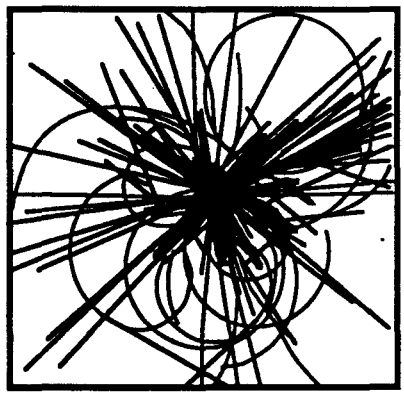
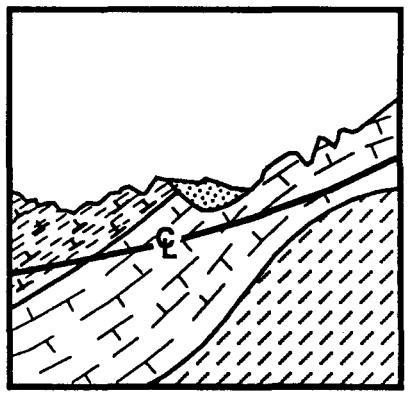
SSCL-SR-1105

SSCL-SR-1105
Project No. 87-888-0017
Report No. SSC-GR-46
July 1990
GR-46

Data Report for Corehole BF 1





Prepared by: The Earth Technology Corporation
Long Beach, California

Prepared for: RTK a joint venture
Oakland, California

FOREWORD

The goal of the geotechnical studies at the Texas Superconducting Super Collider (SSC) site is to allow the geologist and engineer to build their level of knowledge and confidence about the geologic structures and geotechnical properties of the site materials to the point at which there remains only a realistically small risk of encountering geotechnical conditions during construction that would significantly increase construction costs or delay construction schedules. To do this, a characterization program has been designed to meet the following objectives:

- To confirm the site's suitability and optimize the ring location (the "footprint") and hall positions on the ring
- To provide data for a preliminary structural design
- To provide a rational framework within which construction contracts and schedules can be formulated
- To maximize the use of the site-specific data already gathered by the proposer.

The geotechnical program to meet these objectives has been divided into the following three phases of study:

- Footprint location data
- Structure-specific data
- Global data.

This is one in a series of data reports prepared for the global data phase of geotechnical characterization at the SSC site. Data collection for this study phase focused on drillhole-based geological, geohydrological, geophysical, and geotechnical tests in the near vicinity of the E and F access shaft sites. The global data set has three key attributes: (1) uniform geographic distribution over the site footprint, (2) complete coverage of all of the strata through which the SSC tunnels and shafts will pass, and (3) consistency of the data from sampling site to sampling site throughout the SSC site. In combination with data from the other phases, these data will allow conceptual designs of construction methods. Each data report includes the results of both field and laboratory tests for specific drilling and sampling site(s).

DATA REPORT

Site Designator: BF 1

Objective: Drill a corehole at the proposed shaft location and determine geotechnical conditions through laboratory geomechanical testing. The corehole was drilled to at least 35 feet below tunnel depth.

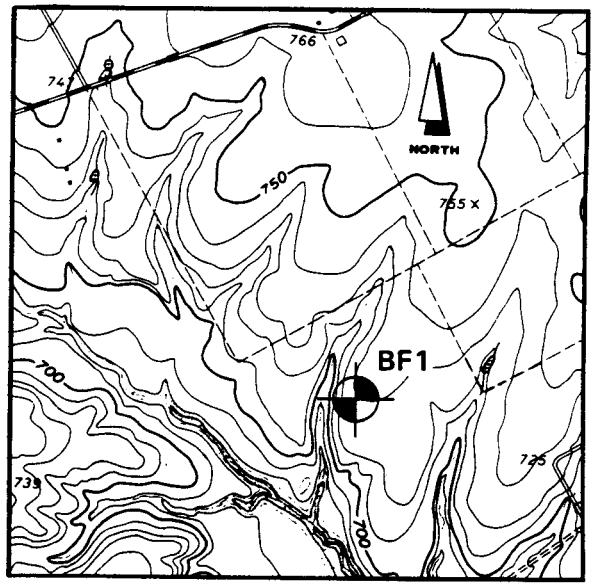
Location:

North 267,430 feet

East 2,171,093 feet

Surface Elevation 727.7 feet

BF 1 is located on the west-northwest section of the proposed tunnel alignment, approximately 0.5 mile west of Lone Elm Road and 0.75 mile south of State Route 875.



SCALE 1:24,000

0 1000 2000 3000 4000 Feet

CONTOUR INTERVAL 10 FEET

Scope and Schedule:

Coring (full depth)	January 12 and 13, 1990
Wire-line Logging	January 15 and 25, 1990
Laboratory Testing	January 22 to March 17, 1990
Well Construction	March 13 to 17, 1990

Conditions Encountered: (see lithologic log, Appendix A)

Total Hole Depth:	221.0 feet
Soil:	0.0 to 1.0 foot
Weathered Austin Chalk:	1.0 to 15.6 feet
Fresh Austin Chalk:	15.6 to 143.6 feet
Eagle Ford Shale:	143.6 to 221.0 feet (bottom of hole)
Static Water Level:	Water level in the well probably has not reached static condition. It was last measured at 610.6 feet above MSL (117.1 feet below ground surface) on June 27, 1990, 102 days after the well had been air-lifted to approximately 534.0 feet above MSL.

Geophysical Logging: (see wire-line logs, Appendix B)

Spontaneous Potential (SP)
Normal Resistivity (short and long)
Guard Resistivity
Point Resistance
Natural Gamma
Short and Long Gamma
Compensated Density (caliper)
Sonic Velocity (full wave)

Bulk and Clay Mineralogy Test Results:

Formation: Austin Chalk **Depth: 128.6 feet**

Whole Rock Composition:

Mineral	Percent
quartz	3
plagioclase	1
calcite	95
pyrite	1
Total	100

Relative Clay Abundance:

Mineral	Percent
Not analyzed	

Formation: Eagle Ford Shale **Depth: 193.5 feet**

Whole Rock Composition:

Mineral	Percent
quartz	20
K feldspar	6
plagioclase	2
calcite	1
dolomite	<1
siderite	<1
pyrite	1
total clay	70
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	35
kaolinite	7
Fe-chlorite	4
mixed layer (illite/smectite)	54
Total	100

Laboratory Geomechanical Test Results Summary: (see also Appendix C)

Vertical Depth (ft)	Formation/ Lithology	Moisture Content (%)	Dry Density (pcf)	*Compressive Strength (psi)	Tangent Young's Modulus E_{50} (psi x 10^5)	Brazil Tensile Strength (psi)
29	Austin Chalk	14-15	118	1600	2.59	
48-51	Austin Chalk	13-14	115-116	2004-2184	1.50-1.74	
67-68	Austin Chalk	15	114	2277	2.11	
74-75	Austin Chalk	10-12	122-130	$1715^{(50)}$-$2315^{(100)}$	$1.68^{(100)}$-$8.73^{(50)}$	
102	Austin Chalk	13	122	2682	7.04	
128-131	Austin Chalk	13-17	113-125			205
137	Austin Chalk	15-16	115	2581	3.68	
146-148	Eagle Ford Shale	18-20	111-113			
167	Eagle Ford Shale	18	111			
191-194	Eagle Ford Shale	16-20	113			
208-213	Eagle Ford Shale	16-17	117-118	$340\text{-}464^{(100)}$	$0.65\text{-}1.29^{(200)}$	

* UU triaxial test indicated by confining pressure in parentheses.

Hole Status: A monitoring well was installed in the boring on March 17, 1990 (see Appendix D).

APPENDIX A

LITHOLOGIC LOG

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 1 PG 1 OF 6

LOCATION: N 267,430 feet
E 2,171,093 feet

GROUND EL: 727.7 feet

DATE: 1-12/13-90 TYPE: NX Core CASED TO: 22.0' CONTRACTOR: SwL (89-192)

SAMPLE LEGEND

S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION

Begin drilling with air rotary at ground surface to 141.0'. No seepage encountered. Begin using water rotary at 141.0'. Unable to determine parameters subsurface water table below 141.0'

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
									CLAY, silty, traces of roots, organic debris and weathered limestone fragments, dark brown
			2.0	1.0					
5		C-1			84	46			LIMESTONE (Austin Chalk) soft, moderately to severely weathered, slightly fractured, tan
10				11.0					
			11.0						
15		C-2			80	48			
					100	100			LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 0.3' to 3.0' thick moderately argillaceous to limestone interbeds 1.0' to 6.0' apart. Also shale layers 0.1' thick, fossil partings.
20				21.0					
			21.0						-moderately argillaceous layer, medium gray, sharp contacts at 21.8'-22.1'
25		C-3			96	95			-moderately argillaceous layer, medium gray, sharp contact at 24.3' to gradational contact 24.8'
30				31.0					-soft shale layer, dark gray, gradational contacts at 30.0'-30.1'
			31.0						-moderately argillaceous layer, medium gray, gradational contacts at 31.7'-32.6'
35		C-4			100	100			-moderately argillaceous layer, medium gray, gradational contacts at 34.7'-37.0' -fossil partings at 31.9' and 39.4'
40				41.0					-moderately argillaceous layer, medium gray, gradational contacts at 38.5'-41.0'
			41.0						

DRILLING GEOLOGIST Mike Granger ASSISTANT Scott Stevens CHECKED BY Clem Bommarito

Shawn Wood

3-7-90

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 1 PG 2 OF 6

LOCATION: N 267,430 feet
E 2,171,093 feet

GROUND EL: 727.7 feet

DATE: 1-12/13-90 TYPE: NX Core CASED TO: 22.0' CONTRACTOR: SwL 89-192

SAMPLE LEGEND:
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION: See p. 1 of 6

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
				41.0					LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 0.3' to 2.0' thick moderately argillaceous to shaly limestone interbeds 1' to 11' apart. Also shale layers, fossil partings, medium angle fractures
45		C-5			100	98			-40° smooth, open, fracture with traces of pyrite at 41.5' -moderately argillaceous layer, medium gray, gradational contacts at 41.3'-41.6' -moderately argillaceous layer, medium gray, gradational contacts at 43.1'-45.4'
50				51.0					-moderately argillaceous layer, medium gray, gradational contacts at 48.2'-49.3'
			51.0						-moderately argillaceous layer, medium gray, gradational contacts at 50.5'-51.3' -fossil parting at 49.1'
55		C-6			100	100			- shaly limestone layer, dark gray, gradational contacts at 52.4'-53.5' -shaly limestone layer, dark gray, gradational contacts at 55.0'-56.0' -shaly limestone layer, dark gray, gradational contacts at 56.9'-58.7'
60				61.0					-shaly limestone layer, dark gray, gradational contacts at 62.0'-63.3'
			61.0						
65		C-7			95	92			
70				71.0					-moderately argillaceous layer, medium gray, gradational contacts at 69.8'-70.8'
			71.0						-moderately argillaceous layer, medium gray, gradational contacts at 70.1'-72.0' -shaly limestone layer, dark gray, gradational contact at 72.2' to sharp contact at 73.3'
75		C-8			100	100			-50° rough, open, fracture at 70.2' -moderately argillaceous layer, medium gray, gradational contacts at 73.9'-74.7' -moderately argillaceous layer, medium gray, gradational contacts at 75.5'-76.6'
80				81.0					-moderately argillaceous layer, medium gray, sharp contact at 77.5' to gradational contact at 78.2'
			81.0						-moderately argillaceous layer, medium gray, gradational contacts at 79.5'-80.7

DRILLING GEOLOGIST Mike Granger ASSISTANT Scott Steven CHECKED BY C. Bommarito

Shawn Wood
3-7-90

LOG OF BORING

PROJECT: Superconducting Supercollider
CLIENT: The Earth Technology Corporation
TASK NO.: 17

BORING NO: BF 1 PG 3 OF 6
LOCATION: N 267,430 feet
E 2,171,093 feet
GROUND EL: 727.7 feet

DATE: 1-12/13-90 TYPE: NX Core CASED TO: 22.0 CONTRACTOR: SwL 89-192

SAMPLE LEGEND: S= SPLIT SPOON; T= 2" THIN WALL TUBE; U= 3" THIN WALL TUBE; C= NX ROCK CORE

WATER INFORMATION: See p. 1 of 6

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
			81.0						LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 0.4' to 2' thick moderately argillaceous to shaly limestone interbeds 2' to 9' apart. Also shale layers 1.0' thick, fossil partings, medium angle fractures.
85		C-9			100	100			-moderately argillaceous layer, gradational contact at 82.0'-84.1'
									-fossil parting at 83.5'
									-shaly limestone layer, dark gray, gradational contacts at 85.7'-85.8'
90				91.0					-moderately argillaceous layer, medium gray, gradational contacts at 87.0'-89.0'
									-fossil parting with ¼" pyrite nodule at 93.2'
			91.0						-soft shale layer, dark gray, sharp contacts at 94.5'-94.7'
95									
									-pyrite nodules (¼") at 97.0', 97.6' and 97.7'
		C-10			100	100			-soft shale layer, dark gray, sharp contacts at 98.5'-99.2'
100				101.0					
			101.0						
105									-moderately argillaceous layer, medium gray, gradational contacts at 104.6'-105.2'
		C-11			100	97			
110				111.0					-moderately argillaceous layer, medium gray, gradational contacts at 110.1'-110.5'
			111.0						
									-55° calcite filled (¼"), healed fracture at 113.2'
115		C-12			97	97			-40° smooth, open, fracture at 113.6'
									-moderately argillaceous layer, medium gray, gradational contacts at 116.5'-117.6'
120				121.0					
			121.0						

DRILLING GEOLOGIST Mike Granger ASSISTANT Scott Stevens CHECKED BY Clem Bommarito

Shawn Wood
3-7-90

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 1 PG 4 OF 6

LOCATION: N 267,430 feet
E 2,171,093 feet

GROUND EL: 727.7 feet

DATE: 1-12/13-90 TYPE: NX Core CASED TO: 22.0' CONTRACTOR: SwL (89-192)

