SSCL-SR-1088

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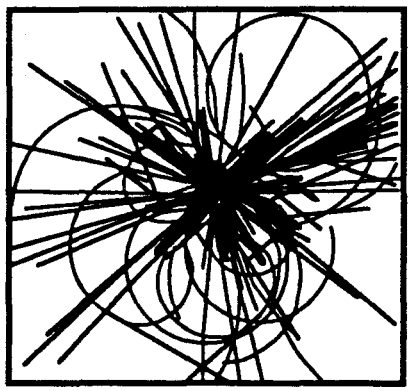
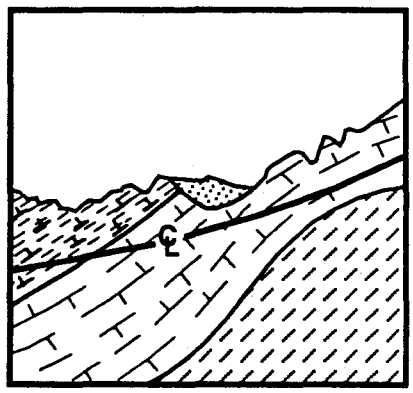
Project No. 87-888-0017
Report No. SSC-GR-29
June 1990
GR-29

Data Report for Corehole BF 8





Prepared by: The Earth Technology Corporation
Long Beach, California

Prepared for: RTK a joint venture
Oakland, California

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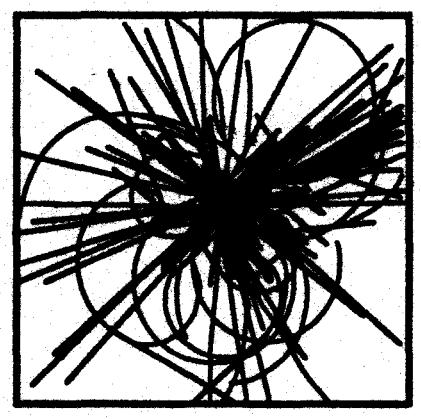
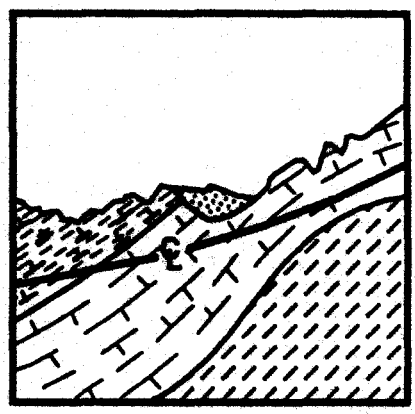




Prepared by: The Earth Technology Corporation
Long Beach, California

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 8

Objective: Drill a corehole at the proposed shaft location and determine geotechnical conditions through in-situ hydrologic testing and laboratory geomechanical testing. The core hole extends at least 35 feet below tunnel depth.

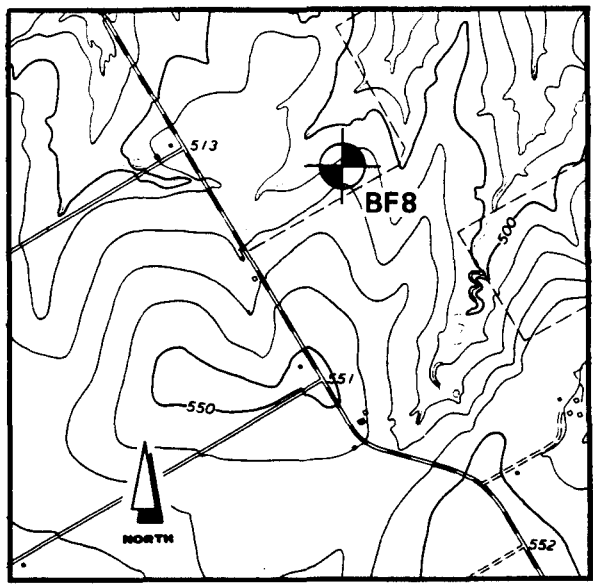
Location:

North 204,307 feet

East 2,215,118 feet

Surface Elevation 512.2 feet

BF 8 is located on the southern side of the proposed tunnel alignment, about 2 miles north of State Route 34.



SCALE 1:24,000

0 1000 2000 3000 4000 Feet

CONTOUR INTERVAL 10 FEET

Scope and Schedule:		
	Coring (full depth)	January 4 to 6, 1990
	Wire-line Logging	January 6, 1990
	Hydrologic Testing	January 8, 1990
	Laboratory Testing	January 14 to March 12, 1990
	Well Construction	January 8 to 10, 1990

Conditions Encountered: (see lithologic log, Appendix A)

Total Hole Depth:	232.0 feet
Soil:	0.0 to 2.5 feet
Weathered Taylor Marl:	2.5 to 36.0 feet
Fresh Taylor Marl:	36.0 to 112.5 feet
Austin Chalk:	112.5 to 232.0 feet (bottom of hole)
Static Water Level:	Measured at 486.8 feet above MSL (25.4 feet below ground surface) on April 5, 1990, 82 days after the well was bailed to 310.0 feet above MSL. Results of repeated measurements indicate that the water level in the boring probably had not reached static condition.

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)

Hydrologic Test Results Summary: (see also Appendix C)

Vertical Depth (ft)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/ Lithology	Hydraulic Conductivity (cm/sec)
82.3-103.4	125	20	Taylor Marl	3.9×10^{-6}
162.3-183.4	150	30	Austin Chalk (fractured)	2.7×10^{-6}

Bulk and Clay Mineralogy Test Results:

Formation: Taylor Marl **Depth: 55.9 ft**

Whole Rock Composition:

Mineral	Percent
quartz	11
K feldspar	2
plagioclase	2
calcite	28
dolomite	1
siderite	16
pyrite	1
total clay	39
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	5
kaolinite	10
mixed layer (illite/smectite)	85
Total	100

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

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)
37	Taylor Marl	23	102-103	191	0.16	
53-57	Taylor Marl	19-21	103-109	356	0.28	
79-80	Taylor Marl	19-20	109-110	444-452 (100)	0.49-0.66 (50)	
107-108	Taylor Marl	17-18	114	452	0.38	
121	Austin Chalk	14-15	121-123	2311	5.88	
136	Austin Chalk	13	122			297
138-140	Austin Chalk	11-12	125-130	1815 (200)-3051 (100)	1.94 (200)-11.63	
158-159	Austin Chalk	11-12	128-131	1939	5.71	
163-164	Austin Chalk	10-12	125-127	2914		
193	Austin Chalk	12-15	120-128	313	0.48	
210-211	Austin Chalk	7	139-140	2037	5.00	
224	Austin Chalk	8	136			165
227-228	Austin Chalk	8-9	134-138	2271	4.65	

* UU triaxial compression test indicated by confining pressure in parentheses.

Hole Status: An observation well was constructed in the boring on January 10, 1990 (see Appendix E).

APPENDIX A

LITHOLOGIC LOG

LOG OF BORING

BORING NO: BF8 PG 1 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 204,307 feet
E 2,215,118 feet

GROUND EL: 512.2 feet

DATE: 1-4-90 TYPE: Nx-Core CASED TO: 4.0' CONTRACTOR: MJA

SAMPLE LEGEND	WATER INFORMATION
S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	Wet Rotary Core Hole Water level not determinable Observation Well installed for monitoring of water level Slight water loss observed in upper section of boring

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 (Residual Soil), silty, calcareous, very fine grained, dk. brown 2.5g
5									SHALE (Taylor Marl), completely weathered, very soft, very thinly bedded, very fine grained, lt. gray, tan and brown, calcareous, w/fractures containing iron stained surfaces
10									
15									
20									
25									25.0g SHALE (Taylor Marl), moderately to faintly weathered, soft, very thinly bedded, very fine grained, dark gray, calcareous, occasional fossils, fractures w/iron stained surfaces
30									
35		C1	32.5	35.2	100	100			36.0s SHALE (Taylor Marl), fresh, soft, very thinly bedded, very fine grained, dark gray, calcareous, occasional fossils
40		C2	35.2	43.0	100	100			

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Mark Thomas CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 8 PG 2 OF 6

LOCATION: N 204,307 feet
E 2,215,118 feet

GROUND EL: 512.2 feet

DATE: 1-4-90 TYPE: Nx-Core CASED TO: 4.0' CONTRACTOR: MJA

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
		C2		43.0						SHALE (Taylor Marl), fresh, soft, very thinly bedded, very fine grained, dk. gray, calcareous, occasional fossils, very homogeneous
45		C3	43.0	53.0	100	100				
50										
55		C4	53.0	63.0	100	100				
60										
65		C5	63.0	73.0	100	100				
70										
75		C6	73.0	83.0	100	100				
80										

SAMPLE LEGEND

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

WATER INFORMATION

Wet Rotary Core Hole
Water level not determinable
Observation well installed for monitoring of water level
Slight water loss observed in upper section of boring

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Mark Thomas CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF8 PG 3 OF 6

LOCATION: N 204,307 feet
E 2,215,118 feet

GROUND EL: 512.2 feet

DATE: 1-4-90 TYPE: Nx-Core CASED TO: 33.0' (1) CONTRACTOR: MJA

SAMPLE LEGEND	WATER INFORMATION
S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	Wet Rotary Core Hole Water level not determinable Observation well installed for monitoring of water level Slight water loss observed in upper section of boring

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
		C6		83.0			Stopped Drilling 1-4-90		SHALE (Taylor Marl), fresh, soft, very thinly bedded, very fine grained, dk. gray, calcareous, occasional fossils, very homogeneous
		C7	83.0	93.0	98	98	Started Drilling 1-5-90		
85, 90									
		C8	93.0	103.0	100	100			
95, 100									
		C9	103.0	112.0	100	100			112.4s-112.6s Very thin, v. fossiliferous, transition bed 112.5s
105, 110									
		C10	112.0	122.0	100	100			LIMESTONE (Austin Chalk), fresh, med. to mod. hard, sli. fossiliferous, lt. gray with 0.2 to 0.35 ft. thick sli. argill. to shaly interbeds 113.85g-114.2g Thin, v. argill./shaly, soft, med. gray bed 119.4g-119.6g Very thin, sli. argill., med. gray bed
115, 120									
			122.0						

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Mark Thomas CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 8 PG 4 OF 6

LOCATION: N 204,307 feet
E 2,215,118 feet

GROUND EL: 512.2 feet

DATE: 1-5-90 TYPE: Nx-Core CASED TO: 33.0' CONTRACTOR: MJA

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
		C10		122.0					LIMESTONE (Austin Chalk), fresh, med. to mod. hard, sli. fossiliferous, lt. gray with 0.1 to 2.05 ft. thick sli. argill. to shaly interbeds 0.7 to 9.35 ft. apart
125		C11	122.0	132.0	100	100			123.2g-124.3s Med., v. argill./shaly, soft, med. gray bed 127.8g-128.7g Thin, sli. argill., med. gray bed
130									
135		C12	132.0	142.0	100	100			133.5g-135.55g Med., sli. argill., med. gray bed 140.0g-140.35g Thin, v. argill./shaly, soft, med. gray bed
140									
145		C13	142.0	152.0	99	99			142.0g-142.3g Thin, v. argill./shaly, soft, med. gray bed 143.0g-143.5g Thin, mod. argill., med. gray bed 152.85s-152.95s Very thin, sli. argill., med. gray bed
150									
155		C14	152.0	162.0	100	100			
160									

SAMPLE LEGEND

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

WATER INFORMATION

Wet Rotary Core Hole
Water level not determinable
Observation well installed for monitoring of water level
Slight water loss observed in upper section of boring

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Mark Thomas CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 8 PG 5 OF 6

LOCATION: N 204,307 feet
E 2,215,118 feet

GROUND EL: 512.2 feet

DATE: 1-5-90 TYPE: Nx-Core CASED TO: 33.0' CONTRACTOR: MJA

SAMPLE LEGEND	WATER INFORMATION
S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	Wet Rotary Core Hole Water level not determinable Observation well installed for monitoring of water level Slight water loss observed in upper section of boring

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
		C14		162.0					LIMESTONE (Austin Chalk), fresh, med. to mod. hd., sli. fossiliferous, lt. gray with 0.2 to 9.2 ft. sli. argill. to shaly interbeds 0.7 to 9.35 ft. apart
165		C15	162.0	172.0	100	100			166.75g-167.45s Thin, v. argill./shaly, soft, med. gray bed 169.5 55° fracture, slickensided, v. rough, planar, ~3/8" calcite filling, fresh surface 170.6s-170.8g Very thin, v. argill., med. hd., med. gray bed 171.6 ~55° fracture, slickensided, rough, planar, closed, fresh
170									
175		C16	172.0	182.0	100	84	Stopped Drilling 1-5-90		173.2-173.7 55° fracture, slickensided, v. rough, planar, up to 1" calcite filling, fresh surface 174.9 50° fracture, slks., rough, sli. undulatory, closed, fresh 175.9 53° fracture, slks., v. rough, planar, closed, fresh surface 176.2 40° fracture, slks., sli. rough, undulatory, closed, fresh 176.35s-176.55s Very thin, shaly, soft, med. gray bed 176.8-177.4 70° fracture, slks., sli. rough, planar, closed, fresh
180									
185		C17	182.0	192.0	100	100	Started Drilling 1-6-90		177.8-178.0 45° fracture, slks., sli. rough, planar, closed, fresh 188.5g-189.0g Thin, sli. argill., med. gray bed 190.4g-190.7g Thin, v. argill./shaly, soft, med. gray bed
190									
195		C18	192.0	202.0	99	99			192.6s-194.2g Med., v. argill./shaly, soft, med. gray bed 195.5g-195.9g Thin, v. argill., med. hard, med. gray bed 197.0g-197.6g Thin, v. argill./shaly, med. hard, med. gray bed 197.6g-206.2g Thick, mod. argill., med. gray bed
200									

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Mark Thomas CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 8 PG 6 OF 6

LOCATION: N 204,307 feet
E 2,215,118 feet

GROUND EL: 512.2 feet

DATE: 1-6-90 TYPE: Nx-Core CASED TO: 33.0' CONTRACTOR: MJA

SAMPLE LEGEND	WATER INFORMATION
S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	Wet Rotary Core Hole Water level not determinable Observation well installed for monitoring of water level Slight water loss observed in upper section of boring

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
		C18		202.0					LIMESTONE (Austin Chalk), fresh, med. hard, sli. to mod. argill., med. gray with fossiliferous to very fossiliferous (Inoceramus) interbeds 19.6 ft. thick and a 0.55 ft. thick thin shaly interbed
205		C19	202.0	212.0	99	99			206.2g-206.75s Thin, shaly, v. soft, med. to dk. gray bed 209.5g- 213.85s Thick, v. argill., v. fossil. (Inoceramus prisms), med. gray bed
210									
215		C20	212.0	222.0	100	100			213.85s-229.1g Very thick, mod. to v. argill., fossil., (Inoceramus prisms), med. gray bed
220									
225		C21	222.0	232.0	100	100			
230									
235									Total Depth: 232.0' 1-6-90 (1) Drill casing extended from 4.0' to 33.0' 1-4-90 (2) Wireline Logged 1-6-90 (3) Hydrotested 1-8-90 (4) Borehole reamed to 6 3/4" down to 213.0' 1-8-90 to 1-10-90 (5) Well construction completed 1-10-90
240									

