SSCL-SR-1096

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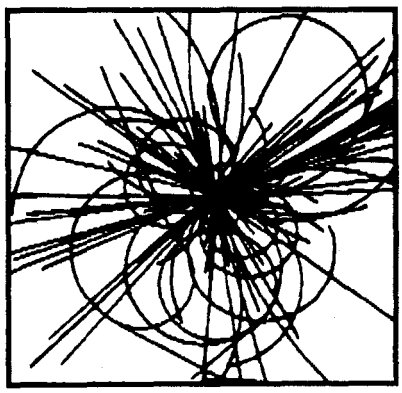
Project No. 87-888-0015

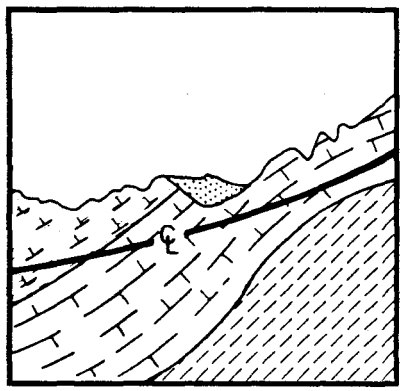
April 1990

2nd Revised Draft

GR-37

Data Report for Interaction Region 1 and Coreholes BIR 11, BIR 12, BIR 13 and BIR 14





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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 (completed)
- Structure-specific data (the present phase)
- Global data (in progress).

This is one in a series of data reports prepared for the structure-specific phase of geotechnical characterization at the SSC site. Data collection for this study phase focused on drillhole-based geological, geohydrological, geophysical, and geotechnical tests at the locations of experimental halls and the injector. In combination with data from the other phases, these data will allow conceptual designs of construction methods and structural supports for key underground structures. Each data report includes the results of both field and laboratory tests for specific drilling and sampling site(s).

DATA REPORT

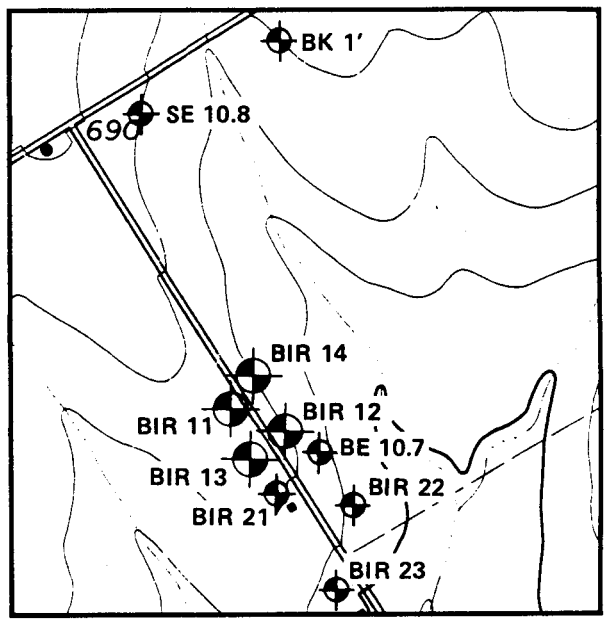
Site Designator: Interaction Region (IR) 1

Objective: Characterization of subsurface conditions at the Interaction Region 1. Drill four coreholes, three vertical and one inclined approximately 45° from horizontal; in situ geohydrological and geophysical testing; excavate one trench to a maximum depth of 4.5 feet; characterize fractures; and obtain samples for mineralogy and geomechanical testing.

Interaction Region 1 is located on the western side of the ring, approximately 1 mile north-northwest of Boz, Texas.

BIR 11, 13, and 14 are vertical coreholes.

BIR 12 is an angled boring with a bearing of approximately S87°W, angled 45.5° from horizontal.



Boring Locations:

Boring	Northing (feet)	Easting (feet)	Surface Elevation (feet)
BIR 11	239,029	2,175,454	670.2
BIR 12	239,008	2,175,582	667.5
BIR 13	238,844	2,175,494	669.9
BIR 14	239,199	2,175,518	667.5

Scope and Schedule:

- Borings

Boring	Coring (full depth)	Wire-Line Logging	Hydrologic Testing	Laboratory Testing	Well Construction or Plugging
BIR 11	Sept.11 to 15, 1989	Sept. 15, 1989	Sept. 15, 1989	Sept. 11 to Oct. 9, 1989	Sept. 21, 1989 (Well)
BIR 12	Sept. 12 to 16, 1989	Sept. 16, 1989	Sept. 18-19, 1989	Sept. 14 to Nov. 9, 1989	Sept. 19, 1989 (Plugging)
BIR 13	Feb. 23 to Mar. 2, 1990	Mar. 2, 1990	Not done	Mar. 6 to 26, 1990	Mar. 3, 1990 (Plugging)
BIR 14	Feb 26 to Mar. 2, 1990	Mar. 2, 1990	Not done	Mar. 14 to 26, 1990	Mar. 3, 1990 (Plugging)

- Geologic mapping and trenching - September 25 to October 1989
- Downhole velocity surveys (in boring BIR 11 only) - November 20 and 21, 1989

Conditions Encountered: (see Lithologic Logs, Appendix A)

Boring No.	Total Depth (feet)	Soil (feet)	Weathered Austin Chalk (feet)	Austin Chalk (feet)	Eagle Ford Shale
BIR 11	265.0	0.0 to 1.0	1.0 to 3.0	3.0 to 217.4	217.4 to 265.0
BIR 12 (Angle Hole)	341.5 (inclined)	0.0 to 2.5	2.5 to 9.7	9.7 to 304.6	304.6 to 341.5
	243.5 (vertical)	0.0 to 1.8	1.8 to 9.0	9.0 to 217.5	217.5 to 243.4
BIR 13	304.0	0.0 to 2.0	2.0 to 7.0	7.0 to 215.0	215.0 to 304.0
BIR 14	303.0	0.0 to 1.7	1.7 to 6.0	6.0 to 216.4	216.4 to 303.0

Note: Water level was measured at 667.1 feet above MSL on April 9, 1990.

Geophysical Logging: (see Wire-line Logs, Appendix B)

Boring No.	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)	Other
BIR 11	*	*	*	*	*	*	*	*	Neutron
BIR 12	*	*	*	*	*	*	*	*	Deviation
BIR 13	*	*	*	*	*	*	*	*	
BIR 14	*	Note 1	*	*	*	*	*	*	

Note 1: Tool malfunction; long resistivity data missing.

Geologic Mapping Results Summary: (see also Appendix C)

Geologic mapping identified exposed bedrock approximately 750 feet east of the IR. This exposure was large enough to provide representative fracture data in the area of the IR. Analyses of boring logs for BIR 11, BIR 12, BIR 13 and BIR 14, as well as logs of adjacent borings, indicate that no major faults cross IR 1. See Appendix C and Drawings GP-1 and GS-3 (in pocket). Comparisons of wire-line and lithologic logs show no evidence of faulting between any of the borings BIR 11, BIR 12, BIR 13, BIR 14, SE 10.7, BIR 21, SE 10.8, or BK 1' (see Appendices A and B and Drawing GS-3).

Hydrologic Test Results Summary: (see also Appendix D).

Boring	Vertical Test Depth (ft)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/Lithology	Hydraulic Conductivity (cm/sec)
BIR 11	140-160	125	20	Austin Chalk	$< 4.6 \times 10^{-8}$
BIR 12	136-151	110	30	Austin Chalk	9.2×10^{-7}
BIR 12	212-226	200	40	Austin Chalk/Eagle Ford Shale Contact	1.5×10^{-5}

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

Formation: Austin Chalk

Whole Rock Composition:		Relative Clay Abundance:	
Mineral	Percent	Mineral	Percent
quartz	up to 2	illite	0-5
calcite	up to 98	kaolinite	0-1
pyrite	up to 1	smectite	0-95
total clay	0-95		

Formation: Eagle Ford Shale

Whole Rock Composition:		Relative Clay Abundance:	
Mineral	Percent	Mineral	Percent
quartz	0-27	montmorillonite	0-18
K feldspar	0-3	illite	6-54
plagioclase	0-3	kaolinite	11-48
calcite	0-2	Fe-chlorite	0-3
siderite	0-1	mixed layer (illite/smectite)	27-74
pyrite	0-4		
total clay	62-100		

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

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)
4-5	Austin Chalk	13-14	120-123	2073-2364	8.33	205
23-30	Austin Chalk	10-13	127-129	2053	1.90	192
41	Austin Chalk	13	120			249
48-53	Austin Chalk	12-15	121-125	1314-2392	1.71-5.56	146-192
75	Austin Chalk	13-15	119	2319	3.80	225
85	Austin Chalk	17	113			
99-103	Austin Chalk	15-18	112-118	1095-2338	3.23	264-274
117-122	Austin Chalk	12-15	119-124	1971-2828	1.50-7.26	184-279
134-140	Austin Chalk	12-17	114-117	419-2978	0.27-3.43	237-339
142-145	Austin Chalk	12-15	117	2164	14.00	226-327
148-149	Bentonite	18-38	84-106			
150-153	Austin Chalk	11-13	123	2655		267
157	Austin Chalk	15-16	120	2559	7.30	
166-170	Austin Chalk	11-14	121-132	2940	7.90	197
181-187	Austin Chalk	9-14	120-132	1317-2880	1.70-6.79	
200	Austin Chalk	15-16	117	2474		256
213-215	Austin Chalk/Transition	11-15	116-128	73-2696	0.05-5.70	
220-221	Eagle Ford Shale	17-18	112-115			
225	Eagle Ford Shale	17-18	113-116			
229-236	Eagle Ford Shale	15-16	118-120	278-446	1.18-2.00	
242-247	Eagle Ford Shale	13-17	115-120	114	0.11	
253-256	Eagle Ford Shale	10-17	116-122	441	0.76-1.90	
259-263	Eagle Ford Shale	15-18	115-120	98	0.37-0.88	
275	Eagle Ford Shale	9-11	130	537	0.96	
283-288	Eagle Ford Shale	12-17	115-123	149-242	0.24-0.26	
292-296	Eagle Ford Shale	15-18	117	128-425	0.16-1.20	

Note: Test results of samples from vertical borings BIR 11, 13, and 14 are only included in the above table.

Downhole Velocity Survey Summary: in boring BIR 11 (see also Appendix F)

Depth (feet)	Compressional Wave Velocity (feet/second)	Shear Wave Velocity (feet/second)	Poisson's Ratio	Shear Modulus (x 10^5 psi)	Constrained Modulus (x 10^5 psi)
Austin Chalk					
0-20	9,200	2,200	0.46	1.44	25.11
20-218	9,200	3,700	0.37	4.06	25.07
Eagle Ford Shale					
218-250	6,100	1,700	0.44	0.85	10.92

Hole Status: (see also Appendix G) A monitoring well was installed in Boring BIR 11. Borings BIR 12, 13, and 14 were plugged with cement/bentonite grout.

APPENDIX A

LITHOLOGIC LOGS

LITHOLOGIC LOG

BIR 11

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 11 PG 1 OF 7

LOCATION: N 239,029 feet
E 2,175,454 feet

GROUND EL: 670.2 feet

DATE: 9/11-9/15/89 TYPE: Nx Core CASED TO: N/A CONTRACTOR: SWL (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

Drilled with air rotary to 25', no seepage encountered; switched to water rotary at 25'

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
									1.0 CLAY, silty, jointed, tan and brown
									3.0 LIMESTONE (Austin Chalk), soft to medium, moderately weathered with occasional clay layers, tan
5		C1	3.0	5.0	96	96			
		C2	5.0	10.0	95	95			LIMESTONE (Austin Chalk), soft to medium, fresh, sound, light gray to dark gray with occasional argillaceous and soft shaly layers and fossil partings -shaly layer, soft, dark gray at 6.4'-7.1', 11.8'-12.6', 16.5'-17.2'
10		C3	10.0	15.0	100	100			
15		C4	15.0	25.0	96	96			-bentonitic shale layer, soft, dark gray at 20.5'-21.0'
25		C5	25.0	35.0	98	98			-shaly layer, soft, dark gray at 26.4'-26.9' -fossil partings at 26.6', 28.3', 29.5', 30.3', 31.3' -slightly argillaceous layer, soft, gray at 30.3'-31.4'
30									
35		C6	35.0		100	100			-shaly layer, soft, dark gray at 38.8'-39.5' -shaly layer, soft, dark gray at 41.8'-42.7' -fossil parting at 43.1' and 43.6'
40									

DRILLING GEOLOGIST S. Wood ASSISTANT J. Lu CHECKED BY C. Bommarito
Shawn Wood
(2-1-90)

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 11 PG 2 OF 7

LOCATION: N 239,029 feet
E 2,175,454 feet

GROUND EL: 670.2 feet

DATE: 9/11-9/15/89 TYPE: Nx Core CASED TO: N/A CONTRACTOR: SWL (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 7

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
				45.0					LIMESTONE (Austin Chalk), medium, fresh, sound, light gray to dark gray with occasional argillaceous and soft shaly layers, fossil partings
45									-fossil partings at 45.2', 47.0' -shaly layer, soft, dark gray at 45.6'-46.7' and 49.0'-50.0'
		C7	45.0	55.0	100	100			
50									-fossil partings at 50.9' and 51.8' -shaly layer, soft, dark gray at 52.0'-52.8' and 55.0'-55.4'
55									
		C8	55.0	65.0	99	99			-fossil partings at 56.9', 57.0', 58.8' -shaly layer, soft, fossiliferous, dark gray at 57.7'-59.2' and 60.8'-61.5'
60									-shaly layer, soft, dark gray at 62.9'-63.6'
65									9-11-89 9-12-89
		C9	65.0	75.0	95	95			-shaly layer, soft, dark gray at 66.2'-66.9' -fossil partings at 67.1', 69.4', 69.8'
70									-shale layer, soft, dark gray at 70.7'-71.1'
75									-very argillaceous, soft, fossiliferous, dark gray at 74.1'-75.0'
		C10	75.0		97	97			-fossil parting at 77.8' -shaly layer, soft, dark gray at 77.8'-79.2' and 84.2'-85.0'
80									

DRILLING GEOLOGIST S. Wood ASSISTANT J. Lu CHECKED BY C. Bommarito

Shawn Wood
(2-1-90)

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 11 PG 3 OF 7

LOCATION: N 239,029 feet
E 2,175,454 feet

GROUND EL: 670.2 feet

DATE: 9/11-9/15/89 TYPE: Nx Core CASED TO: N/A CONTRACTOR: SWL (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 7

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
				85.0					LIMESTONE (Austin Chalk), medium, fresh, sound with occasional argillaceous and soft shaly layers, fossil partings
85		C11	85.0	95.0	98	98			-shaly layer, soft, dark gray at 87.2'-88.2' -very argillaceous layer, medium, fossiliferous, dark gray at 90.0'-90.6' -fossil parting at 90.4' -shaly layer, soft, dark gray at 94.1'-95.0' -fossil partings at 93.8' and 94.3'
90									
95		C12	95.0	105.0	100	100			-shaly layer, soft, dark gray at 95.6'-95.9' -very argillaceous, soft, dark gray at 95.6'-96.1' -fossil parting at 97.4' -shaly layer, soft, fossiliferous, dark gray at 98.7'-99.1' -fossil partings at 100.5' and 100.8' -very argillaceous, soft, dark gray at 100.8'-101.8' -bentonite layer, soft, light to dark gray at 104.2'-104.6' -fossil parting at 106.6'
100									
105		C13	105.0	115.0	100	100			-shaly layer, soft, dark gray at 111.2'-111.9' -bentonitic shale layer, soft, dark gray at 111.9'-112.1'' -fossil partings at 112.7' and 114.4' -shaly layer, soft, fossiliferous dark gray at 116.4'-117.3' -shaly layer, soft, dark gray at 116.4'-118.6' -fossil parting at 117.5'
110									
115		C14	115.0		100	100			-very argillaceous, soft, gray at 120.2'-123.4' -shale partings, dark gray at 121.0' and 123.2'
120									

