.747	1.38	0.644	0.104
80	0.8210	23.554	23.6	13.2	0.204	0.540	0.744	1.38	0.642	0.102
81	0.8364	23.668	23.7	13.5	0.204	0.540	0.744	1.38	0.642	0.102
82	0.8512	24.170	24.2	13.7	0.207	0.540	0.747	1.38	0.644	0.104
83	0.8666	24.208	24.2	14.0	0.206	0.540	0.746	1.38	0.643	0.103
84	0.8813	24.420	24.4	14.2	0.207	0.540	0.747	1.38	0.644	0.104
85	0.8966	24.678	24.7	14.5	0.208	0.540	0.748	1.39	0.644	0.104
86	0.9114	24.643	24.6	14.7	0.207	0.540	0.747	1.38	0.643	0.103
87	0.9268	24.897	24.9	15.0	0.208	0.540	0.748	1.39	0.644	0.104
88	0.9357	24.771	24.8	15.1	0.206	0.540	0.746	1.38	0.643	0.103

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	CH			2.70			0.0	

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 89.2 pcf Optimum moisture = 25.0 %	Dark Gray FAT CLAY

Project No. 08.18.920 **Client:** United States Army Corps of Engineers
Project: Galveston Channel and San Jacinto PA
Contract No. DACW64-03-D-0008, Task Order No. 0080 **Date:**
○ **Source of Sample:** Mix 03 **Sample Number:** 3

Tolunay-Wong Engineers, Inc.

Houston, Texas

Remarks:
Test method: ASTM D 698
Preparation Method: Dry
Specific Gravity: Assumed

Tested By: SA **Checked By:** JL

Hole No. 07-228

BORING LOG	DISTRICT	INSTALLATION	SHEET 1 OF 1 SHEETS

1. PROJECT Galveston Channel and San Jacinto PA	7. ELEVATION OF HOLE
2. LOCATION (Coordinates or Station) N=13690571 E=3319736	8. DATUM FOR ELEVATION
3. DRILLING AGENCY Dempsey (Geotest Engineering, Inc.)	9. ELEVATION OF GROUNDWATER TOD: 24-HR:
4. LABORATORY TESTING AGENCY Tolunay-Wong Engineers, Inc.	10. DRILLING DATE and TIME STARTED: 4/22/08 COMPLETED: 4/22/08
5. DEPTH OF WATER TOD: 24-HR:	11. CLASSIFICATION REFERENCE
6. DEPTH OF HOLE 20 ft	12. ENGINEER

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	NUMBER	RECOVERY (%)	SPT (N)	PENETROMETER (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (% <200)
			FAT CLAY (CH), stiff, brown & gray -w/ roots @ 0' - 2'		1			1.50	78.8	32.0				
			-firm @ 2' - 4'		2			0.75	68.1	53.0	87	25	62	98.9
5			-soft below 4' -w/ slickensides @ 4' - 6'		3			0.50	71.3	48.2				
			-gray below 6'		4			0.50	58.8	66.6				
			-w/ sand & shell fragments on bottom of 8' - 10' sample		5			0.50	61.8	65.1	75	23	52	100
10			**POORLY GRADED SAND WITH SILT (SP-SM)**, dense, gray, w/ shell fragments		6		46							7
15			**POORLY GRADED SAND (SP)**, medium dense, gray, w/ shell fragments		7		24							4
20			**POORLY GRADED SAND WITH SILT (SP-SM)**, very dense, gray, w/ shell fragments		8		84							6.6
25														
30														

SWG 1836 BOR 08.18.920.GPJ TOLUNAY-WONG ENGINEERS.GDT 11/10/08

ENG FORM: SWG 1836 BOR