U.S. ARMY CORPS OF ENGINEERS

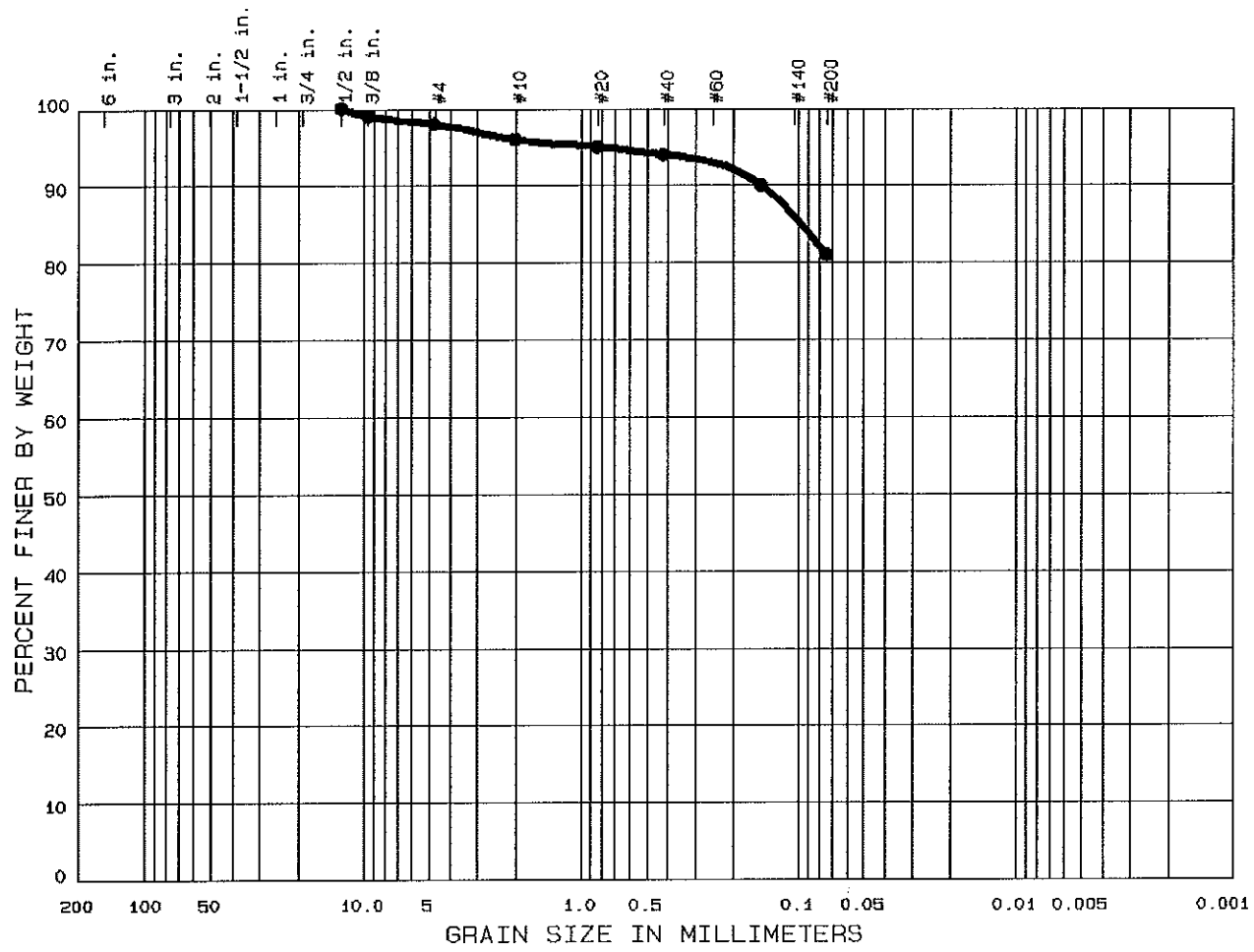
BORING NO. 91-77 DATE: BEGIN 3-28-91 PAGE 1 / 1
JOB NO. 146448 COMPLETE 3-28-91 Thin Walled Tube
PROJECT Bray's Bayou ☐ 3" ☑ 6"
LOCATION Bray's Bayou South Bank
ELEVATION OF HOLE
MANUFACTURER'S DESIGNATION OF DRILL RIG Failing 36
GROUNDWATER: DEPTH 83" ft., ELEV. ____ ft., at end of Drilling
WEATHER Cloudy, Warm
DRILLER D. Mitchell LOGGER T. Berg