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION
See P. 1 of 6

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C-13	121.0	131.0	100	100			LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 1.0' to 4.0' thick moderately argillaceous to shaly limestone interbeds 1' to 4' apart. Also fossil partings. -shaly limestone layer, medium gray, gradational contacts at 121.2'-122.3' -shaly limestone layer, medium gray, gradational contacts at 126.9'-127.1' -shaly limestone layer, medium gray, gradational contact at 128.7' to sharp contact at 129.3' -pyrite nodules (1"), at 128.8' and 128.9'
125 130									
		C-14	131.0	141.0	100	100			-shaly limestone layer, medium gray, gradational contacts at 133.4'-137.5' -pyrite nodule (½") at 136.2' -moderately argillaceous layer, medium gray, gradational contacts at 137.5'-139.0' 141.7 -gradational contact-
135 140									
		C-15	141.0	151.0	82	82			SHALY LIMESTONE (Transition) medium hard, fresh, extremely argillaceous, medium gray with abundant fragments of fish bones and other fossil debris 143.6 -gradational contact- SHALE (Eagle Ford Shale) soft, fresh, fissile, dark gray, with occasional pyrite nodules and septarian concretions -trace pyrite at 145.7'
145 150									
		C-16	151.0	161.0	100	100			-pyrite nodule (½"), at 157.8' -septarian concretion (½"), at 158.3'
155 160									
			161.0						

DRILLING GEOLOGIST Mike Granger ASSISTANT Scott Stevens CHECKED BY Clem Bommarito

Shawn Wood
3-7-90

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 1 PG 5 OF 6

LOCATION: N 267,430 feet
E 2,171,093 feet

GROUND EL: 727.7 feet

DATE: 1-12/13-90 TYPE: NX Core CASED TO: 22.0' CONTRACTOR: SwL 89-192

SAMPLE LEGEND
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION
See p. 1 of 6

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C-17	161.0	171.0	100	100			SHALE (Eagle Ford), soft, fresh, fissile, dark gray with occasional harder carbonate layers, 0.2' thick, fossil partings and septarian concretions.
165									-septarian concretions at 161.8', 162.1', 162.6', 164.4', 167.9' and 169.2'
170									
		C-18	171.0	181.0	18*	18			*-1½" to 2" piece of limestone with calcite vein (1/8") and trace pyrite at 171.7'. Possible healed fracture, unable to determine from recovered core. The limestone jammed in the catcher and destroyed remainder of run C-18.
175									
180									-calcareous shale layer, gradational contacts at 180.5'-182.0'
		C-19	181.0	191.0	100	100			
185									-septarian concretions at 187.3',191.7', 192.6', 194.4', 195.6', and 195.8'
190									
		C-20	191.0	201.0	82	82			
195									-limestone layer (1½"), light gray at 197.3'
200									
			201.0						

DRILLING GEOLOGIST Mike Granger ASSISTANT Scott Stevens CHECKED BY Clem Bommarito
Shawn Wood
3-7-90

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 1 PG 6 OF 6

LOCATION: N 267,430 feet
E 2,171,093 feet

GROUND EL: 727.7 feet

DATE: 1-12/13-90 TYPE: NX Core CASED TO: 22.0' CONTRACTOR: SwL 89-192

SAMPLE LEGEND:
S= SPLIT SPOON
T= 2" THIN WALL TUBE
U= 3" THIN WALL TUBE
C= NX ROCK CORE

WATER INFORMATION: See p. 1 of 6

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
		C-21	201.0	211.0	100	100			SHALE (Eagle Ford), soft, fresh, fissile, dark gray with occasional harder carbonate layers 0.5' thick, medium angle fractures, traces of pyrite. -limestone seam (¼"), light gray at 203.4' -calcareous shale layer, gradational contact at 207.5', grading to a hard limestone layer, light gray, gradational contacts at 207.8'-208.3' -limestone layer, moderately fossiliferous, dark gray, gradational contact at 208.3' to sharp contact at 208.6' -45° smooth, open, fracture at 208.8' -1" pyrite nodule at 209.9'
		C-22	211.0	221.0	56	56			
									Bottom of Exploration at 221.0'

DEPTH IN FEET: 205, 210, 215, 220, 225, 230, 235, 240

DRILLING GEOLOGIST Mike Granger ASSISTANT Scott Stevens CHECKED BY Clem Bommarito

Shawn Wood
3-7-90

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BF 1 **Log Measured From:** Ground Level

Drilling Parameters

Depth 221.0 feet

Bit Diameter 6.5 inches

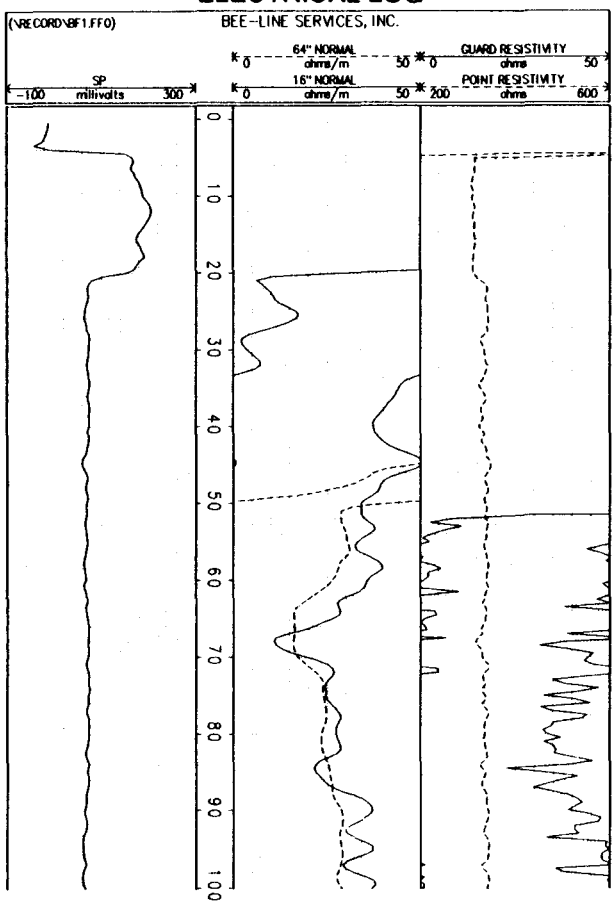
Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	January 15, 1990	January 15 and 25, 1990*	January 15, 1990
Bottom Log Interval	217.0 feet	200.5 feet	209.2 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling fluid	drilling mud
Time Since Circulation Stop	1.5 hours	10 days	1.5 hours
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A
Logging Speed	40 feet/min.	20 feet/min.	20 feet/min.
Sample Interval	0.5 foot	0.5 foot	0.5 foot

*Note: Only the gamma log from January 25, 1990, is shown here.

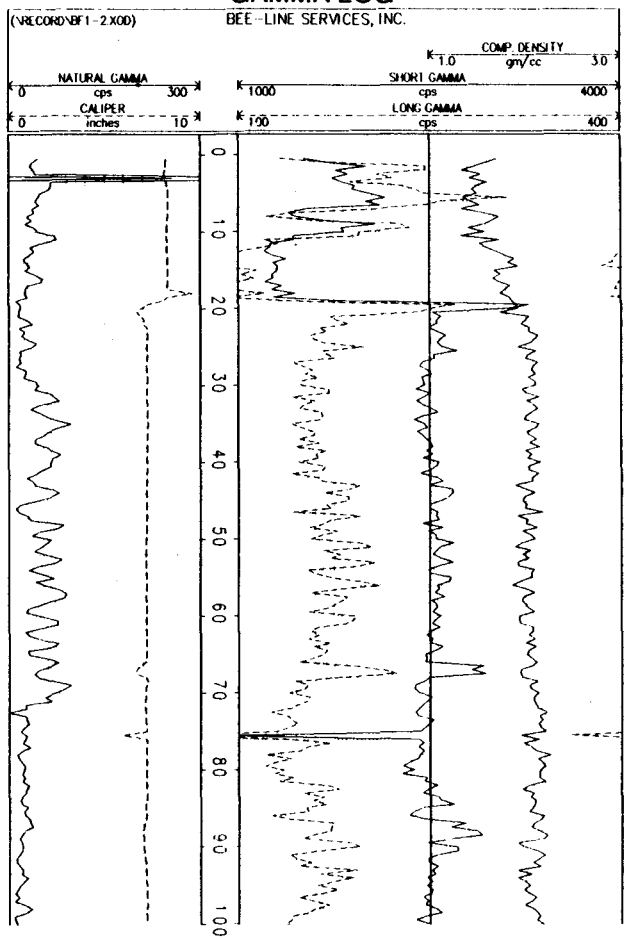
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

BF 1 Wire-line logs run January 15 and 25, 1990. Surface elevation 727.7 feet.

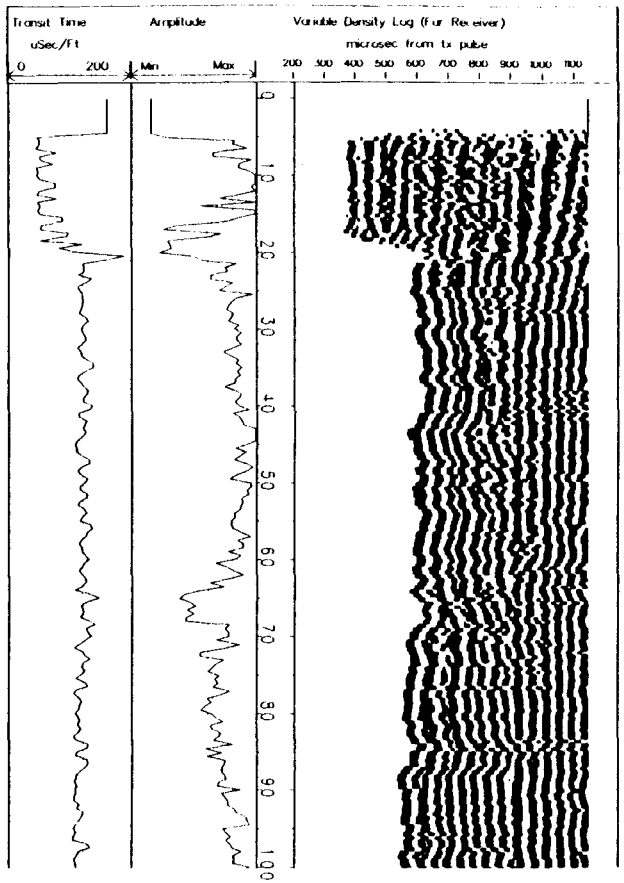
ELECTRICAL LOG



GAMMA LOG

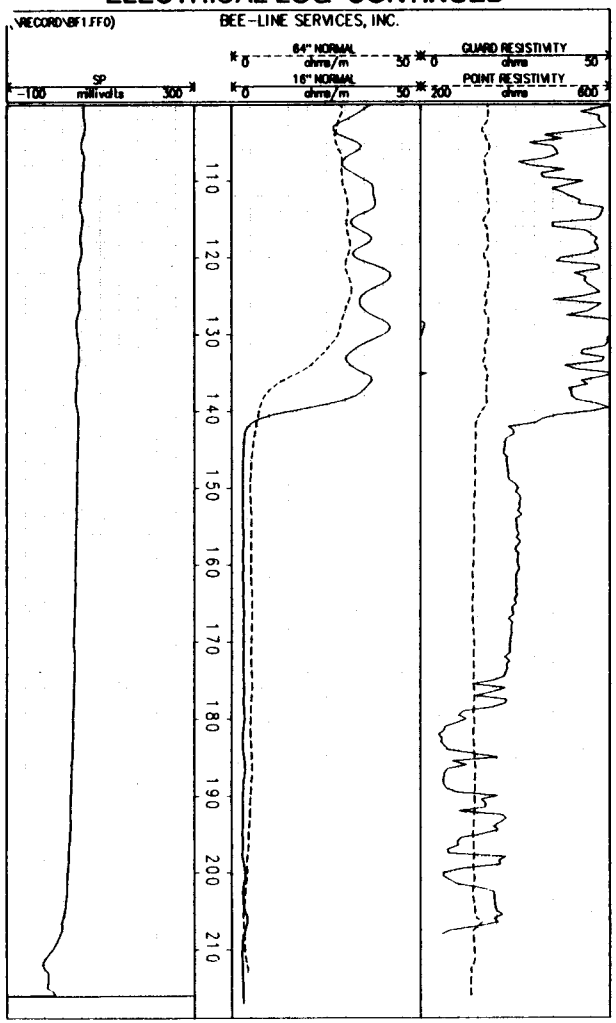


SONIC LOG

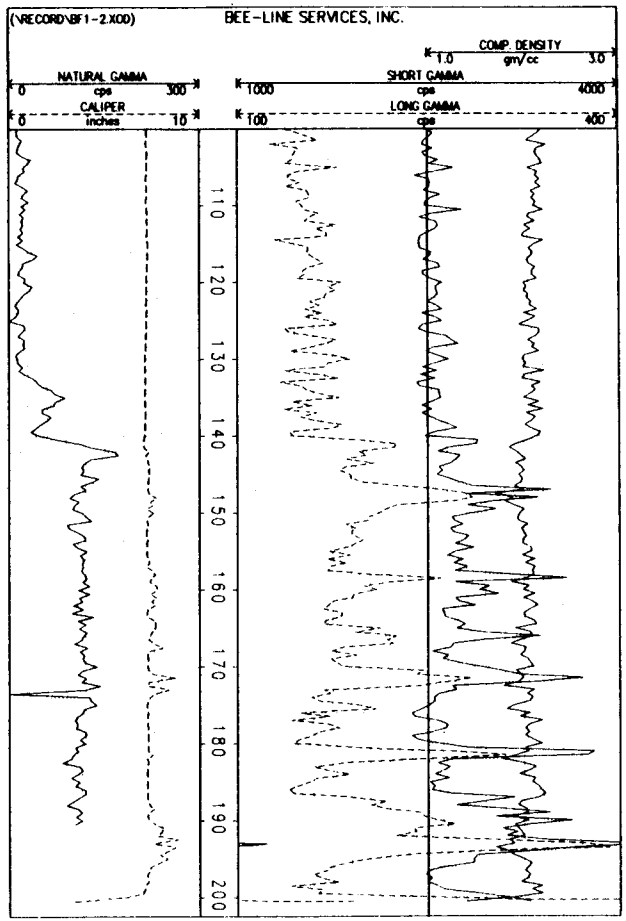


BF 1 Wire-line logs run January 15 and 25, 1990 (Continued). Surface elevation 727.7 feet.

