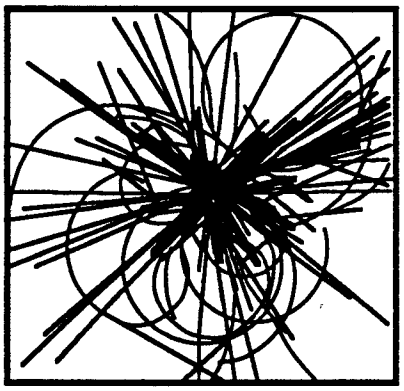
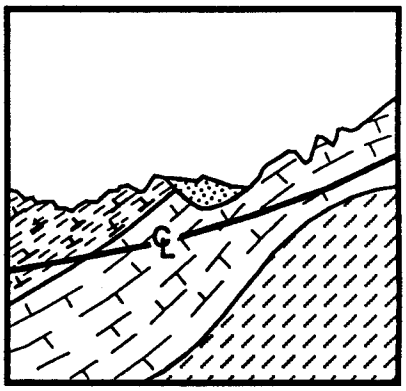
SSCL-SR-1116

SSCL-SR-1116
Project No. 87-888-0017
Report No. SSC-GR-57
August 1990

Data Report for Top of Eagle Ford Shale between F1 and E2 - - Coreholes B 1737, B 22-90, and B 1807





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 report was prepared as part of the global data phase of geotechnical characterization at the SSC site. Data collection for this study was focused on drillhole-based geological, geophysical and geomechanical tests at key locations around the ring. At these locations the main ring tunnel is expected to pass through, or run close to, formational contacts. In combination with data from the other phases, these data will allow conceptual designs of construction methods and structural supports for key underground structures. This data report includes the results of both field and laboratory tests for specific drilling and sampling sites.

DATA REPORT

Site Designator: Top of Eagle Ford Shale

Objective: Drill borings to determine the depth to the top of Eagle Ford Shale at locations where the main ring tunnel is expected to pass through or be close to formation contact; obtain core samples for laboratory geomechanical testing to characterize the geotechnical conditions at the locations of these coreholes.

Three borings, B 1737, B 22-90, and B 1807, were drilled and their locations are shown in Figure 1. The borings are located on the west-northwestern section of the proposed tunnel alignment, approximately 1.5 miles from Lone Elm, Texas.

Boring Locations:

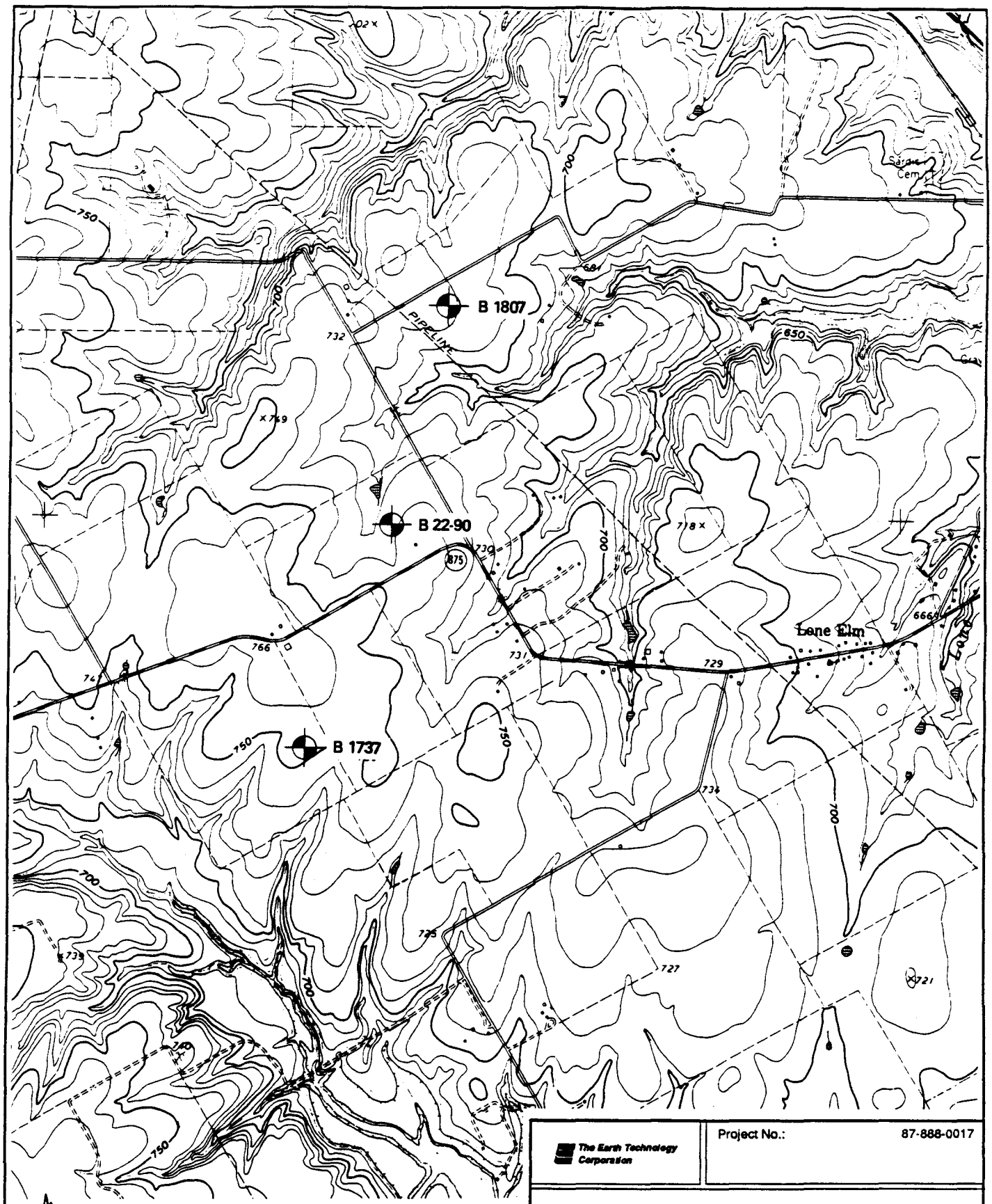
Boring	Northing (feet)	Easting (feet)	Surface Elevation (feet)
B 1737	269,750	2,171,178	752.3
B 22-90	273,231	2,172,395	735.6
B 1807	276,407	2,173,313	716.7

Scope and Schedule:

Boring	Drilling	Wire-Line Logging	Laboratory Testing	Plugging
B 1737	March 23 to 28, 1990	March 28, 1990	April 17 to 28, 1990	March 30, 1990
B 22-90	March 29 to 30, 1990	March 31, 1990	April 10 to 18, 1990	March 31, 1990
B 1807	March 27 to 28, 1990	March 28, 1990	April 7 to 28, 1990	March 28, 1990

Conditions Encountered: (see lithologic logs, Appendix A)

Boring	Total Depth (feet)	Drilling (feet)		Soil (feet)	Weathered Austin Chalk (feet)	Fresh Austin Chalk (feet)	Eagle Ford Shale (feet)
		Wash Boring	Coring				
B 1737	247.0	0.0 to 110.2	110.2 to 247.0	0.0 to 4.5	4.5 to 14.5	14.5 to 173.6	173.6 to 247.0
B 22-90	232.0	0.0 to 102.0	102.0 to 232.0	0.0 to 0.5	0.5 to 7.1	7.1 to 175.9	175.9 to 232.0
B 1807	211.0	0.0 to 121.0	121.0 to 211.0	0.0 to 1.5	1.5 to 13.5	13.5 to 160.3	160.3 to 211.0



The Earth Technology Corporation

Project No.: 87-888-0017

Boring Location Map

5/90

Figure 1

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

Boring	Spontaneous Potential	Normal Resistivity (Short & Long)	Guard Resistivity	Point Resistance	Natural Gamma	Short & Long Gamma	Compensated Density (caliper)	Sonic Velocity (full wave)
B 1737	X	X	X	X	X	X	X	X
B 22-90	X	X	X	X	X	X	X	X
B 1807	X	X	X	X	X	X	X	X

Bulk and Clay Mineralogy Test Results Summary: (see also Appendix C)

Formation: Eagle Ford Shale

Whole Rock Composition:

Mineral	Percent
Not analyzed	

Absolute Clay Abundance:

Mineral	Percent
montmorillonite	61-69
illite	13-14
kaolinite	17-25

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

Vertical Depth (ft)	Formation/ Lithology	Moisture Content (%)	Dry Density (pcf)	Unconfined Compressive Strength (psi)	Tangent Young's Modulus E_{50} (psi x 10^5)	Brazil Tensile Strength (psi)
			Boring B 1737			
124-125	Austin Chalk	13-14	122-124	1517	6.67	
150	Austin Chalk	12-13	123-127	1273	1.19	
157-158	Austin Chalk	14-16	116-121	2401	5.75	213
166-169	Austin Chalk	12-15	119-126	1702	0.87-4.39	
172-173	Austin Chalk	13	120-123	426	0.56	235
177-178	Eagle Ford Shale	19	113-114	223	0.90	
182	Eagle Ford Shale	18	113			
186-188	Eagle Ford Shale	18-19	110-114	209	0.59-0.64	
220	Eagle Ford Shale	12-15	120-123	137	0.26	
240	Eagle Ford Shale	8-9	135-138	795	1.26	
			Boring B 22-90			
125	Austin Chalk	14	120-121	2322	4.40	
132	Austin Chalk	15	119			
157-158	Austin Chalk	13	122-123	1978	6.04	
170-175	Austin Chalk	11-15	116-126	1900-1924	2.37-16.00	252
183-188	Eagle Ford Shale	13-18	115-123	245-253	0.47-0.65	
227	Eagle Ford Shale	15-16	119-122	158	0.68	
			Boring B 1807			
124-125	Austin Chalk	11-13	128-129	1895	3.81	
152-156	Austin Chalk	12-16	115-123	2119	0.93-5.65	266
159-160	Austin Chalk	12-13	126	477	0.71	
162-167	Eagle Ford Shale	17-19	108-115	150	0.64-0.69	
197	Eagle Ford Shale	12-16	117-127	230	0.71	
203-204	Eagle Ford Shale	13-16	117-127	239	0.68	

Hole Status: All the borings were plugged with cement grout (see Appendix D).

APPENDIX A

LITHOLOGIC LOGS

LITHOLOGIC LOG

BORING B 1737

LOG OF BORING

BORING NO: B1737 PG 1 OF 7

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 269,750 Feet
E 2,171,178 Feet

GROUND EL: 752.3 Feet

DATE: 3/23/90 TYPE: Wash/NX Core(1) CASED TO: 13.0' 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
									CLAY (Residual soil), slightly silty, calcareous, w/small tan weathered limestone fragments (CH-CL) 2.0
									CLAY (Residual soil), silty, calcareous, tan w/small tan weathered limestone fragments (CH-CL) 4.5
5									LIMESTONE (Austin Chalk), highly weathered, med. to mod. hard, tan and white, w/soft to v.soft argillaceous interbeds
10									
							Stopped Drilling 3-23-90		14.5
15							Started Drilling 3-24-90		LIMESTONE (Austin Chalk) fresh, med. to mod. hard, lt. gray w/soft to med. hard, dark gray, argillaceous/shaly interbeds
20									
25									
30									
35									
40									

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

WATER INFORMATION
Wash boring from 0.0' to 110.2'
No water loss observed
Wet Rotary Wash/Core boring, water level not determinable

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY J.D. Murphy

LOG OF BORING

BORING NO: B1737 PG 2 OF 7

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 269,750 Feet
E 2,171,178 Feet

GROUND EL: 752.3 Feet

DATE: 3/24/90 TYPE: Wash/NX Core(1) CASED TO: 13.0' CONTRACTOR: MJA

SAMPLE LEGEND	WATER INFORMATION
S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	Wash boring from 0.0' to 110.2' No water loss observed Wet Rotary Wash/Core boring, water level not determinable

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
										LIMESTONE(Austin Chalk),fresh,med.to mod.hard,lt.gray w/soft to med.hard,dk.gray argillaceous and occ. shaly interbeds
45										
50										
55										
60										
65										
70										
75										~75.0-76.0 very hard bed
80										

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY J.D. Murphy

LOG OF BORING

BORING NO: B1737 PG 3 OF 7

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 269,750 Feet
E 2,171,178 Feet

GROUND EL: 752.3 Feet

DATE: 3/24/90 TYPE: Wash/NX Core CASED TO: 13.0' CONTRACTOR: MJA

SAMPLE LEGEND	WATER INFORMATION
S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	Wash boring from 0.0' to 110.2' No water loss observed Wet Rotary Wash/Core boring, water level not determinable

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
									LIMESTONE (Austin Chalk), fresh, med. to mod. hard, lt. gray, sli. fossil., occ. pyrite nodules w/sli. argill. to v. argill. interbeds (0.1 to 1.1ft. thick and spaced 0.2 to 1.05 ft. apart below 110.2')
85									
90									
95									
100									~100.5-101.0 thin, v. hard bed 101.0-102.0 med. thick bentonitic, v. soft, bluish-gray bed
105									
110							Started Coring		
			110.2						111.0s-111.6g thin, v. argill., dk. gray bed 111.9s-112.0g v. thin, sli. argill., med. gray bed 112.9 ~1-1/2" dia. pyrite nodule 113.0g-113.7g thin, sli. argill., med. gray bed w/ Inoceramus prisms
115		C1			95	93			113.8-114.05 68° fracture, slks., rough, fresh, up to 1/8" calcite filling 113.9s-114.4g thin, sli. to mod. argill., med. gray bed 115.0g-116.1g med. thick, mod. argill., med. gray bed 116.5g-117.2g thin, mod. argill., med. gray bed
				119.0			Stopped Drilling 3-24-90		
120			119.0				Started Drilling 3-26-90		118.25g-119.5g med. thick sli. to mod. argill., med. to dk. gray bed 119.2-119.5 64° incipient fracture, w/1/8" calcite filling
		C2		123.0	100	98			119.4g-121.6g med. thick, mod. argill., w/v. argill., med. to dk. gray interbed from 120.3g-121.1g

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY J.D. Murphy

LOG OF BORING

BORING NO: B1737 PG 4 OF 7

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 269,750 Feet
E 2,171,178 Feet

GROUND EL: 752.3 Feet

DATE: 3/26/90 TYPE: Wash/NX Core(1) CASED TO: 13.0' 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.
		C2		123.0				
125		C3	123.0	131.5	99	98		
130								
135		C4	131.5	141.5	99	97		
140								
145		C5	141.5	151.5	99	99		
150								
155		C6	151.5	161.5	99	92		
160								
			161.5					

SAMPLE LEGEND

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

WATER INFORMATION

No water loss observed
Wet Rotary Wash/Core boring, water level not determinable

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), fresh, med. to mod. hard, lt. gray, sli. fossil., with .05 to 2.0ft. thick sli. argill. to shaly interbeds spaced 0.35 to 2.4ft. apart

120.9	25° fracture, slks., sli. rough, clean, closed
122.0g-123.0g	med. thick, sli. argill., lt. to med. gray bed
123.5g-123.9g	thin, sli. argill., lt. to med. gray bed
123.8-123.9	50° fracture, slks., clean, closed
124.0-124.25	60° frac., incipient w/1/8"-1/16" calcite filling
125.4g-125.5g	(2) v. thin sli. argill., lt. to med. gray beds
125.7g-126.2g	thin, mod. argill., med. gray bed
126.5-126.85	65°-70° frac., multiple (2), rough, clean, closed
127.0g-127.15g	thin, shaly, soft, dk. gray bed
128.0-128.7	multiple (2) 75° frac., clean, closed, enechelon
129.05s	v. thin, v. argill., dk. gray bed (~1/2")
130.7g-131.2g	thin, v. argill. to shaly, soft to mod. hard, dk. gray bed
133.4g-133.7g	thin, sli. argill., lt. to med. gray bed
133.8g-134.0g	thin, mod. argill., med. gray bed
135.5g-136.4g	thin, sli. argill., lt. to med. gray bed
136.4g-136.75g	thin, v. argill., dk. gray bed
136.75g-137.85g	med. thick, sli. argill., lt. to med. gray bed
138.2g-138.4g	thin, v. argill., dk. gray bed
140.3g-141.1g	thin, sli. to mod. argill., med. gray bed
141.0-141.4	60°-65° incipient frac., clean, closed
142.3g-142.6g	thin, mod. argill., med. gray bed
142.6g-143.0g	thin, sli. argill., bioturbated, lt. to med. gray bed
143.9g-144.1g	thin, v. argill., dk. gray bed
144.1g-145.1g	med. thick, sli. argill., lt. to med. gray bed
146.6g-146.7g	thin, mod. to v. argill., dk. gray bed
149.4g-150.5g	thin, v. argill., dk. gray bed
150.5g-151.4g	thin, mod. argill., med. gray bed
151.7g-152.4g	thin, sli. argill., lt. to med. gray bed
153.2g-154.8g	med. thick, mod. to v. argill., med. to dk. gray
157.0g-157.9g	thin, sli. argill., lt. to med. gray bed
158.7g-159.3s	thin, mod. argill., becoming v. argill. below 159.1, med. to dk. gray bed
160.5g-161.4g	thin, mod. to v. argill., med. to dk. gray bed

DRILLING GEOLOGIST W.D. Flanigan ASSISTANT Jack L. Cooper CHECKED BY J.D. Murphy

LOG OF BORING

BORING NO: B1737 PG 5 OF 7

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 269,750 Feet
E 2,171,178 Feet

GROUND EL: 752.3 Feet

DATE: 3/26/90 TYPE: Wash/NX Core(1) CASED TO: 13.0' 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.
		C6		161.5				
		C7	161.5	171.5	98	97		
		C8	171.5	181.5	100	96	Stopped Drilling 3-26-90	
		C9	181.5	191.5	100	98	Started Drilling 3-27-90	
		C10	191.5	202.0	89	50		
			202.0					

SAMPLE LEGEND

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

WATER INFORMATION

No water loss observed
Wet Rotary Wash/Core boring, water level not determinable

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), fresh, med. to mod. hard, lt. gray, sli. fossil., w/ 0.3 to 3.1ft. thick sli. argill. to v. argill. interbeds spaced 0.1 to 0.4 ft. apart

161.5g-161.7g	thin, mod. argill., med. gray bed
162.0g-162.3g	thin, sli. argill., lt. to med. gray bed
164.65g-164.9g	thin, sli. argill., lt. to med. gray bed
164.9-165.2	65° frac., slks., med. rough, clean, closed
165.3g-168.4g	med. thick, mod. to v. argill., dk. gray bed
168.5g-168.9g	thin, sli. argill., soft, lt. to med. gray bed
168.9g-170.6g	med. thick, sli. to mod. argill., lt. to med. gray bed
170.6g	

LIMESTONE (Austin Chalk), fresh, med. to mod. hard, fossil. w/ abund. sharks teeth from 173.1' to 173.65' and phosphate nodules from 173.5' to 173.65' (Transition Zone)
173.65s

SHALE (Eagle Ford), fresh, soft to med. hard, v. thinly bedded, v. fine grained, dk. gray, w/ occ. pyrite nodules, concretions, claystone lenses, and thin arenaceous interbeds

174.8-175.2	Pyrite nodule
175.4-175.6	45° frac., smooth, clean, closed, planar
176.1	20° frac., slks., sli. rough, clean, closed, planar
176.35-176.5	30° frac., incipient
177.1-177.3	45° frac., slks., clean, closed, curvilinear
179.2	20° frac., slks., sli. rough, clean, closed
179.7	50° frac., slks., smooth, clean, closed
183.9	40° frac., slks., sli. rough, clean, closed
185.8g-186.2g	thin, arenaceous, med. hard, fossil. bed
190.2	claystone concretion
191.7-191.8	45° frac., incipient, clean, closed,
191.9	1/4" thick claystone, hard, tan bed
193.1s	<1/16" thick claystone, hard, tan lens
193.8	1/4" thick claystone, hard, tan lens
194.2	1/4" thick claystone, hard, tan lens

NOTE: Core Run C10-Lost all recovery, retrieved on second attempt (low RQD)

DRILLING GEOLOGIST W.D. Flanigan ASSISTANT Jack L. Cooper CHECKED BY J.D. Murphy

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: B1737 PG 6 OF 7

LOCATION: N 269,750 Feet
E 2,171,758 Feet

GROUND EL: 752.3 Feet

DATE: 3/27/90 TYPE: Wash/NX Core CASED TO: 13.0'(2) 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.
		C10		202.0				
205		C11	202.0	212.0	100	84	Stopped Drilling 3-27-90	
210								
215		C12	212.0	222.0	100	98	Started Drilling 3-28-90	
220								
225		C13	222.0	232.0	100	87		
230								
235		C14	232.0	242.0	100	96		
240								

SAMPLE LEGEND

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

WATER INFORMATION

No water loss observed
Wet Rotary Wash/Core boring, water level not determinable

DESCRIPTION OF STRATUM

SHALE(Eagle Ford), fresh, soft to med.hard, v.thinly bedded, dk.gray, w/occ.pyrite, claystone and septarian concretions, and thin arenaceous beds.

203.7	20°frac., slks., rough, clean, closed
203.8	do. above
203.95	do. above
204.5	40°frac., smooth, clean, closed
205.5-206.1	multiple(3)frac.zone, slks., sli.rough, clean, closed(45°)
208.0	20°frac., slks., sli.rough, clean, closed
208.7,209.3	15°-20°frac., slks., sli.rough, clean, closed
209.75-209.85	25°frac., slks., sli.rough, clean, closed
213.6g-214.1g	thin, med.hard, med.gray, sli.arenaceous bed
214.1s-214.55s	thin, claystone, v.hard to hard, sli.calc., tan bed
214.55s-214.7g	thin, arenaceous, med.hard, med.gray bed
216.2	30°frac., slks.sli.rough, clean, closed
216.3-216.4	45°frac., slks., sli.rough, v.narrow (1/16"clay)
216.8	45°frac., sli.rough, clean, closed
218.25g	v.thin(1/2")arenaceous, med.hard, lt.gray to white bed
218.9s-219.6g	thin, arenaceous, med.gray bed
222.25g	v.thin, claystone, mod.hard, tan bed
224.85,225.0	pyrite inclusions
225.35	v.thin(<1/2")claystone, med.hard, tan bed
225.85-225.95	20°frac., slks., sli.rough, clean, closed
227.0-227.2	45°frac., incipient
228.0-228.1	30°frac., slks., sli.rough, clean, closed
228.2,228.3,228.45,228.85,&229.1	20°frac., slks., sli. rough, clean, closed
229.15-229.4	70°frac., incipient, closed
229.7	30°frac., slks., sli.rough, clean, closed
229.75s-230.0s	septarian concretion, v.hard
230.0-230.3	multiple(3)frac., 25°-40°, slks., sli. rough, clean, closed
232.1	pyrite inclusion
233.0	claystone concretion (1/2")tan
233.6s	v.thin(1/8"), limy, lt.gray bed
233.9s	do. above
234.5s	do. above
235.4-235.55	numerous v.thin, limy, lt.gray lamine
237.6	50°frac., slks., sli.rough, clean, closed
237.85	20° do. descrip. above
240.7	30° do. descrip. above

DRILLING GEOLOGIST W.D. Flanigan ASSISTANT Jack L. Cooper CHECKED BY J.D. Murphy

LOG OF BORING

BORING NO: B1737 PG 7 OF 7

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 269,750 Feet
E 2,171,178 Feet

GROUND EL: 752.3 Feet

DATE: 3/28/90 TYPE: Wash/NX Core(1) CASED TO: 16.0' 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
		C14		242.0					SHALE(Eagle Ford),fresh,soft-med.hard,dk.gray with occ. claystone concretions and lenses.
			242.0						242.9 mod.hard claystone concretion(3/4")tan 243.1 v.thin claystone,v.hard,lens,tan
245		C15		247.0	100	100			
250									
255									
260									
265									
270									
275									
280									

SAMPLE LEGEND

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

WATER INFORMATION

No water loss observed
Wet Rotary Wash/Core boring,water level not determinable

Total Depth 247.0' 3/28/90

(1) Rotary Wash Boring from 0.0' to 110.2';
NX Core Boring from 110.2' to 247.0'

(2) NX casing extended from 13.0' to 16.0'
on 3-28-90

(3) Wireline Logged 3-28-90

(4) Boring Plugged 3-30-90

NOTE: BENTONITIC MARKER BED CHANGED TO 101.0'-102.0'
BASED UPON WIRELINE LOGS

DRILLING GEOLOGIST W.D. Flanigan ASSISTANT Jack L. Cooper CHECKED BY J.D. Murphy

LITHOLOGIC LOG

BORING B 22-90

LOG OF BORING

BORING NO: B22-90 PG 1 OF 6

PROJECT: SSC - Texas

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 273,231 feet
E 2,172,395 feet

GROUND EL: 735.6 feet

DATE: 3/29/90 TYPE: Wash/NX Core(1) 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
										CLAY(Residual Soil),silty,brown,w/small(up to 0.5 1"dia.)limestone fragments (CH-CL)
										LIMESTONE(Austin Chalk),highly weath.,becoming mod. weath.w/depth,med.to mod.hard,white to tan,w/soft to med.hard argillaceous(clay)interbeds
5										
										7.1
										LIMESTONE(Austin Chalk),fresh,med.to mod.hard,lt.gray w/soft to med.hard,dk.gray argillaceous/shaly interbeds
10										
15										
20										
25										
30										
35										
40										

SAMPLE LEGEND

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

WATER INFORMATION

Wash bore from 0.0' to 102.0'
No detectable water loss observed
Wet Rotary Wash/Core hole,water level not determinable

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY W.D.Flanigan

LOG OF BORING

BORING NO: B22-90 PG 2 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 273,231 feet
E 2,172,395 feet

GROUND EL: 735.6 feet

DATE: 3/29/90 TYPE: Wash/NX Core (1) 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
										LIMESTONE (Austin Chalk), fresh, med. to mod. hard, lt. gray w/soft to med. hard, dk. gray, argillaceous/shaly interbeds
45										
50										
55										
60										
65										
70										
75										
80										

SAMPLE LEGEND

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

WATER INFORMATION

Wash bore from 0.0' to 102.0'
No detectable water loss observed
Wet Rotary Wash/Core hole, water level not determinable

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY W.D. Flanigan

LOG OF BORING

BORING NO: B22-90 PG 3 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 273,231 feet
E 2,172,395 feet

GROUND EL: 735.6 feet

DATE: 3/29/90 TYPE: Wash/NX Core(1) CASED TO: 4.0' CONTRACTOR: MJA

SAMPLE LEGEND

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

WATER INFORMATION

Wash bore from 0.0' to 102.0'
No detectable water loss observed
Wet Rotary Wash/Core hole, water level not determinable

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
85, 90, 95, 100							Started Coring		LIMESTONE(Austin Chalk), fresh, med. to mod. hard, sli. fossil., lt. gray, w/sli. argill. to v. argill. and occ. shaly interbeds (0.15 to 1.7ft. thick and spaced 0.15 to 3.0ft. apart in cored interval starting at 102.0')
105, 110		C1	102.0	112.0	85	85			101.7-102.35s thin, bentonitic clay, v. soft, non-laminated, waxy bluish-gray bed w/ pyrite crystals 102.75g-104.45g med. thick, mod. argill., med. to dk. gray bed 106.4g-107.3g thin, mod. argill., med. to dk. gray bed 108.0g-109.0g med. thick, sli. argill., med. gray bed 112.0g-113.5g med. thick, sli. argill., med. gray bed
115, 120		C2	112.0	122.0	100	100	Stopped Drilling 3-29-90		114.4g-115.4g med. thick, sli. to mod. argill., med. to dk. gray bed 115.8g-116.6g thin, mod. argill., med. to dk. gray bed 117.9g-118.05g v. thin, v. argill., soft to med. hard, dk. gray bed 118.2 45° fracture, incipient, clean, closed, fresh 118.2s-118.45s thin, shaly, soft, dk. gray bed 119.7g-121.4g med. thick mod. argill., med. to dk. gray bed