DEPTH, FEET	SAMPLE	SAMPLE NO.	PEN./TORVANE SPT.-BLOW COUNT	COLOR	MATERIAL TYPE	CONSISTENCY	SECONDARY CONSTITUENTS	STRUCTURAL FEATURES AND COMMENTS
0		1		Gray				
		2		"				
5		3	5.0					
		4	4.5+	"	"	hard		
		5	4.5+	Gr. Gray	Clay	"		w/cal. nods.
10		6	4.5+	"	"	"		w/ " "
		7	4.5+	Tan + Gray	"	"		w/ " "
15		8	4.5+	"	"	"		w/ " "
		9	4.5+	"	"	"		
		10	4.5+	"	"	"		
20		11	3.5	Tan + Gray	Clay	Very Stiff		
		12	4.25	"	"	hard		w/cal. Nods.
25		13	4.25+	"	"	"		w/ " "
		14	4.5+	Tan + Gray	Clay	hard		
		15	4.5+	"	"	"		
30								Bottom of 91-77 (30')
35								

GEOTEST ENGINEERING, INC.

DEPARTMENT OF THE ARMY, SOUTHWESTERN DIVISION LABORATORY
CORPS OF ENGINEERS, 4815 CASS STREET, DALLAS, TX 75235

W.O. No.
Req. No.
Contract No.



	% COBBLES	% GRAVEL	% SAND	% SILT OR CLAY
●	0.0	2.0	17.0	81.0

	Sample No.	Elev or Depth	Nat W%	LL	PL	PI	C_c	C_u
●	91/2518	8.0-10.0	18.0	67	16	51		

CLASSIFICATION

● FAT CLAY WITH SAND (CH)

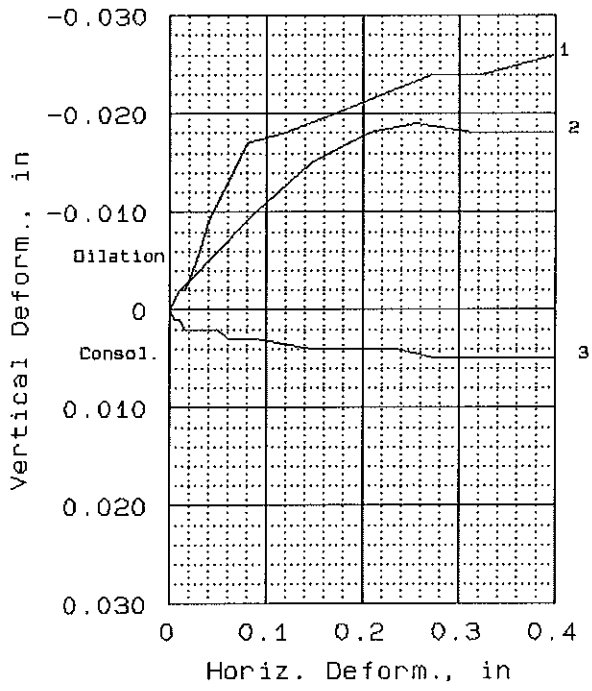
Remarks:

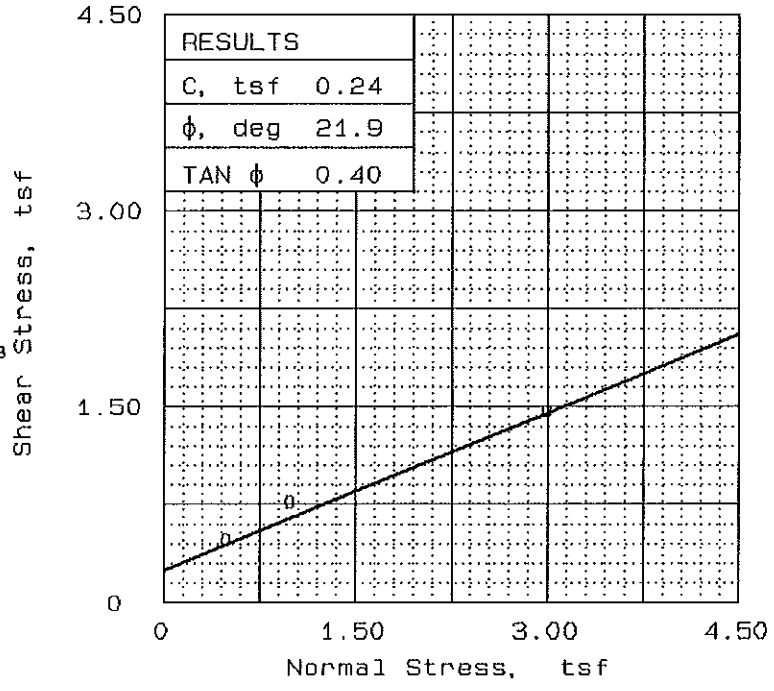
Project BRAYS BAYOU
FLOOD DAMAGE REDUCTION PROJECT
Lab No. SWDED-GL RPT NO. 15363