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LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 11PG

LOCATION: N 239,029 feet
E 2,175,454 feet

GROUND EL: 670.2 feet

DATE: 9/11-9/15/89 TYPE: Nx Core CASED TO: N/A CONTRACTOR: SWI (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 7

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
125				125.0					LIMESTONE (Austin Chalk) medium, fresh, sound, light gray to dark gray with occasional argillaceous and soft shaly layers and fossil partings
130		C15	125.0	135.0	100	100			-bentonitic shale, soft, light gray at 125.0'-125.3' -bentonite (1") parting, light gray at 127.1' -shaly layer, soft, dark gray at 129.7'-130.8' -fossil partings at 130.0' amd 131.7' -50° smooth, tight, fracture at 132.7' -shaly layer, soft, dark gray at 134.1'-134.8', 136.3'-137.1' and 138.5'-140.4' -fossil partings at 135.1', 136.8' and 138.7'
135									
140		C16	135.0	145.0	100	88			-20° loose, rough slickensided fracture at 141.9' -20° smooth, tight slickensided fracture with 45° smooth, tight transverse slickensided at 142.2' -50° rough, tight slickensided fracture with 40° rough, loose transverse fracture at 142.5' -70° calcite filled (1" wide) healed fracture at 142.6' -70° calcite filled (2" wide) healed fracture at 143.0' -45° tight, rough slickensided fracture at 143.1' -shaly layer, soft, dark gray at 143.1'-144.1', 145.4'-146.2', 147.6'-148.2' -bentonite layer, soft, dark gray at 149.1'-150.2' -40° smooth, tight slickensided fracture at 150.6' -fossil partings at 153.0' and 159.5' -shaly layer, soft, dark gray at 155.5'-156.4' and 157.2'-157.9'
145									
150		C17	145.0	155.0	100	100			
155									
160		C18	155.0		100	100			-very argillaceous, soft, gray at 159.2'-160.4', 161.4'-163.4' and 169.6'-170.0'

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Shawn Wood
(2-1-90)

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 11 PG 5 OF 7

LOCATION: N 239,029 feet
E 2,175,454 feet

GROUND EL: 670.2 feet

DATE: 9/11-9/15/89 TYPE: Nx Core CASED TO: N/A CONTRACTOR: SWL (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 7

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
				165.0					LIMESTONE (Austin Chalk) medium, fresh, sound, light gray to dark gray with occasional argillaceous and soft shaly layers and fossil partings 9-12-89 9-14-89
165		C19	165.0		100	100			-shaly layer, soft, dark gray at 166.4'-167.6' -pyrite nodule at 166.8'
170									-shaly layer, soft, dark gray at 172.2'-172.6' -bentonitic shale layer, soft, light to dark gray at 173.3'-173.5'
				175.0					
175		C20	175.0		100	100			-shaly layer, soft, dark gray at 177.0'-177.6' and 182.5'-183.0'
180									-20° smooth, tight slickensided fracture at 182.8' -very argillaceous, soft, dark gray at 183.6'-184.0'
				185.0					
185		C21	185.0		100	100			-shaly layer, soft, dark gray at 187.6'-188.3'
190									-fossil parting at 190.0' -bentonitic shale layer, soft, gray at 191.6' and 191.8'
				195.0					
195		C22	195.0		100	100			-shaly layer, soft, gray at 197.9'-198.5'
200									-fossil parting at 201.1' -shaly layer, soft, dark gray at 203.1'-203.6'

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Shawn Wood
(2-1-90)

LOG OF BORING

BORING NO: BIR 11 PG 6 OF 7

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

LOCATION: N 239,029 feet
E 2,175,454 feet

GROUND EL: 670.2 feet

DATE: 9/11-9/15/89 TYPE: Nx Core CASED TO: N/A CONTRACTOR: SWL (89-192)

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

WATER INFORMATION: See p. 1 of 7

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
				205.0					LIMESTONE (Austin Chalk) medium, fresh, sound, light gray to dark gray with occasional argillaceous and soft shaly layers and fossil partings
205			205.0						
210		C23			100	100			-shaly layer, soft, dark gray at 209.6'-213.2' and 213.8'-214.4' -shaly layer, soft, fossiliferous, dark gray at 215.0'-216.0' -fossil parting at 215.5'
				215.0					
215			215.0						216.0
									217.4 SHALY LIMESTONE (Transition) moderately hard, fresh, sound, dark gray with abundant fragments of fish bones, teeth and other fossil debris
220		C24			100	96			
				225.0					
225			225.0						SHALE (Eagle Ford) medium, fresh, sound, slightly fossiliferous, fissile, dark gray with occasional pyrite nodules and septarian concretions -30° smooth, tight slickensided fractures at 219.0' and 219.2' -carbonate nodule, hard, light gray at 231.7' -carbonate nodule, hard, light gray at 234.3' -40° smooth, tight slickensided fracture at 234.2' -20° smooth, tight slickensided fracture at 235.0' -30° smooth, tight slickensided fracture at 235.8' -45° smooth, tight slickensided fracture at 236.0' -carbonate nodule, hard, gray at 236.5' -20° smooth, tight slickensided fracture at 237.6' -carbonate nodules at 240.3', 240.8', 242.6' -20° smooth, tight slickensided fracture at 243.0', 243.1', 243.3' -40° smooth, tight slickensided fracture at 243.5'
230		C25			95	95			
				235.0					
235			235.0						
240		C26			100	100			

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Shawn Wood
(2-1-90)

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 11 PG 7 OF 7

LOCATION: N 239,029 feet
E 2,175,454 feet

GROUND EL: 670.2 feet

DATE: 9/11-9/15/89 TYPE: Nx Core CASED TO: N/A CONTRACTOR: SWL (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 7

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
245				245.0						SHALE (Eagle Ford) medium, fresh, sound, slightly fossiliferous, dark with occasional pyrite nodules and septarian concretious
250		C27	245.0	255.0	100	100				-40° smooth, tight slickensided fractures at 245.2' -carbonate nodule, hard, gray at 245.4' -30° smooth, tight slickensided fractures at 246.4' -50° smooth, tight slickensided fractures at 250.7' -45° smooth, tight slickensided fractures at 251.3' and 252.2'
255										-25° smooth, tight slickensided fractures at 255.0'
260		C28	255.0	265.0	100	100				-60° loose, rough slickensided fractures at 258.1' -30° loose, rough slickensided fractures at 258.3' -very fossiliferous, trace pyrite, gray at 257.0'-257.8' -fossil parting at 259.4'
265										
270										Bottom of Exploration at 265.0' NOTE: Monitor well installed upon completion
275										
280										

DRILLING GEOLOGIST S. Wood ASSISTANT J. Lu CHECKED BY C. Bommarito

Shawn Wood
(2-1-90)

LITHOLOGIC LOG

BIR 12

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 1 OF 9

LOCATION: N 239,008 feet
E 2,175 582 feet

GROUND EL: 667.5 feet

DATE: 9/12/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' 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 Slight water losses noted in weathered limestone only

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, brown 2.5
5		C1	5.0	10.0	54	0				LIMESTONE (Austin Chalk), med. hard, mod. wea., fractured, tan with 0.5 thick slightly argill. gray interbed 9.7s
10		C2	10.0	17.5	100	100				LIMESTONE (Austin Chalk), fresh, mod. hard, slightly fossiliferous, lt. gray with 0.3' to 4.4' thick slightly to very argill. occasionally bentonitic interbeds 1.8 to 11.7' apart
15										
20		C3	17.5	27.5	99	99				21.4g-22.0g Thin mod. argill. bed, dk. gray
25										26.8g-27.5s Thin very argill. bed, slightly bentonitic, dk. gray
30		C4	27.5	37.5	100	100				29.3g-29.6g Thin mod. argill. bed, dk. gray 33.1g-37.5g Thick slightly-mod. argill. bed, dk. gray
35										
40		C5	37.5		100	100				

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D

LOG OF BORING

BORING NO: BIR 12 PG 2 OF 9

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

LOCATION: N 239,008 feet, E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/12/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' CONTRACTOR: MJA

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
Slight water losses noted in weathered limestone only

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
45		C5		47.5	100	100				40.8g-42.7g Mod.-v. argill. bed, dk. gray, sli. bentonitic at 42.4' LIMESTONE (Austin Chalk), fresh, mod. hard, slightly fossiliferous, lt. gray, with 0.5 - 1.9' thick slightly to very argill. occasionally bentonitic interbeds 2.9 to 9.2' apart
50, 55		C6	47.5	57.5	100	100				51.9g-53.0g Med. thick sli. argill. bed, dk. gray
60, 65		C7	57.5	67.5	100	100				61.3s-62.8g Med. thick mod. argill. bed, dk. gray 66.2s-67.2g Med. thick mod. argill. bed, dk. gray
70, 75		C8	67.5	76.5	100	100				70.1g-71.6g Med. thick mod. argill. bed, dk. gray 74.5g-75.2s Med. thick mod. argill. bed, dk. gray
80		C9	76.5		100	100				78.4s-80.3g Med. thick mod.-v. argill. bed, dk. gray

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 3 OF 9

LOCATION: N 239,008 feet, E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/12/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' CONTRACTOR: MJA

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
Slight water losses noted in weathered limestone only

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
		C9		86.5	100	100				LIMESTONE (Austin Chalk), fresh, mod. hard, slightly fossiliferous, lt. gray with 1.0 - 2.3' thick mod. to very argill. interbeds 2.8 to 10.4' apart
85										85.3g-86.3g- Med. thick mod. arg. bed, dk. gray
		C10	86.5	96.5	96	96				89.1s-90.1g Med. thick very argill. bed, dk. gray
90										
95										
		C11	96.5	106.5	100	100				100.5g-102.0s Med. thick mod. argill. bed, dk. gray
100										
										105.4s-107.7g Med. thick mod.-v. argill. bed, dk. gray
105										
		C12	106.5	116.5	88	88				113.9g-115.0g Med. thick mod. arg.-v. arg. bed, dk. gray
110										
115										
		C13	116.5	117.5	100	100				
		C14	117.5		97	97				
120										

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 4 OF 9

LOCATION: N 239,008 feet
E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/12/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' CONTRACTOR: MJA

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
Slight water losses noted in weathered limestone only

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.
		C14			97	97		
125				127.0			Stopped Drilling 9/12/89	
		C15	127.0		100	100	Started Drilling 9/14/89	
130								
135				137.0				
		C16	137.0		100	100		
140								
145				147.0				
		C17	147.0		100	100		
150								
155				157.0				
		C18	157.0		100	100		
160								

DESCRIPTION OF STRATUM

122.0g-123.0g Med. thick sli. argill. bed, dk. gray

LIMESTONE (Austin Chalk), fresh, mod. hard, slightly fossiliferous, lt. gray, with 0.4 - 6.9' thick sli. to very argill. occasionally shaly and bentonitic interbeds 1.6 to 7.0' apart

127.5g-127.9g Thin mod.-v. argill. bed, dk. gray

130.0g-130.5g Thin sli. argill. bed, dark gray

134.2s-134.4g Thin shaly bed, dark gray
134.4g-134.9g Thin mod. argill. bed, dark gray
134.9g-135.6g Thin sli. argill. bed, dark gray

137.0g-142.3g Thin shaly bed with 1/2" bentonitic clay at 142.1, dark gray

145.1s-145.8g Thin very argill. bed, dark gray
145.8g-146.2g Thin sli. argill. bed, dark gray

150.1g-154.5g Thick sli. argill.-mod. argill. bed, dark gray

154.5g-155.6g Med. thick mod. argill.-v. argill. bed, dark gray, shaly from 154.9-155.0'
155.6s-157.0g Thin sli. argill. bed, dark gray

158.6g-161.3g Med. thick mod. argill.-v. argill. bed, dark gray

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 5 OF 9

LOCATION: N 239,008 feet, E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/14/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' CONTRACTOR: MJA

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
Slight water losses noted in weathered limestone only

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		167.0	100	100				161.3g-164.0g Med. thick sli. argill. bed, dk. gray LIMESTONE (Austin Chalk), fresh, mod. hd., sli. fossiliferous, with 1.4 to 12.7' thick sli. argill. shaly and bentonitic interbeds 0.5 to 3.6' thick 164.0g-168.1g Thick mod. argill. bed, dark gray
165										
		C19	167.0	177.0	100	100				168.1g-168.5s Thin v. argill. bed, sli. shaly, dk. gray with 1/4" bentonitic clay lamination at 168.3' 168.5s-170.85g Med. thick sli. argill. bed, dk. gray 170.85g-174.0g Thick mod. argill.-v. argill. bed, dark gray 177.6g-179.0g Mod. argill. bed, dark gray
170										
175										
		C20	177.0	187.0	98	98				180.8g-182.3g Mod. argill.-v. argill. bed, dark gray 183.5g-185.0g Mod. argill.-v. argill. bed, dark gray, zone of probable core loss 185.0g-185.5g Slightly argill. bed, dark gray 187.0g-188.3g Mod. argill. bed, dark gray 188.3g-189.7g Slightly argill. bed, dark gray 189.7g-192.0g Mod. argill. bed, dark gray
180										
185										
		C21	187.0	197.0	95	90				192.0g-192.9g Slightly argill. bed, dark gray 195.0g-197.4g Mod. argill. zone, dark gray 195.8-196.0 65° fracture, sli. rough to rough, undulatory, clean, Strike ~N55° W, Dip ~60° SW 196.2,196.3 Parallel 45° fractures, closed partially, clean, sli. rough to rough, undulatory Strike~N35° W, Dip~50° NE 197.2-198.0 90° vertical fracture zone (3-4) partially closed, sli. rough to rough, slickensided, 1/8" to 1/4" calcite filled closely spaced Strike~N45°W, Dip~50° SW, movement parallel to dip direction
190										
195										
		C22	197.0		100	83				198.0-198.5 80° fracture, rough to v. rough, slic' sided, w/~ 1 1/2" calcite Strike~ N35°-45°W, Dip~45°-55°NE, movement parallel to dip
200										

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. F

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 6 OF 9

LOCATION: N 239,008 feet
E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/14/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' 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 Slight water losses noted in weathered limestone only

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
		C22		207.0	100	83				200.0s-201.3g Med. thick mod.-v. argill. bed, dk. gray 201.3g-203.5g Med. thick sli. argill. bed, dark gray 203.5g-204.3g Thin mod. argill. bed, dark gray 205.1s-205.7g Thin waxy bentonitic shale bed, dk. gray 205.7g-206.8s Med. thick, soft, waxy non-laminated bentonitic clay, bluish gray
205										
		C23	207.0	217.0	100	99				207.5 12° fracture, sli. rough, clean, slickensided surface Strike Due North, Dip E, movement parallel to dip direction 212.0g-213.3g Med. thick mod. argill. bed, dk. gray 214.4g-215.6g Med. thick mod. argill. bed, dark gray 217.1s-219.6g Med. thick sli. argill. bed, dark gray
210										
215										
		C24	217.0	227.0	100	100				219.6g-220.0g Thin mod. argill. bed, dark gray 220.0g-225.3g Thick sli. argill. bed, dark gray 225.3g-225.8g Thin mod. argill. bed, dark gray 225.8g-227.35g Med. thick sli. argill. bed, dk. gray 227.35g-228.35g Med. thick mod. argill. bed, dk. gray
220										
225										
		C25	227.0	236.5	100	100				228.35g-229.9g Thin sli. argill. bed, dark gray 229.9g-231.65g Med. thick mod. argill. bed, dk. gray 231.65g-240.1g Thick sli. argill. bed, dark gray LIMESTONE (Austin Chalk), fresh, mod. hard, slightly fossiliferous, lt. gray to gray with 1.7 - 23' thick slightly argill. to shaly and bentonitic interbeds spaced 0.8 to 5.2' apart
230										
235										
		C26	236.5		100	100				
240										