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY W.D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: B22-90 PG 4 OF 6

LOCATION: N 273,231 feet
E 2,172,395 feet

GROUND EL: 735.6 feet

DATE: 3/29/90 TYPE: Wash/NX Core(1) CASED TO: 4.0' CONTRACTOR: MJA

SAMPLE LEGEND

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

WATER INFORMATION

No detectable water loss observed Wet Rotary Wash/Core hole, water level not determinable

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		122.0			Stopped Drilling 3-29-90		LIMESTONE (Austin Chalk), fresh, med. to mod. hard, sli. fossil., occ. pyrite nodules, lt. gray, w/ 0.05 to 1.3ft. thick sli. argill. to v. argill. and occ. shaly interbeds spaced 0.8 to 4.0ft. apart
		C3	122.0	132.0	100	100	Started Drilling 3-30-90		123.6s-123.65s v. thin, shaly, soft, dk. gray bed 125.7g-126.3s thin, shaly, soft, dk. gray bed 127.1s-127.2s v. thin, shaly, soft, dk. gray bed 131.0g-131.6g thin, v. argill./shaly, soft to med. hard, dk. gray bed
125									
130									
		C4	132.0	142.0	100	100			134.4g-135.0g thin, mod. to v. argill., dk. gray bed 137.05g-137.15s v. thin, shaly, soft, dk. gray bed 138.2g-138.7g thin, sli. to mod. argill., med. gray bed 140.4g-141.7g med. thick, sli. to mod. argill., med. to dk. gray bed
135									
140									
		C5	142.0	152.0	100	100			142.5g-142.7g thin, v. argill., soft to med. hard, dk. gray bed 144.3s-144.4s v. thin, v. argill., dk. gray bed 146.9g-147.1s thin, v. argill., dk. gray bed 149.8g-150.9g med. thick, mod. to v. argill., dk. gray bed
145									
150									
		C6	152.0	162.0	100	100			153.8g-155.0g med. thick, mod. to v. argill., dk. gray bed 159.0g-159.7s thin, sli. argill., med. gray bed 159.7s-159.9s thin, v. argill., dk. gray bed 161.0g-161.6g thin, sli. argill., med. gray bed 161.6g-162.0g thin, v. argill., dk. gray bed
155									
160									

DRILLING GEOLOGIST Scott E. Iesikar ASSISTANT Jack L. Cooper CHECKED BY W.D. Flanigan

LOG OF BORING

BORING NO: B22-90 PG 5 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 273,231 feet
E 2,172,395 feet

GROUND EL: 735.6 feet

DATE: 3/30/90 TYPE: Wash/NX Core(1) 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.
		C6		162.0	100	100			
165		C7	162.0	172.0	100	100			
170									
175		C8	172.0	182.0	100	64			
180									
185		C9	182.0	192.0	100	100			
190									
195		C10	192.0	202.0	100	100			
200									

SAMPLE LEGEND

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

WATER INFORMATION

No detectable water loss observed
Wet Rotary Wash/Core hole, water level not determinable

DESCRIPTION OF STRATUM

LIMESTONE (Austin Chalk), fresh, med. to mod. hard, sli. fossil., occ. pyrite, lt. gray w/ 0.6 to 2.6ft. thick, sli. argill. to v. argill. interbeds spaced 0.8 to 4.2ft. apart

166.2g-167.2g med. thick, mod. argill., med. to dk. gray bed
166.2-166.5 abundant pyrite
168.0g-170.6g med. thick, mod. to v. argill., dk. gray bed
169.4-169.7 abundant Inoceramus prisms
171.4g-172.0g thin, mod. argill., med. to dk. gray bed

173.0g-174.0g med. thick, mod. to v. argill., arenaceous bed w/ abundant Inoceramus prisms

174.0g Transition Zone, v. argill., arenaceous, fossil. (bioclastics), dk. gray

175.9s

SHALE (Eagle Ford), fresh, soft to med. hard, v. thinly bedded v. fine grained, non-calc., sli. fossil., dk. gray w/ lt. brown, non-calc., mod. hard inclusions and occ. calcareous, arenaceous interbeds

175.9-178.8 ~12 fractures, slks, most incipient, clean, closed, fresh, 30°-60°, various orientations
180.1-182.0 ~15 fractures, same characteristics as above
186.5g-187.5g med. thick, calcareous, arenaceous bed
188.8-190.0 ~5 fractures, slks., most incipient, clean, closed, fresh, 30°-60°, various orientations
192.0-202.0 ~2 to 4 fractures/ft, slks., most incipient, clean, closed, fresh, 30°-60°, various orientation
193.1-199.65 non-calc. inclusions, mod. hard, lt. brown- all 1/2" thick except as noted @193.1 (~1-1/2"), 193.9, 194.15, 196.0, 196.75, 197.15, 198.05, 198.45 & 199.65
194.4 30° fracture, slks., rough, clean, closed, fresh
198.9 30° fracture, slks., sli. rough, clean, closed, fresh
200.55 30° fracture, slks., sli. rough, clean, closed, fresh

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY W.D. Flanigan

LOG OF BORING

BORING NO: B22-90 PG 6 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 273,231 feet
E 2,172,395 feet

GROUND EL: 735.6 feet

DATE: 3/30/90 TYPE: Wash/NX Core (1) 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.
		C 10		202.0					
		C11	202.0	212.0	100	100			
		C12	212.0	222.0	100	100			
		C13	222.0	232.0	100	100			
205									
210									
215									
220									
225									
230									
235									
240									

SAMPLE LEGEND

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

WATER INFORMATION

No detectable water loss observed
Wet Rotary Wash/Core hole, water level not determinable

DESCRIPTION OF STRATUM

SHALE (Eagle Ford), fresh, soft to medium hard, v.thinly bedded, v.fine grained, non-calcareous, dark gray, w/ occasional pyrite, calcareous concretions and thin arenaceous interbeds.

204.0-208.0	~25 fractures, slks., incipient, most 20°-30°, clean, closed, fresh
207.95	40° fracture, slks., smooth, clean, closed, fresh
209.8-209.9	calcareous concretion (septarian), mod. hard, lt.gray w/calcite crystals
213.6-214.3	calcareous concretion (septarian), mod. hard, lt.gray, w/calcite crystals
217.6g-218.3g	thin, calcareous, arenaceous bed
225.0	45° fracture, slks., rough, closed, fresh, w/ small amount of pyrite crystals along fracture surface
225.4	25° fracture, slks., sli.rough, clean, closed, fresh
228.0-229.0	~6 fractures, incipient, slks., most 20°-40°, clean, closed, fresh
229.8	mod.hard, non-calc., lt.brown inclusion, ~1/2" thick
230.8	~1/4" thick pyrite lens

Total Depth: 232.0' 3-30-90

(1) Rotary wash boring from 0.0' to 102.0';
Rotary core boring from 102.0' to 232.0'
(2) Wireline Logged: 3-31-90
(3) NX Boring Plugged: 3-31-90

DRILLING GEOLOGIST Scott E. Lesikar ASSISTANT Jack L. Cooper CHECKED BY W.D. Flanigan

LITHOLOGIC LOG

BORING B 1807

LOG OF BORING

BORING NO: B1807 PG 1 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 276,407 Feet
E 2,173,313 Feet

GROUND EL: 716.7 Feet

DATE: 3/27/90 TYPE: Wash/NX Core(1) 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
									CLAY, (Residual Soil), sli.silty, dk.brown, w/small (up to 1/2" dia.) weath. limestone fragments (CH)
									1.5 LIMESTONE (Austin Chalk), highly weathered, med. to mod. hard, white to tan, w/soft to med. hard argillaceous (clay) interbeds and occasional iron-staining.
5									
10									
									13.5
									LIMESTONE (Austin Chalk), fresh, med. to mod. hard, lt. gray w/soft to med. hard, dk. gray argillaceous/shaly interbeds
15									
20									
25									
30									
35									
40									

SAMPLE LEGEND

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

WATER INFORMATION

Slight water loss (~3—4 gal/min) from 4.0'- gradually decresed w/depth.
Wet Rotary Wash/Core hole, water level not determinable

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

LOG OF BORING

BORING NO: B1807 PG 2 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 276,407 Feet
E 2,173,313 Feet

GROUND EL: 716.7 Feet

DATE: 3/27/90 TYPE: Wash/NX Core(1) 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
										LIMESTONE(Austin Chalk),fresh,med.to mod.hard,lt.gray, w/ soft to med.hard,dk.gray argillaceous/shaly interbeds
45										
50										
55										
60										
65										
70										
75										
80										

SAMPLE LEGEND

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

WATER INFORMATION

Slight water loss (~3-4 gal/min) from 4.0'- gradually decresed w/depth.
Wet Rotary Wash/Core hole,water level not determinable

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

LOG OF BORING

BORING NO: B1807 PG 3 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 276,407 Feet
E 2,173,313 Feet

GROUND EL: 716.7 Feet

DATE: 3/27/90 TYPE: Wash/NX Core(1) CASED TO: 4.0' CONTRACTOR: MJA

SAMPLE LEGEND

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

WATER INFORMATION

Slight water loss (~3-4 gal/min) from 4.0'- gradually decresed w/depth.
Wet Rotary Wash/Core hole, water level not determinable

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
									LIMESTONE (Austin Chalk), fresh, med. to mod. hard, lt. gray w/soft to med. hard, dk. gray argillaceous/shaly interbeds
									84.6-85.3 thin, soft, bentonitic clay bed
85									
90									
95									
100									101.9-102.3 thin, soft bentonitic clay bed
105									
110									
115									
120				121.0			Started Coring		
		C1	121.0						

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

LOG OF BORING

BORING NO: B1807 PG 4 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 276,407 Feet
E 2,173,313 Feet

GROUND EL: 716.7 Feet

DATE: 3/27/90 TYPE: Wash/NX Core (1) CASED TO: 4.0' CONTRACTOR: MJA

SAMPLE LEGEND

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

WATER INFORMATION

Slight water loss (~3-4 gal/min) from 4.0'- gradually decresed w/depth.
Wet Rotary Wash/Core hole, water level not determinable

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
				121.0			Started Coring		LIMESTONE (Austin Chalk), fresh, med. to mod. hard, lt. gray, occ. pyrite sli. foss, w/0.2 to 4.1ft. thick sli. to v. argill. interbeds spaced 0.7 to 4.2ft. apart.
		C1	121.0	131.0	100	100			121.0-121.25s mod. argill., dk. gray bed (thickness not determinable) 123.35g-124.0g thin, sli. argill., med. gray bed 124.7g-125.1g thin, v. argill., dk. gray bed 125.8s-126.0s thin, v. argill., dk. gray bed 127.5g-128.3g thin, sli. argill., med. gray bed 130.3s-130.5s thin, v. argill., soft to med. hard, dk. gray bed
125									
130									
		C2	131.0	141.0	100	100	Stopped Drilling 3-27-90		133.5g-134.5g med. thick, mod. to v. argill., dk. gray 135.3g-136.2g thin, sli. argill., med. gray bed 137.6g-138.8g med. thick, mod. to v. argill., dk. gray bed
135									
140									
		C3	141.0	151.0	98	98	Started Drilling 3-28-90		143.0g-143.6g thin, sli. to mod. argill., med. gray bed 145.0g-146.1g med. thick, mod. to v. argill., dk. gray bed 147.3 ~1/2" dia. pyrite nodule 150.3g-151.0g thin, mod. argill., med. to dk. gray bed
145									
150									
		C4	151.0	161.0	100	100			152.1g-154.1g med. thick, mod. to v. argill., dk. gray bed w/ abundant Inoceramus prisms from 153.6' to 153.8' 154.1g-156.2g med. thick, sli. argill., med. gray bed 157.5g-158.55g med. thick, v. argill, dk. gray bed w/ Inoceramus prisms 158.55g becoming increasingly arenaceous 159.2g Transition Zone, med. thick, arenaceous, fossiliferous, argill., soft to med. hard bed 160.35s
155									
160									
									160.35s SHALE (Eagle Ford), fresh, soft to med. hard, v. fine grained sli. fossil. non-calc., dk. gray w/ pyrite nodules and mod. hard non-calc., lt. brown inclusions

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

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: B1807 PG 5 OF 6

LOCATION: N 276,407 Feet
E 2,173,313 Feet

GROUND EL: 716.7 Feet

DATE: 3/28/90 TYPE: Wash/NX Core(1) 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.
				161.0				
165		C5	161.0	171.0	100	100		
170								
175		C6	171.0	181.0	100	100		
180								
185		C7	181.0	191.0	100	100		
190								
195		C8	191.0	201.0	100	100		
200								

SAMPLE LEGEND

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

WATER INFORMATION

Slight water loss (~3-4 gal/min) from 4.0'- gradually decresed w/depth.

Wet Rotary Wash/Core hole, water level not determinable

DESCRIPTION OF STRATUM

160.35s SHALE(Eagle Ford), fresh, soft to med.hard, v. thinly bedded, v.fine grained, sli.fossil., non-calc., dk.gray w/pyrite nodules and mod.hard, lt.brown, non-calc. inclusions

160.75	40° fracture, slks., sli.rough, clean, closed, fresh
161.0-169.0	~2 to 3 incipient fractures/ft., clean closed, fresh, various orientations and angles
170.1-170.5	calcareous concretion, mod.hard, lt.gray w/calcite crystals inside
171.5g-171.9g	thin, arenaceous, mod.hard, fossil.bed
171.9-172.2	~6 incipient fractures, clean, closed, fresh, various orientations and angles
176.05	mod.hard, ~1/4" thick, lt.brown, non-calc. inclusion
177.0	mod.hard, ~1/4" thick, lt.brown, non-calc. inclusion
177.55	mod.hard, ~1/4" thick, lt.brown, non-calc. inclusion
178.35	mod.hard, ~1/2" thick, lt.brown, non-clac. inclusion
178.2-180.2	~11 incipient fractures, clean, closed, fresh, various angles and orientations
181.1	~1/4" thick pyrite lens
181.2-181.7	~10 incipient fractures, clean, closed, fresh, various angles and orientations
182.15	mod.hard, ~1/2" thick, lt.brown, non-calc. inclusion
182.15-182.35	calcareous concretion, mod.hard, lt.gray, w/calcite crystals
182.6	70° frac., slks., rough, clean, closed, fresh
185.2	~2" dia.pyrite nodule
185.2-185.8	~6 incipient fractures, clean, closed, fresh, various angles and orientations
186.4	mod.hard, ~1/4" thick, lt.brown, non-calc. inclusion
192.1	mod.hard, ~1/2" thick, lt.brown, non-calc. inclusion
195.5	~1/4" pyrite lens
197.0g-197.6g	abundant pyrite
197.3g-198.0s	thin, mod.hard, arenaceous, calc.bed

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

LOG OF BORING

BORING NO: B1807 PG 6 OF 6

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 276,407 Feet
E 2,173,313 Feet

GROUND EL: 716.7 Feet

DATE: 3/28/90 TYPE: Wash/NX Core(1) 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
		C8		201.0					SHALE(Eagle Ford),fresh,soft to med.hard,v.thinly bedded,v.fine grained,sli.fossil.,dk.gray w/pyrite nodules,mod.hard,lt.brown,non-calc.inclusions,calc. concretions
		C9	201.0	211.0	100	100			202.4-203.2 thin,calc.arenaceous,med.to mod.hard bed 204.5-207.2 ~18 incipient fracs.,clean,closed,fresh, various angles and orientations 206.0 35°frac.,slks.,rough,clean,closed,fresh, undulatory 207.2 35°frac.,slks.,rough,clean,closed fresh 208.0-208.25 mod.hard calc.concretion,lt.gray w/ calcite crystals
205									
210									
215									
220									
225									
230									
235									
240									

SAMPLE LEGEND

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

WATER INFORMATION

Slight water loss (~3-4 gal/min) from 4.0'- gradually decresed w/depth.

Wet Rotary Wash/Core hole,water level not determinable

Total Depth: 211.0 3-28-90

(1) Rotary wash boring from 0.0'to 121.0'; Rotary core boring from 121.0'to 211.0'

(2) Wireline Logged: 3-28-90

(3) NX Boring Plugged: 3-28-90

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

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. B 1737 Log Measured From: Ground Level

Drilling Parameters

Depth 247.0 feet

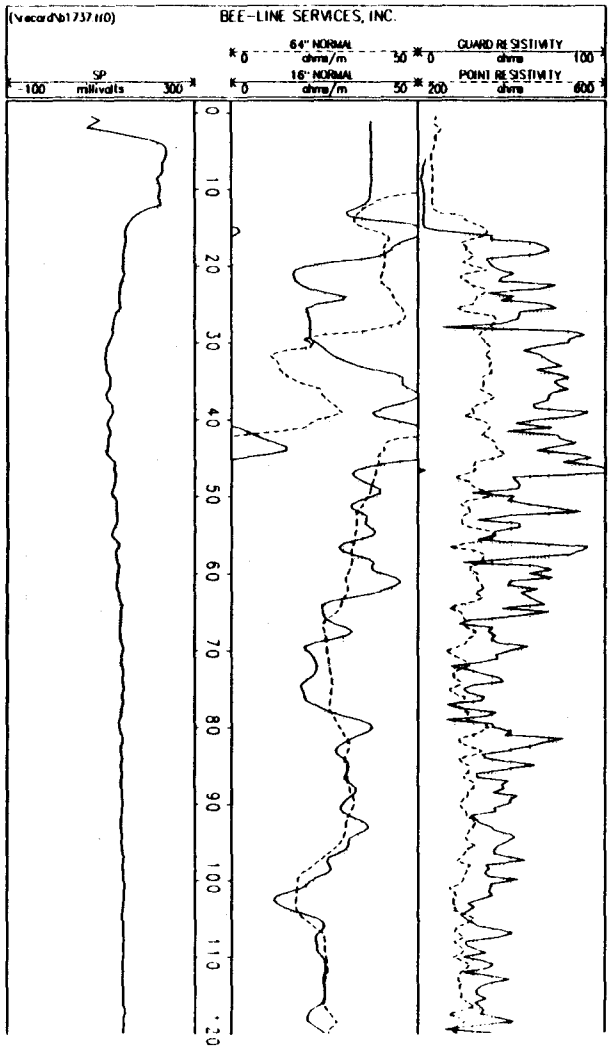
Bit Diameter 3.25 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	March 28, 1990	March 28, 1990	March 28, 1990
Bottom Log Interval	246.0 feet	246.0 feet	240.0 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	20 minutes	20 minutes	20 minutes
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

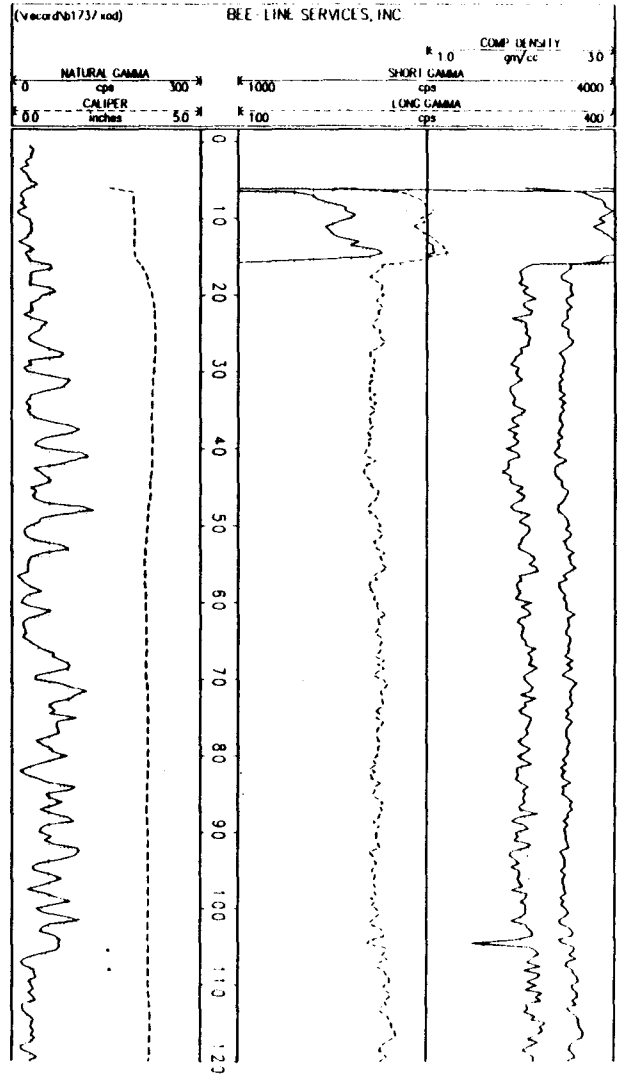
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

B 1737 Wire-line logs run March 28, 1990. Surface elevation 752.3 feet.

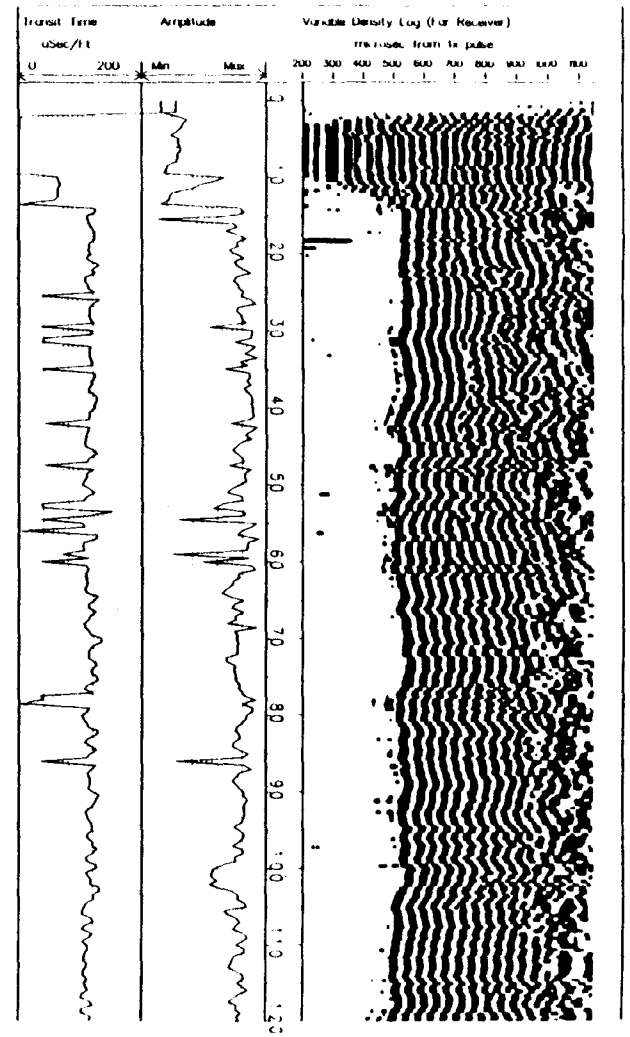
ELECTRICAL LOG



GAMMA LOG

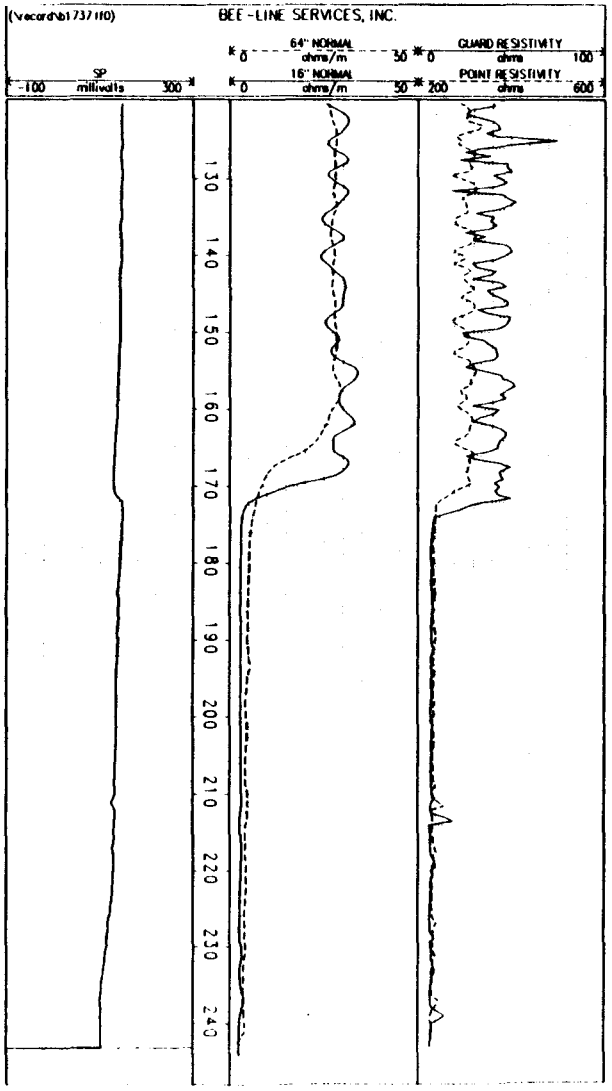


SONIC LOG

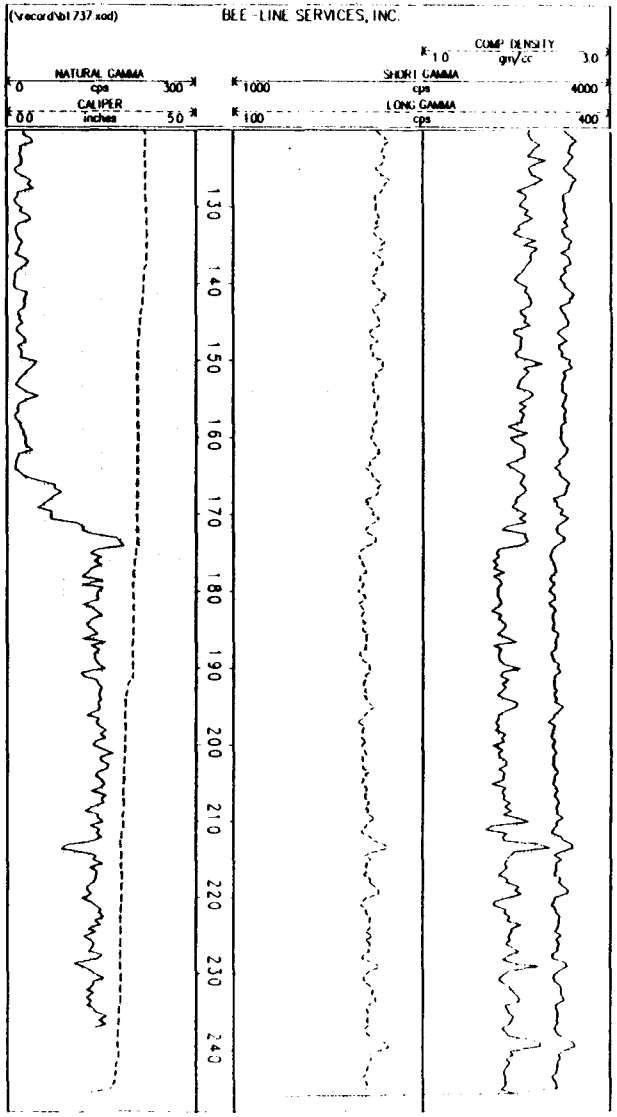


B 1737 Wire-line logs run March 28, 1990 (Continued). Surface elevation 752.3 feet.