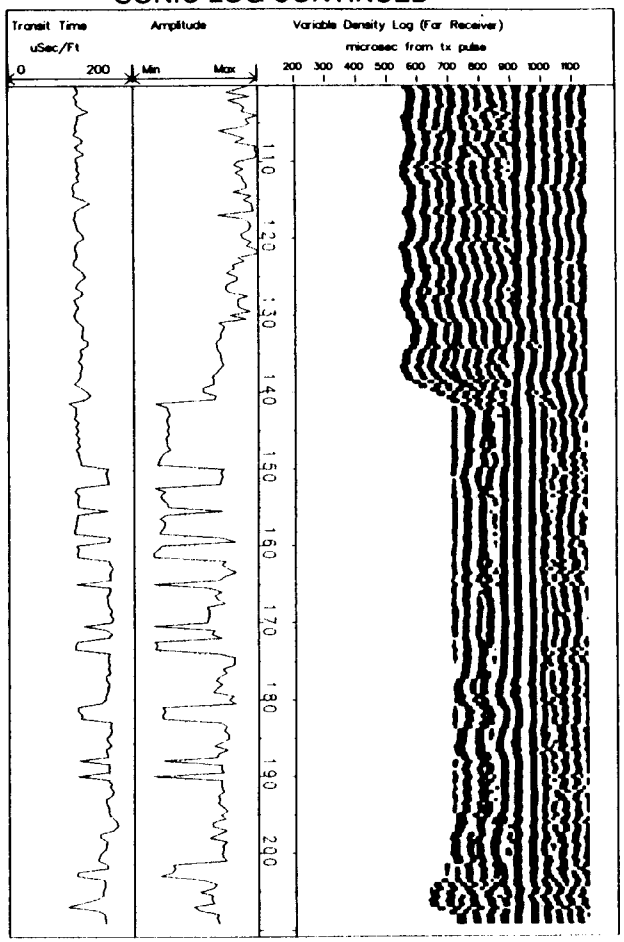
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



APPENDIX C

LABORATORY RESULTS

TABLE C-1. GEOMECHANICAL TEST RESULTS - BORING BF 1

GENERAL LITHOLOGY	BORING DEPTH feet	MOISTURE CONTENT percent	DRY DENSITY pcf	SPECIFIC GRAVITY	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	FRACTION FINER THAN # 200 SIEVE percent	CARBONATE CONTENT percent	SAMPLE DIMENSION RATIO L/D	SAMPLE FAILURE MODE/ DEGREES *	UNCONFINED COMPRESSIVE STRENGTH psi	TRIAXIAL COMPRESSION CONFINING PRESSURE σ_3 psi	TRIAXIAL COMPRESSION DEVIATOR STRESS $\sigma_1-\sigma_3$ psi	FAILURE STRAIN percent	TANGENT YOUNG'S MODULUS E50 (psi)x10E5	TANGENT YOUNG'S MODULUS UNLOAD/ RELOAD (psi)x10E5	TANGENT YOUNG'S MODULUS σ_3 psi	POISSON'S RATIO	BRAZIL TENSILE STRENGTH psi	2ND CYCLE SLAKE DURABILITY INDEX percent	MODIFIED TABER ABRASION INDEX	SWELL PRESSURE INDEX psi	COMMENTS
AUSTIN CHALK	28.8	13.8																					
AUSTIN CHALK	29.0	14.6	117.7						2.3	B-1/30	1600			0.77	2.59		0						NOTE 1
AUSTIN CHALK	48.2	13.8																					
AUSTIN CHALK	48.4	14.4	116.5	2.67					2.3	B-1/45	2184			1.73	1.50		0						
AUSTIN CHALK	51.0	13.4																					
AUSTIN CHALK	51.1	13.1	114.9						2.4	E	2004			1.26	1.74		0						
AUSTIN CHALK	67.5	14.8																					
AUSTIN CHALK	67.6	15.0	113.8						2.4	B-1/30	2277			1.31	2.11		0						
AUSTIN CHALK	74.1	11.9	125.8																				
AUSTIN CHALK	75.0	12.1	122.2						2.3	D		50	1715	0.37	5.11		50						
AUSTIN CHALK	75.0														8.73(2)			0.23					NOTES 2 AND 3
AUSTIN CHALK	75.4	10.3	129.8						2.3	B-1/20		100	2315	1.46	1.68		100						
AUSTIN CHALK	75.4														1.89			0.25					NOTE 2
AUSTIN CHALK	101.8	13.4																					
AUSTIN CHALK	101.9	13.2	121.8						2.1	D	2682			0.60	7.04		0						
AUSTIN CHALK	128.5	13.3	125.4																				
AUSTIN CHALK	131.0	17.1	112.6																				
AUSTIN CHALK	131.1	15.9							0.4										205				
AUSTIN CHALK	137.0	15.1																					
AUSTIN CHALK	137.2	15.7	115.0						2.3	B-1/30	2581			0.94	3.68		0						
EAGLE FORD SHALE	146.0	19.7																					
EAGLE FORD SHALE	146.3	18.5	112.9																			21.7	
EAGLE FORD SHALE	146.5	18.4	110.6																			21.6	
EAGLE FORD SHALE	147.1	19.3			116	78	99.9																
EAGLE FORD SHALE	147.2	18.8	111.8																				
EAGLE FORD SHALE	147.3			2.69																			
EAGLE FORD SHALE	147.9	19.0																					
EAGLE FORD SHALE	148.0	18.0																					
EAGLE FORD SHALE	148.1				107	70		6.8															
EAGLE FORD SHALE	148.4																						
EAGLE FORD SHALE	166.9	18.3	111.5	2.73	82	51	97.9	4.4															
EAGLE FORD SHALE	191.0	16.5																					
EAGLE FORD SHALE	191.1			2.70																			
EAGLE FORD SHALE	191.3	19.0	112.6																			36.0	
EAGLE FORD SHALE	191.4	20.0			105	68	96.3	5.6															
EAGLE FORD SHALE	191.5	18.9	113.3																			28.8	
EAGLE FORD SHALE	192.1	18.2																					
EAGLE FORD SHALE	192.3	17.9																		14.8			
EAGLE FORD SHALE	193.3	18.3																					
EAGLE FORD SHALE	193.7				108	74		6.6															
EAGLE FORD SHALE	208.4	15.6																					
EAGLE FORD SHALE	211.0	15.6	118.1	2.72	64	32	98.6	3.8	2.2	B-1/40		100	464	0.63	1.13		100						
EAGLE FORD SHALE	211.0														1.25			0.30					NOTE 2
EAGLE FORD SHALE	211.4	16.2	117.6																				
EAGLE FORD SHALE	212.3	16.3	117.4						2.3	B-1/40		200	430	0.91	1.29		200						
EAGLE FORD SHALE	212.3														1.12			0.33					NOTE 2
EAGLE FORD SHALE	212.7	16.7	116.6																				
EAGLE FORD SHALE	213.5	15.8	117.9		63	34	98.7	4.1	2.2	D	340			0.77	0.65		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664				ASTM-D3148		ASTM-D3148	ASTM-D3967	ISRM	ISRM	ISRM	

BF1PRT21.WK1
REVISION: 2.1
DATE: 06/15/90

* *EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.*

Symbol	Failure Type
A	*No discernible failure plane*
(B)	*Well defined shear plane @ "X" angle (deg) to vertical or to long axis of core*
B-1	*Shear plane*
B-2	Bedding plane shear
B-3	Shear plane along pre-existing fracture, shear zone, etc
B-4	Combination
C	Barreling/Bulging
D	Longitudinal (axial) splitting
E	Conical
F	No information

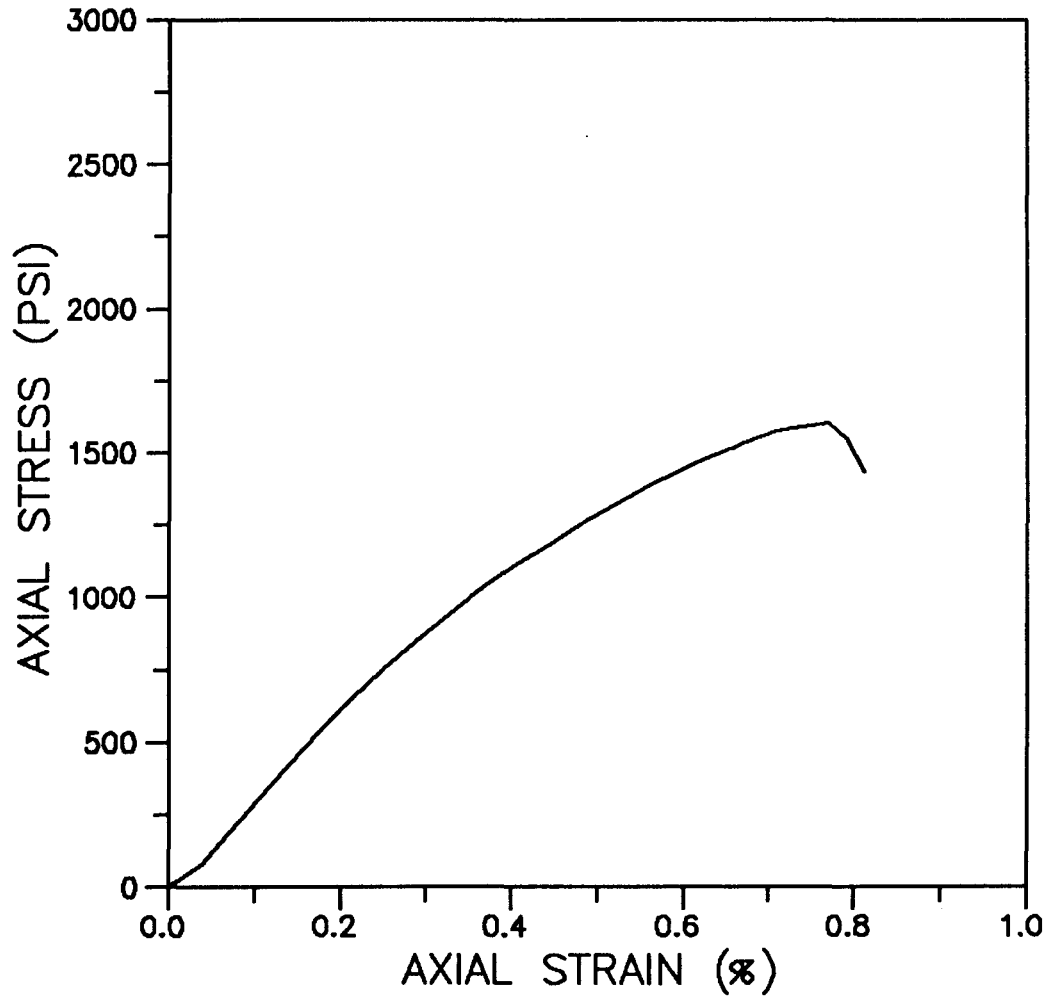
NOTES:

1) All moduli calculated from axial strains using a dial micrometer except where noted. Axial gage length is sample length.

2) Modulus and Poisson's ratio calculated from axial and lateral strains measured using LVDTs. Axial gage length is 2.8 inches

3) For Young's modulus values: the value within parenthesis indicates the number of LVDTs recording axial strains. Otherwise all 3 recorded strains

BORING NO: BF1
DEPTH (FT): 29.0
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.6
DRY UNIT WEIGHT (PCF): 117.7
DEG. OF SATURATION (%): 91.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
2.59 x 10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

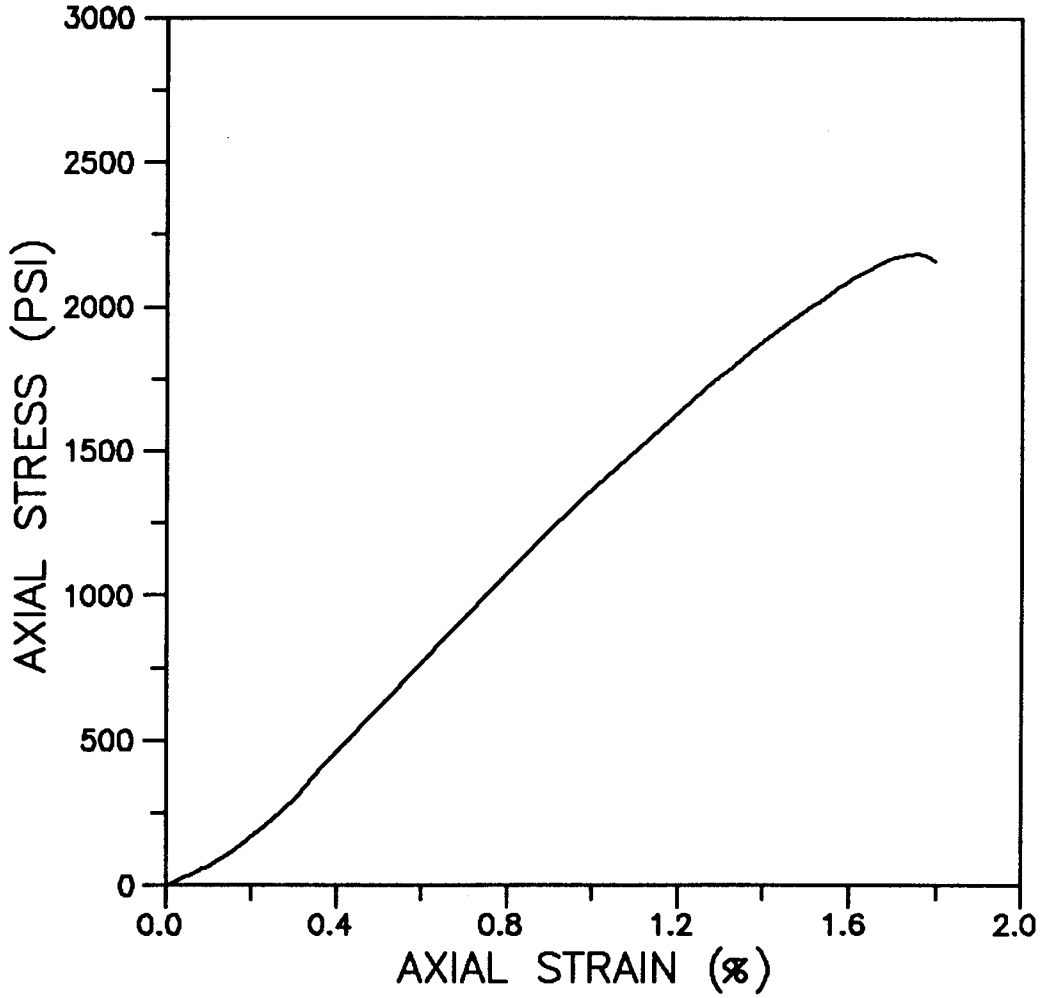
STRESS–STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89–192