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 7 OF 9

LOCATION: N 239,008 feet, E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/15/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' 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.
245		C26		246.5	100	100	Stopped Drilling 9/14/89	
250, 255		C27	246.5	256.5	100	99	Started Drilling 9/15/89	
260, 265		C28	256.5	266.5	100	100		
270, 275		C29	266.5	276.0	100	96		
280		C30	276.0		97	97		

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
Slight water losses noted in weathered limestone only

DESCRIPTION OF STRATUM

240.1g-240.45g Thin med. hard shaly bed, dk. gray

LIMESTONE (Austin Chalk), fresh, mod. hard, slightly fossiliferous, lt. gray, with 0.3 - 2.0' thick sli. argill. to shaly interbeds spaced 0.6 to 4.95 ft. apart

245.4s-245.9g Thin med. hard shaly bed, dk. gray

249.5g-249.8g Thin sli. argill. bed, dark gray

249.6, 249.7 Set of (2) 55° fractures, sli. rough, non-slickensided, w/$CaCO_3$ sand-size granular filling

253.2g-254.1g Thin mod.-v. argill. bed, dark gray

254.7g-255.0g Thin mod. argill. bed, dark gray

257.4 45° fracture, sli. rough, non-slickensided, w/$CaCO_3$ sand-size granular filling
Strike ~ N45°E Dip ~ 90° (vertical)

258.0g-259.0g Med. Thick mod. argill. bed, dk. gray

260.1g-261.5g Thin sli. argill. bed, dark gray

263.0g-265.0g Med. thick sli. argill. bed, dark gray

263.0 50° fracture, sli. rough, non-slickensided, w/$CaCO_3$ sand-size granular filling
Strike ~ N25°E Dip ~ 85°NW

266.8g-267.3g Thin mod. argill. bed, dark gray

268.2-268.6 75° fracture, closed, 1/8"-1/4" calcite filled, planar
Strike ~ N10°W, Dip ~ 60°NE

269.4 60° fracture, sli. rough to rough, 1/8"-1/4", calcite filled, undulatory surface, movement parallel to dip direction
Strike ~ N45°E, Dip ~ 75° NW

271.0g-272.5g Med. thick mod.-v. argill. bed, dk. gray

272.2 45° fracture, sli. rough, clean surface, movement parallel to dip (unable to orientate)

276.0g-277.0s Med. thick mod. argill. bed, dk. gray

278.15 45° fracture, sli. rough, non-slickensided w/$CaCO_3$ sand-size granular filling
Strike ~ N40°E, Dip ~ 90° (vertical)

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 8 OF 9

LOCATION: N 239,008 feet
E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/15/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' 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 Slight water losses noted in weathered limestone only

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
		C30			97	97			282.1 50° fracture, sli. rough, non-slickensided, w/$CaCO_3$ sand-size granular filling Strike ~N40°E, Dip ~90° (vertical) 282.6g-283.4g Thin sli. argill. bed, dark gray 283.4g-283.7g Thin mod. argill. bed, dark gray 285.0g-287.1g Med. thick sli. argill. bed, dk. gray
285				286.0					
		C31	286.0		100	100			LIMESTONE (Austin Chalk), fresh, mod. hd., slightly fossiliferous, lt. gray with 1.1 - 8.3' thick sli. to very argill. interbeds spaced 0.5 to 5.6' thick apart 292.7g-295.0g Med. thick sli. argill. bed, dk. gray 295.0g-295.9g Thin mod.-v. argill. bed, dk. gray 295.9g-301.0g Thick sli. argill. bed, dark gray
290									
295				295.5					
		C32	295.5		100	100			301.5-302.7 Increasingly argill. and arenaceous, dk. gray, w/occasional bioclastics 302.7 Transition Zone, v. argill., v. arenaceous, fossil., (bioclastics), mod. hd., med. to dk. gray, calcareous 304.6
300									
305				305.5					
		C33	305.5		100	100			SHALE (Eagle Ford), soft to med. hard, very thin bedding planes, v. fine grained, fresh, sli. calcareous, dk. gray with hard to very hard calcareous concretions 312.4 60° fracture, smooth, clean, slickensided surface Strike ~N80°E, Dip ~20°NW
310									
315				315.5			Stopped Drilling 9/15/89		
		C34	315.5				Started Drilling 9/16/89		319.8-320.0 Calcareous Concretion (Septarian), light gray to dark gray, hard to very hard, white calcite crystans inside
320									

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. Flanigan

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 12 PG 9 OF 9

LOCATION: N 239,008 feet
E 2,175,582 feet

GROUND EL: 667.5 feet

DATE: 9/16/89 TYPE: Nx Angle Core(1) CASED TO: 5.5' 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
		C34		322.0	71	66				SHALE (Eagle Ford), soft to med. hard, very close bedding planes, v. fine grained, fresh, sli. calc., dk. gray with hard non-calcareous claystone inclusions and hard to very hard calcareous concretions
-325		C35	322.0	331.5	100	100				Lt. brown, hard, non-calcareous claystone inclusions at the following depths: 322.2 (1/2"), 322.4 (1/2"), 322.5-322.7, 325.2 (1/2"), 325.7-325.8, 329.5-329.6, 332.5, 333.8-333.9
-330										330.0-330.3 Calcareous Concretion (Septarian), lt. gray to dark gray, hard to very hard, white calcite crystals inside
-335		C36	331.5	341.5	95	95				
-340										
-345										Total Depth: 341.5 9/16/89
-350										(1) Angle Hole Field Azimuth: ~N70°W Plunge: ~45°
-355										(2) Fractures: First angle is measured normal to core axis, second strike and dip trends approximated from field azimuth and dip.
-360										(3) Wireline Logged 9/16/89
										(4) Hydrotested 9/18/89 & 9/19/89
										(5) Boring Plugged 9/19/89
										Log Revised 1/22/90

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
Slight water losses noted in weathered limestone only

DRILLING GEOLOGIST Scott Lesikar ASSISTANT Beth Flowers CHECKED BY W. D. Flanigan

LITHOLOGIC LOG

BIR 13

LOG OF BORING

PROJECT: Superconducting Supercollider
CLIENT: The Earth Technology Corporation
TASK NO.: 15

BORING NO: BIR 13PG 1 OF 8
LOCATION: N 238,844 ft. E 2,175,494 ft.
GROUND EL: 669.9 ft.

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

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

WATER INFORMATION
Seepage 2.0'. began water rotary NX Core at 2.0'

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE TOP	DEPTH RANGE BOT.	PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	DESCRIPTION OF STRATUM
		S-1	Shelby Tube 0'	1.0'					CLAY, silty, dark brown with traces of roots and organic debris. 1.0
5		C1	2.0		90	42			CLAY, silty, tan and brown with embedded limestone fragments. 2.0
10				11.0	100	100			LIMESTONE (Austin Chalk) severely weathered, moderately fractured, tan. 7.0
15		C2	11.0		97	97			LIMESTONE (Austin Chalk) medium, fresh, sound, light gray with occasional argillaceous and soft shale layers, pyrite nodules and fossil partings.
20				21.0					-slightly argillaceous layer , medium gray, gradational contacts at 11.3'-12.2'
		C3	21.0						-slightly argillaceous layer , medium gray , gradational contact at 13.4' to sharp contact at 14.0'
25					99	97			-slightly argillaceous layer , medium gray, gradational contacts at 15.9'-16.8'
									-½" shale layer , soft, dark gray, sharp contact at 20.3'
									-slightly argillaceous layer , medium gray, gradational contacts at 21.7'-22.1'
									-1" pyrite nodule at 22.9'
									-45°, smooth,open, slickensided fracture at 25.6'
30				31.0					-1" shale layer, soft, dark gray, sharp contact at 25.8'
		C4	31.0						-fossil partings at 28.8' and 30.1'
									-¼" pyrite nodules at 28.7'
									-shale layer , soft dark brown, gradational contacts at 30.6'-31.1'
35					100	100			-moderately argillaceous layer , medium gray, gradational contacts at 32.4'-32.8'
									-moderately argillaceous layer , medium gray, gradational contacts at 33.8'-34.8'
									-fossil partings at 35.7', 38.1', and 38.6'
40				41.0					-moderately argillaceous layer , medium gray, gradational contacts at 37.8'-38.6'
									-moderately argillaceous layer , medium gray, gradational contacts 40.6'-41.7'

DRILLING GEOLOGIST Mike Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR13 PG 2 OF 8

LOCATION: N 238,844 ft.
E 2,175,494 ft.

GROUND EL: 669.9 ft.

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

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

WATER INFORMATION: See p. 1 of 8

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
45, 50		C5	41.0	51.0	100	100			LIMESTONE (Austin Chalk) medium, fresh, sound, light gray with occasional argillaceous, shaly limestone and soft shale layers, moderately fossiliferous layers, and fossil partings. -fossil partings at 42.5', 44.5', 45.5', 46.2', and 47.1' -moderately argillaceous layer , medium gray, sharp contacts at 43.4'-44.5' -shaly limestone layer , dark gray, gradational contacts at 48.0'-48.9' -shaly limestone layer , dark gray, gradational contacts at 50.7'-51.6'
55, 60		C6	51.0	61.0	100	93			-fossil partings at 53.4', 54.4', 54.6', 56.2' 58.4', 58.7', 59.0' and 60.0' -moderately argillaceous layer , medium gray, sharp contacts at 53.9'-54.3' -shale layer , soft, dark gray, sharp contacts at 56.6'-56.9' -shaly limestone layer , dark gray, gradational contacts at 56.9'-58.0' -slightly argillaceous, moderately fossiliferous layer , medium gray, gradational contacts at 59.4'-60.4'
65, 70		C7	61.0	71.0	100	100			-moderately argillaceous layer , medium gray, 61.7'-62.5' -shaly limestone layer , dark gray, sharp contacts at 64.5'-64.9' -fossil parting at 64.9' -slightly argillaceous layer , medium gray, sharp contacts at 66.5'-67.2' -shale layer , soft, dark gray, sharp contacts at 68.8'-69.0' -slightly argillaceous layer , medium gray, sharp contact at 69.0' to gradational contact at 70.1'
75, 80		C8	71.0	81.0	98	97			-shaly limestone layer , dark gray, gradational contact at 72.2' to sharp contact at 73.4' -shaly limestone layer , dark gray, sharp contacts at 75.8'-77.3' -fossil partings at 77.9' and 78.0'

DRILLING GEOLOGIST M. Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR13 PG 3 OF 8

LOCATION: N 238,844 ft. E 2,175,494 ft.

GROUND EL: 669.9 ft.

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

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		C9	81.0	91.0	54	54			LIMESTONE (Austin Chalk) medium, fresh, sound, light gray with occasional argillaceous, shaly limestone, soft shale, bentonite and moderately fossiliferous layers. Occasional fossil partings. -shaly limestone layer , dark gray, gradational contacts at 81.7'-83.1' -shaly limestone layer , dark gray, gradational contacts at 83.9'-84.9' -shaly limestone layer , dark gray, gradational contacts at 91.6'-92.4'
95, 100		C10	91.0	101.0	100	100			-fossil partings at 92.8', 93.5', 95.4', 96.5' and 99.0' -shale layer , soft dark gray with traces of bentonite, sharp contacts at 93.4'-93.7' -shaly limestone layer , dark gray, sharp contacts at 96.4'-96.9' -moderately argillaceous layer , medium gray, gradational contacts at 98.0'-99.5' -shale layer , soft, dark gray, sharp contacts at 101.5'-101.9' with 1" bentonite layer, soft, bluish-gray at 101.7'
105, 110		C11	101.0	111.0	52	52			-moderately argillaceous layer , medium gray, gradational contacts at 111.0'-111.7'
115, 120		C12	111.0	121.0	100	100			-shaly limestone layer , dark gray, sharp contact at 113.6' to gradational contact at 115.1' -moderately fossiliferous layer , gradational contacts at 113.6'-114.4' -fossil parting at 115.9' -moderately argillaceous layer , medium gray, gradational contacts at 117.2'-119.6' -shale layer , soft, dark gray, sharp contacts at 120.1'-120.3' with ¼" bentonite seam, soft, bluish-gray at 120.25' -fossil parting at 120.7'

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 8

DRILLING GEOLOGIST M. Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR13 PG 4 OF 8

LOCATION: N 238,844 ft.
E 2,175,494 ft.

GROUND EL: 669.9 ft.

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 8

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
125		C13	121.0	128.0	81	81			LIMESTONE (Austin Chalk) medium, fresh, sound, light gray with occasional argillaceous, shaly limestone and bentonite layers, and fossil partings. -moderately argillaceous layer , medium gray, gradational contacts at 122.0'-124.1' -numerous mechanical breaks at 123.0'-126.7' -moderately argillaceous layer , medium gray, sharp contacts at 129.0'-129.4'
130 135		C14	128.0	138.0	95	95			-shaly limestone layer , dark gray, sharp contacts at 129.4'-129.8' -shaly limestone layer , dark gray, gradational contacts at 131.0'-131.8' -fossil parting at 131.5' -moderately argillaceous layer , medium gray, sharp contacts at 133.5'-134.1' -moderately argillaceous layer , medium gray, gradational contacts at 135.2'-136.6' -moderately argillaceous layer , medium gray, gradational contact at 139.3' to sharp contact at 140.7'
140 145		C15	138.0	148.0	100	100			-moderately argillaceous layer , medium gray, sharp contacts at 141.5'-143.0' -shaly limestone layer , dark gray, gradational contact at 144.3' to sharp contact at 145.3' -shaly limestone layer , dark gray, gradational contacts at 146.1'-146.3' -shaly limestone layer , dark gray, gradational contacts at 146.9'-147.4'
150 155		C16	148.0	158.0	93	93			-bentonite layer , soft, bluish-gray, sharp contacts at 148.0'-148.7' -45°, closed, calcite filled, healed fracture, (1/16") at 150.1' -moderately argillaceous layer , medium gray, gradational contacts at 155.9'-156.5'
160									

DRILLING GEOLOGIST M. Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR13 PG 5 OF 8

LOCATION: N 238,844 ft.
E 2,175,494 ft.

GROUND EL: 669.9 ft.

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 8

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
165		C17		168.0	89	89			LIMESTONE (Austin Chalk) medium, fresh, sound, light gray with occasional argillaceous, shaly limestone, soft shale layers, fossil partings and traces of pyrite. -moderately argillaceous layer , medium gray, gradational contacts at 161.6'-162.0' -shaly limestone layer , dark gray, sharp contacts at 163.3'-163.9' -shaly limestone layer , dark gray, gradational contacts at 165.1'-165.8' -¼" pyrite nodule at 165.7'
170		C18	168.0	176.0	100	100			-moderately argillaceous layer , medium gray, gradational contacts at 167.0'-167.8' -moderately argillaceous layer , medium gray, gradational contacts at 169.3'-169.5' -moderately argillaceous layer , medium gray, gradational contacts at 171.9'-172.3'
175									
180		C19	176.0	186.0	95	95			-shale layer , soft, dark gray, sharp contacts at 172.7'-172.9' -½" pyrite nodule at 172.4' -shaly limestone layer , dark gray, sharp contacts at 175.7'-176.0' -moderately argillaceous layer , medium gray, gradational contacts at 178.6'-179.6' -moderately argillaceous layer , medium gray, gradational contacts at 181.1'-181.6' -moderately argillaceous layer , medium gray, gradational contacts at 182.0'-182.2'
185									
190		C20	186.0	196.0	99	99			-moderately argillaceous layer , medium gray, gradational contacts at 184.1'-185.5' -moderately argillaceous layer , medium gray, gradational contacts at 186.3'-186.7' -fossil parting at 188.2' -shaly limestone layer , dark gray, sharp contacts at 192.7'-193.2' -shaly limestone layer , dark gray, sharp contacts at 196.2'-196.7'
195									-shaly limestone layer , dark gray, sharp contacts at 196.2'-196.7'
200		C21	196.0		26	26			

DRILLING GEOLOGIST M. Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR13 PG 6 OF 8

LOCATION: N 238,844 ft.
E 2,175,494 ft.