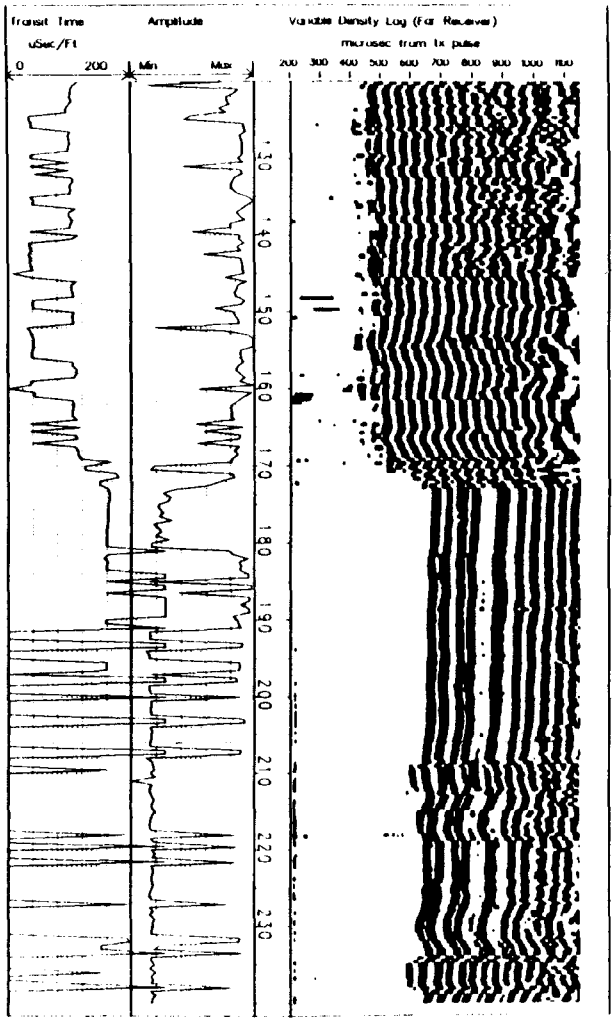
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



WIRE-LINE LOGGING PARAMETERS

Hole No. B 22-90 Log Measured From: Ground Level

Drilling Parameters

Depth 232.0 feet

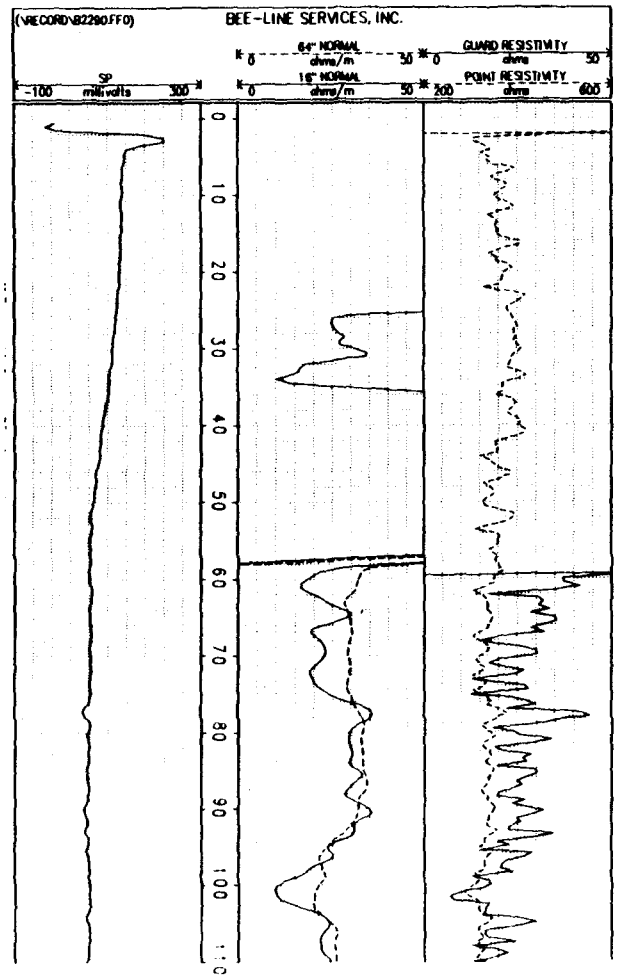
Bit Diameter 3.125 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	March 31, 1990	March 31, 1990	March 31, 1990
Bottom Log Interval	230.0 feet	228.5 feet	222.6 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling fluid	drilling fluid	drilling fluid
Time Since Circulation Stop	20 hours	20 hours	20 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

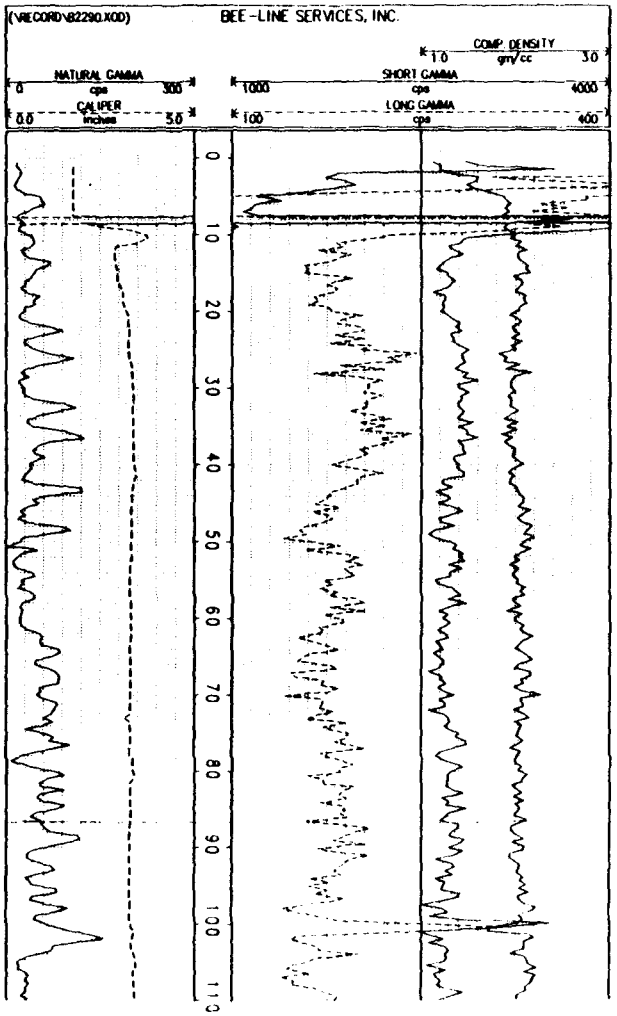
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

B 22-90 Wire-line logs run March 31, 1990. Surface elevation 735.6 feet.

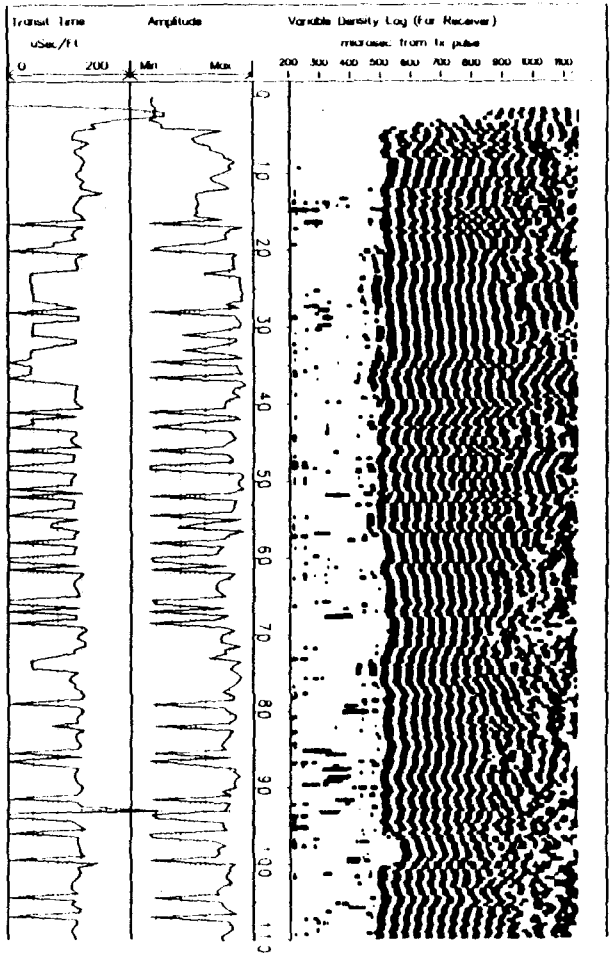
ELECTRICAL LOG



GAMMA LOG

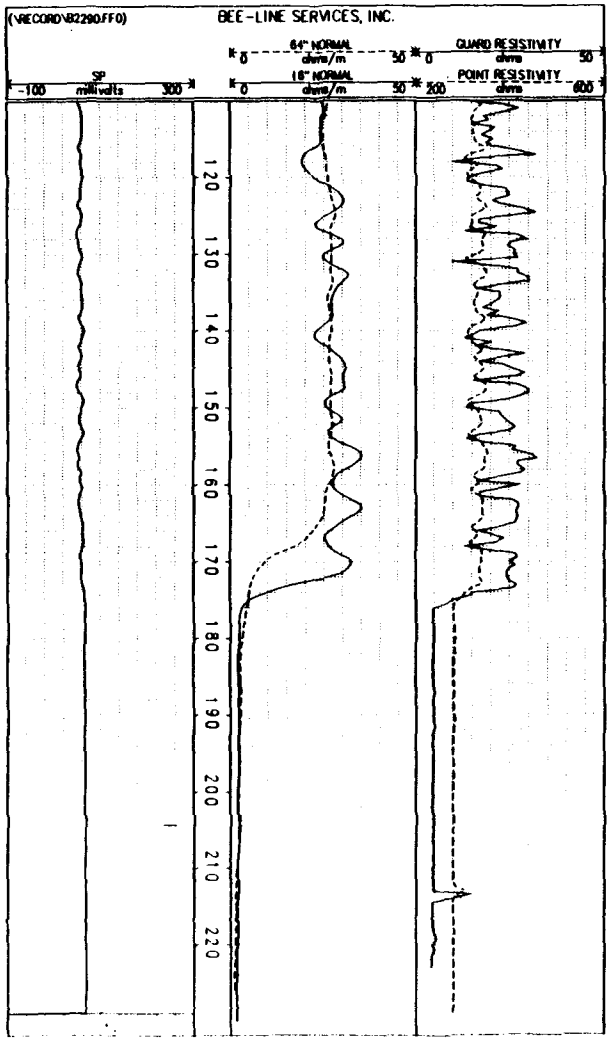


SONIC LOG

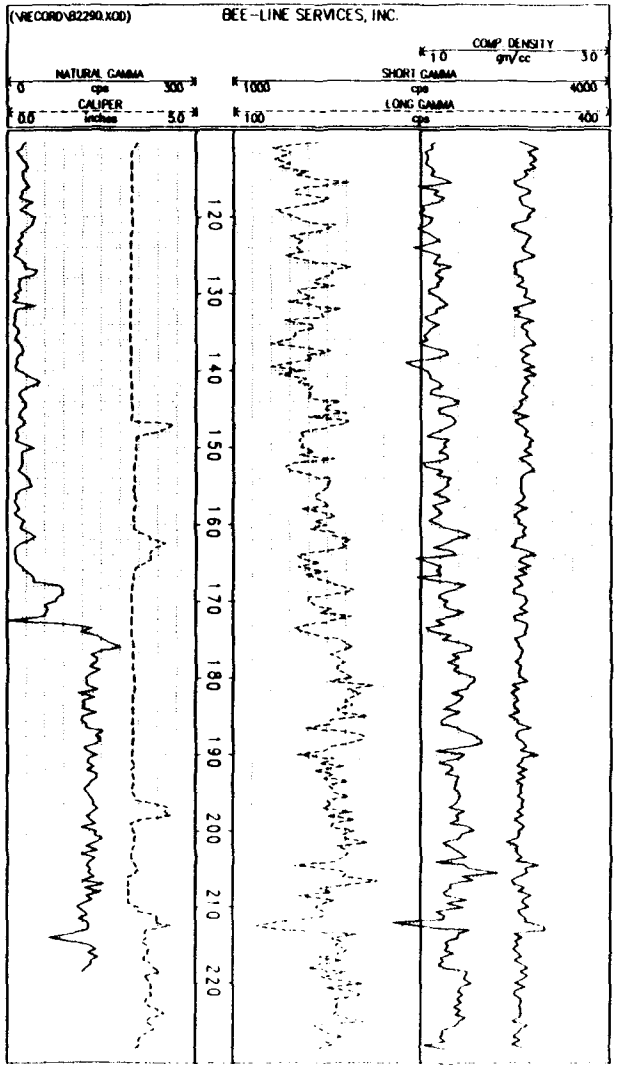


B 22-90 Wire-line logs run March 31, 1990 (Continued) Surface elevation 735.6 feet.

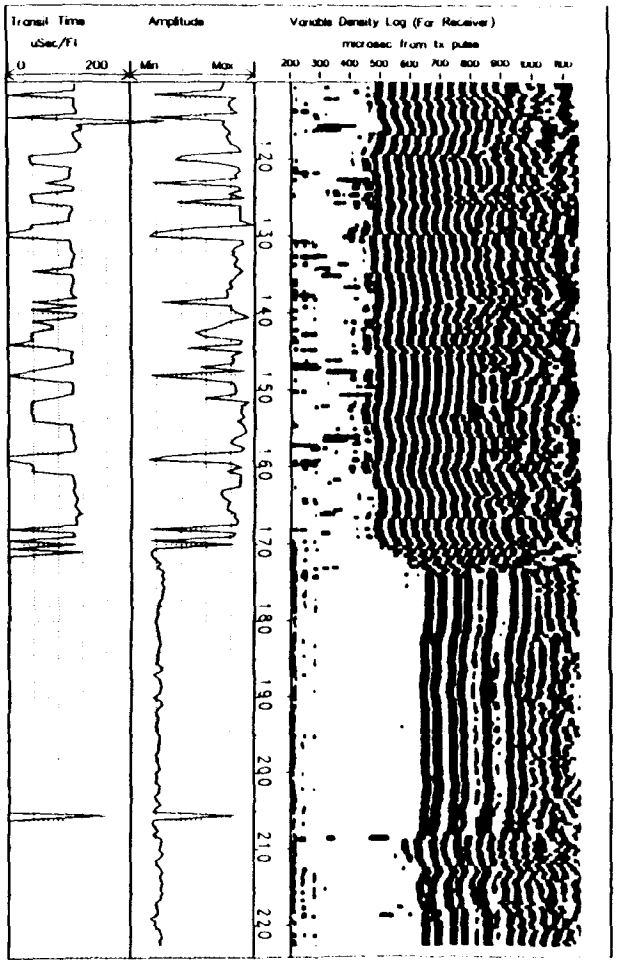
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



WIRE-LINE LOGGING PARAMETERS

Hole No. B 1807 **Log Measured From:** Ground Level

Drilling Parameters

Depth 211.0 feet

Bit Diameter 4.75 and 3.125 inches

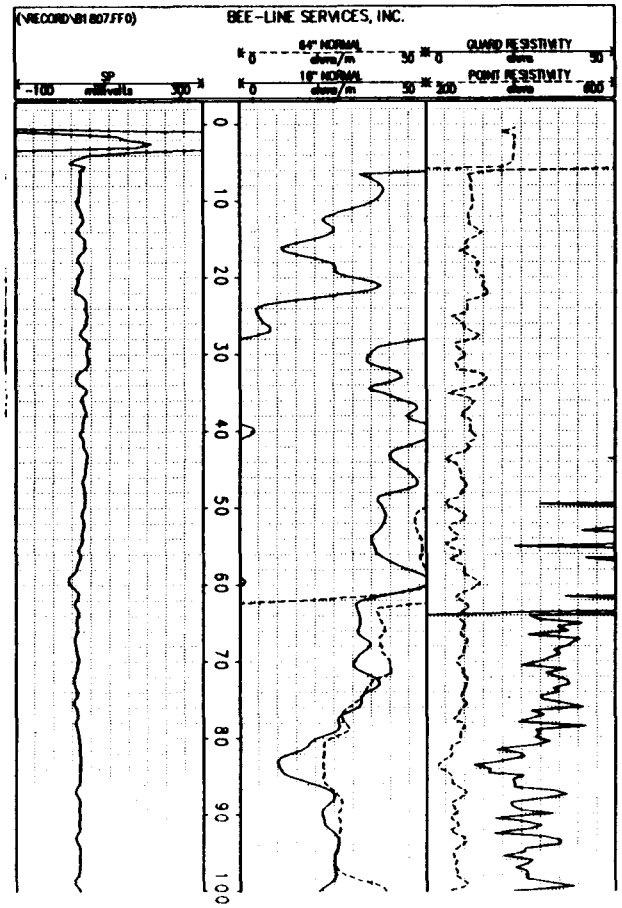
Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	March 28, 1990	March 28, 1990	March 28, 1990
Bottom Log Interval	209.0 feet	209.0 feet	205.0 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	45 minutes	45 minutes	45 minutes
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

Logged by:

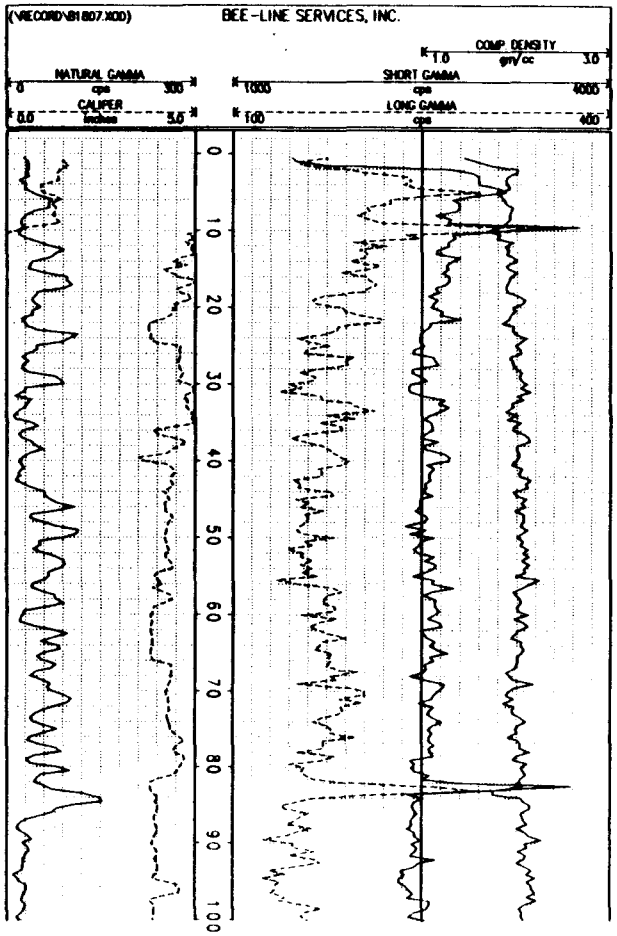
BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

B 1807 Wire-line logs run March 28, 1990. Surface elevation 716.7 feet.

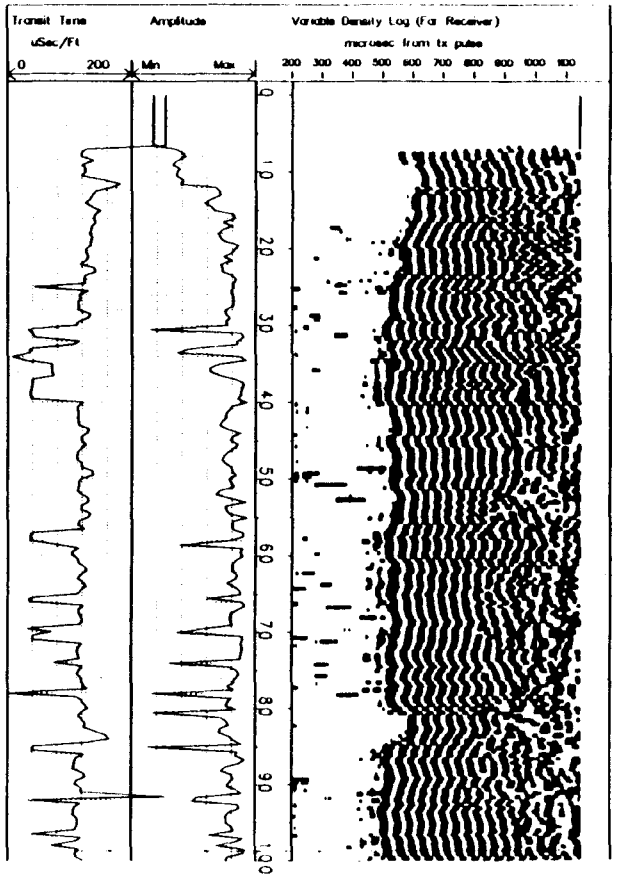
ELECTRICAL LOG



GAMMA LOG

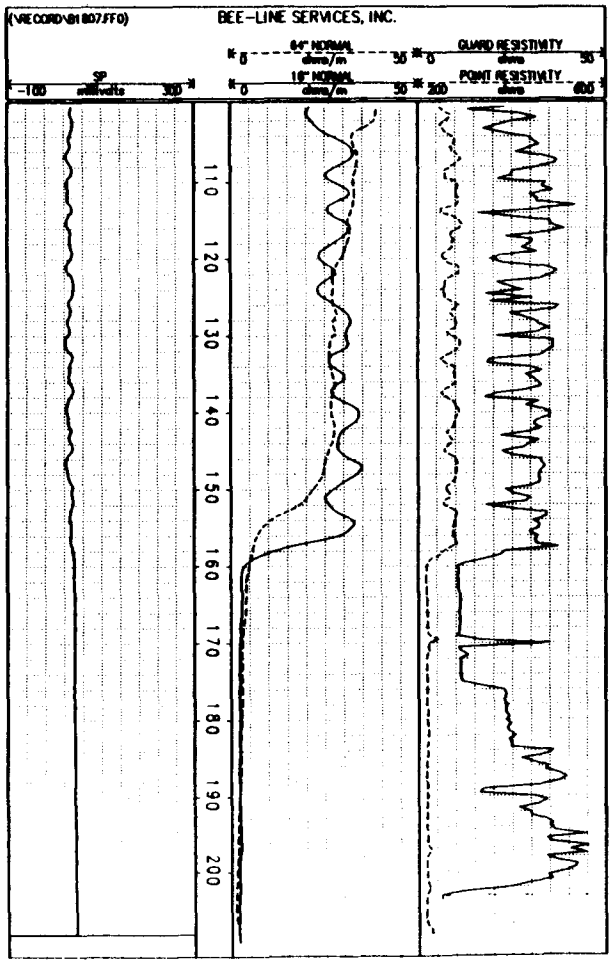


SONIC LOG

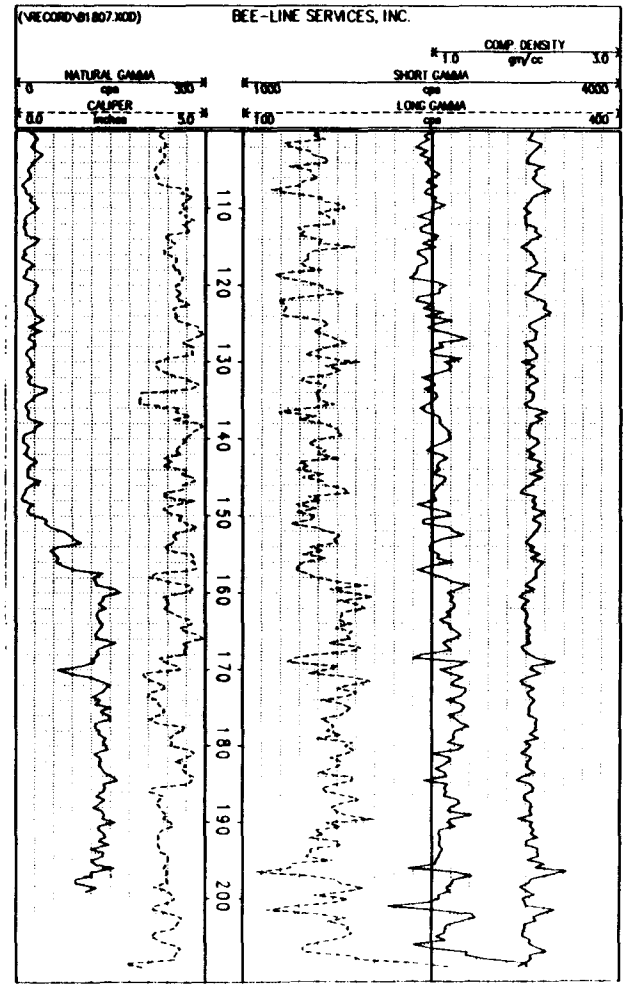


B 1807 Wire-line logs run March 28, 1990 (Continued). Surface elevation 716.7 feet.