FIGURE

BORING NO: BF1
DEPTH (FT): 48.4
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.4
DRY UNIT WEIGHT (PCF): 116.5
DEG. OF SATURATION (%): 87.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.50 x 10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 45 DEG

TEXAS SSC SITE

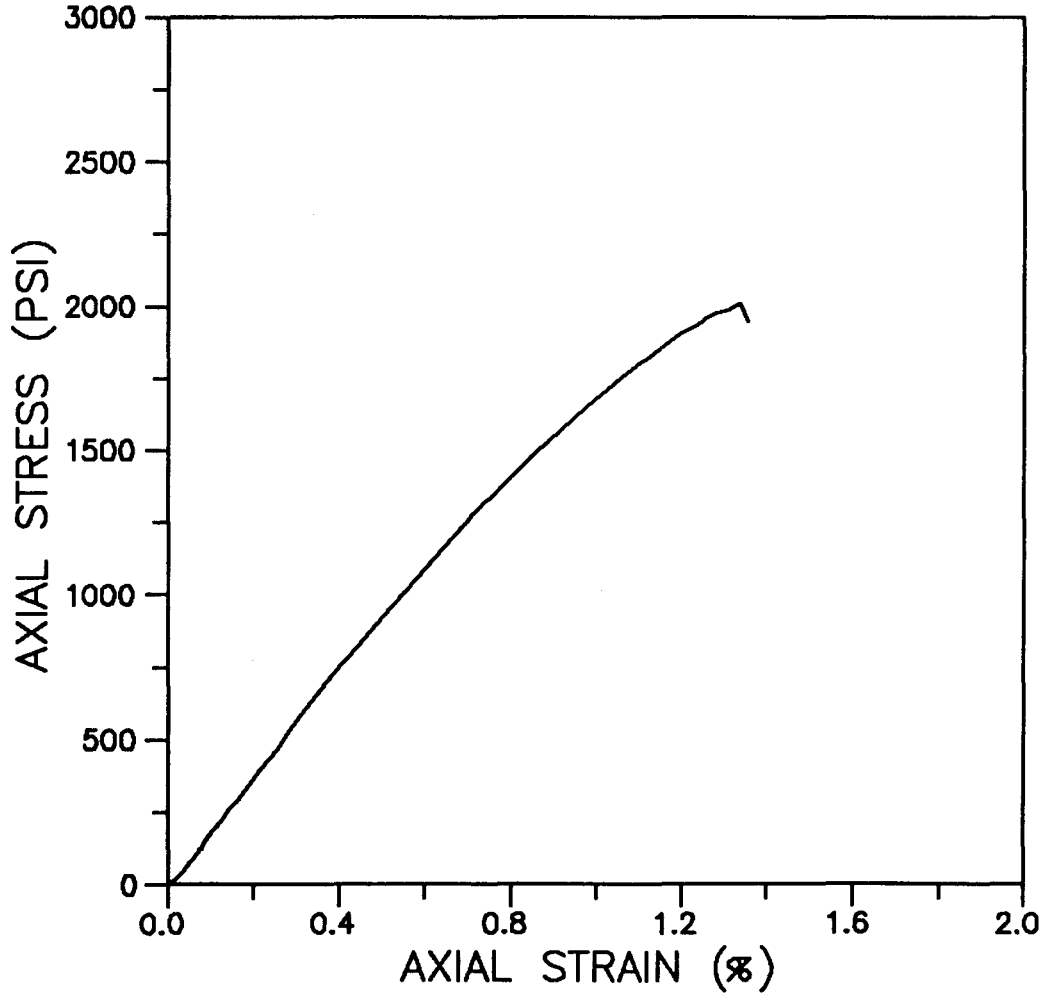
STRESS–STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89–192

FIGURE

BORING NO: BF1
DEPTH (FT): 51.1
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.1
DRY UNIT WEIGHT (PCF): 114.9
DEG. OF SATURATION (%): 75.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.74 x 10E5 PSI

FAILURE MODE:
CONICAL BREAK

TEXAS SSC SITE

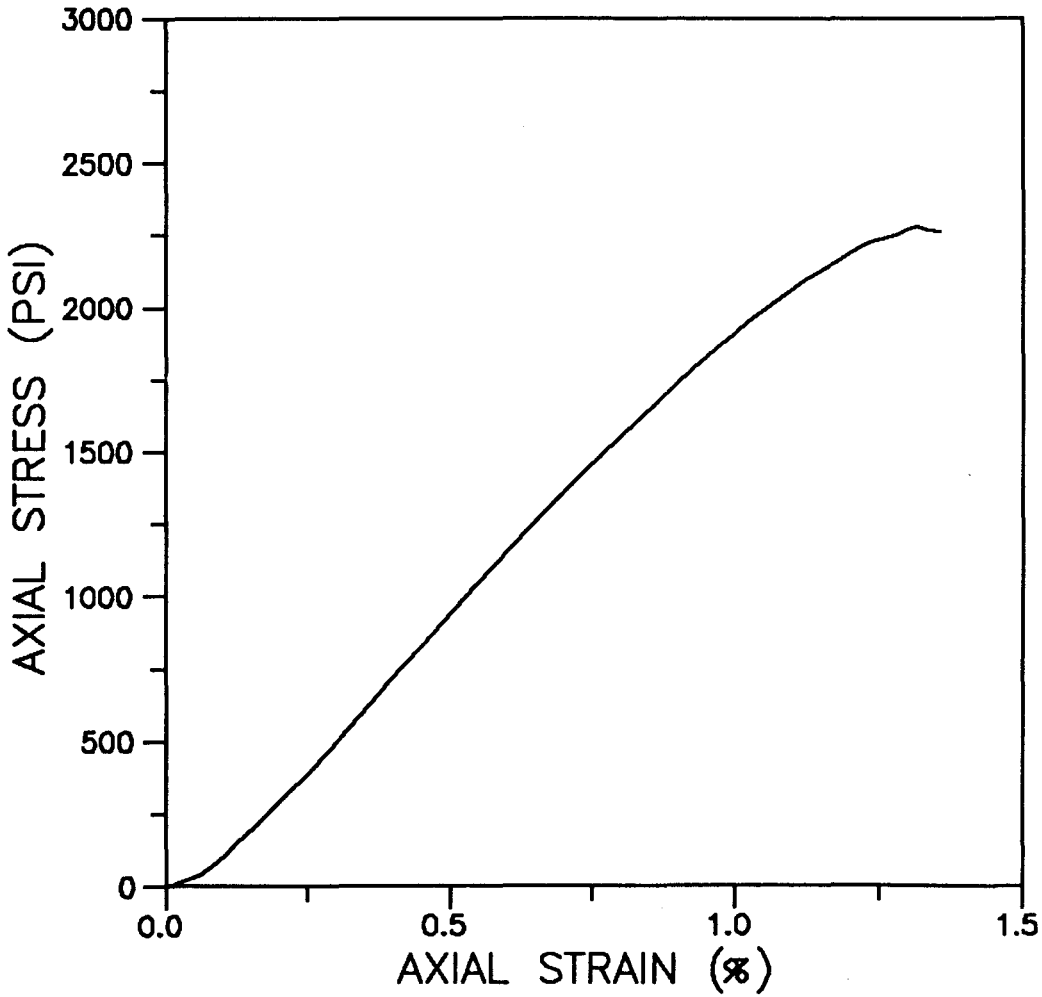
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BF1
DEPTH (FT): 67.6
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.0
DRY UNIT WEIGHT (PCF): 113.8
DEG. OF SATURATION (%): 84.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
2.11 x 10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

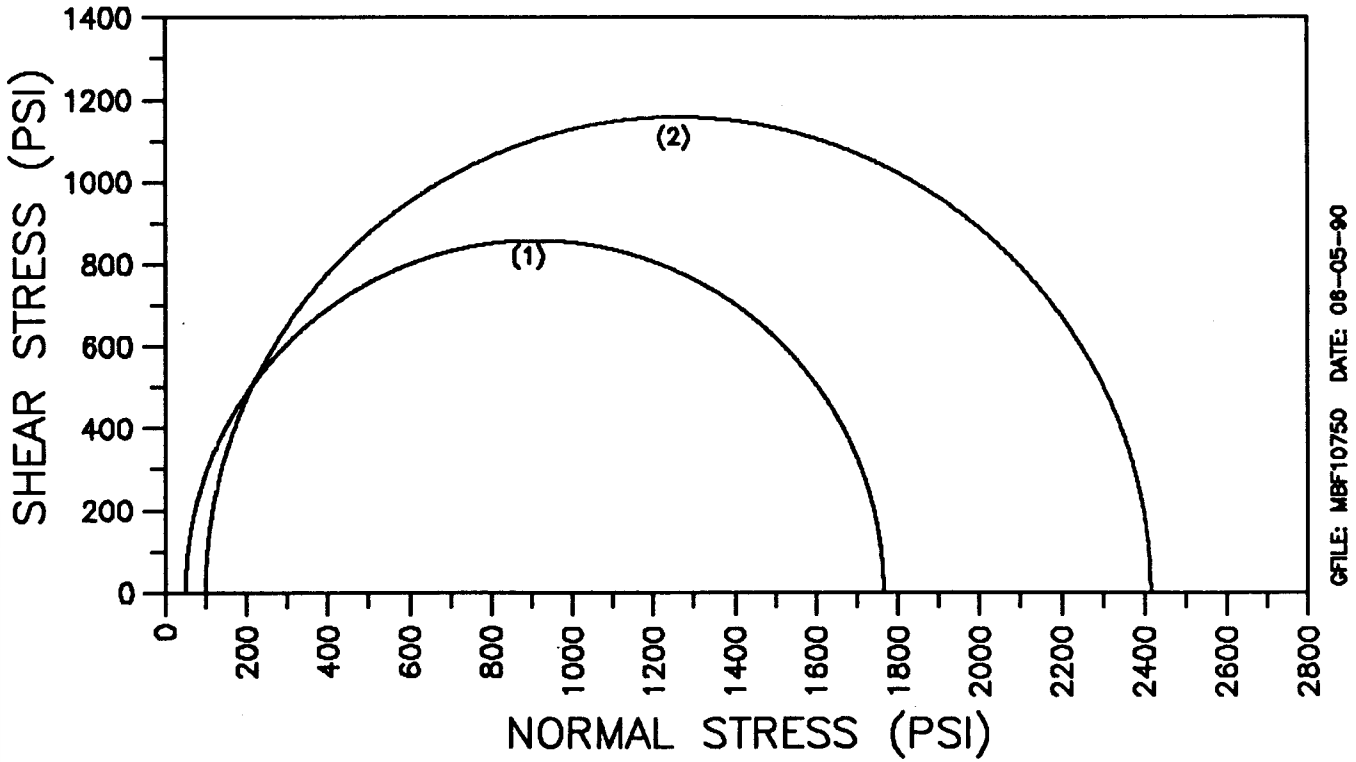
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BF1
DEPTH RANGE (FT): 75.0–75.8
AUSTIN CHALK LIMESTONE



GFILE: MBF10750 DATE: 08-05-90

SEE STRESS–STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 75.0
(2) DEPTH (FT): 75.4

INCLINATION (DEG): VERTICAL
TEST TYPE: TRIAXIAL COMPRESSION (ASTM D2664)

TEXAS SSC SITE

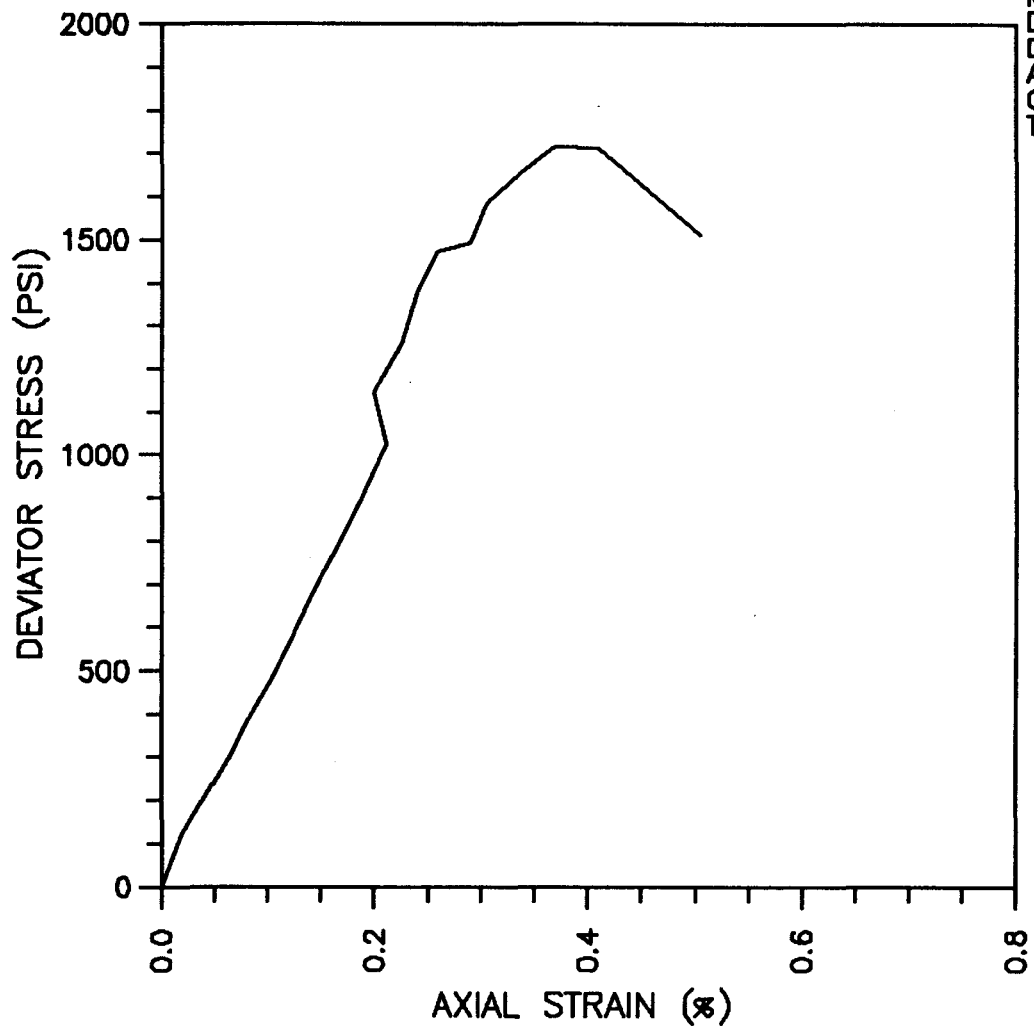
MOHR CIRCLE PLOT

MASON–JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS–ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF1
DEPTH (FT): 75.0
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.1
DRY UNIT WEIGHT (PCF): 122.2
DEG. OF SATURATION (%): 86.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 50
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