GROUND EL: 669.9 ft.

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

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
205									LIMESTONE (Austin Chalk) medium, fresh, sound, light gray with occasional argillaceous and shaly limestone layers, traces of pyrite.
									-moderately argillaceous layer , medium gray, gradational contacts at 207.3'-208.1'
			206.0						-shaly limestone layer , dark gray, gradational contacts at 208.8'-211.0'
210		C22			90	90			-½" pyrite nodule at 213.0'
									213.2
215				216.0					SHALY LIMESTONE (Transition) medium, fresh, sound, extremely argillaceous, medium gray with abundant fragments of fish bones, teeth and other fossil debris.
			216.0						
220		C23			24	24			215.0
									SHALE (Eagle Ford) soft, fresh, sound, fissile, dark gray with occasional septarian concretions and fossil partings.
225				226.0					
			226.0						-septarian concretion at 227.2'
230		C24			13	13			
235				236.0					-septarian concretions at 236.3', 238.8' 239.1 and 241.3'
			236.0						-35°, smooth, open, slickensided fracture at 238.5'
									-35°, smooth, open, slickensided fracture at 244.1'
240		C25			92	92			

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

WATER INFORMATION
See p. 1 of 8

DRILLING GEOLOGIST M. Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIP12 PG 7 OF 8

LOCATION: N 238,844 ft. E 2,175,494 ft.

GROUND EL: 669.9 ft

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

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

WATER INFORMATION: See p. 1 of 8

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
245									LIMESTONE (Eagle Ford) soft, fresh, sound, fissile, dark gray with occasional limestone seams and septarian concretions. -septarian concretions at 246.9'
250		C26	246.0	256.0	95	95			
255									
260		C27	256.0	266.0	98	98			-¼" limestone seams, light gray at 263.5'-263.7'
265									
270		C28	266.0	276.0	59	59			-septarian concretion at 268.0'
275									
280		C29	276.0	281.0	100	100			-½" limestone seam at 280.6'

DRILLING GEOLOGIST M. Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider
CLIENT: The Earth Technology Corporation
TASK NO.: 15

BORING NO: BIR13 PG 8 OF 8
LOCATION: N 238,844 ft. E 2,175,494 ft.
GROUND EL: 669.9 ft.

DATE: 2-23/3-1-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL (89-192)

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

WATER INFORMATION: See p. 1 of 8

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
				281.0					
		C30	281.0	291.0	100	100			LIMESTONE (Eagle Ford) soft, fresh, sound, fissile, dark gray with occasional pyrite nodules and septarian concretions.
285									
290									-1" pyrite nodule at 291.0'
		C31	291.0	301.0	100	100			-septarian concretion at 293.1'
295									
300									-¼" pyrite nodule at 297.9'
		C32	301.0	304.0	100	100			
305									Bottom of Exploration at 304.0 feet.
									Boring grouted upon completion.
310									
315									
320									

DRILLING GEOLOGIST M. Granger ASSISTANT Randy Grimstead CHECKED BY Shawn Wood

LITHOLOGIC LOG

BIR 14

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR14 PG 1 OF 8

LOCATION: N 239,199 ft. E 2,175,518 ft.

GROUND EL: 667.5 ft.

DATE: 2-26/3-2-90 TYPE: NX core CASED TO: N/A CONTRACTOR: SwL 89-192

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- soft, silty, organic, dark grayish brown. 1.7
5									LIMESTONE (Austin Chalk) soft, extremely weathered, light tan to tan 6.0
		C1	6.0	11.0	98	98			
10									
		C2	11.0	21.0	93	93			LIMESTONE (Austin Chalk) soft to medium, fresh, sound light gray to gray with occasional argillaceous layers and fossil partings. -slightly weathered layers,soft, dark gray gradational contacts at 7.5'-7.9' and gradational contacts at 10.0'-10.7' -slightly weathered layer, soft light tan to tan sharp contact at 6.0' to gradational contact at 6.2' -slightly argillaceous layer, soft, dark gray, gradational contacts at 12.3'-12.7' and gradational contacts at 19.6'-20.1' -moderately argillaceous layer, soft, dark gray, gradational contacts at 14.7'-15.3' and gradational contacts at 18.3'-18.6' -fossil partings at 21.7' and 24.6' -fossil pyrite at 26.5' -moderately argillaceous layer, soft, dark gray, gradational contacts at 23.3'-24.2' and gradational contacts at 25.5'-26.2' -shaly layer, soft, dark gray, gradational contacts at 24.2'-24.7', gradational contacts at 25.2'-25.5', fissile, gradational contacts at 29.1'-29.9' -85°, fracture, rough, broken, at 26.8'-28.0' -pyrite nodules, small, 29.8'-30.4' -moderately argillaceous layer, soft, dark gray gradational contact at 31.4' to sharp contact at 31.7'; gradational contacts at 32.9'-33.9'; gradational contacts at 36.8'-37.7'; and gradational contacts at 39.8'-40.8' -fossil partings at 33.4', 33.7', 36.1', 37.3', 37.6', 39.9', 40.4' and 40.7'
15									
20									
		C3	21.0	31.0	98	98			
25									
30									
		C4	31.0	41.0	100	100			
35									
40									

SAMPLE LEGEND

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

WATER INFORMATION

Began drilling with water at 1.75'. Unable to determine parameters of subsurface water table

DRILLING GEOLOGIST D. Brown ASSISTANT C. Jones CHECKED BY Shawn Wood

LOG OF BORING

BORING NO: BIR14 PG 2 OF 8

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

LOCATION: N 239,199 ft. E 2,175,518 ft.

GROUND EL: 667.5 ft

DATE: 2-26/3-2-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL 89-192

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
45, 50		C5	41.0	51.0	100	100			LIMESTONE (Austin Chalk) soft, fresh, sound light gray to gray with occasional argillaceous layers and fossil partings. -very argillaceous layer, soft, sharp contact at 43.4' to gradational contact at 44.2'; fossiliferous, gradational contacts at 46.8'-48.0'; fissile, gradational contact at 49.8' to sharp contact at 51.0' -fossil partings at 42.7', 43.1', 44.5', 46.3', 47.2', 47.9', 49.7, and 50.0'
55		C6	51.0	57.0	100	100			-very argillaceous layer, soft, dark gray, gradational contact at 52.8' to sharp contact at 53.2' -fissile, gradational contacts at 55.5'- 55.8' -moderately argillaceous layer, gradational contact at 55.8' to sharp contact at 57.0' -fossil parting at 52.4', 53.6', and 54.7'
60, 65		C7	57.0	67.0	98	98			-fossil partings at 57.5', 57.6', 58.0', 59.4', 61.1', 64.0' and 64.9' -fossiliferous limestone layer, sharp contacts at 58.3'-59.2' -moderately argillaceous layers, soft, dark gray, gradational contacts at 58.3'-59.4; gradational contacts at 60.7'-61.3'; gradational contacts at 63.3'-63.8' -slightly argillaceous layers, gray, gradational contacts at 63.8'-65.9'
70, 75		C8	67.0	77.0	100	100			-shaly layer, soft, fissile, gradational contacts at 68.0'-68.3'; and sharp contacts at 72.0'-72.4' -moderately argillaceous layers, soft, dark gray, gradational contact at 71.2' to sharp contact at 72.0'; gradational contacts at 75.1'-76.5' -fossil partings at 68.8', 70.9', 71.5' and 74.7'
80		C9	77.0		97	97			-fossil parting at 84.8' -fossiliferous limestone layer, sharp contacts at 80.7'-81.0' -moderately argillaceous layers, dark gray, gradational contacts at 81.0'-82.2'; and gradational contacts at 84.2'-85.5'

SAMPLE LEGEND

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

WATER INFORMATION

See p. 1 of 8

DRILLING GEOLOGIST D. Brown ASSISTANT C. Jones CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR 14 PG 3 OF 8

LOCATION: N 239,199 ft. E 2,175,518 ft.

GROUND EL: 667.5 ft

DATE: 2-26/3-290 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL 89-192

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

WATER INFORMATION: See p. 1 of 8

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									LIMESTONE (Austin Chalk) soft to medium, fresh, sound, light gray to gray with occasional argillaceous layers and fossil partings.
90, 95		C10	87.0	97.0	99	99			-fossil partings at 87.3', 88.6', 89.5', 89.7', 89.9', 92.6', 94.1', and 94.6' -moderately argillaceous layers, gray, fossiliferous sharp contact at 87.0' to gradational contact at 87.4'; fissile, gradational contacts at 92.5'-92.9' -very argillaceous layers, dark gray, fossiliferous, gradational contacts at 90.7'-91.6'; sharp contact at 95.6' to gradational contact at 96.2' -slightly argillaceous layer, gray, gradational contacts at 98.2'-98.5'
100, 105		C11	97.0	107.0	96	96			-fossil partings at 97.8', 99.9', 102.4', 104.3', and 104.5' -bentonitic shale layer, soft, fissile, gray to bluegray, broken, gradational contacts at 101.0'-101.4' -moderately argillaceous layer, dark gray, gradational contacts at 103.5'-104.0' -fossil partings at 107.2', 108.0', 108.6', 110.0', 110.3', 110.9', 111.7', and 113.6' -slightly argillaceous layers, gray, gradational contacts at 107.7'-108.3'; gradational contacts at 109.2'-109.9'; gradational contacts at 110.7'-111.4'; and gradational contacts at 114.5'-117.0'
110, 115		C12	107.0	117.0	99	99			-moderately argillaceous layer, dark gray, gradational contacts at 109.9'-110.7'; fossiliferous, gradational contacts at 113.0'-113.9' -shaly interbed, gray, fissile, fossiliferous, gradational contacts at 108.4'-108.9' -very argillaceous layer, dark gray, sharp contact at 117.0 to gradational contact at 117.8'; gradational contacts at 118.1'-118.5'; gradational contact at 121.5' to sharp contact at 123.7'
120			117.0						-very argillaceous layers, dark gray, soft, fissile, gradational contacts at 117.8'-118.1'; bentonitic sharp contacts at 119.7'-119.9'

DRILLING GEOLOGIST D. Brown ASSISTANT Clay Jones CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO. BIR14 PG 4 OF 8

LOCATION: N 239,199 ft.
E 2,175,518 ft.

GROUND EL: 667.5 ft

DATE: 2-26/3-2-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL 89-192

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

WATER INFORMATION: See p. 1 of 8

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
125		C13		127.0	90	90			LIMESTONE (Austin Chalk) soft to medium, fresh, sound, light gray to gray with occasional argillaceous and shaly layers and fossil partings. -fossil partings at 121.1' -moderately argillaceous layers at 127.0'-127.4'; fossiliferous, gradational contacts at 128.6'-129.5'; gradational contacts at 131.7'-131.4'
130		C14	127.0	132.0	96	96			-fossil partings at 128.5', 129.9' and 131.6' -moderately argillaceous layer soft, dark gray gradational contacts at 133.2'-134.0'; gradational contact at 136.8' to sharp contact at 137.2'; gradational contacts at 138.7'-140.2'; gradational contact at 141.0' to sharp contact at 142.0'
135		C15	132.0	142.0	100	100			-fossil partings at 132.2' 136.0', and 137.2' -shaly interbed, soft, fissile, gradational contacts at 135.0'-136.5'
140									-moderately argillaceous layer, soft, dark gray, sharp contacts at 142.0'-142.6'; gradational contact at 143.9 to sharp contact at 144.8'; gradational contacts at 146.4'-147.6'; gradational contacts at 149.0-150.6'
145		C16	142.0	152.0	92	92			-bentonitic shale, very soft, gray, sharp contacts at 145.6'-145.8', fractured, gradational contacts at 147.6'-148.6' -fossil partings at 144.4', 146.7' and 150.6'
150									
155		C17	152.0	162.0	100	100			-moderately argillaceous layer, dark gray, gradational contacts at 152.4'-153.3'; gradational contacts at 154.0'-154.9'; gradational contacts at 155.8'-156.5'; gradational contacts at 157.8'-159.0', gradational contacts at 159.8'-160.6'; gradational contact at 161.1' to sharp contact at 162.0' -fossil partings at 158.4' and 160.6' -pyrite nodule at 161.7'
160									
			162.0						

DRILLING GEOLOGIST D. Brown ASSISTANT C. Jones CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider
CLIENT: The Earth Technology Corporation
TASK NO.: 15

BORING NO: BIR14 PG 5 OF 8
LOCATION: N 239,199 ft. E 2,175,518 ft.
GROUND EL: 667.5 ft

DATE: 2-26/3-290 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL 89-192

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

WATER INFORMATION
See p. 1 of 8

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
			162.0	172.0	100	100				LIMESTONE (Austin Chalk) soft to medium, fresh, sound, light gray to gray with occasional argillaceous and shaly layers and fossil partings. -moderately argillaceous layers, soft, dark gray sharp contact at 163.2' to gradational contact at 163.5'; gradational contacts at 164.9'-165.5'; gradational contacts at 170.8'-171.2'; gradational contacts at 171.8'-172.0' -pyrite nodules at 165.6', 165.9', 166.0', and 168.6' -35° smooth, tight, slickensided fracture at 163.6'
		C18	172.0	182.0	98	98				-bentonitic shale, soft, bluegray to gray, gradational contact at 163.5' to sharp contact at 163.7' -fossil partings at 168.4' and 171.0' -very argillaceous layer, fissile, dark gray gradational contacts at 175.5'-176.0' -slightly argillaceous layer, gray, gradational contacts at 180.9'-181.5' -pyrite nodules at 178.8', 179.5', and 180.1'
		C19	182.0	192.0	93	93				-moderately argillaceous, dark gray, sharp contact at 182.1' to gradational contact at 182.3'; gradational contacts 185.0'-185.3'; gradational contacts at 186.0'-186.6'; gradational contacts at 190.2'-190.4' -slightly argillaceous layer, gray, gradational contacts at 185.3'-186.0'; gradational contacts at 187.9'-188.2' -fossil parting at 186.2'
		C20	192.0	202.0	100	100				-moderately argillaceous layers, dark gray, gradational contacts 193.2-193.9'; gradational contacts at 196.5'-197.3'; gradational contact 201.7' to sharp contact at 202.0' -30° smooth, tight, slickensided fracture at 193.3'
		C21								

DRILLING GEOLOGIST D. Brown ASSISTANT C. Jones CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology corporation

TASK NO.: 15

BORING NO: BIR14 PG 6 OF 8

LOCATION: N 239,199 ft. E 2,175,518 ft.

GROUND EL: 667.5 ft.