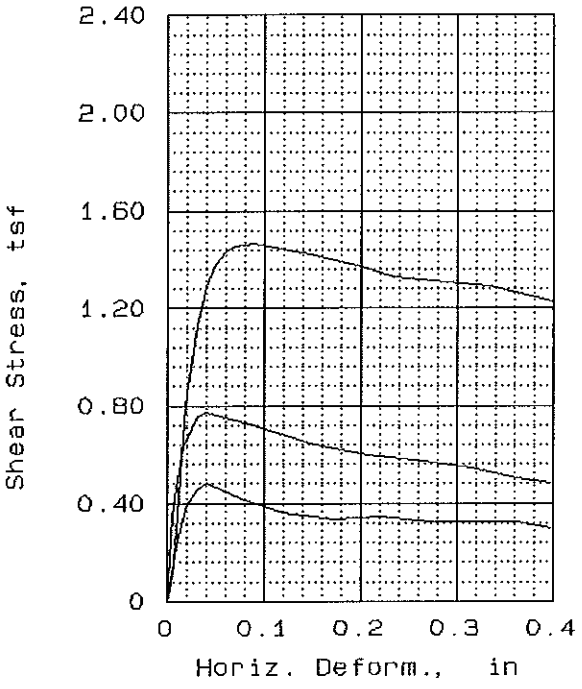
Area

Boring No. 91-77 Date AUGUST 1991

GRADATION CURVES







SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	15.5	17.9	17.2
	DRY DENSITY, pcf	111.9	108.0	108.6
	SATURATION, %	82.6	86.1	84.3
	VOID RATIO	0.506	0.560	0.552
	SIDE LENGTH, in	3.00	3.00	3.00
	HEIGHT, in	1.00	1.00	1.00
AT TEST	WATER CONTENT, %	19.1	20.8	20.0
	DRY DENSITY, pcf	112.1	108.5	109.6
	SATURATION, %	102.2	101.3	100.4
	VOID RATIO	0.504	0.553	0.538
	SIDE LENGTH, in	3.39	3.39	3.39
	HEIGHT, in	1.00	1.00	0.99
NORMAL STRESS, tsf		0.50	1.00	3.00
MAX. SHEAR, tsf		0.48	0.77	1.47
STRAIN RATE, %/min.		0.002	0.002	0.002
ULT. SHEAR, tsf				

SAMPLE DATA

SAMPLE TYPE: UNDISTURBED

DESCRIPTION: FAT CLAY WITH SAND (CH)

LL= 67 PL= 16 PI= 51.0

SPECIFIC GRAVITY= 2.70

REMARKS: SPECIFIC GRAVITY ESTIMATED

FIG. NO.

CLIENT: US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT

PROJECT: BRAYS BAYOU FLOOD DAMAGE REDUCTION PROJECT, HOUSTON, TX.