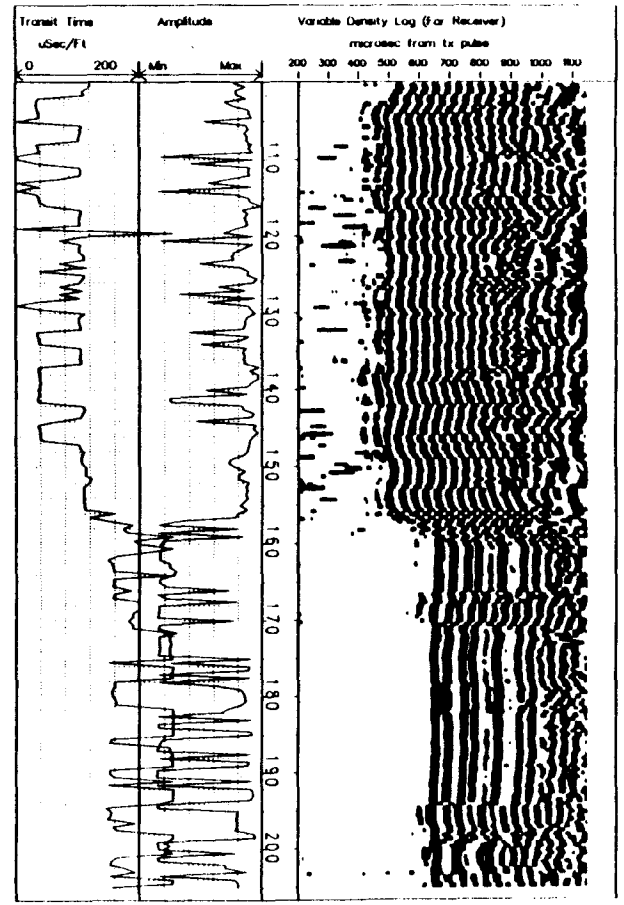
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



APPENDIX C

LABORATORY RESULTS

BULK AND CLAY MINERALOGY

TEST RESULTS

TABLE C-1. BULK AND CLAY MINERALOGY TEST RESULTS

Formation: Eagle Ford Shale

Boring: B 1737 **Depth:** 188.6-188.7

Whole Rock Composition:

Mineral	Percent
Not analyzed	

Absolute Clay Abundance:

Mineral	Percent
montmorillonite	61
illite	14
kaolinite	25
Total	100

Boring: B 22-90 **Depth:** 185.2-185.4

Whole Rock Composition:

Mineral	Percent
Not analyzed	

Absolute Clay Abundance:

Mineral	Percent
montmorillonite	69
illite	13
kaolinite	18
Total	100

Boring: B 1807 **Depth:** 163.2-163.5

Whole Rock Composition:

Mineral	Percent
Not analyzed	

Absolute Clay Abundance:

Mineral	Percent
montmorillonite	69
illite	14
kaolinite	17
Total	100

GEOMECHANICAL TEST RESULTS

GEOMECHANICAL TEST RESULTS

BORING B 1737

TABLE C-2. GEOMECHANICAL TEST RESULTS-BORING B 1737

GENERAL LITHOLOGY	VERTICAL 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 TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX percent	COMMENTS
AUSTIN CHALK	124.3	14.1	124.1																				
AUSTIN CHALK	124.7	13.4	121.9						2.4	D	1517			0.30	6.67		0						
AUSTIN CHALK	149.6	12.9	122.6																				
AUSTIN CHALK	149.8	11.6	126.7						2.3	D	1273			1.10	1.19		0						
AUSTIN CHALK	157.1	14.0	120.6																				
AUSTIN CHALK	157.4	14.2	121.1						2.4	E	2401			0.45	5.75		0						
AUSTIN CHALK	157.8	15.6	116.3																213				
AUSTIN CHALK	166.4	12.8	126.1																				
AUSTIN CHALK	166.8	12.1	124.2						2.3	D		100	2751	0.96	3.31		100						
AUSTIN CHALK	167.2	14.0	120.0	2.64					2.3	B-1/20		200	3360	1.06	4.39		200						
AUSTIN CHALK	168.9	14.9	118.6																				
AUSTIN CHALK	169.3	13.4	121.1						2.5	D	1702			1.72	0.87		0						
AUSTIN CHALK	171.9	13.4	120.0																				
AUSTIN CHALK	172.3	13.4	119.6																235				
AUSTIN CHALK	172.6	13.3	122.0																				
AUSTIN CHALK	173.0	13.3	122.7						2.4	D	426			0.73	0.56		0						
EAGLE FORD SHALE	177.2	19.5	113.6																				
EAGLE FORD SHALE	177.6	18.7	113.5		103	76	98.5	4.2	2.4	D	223			0.52	0.90		0						
EAGLE FORD SHALE	182.0	18.5	112.9																				
EAGLE FORD SHALE	186.5	18.8	110.3																				
EAGLE FORD SHALE	186.8	18.6	112.5		104	76	96.4	3.0	2.4	D	209			0.51	0.59		0						
EAGLE FORD SHALE	187.5	18.5	111.6																				
EAGLE FORD SHALE	187.8	18.2	112.8						2.3	D		200	315	1.70	0.64		200						
EAGLE FORD SHALE	188.2	18.4	114.2	2.72	112	73	99.8	5.8	2.4	B-1/30		300	298	1.51	0.61		300						
EAGLE FORD SHALE	220.2	11.6	123.0																				
EAGLE FORD SHALE	220.4	14.9	120.1		69	44	86.8	11.6	2.4	D	137			0.79	0.26		0						
EAGLE FORD SHALE	239.6	9.0	135.4																				
EAGLE FORD SHALE	240.0	7.9	137.7						2.2	B-1/20	795			0.70	1.26		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ISRM	ISRM	ISRM	ISRM	

B1737PRT.WK1
REVISION 1.0
DATE: 5/1/90

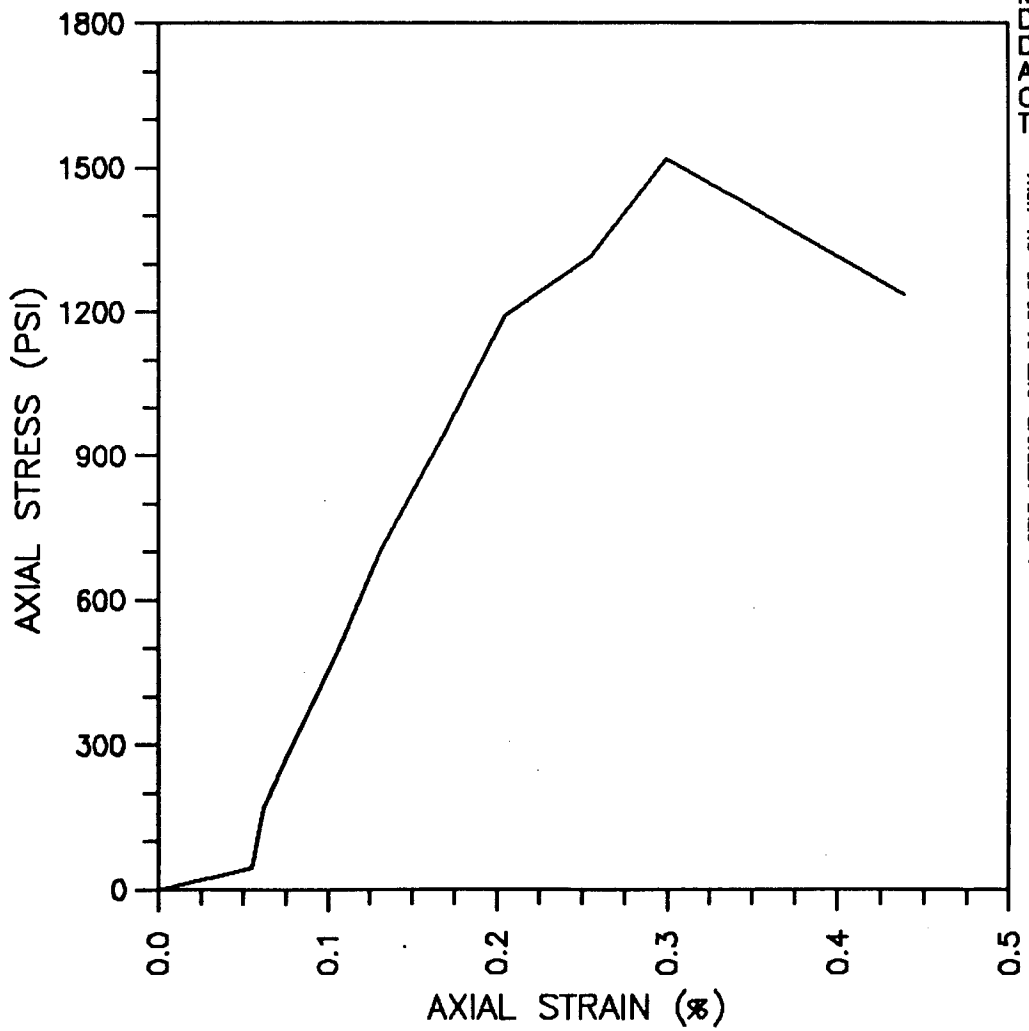
PRELIMINARY
(Subject to Revision)

* 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

Note: Some values in this table may be revised based on reviews of test procedures and individual test results. The reader should refer to the latest revision of the gINT geotechnical data base (geotechnical report GR-70).

BORING NO.: B1737
DEPTH (FT): 124.7
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.4
DRY UNIT WEIGHT (PCF): 121.9
DEG. OF SATURATION (%): 94.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 1737124.7 DATE: 04-30-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
6.667 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

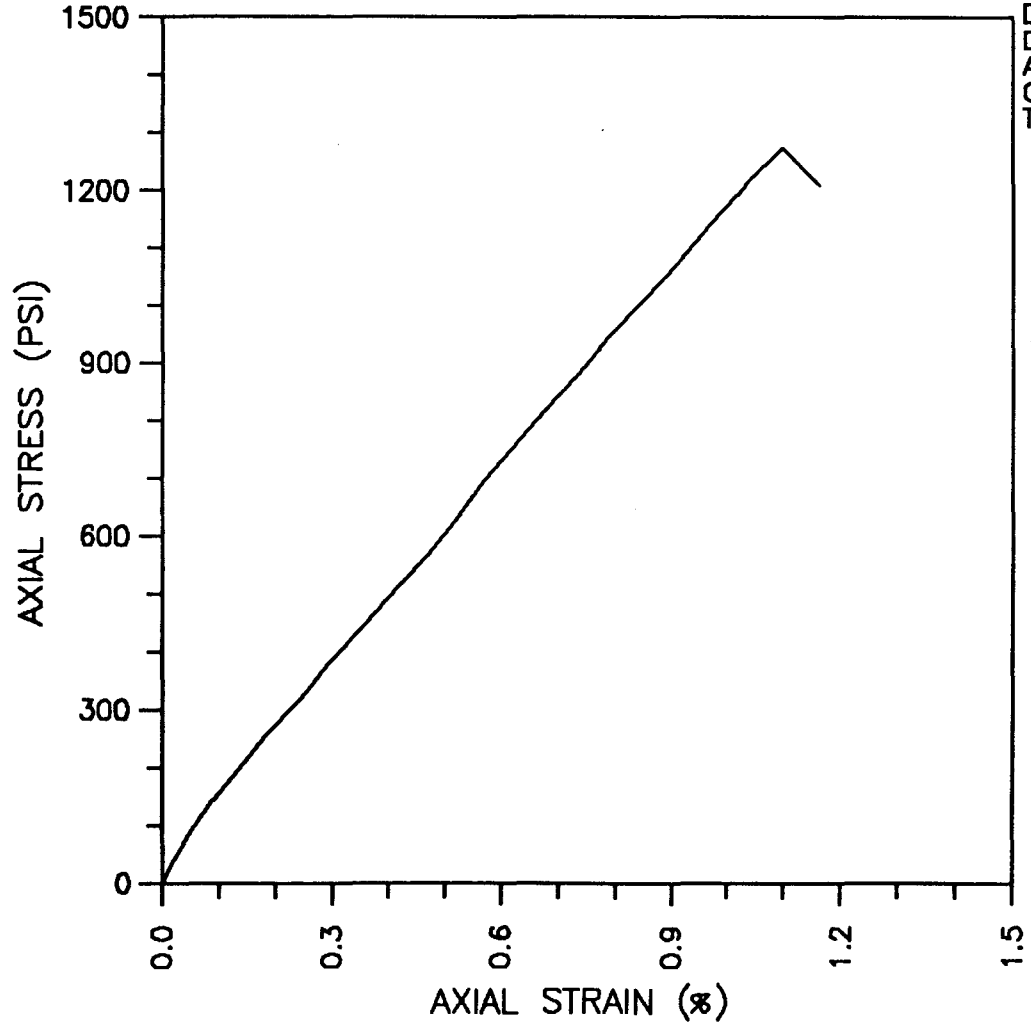
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 149.8
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 11.6
DRY UNIT WEIGHT (PCF): 126.7
DEG. OF SATURATION (%): 95.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

DFILE: 17371498 DATE: 04-30-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.186 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

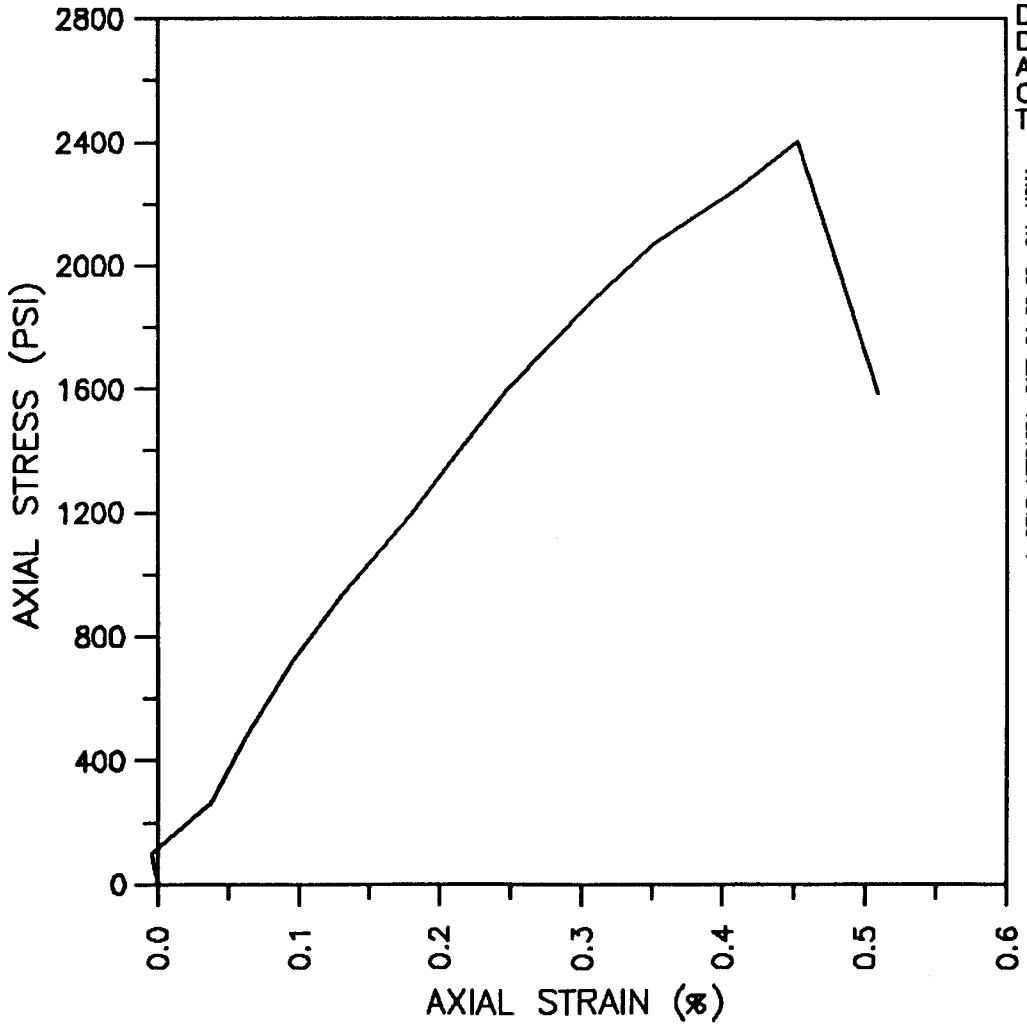
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 157.4
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.2
DRY UNIT WEIGHT (PCF): 121.1
DEG. OF SATURATION (%): 98.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 17371574 DATE: 04-30-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.747 x10E5 PSI

FAILURE MODE:
CONICAL FAILURE AT TOP

TEXAS SSC SITE

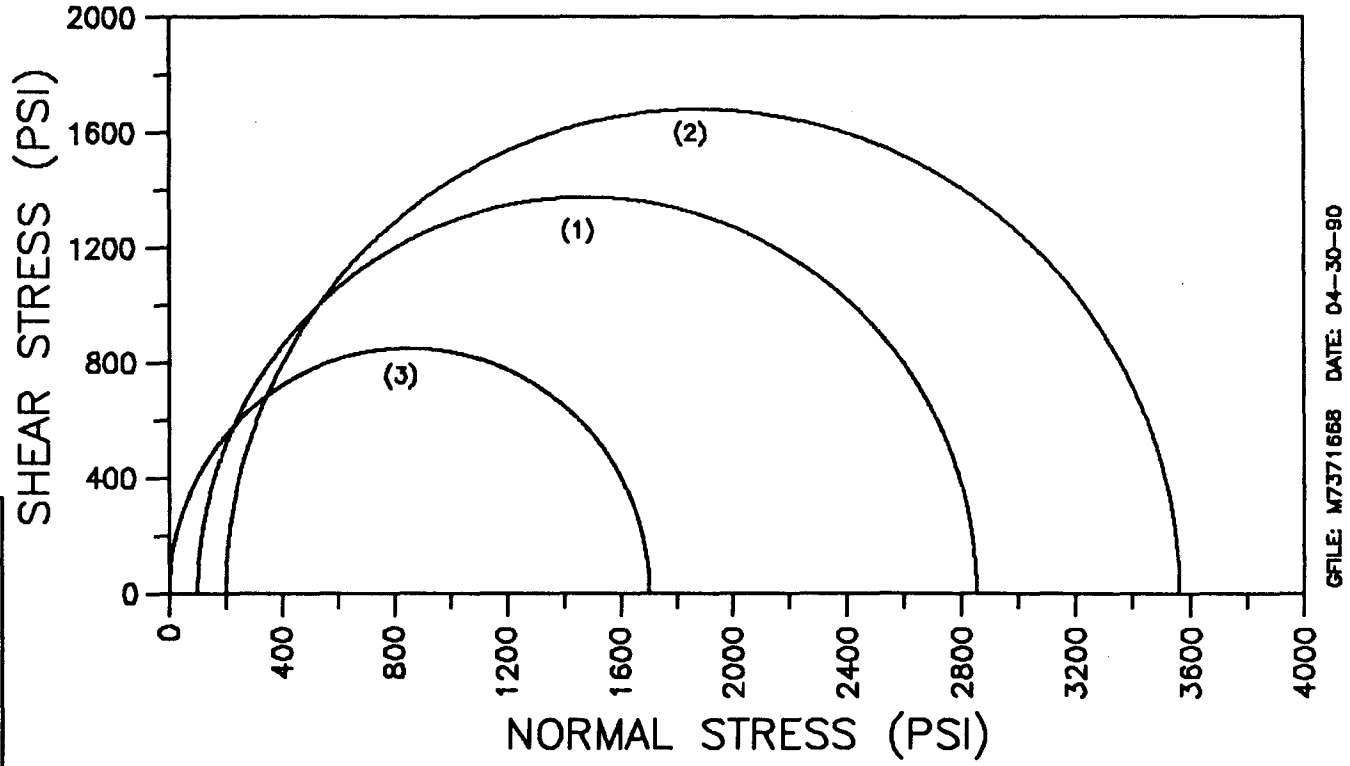
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH RANGE (FT): 166.8–169.7
AUSTIN CHALK LIMESTONE



GFILE: M7371668 DATE: 04-30-90

SEE STRESS-STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 166.8
(2) DEPTH (FT): 167.2
(3) DEPTH (FT): 169.3

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

TEXAS SSC SITE

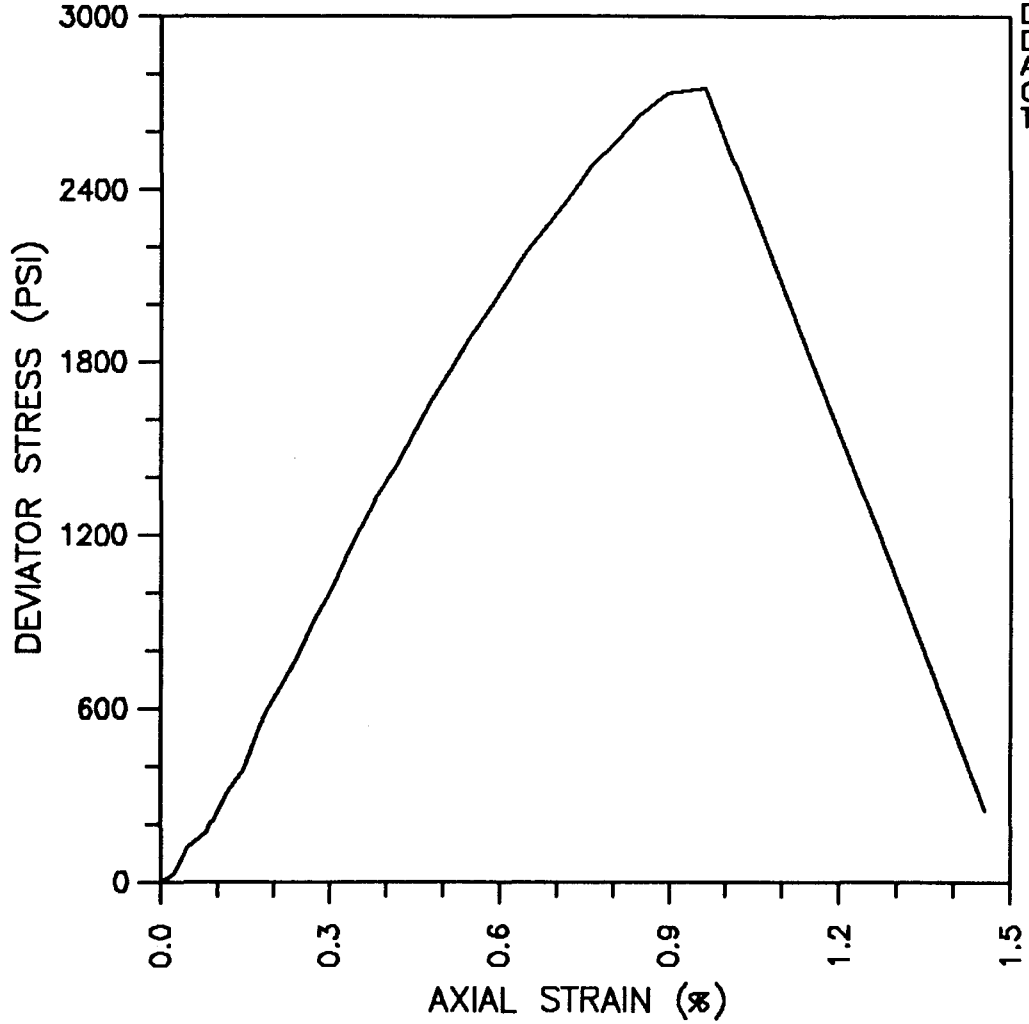
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 166.8
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.1
DRY UNIT WEIGHT (PCF): 124.2
DEG. OF SATURATION (%): 91.9
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

DFILE: 1737168B DATE: 04-30-90 CAL: MCT5

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.310 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

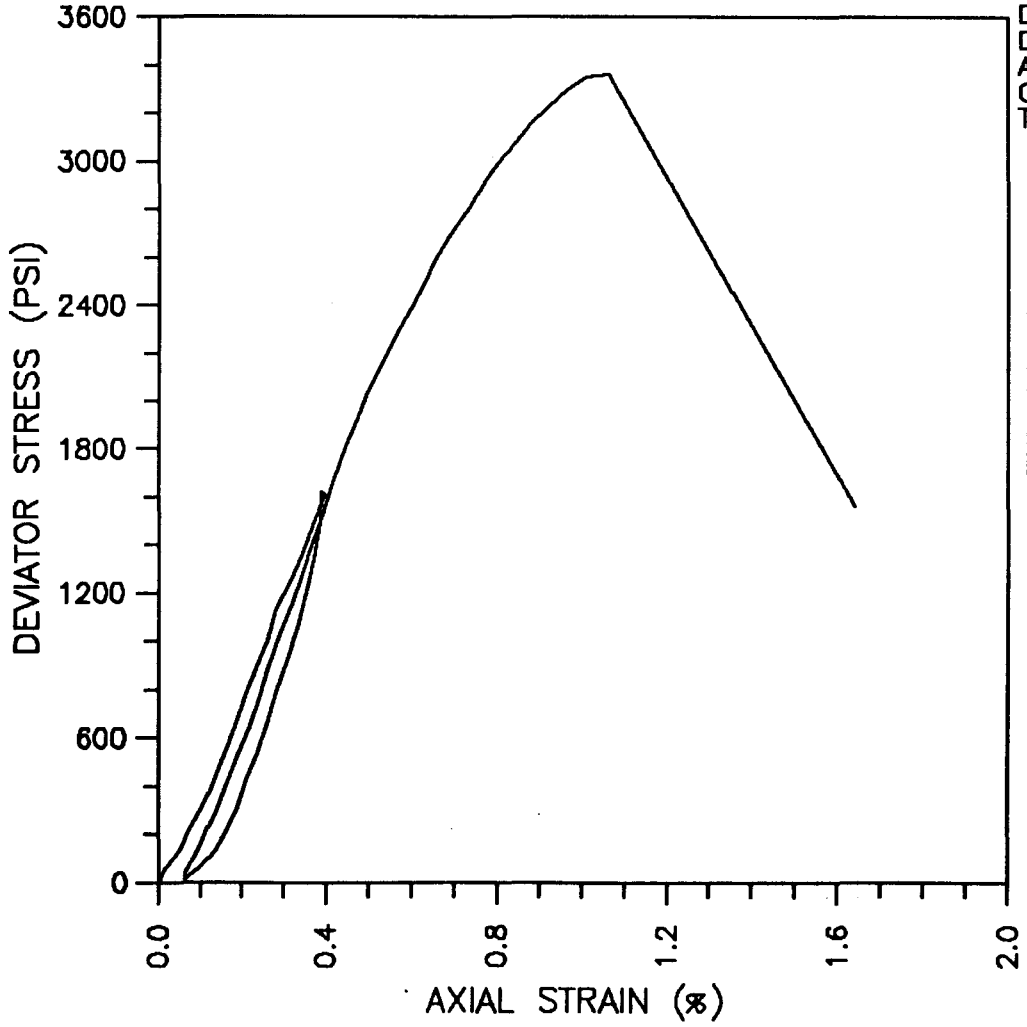
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 167.2
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.0
DRY UNIT WEIGHT (PCF): 120.0
DEG. OF SATURATION (%): 93.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

BFILE: 17371672 DATE: 04-30-90 CAL: MCT5

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.390 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 20 DEG.