FILE: BF10750 DATE: 08-05-90 CAL: MGT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.106 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

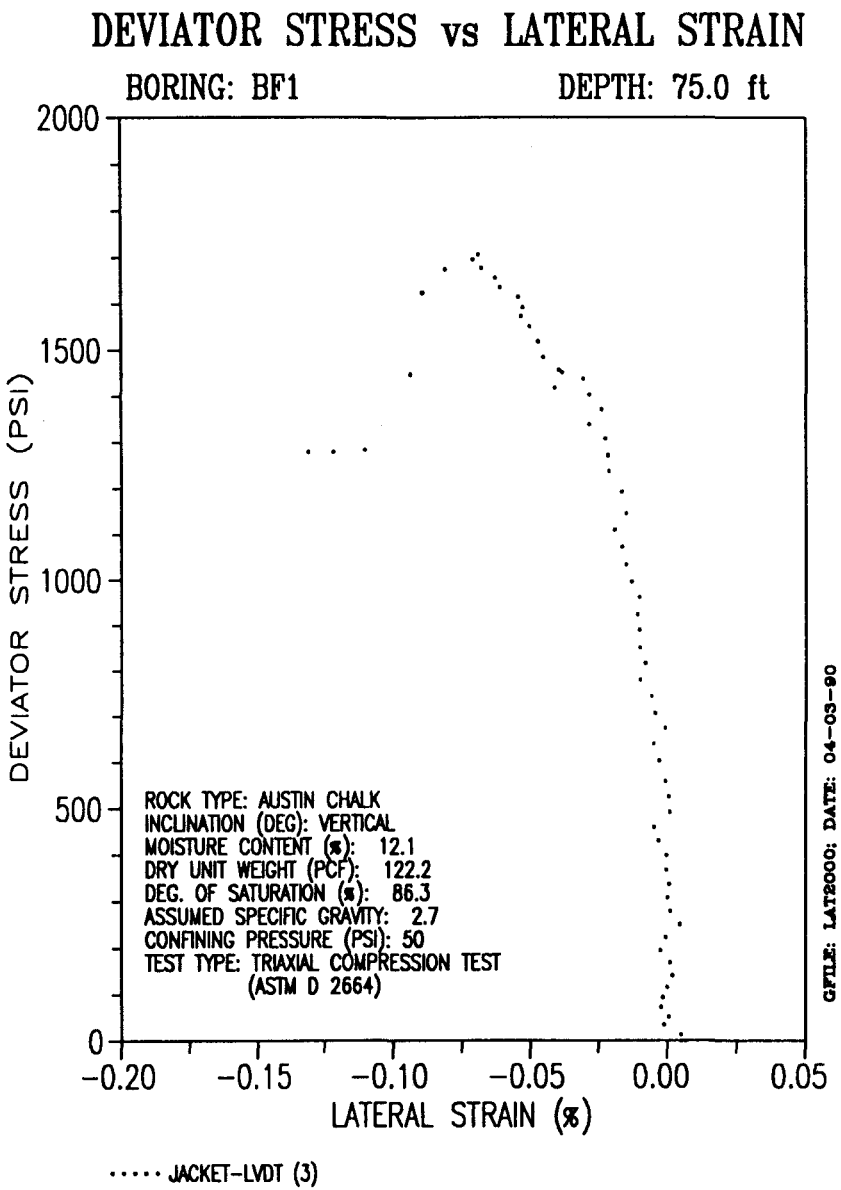
TEXAS SSC SITE

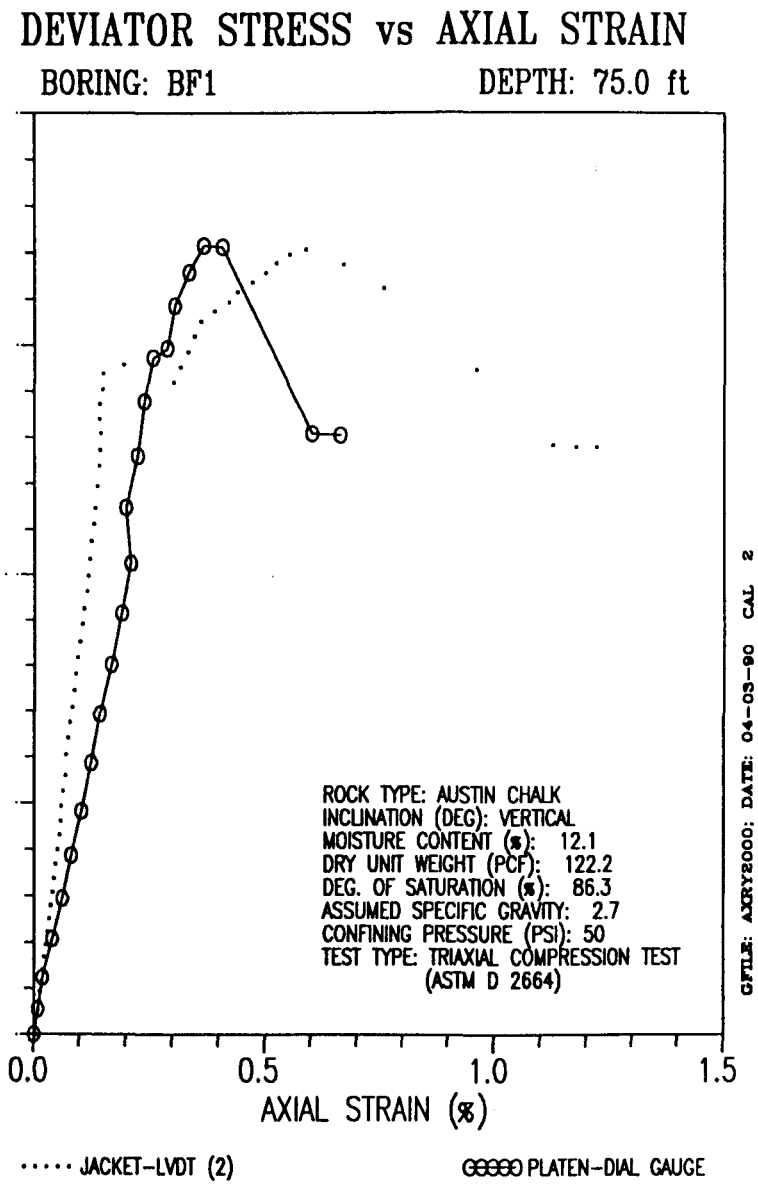
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

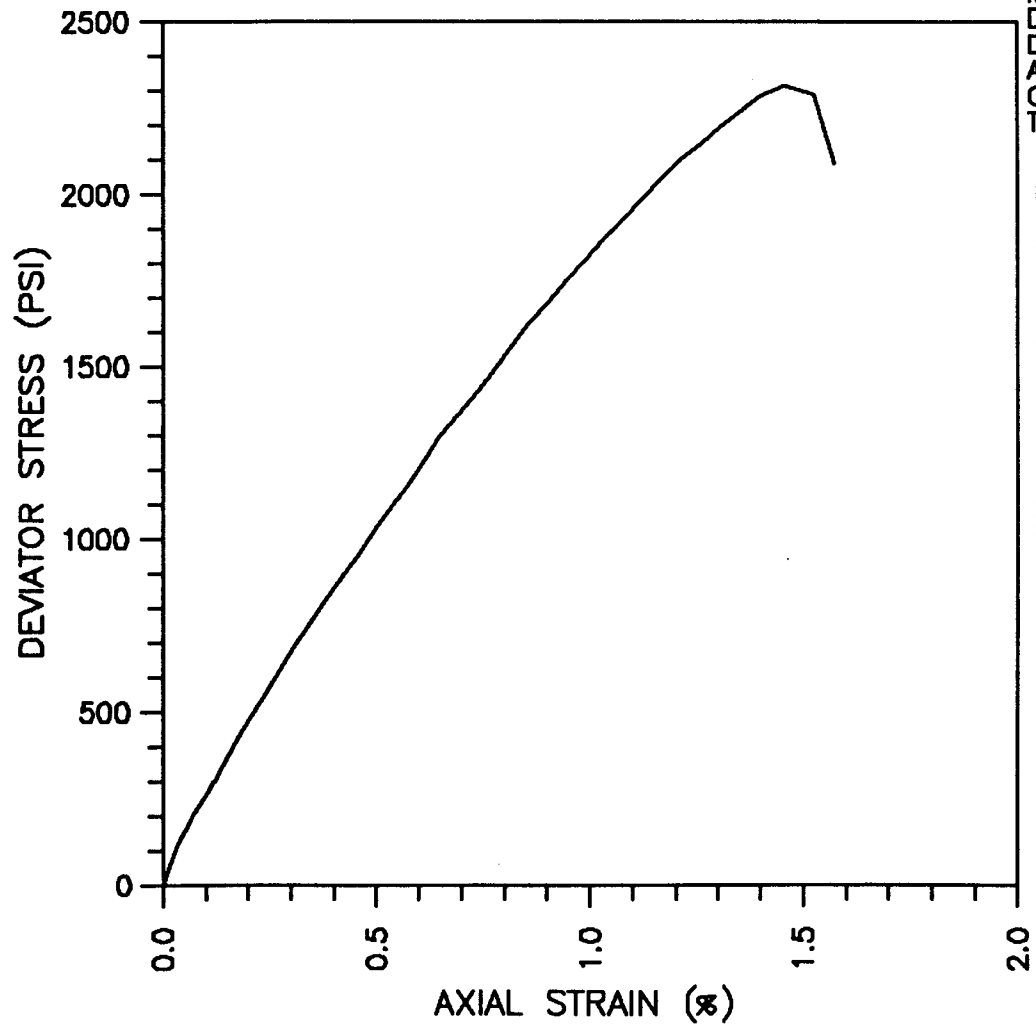
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BF1
DEPTH: 75.0 ft
DEVIATOR STRESS (PSI)
2000
1500
1000
500
0
-0.20
-0.15
-0.10
-0.05
0.00
0.05
LATERAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.1
DRY UNIT WEIGHT (PCF): 122.2
DEG. OF SATURATION (%): 86.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 50
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT2000; DATE: 04-03-90
JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BF1
DEPTH: 75.0 ft
0.0
0.5
1.0
1.5
AXIAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.1
DRY UNIT WEIGHT (PCF): 122.2
DEG. OF SATURATION (%): 86.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 50
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY2000; DATE: 04-03-90 CAL 2
JACKET-LVDT (2)
PLATEN-DIAL GAUGE

BORING NO.: BF1
DEPTH (FT): 75.4
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.3
DRY UNIT WEIGHT (PCF): 129.8
DEG. OF SATURATION (%): 93.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.681 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 20 DEG.