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Mark Thomas CHECKED BY W. D. Flanigan

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BF 8 **Log Measured From:** Ground Level

Drilling Parameters

Depth 232.0 feet

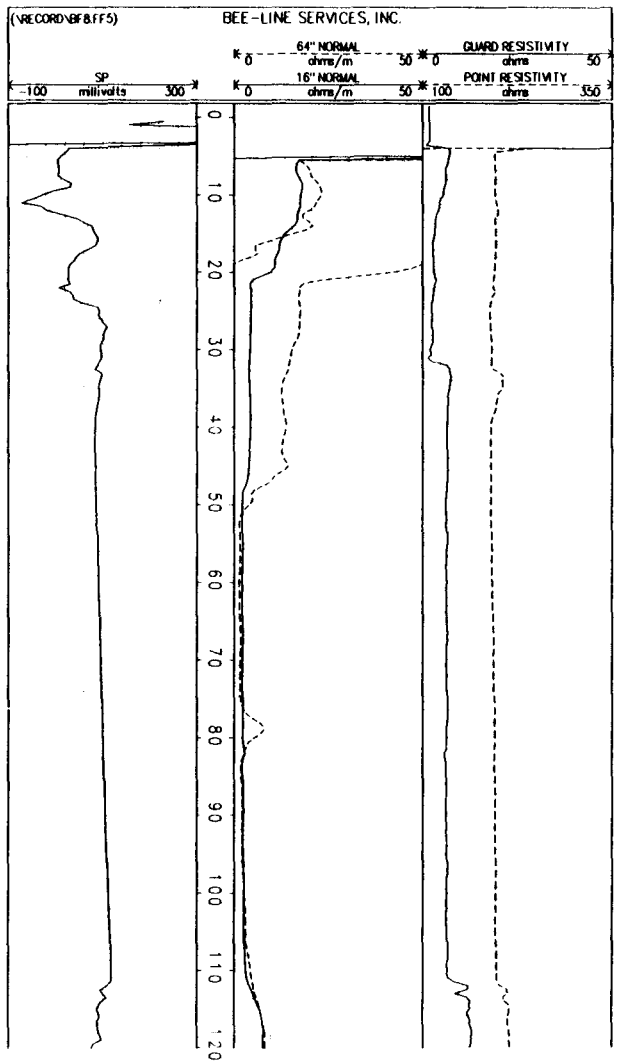
Bit Diameter 3.125 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	January 6, 1990	January 6, 1990	January 6, 1990
Bottom Log Interval	231.5 feet	231.5 feet	226.2 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	30 min.	30 min.	30 min.
Probe Type/S.N.	ALP-4979	9035AA	CLP-4877A
Module Type/S.N.	ALM-4979	COMPULOG II	CLM-4877A
Logging Speed	40 feet/min.	35 feet/min.	20 feet/min.
Sample Interval	0.5 foot	0.5 foot	0.5 foot

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

BF 8 Wire-line logs run January 6, 1990. Surface elevation 512.2 feet.

ELECTRICAL LOG



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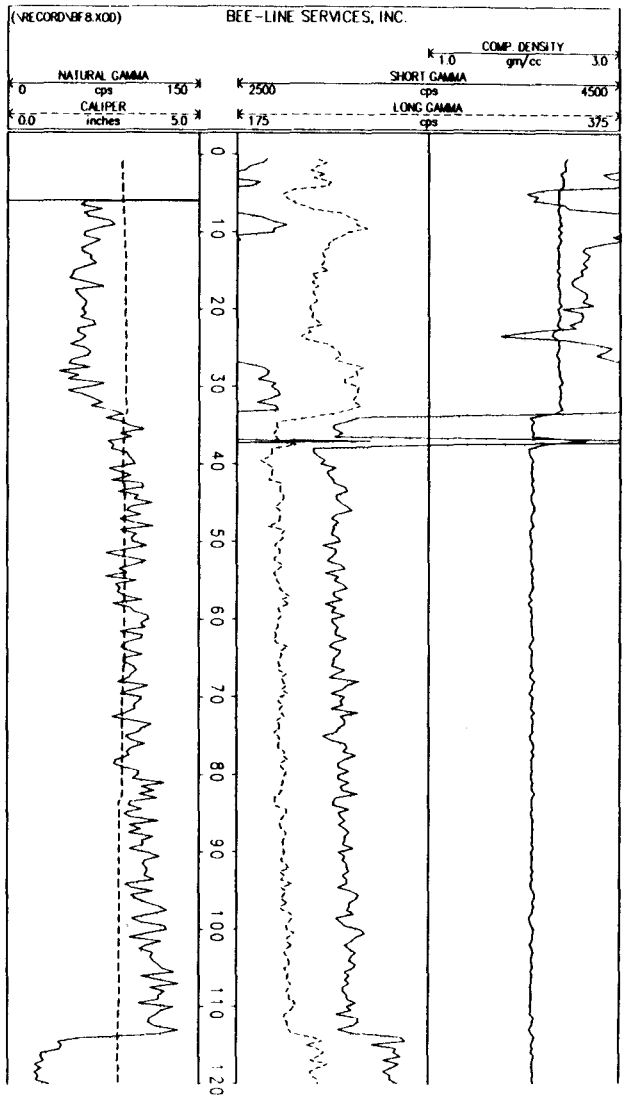

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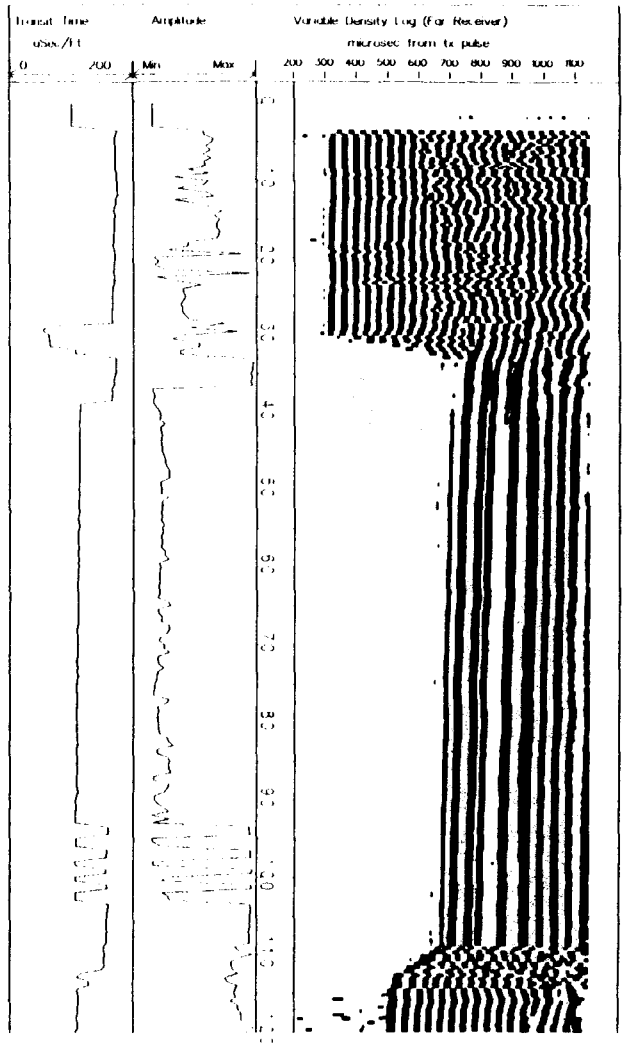
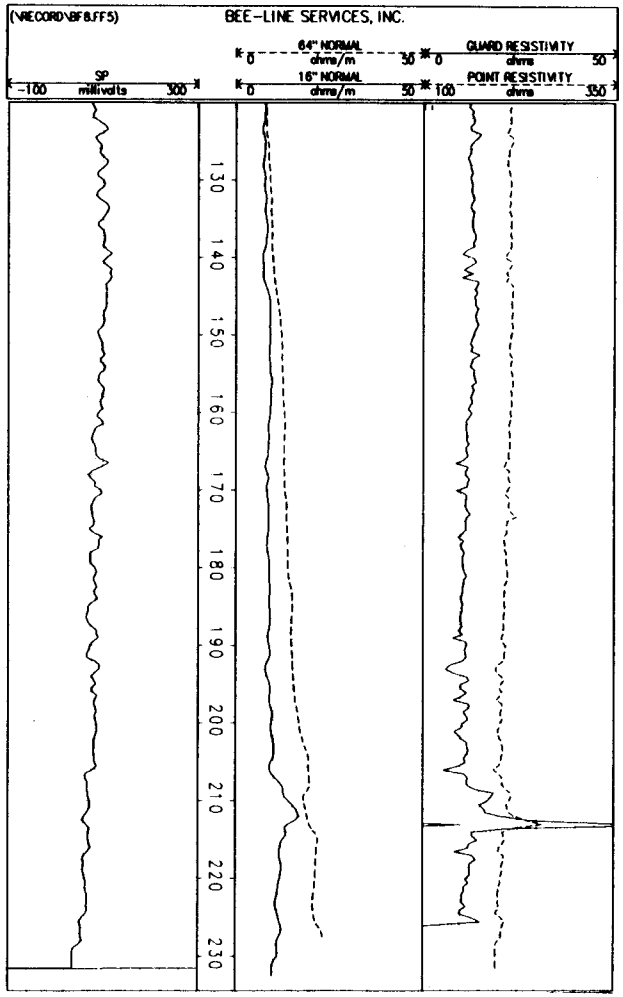


BF 8 Wire-line logs run January 6, 1990 (Continued). Surface elevation 512.2 feet.

ELECTRICAL LOG CONTINUED



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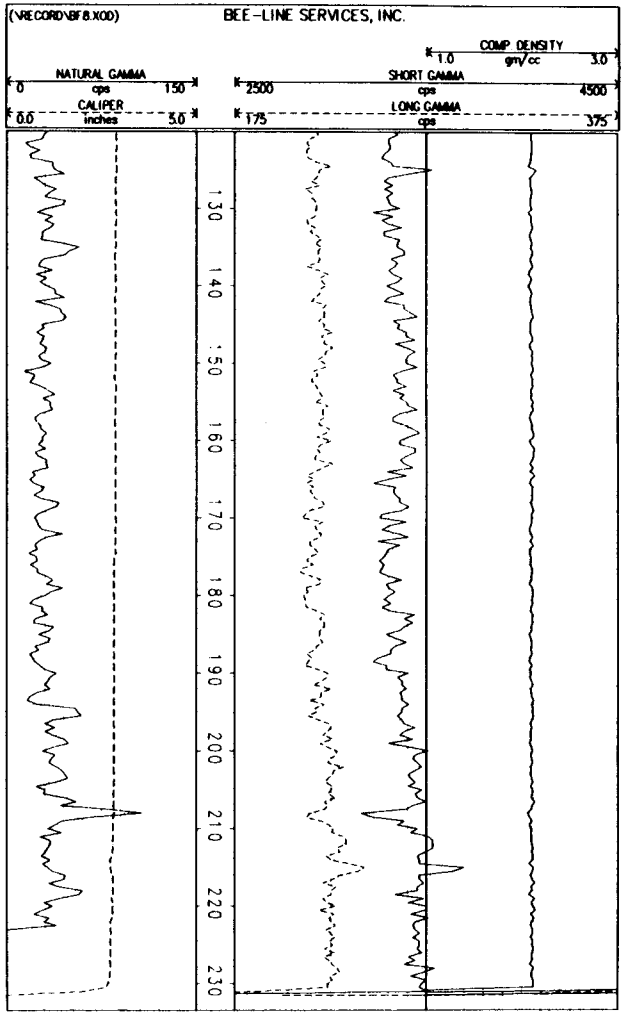
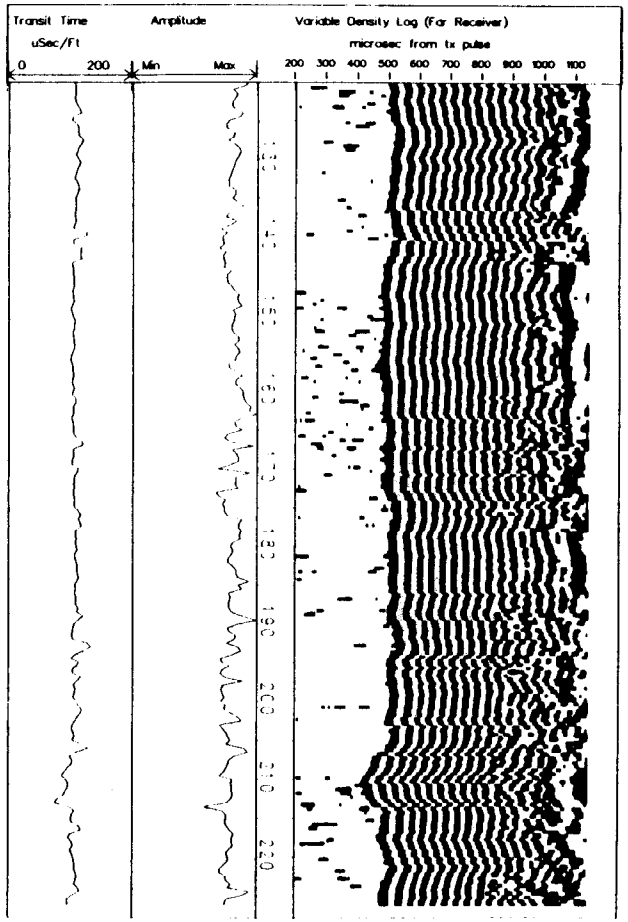


SONIC LOG CONTINUED



APPENDIX C

HYDROLOGIC TEST RESULTS

APPENDIX C

The overall objectives of the hydrologic (packer) tests were to provide estimates of the hydraulic conductivity within the Taylor Marl, Austin Chalk, and Eagle Ford Shale formations in unfractured zones, fractured or other suspected water-bearing zones, at the formation contacts, and at the tunnel elevation. Intervals within boreholes were selected for packer testing based on visual inspections of rock cores and the results of borehole geophysical testing. Sections of a borehole that exhibited increased frequency of fractures or bedding plane parting were commonly packer tested.

Standard procedures used to conduct these tests included lowering a pair of pneumatically operated rubber packers (in straddle-packer configuration) separated by a known length of perforated pipe into the drill hole to a predetermined depth. The packer interval was approximately 20 feet. The packers were then inflated to a precalculated pressure to seal against the rock side walls and water was pumped into the test interval at a selected pressure while the flow rate was measured with a cumulative flow meter. To improve the accuracy of measurements at low flow rates, water was pumped from a large container (e.g., a drum or section of casing) and the volume removed was recorded. In addition to monitoring the water pressure and flow rate at appropriate intervals, the height of the water pressure gauge above ground surface, as well as the diameter and length of water pipe used, was recorded. The tests were continued until five consecutive readings indicated a stabilization of the flow rate but for a minimum of at least 10 minutes. Standard forms were used for data records and the hydraulic conductivity was calculated using standard Bureau of Reclamation procedures.