TEXAS SSC SITE

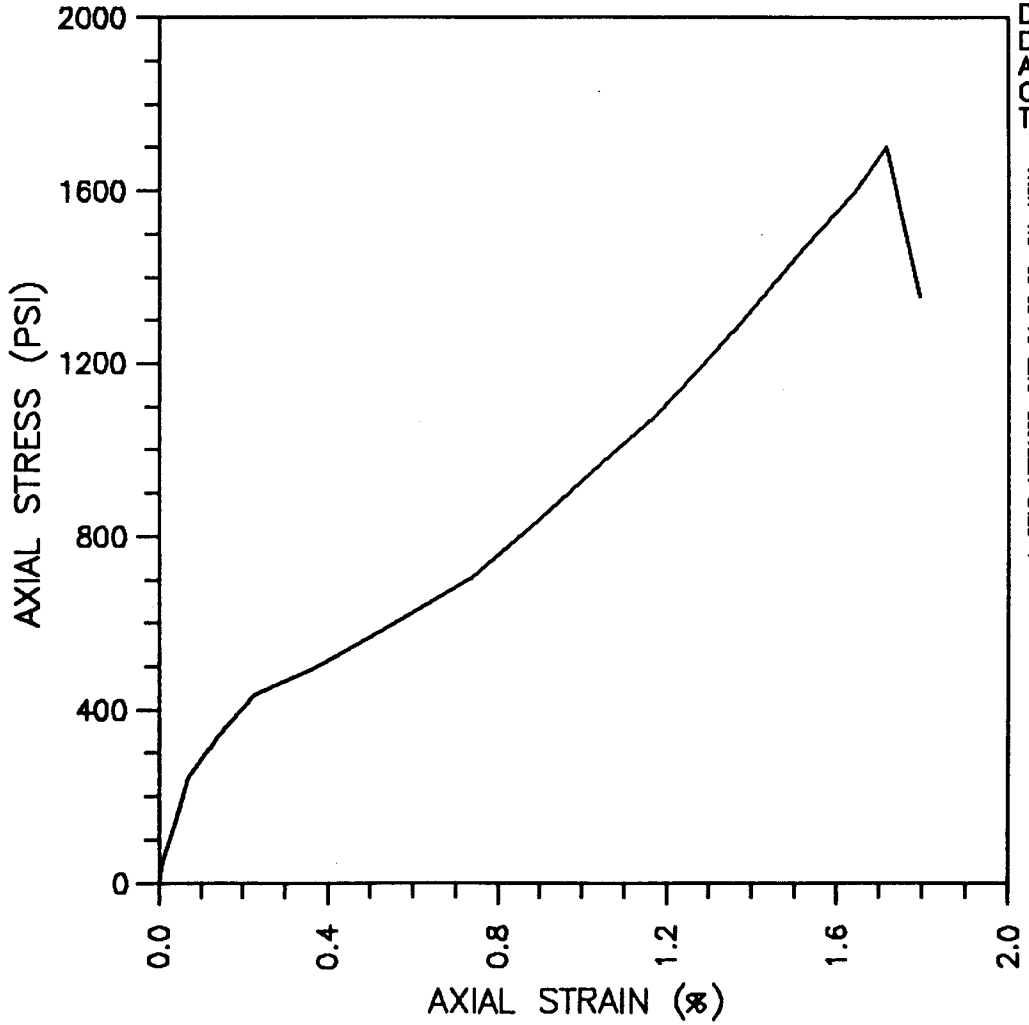
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 169.3
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.4
DRY UNIT WEIGHT (PCF): 121.1
DEG. OF SATURATION (%): 92.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: 17371683 DATE: 04-30-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.872 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

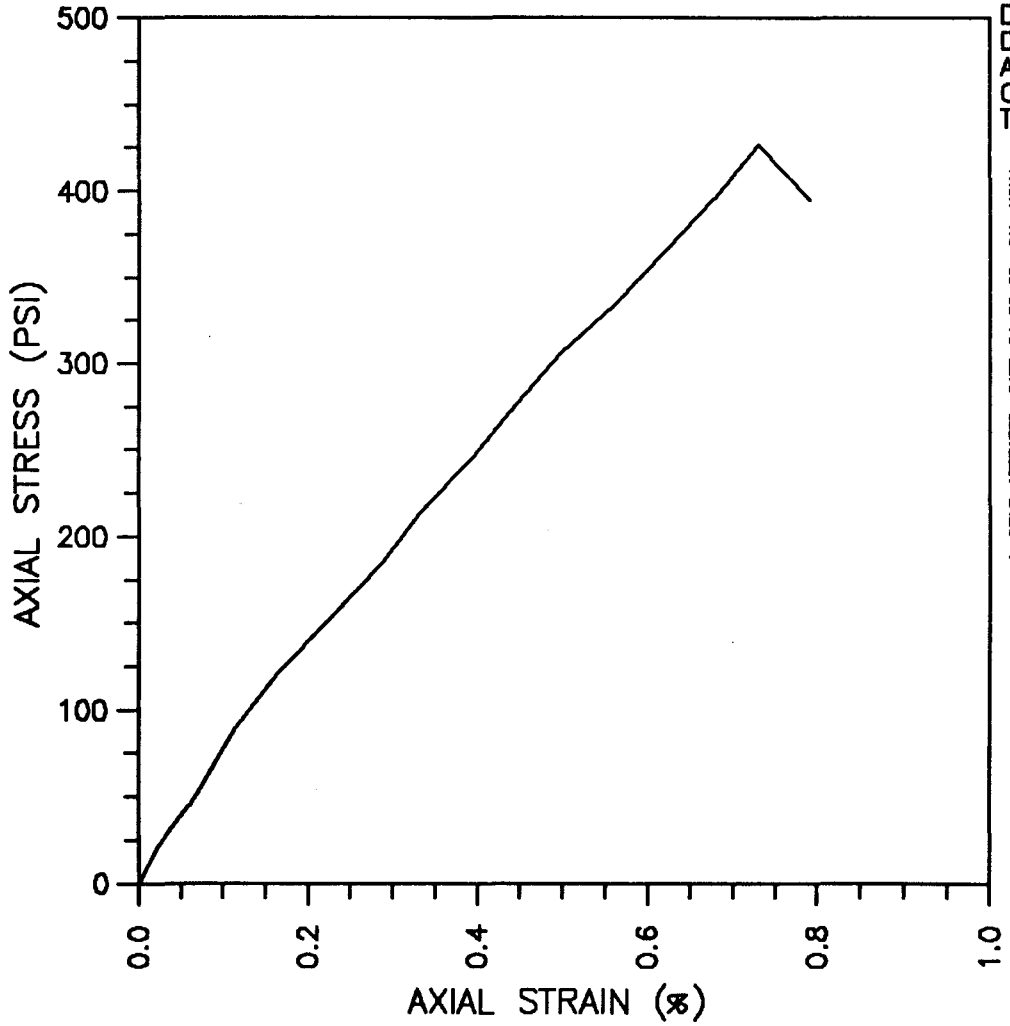
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 173.0
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.3
DRY UNIT WEIGHT (PCF): 122.7
DEG. OF SATURATION (%): 96.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFILE: 1737173D DATE: 04-30-00 CAL: MGU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.562 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

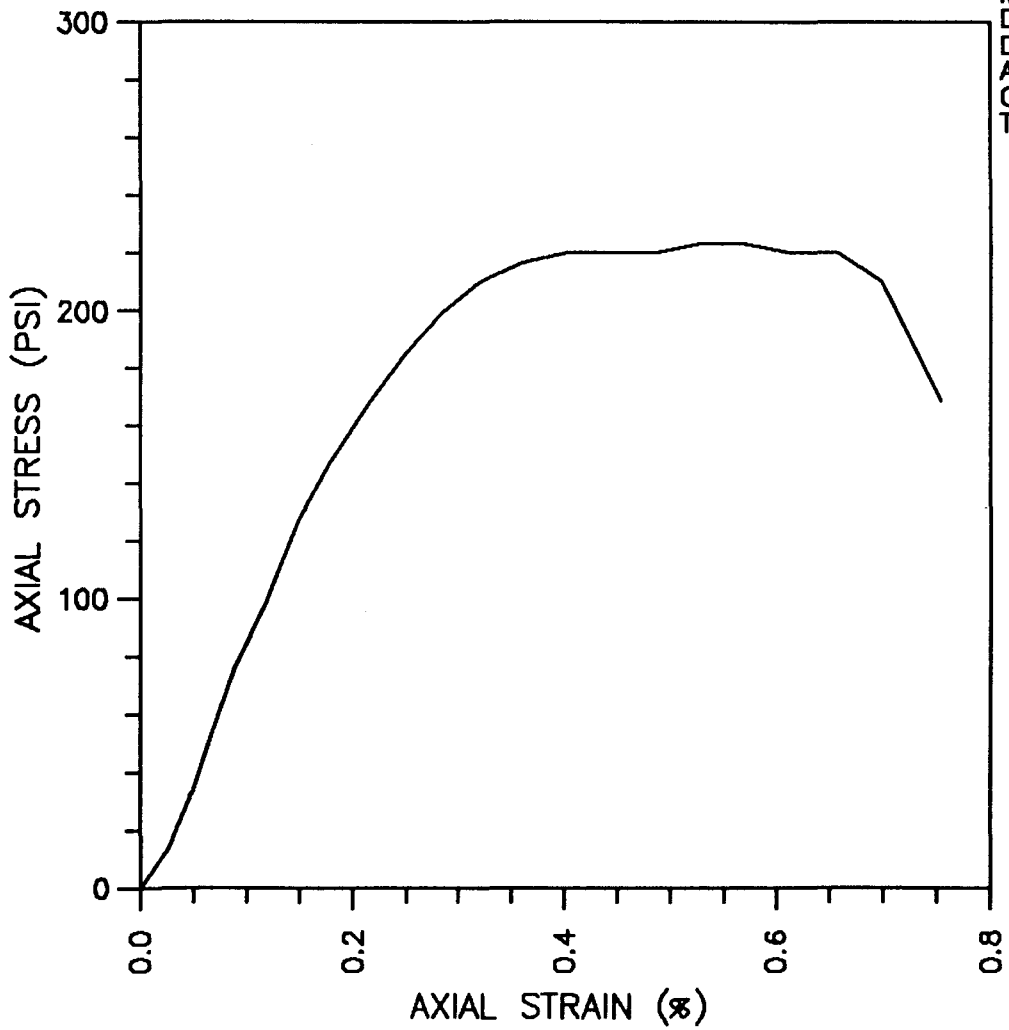
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 177.6
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 18.7
DRY UNIT WEIGHT (PCF): 113.5
DEG. OF SATURATION (%): 104.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFILE: 1737177B DATE: 04-30-90 CAL: MC34

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.896 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

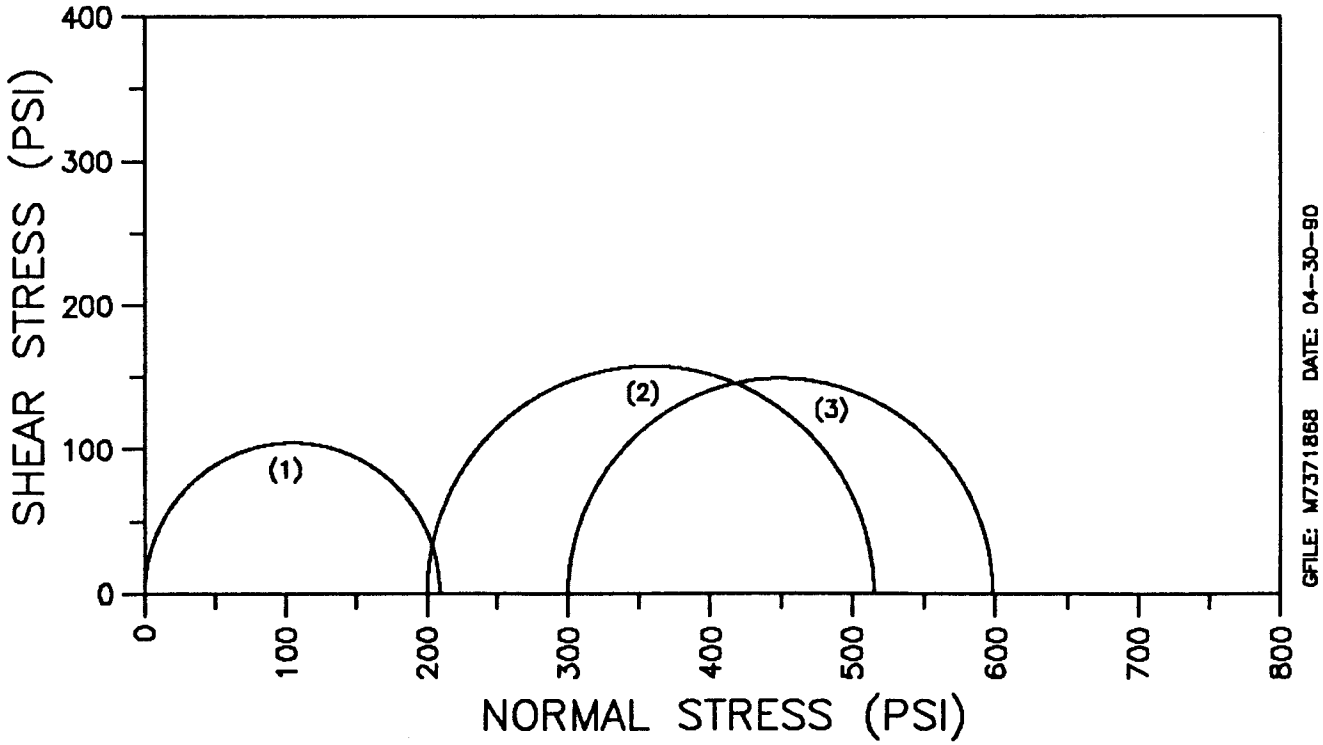
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH RANGE (FT): 186.8–188.6
EAGLE FORD SHALE



GFILE: M7371868 DATE: 04-30-90

SEE STRESS–STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 186.8
(2) DEPTH (FT): 187.8
(3) DEPTH (FT): 188.2

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

TEXAS SSC SITE

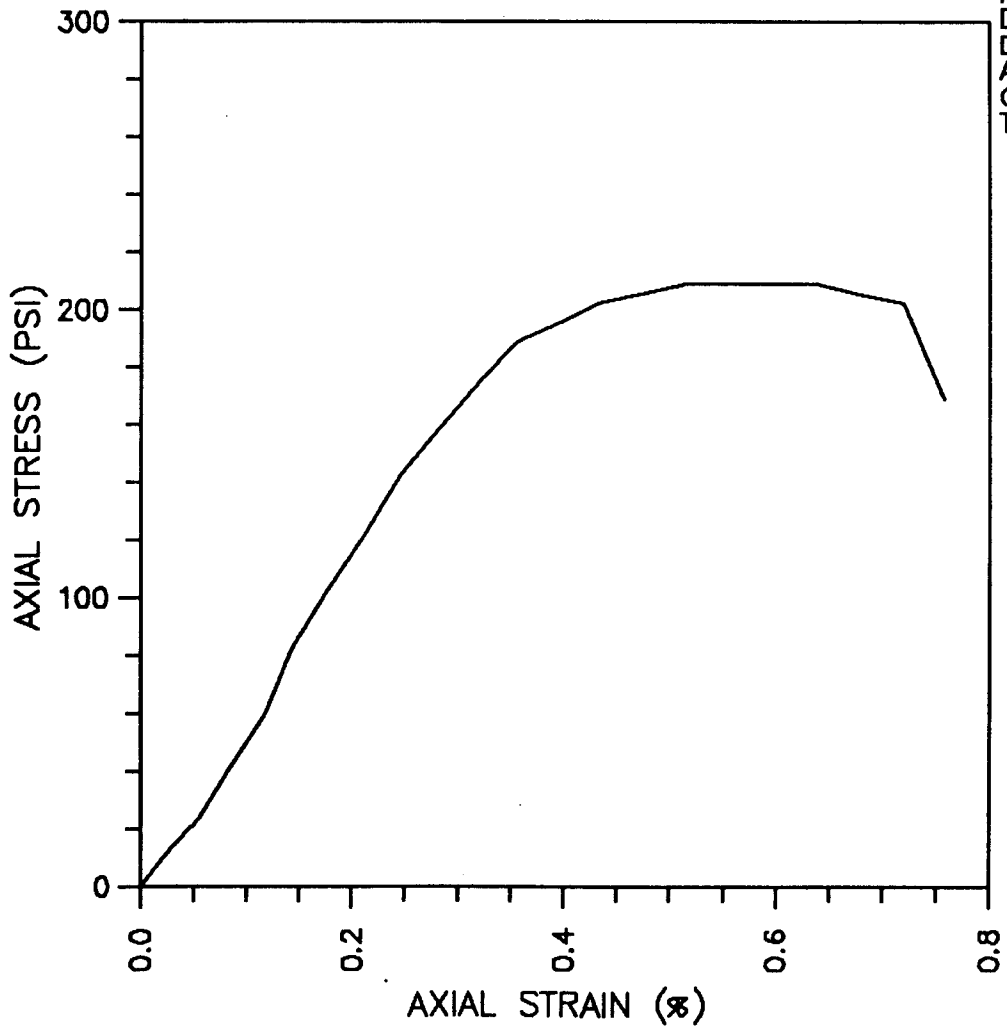
STRESS–STRAIN PLOT

MASON–JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS–ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 186.8
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 18.6
DRY UNIT WEIGHT (PCF): 112.5
DEG. OF SATURATION (%): 100.9
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 1737177B DATE: 04-30-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.588 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

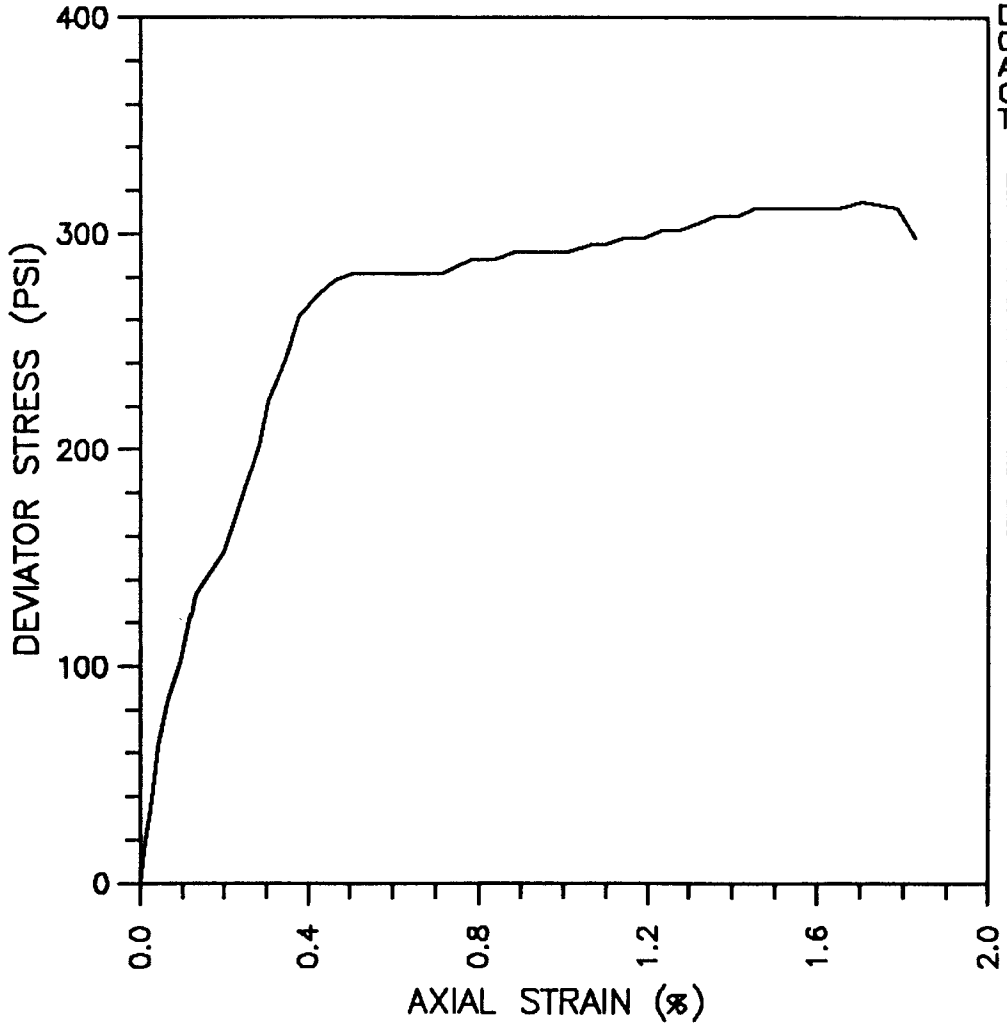
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 187.8
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 18.2
DRY UNIT WEIGHT (PCF): 112.8
DEG. OF SATURATION (%): 99.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

SFILE: 1737167B DATE: 04-30-90 CAL: MCTS

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.640 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

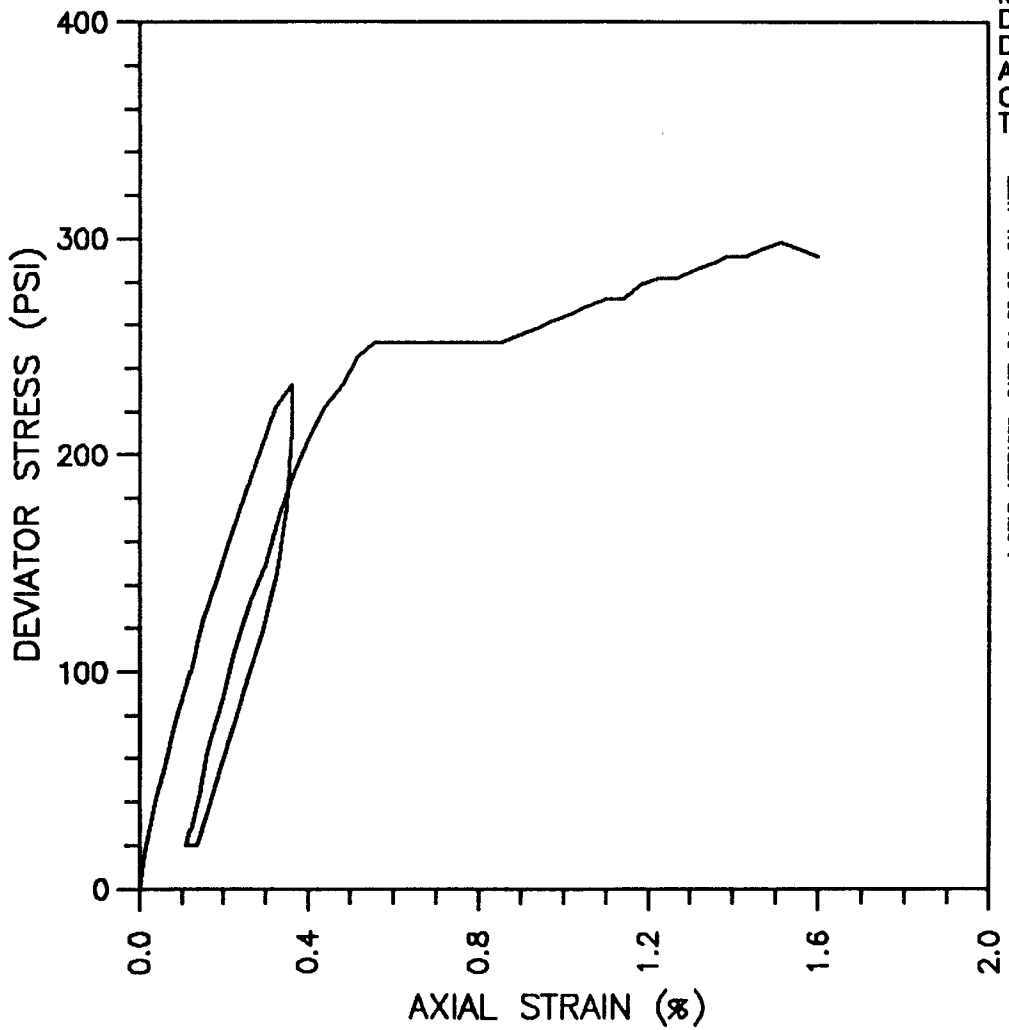
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 188.2
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 18.4
DRY UNIT WEIGHT (PCF): 114.2
DEG. OF SATURATION (%): 104.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 300
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

BFILE: 17371882 DATE: 04-30-00 CAL: MCTS

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.606 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 30 DEG.

TEXAS SSC SITE

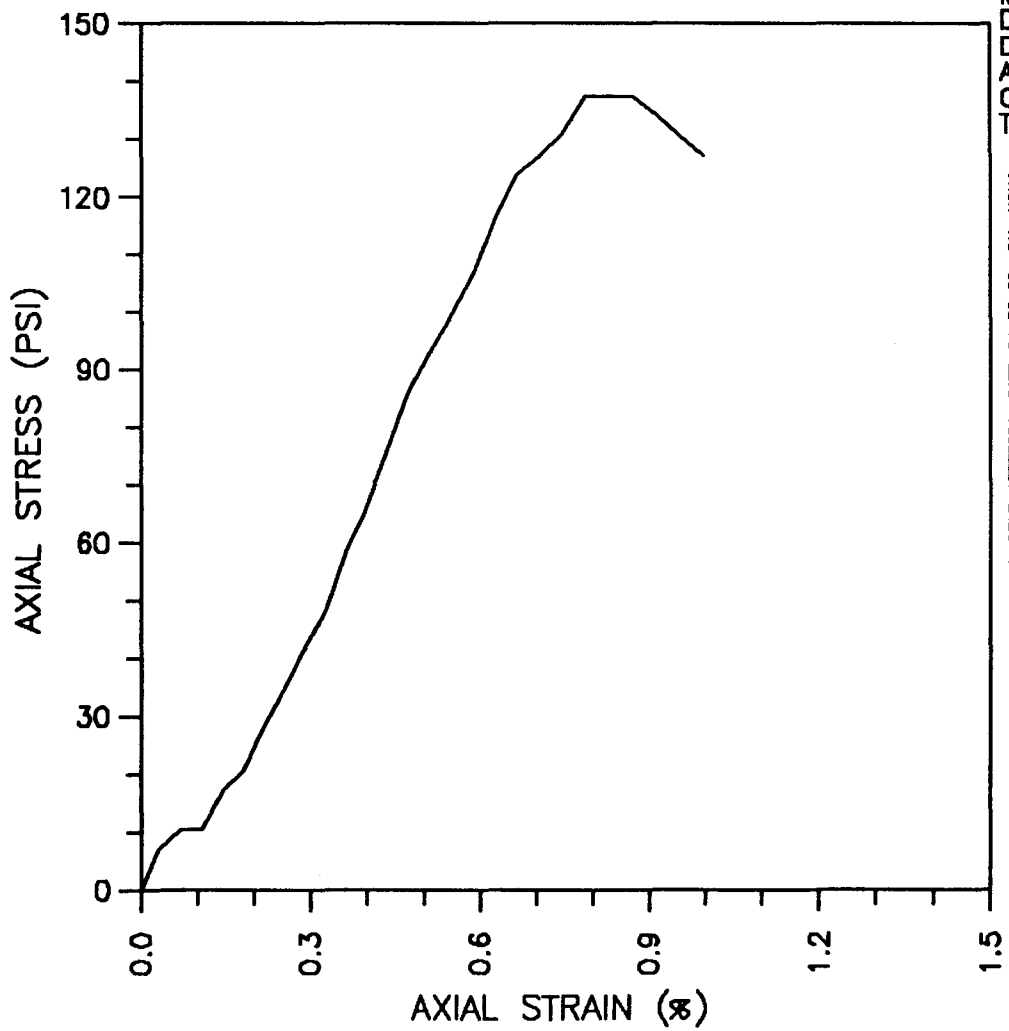
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 220.4
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.9
DRY UNIT WEIGHT (PCF): 120.1
DEG. OF SATURATION (%): 100.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFILE: 17372204 DATE: 04-30-00 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.260 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

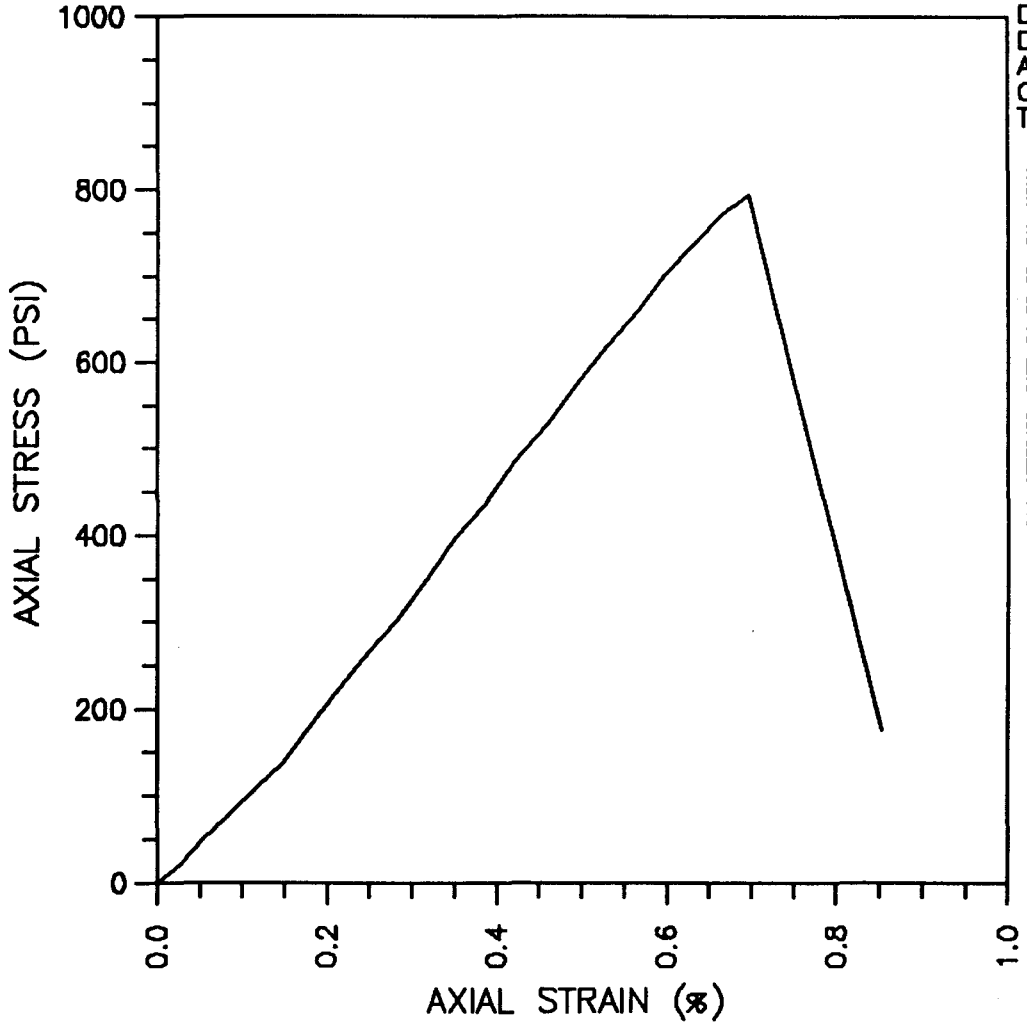
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1737
DEPTH (FT): 240.0
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 7.9
DRY UNIT WEIGHT (PCF): 137.7
DEG. OF SATURATION (%): 94.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 17372400 DATE: 04-30-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.258 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