DATE: 2-26/3-2-90 TYPE: N/A CASED TO: CONTRACTOR: SwL 89-192

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

WATER INFORMATION: See p. 1 of 8

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
		C22	202.0	212.0	79	79			LIMESTONE (Austin Chalk) soft to medium, fresh, sound, light gray to gray with occasional argillaceous layer and fossil partings. -moderately argillaceous layer, dark gray, gradational contacts at 203.7'-204.2'; gradational contacts at 207.6'-209.8' -moderately argillaceous layer, gray, sharp contact at 212.0' to gradational contact at 214.1' -very argillaceous layer, dark gray, gradational contacts at 214.1-214.5'; fossiliferous, gradational contact at 214.5' to sharp contact at 215.2'
205, 210									
		C13	212.0	222.0	98	98			215.2 -sharp contact- SHALY LIMESTONE(Transition) medium, fresh, sound, extremely argillaceous, gray to dark gray with abundant fragments of fish bones, teeth and other fossil debris. 216.4 -gradational contact-
215, 220									
		C24	222.0	232.0	72	72			SHALE (Eagle Ford) soft, dark gray, fissile, fresh, with occasional fossil partings. and septarian concretions. -pyrite nodule at 222.7', 226.2' and 228.0' - 30° smooth tight, slickensided fracture at 228.0' with transverse 60° smooth, tight fracture at 228.9' -septarian concretions at 226.2' and 228.0'
225, 230									
		C25	232.0	242.0					-limestone seam (3/4"), dark tan, medium at 233.2'; (¼"), dark tan, medium, at 234.3'; (3/4"), dark tan, medium at 234.6'; (½"), dark tan, medium at 235.4'; (¼"), dark tan, medium at 237.5'; (3/4"), dark tan, medium at 238.2'; (½"), dark tan, medium, at 239.7' -septarian concretions at 235.7', 237.0', 237.2', and 237.4' -severely fractured
235, 240									

DRILLING GEOLOGIST D. Brown ASSISTANT C. Jones CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider
CLIENT: The Earth Technology Corporation
TASK NO.: 15

BORING NO: BIR14 PG 7 OF 8
LOCATION: N 239,199 ft. E 2,175,518 ft.
GROUND EL: 667.5 ft.

DATE: 2-26/3-2-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL 89-192

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
				242.0					SHALE (Eagle Ford) soft, fresh, fissile, dark gray, with occasional septarian concretions and fossil partings.
		C26	242.0	252.0	92	92			-core is severely fractured, very fissile -limestone seam (3/4") dark tan, medium, at 251.2' -pyrite seam (1/8"), at 252.9' -pyrite seam (¼"), at 253.1' -septarian concretion at 254.7' -limestone layer, medium, light gray, sharp contacts at 256.3'-256.5' -shaly limestone layer, medium, fresh, gray to dark gray with trace pyrite at 256.5' and 256.9'
		C27	252.0	256.5	100	90			-35°, smooth, tight, slickensided fracture at 257.1' -60°, tight, healed fracture at 258.1' -50°, tight, healed fracture at 258.5' -80°, tight, smooth, slickensided fractures at 258.8'-259.3'
		C28	256.5	262.0	100	100			-pyrite nodules at 257.6' and 259.8' -pyrite nodule at 263.2' -fossil parting at 263.6' -shaly limestone, medium, dark gray, pryite, gradational contact at 264.5' to sharp contact at 265.3'
		C29	262.0	272.0	100	98			-30°, smooth, tight, slickensided fracture at 265.8' with transverse 45° smooth, tight, slickensided fracture at 265.9' -45°, smooth, tight, slickensided fracture at 266.5' -45°, smooth, tight, fracture at 269.2' -limestone/pyrite seam (1/8") at 270.1; (1/8") at 270.4' -pyrite nodule at 271.7' -septarian concretions at 276.1', 278.0' and 281.5'
		C30	272.0	282.0	100	100			-limestone seam (1/8"), light gray trace pyrite at 273.0' -limestone seam (¼"), light gray, trace pyrite at 273.9' -shaly limestone layer, gray to dark gray, fossiliferous, gradational contact at 275.0' to sharp contact at 276.1' -fossil partings at 275.3', and 276.4' -limestone seam (¼"), light gray at 276.6' -shaly limestone layer, gray to dark gray, fossiliferous, gradational contacts at 277.8'-278.5' -pyrite nodule at 280.5'
			282.0						

SAMPLE LEGEND	WATER INFORMATION
S= SPLIT SPOON T= 2" THIN WALL TUBE U= 3" THIN WALL TUBE C= NX ROCK CORE	See p.1 of 8

DRILLING GEOLOGIST D. Brown ASSISTANT A. Dover CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: Superconducting Supercollider

CLIENT: The Earth Technology Corporation

TASK NO.: 15

BORING NO: BIR14 PG 8 OF 8

LOCATION: N 239,199 ft. E 2,175,518 ft.

GROUND EL: 667.5 ft

DATE: 2-26/3-2-90 TYPE: NX Core CASED TO: N/A CONTRACTOR: SwL 89-192

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

WATER INFORMATION: See p. 1 of 8

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
				282.0						SHALE (Eagle Ford) soft, fresh, fissile, dark gray with occasional pyrite nodules and septarian concretions.
			282.0							
285		C31			87	87				-pyrite nodule (¼"), at 287.1'
290				292.0						
			292.0							
295		C32			100	100				-pyrite nodules at 293.0', 296.6', 296.8', and 297.1' -fossil parting at 298.4'
300				301.0						
		C33	301.0		100	100				
305										Bottom of Exploration at 303.0'
310										
315										
320										

DRILLING GEOLOGIST D. Brown ASSISTANT A. Dover CHECKED BY Shawn Wood

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BIR 11 **Log Measured From:** Ground Level

Drilling Parameters

Depth 265.0 feet

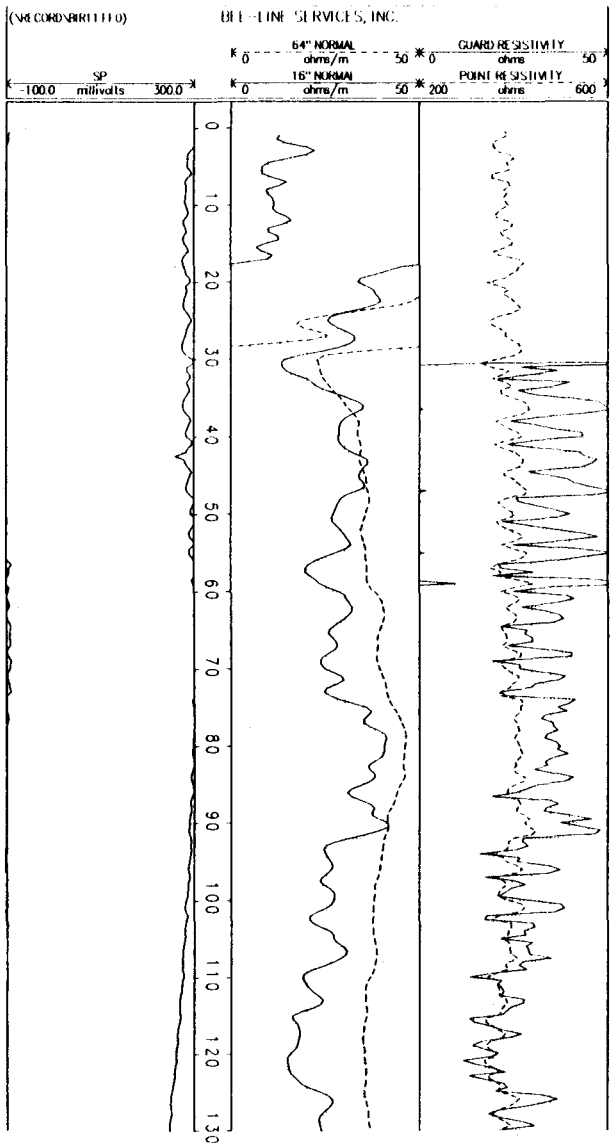
Bit Diameter 3.5 inches

Logging Parameters	Electrical Log	Gamma and Neutron Logs	Sonic Log
Date	September 15, 1989	September 15, 1989	September 15, 1989
Bottom Log Interval	262.0 feet	262.5 feet	257.7 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	30 minutes	30 minutes	30 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

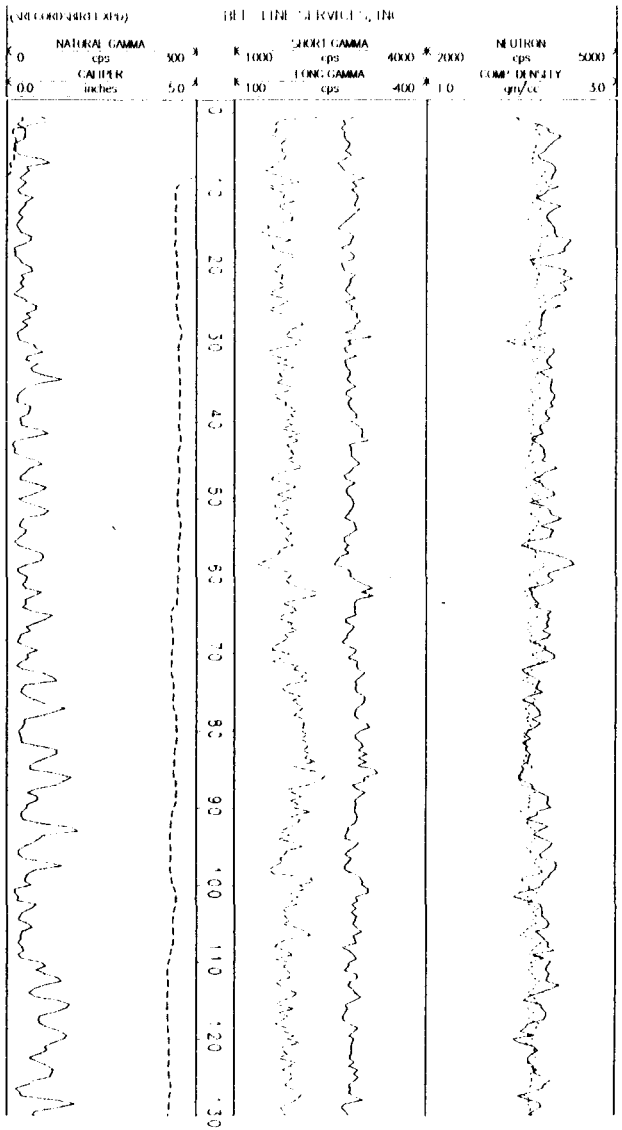
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

BIR 11 Wire-line logs run September 15, 1989. Surface elevation 670.2 feet.

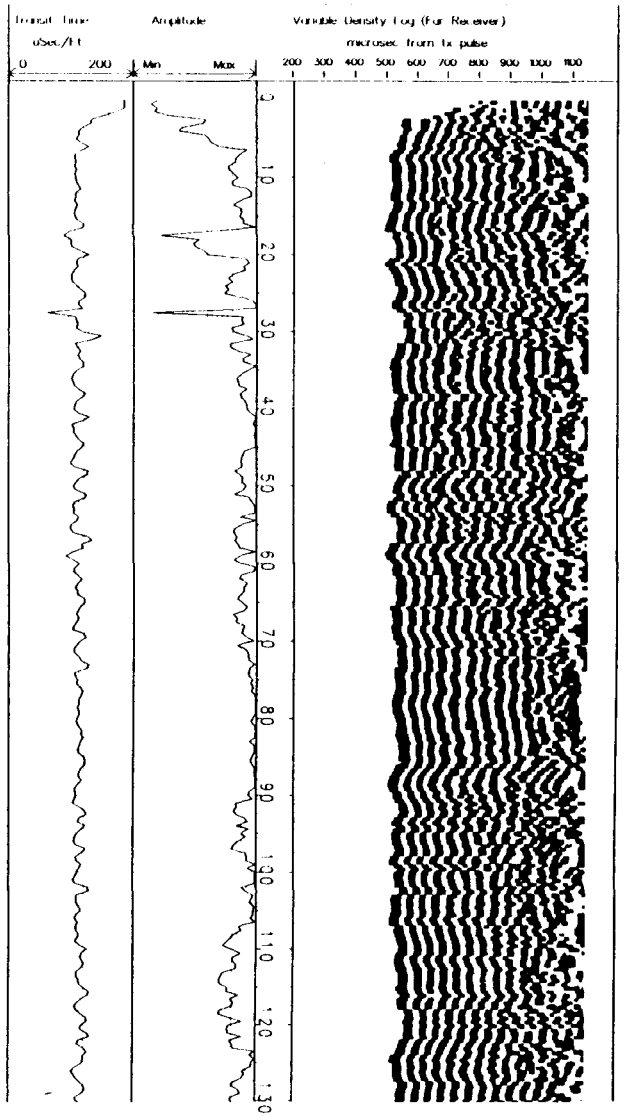
ELECTRICAL LOG



GAMMA AND NEUTRON LOGS

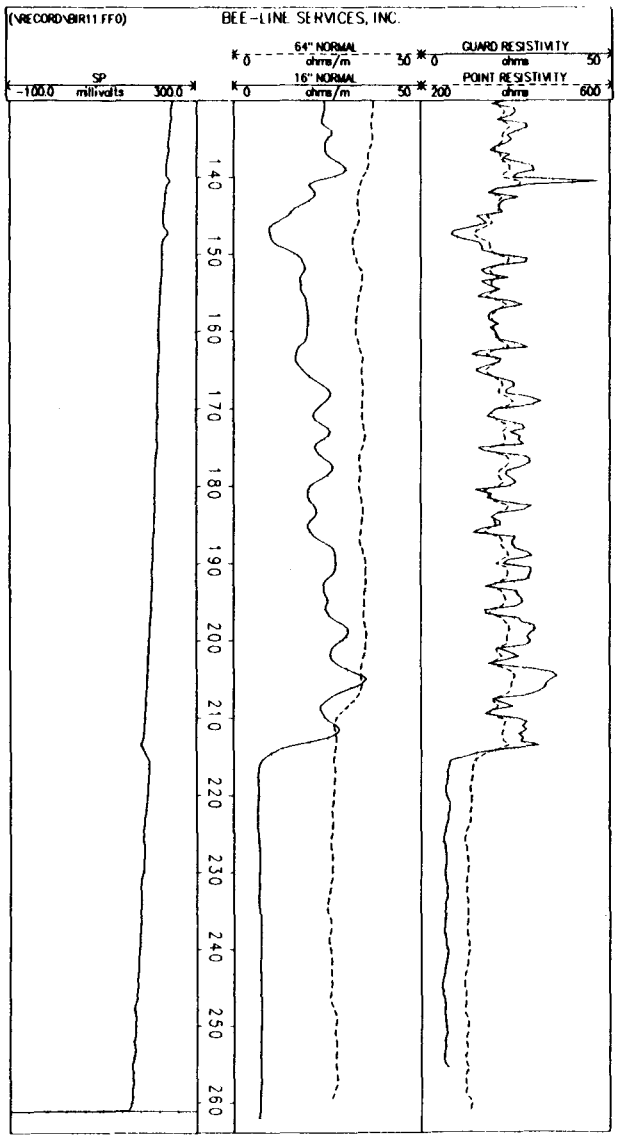


SONIC LOG

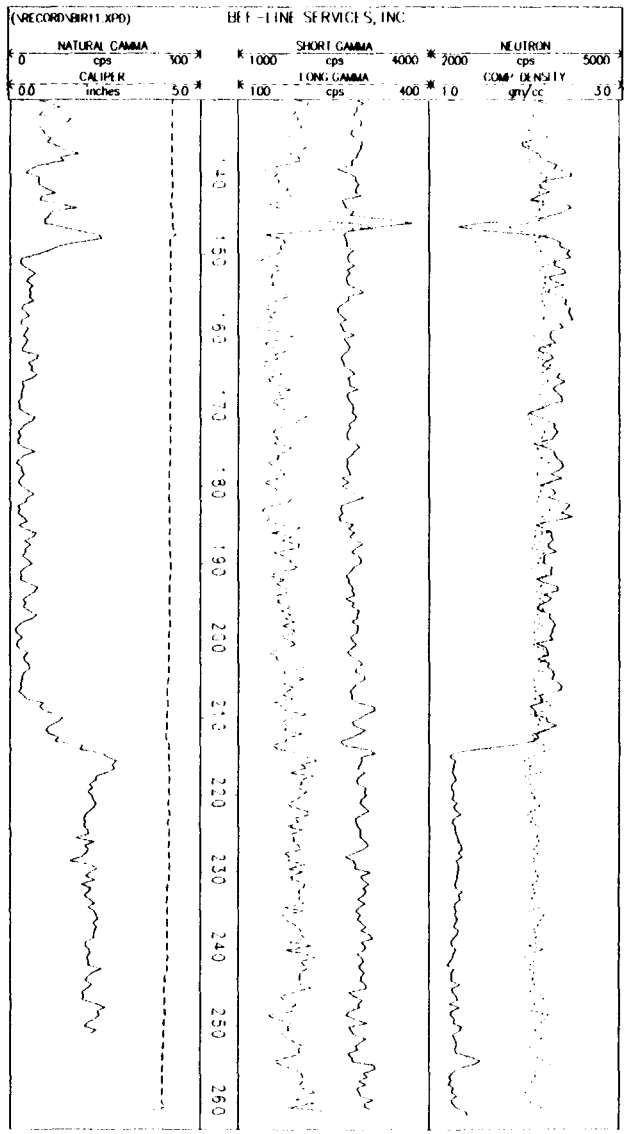


BIR 11 Wire-line logs run September 15, 1989 (Continued). Surface elevation 670.2 feet.