STRADDLE PACKER TEST RESULTS

Test Depth (feet)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/ Lithology	Hydraulic Conductivity (cm/sec)	Estimated Depth to Static Water Level*
82.3-103.4	125	20	Taylor Marl	3.9×10^{-6}	25.4
162.3-183.4	150	30	Austin Chalk (fractured)	2.7×10^{-6}	25.4

Two test intervals were selected at boring BF 8 based on evaluation of the core and a review of the lithologic and wire-line logs. The upper test interval was selected to provide hydrologic data for unfractured Taylor Marl. The lower test interval straddled an area of fractured Austin Chalk. These hydrologic (packer) tests followed the general procedures outlined above. Packer and gauge pressures used during the testing along with the calculated hydraulic conductivities are listed in the table above.

* The hydraulic conductivity values presented are based on an estimated static water level 25.4 feet below ground surface. When last measured, the water level was 97.2 feet below ground surface. Hydraulic conductivity values would be lower for a static water level less than the estimated value.

APPENDIX D

LABORATORY RESULTS

GEOMECHANICAL TEST RESULTS – BORING BF 8

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
TAYLOR MARL	36.9	23.1	102.5	2.70	64	35	98.6	23.4															
TAYLOR MARL	37.3	22.7	102.9						2.2	D	191			1.48	0.16		0						NOTE 1
TAYLOR MARL	53.4	20.4	108.6																				
TAYLOR MARL	53.7	19.9	103.3																			12.7	
TAYLOR MARL	53.9	20.7	107.2																			11.7	
TAYLOR MARL	54.1				74	44	98.4																
TAYLOR MARL	55.3	19.2																					
TAYLOR MARL	55.4	19.7	109.2						2.5	B-1/10	356			1.44	0.28		0						
TAYLOR MARL	56.2	18.7			84	54	95.7													58.9			
TAYLOR MARL	57.0			2.70				23.9															
TAYLOR MARL	79.1	19.4	109.9		71	41		23.3															
TAYLOR MARL	79.5	19.4	109.4						2.3	D	444			1.31	0.49		0						
TAYLOR MARL	79.9	19.3	109.8	2.70	67	37	98.6	19.6	2.3	B-1/15		50	439	1.23	0.66		50						
TAYLOR MARL	79.9														0.86			0.44					NOTE 2
TAYLOR MARL	80.3	19.8	108.8						2.3	B-1/20		100	452	1.24	0.60		100						
TAYLOR MARL	80.3														0.74			0.33					NOTE 2
TAYLOR MARL	107.5	17.7																					
TAYLOR MARL	107.6	17.6	114.1						2.3	D	452			1.48	0.38		0						
TAYLOR MARL	108.0	17.2			90	56	99.2													45.8			
TAYLOR MARL	108.4							19.6															
AUSTIN CHALK	120.8	14.9	122.9																				
AUSTIN CHALK	121.2	14.0	121.5						2.4	D	2311			0.50	5.88		0						
AUSTIN CHALK	135.6	13.1	122.5																				
AUSTIN CHALK	136.0								0.6										297				
AUSTIN CHALK	138.5	11.2	128.4																				
AUSTIN CHALK	138.9	12.4	125.4						2.3	D	2893			0.43	11.63		0						
AUSTIN CHALK	139.3	12.1	125.5						2.3	D & E		100	3051	0.65	5.33		100						
AUSTIN CHALK	139.3														7.00			0.48					NOTE 2
AUSTIN CHALK	139.7	10.8	129.9	2.66					2.3	B-4		200	1815	0.93	1.94		200						
AUSTIN CHALK	139.7														2.37			0.07					NOTE 2
AUSTIN CHALK	158.2	10.8	130.6																				
AUSTIN CHALK	158.6	11.5	127.7						2.3	D	1939			0.46	5.71		0						
AUSTIN CHALK	163.5	12.5	124.8	2.66																			
AUSTIN CHALK	163.9	10.5	127.0						2.4	B-1/30	2914			0.45									
AUSTIN CHALK	193.0	12.3	127.9																				
AUSTIN CHALK	193.4	14.6	120.1						2.4	D	313			1.06	0.48		0						SHALY
AUSTIN CHALK	210.2	7.5	138.7																				
AUSTIN CHALK	210.6	7.4	140.4						2.3	D	2037			0.49	5.00		0						
AUSTIN CHALK	224.1	8.3	135.8																				
AUSTIN CHALK	224.5								0.5										165				
AUSTIN CHALK	227.5	9.4	134.3																				
AUSTIN CHALK	227.9	7.7	138.2						2.3	D	2271			0.64	4.65		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ASTM-D3967	ISRM	ISRM	ISRM	

BF8PRT21.WK1
REVISION: 2.1
DATE: 06/05/90

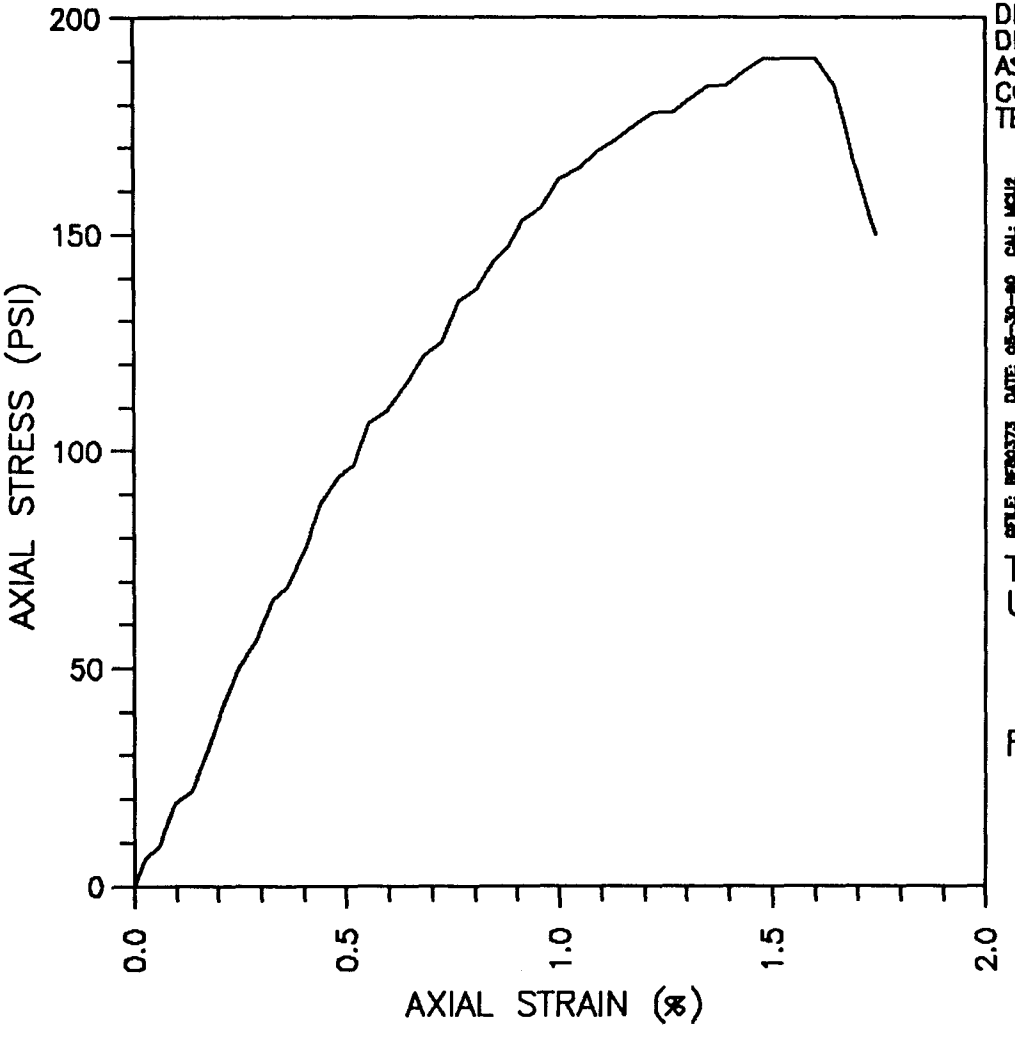
* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

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

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

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

BORING NO.: BF8
DEPTH (FT): 37.3
TAYLOR MARL



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 22.7
DRY UNIT WEIGHT (PCF): 102.9
DEG. OF SATURATION (%): 96.2
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: BF80373 DATE: 05-30-90 CAL: MCU2

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.163 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

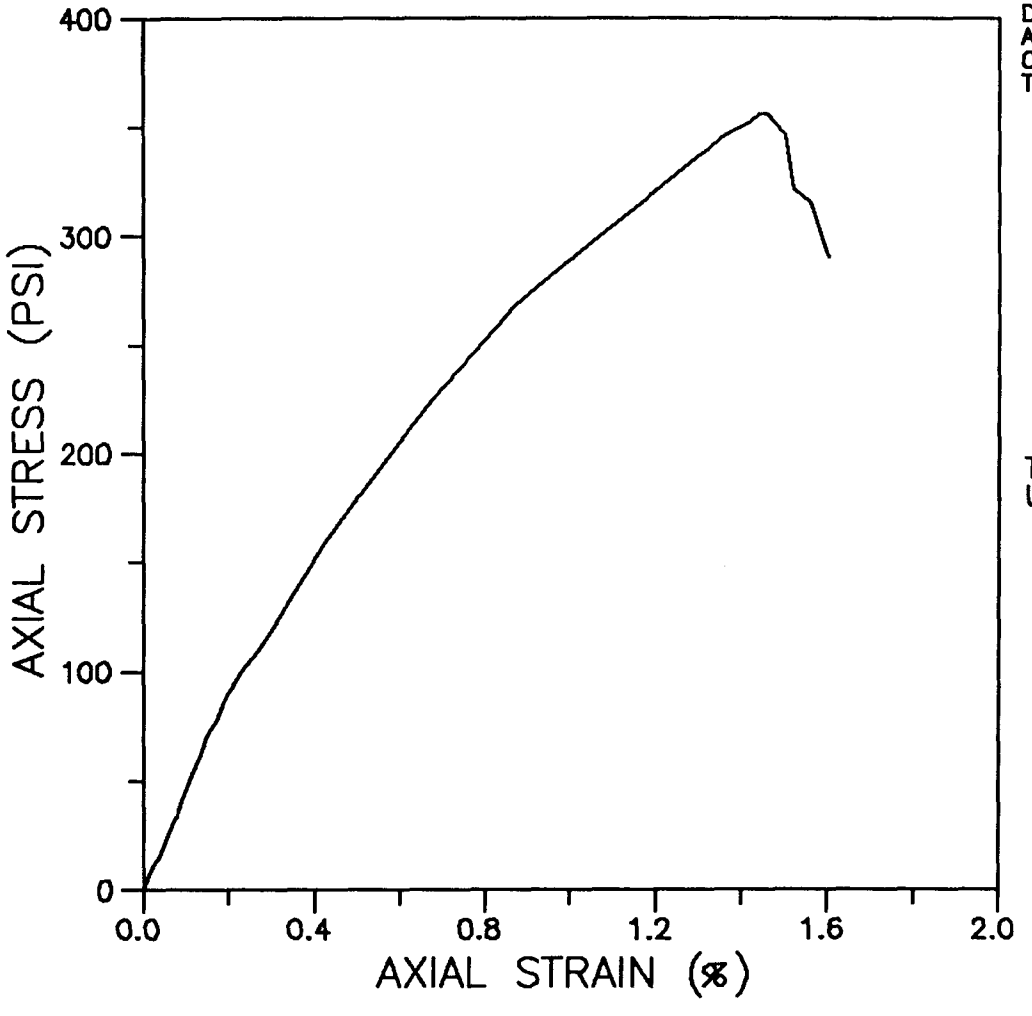
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO: BF8
DEPTH (FT): 55.4
TAYLOR MARL



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 19.7
DRY UNIT WEIGHT (PCF): 109.2
DEG. OF SATURATION (%): 98.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
2.77 x 10E4 PSI

FAILURE MODE:
SHEAR PLANE AT 10 DEG.

TEXAS SSC SITE

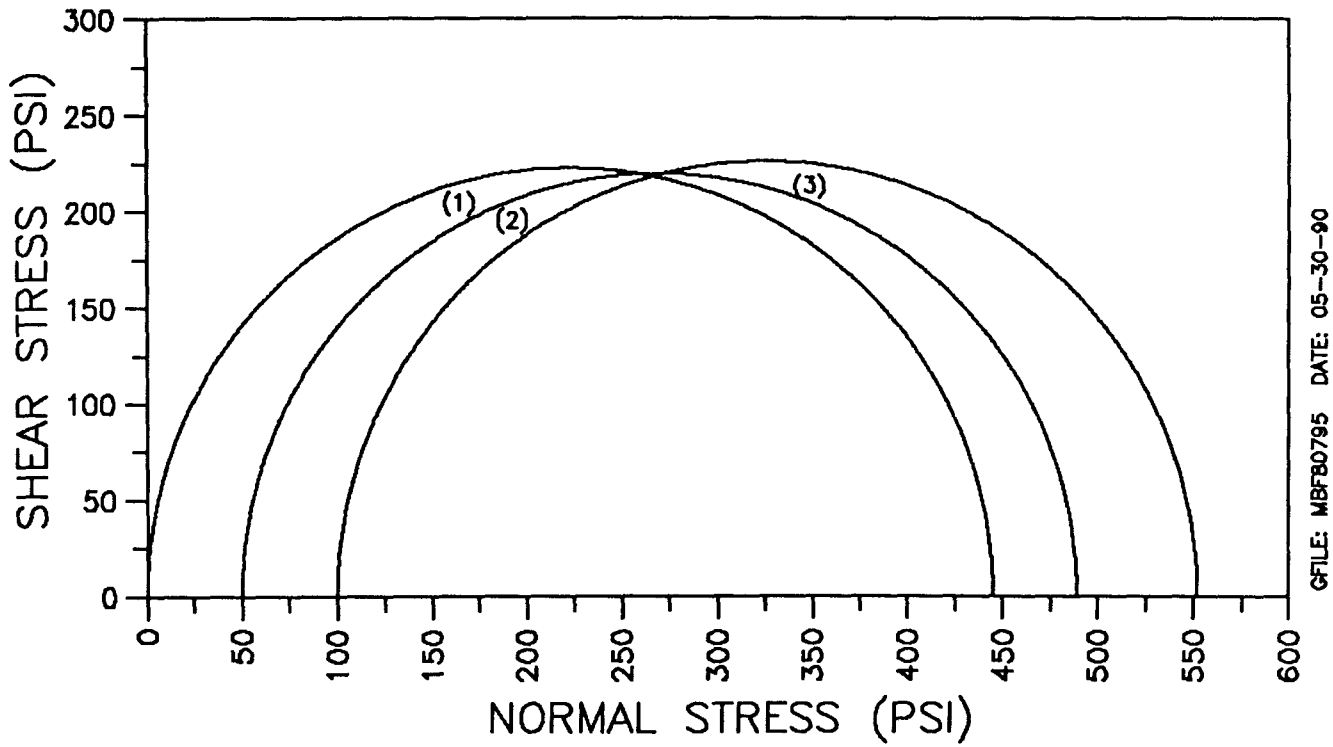
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BF8
DEPTH RANGE (FT): 79.5–80.7
TAYLOR MARL



GFILE: MBF80795 DATE: 05-30-90

SEE STRESS-STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 79.5
(2) DEPTH (FT): 79.9
(3) DEPTH (FT): 80.3