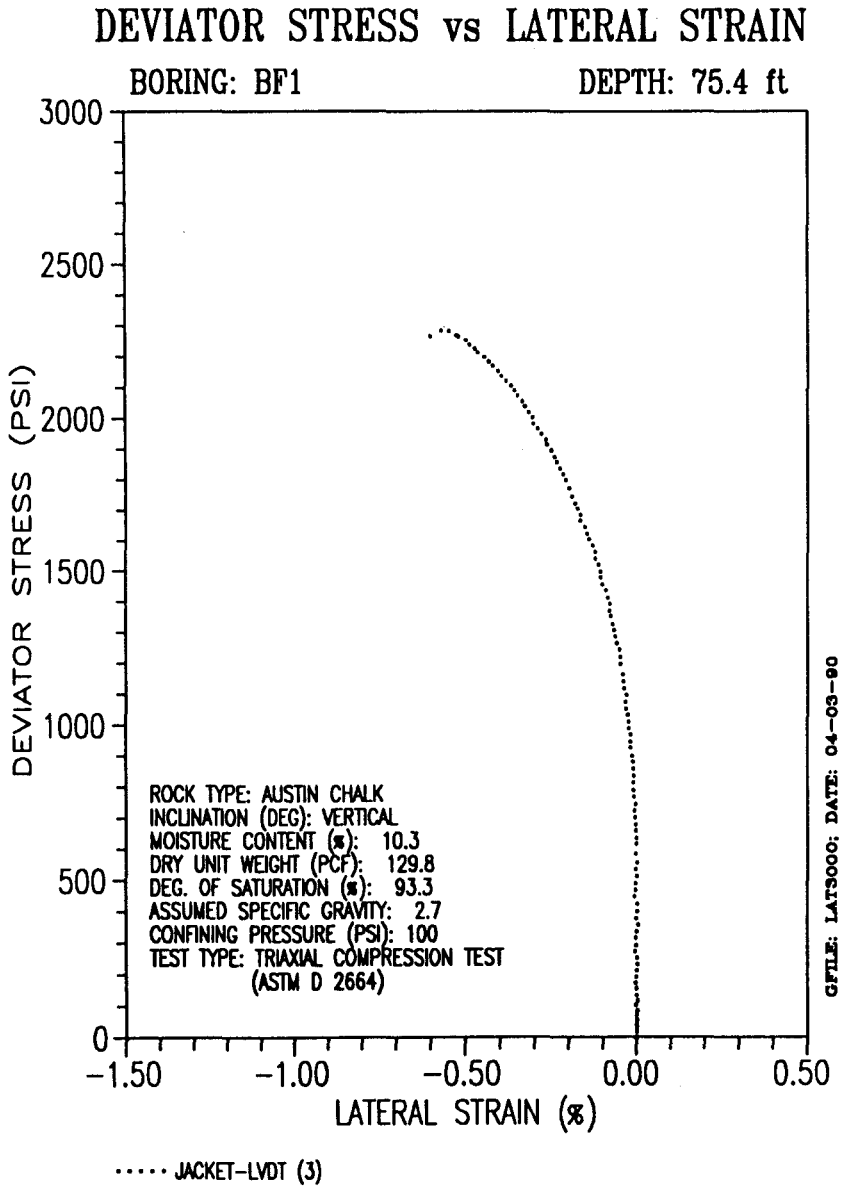
TEXAS SSC SITE

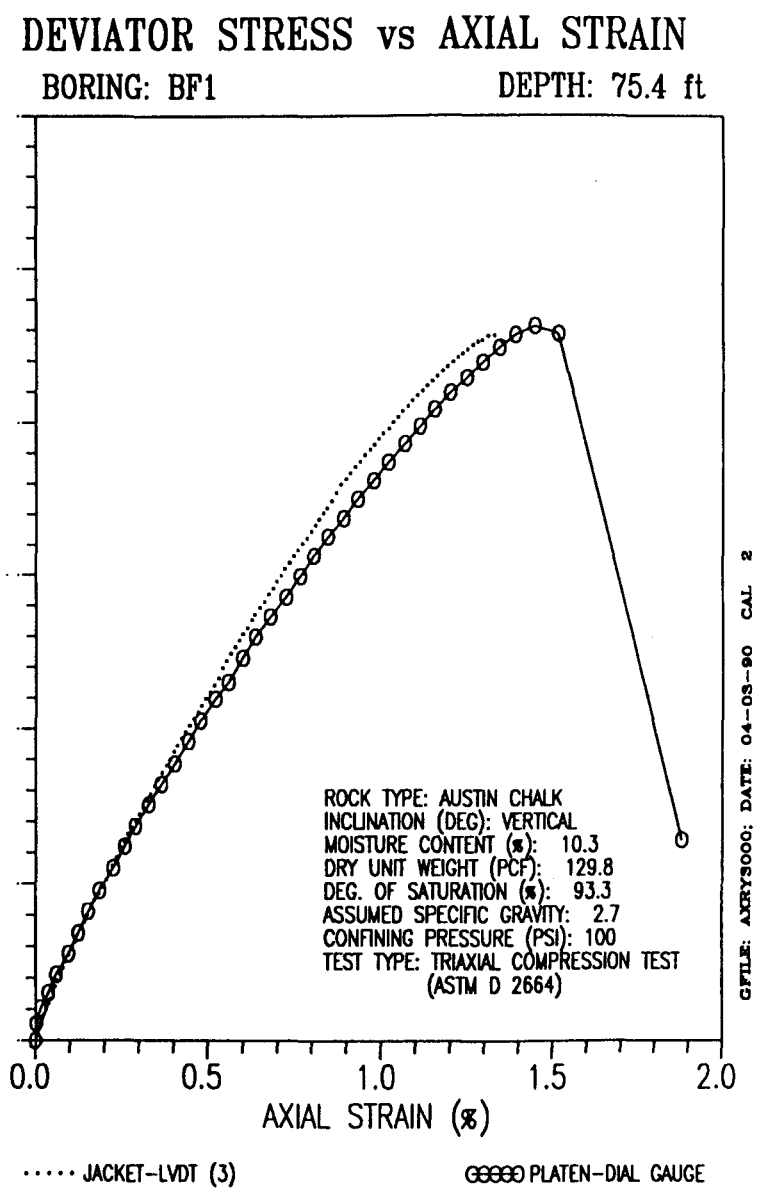
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

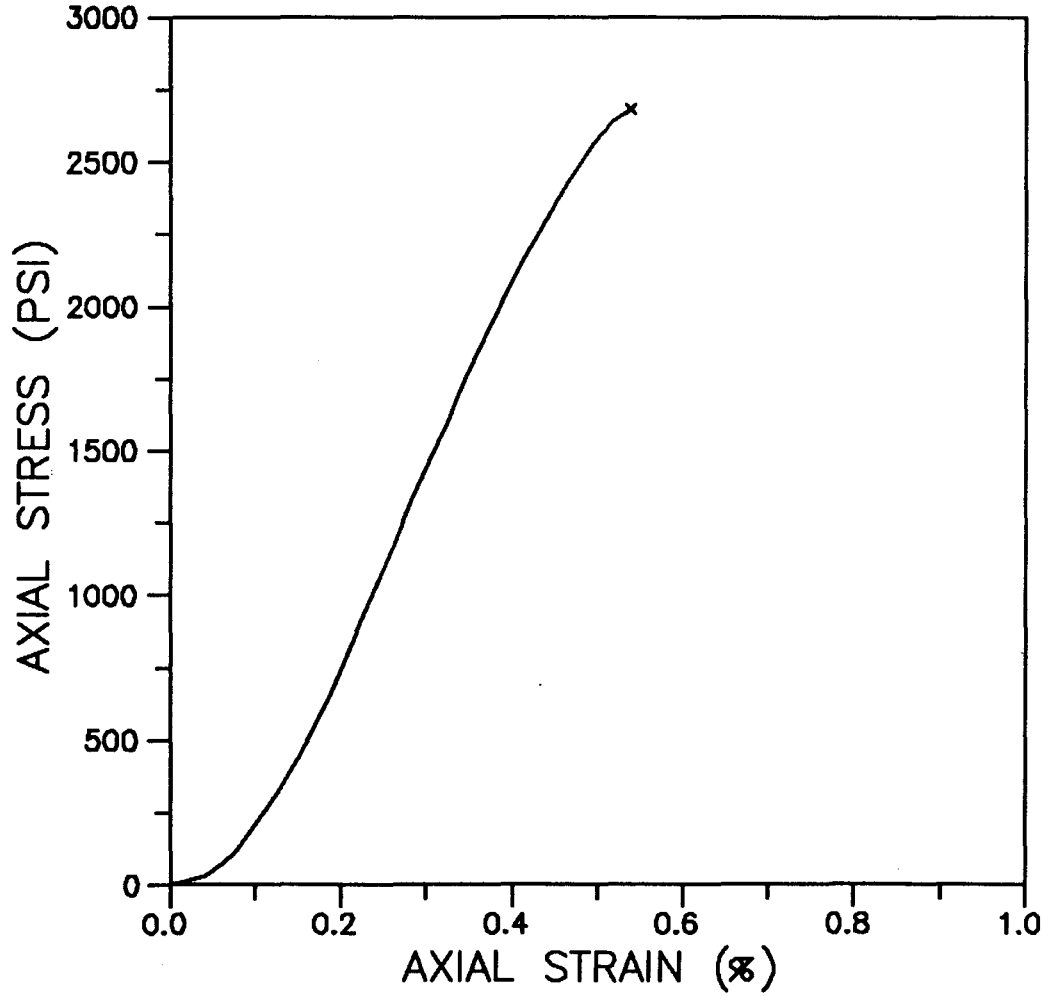
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BF1
DEPTH: 75.4 ft
DEVIATOR STRESS (PSI)
3000
2500
2000
1500
1000
500
0
-1.50
-1.00
-0.50
0.00
0.50
LATERAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.3
DRY UNIT WEIGHT (PCF): 129.8
DEG. OF SATURATION (%): 93.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT3000; DATE: 04-03-90
JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BF1
DEPTH: 75.4 ft
0.0
0.5
1.0
1.5
2.0
AXIAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.3
DRY UNIT WEIGHT (PCF): 129.8
DEG. OF SATURATION (%): 93.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY3000; DATE: 04-03-90 CAL 2
JACKET-LVDT (3)
PLATEN-DIAL GAUGE

BORING NO: BF1
DEPTH (FT): 101.9
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.2
DRY UNIT WEIGHT (PCF): 121.8
DEG. OF SATURATION (%): 93.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
7.04 x 10E5 PSI

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

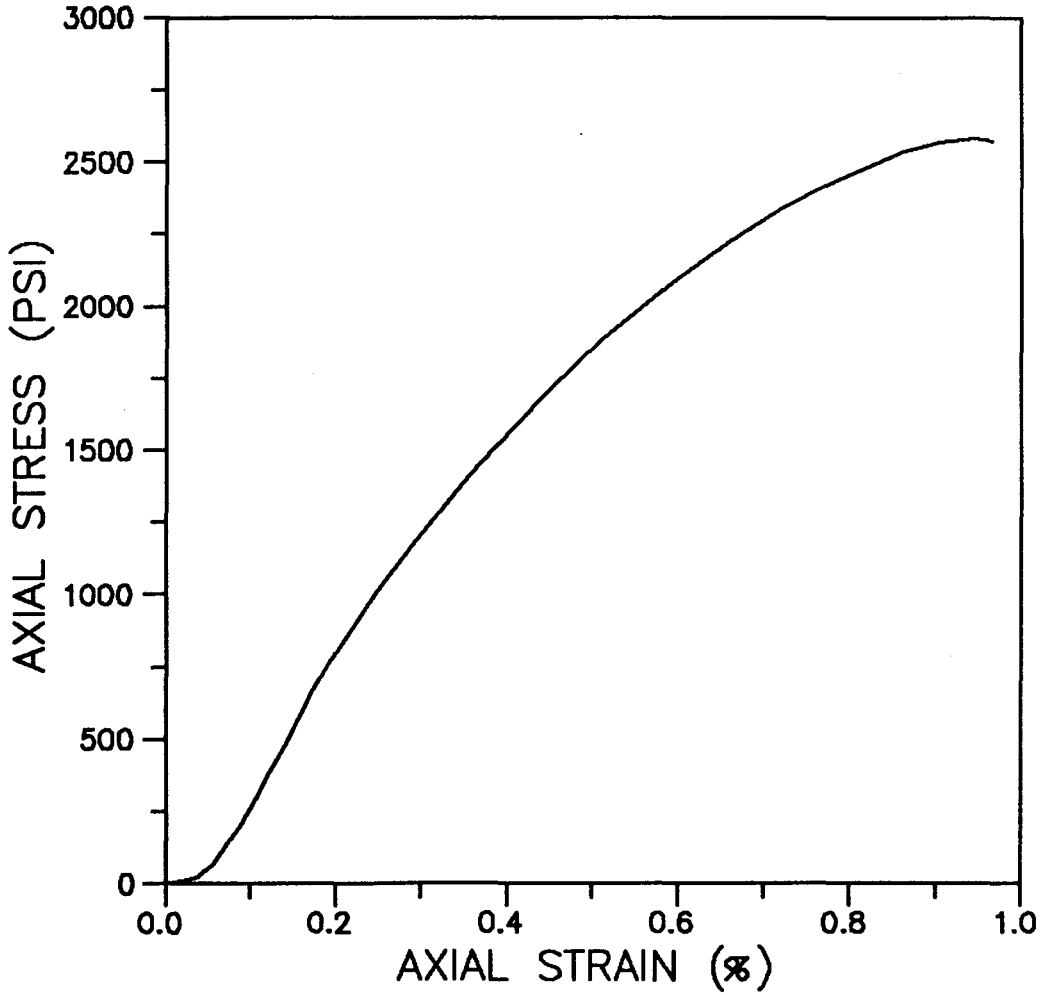
STRESS–STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89–192

FIGURE

BORING NO: BF1
DEPTH (FT): 137.2
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.7
DRY UNIT WEIGHT (PCF): 115.0
DEG. OF SATURATION (%): 91.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.68 x 10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

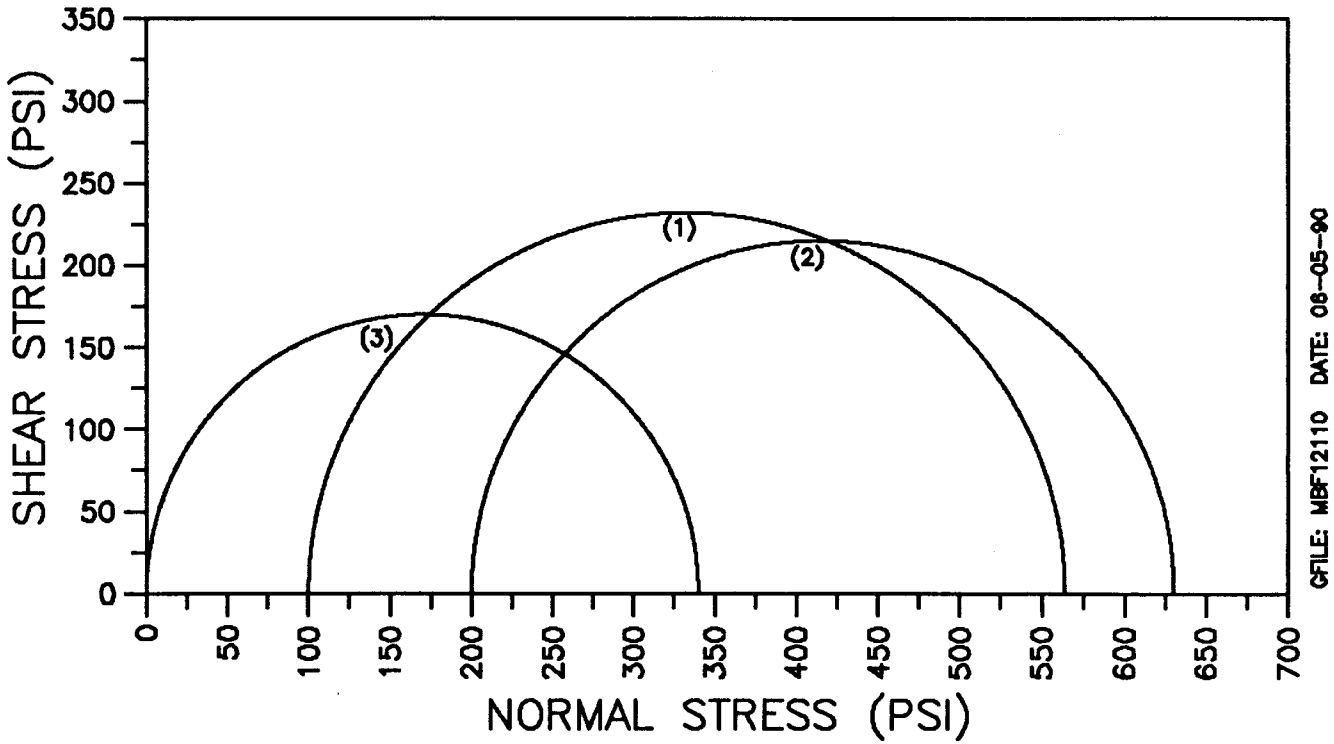
STRESS—STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BF1
DEPTH RANGE (FT): 211.0–213.9
EAGLE FORD SHALE



GFILE: MBF12110 DATE: 08-05-90

SEE STRESS-STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 211.0
(2) DEPTH (FT): 212.3
(3) DEPTH (FT): 213.5

INCLINATION (DEG): VERTICAL
TEST TYPE: UNCONFINED COMPRESSION (ASTM D2938)
TRIAXIAL COMPRESSION (ASTM D2664)