GEOMECHANICAL TEST RESULTS

BORING B 22-90

TABLE C-3. GEOMECHANICAL TEST RESULTS-BORING B 22-90

GENERAL LITHOLOGY	VERTICAL 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 TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX percent	COMMENTS
AUSTIN CHALK	124.7	14.3	119.7																				
AUSTIN CHALK	125.1	14.1	120.9						2.4	D	2322			0.61	4.40		0						
AUSTIN CHALK	132.1	15.3	119.5																				
AUSTIN CHALK	157.2	12.9	123.1																				
AUSTIN CHALK	157.6	13.3	122.0						2.3	D	1978			0.44	6.04		0						
AUSTIN CHALK	169.8	14.5	115.8																				
AUSTIN CHALK	170.2	15.2	117.9	2.64					2.4	D		100	2793	0.60	5.87		100						
AUSTIN CHALK	172.0	13.2	121.5						2.5	D	1924			0.29	16.00		0						
AUSTIN CHALK	172.5	12.9	123.8																				
AUSTIN CHALK	174.0	12.5	121.7																				
AUSTIN CHALK	174.4	10.9	126.3						2.3	D	1900			0.97	2.37		0						
AUSTIN CHALK	174.8	11.2	125.8						0.6										252				
EAGLE FORD SHALE	182.9	17.6	115.3																				
EAGLE FORD SHALE	184.4	17.6	116.0																				
EAGLE FORD SHALE	184.8	17.2	116.6		91	61	98.9	10.2	2.4	D	245			0.51	0.47		0						
EAGLE FORD SHALE	185.6	16.7	117.0																				
EAGLE FORD SHALE	185.8	17.1																		16.6			
EAGLE FORD SHALE	186.6	17.3	115.5																				
EAGLE FORD SHALE	187.0	13.4	122.7						2.4	D	253			0.57	0.65		0						
EAGLE FORD SHALE	187.7	17.2	119.3																				
EAGLE FORD SHALE	227.0	15.1	121.6																				
EAGLE FORD SHALE	227.4	16.1	118.7		85	58	97.0	5.0	2.5	B-1/70	158			0.31	0.68		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ISRM	ISRM	ISRM	ISRM	

B2290PRT.WK1
REVISION: 1.0
DATE: 4/30/90

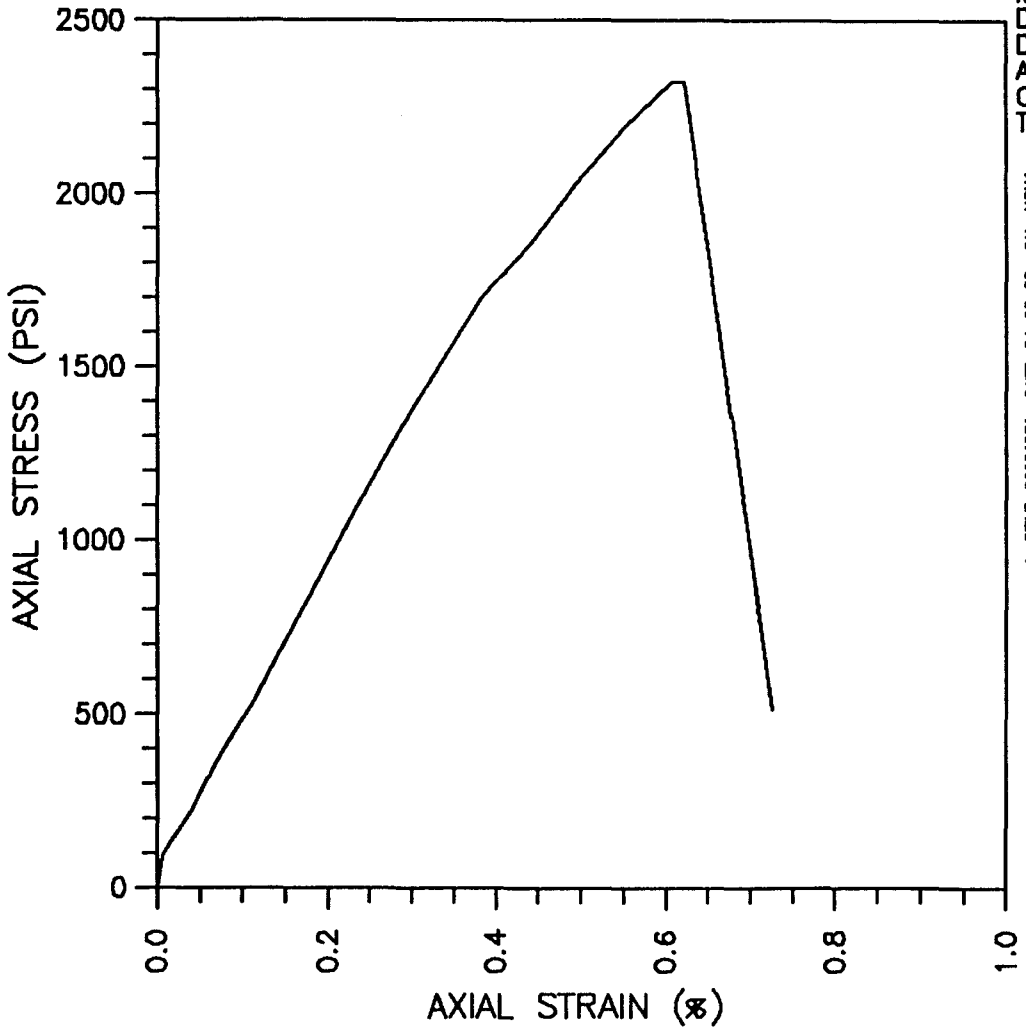
PRELIMINARY
(Subject to Revision)

* 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

Note: Some values in this table may be revised based on reviews of test procedures and individual test results. The reader should refer to the latest revision of the gINT geotechnical data base (geotechnical report GR-70).

BORING NO.: B22-90
DEPTH (FT): 125.1
AUSTIN CHALK LIMESTONE



INCLINATION: (VERTICAL)
MOISTURE CONTENT (%): 14.1
DRY UNIT WEIGHT (PCF): 120.9
DEG. OF SATURATION (%): 96.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: 22901251 DATE: 04-28-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.396 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

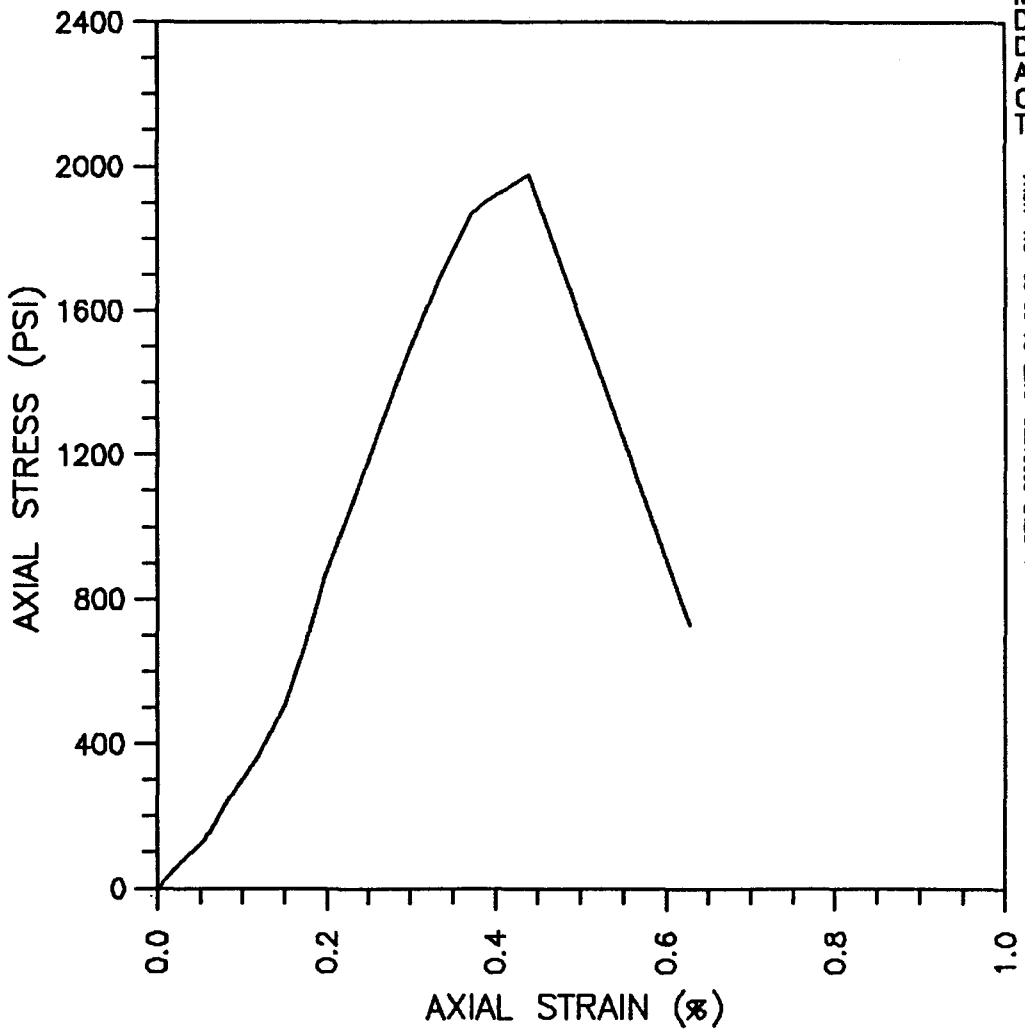
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B22-90
DEPTH (FT): 157.6
AUSTIN CHALK LIMESTONE



INCLINATION (DEG) VERTICAL
MOISTURE CONTENT (%): 13.3
DRY UNIT WEIGHT (PCF): 122.0
DEG. OF SATURATION (%): 94.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFILE: 22901578 DATE: 04-25-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
6.038 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

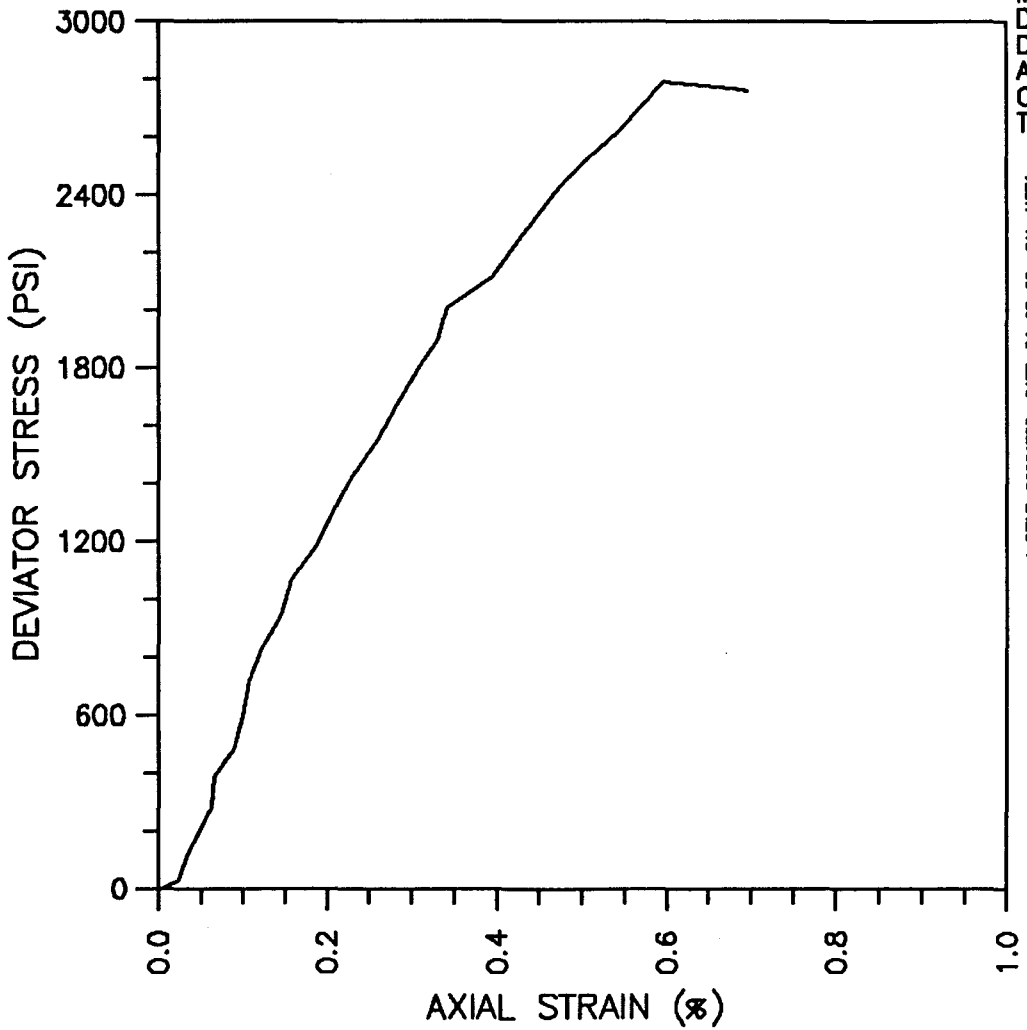
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B22-90
DEPTH (FT): 170.2
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.2
DRY UNIT WEIGHT (PCF): 117.9
DEG. OF SATURATION (%): 95.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

BFILE: 22901702 DATE: 04-23-90 CAL: MGT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.869 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

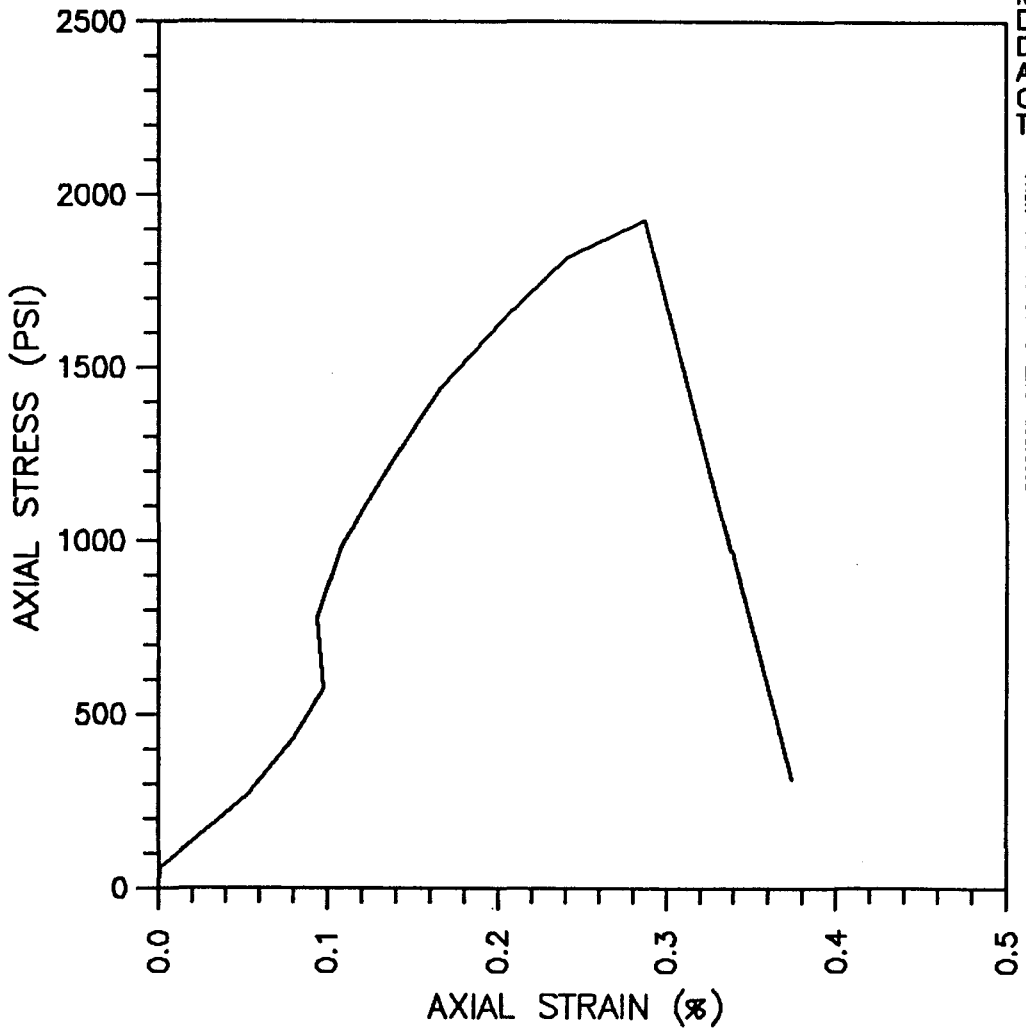
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B22-90
DEPTH (FT): 172.0
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.2
DRY UNIT WEIGHT (PCF): 121.5
DEG. OF SATURATION (%): 92.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFILE: 22901720 DATE: 04-28-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
16.000 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

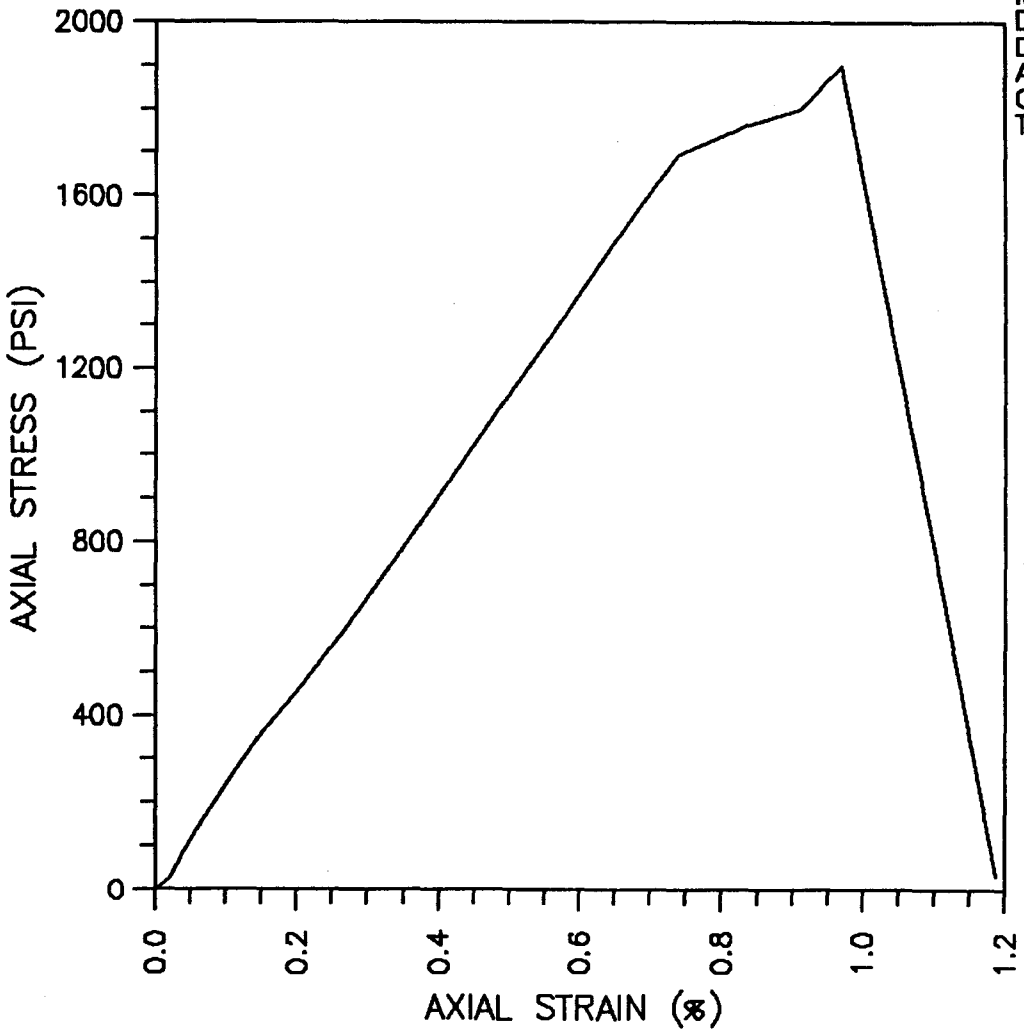
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B22-90
DEPTH (FT): 174.4
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.9
DRY UNIT WEIGHT (PCF): 126.3
DEG. OF SATURATION (%): 88.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: 22901744 DATE: 04-25-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
2.374 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

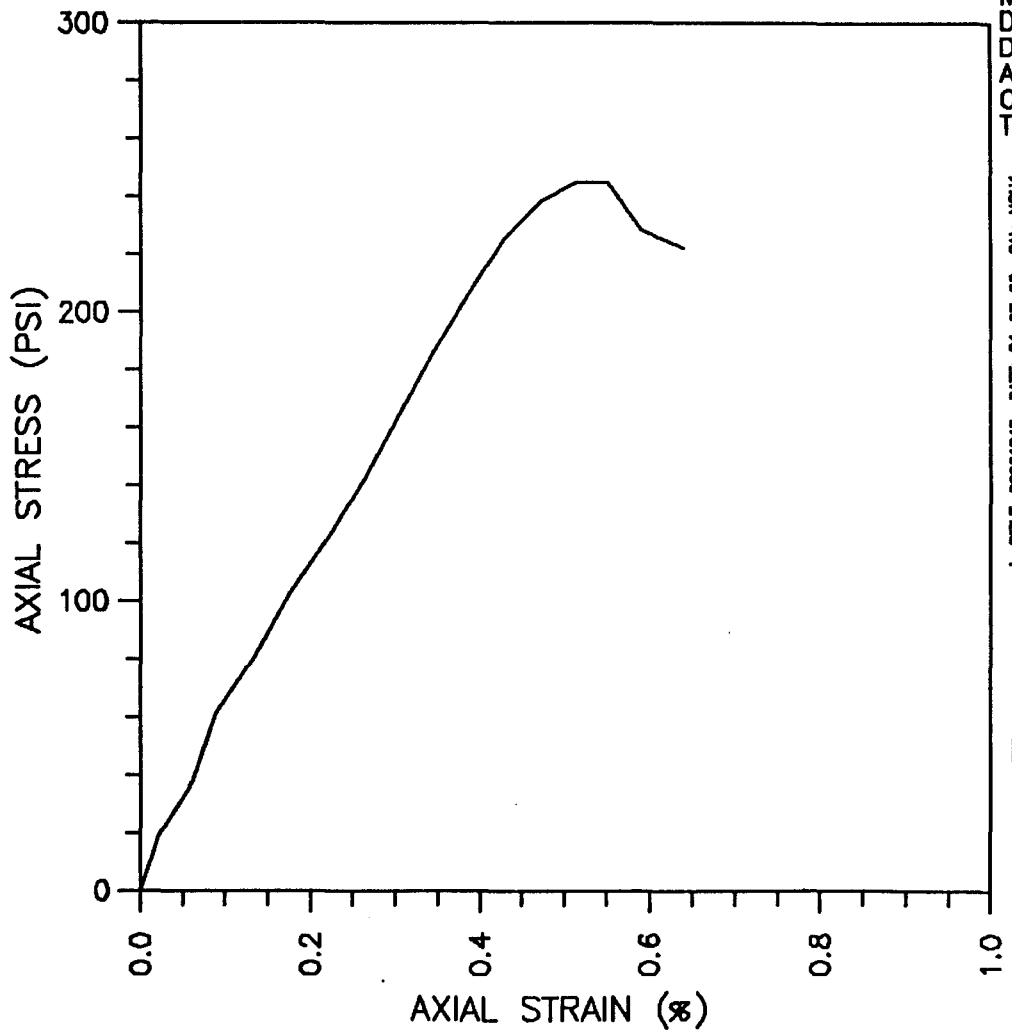
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B22-90
DEPTH (FT): 184.8
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 17.2
DRY UNIT WEIGHT (PCF): 116.6
DEG. OF SATURATION (%): 104.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GTLE: 22801848 DATE: 04-27-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.471 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

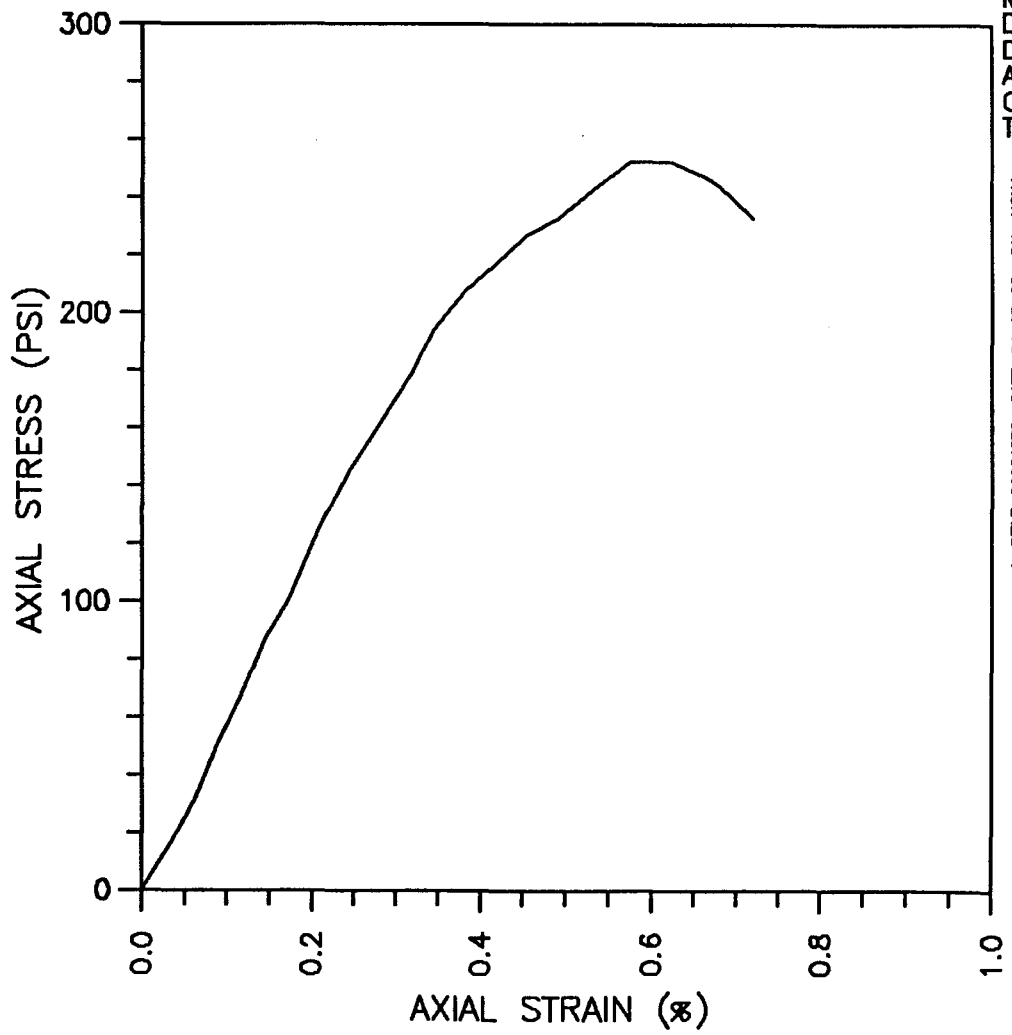
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B22-90
DEPTH (FT): 187.0
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.4
DRY UNIT WEIGHT (PCF): 122.7
DEG. OF SATURATION (%): 96.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 22901870 DATE: 04-27-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.645 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