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

TEXAS SSC SITE

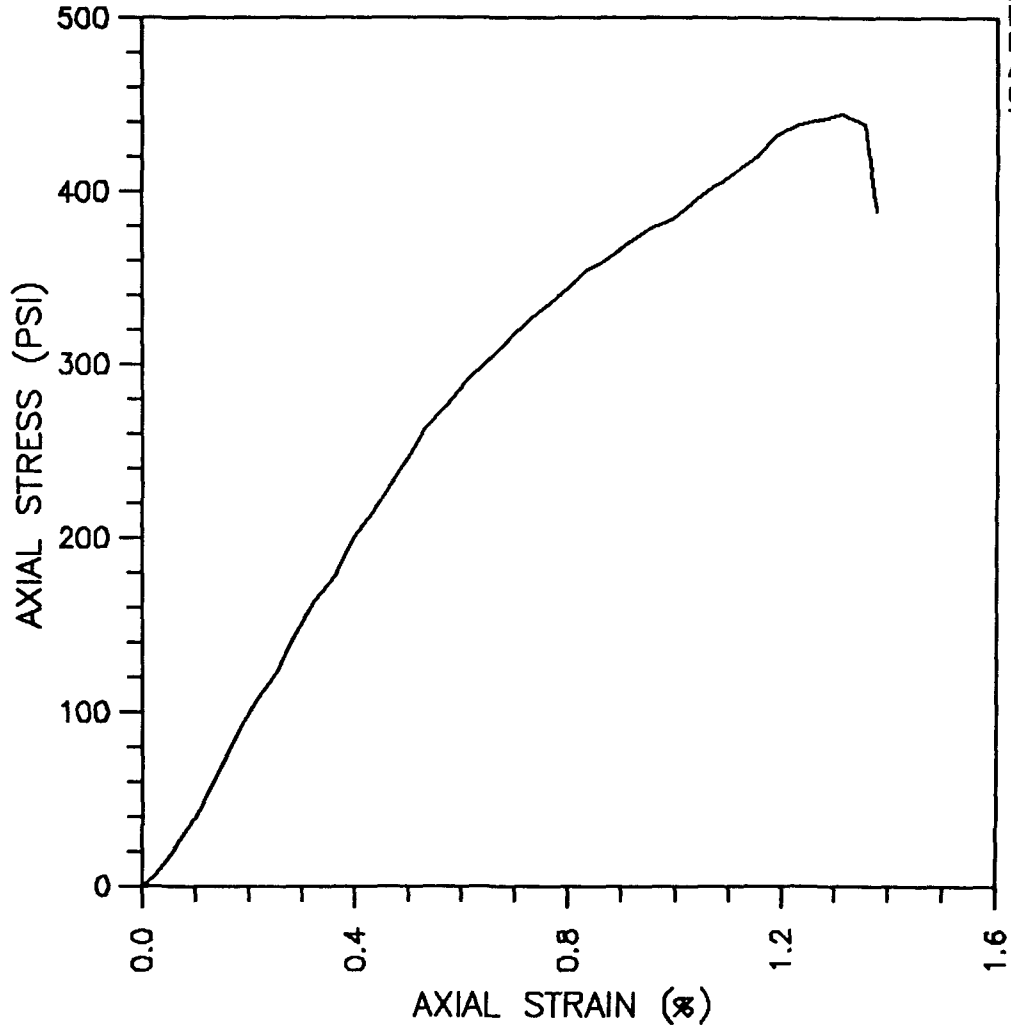
MOHR CIRCLE PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 79.5
TAYLOR MARL



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 19.4
DRY UNIT WEIGHT (PCF): 109.4
DEG. OF SATURATION (%): 97.3
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: BF80795 DATE: 05-30-90 CAL: MCU2

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.493 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

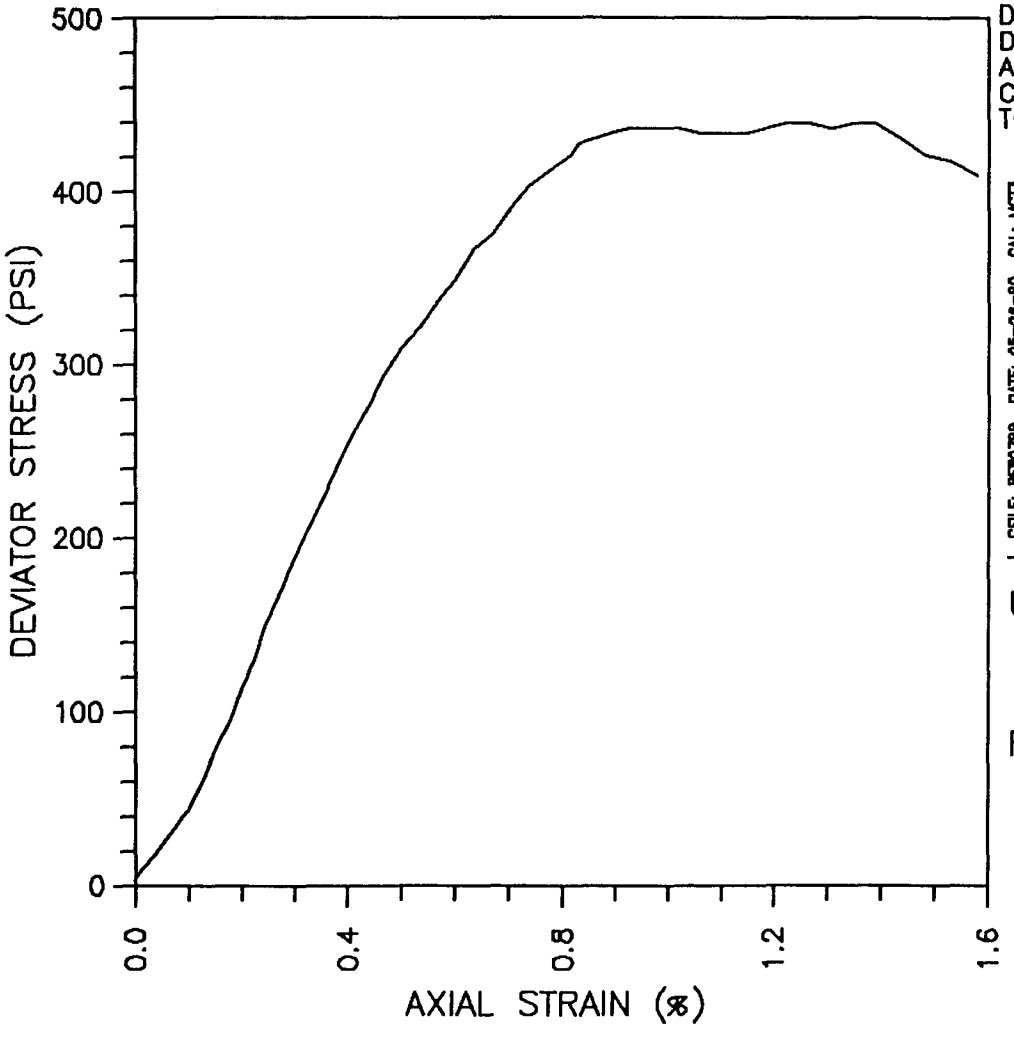
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 79.9
TAYLOR MARL



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 19.3
DRY UNIT WEIGHT (PCF): 109.8
DEG. OF SATURATION (%): 97.5
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 50
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

GFILE: BF86799 DATE: 05-28-90 CAL: MCTS

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.656 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 15 DEG.

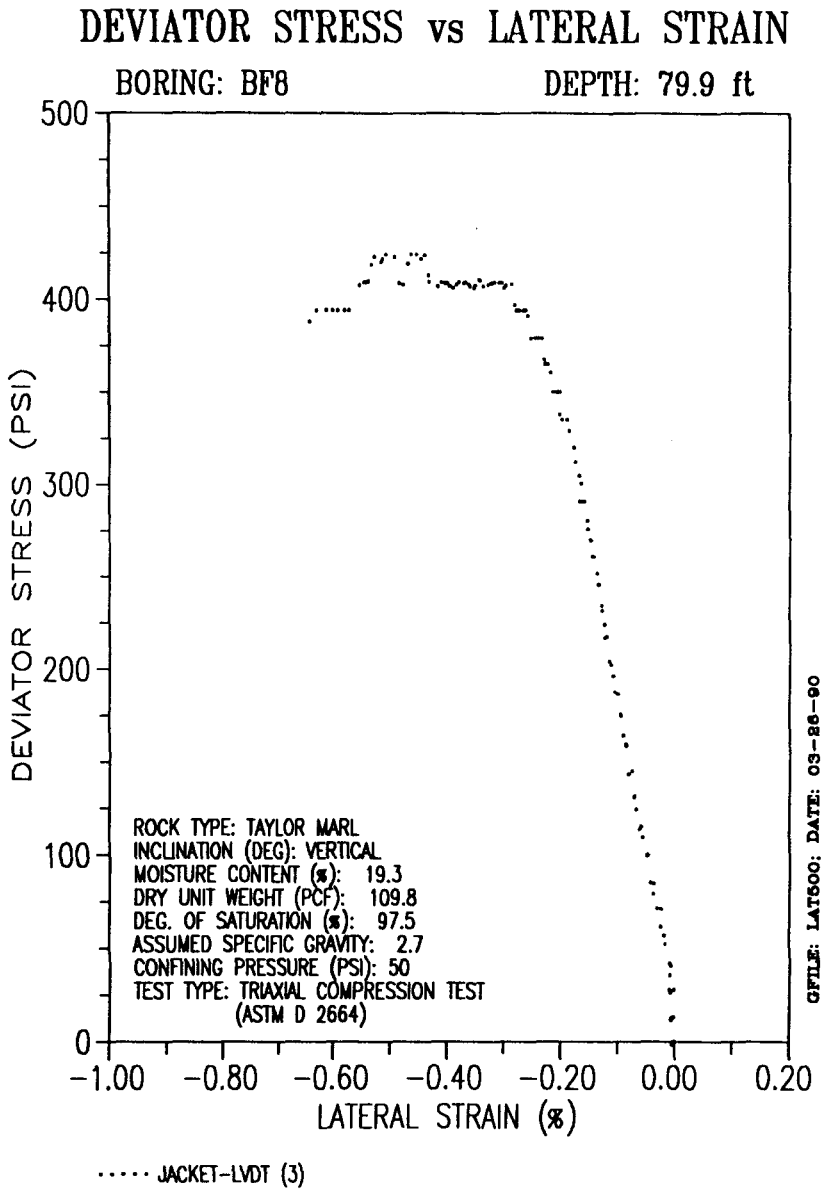
TEXAS SSC SITE

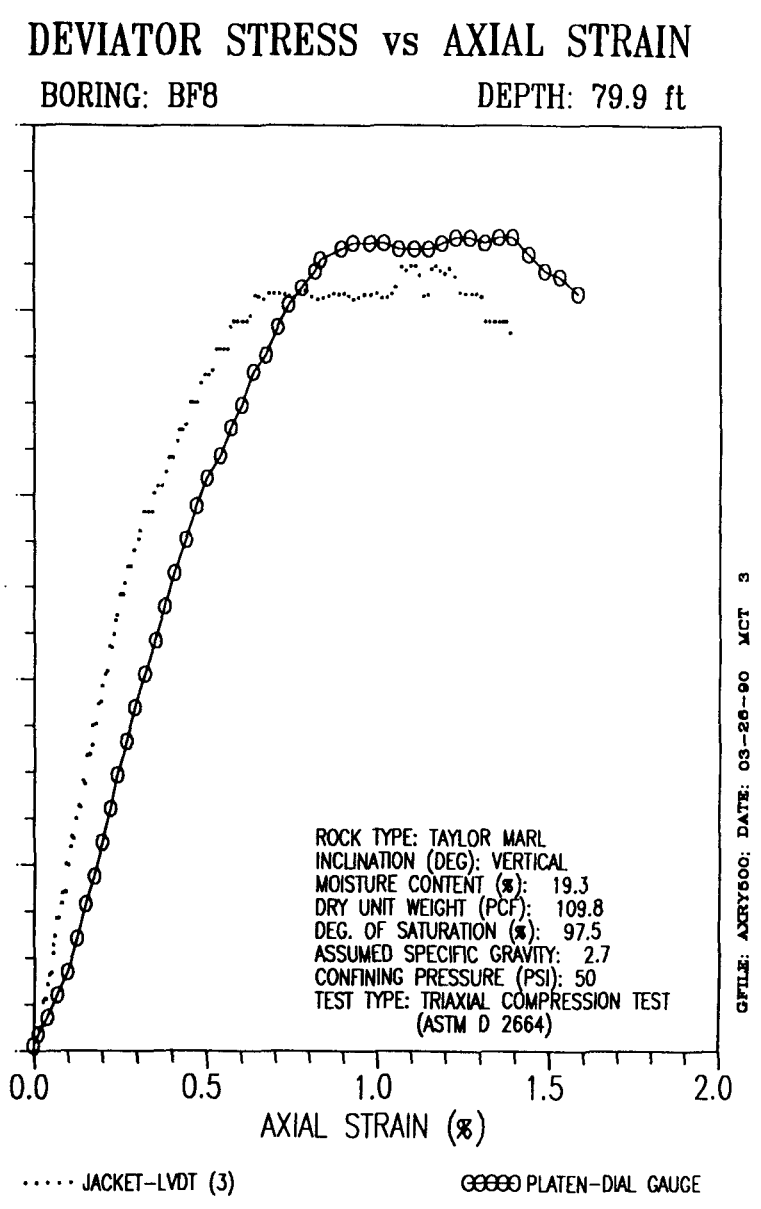
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