SAMPLE LOCATION: BORING: 91-77, CTN-5 9.2'-10.0', SWD LAB NO. 91/2518

PROJ. NO.: 15363 DATE: JULY 1991

DIRECT SHEAR TEST

CORPS OF ENGINEERS - SOUTHWESTERN

TABLE 1

RESULTS OF TESTS OF DISTURBED AND UNDISTURBED SOIL SAMPLES

SWDED-GL REPORT NO. 15363 BRAYS BAYOU - FLOOD DAMAGE REDUCTION PROJECT

BORING	NO.	SWD NO. FLD NO.	DEPTH, FT	GR	SA	FI	LL	PL	PI	LS	WC, %	PCF	MAJOR TESTS	DESCRIPTION OF MATERIAL
91	77	91/2518 CTN-5	8.0 - 10.0	2	17	81	67	16	51		18.0	110	DS	CH - FAT CLAY WITH SAND, GRAYISH BROWN MOTTLED WITH BROWNISH GRAY AND GRAY, MOIST, HARD(>4.0), NON-CALCAREOUS, IRON-OXIDE DEPOSITS, CALCAREOUS POCKETS, CALCAREOUS NODULES TO 1/2" IN BOTTOM 2".
91	79	91/2519 CTN-3	4.0 - 6.0	3	15	82	60	13	47		20.2	106	DS	CH - FAT CLAY WITH SAND, LIGHT GRAYISH BROWN MOTTLED WITH YELLOW AND GRAY, MOIST, VERY STIFF(2.0-2.5), NON-CALCAREOUS, IRON-OXIDE DEPOSITS, CALCAREOUS NODULES THROUGHOUT.
91	79	91/2520 CTN-10	18.0 - 20.0	0	24	76	35	12	23		18.3	110	DS	CL - LEAN CLAY WITH SAND, REDDISH YELLOW, MOIST, VERY STIFF(2.25), NON-CALCAREOUS, POCKETS OF GRAY VERY FINE SILTY SAND.
91	82	91/2521 CTN-3	4.0 - 6.0	1	23	76	57	14	43		19.5	107	DS	CH - FAT CLAY WITH SAND, LIGHT GRAYISH BROWN MOTTLED WITH GRAY, MOIST, VERY STIFF(3.25), NON-CALCAREOUS, IRON-OXIDE DEPOSITS, CALCAREOUS NODULES AND GRAVELS TO 1".
91	82	91/2522 CTN-12	22.0 - 24.0	1	14	85	37	13	24		21.3	106	DS	CL - LEAN CLAY WITH SAND, LIGHT BROWN AND LIGHT GRAY, MOIST, VERY STIFF(2.25), NON-CALCAREOUS, A FEW GRAVELS, CALCAREOUS NODULES THROUGHOUT.
91	84	91/2523 CTN-8	14.0 - 16.0	0	17	83	39	13	26		25.3	98	DS	CL - LEAN CLAY WITH SAND, YELLOW AND GRAY, MOIST, SOFT(0.5), NON-CALCAREOUS, CALCAREOUS NODULES, SEAMS AND POCKETS THROUGHOUT, VERY SANDY IN TOP 1".
91	87	91/2524 CTN-3	4.0 - 6.0	1	10	89	95	22	73		39.1	80	DS	CH - FAT CLAY, GRAY, MOIST, STIFF(1.5), NON-CALCAREOUS, IRON-OXIDE DEPOSITS, CALCAREOUS NODULES.
91	87	91/2525 CTN-8	14.0 - 16.0	1	16	83	64	20	44		28.2	96	DS	CH - FAT CLAY WITH SAND, LIGHT GRAY AND BROWN AND OLIVE SPOTS, MOIST, VERY STIFF(2.25), NON-CALCAREOUS CALCAREOUS NODULES TO 1 1/2", IRON-OXIDE DEPOSITS, INDURATED THROUGHOUT.

Project : Brays and Sims bayou and Fondren Ditch, Houston, Texas
Contract No.DACW64-91-D-0001 Delivery Order No. 0016