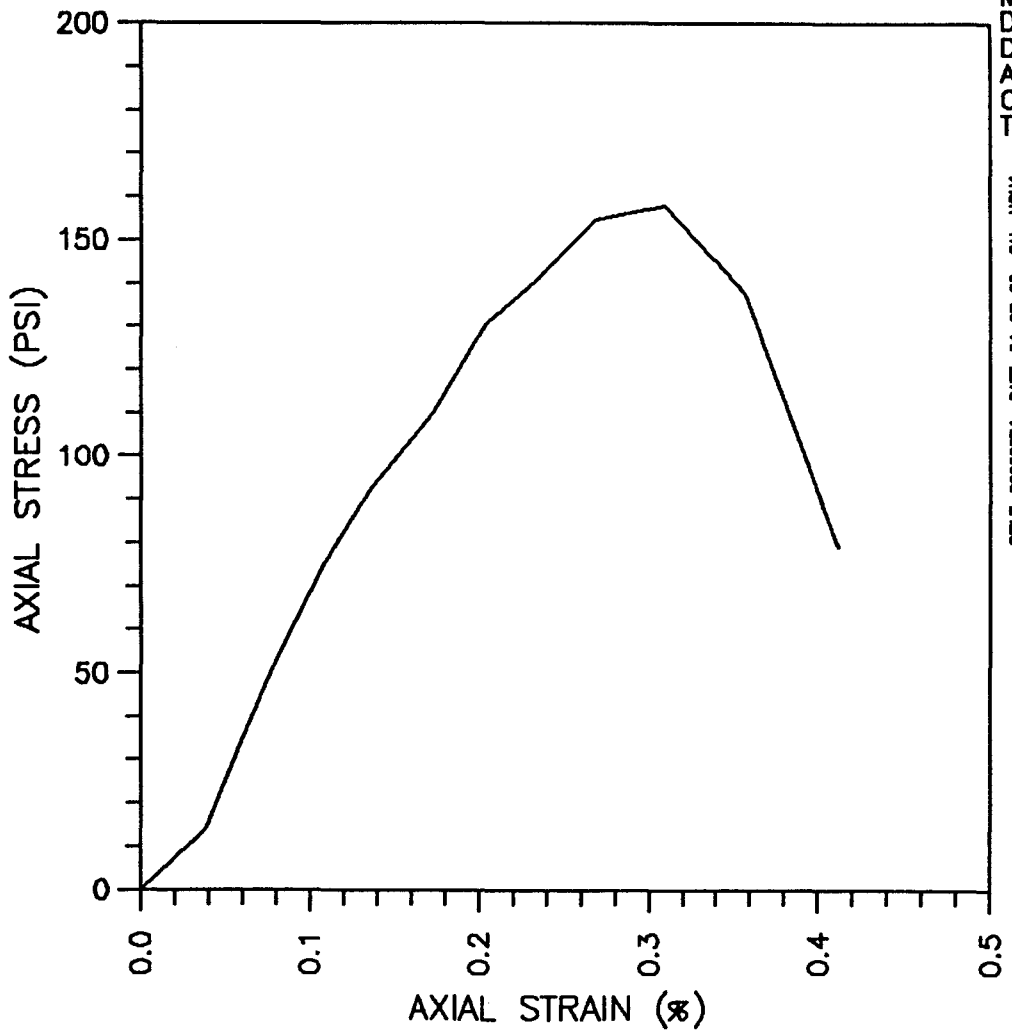
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B22-90
DEPTH (FT): 227.4
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 16.1
DRY UNIT WEIGHT (PCF): 118.7
DEG. OF SATURATION (%): 103.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 23902274 DATE: 04-27-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.683 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 70 DEG.

TEXAS SSC SITE

STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

GEOMECHANICAL TEST RESULTS

BORING B 1807

TABLE C-4. GEOMECHANICAL TEST RESULTS–BORING B 1807

GENERAL LITHOLOGY	VERTICAL 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 TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX percent	COMMENTS
AUSTIN CHALK	124.3	10.9	129.3						2.5	B-1/30	1895			0.55	3.81		0						
AUSTIN CHALK	125.2	13.1	128.4																				
AUSTIN CHALK	151.7	13.8	115.4																				
AUSTIN CHALK	152.1	13.0	123.3	2.67					2.3	D		100	906	1.24	0.93		100						
AUSTIN CHALK	152.5	12.6	123.4						2.3	B-1/20		200	1609	1.34	1.10		200						
AUSTIN CHALK	153.5	11.9	116.6						2.4	D	2119			0.51	5.65		0						
AUSTIN CHALK	154.0	14.6	120.0																				
AUSTIN CHALK	154.3	15.7	117.4																				
AUSTIN CHALK	154.7	15.4	115.9						0.5										266				
AUSTIN CHALK	155.6	13.5	121.3																				
AUSTIN CHALK	159.4	13.2																					
AUSTIN CHALK	159.6	12.2	126.5						2.3	D	477			0.82	0.71		D						
EAGLE FORD SHALE	162.0	18.8	108.3						2.4	D		100	274	0.44	0.66		100						TRANSITION ZONE
EAGLE FORD SHALE	162.4	18.7	112.0	2.71	105	69	98.1	5.5	2.4	B-1/30		200	238	0.57	0.69		200						
EAGLE FORD SHALE	162.8	17.3	115.2																				
EAGLE FORD SHALE	164.5	18.1	112.4		85	55	98.7	5.8	2.5	D	150			0.29	0.64		0						
EAGLE FORD SHALE	164.9	18.6	113.5																				
EAGLE FORD SHALE	165.6	18.1	111.6																				
EAGLE FORD SHALE	166.6	17.7	112.2		78	50	95.4															30.0	
EAGLE FORD SHALE	166.8	18.2	113.8																			41.0	
EAGLE FORD SHALE	167.1	18.5	110.9																				
EAGLE FORD SHALE	167.3	18.5																		14.2			
EAGLE FORD SHALE	196.7	15.8	117.5																				
EAGLE FORD SHALE	197.4	12.0	126.9						2.2	D	230			0.48	0.71		D						
EAGLE FORD SHALE	203.2	13.3	127.1																				
EAGLE FORD SHALE	203.6	16.2	117.0		80	54	98.6	4.4	2.5	D	239			0.45	0.68		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ISRM	ISRM	ISRM	ISRM	

B1807PRT.WK1
REVISION: 1.0
DATE 5/1/90

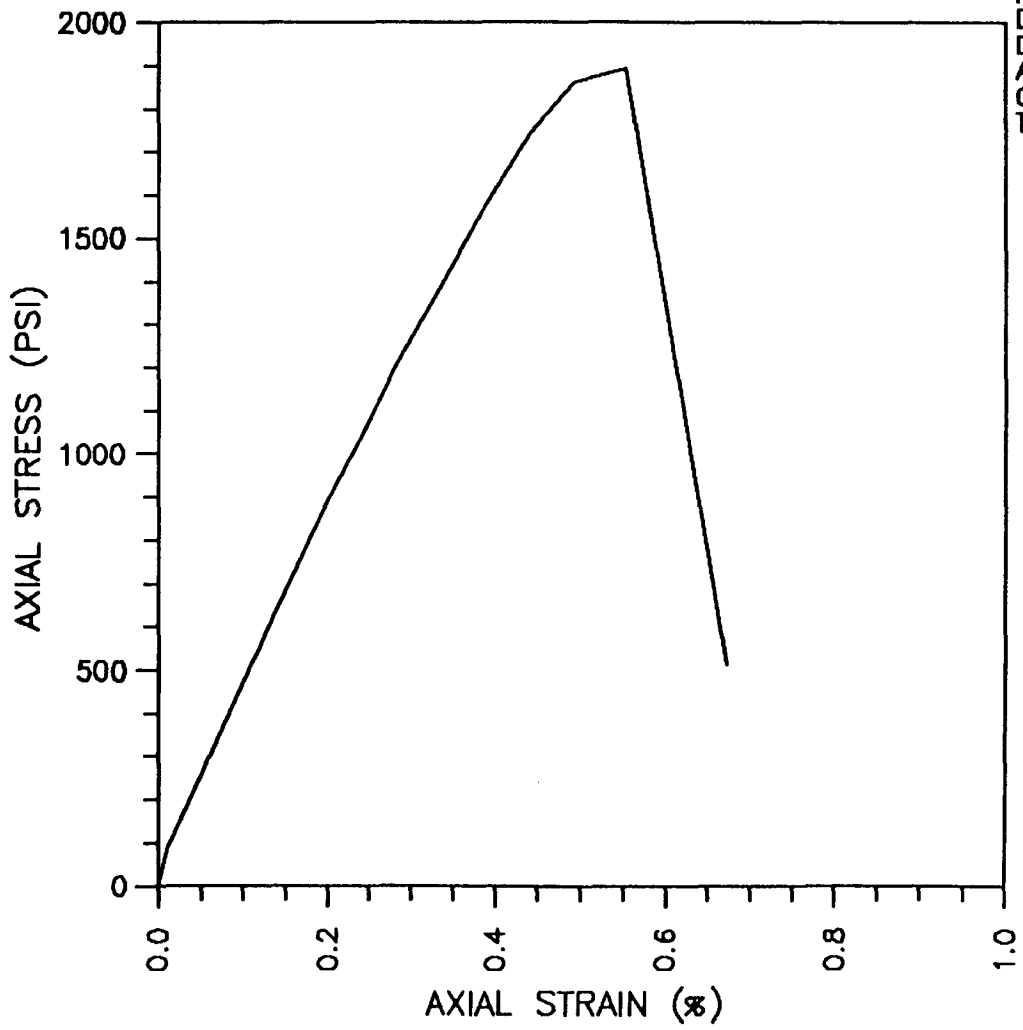
PRELIMINARY
(Subject to Revision)

* 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

Note: Some values in this table may be revised based on reviews of test procedures and individual test results. The reader should refer to the latest revision of the gINT geotechnical data base (geotechnical report GR-70).

BORING NO.: B1807
DEPTH (FT): 124.3
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.9
DRY UNIT WEIGHT (PCF): 129.3
DEG. OF SATURATION (%): 97.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GTLE: 1807124.3 DATE: 04-29-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.810 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 30 DEG.

TEXAS SSC SITE

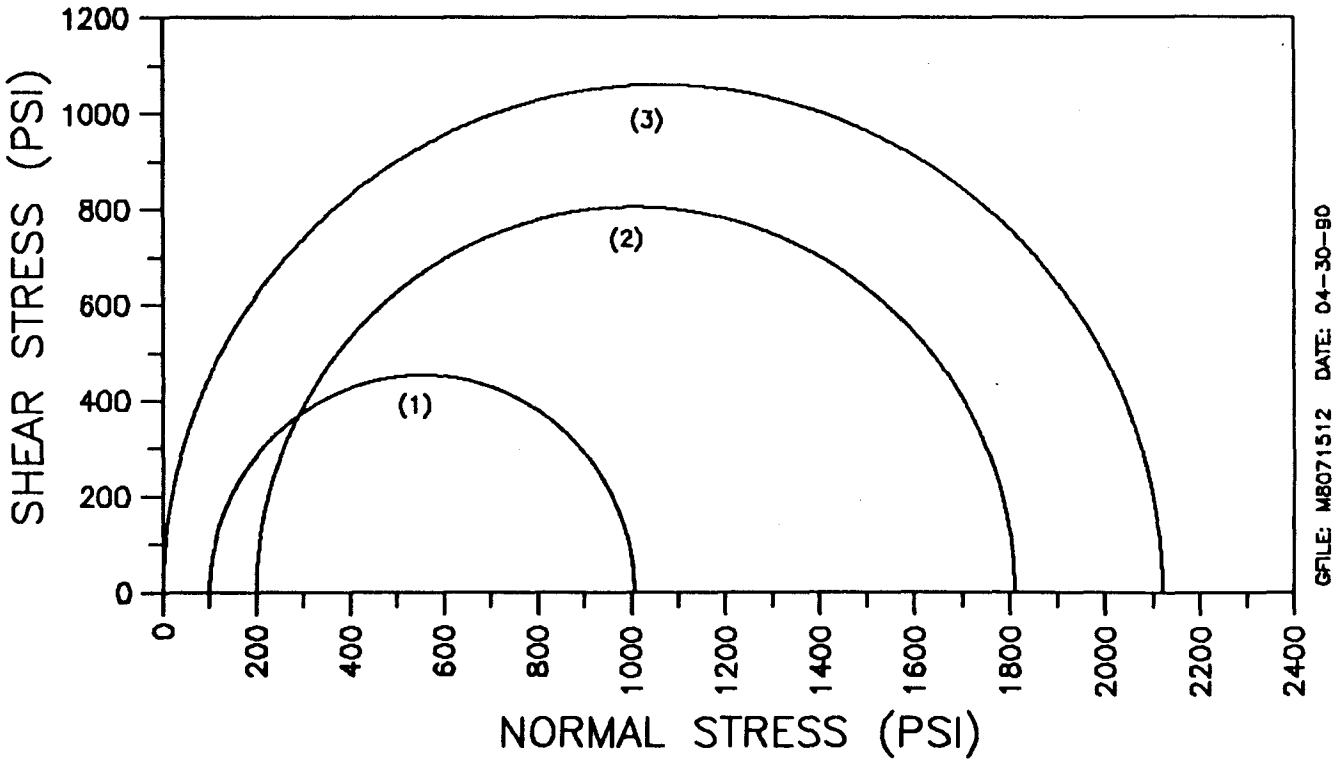
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH RANGE (FT): 152.1-153.9
AUSTIN CHALK LIMESTONE



GFILE: M8071512 DATE: 04-30-90

SEE STRESS-STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 152.1
(2) DEPTH (FT): 152.5
(3) DEPTH (FT): 153.5

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

TEXAS SSC SITE

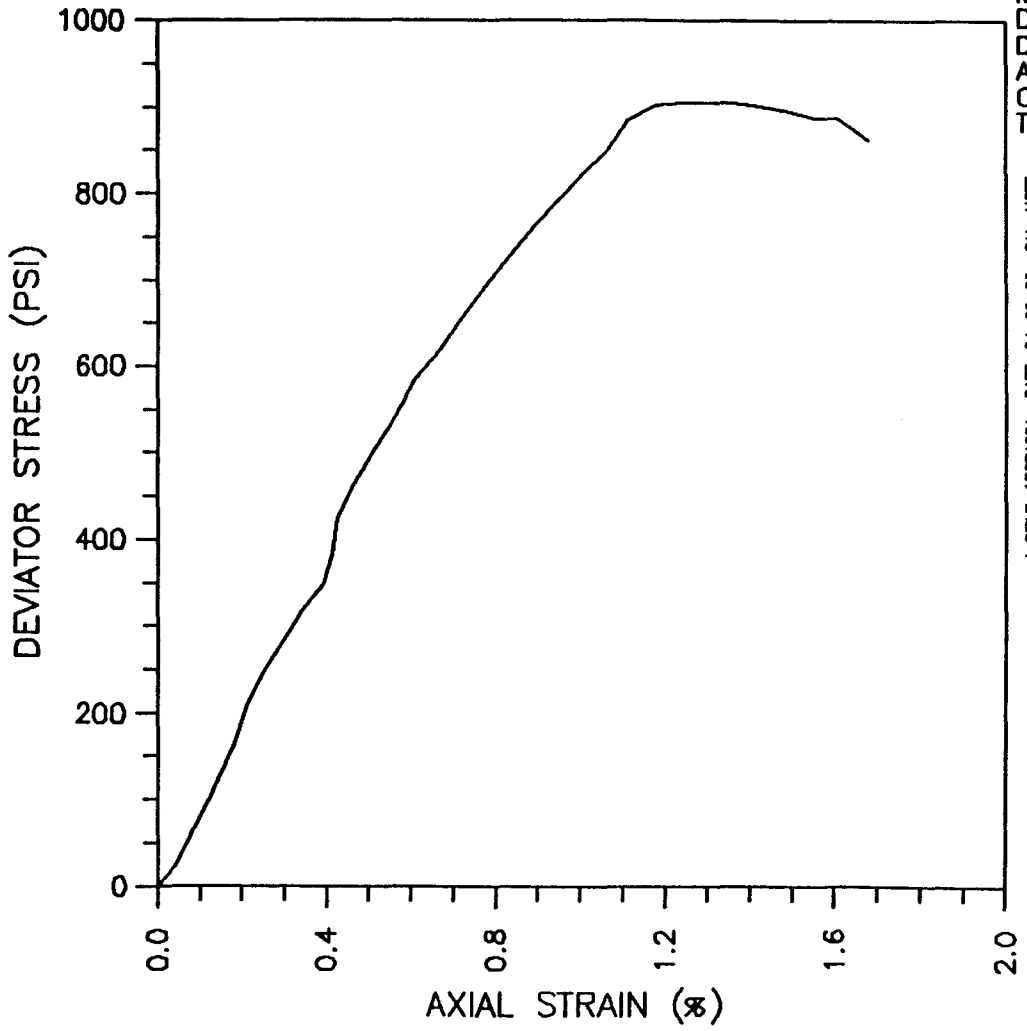
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 152.1
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.0
DRY UNIT WEIGHT (PCF): 123.3
DEG. OF SATURATION (%): 95.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TITLE: 18071521 DATE: 04-29-90 CAL: MCT5

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.930 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

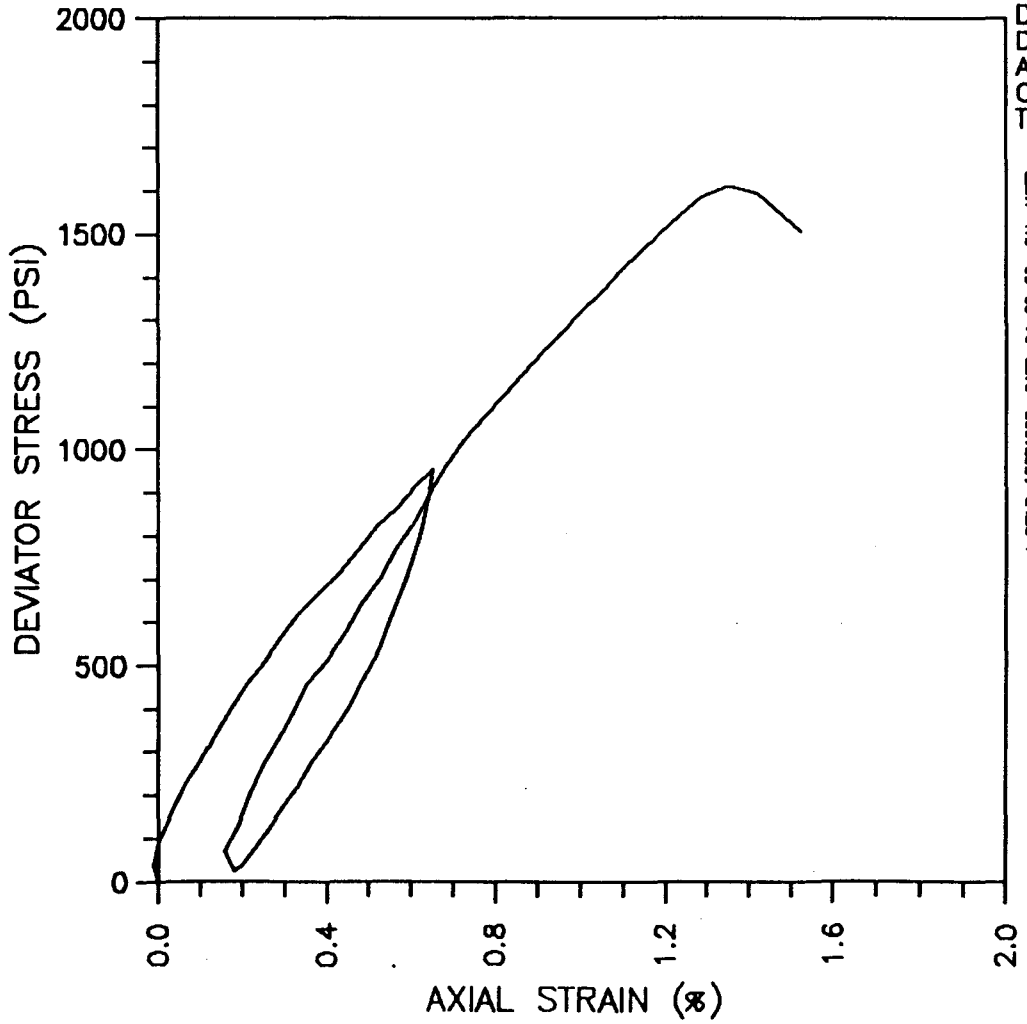
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 152.5
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.6
DRY UNIT WEIGHT (PCF): 123.4
DEG. OF SATURATION (%): 92.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

DFILE: 18071525 DATE: 04-29-90 CAL: MCT3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.099 x10E5 PSI

FAILURE MODE:
SHEAR PLANES
AT 20 DEG.

TEXAS SSC SITE

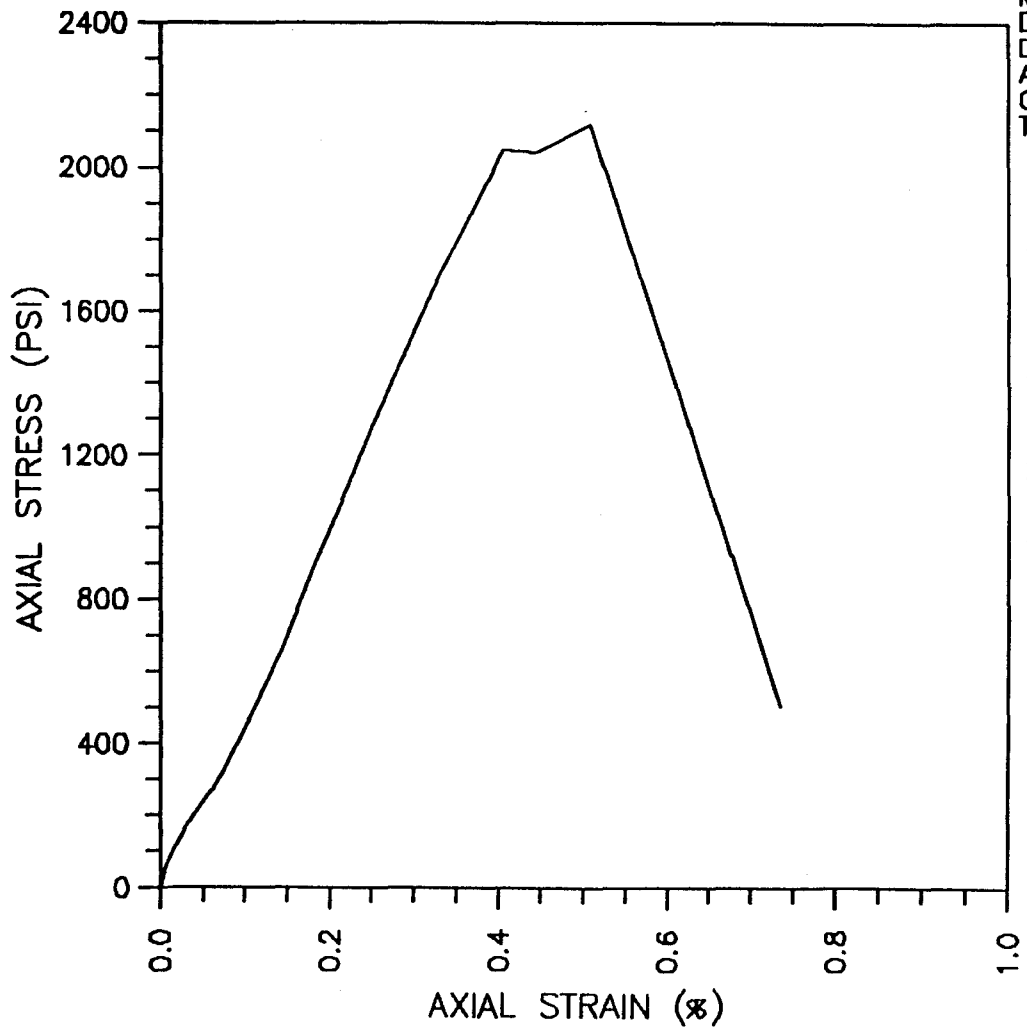
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 153.5
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 11.9
DRY UNIT WEIGHT (PCF): 116.6
DEG. OF SATURATION (%): 72.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 18071535 DATE: 04-29-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.647 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

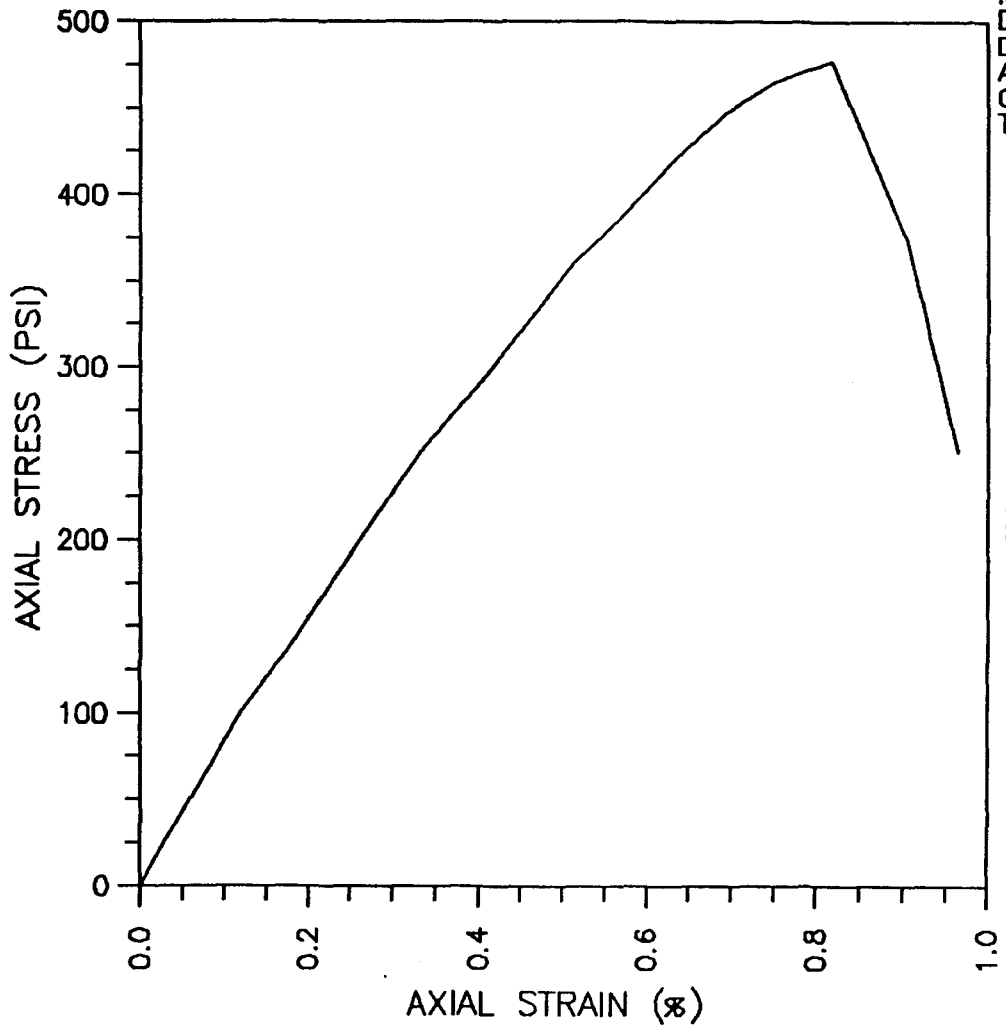
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 159.6
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.2
DRY UNIT WEIGHT (PCF): 126.5
DEG. OF SATURATION (%): 99.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 18071598 DATE: 04-29-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.714 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