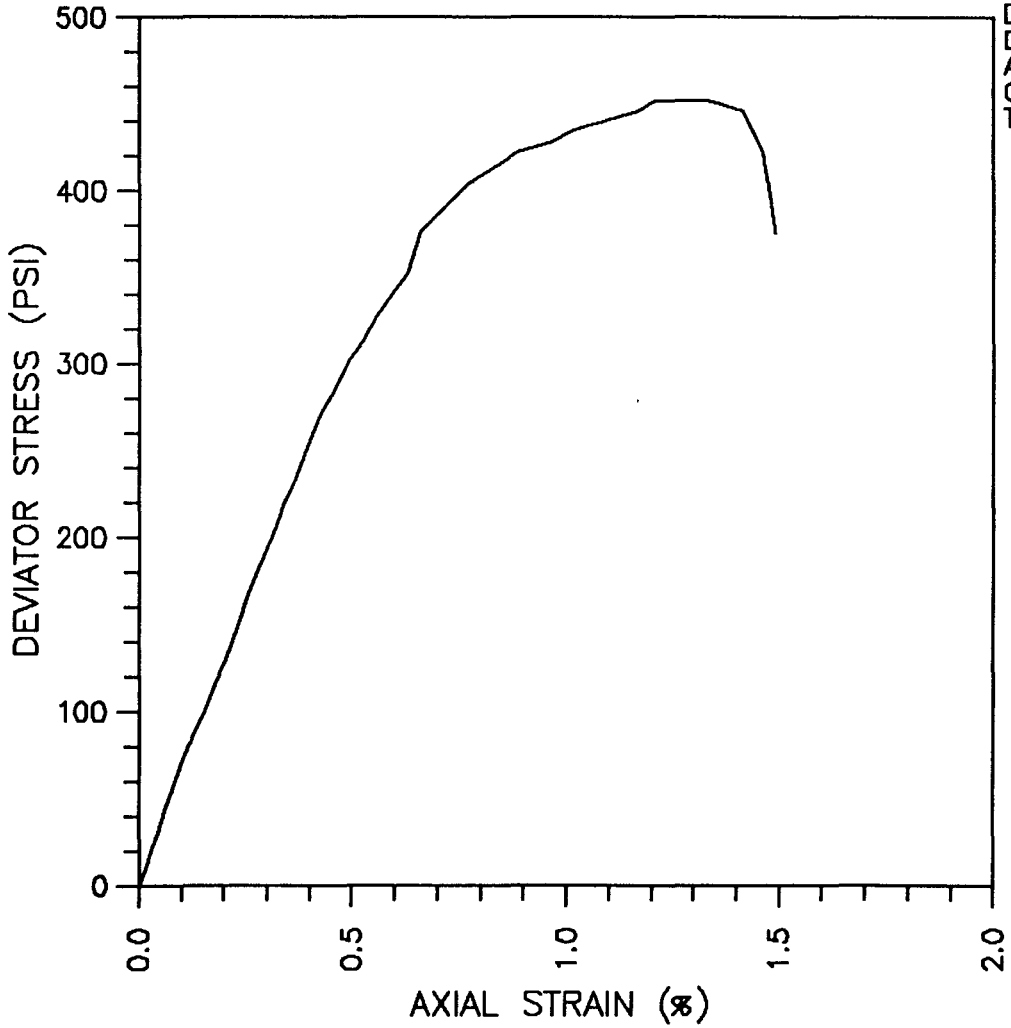
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BF8
DEPTH: 79.9 ft
DEVIATOR STRESS (PSI)
500
400
300
200
100
0
-1.00
-0.80
-0.60
-0.40
-0.20
0.00
0.20
LATERAL STRAIN (%)
ROCK TYPE: TAYLOR MARL
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 19.3
DRY UNIT WEIGHT (PCF): 109.8
DEG. OF SATURATION (%): 97.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 50
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT500; DATE: 03-26-90
JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BF8
DEPTH: 79.9 ft
0.0
0.5
1.0
1.5
2.0
AXIAL STRAIN (%)
ROCK TYPE: TAYLOR MARL
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 19.3
DRY UNIT WEIGHT (PCF): 109.8
DEG. OF SATURATION (%): 97.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 50
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY500; DATE: 03-26-90 MCT 3
JACKET-LVDT (3)
PLATEN-DIAL GAUGE

BORING NO.: BF8
DEPTH (FT): 80.3
TAYLOR MARL



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 19.8
DRY UNIT WEIGHT (PCF): 108.8
DEG. OF SATURATION (%): 97.6
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

GFILE: BF80803 DATE: 05-28-90 CAL: MCT3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.597 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 20 DEG.

TEXAS SSC SITE

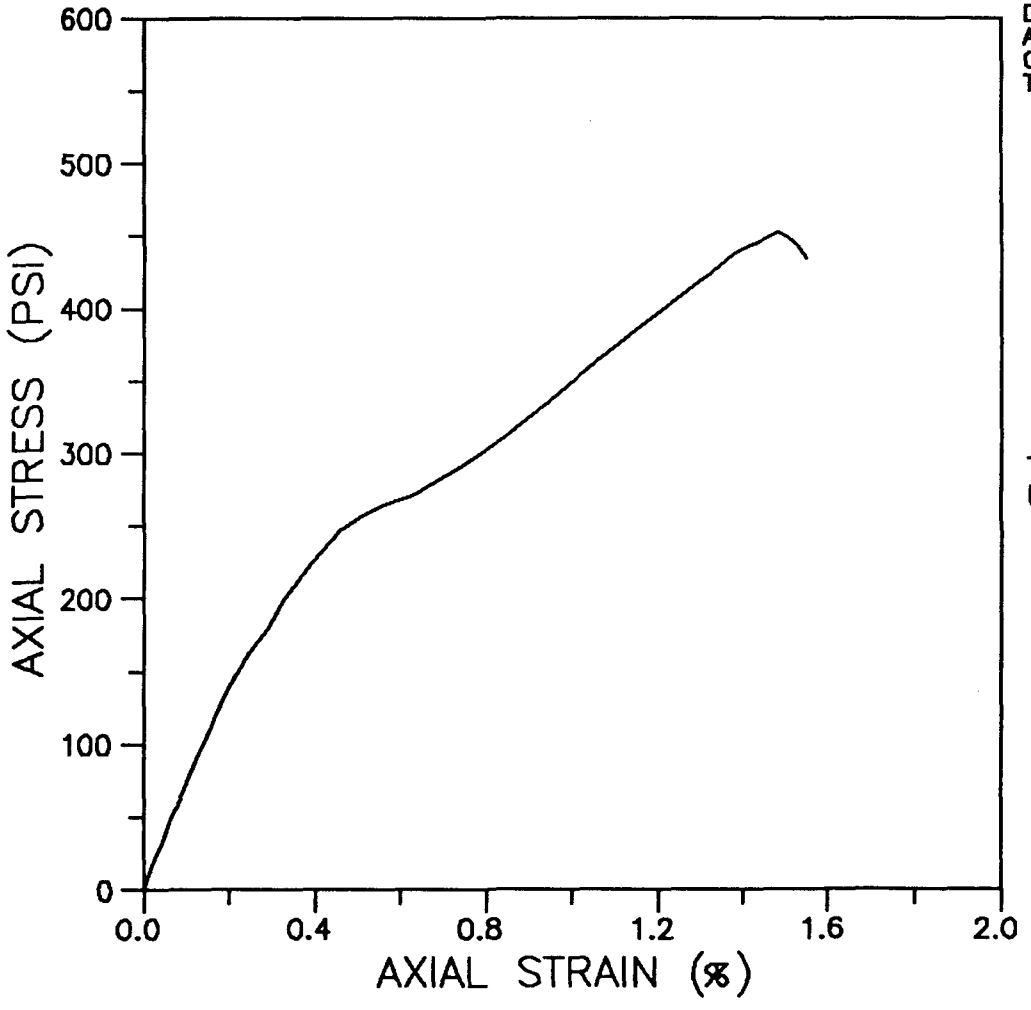
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO: BF8
DEPTH (FT): 107.6
TAYLOR MARL



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 17.6
DRY UNIT WEIGHT (PCF): 114.1
DEG. OF SATURATION (%): 99.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.77 x 10E4 PSI

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

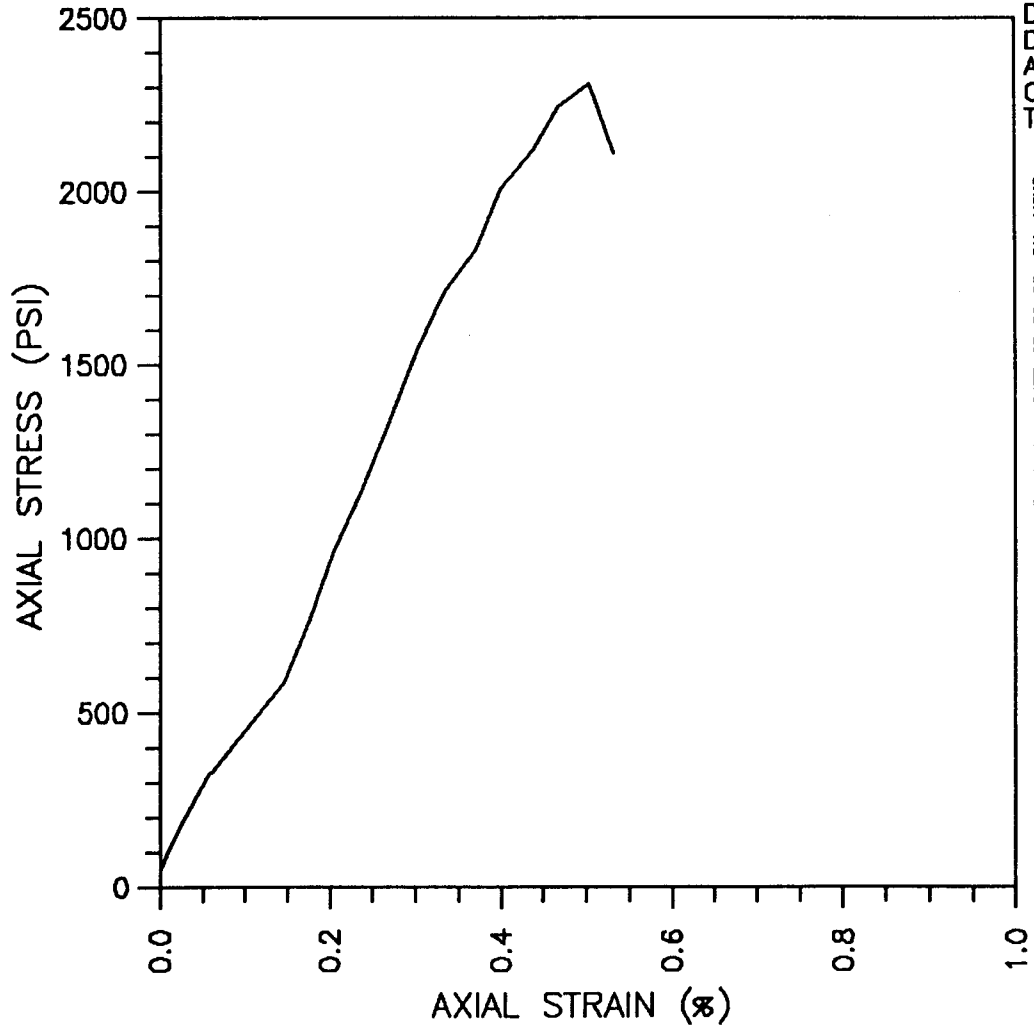
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BF8
DEPTH (FT): 121.2
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.0
DRY UNIT WEIGHT (PCF): 121.5
DEG. OF SATURATION (%): 97.7
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: BF81212 DATE: 05-28-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.882 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

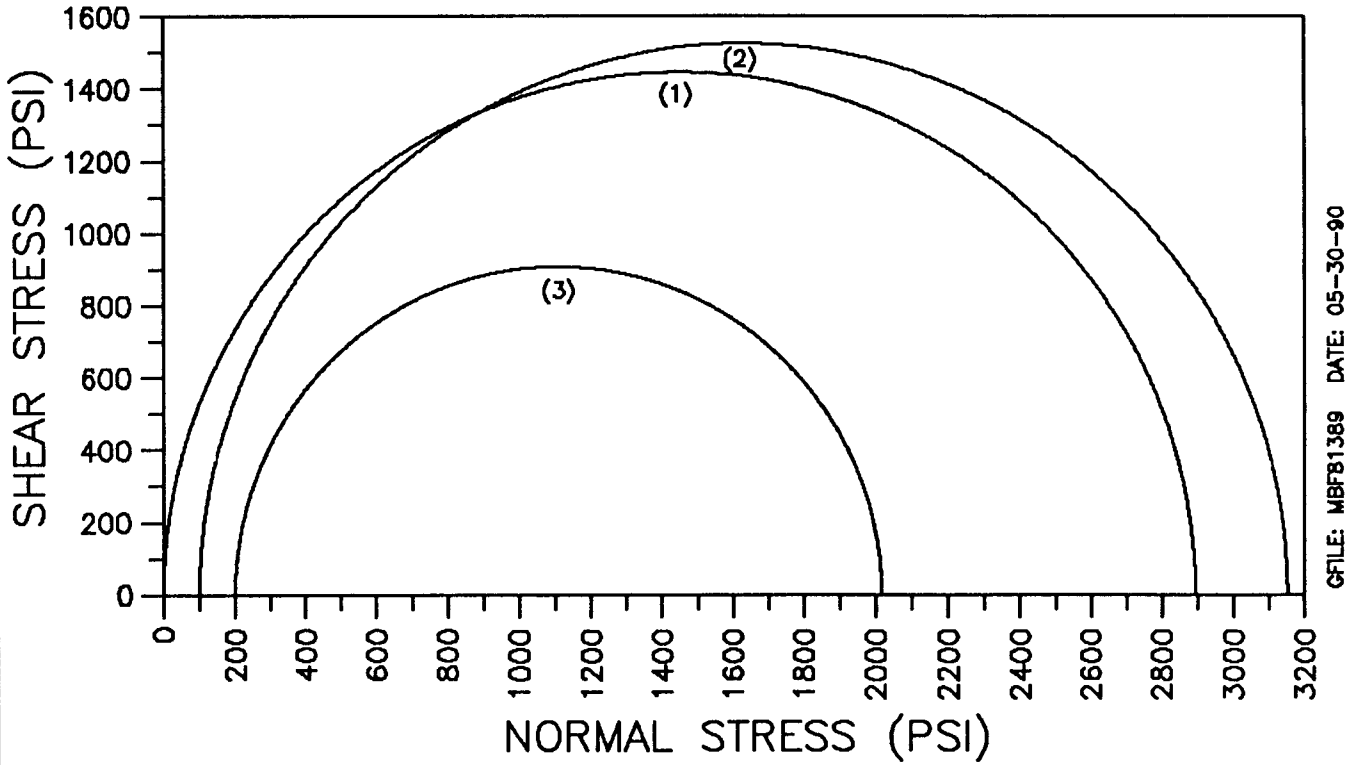
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH RANGE (FT): 138.9–140.1
AUSTIN CHALK LIMESTONE



GFILE: MBFB1389 DATE: 05-30-90

SEE STRESS–STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 138.9
(2) DEPTH (FT): 139.3
(3) DEPTH (FT): 139.7