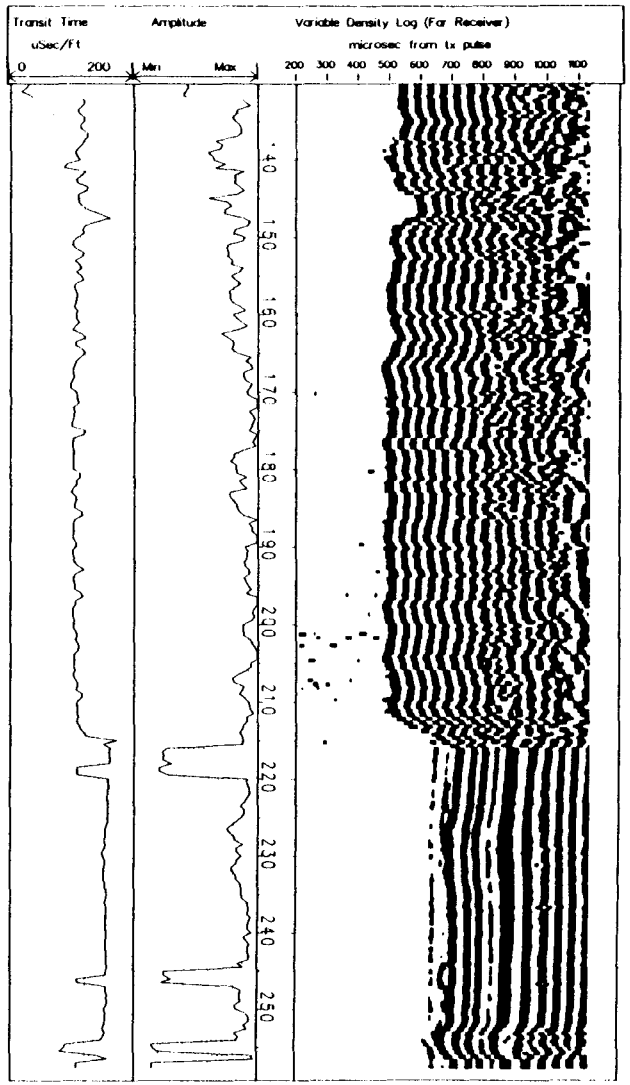
ELECTRICAL LOG CONTINUED



GAMMA AND NEUTRON LOGS CONTINUED



SONIC LOG CONTINUED



WIRE-LINE LOGGING PARAMETERS

Hole No. BIR 12 **Log Measured From:** Ground Level

Drilling Parameters

Depth 341.5 feet

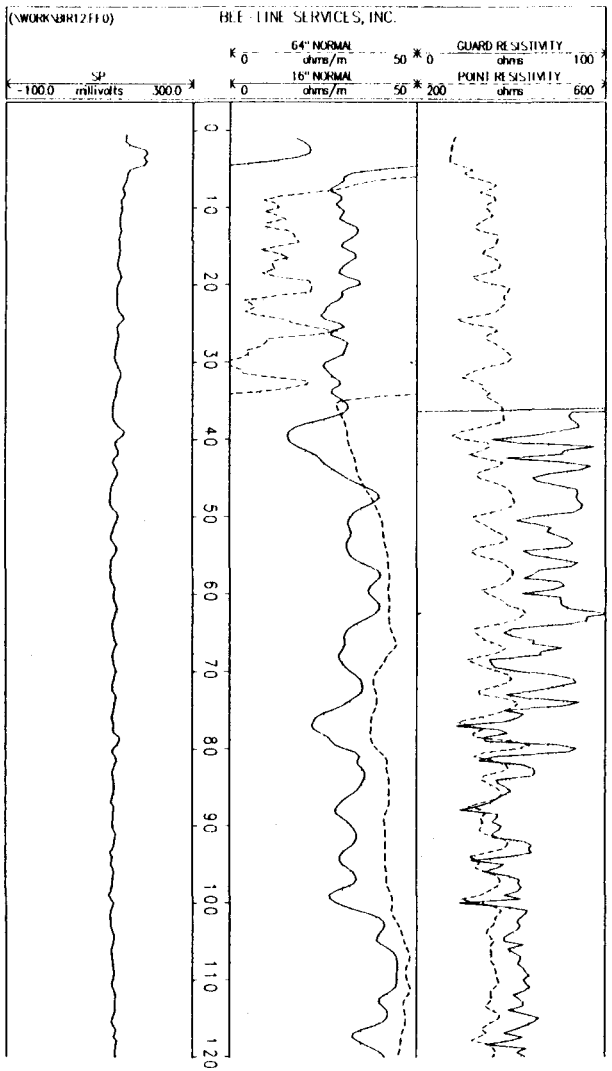
Bit Diameter 3.125 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	September 16, 1989	September 16, 1989	September 16, 1989
Bottom Log Interval	339.5 feet	339.5 feet	334.8 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	30 minutes	30 minutes	30 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

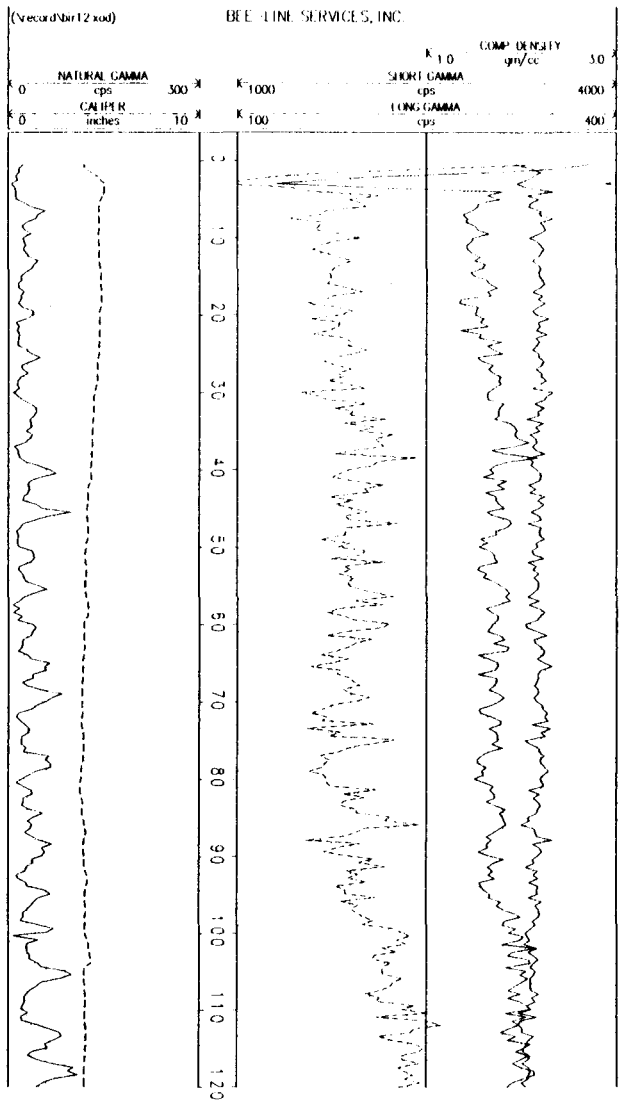
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

BIR 12 Wire-line logs run September 16, 1989. Surface elevation 667.5 feet.

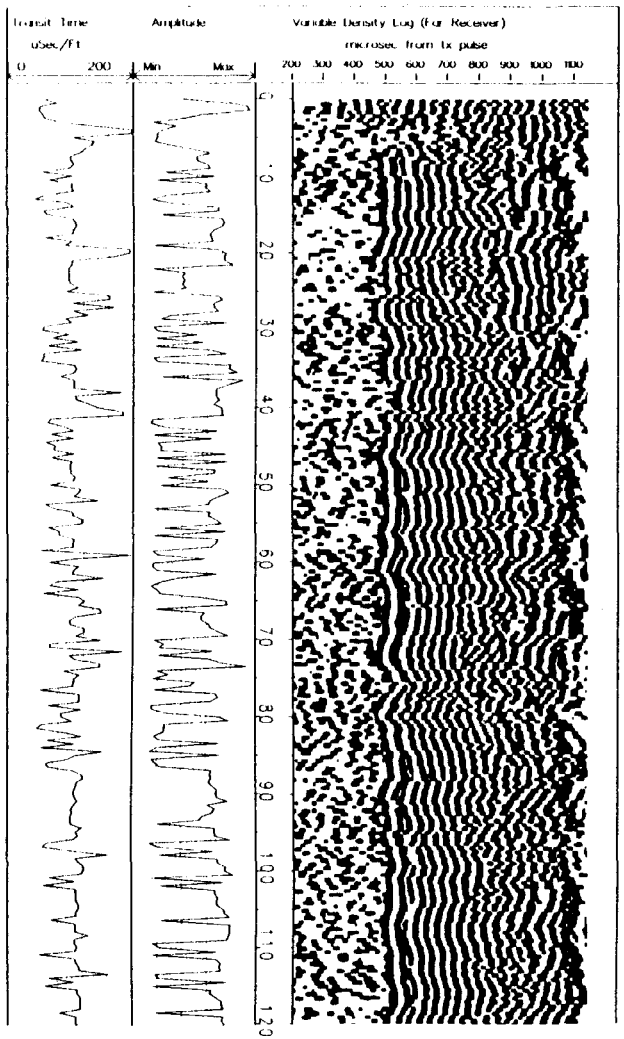
ELECTRICAL LOG



GAMMA LOG

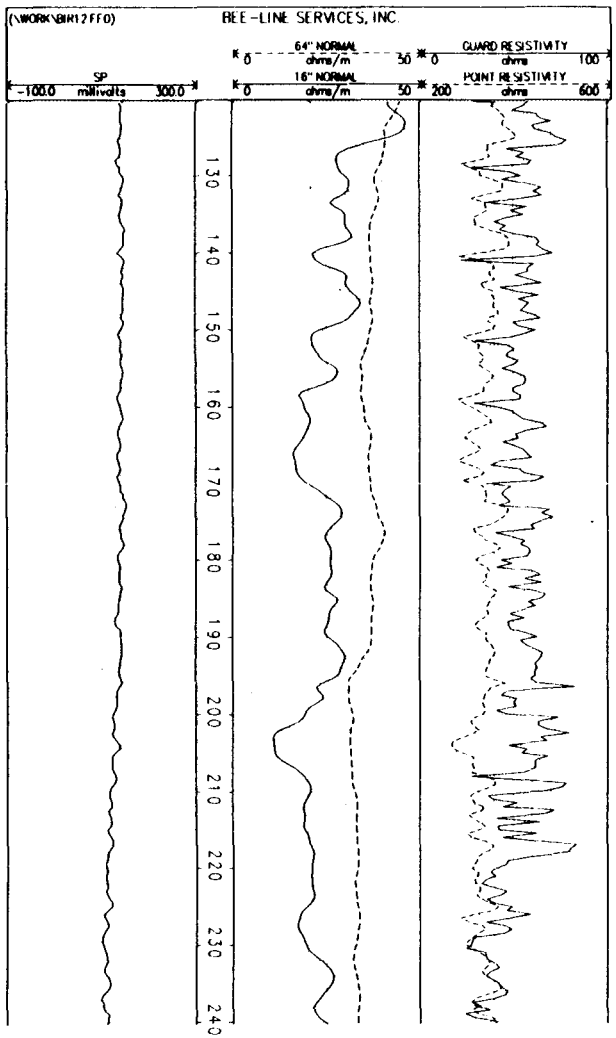


SONIC LOG

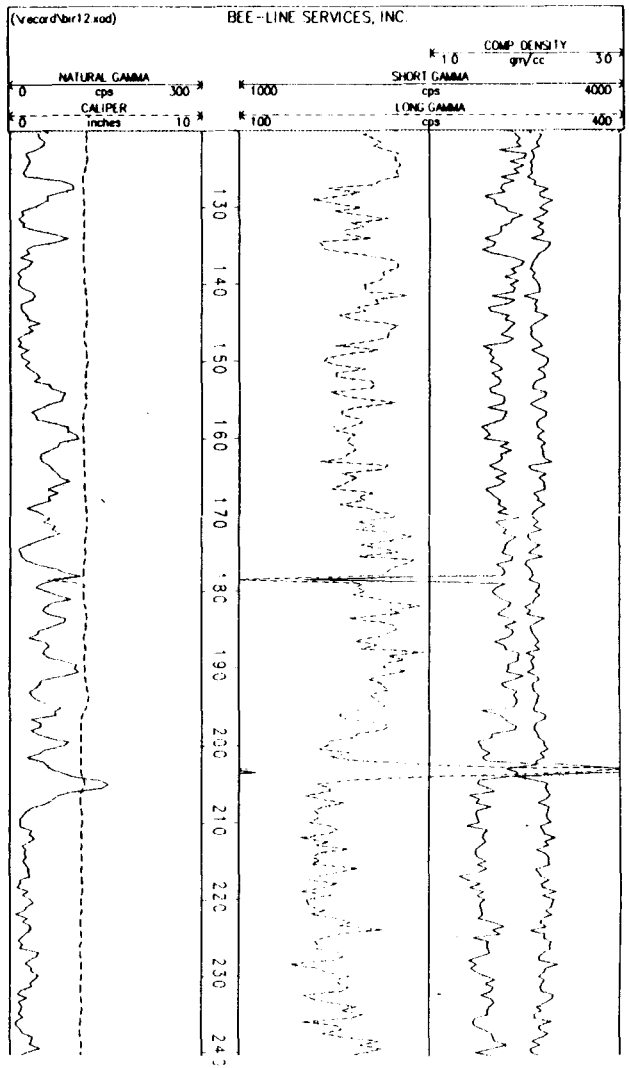


BIR 12 Wire-line logs run September 16, 1989 (Continued). Surface elevation 667.5 feet.