SUMMARY OF LABORATORY TEST RESULTS

Boring No. 91-77

S #	Depth (ft)	P P (tsf)	SPT Blows per Foot	Visual Classification	U S C	M c (%)	Dry Unit Wt (pcf)	Wet Unit Wt (pcf)	L L (%)	P L (%)	Mechanical Analysis % Passing					Torvane Shear Strength (tsf)	q u (tsf)
											#4	#10	#40	#100	#200		
1	0-2	2.00		Dark gray & brown, clay, very stiff, w/ roots & calcareous nodules	CH	27.0											
2	2-4	2.75		Dark gray, clay, very stiff, w/ calcareous nodules	CH	21.8	100.9	123.0	57	23	99.9	99.1	98.2		94.4		1.02
3	4-6	2.50		Dark gray, clay, very stiff	CH	23.2											
4	6-8	4.5+		Dark gray, clay, hard, w/ ferrous nodules	CH	20.1											
5	8-10	4.5+		Gray, clay, hard, w/ calcareous nodules	CH												
6	10-12	4.50		Gray, clay, hard, w/ calcareous nodules & ferrous stains, slickensided	CH	19.7											
7	12-14	4.5+		Gray & brown, clay, hard, w/ calcareous nodules & ferrous stains, slickensided	CH	20.1			59	22							
8	14-16	4.5+		Red & gray, clay, hard, w/ calcareous & ferrous nodules	CH	15.2											
9	16-18	4.5+		Red & gray, clay, hard, w/ ferrous stains, slickensided	CH	23.4											
10	18-20	4.5+		Red & gray, clay, hard, w/ ferrous stains, slickensided	CH	24.0											
11	20-22	3.00		Gray, clay very stiff, w/ calcareous nodules, slickensided	CH	25.1	101.5	127.0	69	25	100.0	99.5	99.0		93.7		0.90
12	22-24	3.25		Gray & brown, clay, very stiff, w/ calcareous nodules	CH	24.3											
13	24-26	3.50		Gray & yellowish brown, clay, very stiff, w/ calcareous nodules & ferrous stains, slickensided	CH	25.6			72								
14	26-28	3.50		Red & gray, clay, very stiff, w/ ferrous stains & blocky structure, slickensided	CH	21.1											
15	28-30	3.50		Red & gray, clay, very stiff, w/ ferrous stains, slickensided	CH	20.7											

S # : Sample Number, P P : Pocket Penetrometer Reading, U S C : Unified Soil Classification, M c : Moisture Content
q u : Unconfined Compressive Strength, W O H : Weight of hammer, W O P : Weight of pipe

JOB NO. 14G487 DATE 7/11/91

PROJECT BRAYS BAYOU, SIMS BAYOU AND FONDREN DITCH

BORING NO. 91-77 SAMPLE NO. 2 DEPTH 2-4 ft

SPECIMEN NO. 1

CLASSIFICATION
Dark gray, clay, very stiff, w/ calcareous nodules

Tare No.	P-7	Height	5.595 in.
Tare plus Wet Specimen	1178.36 gm	Average Diameter	2.830 in.
Tare plus Dry Specimen	974.77 gm	Initial Area	6.290 sq in.
Water Weight	203.59 gm	Volume	35.194 cu in.
Tare Weight	42.53 gm	Volume of Solids	cu in.
Wet Specimen	1135.83 gm	Void Ratio	
Dry Specimen	932.24 gm	Saturation	%
Water Content	21.84 %	Dry Density	100.9 lb/cu ft

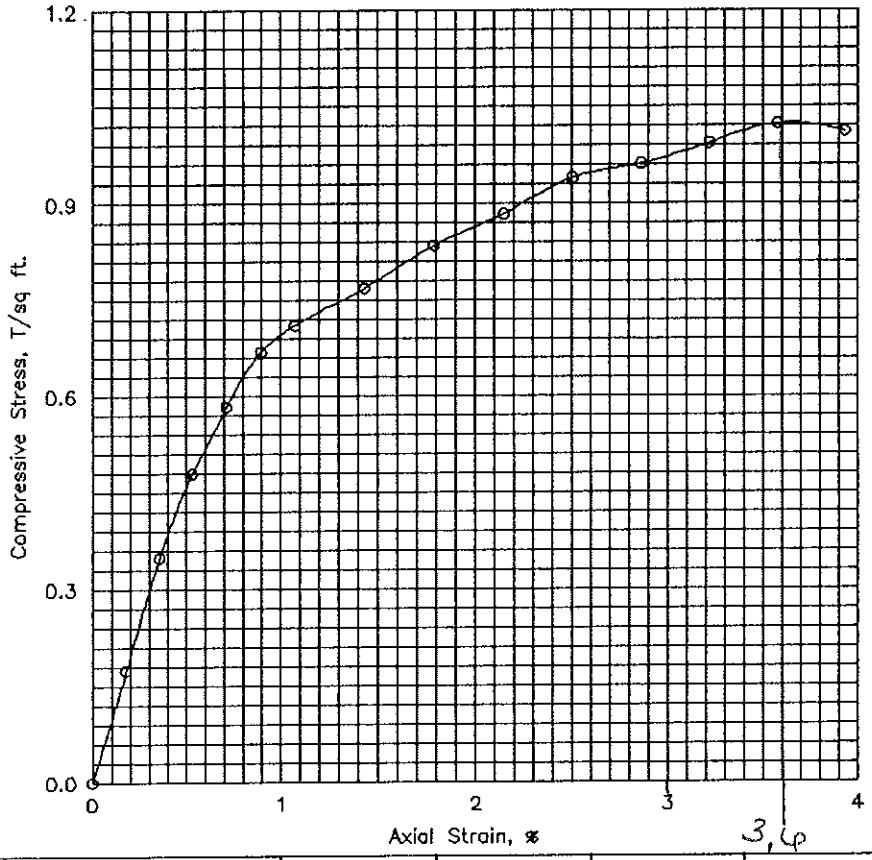
Specific Gravity of Solids
LL = 57 PL = 23 PI = 34