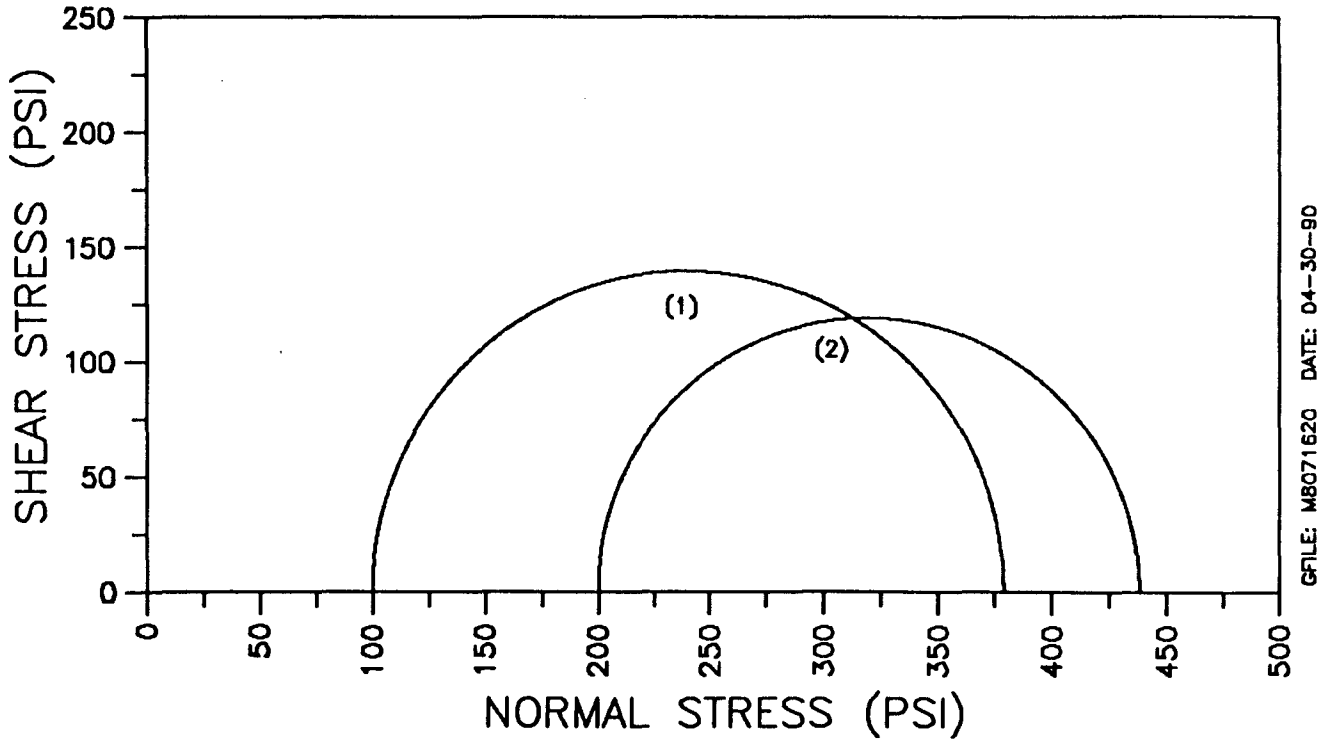
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH RANGE (FT): 162.0–162.8
EAGLE FORD SHALE



GFILE: M8071620 DATE: 04-30-90

SEE STRESS-STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 162.0
(2) DEPTH (FT): 162.4

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

TEXAS SSC SITE

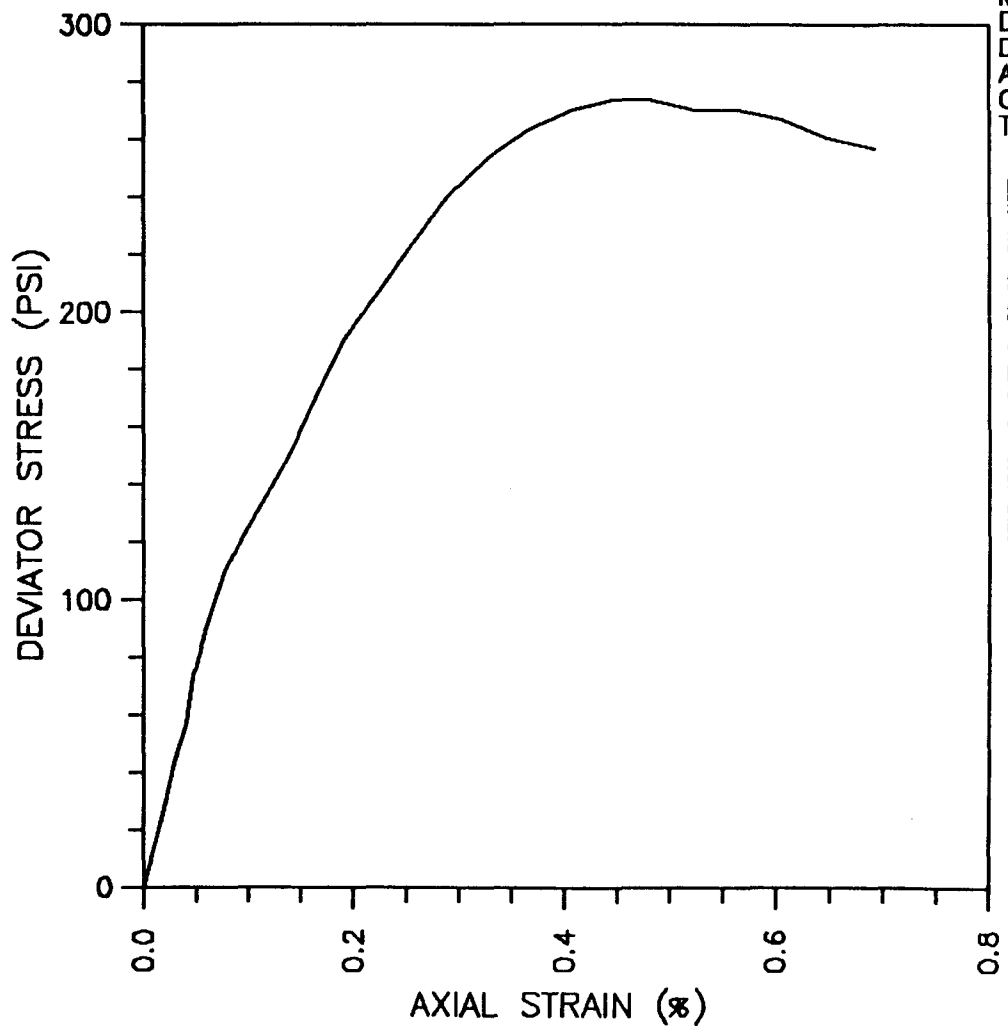
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 162.0
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 18.8
DRY UNIT WEIGHT (PCF): 108.3
DEG. OF SATURATION (%): 91.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

DFILE: 18071820 DATE: 04-30-90 CAL: MCT5

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.659 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

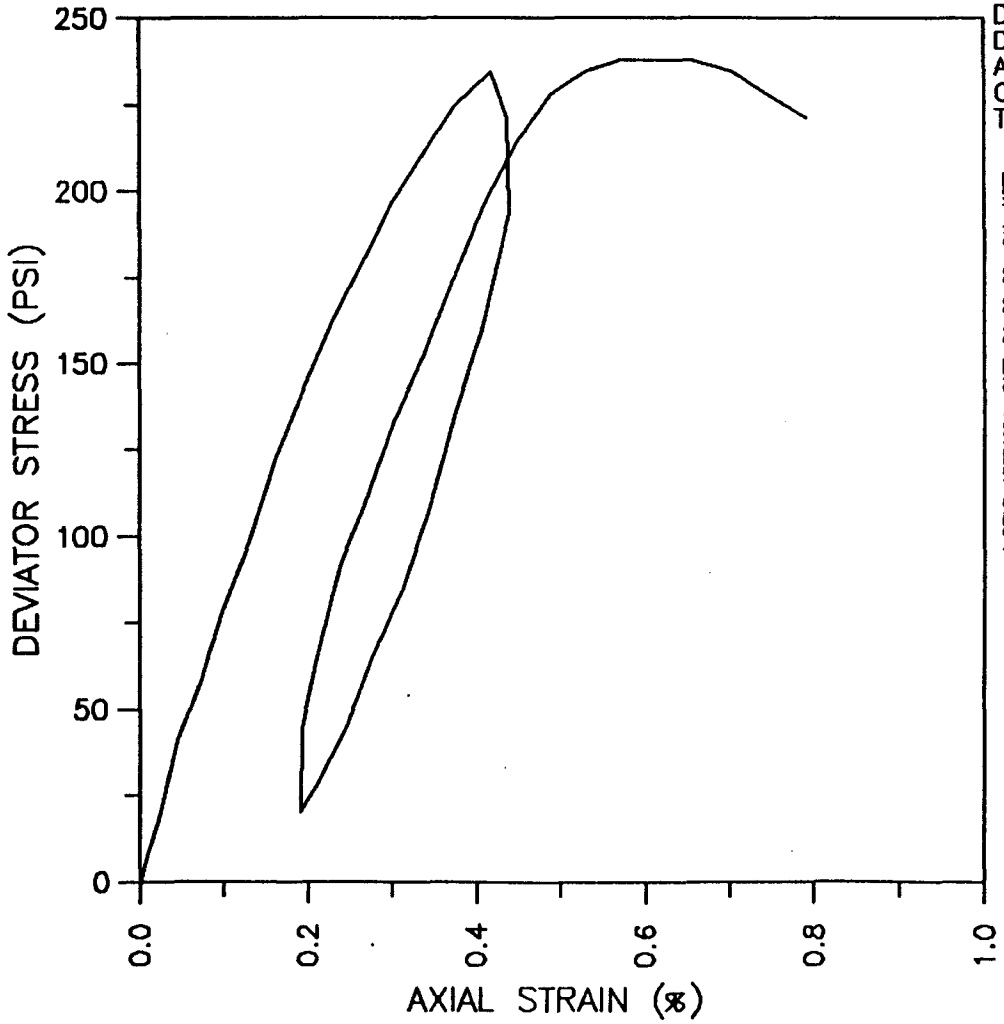
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 162.4
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 18.7
DRY UNIT WEIGHT (PCF): 112.0
DEG. OF SATURATION (%): 100.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

STLE: 18071624 DATE: 04-29-90 CAL: MCTS

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.690 x10E5 PSI

FAILURE MODE:
SHEAR PLANE
AT 30 DEG.

TEXAS SSC SITE

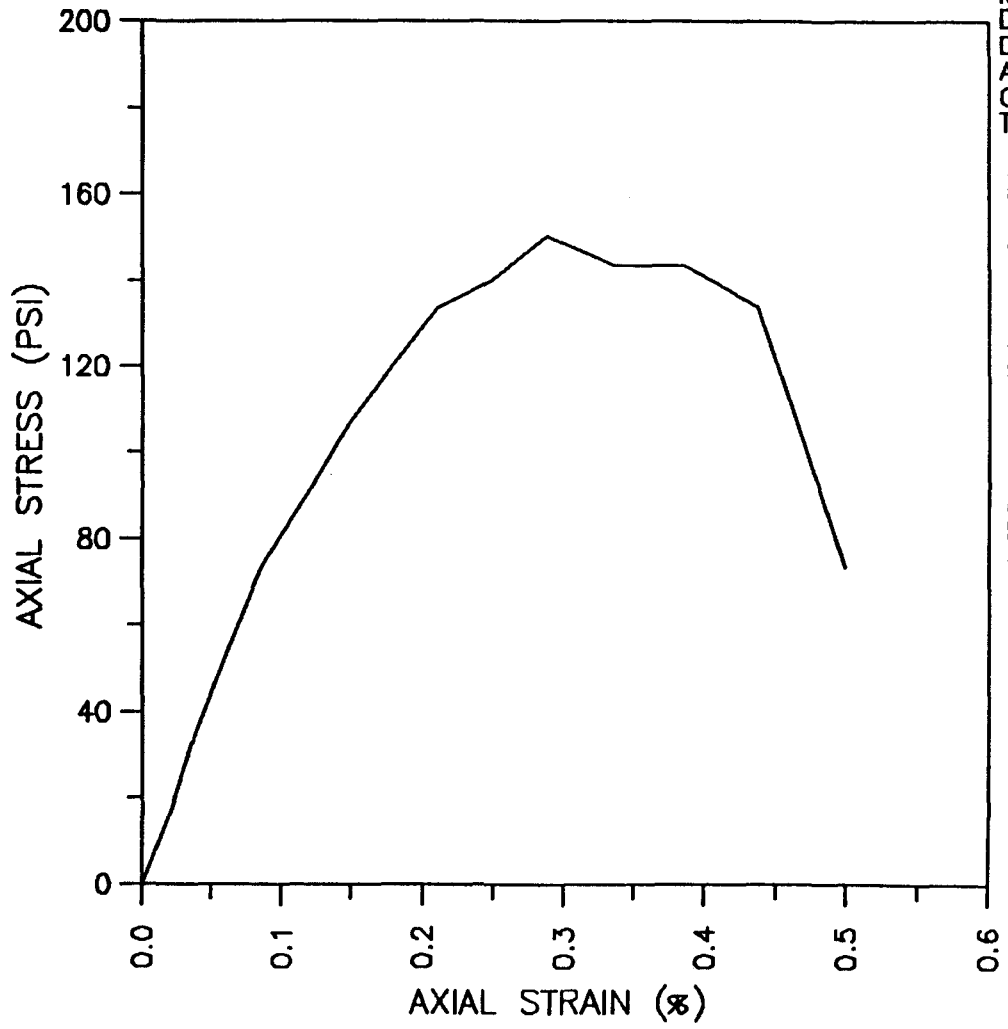
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 164.5
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 18.1
DRY UNIT WEIGHT (PCF): 112.4
DEG. OF SATURATION (%): 97.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: 18071645 DATE: 04-29-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.635 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

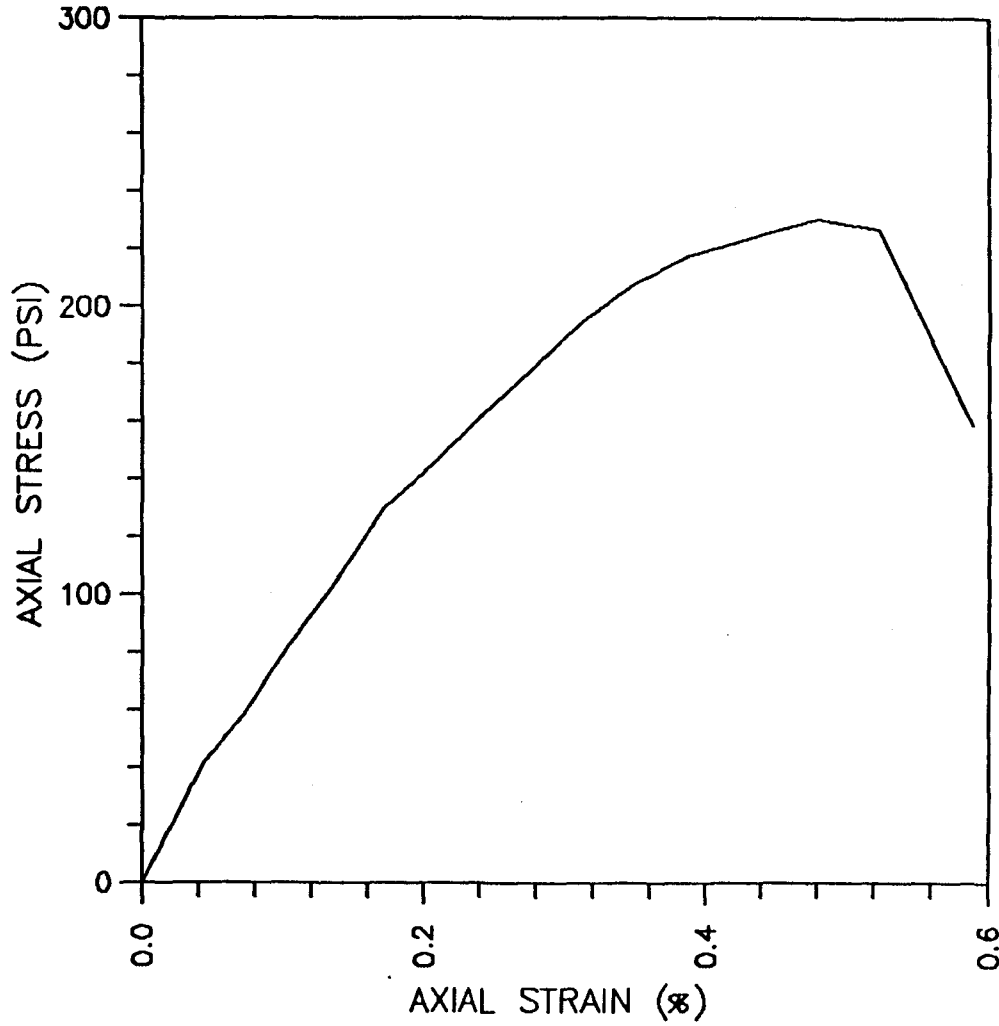
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 197.4
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.0
DRY UNIT WEIGHT (PCF): 126.9
DEG. OF SATURATION (%): 98.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

BFILE: 18071974 DATE: 04-29-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.706 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

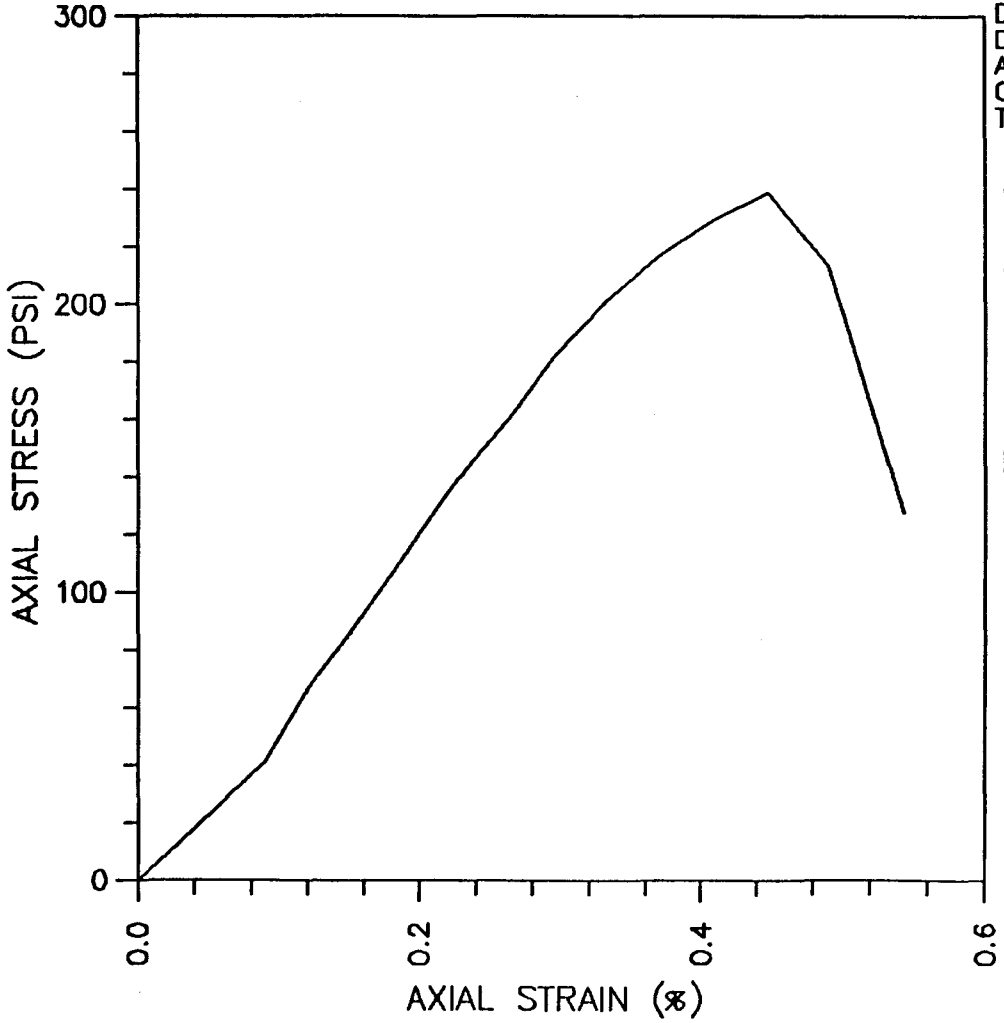
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 203.6
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 16.2
DRY UNIT WEIGHT (PCF): 117.0
DEG. OF SATURATION (%): 99.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: 18072038 DATE: 04-29-90 CAL: MCU4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.682 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

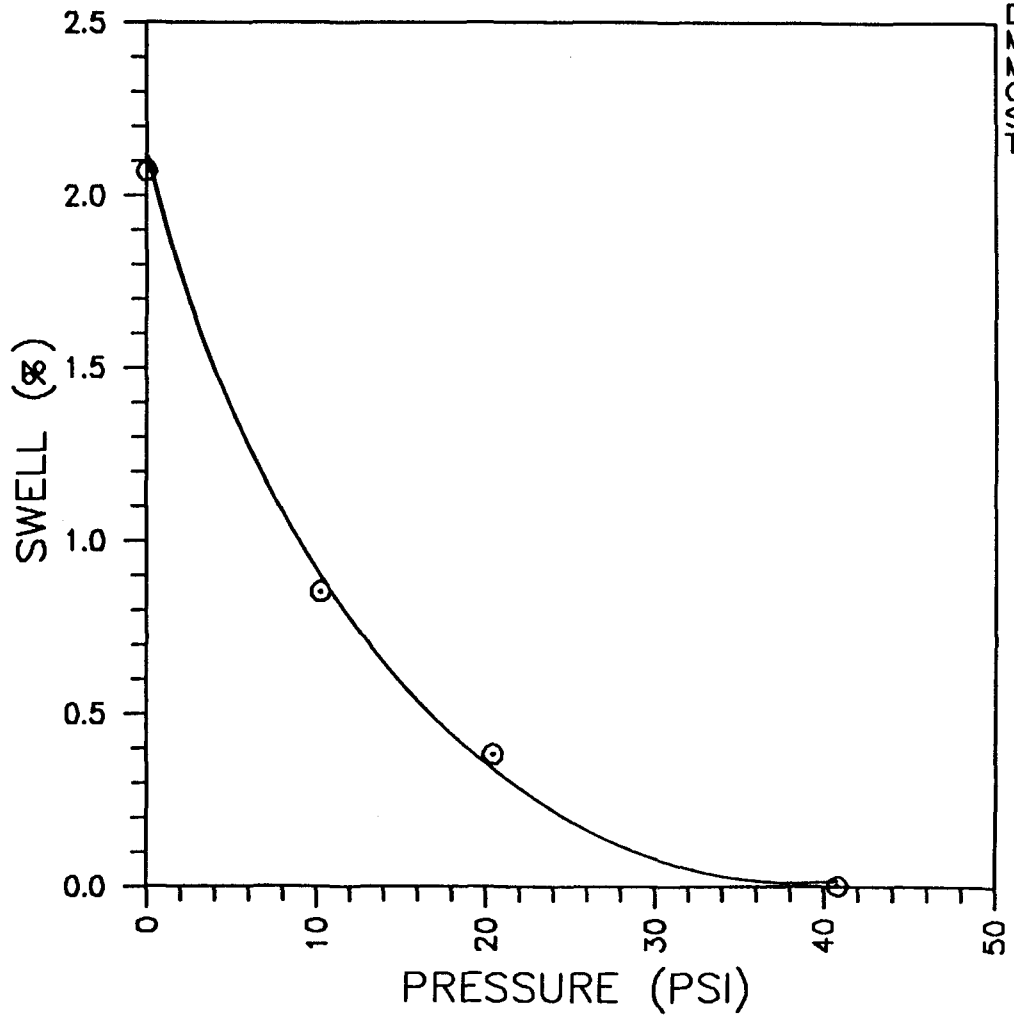
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: B1807
DEPTH (FT): 166.8
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
DRY UNIT WEIGHT (PCF): 113.8
M.C. BEFORE TEST (%): 18.2
M.C.AFTER TEST (%): 22.0
GAIN IN MOISTURE (%): 3.7
SWELLING PRESSURE INDEX (PSI): 41
TEST TYPE: SWELLING PRESSURE INDEX (ISRM)

TEXAS SSC SITE

SWELLING PRESSURE INDEX

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

APPENDIX D

PLUGGING REPORTS

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-888-0017

Task No. 17

Boring No. B 1737

Texas Coordinate Location:

N269,750 Feet; E2,171,178 Feet

Surface Elevation: 752.3 Feet

Total Boring Depth: 247.0 Feet

Plugging Remarks:

Grout mixed with approximate water cement ratio of 7-1/2 gallons per sack. Two shovels of bentonite were added for each 4 sack batch. Grout was placed through tremie pipe for total depth. Grout was held approximately 2 feet below ground surface in field.

Date Plugged: 3/30/90

Time Completed: 10:00 am

Drilling Geologist: W.D. Flanigan
MJA Coordinator: W.D. Flanigan
MJA No.: 5530.17

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-888-0017

Task No. 17

Boring No. B 22-90

Texas Coordinate Location:

N 273,231 Feet E 2,172,395 Feet

Surface Elevation: 735.6 Feet

Total Boring Depth: 232.0 Feet

Plugging Remarks:

Plugged boring with a cement/bentonite mixture of 7:1 water: mixture ratio using 2" PVC tremie pipe to ensure grout was placed from bottom to surface. Removed surface casing and topped off hole with grout.

Date Plugged: 3/31/90

Time Completed: 2:00 pm

Drilling Geologist: Scott Lesikar
MJA Coordinator: W.D. Flanigan
MJA No.: 5530.17

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-888-0017

Task No. 17

Boring No. B 1807

Texas Coordinate Location:

N276,407 Feet; E2,173,313 Feet

Surface Elevation: 716.7 Feet

Total Boring Depth: 211.0 Feet

Plugging Remarks:

Plugged boring with a cement/bentonite mixture @ approx. 7:1 water: mixture ratio. Used a 2" pvc tremie pipe to ensure grout was placed from bottom of boring to the surface. Removed surface casing and topped off with grout.

Date Plugged: 3/28/90

Time Completed: 5:00 pm

Drilling Geologist: Scott Lesikar
MJA Coordinator: W.D. Flanigan
MJA No.: 5530.17