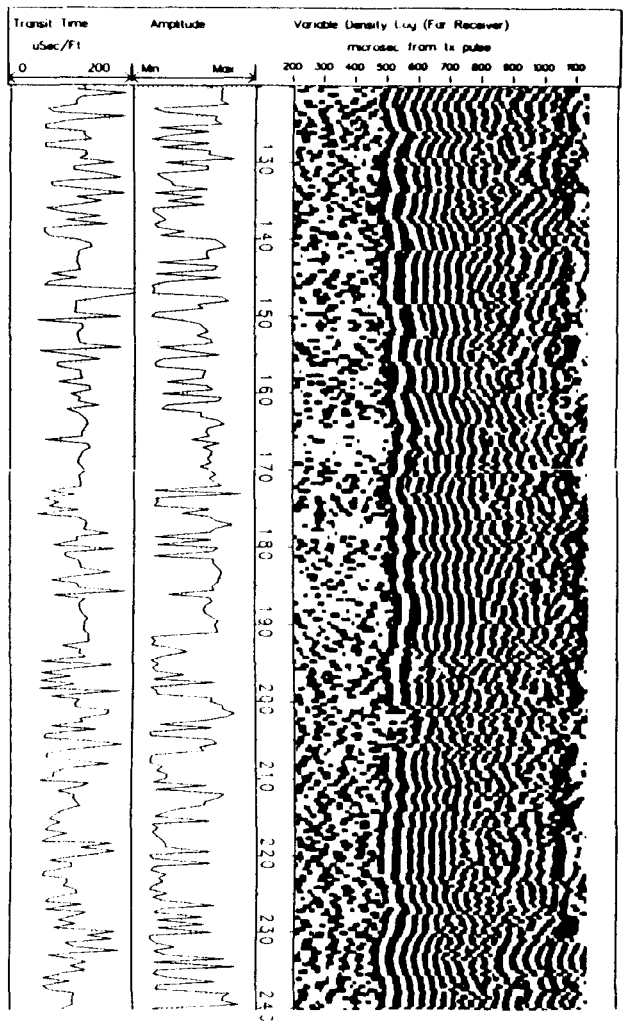
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED

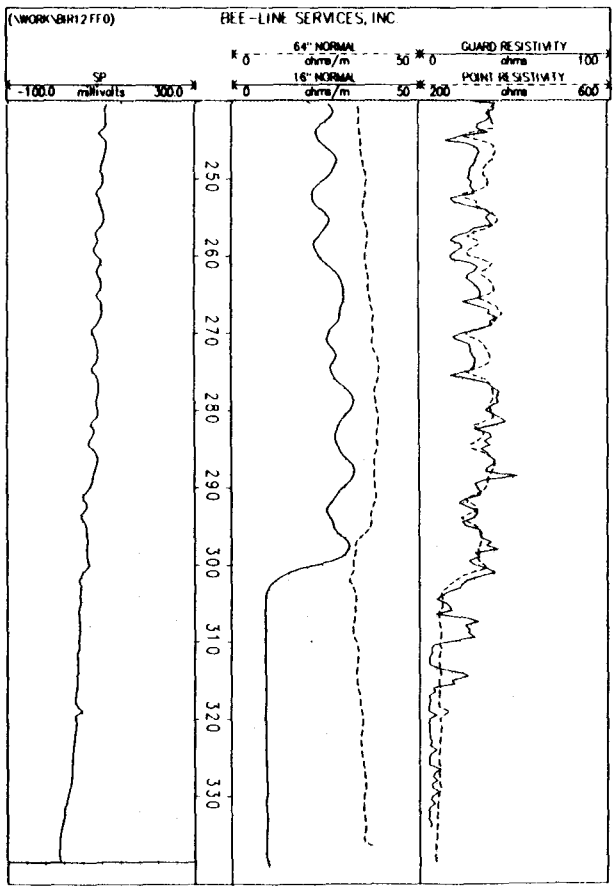


SONIC LOG CONTINUED

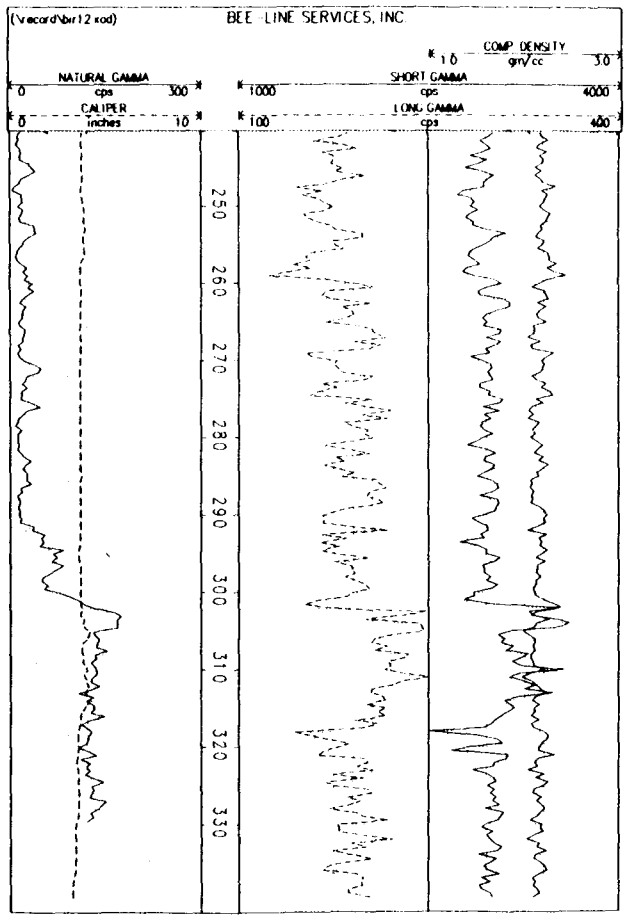


BIR 12 Wire-line logs run September 16, 1989 (Continued). Surface elevation 667.5 feet.

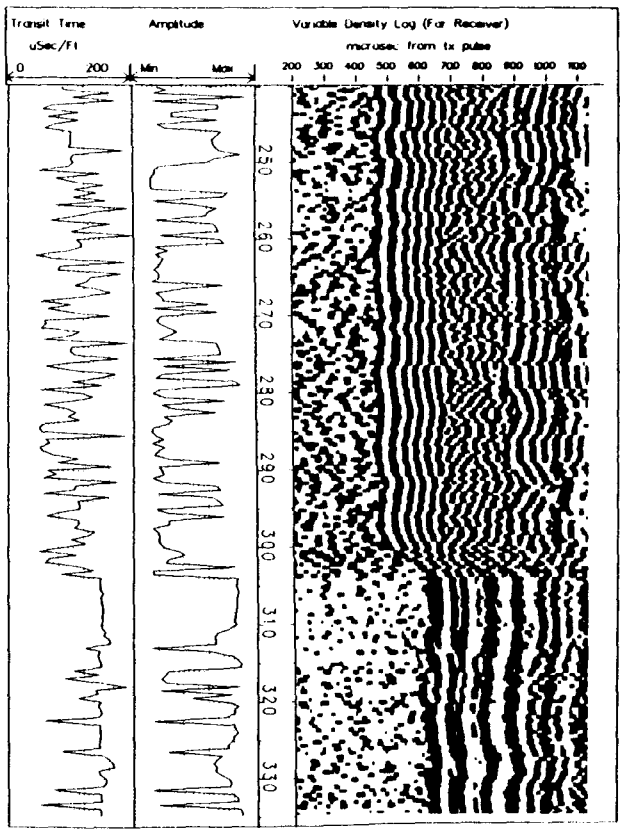
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



DEVIATION SURVEY RESULTS

BORING BIR 12

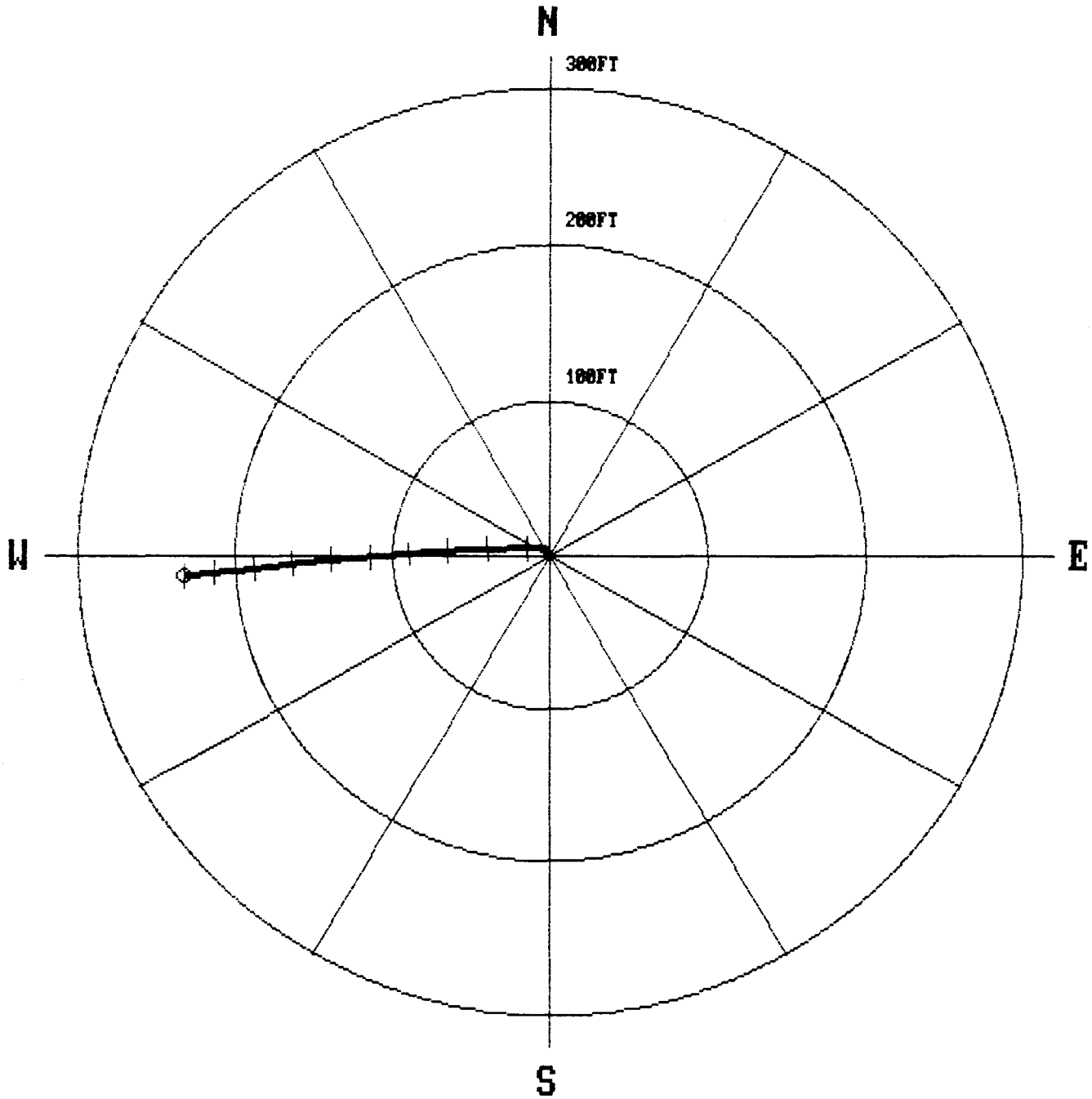
PLAN VIEW

COMPU-LOG DEVIATION

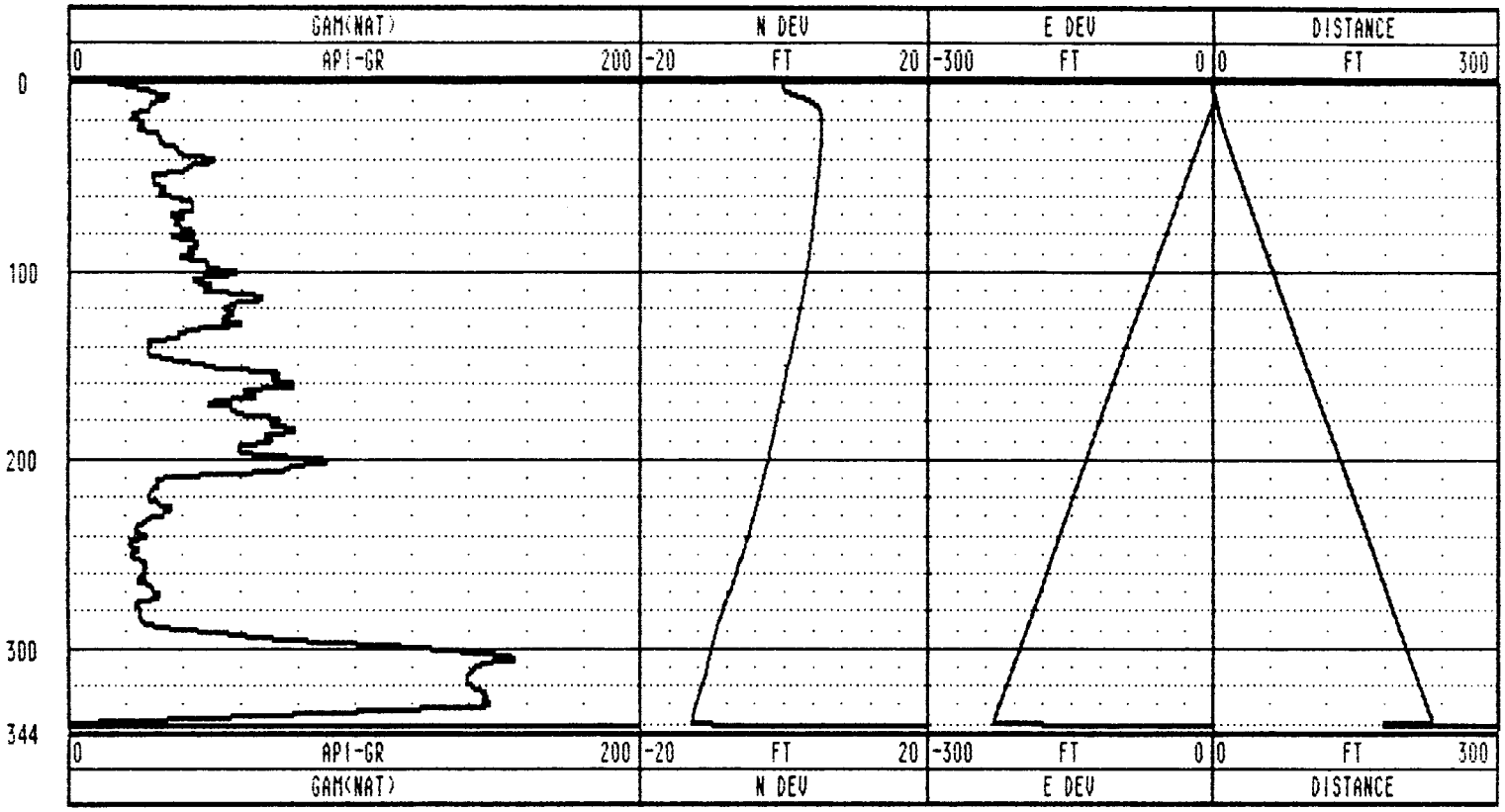
CLIENT: TEXAS SSC SITE
LOCATION: PROJECT 87-888
HOLE ID: BIR 12 TASK #15
DATE OF LOG: 09/16/89
PROBE: 9055A 135