Proving Ring No. 10170
Proving Ring Constant, K = .766 lbs/div.

Elapsed Time min.	Dial Reading 0.001"	Cumulative Change in.	Proving Ring Dial Reading	Axial Load lb	Axial Strain	Area Corr. sq in.	Compr. Stress tsf
.0	0.	.000	.0	.0	.000	6.29	.000
.2	10.	.010	20.0	15.3	.002	6.30	.175
.4	20.	.020	40.0	30.6	.004	6.31	.349
.6	30.	.030	55.0	42.1	.005	6.32	.480
.8	40.	.040	67.0	51.3	.007	6.34	.583
1.0	50.	.050	77.0	59.0	.009	6.35	.669
1.2	60.	.060	82.0	62.8	.011	6.36	.711
1.4	80.	.080	89.0	68.2	.014	6.38	.769
1.6	100.	.100	97.0	74.3	.018	6.40	.835
1.8	120.	.120	103.0	78.9	.021	6.43	.884
2.1	140.	.140	110.0	84.3	.025	6.45	.940
2.5	160.	.160	113.0	86.6	.029	6.48	.962
2.8	180.	.180	117.0	89.6	.032	6.50	.993
3.0	200.	.200	121.0	92.7	.036	6.52	1.023
3.4	220.	.220	120.0	91.9	.039	6.55	1.011

Job No. 14G487

Failure Sketches



☐ Controlled stress
☒ Controlled strain

Test No.			1			
Type of Specimen			Undisturbed			
Initial	Water content	w_0	21.8 %	%	%	%
	Void ratio	e_0				
	Saturation	S_0	%	%	%	%
	Dry density, lb/cu ft	γ_d	100.9			
Time to failure, min		t_f	3.03			
Unconfined compressive strength, T/sq ft		q_u	1.02			
Undrained shear strength, T/sq ft		S_u	.51			
Sensitivity ratio		S_t				
Initial specimen diameter, in.		D_0	2.830			
Initial specimen height, in.		H_0	5.595			

Classification Dark gray, clay, very stiff, w/ calcareous nodules

LL	PL	PI	G_s
57	23	34	

Remarks

Project BRAYS BAYOU, SIMS BAYOU AND FONDREN DITCH

Area Houston, Texas

Boring No. 91-77 | Sample No. 2

Depth 2-4 ft | Date 7/11/91

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UNCONFINED COMPRESSION TEST REPORT

ENG FORM 3659
1 JUN 65

PLATE XI-2

Geotest Engineering, Inc.

PLATE

JOB NO. 14G487 DATE 7/11/91

PROJECT BRAYS BAYOU, SIMS BAYOU AND FONDREN DITCH

BORING NO. 91-77 SAMPLE NO. 11 DEPTH 20-22 ft

SPECIMEN NO. 1

CLASSIFICATION
Gray, clay, very stiff, w/ calcareous nodules, slickensided

Tare No.	P-3	Height	5.595 in.
Tare plus Wet Specimen	1215.81 gm	Average Diameter	2.830 in.
Tare plus Dry Specimen	980.34 gm	Initial Area	6.290 sq in.
Water Weight	235.47 gm	Volume	35.194 cu in.
Tare Weight	42.59 gm	Volume of Solids	cu in.
Wet Specimen	1173.22 gm	Void Ratio	
Dry Specimen	937.75 gm	Saturation	%
Water Content	25.11 %	Dry Density	101.5 lb/cu ft