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

TEXAS SSC SITE

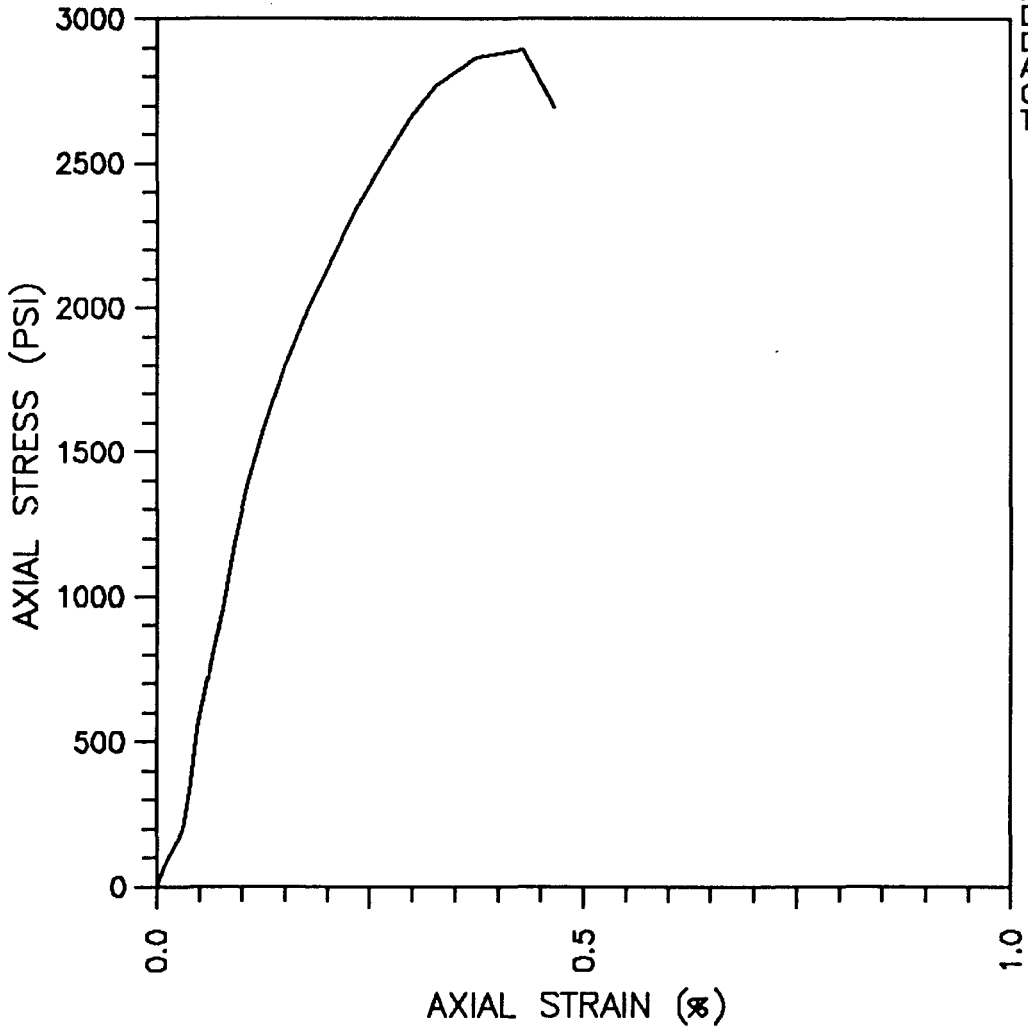
MOHR CIRCLE PLOT

MASON–JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS–ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 138.9
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.4
DRY UNIT WEIGHT (PCF): 125.4
DEG. OF SATURATION (%): 97.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: BF81389 DATE: 05-30-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
11.628 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

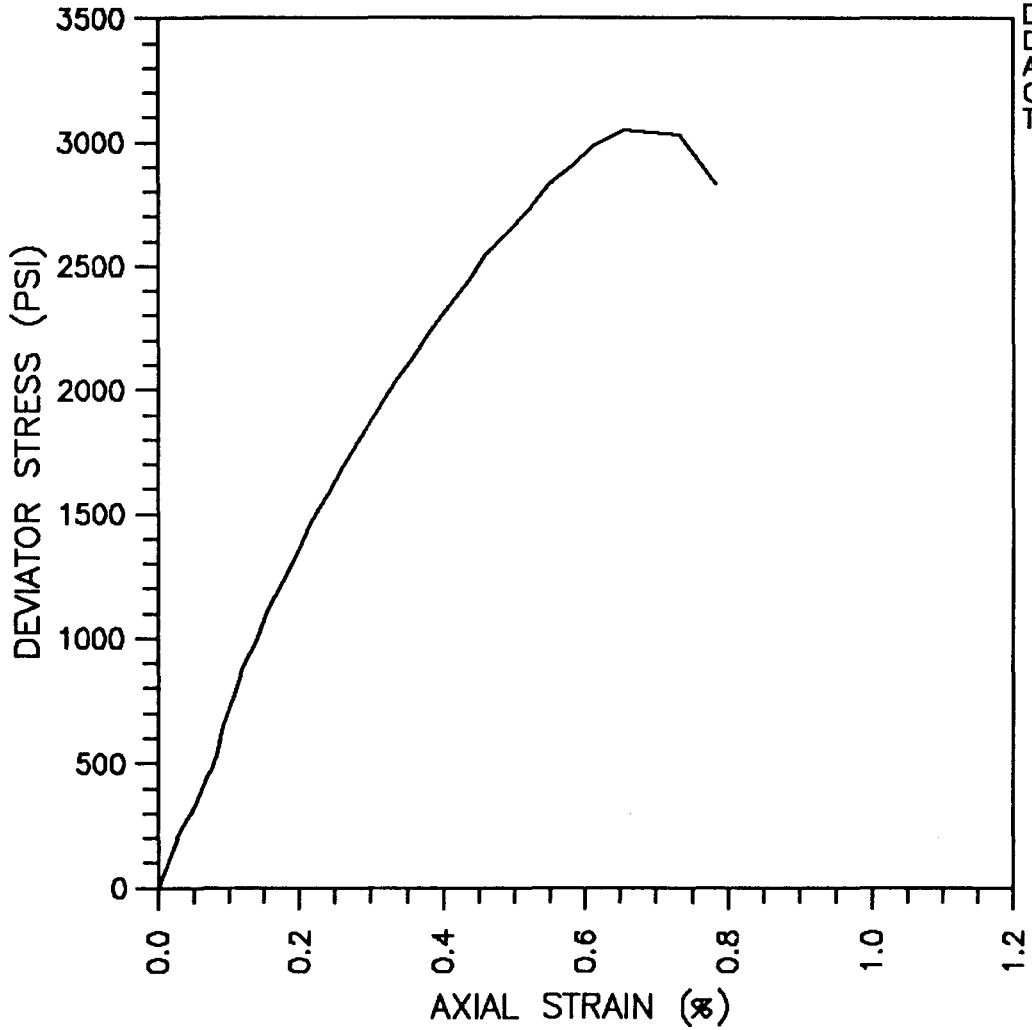
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 139.3
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.1
DRY UNIT WEIGHT (PCF): 125.5
DEG. OF SATURATION (%): 95.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

FILE: BF81303 DATE: 05-30-90 CAL: MCT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.333 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING W/
CONICAL AT BOTTOM

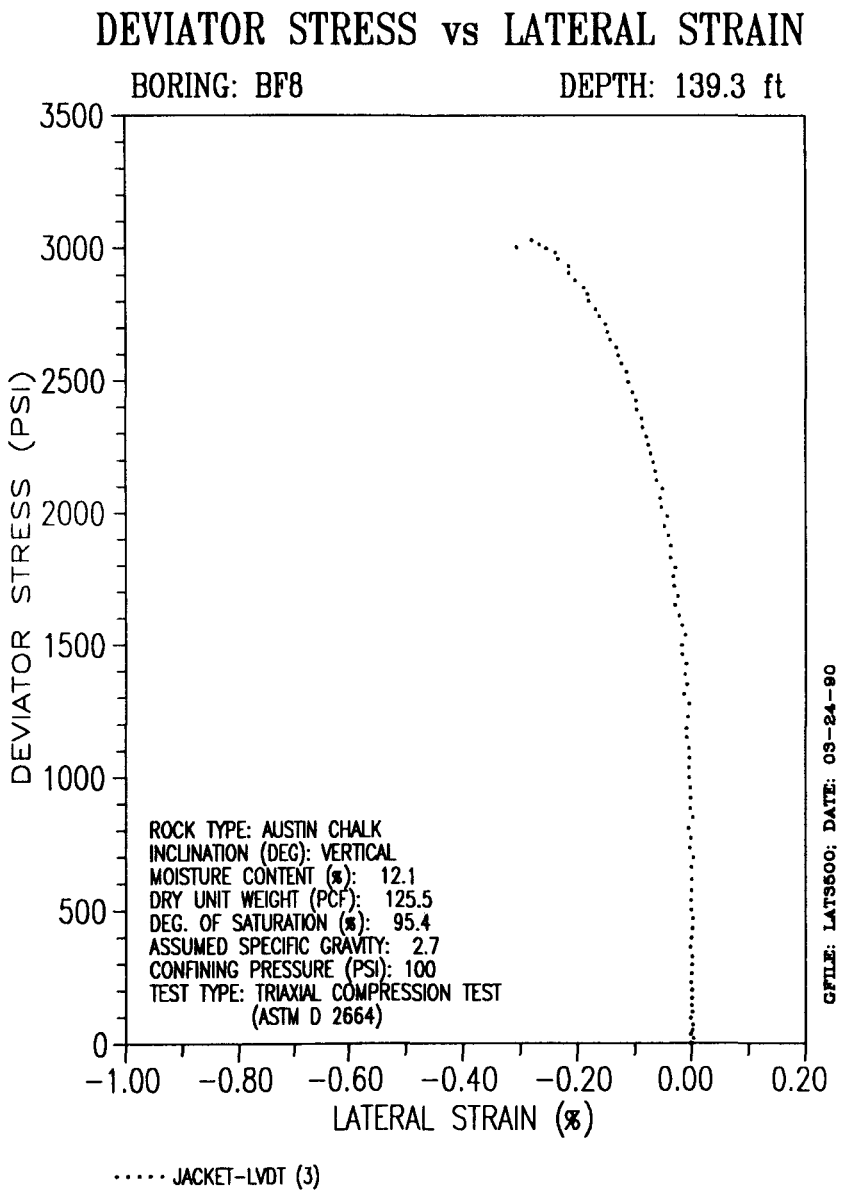
TEXAS SSC SITE

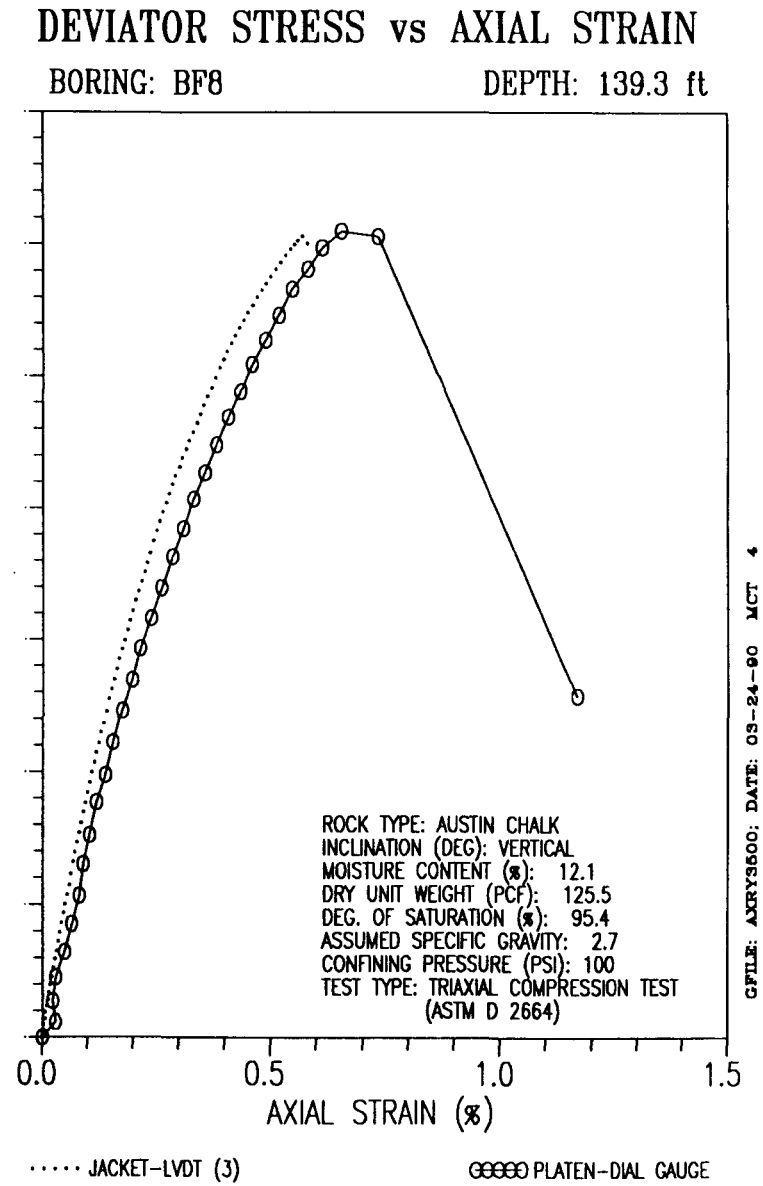
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

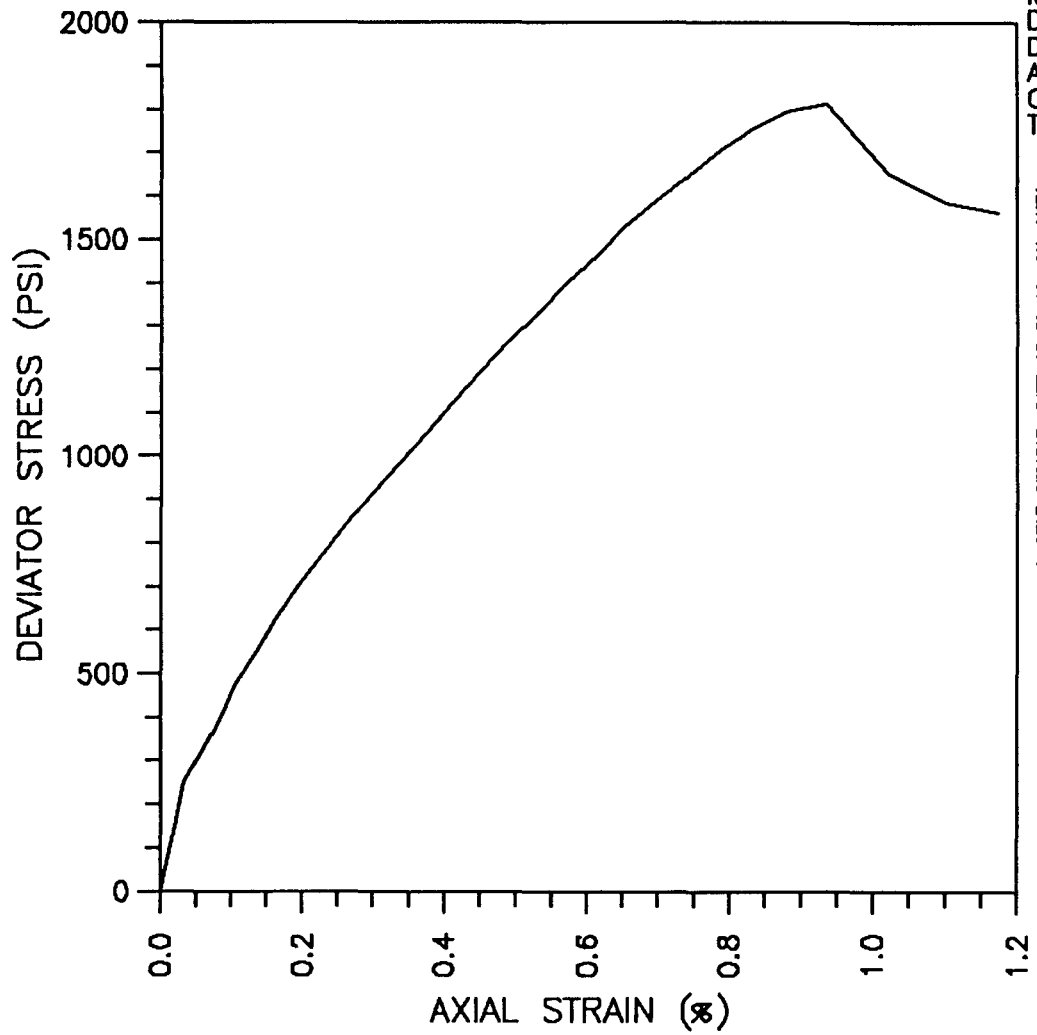
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BF8
DEPTH: 139.3 ft
DEVIATOR STRESS (PSI)
3500
3000
2500
2000
1500
1000
500
0
-1.00
-0.80
-0.60
-0.40
-0.20
0.00
0.20
LATERAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.1
DRY UNIT WEIGHT (PCF): 125.5
DEG. OF SATURATION (%): 95.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT3500; DATE: 03-24-90
JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BF8
DEPTH: 139.3 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): 125.5
DEG. OF SATURATION (%): 95.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY3500; DATE: 03-24-90 MCT 4
JACKET-LVDT (3)
PLATEN-DIAL GAUGE