TEXAS SSC SITE

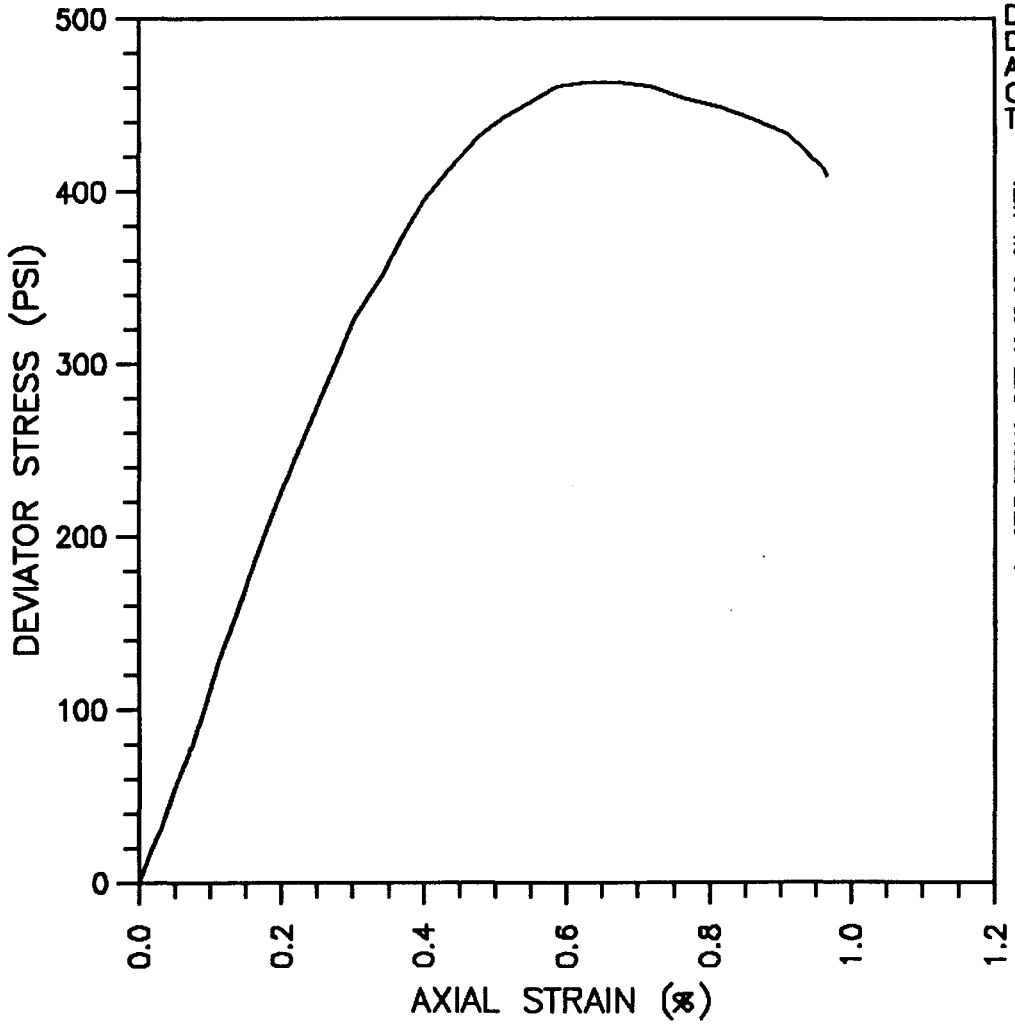
MOHR CIRCLE PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF1
DEPTH (FT): 211.0
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.6
DRY UNIT WEIGHT (PCF): 118.1
DEG. OF SATURATION (%): 98.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

BFILE: BF12110 DATE: 08-05-99 CAL: MGT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.127 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 40 DEG.

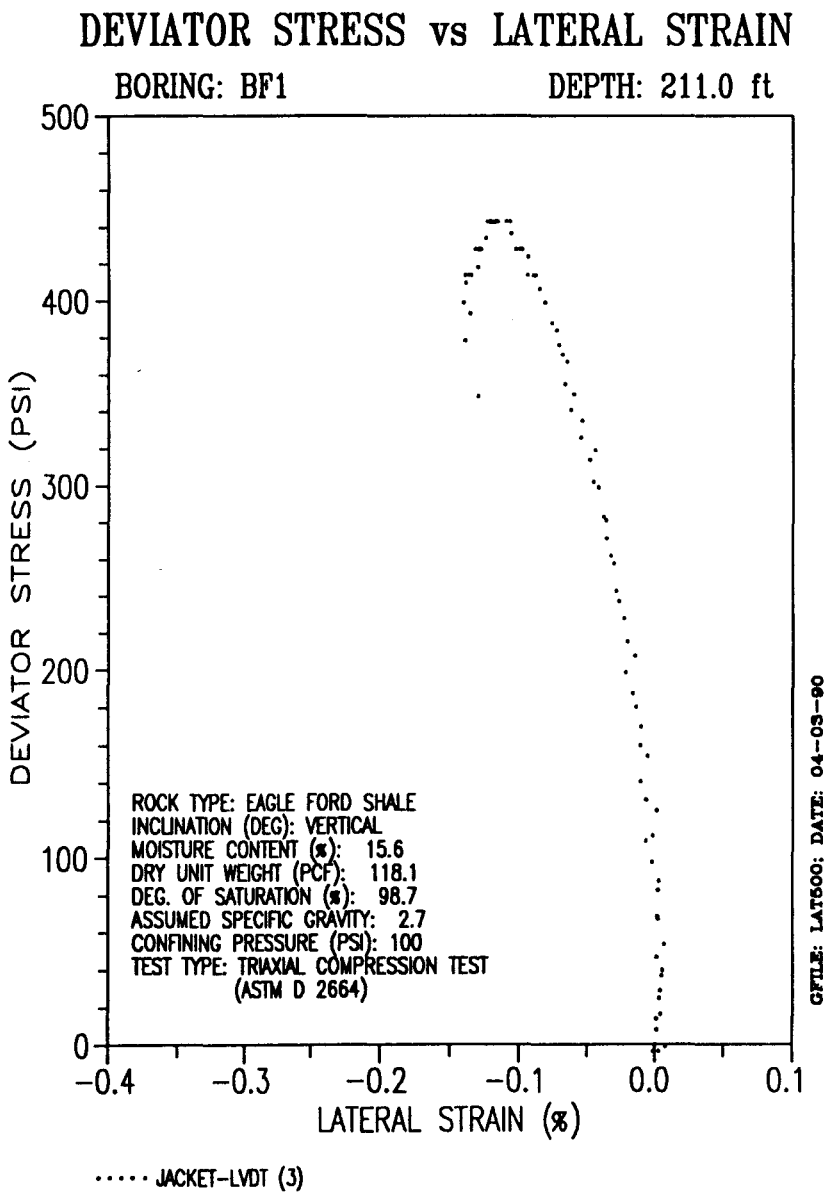
TEXAS SSC SITE

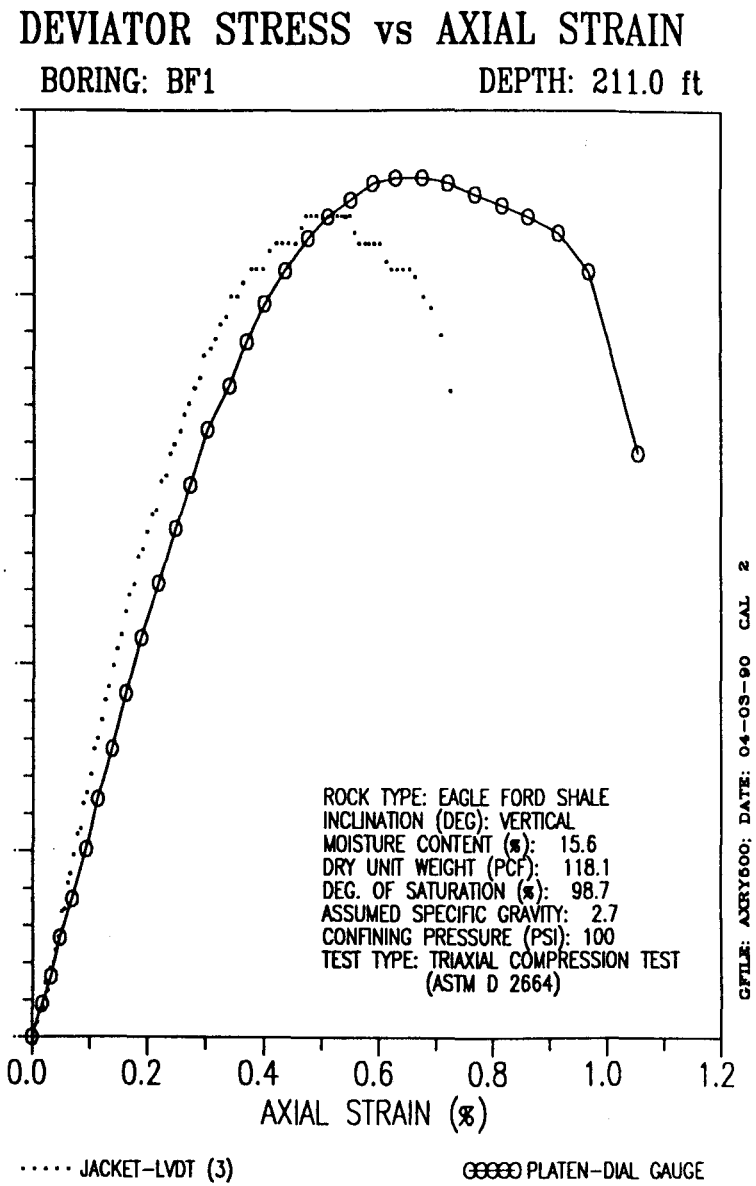
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

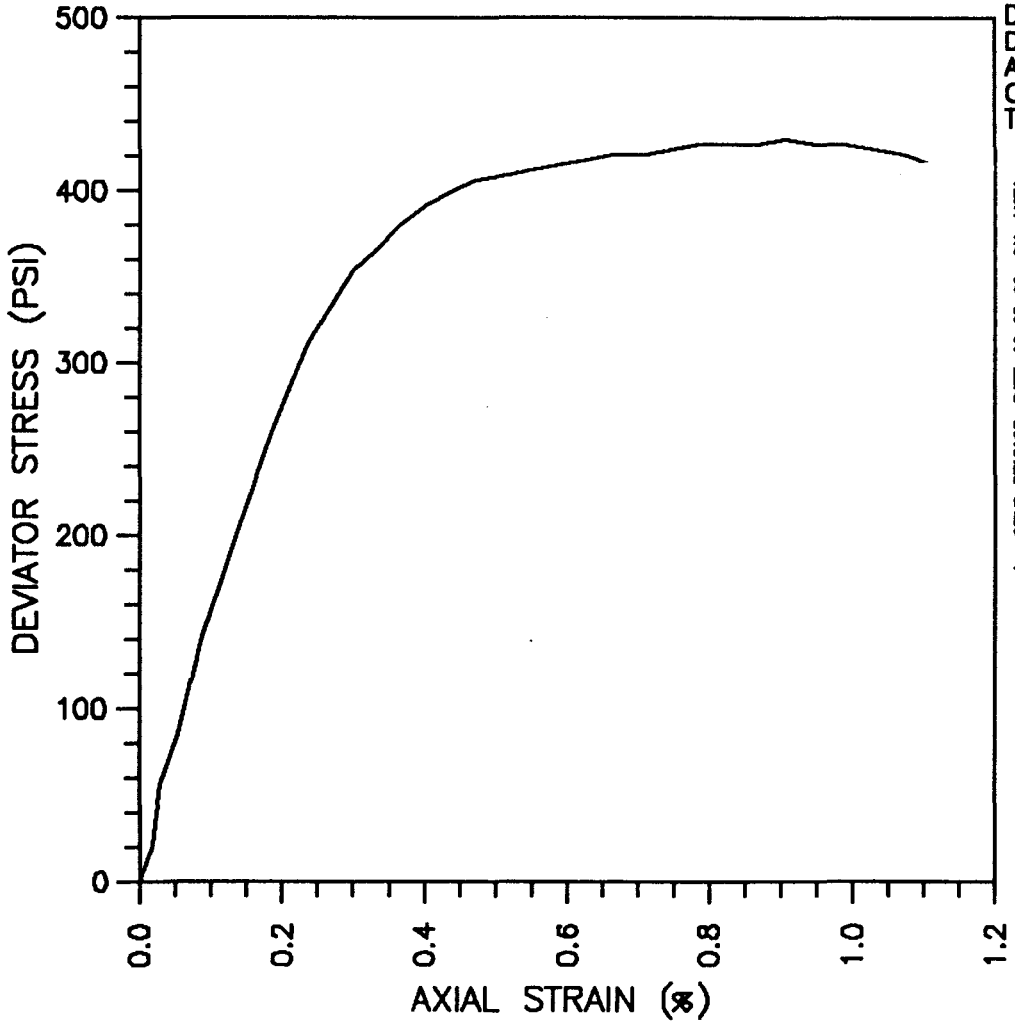
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BF1
DEPTH: 211.0 ft
DEVIATOR STRESS (PSI)
500
400
300
200
100
0
-0.4
-0.3
-0.2
-0.1
0.0
0.1
LATERAL STRAIN (%)
ROCK TYPE: EAGLE FORD SHALE
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.6
DRY UNIT WEIGHT (PCF): 118.1
DEG. OF SATURATION (%): 98.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT500; DATE: 04-03-90
JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BF1
DEPTH: 211.0 ft
0.0
0.2
0.4
0.6
0.8
1.0
1.2
AXIAL STRAIN (%)
ROCK TYPE: EAGLE FORD SHALE
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.6
DRY UNIT WEIGHT (PCF): 118.1
DEG. OF SATURATION (%): 98.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY500; DATE: 04-03-90 CAL 2
JACKET-LVDT (3)
PLATEN-DIAL GAUGE

BORING NO.: BF1
DEPTH (FT): 212.3
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 16.3
DRY UNIT WEIGHT (PCF): 117.4
DEG. OF SATURATION (%): 101.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

BFILE: BF12123 DATE: 06-05-90 CAL: MCT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.286 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 40 DEG.