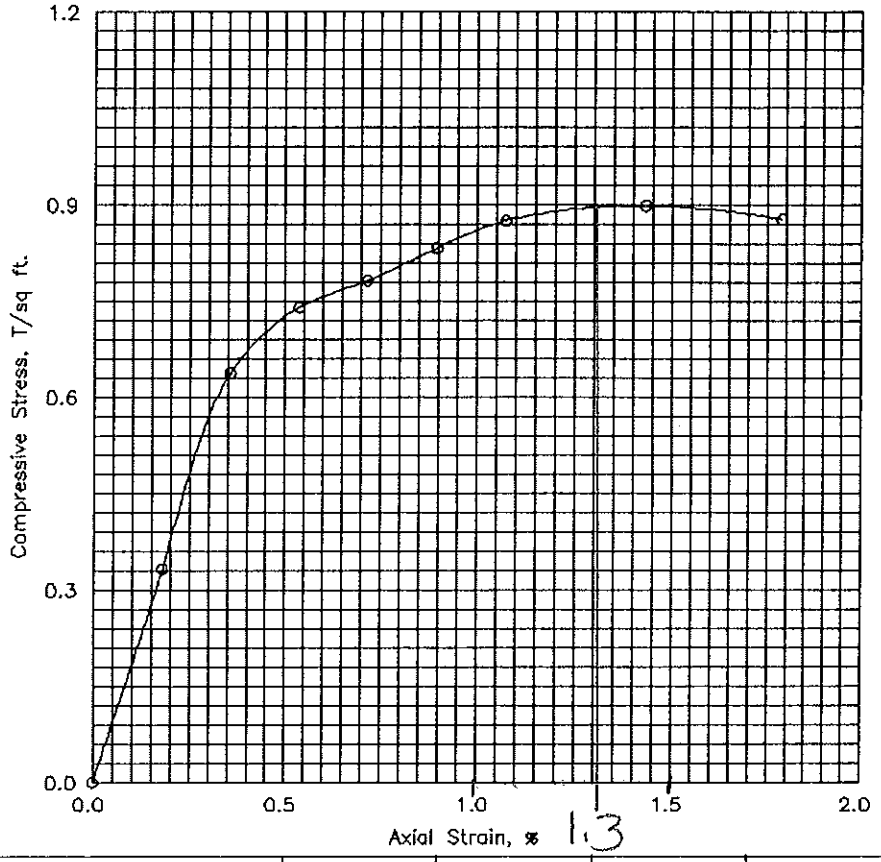
Specific Gravity of Solids
LL = 69 PL = 25 PI = 44

Proving Ring No. 10170
Proving Ring Constant, K = .766 lbs/div.

Elapsed Time min.	Dial Reading 0.001"	Cumulative Change in.	Proving Ring Dial Reading	Axial Load lb	Axial Strain	Area Corr. sq in.	Compr. Stress tsf
.0	0.	.000	.0	.0	.000	6.29	.000
.3	10.	.010	38.0	29.1	.002	6.30	.333
.6	20.	.020	73.0	55.9	.004	6.31	.638
.8	30.	.030	85.0	65.1	.005	6.32	.741
.9	40.	.040	90.0	68.9	.007	6.34	.783
1.1	50.	.050	96.0	73.5	.009	6.35	.834
1.3	60.	.060	101.0	77.4	.011	6.36	.876
1.7	80.	.080	104.0	79.7	.014	6.38	.899
2.0	100.	.100	102.0	78.1	.018	6.40	.878

Job No. 14G487

Failure Sketches



☐ Controlled stress
☒ Controlled strain

Test No.			1			
Type of Specimen			Undisturbed			
Initial	Water content	w_o	25.1 %	%	%	%
	Void ratio	e_o				
	Saturation	S_o	%	%	%	%
	Dry density, lb/cu ft	γ_d	101.5			
Time to failure, min		t_f	1.72			
Unconfined compressive strength, T/sq ft		q_u	.90			
Undrained shear strength, T/sq ft		S_u	.45			
Sensitivity ratio		S_t				
Initial specimen diameter, in.		D_o	2.830			
Initial specimen height, in.		H_o	5.595			

Classification Gray, clay, very stiff, w/ calcareous nodules, slickensided

LL	69	PL	25	PI	44	G_s	

Remarks

Project BRAYS BAYOU, SIMS BAYOU AND FONDREN DITCH

Area Houston, Texas

Boring No. 91-77 | Sample No. 11

Depth 20-22 ft | Date 7/11/91
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UNCONFINED COMPRESSION TEST REPORT

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PLATE XI-2

Geotest Engineering, Inc.

PLATE