BORING NO.: BF8
DEPTH (FT): 139.7
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.8
DRY UNIT WEIGHT (PCF): 129.9
DEG. OF SATURATION (%): 98.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

BFTLE: BF81307 DATE: 05-30-90 CAL: MCT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.939 x10E5 PSI

FAILURE MODE:
COMBINATION

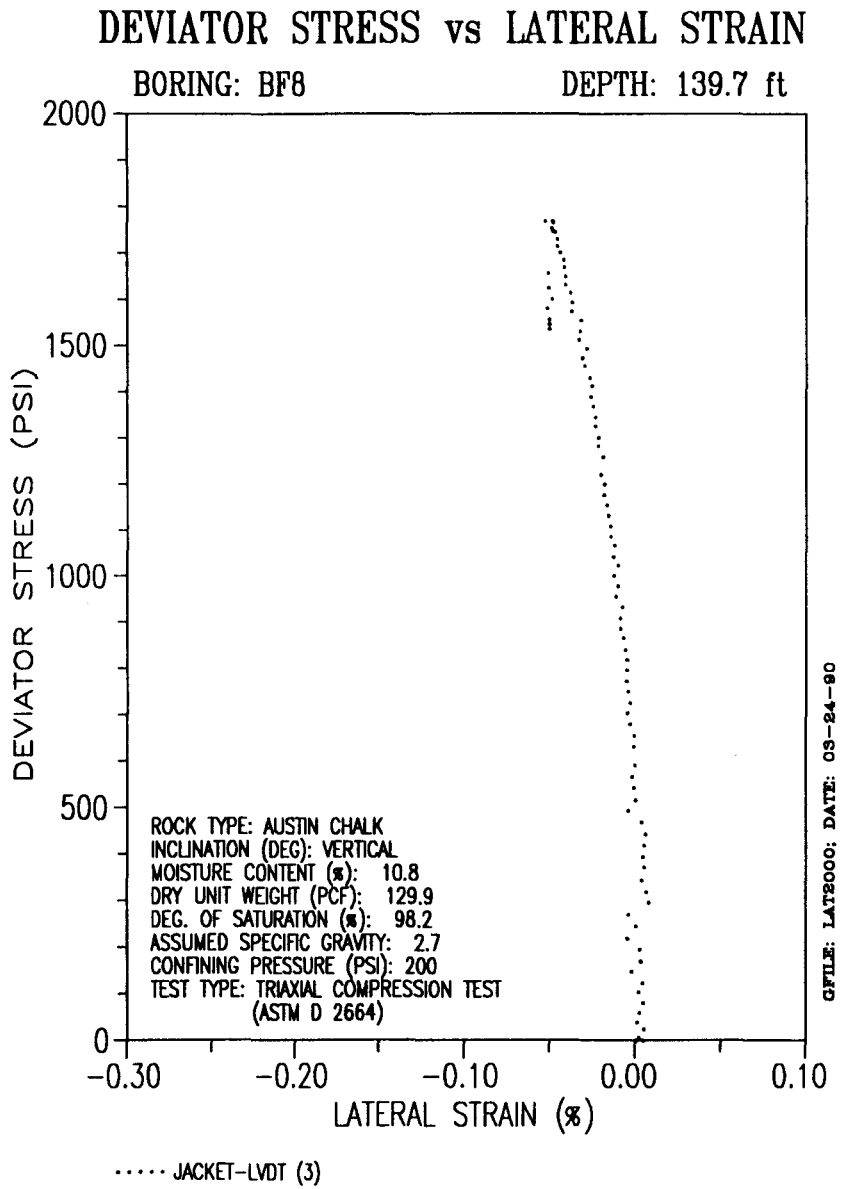
TEXAS SSC SITE

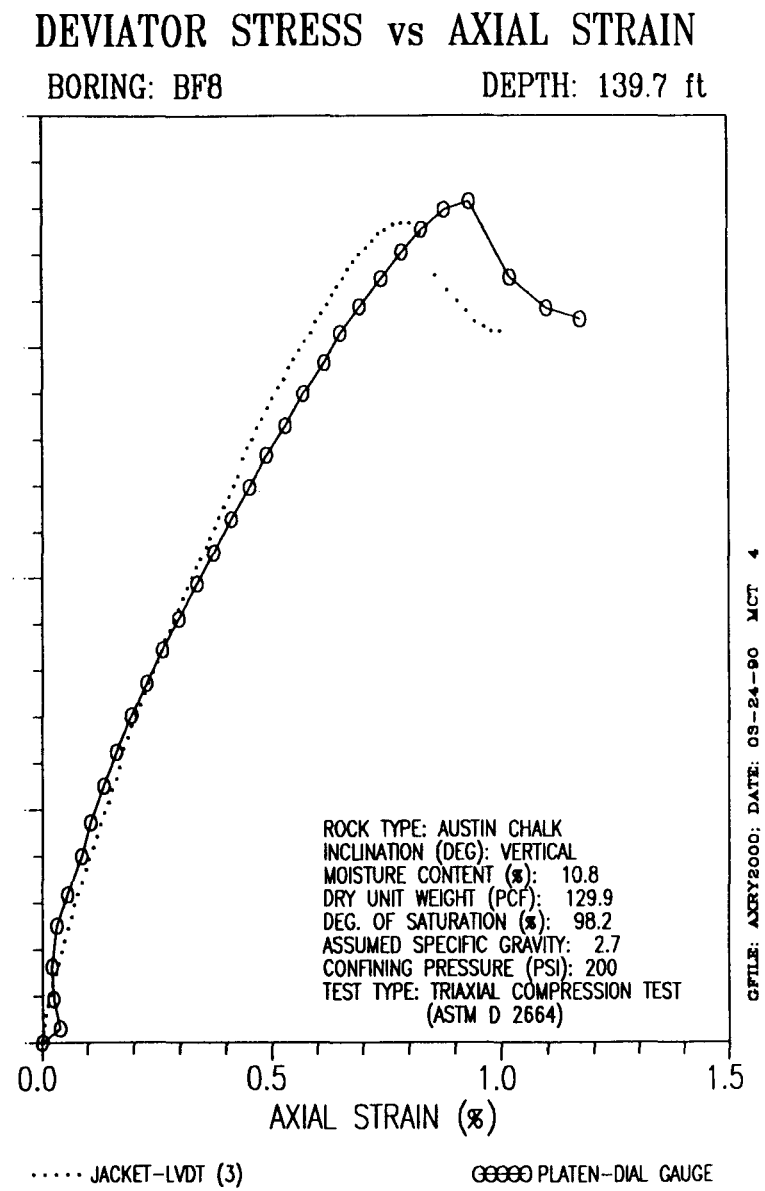
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

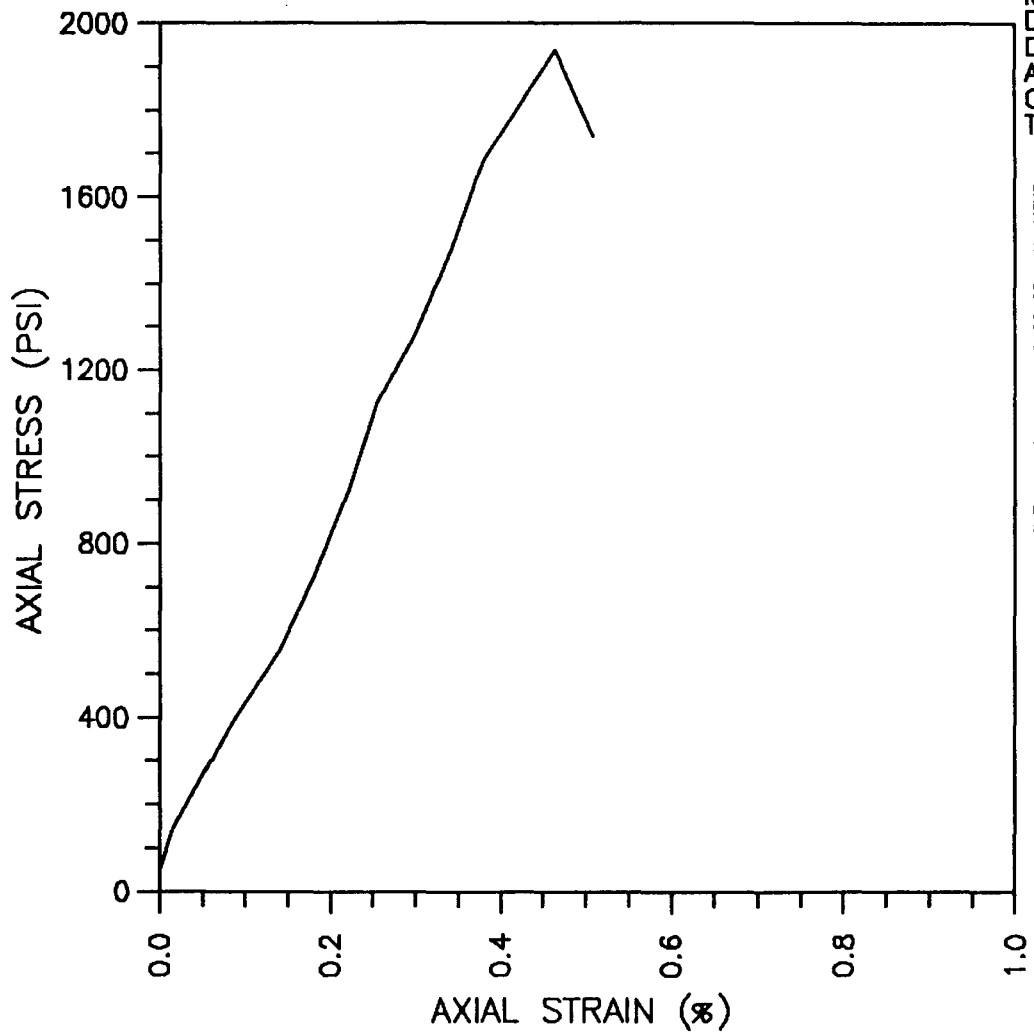
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BF8
DEPTH: 139.7 ft
DEVIATOR STRESS (PSI)
2000
1500
1000
500
0
-0.30
-0.20
-0.10
0.00
0.10
LATERAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.8
DRY UNIT WEIGHT (PCF): 129.9
DEG. OF SATURATION (%): 98.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT2000; DATE: 03-24-90
····· JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BF8
DEPTH: 139.7 ft
0.0
0.5
1.0
1.5
AXIAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.8
DRY UNIT WEIGHT (PCF): 129.9
DEG. OF SATURATION (%): 98.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY2000; DATE: 03-24-90 MCT 4
····· JACKET-LVDT (3)
ooooo PLATEN-DIAL GAUGE

BORING NO.: BF8
DEPTH (FT): 158.6
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 11.5
DRY UNIT WEIGHT (PCF): 127.7
DEG. OF SATURATION (%): 97.7
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: BF81588 DATE: 05-28-90 CAL: MCUJ

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.714 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

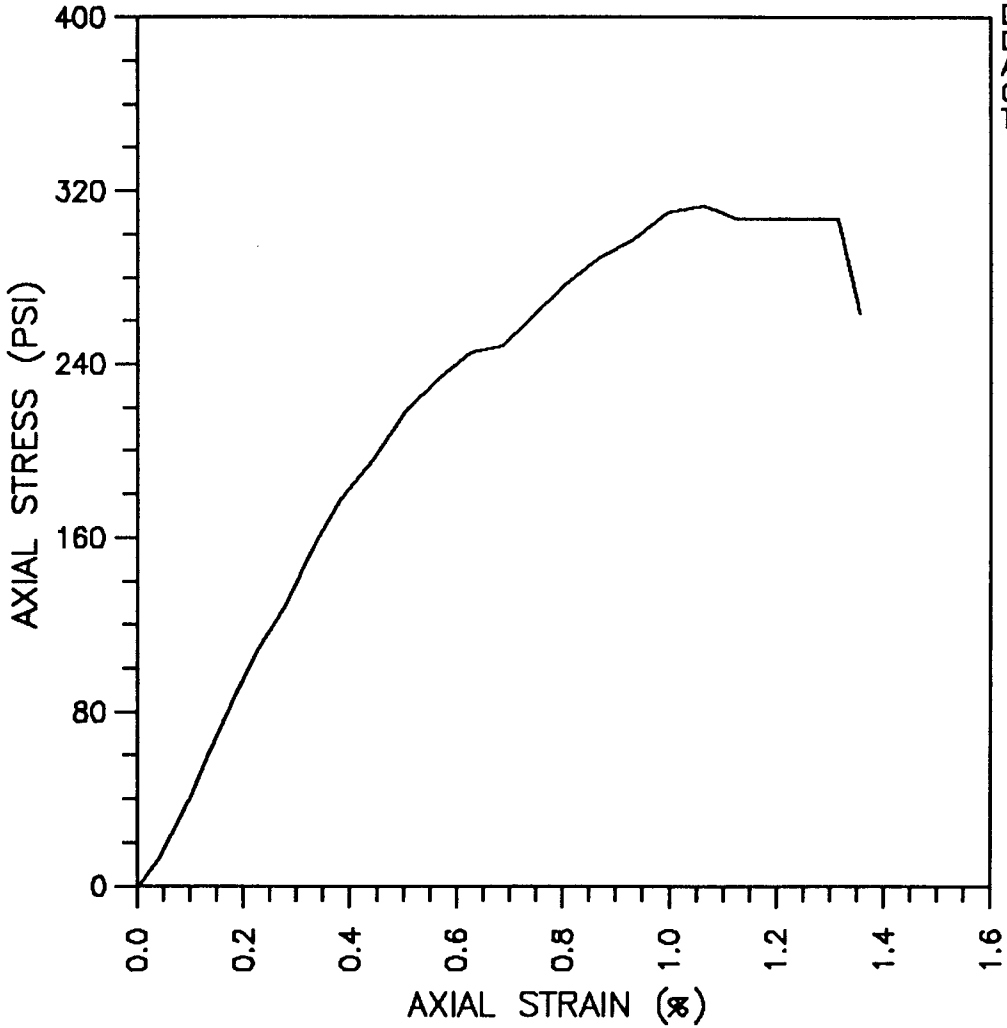
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 193.4
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.6
DRY UNIT WEIGHT (PCF): 120.1
DEG. OF SATURATION (%): 97.9
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFTLE: BF81934 DATE: 05-30-90 CAL: MCU2

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.482 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