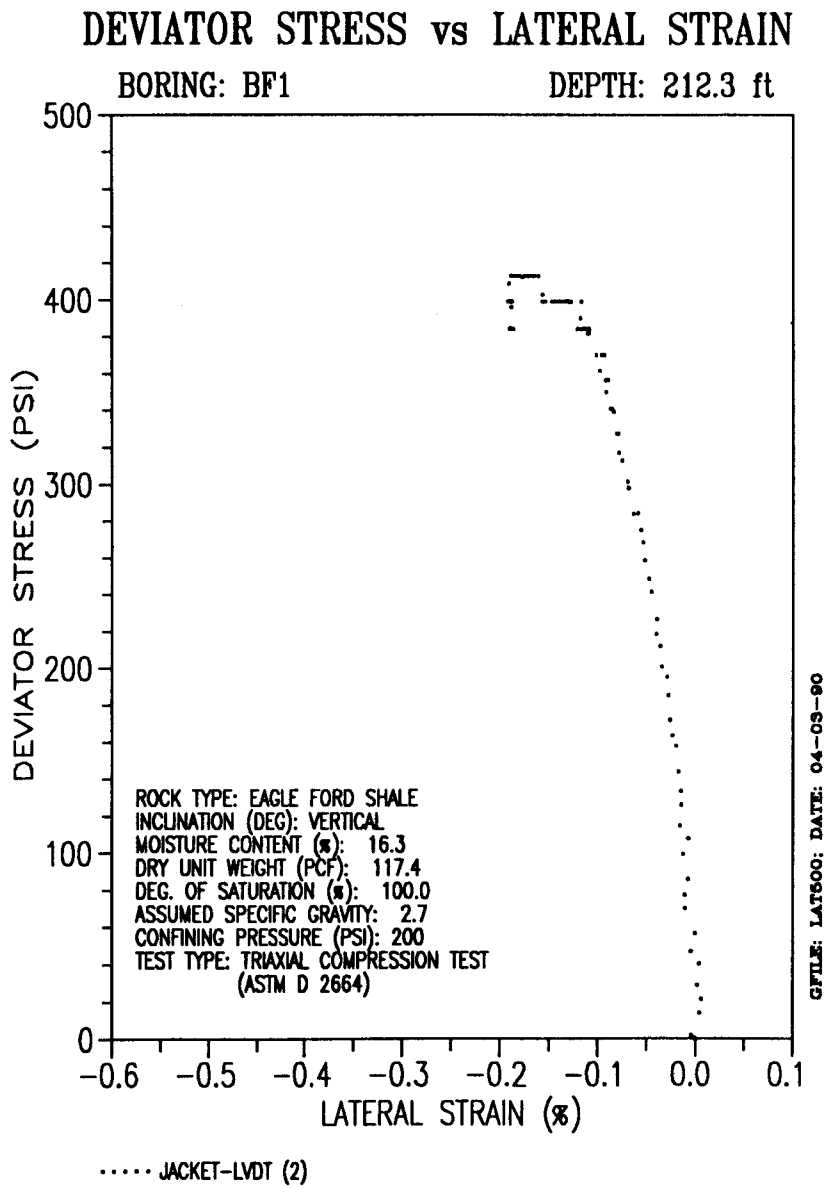
TEXAS SSC SITE

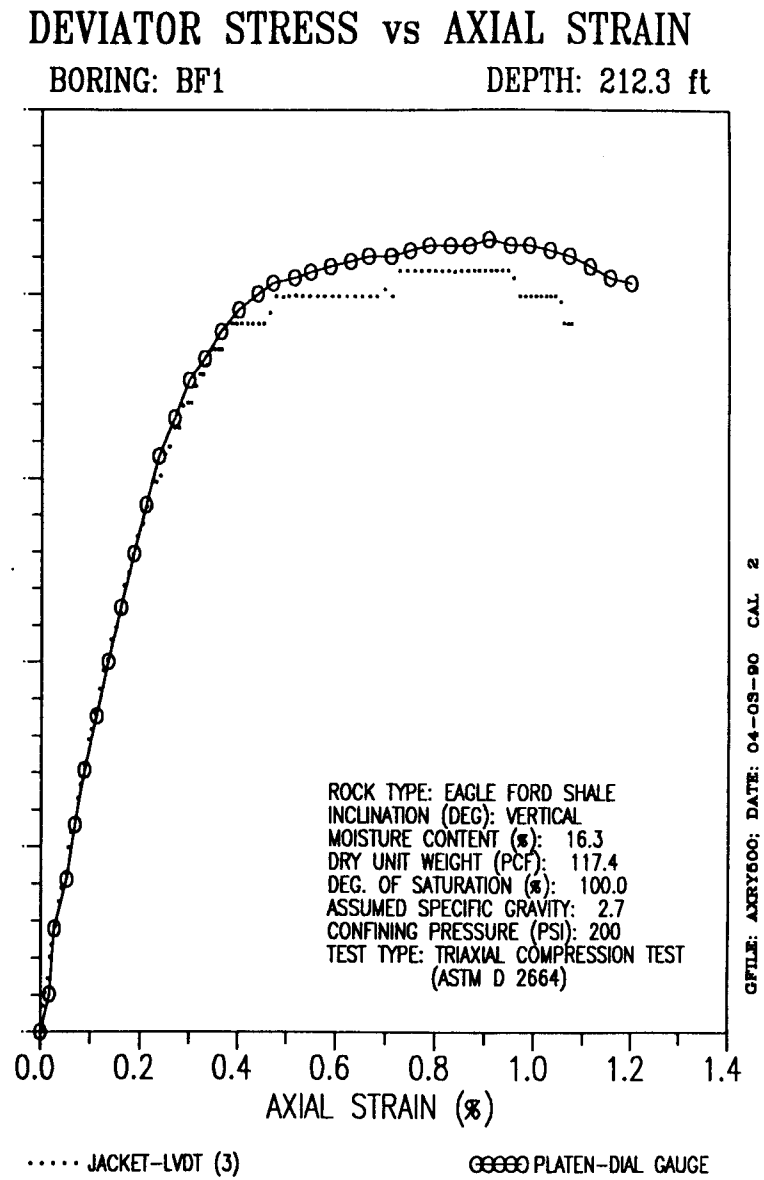
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

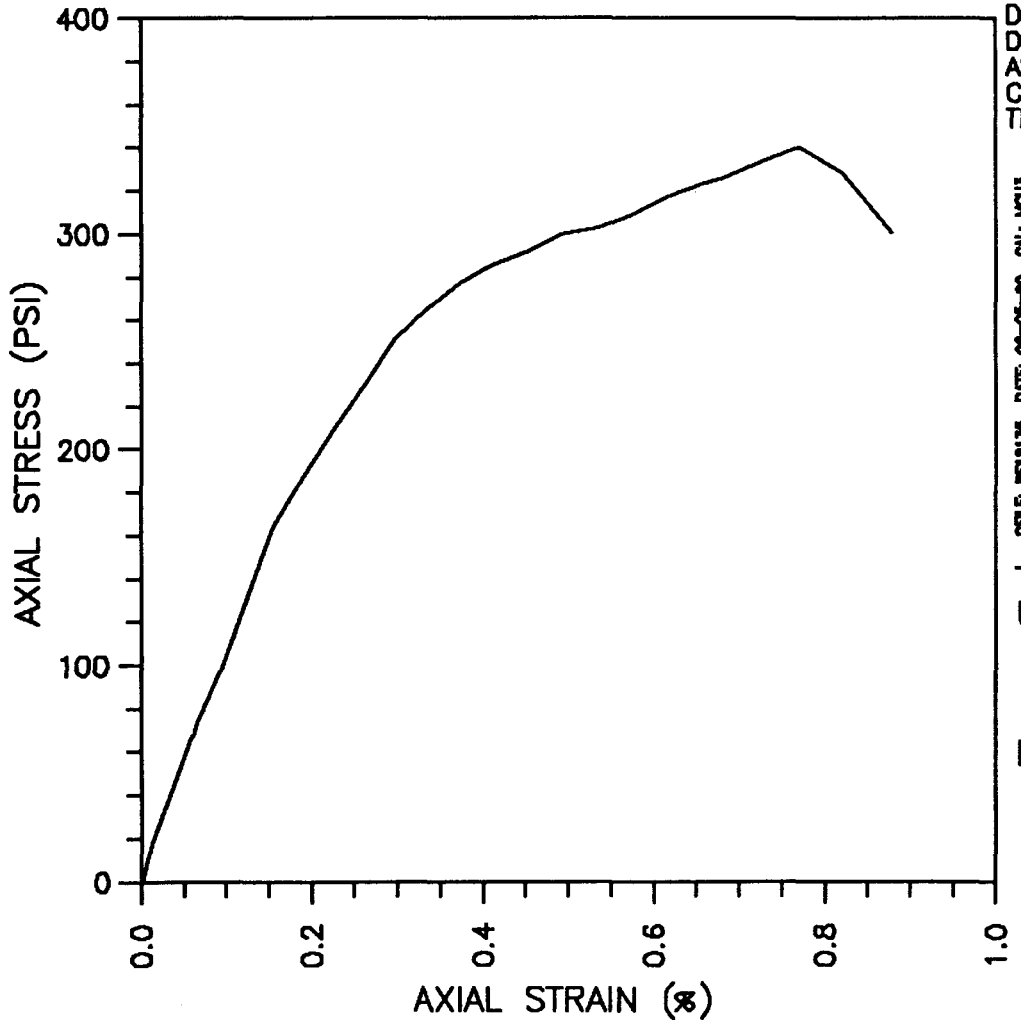
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BF1
DEPTH: 212.3 ft
DEVIATOR STRESS (PSI)
500
400
300
200
100
0
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
LATERAL STRAIN (%)
ROCK TYPE: EAGLE FORD SHALE
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 16.3
DRY UNIT WEIGHT (PCF): 117.4
DEG. OF SATURATION (%): 100.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT500; DATE: 04-03-90
JACKET-LVDT (2)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BF1
DEPTH: 212.3 ft
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
AXIAL STRAIN (%)
ROCK TYPE: EAGLE FORD SHALE
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 16.3
DRY UNIT WEIGHT (PCF): 117.4
DEG. OF SATURATION (%): 100.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY500; DATE: 04-03-90 CAL 2
JACKET-LVDT (3)
PLATEN-DIAL GAUGE

BORING NO.: BF1
DEPTH (FT): 213.5
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.8
DRY UNIT WEIGHT (PCF): 117.9
DEG. OF SATURATION (%): 99.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: BF12135 DATE: 08-05-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.652 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

STRESS-STRAIN PLOT

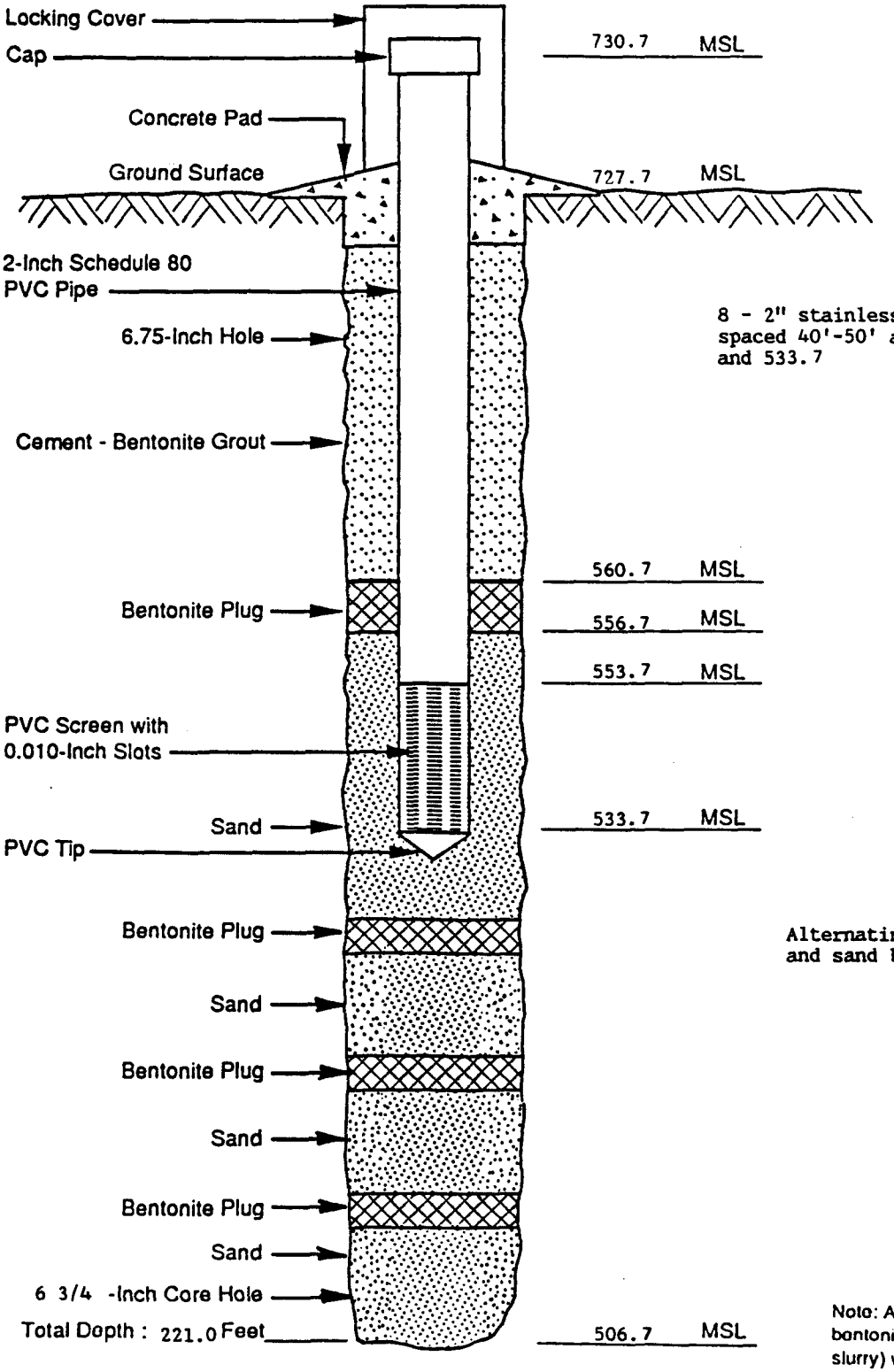
MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

APPENDIX D

WELL AS-BUILT DIAGRAM



8 - 2" stainless steel centralizers spaced 40'-50' apart between 727.7 and 533.7

Alternating layers of bentonite and sand between 533.7 and 506.7

Note: All the backfill materials (sand, bentonite pellets and cement/ bentonite slurry) were placed by tremie.

NOT TO SCALE

Boring: BF 1
Location: N 267,430
E 2,171,093
Date(s) Installed: 3-16-90
Well Construction
Supervising Geologist: Alan Dover
Approved By: Shawn Wood

Date: 6-4-90

"As Built"
Well Construction Diagram
Observation Well
No.

5/90 BF 1 Figure