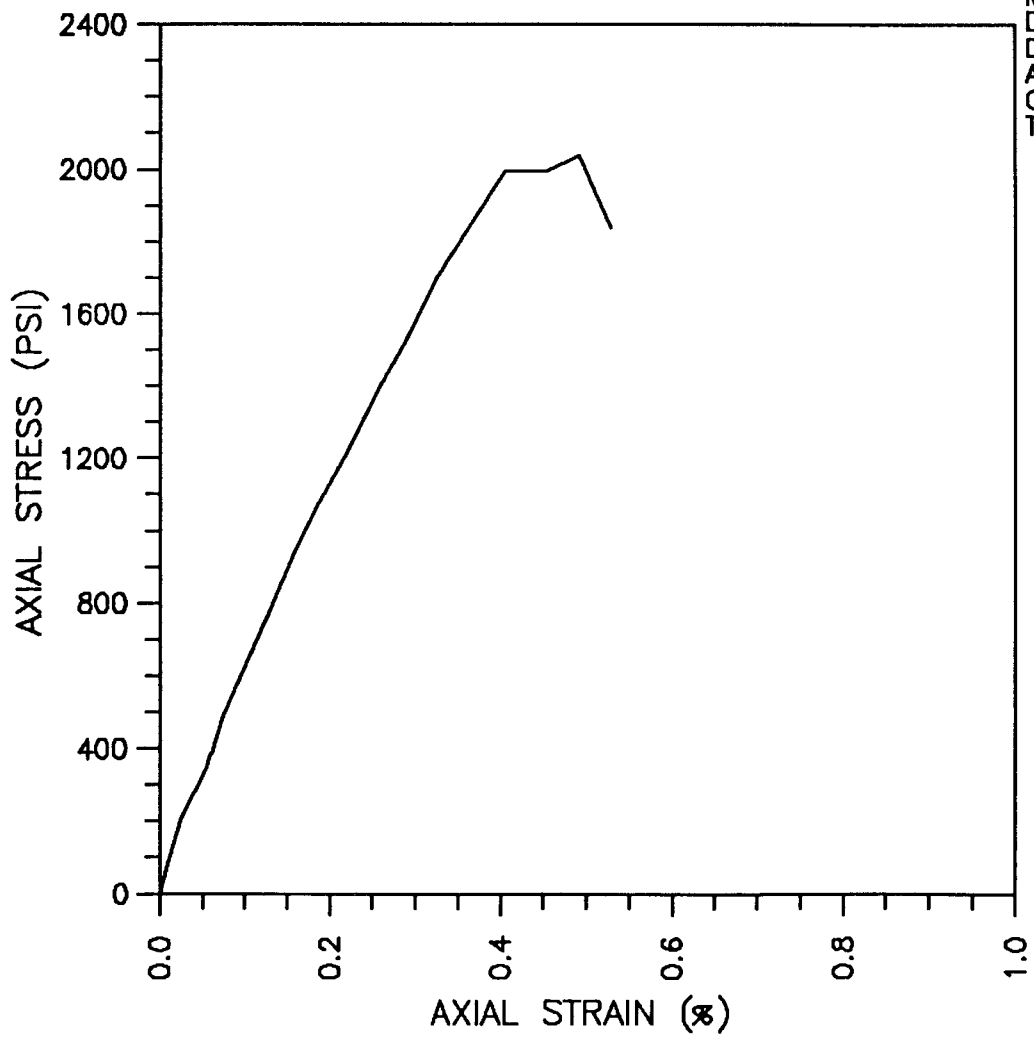
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 210.6
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 7.4
DRY UNIT WEIGHT (PCF): 140.4
DEG. OF SATURATION (%): 99.9
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

DFILE: BF82106 DATE: 05-30-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.000 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

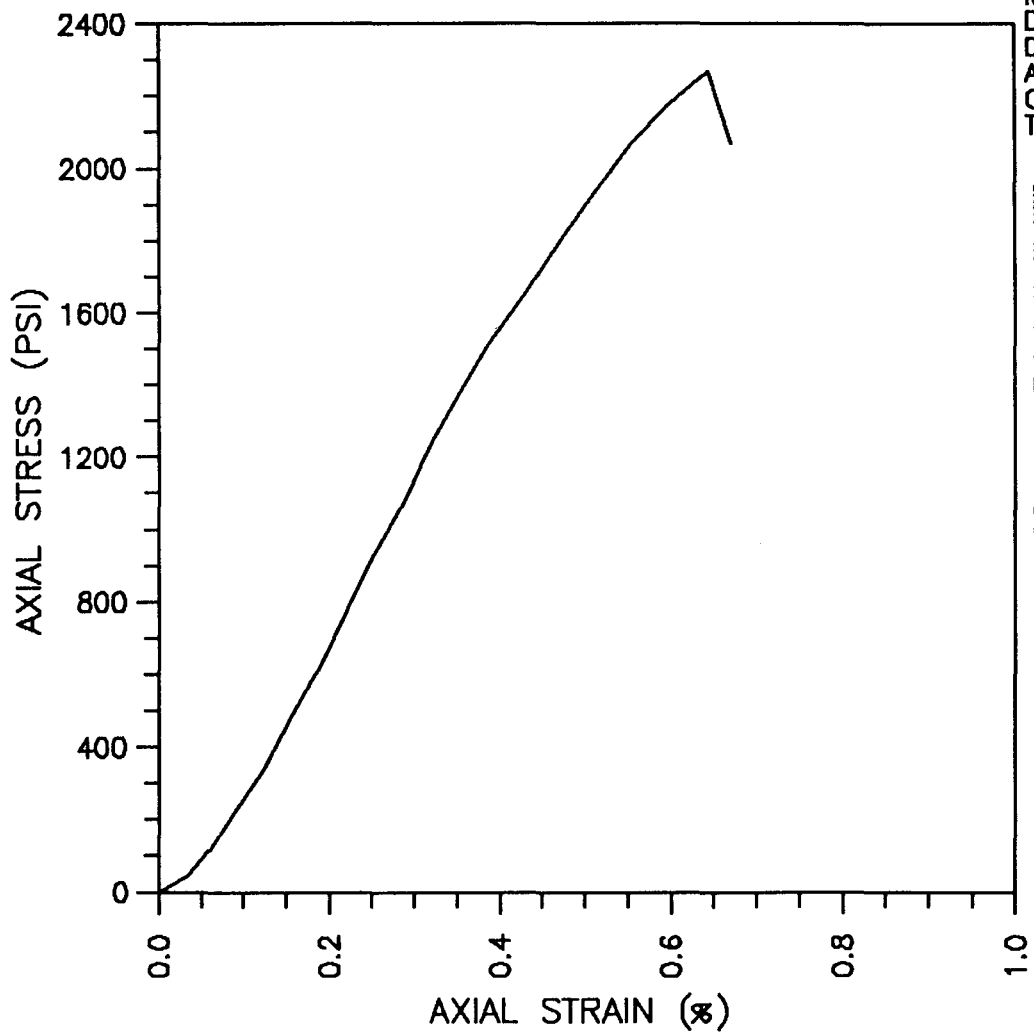
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 227.9
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 7.7
DRY UNIT WEIGHT (PCF): 138.2
DEG. OF SATURATION (%): 95.3
ASSUMED SPECIFIC GRAVITY: 2.70
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFILE: BF82279 DATE: 05-30-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.651 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

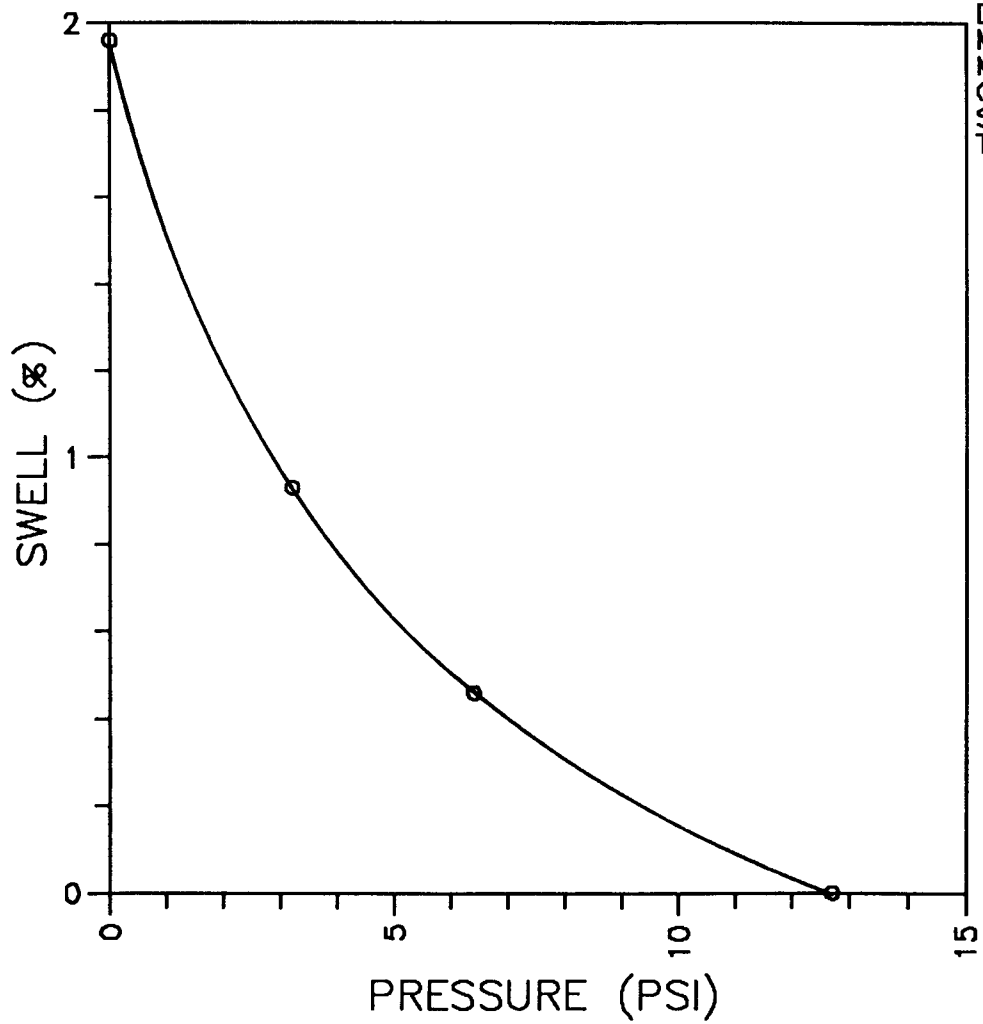
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BF8
DEPTH (FT): 53.7
TAYLOR MARL



INCLINATION (DEG): VERTICAL
DRY UNIT WEIGHT (PCF): 103.3
M.C. BEFORE TEST (%): 19.9
M.C.AFTER TEST (%): 25.3
GAIN IN MOISTURE (%): 5.3
SWELLING PRESSURE INDEX (PSI): 13
TEST TYPE: SWELLING PRESSURE INDEX (ISRM)

TEXAS SSC SITE

SWELLING PRESSURE INDEX

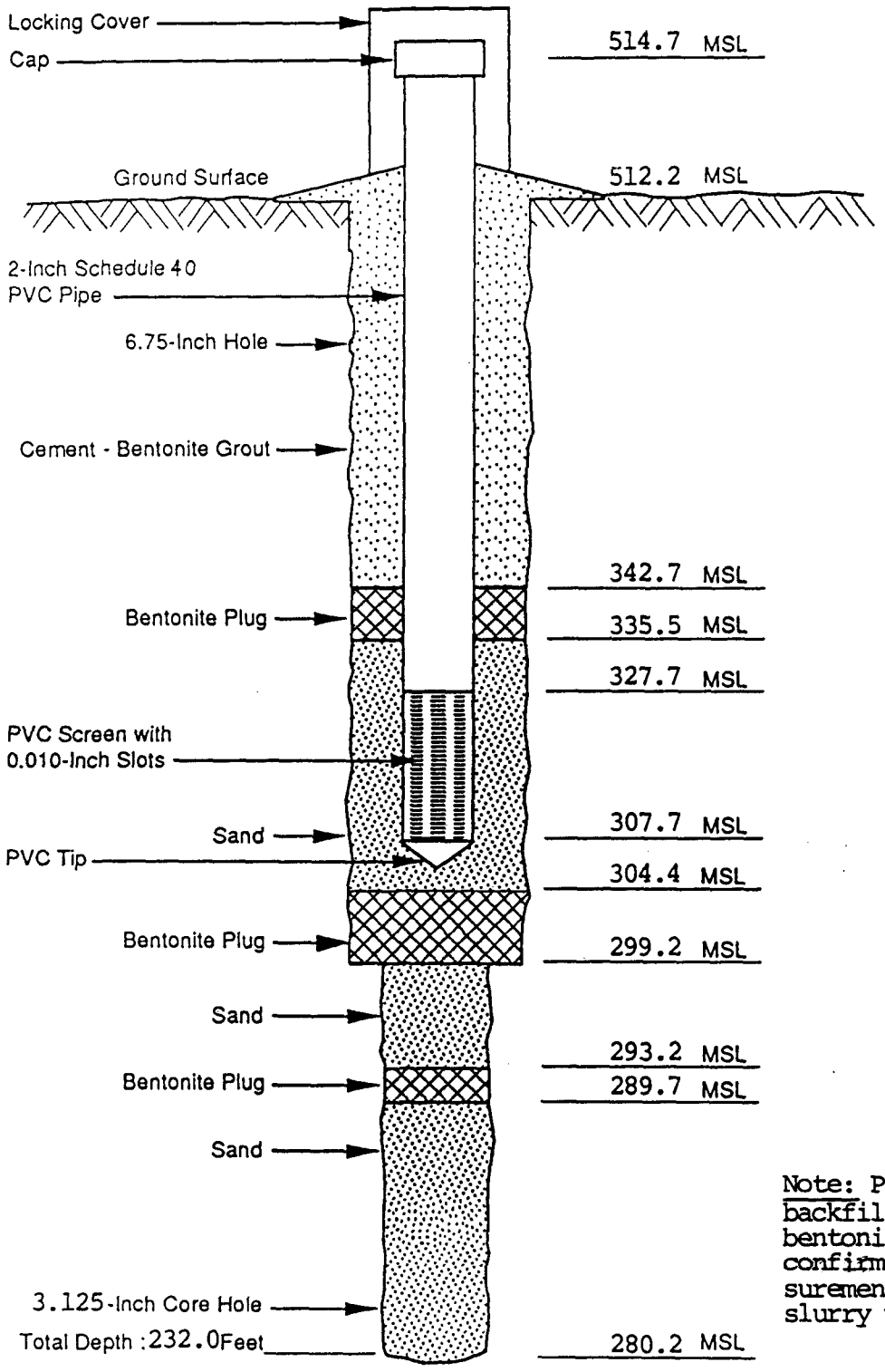
MASON–JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS–ENGINEERS

JOB NO.: 5530.17

FIGURE

APPENDIX E

WELL AS-BUILT DIAGRAM



Note: Placement depths of backfill materials (sand & bentonite pellets) were confirmed by manual measurement. Cement/bentonite slurry was placed by tremie.

NOT TO SCALE

Boring: BF 8
Location: N 204,307
E 2,215,118
Date(s) Installed: 1/8/90-1/10/90
Well Construction
Supervising Geologist: Mark G. Thomas
Approved By: W.D. Flanigan Date: 5/15/90

Observation Well
No. BF 8

5/90 Figure