MAG DECL: 7.0

SCALE: 100 FT/IN
TRUE DEPTH: 244.28 FT
AZIMUTH: 266.9
DISTANCE: 232.4 FT
+ = 25 FT INCR
○ = BOTTOM OF HOLE



Profile View
Compu-Log Deviation Survey
BIR 12



* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : BIR 12 TASK
DATE OF LOG : 09/16/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 4

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
3.0	3.00	0.00	0.00	0.0	0.0	0.0	0.0
4.0	4.00	0.00	0.00	0.0	0.0	0.0	0.0
5.0	5.00	0.00	0.00	0.0	0.0	0.0	0.0
6.0	6.00	0.00	0.00	0.0	0.0	0.0	0.0
7.0	7.00	0.00	0.00	0.0	0.0	0.0	0.0
8.0	7.76	0.52	0.19	0.6	20.4	45.5	353.2
9.0	8.46	1.23	0.25	1.3	11.5	45.5	2.0
10.0	9.16	1.94	0.19	2.0	5.6	45.5	353.8
11.0	9.86	2.65	0.09	2.7	2.0	45.6	352.5
12.0	10.56	3.35	0.03	3.4	0.5	45.5	334.6
13.0	11.26	3.78	-0.33	3.8	355.0	45.5	13.2
14.0	11.96	4.17	-0.90	4.3	347.8	45.1	314.8
15.0	12.66	4.60	-1.46	4.8	342.4	45.3	298.1
16.0	13.37	4.82	-2.14	5.3	336.1	45.6	284.7
17.0	14.07	4.95	-2.84	5.7	330.2	45.4	278.6
18.0	14.78	5.04	-3.54	6.2	324.9	44.9	276.6
19.0	15.49	5.11	-4.24	6.6	320.3	45.0	274.6
20.0	16.19	5.16	-4.94	7.1	316.2	44.8	273.1
21.0	16.90	5.20	-5.65	7.7	312.6	45.0	273.0
22.0	17.61	5.23	-6.36	8.2	309.4	45.1	272.1
23.0	18.32	5.25	-7.06	8.8	306.6	45.1	271.1
24.0	19.02	5.26	-7.77	9.4	304.1	45.0	270.7
25.0	19.73	5.26	-8.48	10.0	301.8	44.8	270.3
26.0	20.44	5.27	-9.18	10.6	299.8	45.1	270.3
27.0	21.14	5.27	-9.89	11.2	298.0	45.1	270.3
28.0	21.85	5.27	-10.60	11.8	296.4	45.1	269.8
29.0	22.55	5.27	-11.31	12.5	295.0	45.6	270.6
30.0	23.25	5.27	-12.02	13.1	293.6	45.1	269.6
31.0	23.96	5.26	-12.73	13.8	292.4	45.3	269.8
32.0	24.66	5.25	-13.45	14.4	291.3	45.3	269.1
33.0	25.36	5.24	-14.16	15.1	290.3	45.4	269.1
34.0	26.07	5.22	-14.87	15.8	289.4	45.5	269.2
35.0	26.77	5.21	-15.58	16.4	288.5	45.5	268.9
36.0	27.47	5.19	-16.29	17.1	287.7	45.4	268.8
37.0	28.17	5.17	-17.01	17.8	286.9	45.4	268.5
38.0	28.87	5.15	-17.72	18.4	286.2	45.3	268.2
39.0	29.58	5.13	-18.43	19.1	285.5	45.2	268.3
40.0	30.28	5.10	-19.14	19.8	284.9	45.3	268.3
41.0	30.98	5.08	-19.85	20.5	284.4	45.5	268.4
42.0	31.69	5.06	-20.56	21.2	283.8	45.4	268.3
43.0	32.39	5.04	-21.27	21.9	283.3	45.5	268.3
44.0	33.09	5.02	-21.99	22.6	282.9	45.5	268.2
45.0	33.79	4.99	-22.70	23.2	282.4	45.4	268.0
46.0	34.49	4.97	-23.41	23.9	282.0	45.4	268.0
47.0	35.19	4.95	-24.12	24.6	281.6	45.4	268.0
48.0	35.90	4.92	-24.83	25.3	281.2	45.3	268.2
49.0	36.60	4.90	-25.54	26.0	280.9	45.4	267.9
50.0	37.30	4.87	-26.25	26.7	280.5	45.4	268.3
51.0	38.00	4.85	-26.97	27.4	280.2	45.4	268.3
52.0	38.70	4.83	-27.68	28.1	279.9	45.5	268.1
53.0	39.40	4.81	-28.39	28.8	279.6	45.5	267.9
54.0	40.11	4.78	-29.11	29.5	279.3	45.5	267.6

* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : BIR 12 TASK
DATE OF LOG : 09/16/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 4

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
55.0	40.81	4.76	-29.82	30.2	279.1	45.3	267.5
56.0	41.51	4.72	-30.53	30.9	278.8	45.6	266.9
57.0	42.21	4.69	-31.24	31.6	278.5	45.5	267.2
58.0	42.91	4.66	-31.95	32.3	278.3	45.5	268.0
59.0	43.61	4.64	-32.67	33.0	278.1	45.4	267.8
60.0	44.31	4.61	-33.38	33.7	277.9	45.4	267.9
61.0	45.02	4.58	-34.09	34.4	277.7	45.4	267.9
62.0	45.72	4.56	-34.80	35.1	277.5	45.4	267.7
63.0	46.42	4.53	-35.51	35.8	277.3	45.4	267.7
64.0	47.12	4.50	-36.22	36.5	277.1	45.6	268.2
65.0	47.82	4.47	-36.94	37.2	276.9	45.3	267.4
66.0	48.53	4.44	-37.65	37.9	276.7	45.5	267.6
67.0	49.23	4.42	-38.36	38.6	276.6	45.5	268.0
68.0	49.93	4.39	-39.07	39.3	276.4	45.4	266.9
69.0	50.63	4.35	-39.78	40.0	276.2	45.3	267.5
70.0	51.34	4.32	-40.49	40.7	276.1	45.3	267.4
71.0	52.04	4.30	-41.20	41.4	276.0	45.4	267.5
72.0	52.74	4.27	-41.91	42.1	275.8	45.4	268.0
73.0	53.44	4.24	-42.63	42.8	275.7	45.4	267.5
74.0	54.15	4.21	-43.34	43.5	275.5	45.3	267.4
75.0	54.85	4.18	-44.05	44.2	275.4	45.3	267.7
76.0	55.55	4.15	-44.76	45.0	275.3	45.3	267.5
77.0	56.25	4.12	-45.47	45.7	275.2	45.5	267.8
78.0	56.95	4.09	-46.18	46.4	275.1	45.4	267.9
79.0	57.66	4.07	-46.90	47.1	275.0	45.5	267.9
80.0	58.36	4.04	-47.61	47.8	274.9	45.3	267.3
81.0	59.06	4.02	-48.32	48.5	274.8	45.4	267.1
82.0	59.76	3.99	-49.03	49.2	274.7	45.5	267.3
83.0	60.46	3.96	-49.75	49.9	274.6	46.2	268.9
84.0	61.16	3.93	-50.46	50.6	274.5	45.5	266.6
85.0	61.86	3.90	-51.17	51.3	274.4	45.9	265.4
86.0	62.56	3.87	-51.88	52.0	274.3	45.3	266.8
87.0	63.27	3.82	-52.59	52.7	274.2	45.3	266.3
88.0	63.98	3.79	-53.29	53.4	274.1	45.1	266.7
89.0	64.68	3.75	-54.00	54.1	274.0	45.1	267.2
90.0	65.39	3.72	-54.71	54.8	273.9	45.0	267.0
91.0	66.10	3.68	-55.41	55.5	273.8	45.1	266.9
92.0	66.80	3.64	-56.12	56.2	273.7	45.0	266.7
93.0	67.51	3.61	-56.83	56.9	273.6	45.0	267.0
94.0	68.21	3.57	-57.53	57.6	273.6	45.1	267.2
95.0	68.92	3.54	-58.24	58.4	273.5	45.1	267.3
96.0	69.63	3.50	-58.95	59.1	273.4	45.1	266.6
97.0	70.33	3.46	-59.66	59.8	273.3	45.1	266.7
98.0	71.04	3.42	-60.36	60.5	273.2	45.1	267.0
99.0	71.75	3.38	-61.07	61.2	273.2	45.0	266.9
100.0	72.45	3.34	-61.77	61.9	273.1	44.9	266.3
101.0	73.16	3.29	-62.48	62.6	273.0	44.8	266.7
102.0	73.87	3.25	-63.18	63.3	272.9	44.8	266.6
103.0	74.58	3.21	-63.89	64.0	272.9	44.9	266.3
104.0	75.29	3.17	-64.59	64.7	272.8	44.9	266.6
105.0	76.00	3.13	-65.30	65.4	272.7	44.9	266.6
106.0	76.71	3.09	-66.00	66.1	272.7	44.9	266.4

* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : BIR 12 TASK
DATE OF LOG : 09/16/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 4

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
107.0	77.41	3.04	-66.70	66.8	272.6	44.9	266.6
108.0	78.12	3.00	-67.41	67.5	272.5	44.9	266.5
109.0	78.83	2.96	-68.11	68.2	272.5	44.9	266.3
110.0	79.54	2.91	-68.82	68.9	272.4	44.8	266.2
111.0	80.25	2.87	-69.52	69.6	272.4	44.8	266.4
112.0	80.96	2.82	-70.22	70.3	272.3	44.8	266.2
113.0	81.67	2.78	-70.93	71.0	272.2	44.9	266.8
114.0	82.38	2.74	-71.63	71.7	272.2	44.9	266.9
115.0	83.08	2.70	-72.34	72.4	272.1	45.0	266.2
116.0	83.79	2.65	-73.04	73.1	272.1	44.9	266.1
117.0	84.50	2.61	-73.75	73.8	272.0	44.9	266.1
118.0	85.21	2.56	-74.45	74.5	272.0	44.8	266.1
119.0	85.92	2.51	-75.15	75.2	271.9	44.8	266.3
120.0	86.63	2.47	-75.86	75.9	271.9	44.8	267.1
121.0	87.34	2.42	-76.56	76.6	271.8	44.6	265.9
122.0	88.05	2.37	-77.26	77.3	271.8	44.7	266.0
123.0	88.76	2.32	-77.96	78.0	271.7	44.7	266.0
124.0	89.47	2.27	-78.66	78.7	271.7	44.7	266.2
125.0	90.18	2.23	-79.37	79.4	271.6	44.8	266.5
126.0	90.89	2.19	-80.07	80.1	271.6	45.1	267.6
127.0	91.60	2.14	-80.78	80.8	271.5	44.7	264.8
128.0	92.31	2.09	-81.48	81.5	271.5	44.7	265.9
129.0	93.02	2.04	-82.18	82.2	271.4	44.7	265.8
130.0	93.73	1.99	-82.88	82.9	271.4	44.8	266.1
131.0	94.44	1.94	-83.58	83.6	271.3	44.8	265.7
132.0	95.15	1.89	-84.29	84.3	271.3	44.8	265.8
133.0	95.86	1.84	-84.99	85.0	271.2	44.7	265.4
134.0	96.57	1.78	-85.69	85.7	271.2	44.8	266.3
135.0	97.28	1.72	-86.39	86.4	271.1	44.7	261.8
136.0	97.99	1.64	-87.09	87.1	271.1	44.7	265.2
137.0	98.70	1.59	-87.79	87.8	271.0	44.6	265.5
138.0	99.41	1.53	-88.49	88.5	271.0	44.7	265.4
139.0	100.12	1.48	-89.19	89.2	270.9	44.6	265.2
140.0	100.83	1.42	-89.89	89.9	270.9	44.6	265.0
141.0	101.55	1.36	-90.59	90.6	270.9	44.5	266.1
142.0	102.26	1.30	-91.29	91.3	270.8	44.5	265.4
143.0	102.97	1.24	-91.99	92.0	270.8	44.5	265.0
144.0	103.69	1.18	-92.69	92.7	270.7	44.3	264.7
145.0	104.40	1.11	-93.38	93.4	270.7	44.5	265.1
146.0	105.12	1.05	-94.08	94.1	270.6	44.4	265.1
147.0	105.83	0.99	-94.78	94.8	270.6	44.4	264.5
148.0	106.54	0.93	-95.48	95.5	270.6	44.4	265.4
149.0	107.26	0.87	-96.17	96.2	270.5	44.5	264.9
150.0	107.97	0.81	-96.87	96.9	270.5	44.4	265.1
151.0	108.68	0.75	-97.57	97.6	270.4	44.6	265.6
152.0	109.40	0.69	-98.27	98.3	270.4	44.5	264.5
153.0	110.11	0.62	-98.96	99.0	270.4	44.4	265.2
154.0	110.83	0.56	-99.66	99.7	270.3	44.6	265.7
155.0	111.54	0.51	-100.36	100.4	270.3	44.6	265.6
156.0	112.25	0.45	-101.06	101.1	270.3	44.7	265.7
157.0	112.96	0.40	-101.76	101.8	270.2	44.8	265.9
158.0	113.67	0.34	-102.47	102.5	270.2	44.8	265.8

* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : BIR 12 TASK
DATE OF LOG : 09/16/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 4

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
159.0	114.38	0.29	-103.17	103.2	270.2	44.8	265.5
160.0	115.09	0.23	-103.87	103.9	270.1	44.8	265.3
161.0	115.80	0.17	-104.57	104.6	270.1	44.8	265.2
162.0	116.51	0.12	-105.28	105.3	270.1	44.8	265.3
163.0	117.22	0.06	-105.98	106.0	270.0	44.8	265.1
164.0	117.93	0.01	-106.68	106.7	270.0	44.9	265.3
165.0	118.64	-0.05	-107.39	107.4	270.0	44.9	265.6
166.0	119.34	-0.10	-108.09	108.1	269.9	44.9	265.7
167.0	120.05	-0.15	-108.79	108.8	269.9	45.0	265.9
168.0	120.76	-0.21	-109.50	109.5	269.9	45.0	265.4
169.0	121.47	-0.26	-110.20	110.2	269.9	44.8	265.7
170.0	122.18	-0.31	-110.90	110.9	269.8	44.9	265.5
171.0	122.89	-0.37	-111.61	111.6	269.8	44.9	265.3
172.0	123.59	-0.42	-112.31	112.3	269.8	44.9	265.6
173.0	124.30	-0.48	-113.02	113.0	269.8	44.9	265.7
174.0	125.01	-0.54	-113.72	113.7	269.7	44.9	265.6
175.0	125.72	-0.59	-114.42	114.4	269.7	45.0	265.3
176.0	126.43	-0.65	-115.13	115.1	269.7	44.8	265.4
177.0	127.13	-0.70	-115.83	115.8	269.7	44.9	265.5
178.0	127.84	-0.75	-116.54	116.5	269.6	45.0	265.7
179.0	128.55	-0.81	-117.24	117.2	269.6	44.9	265.1
180.0	129.26	-0.86	-117.94	117.9	269.6	45.0	266.4
181.0	129.96	-0.91	-118.65	118.7	269.6	45.1	265.6
182.0	130.67	-0.97	-119.36	119.4	269.5	45.0	265.5
183.0	131.38	-1.02	-120.06	120.1	269.5	45.0	265.3
184.0	132.09	-1.08	-120.77	120.8	269.5	44.9	266.2
185.0	132.79	-1.13	-121.47	121.5	269.5	44.9	264.9
186.0	133.50	-1.19	-122.17	122.2	269.4	44.9	264.7
187.0	134.21	-1.25	-122.88	122.9	269.4	44.9	265.3
188.0	134.92	-1.31	-123.58	123.6	269.4	44.9	265.4
189.0	135.63	-1.37	-124.28	124.3	269.4	44.9	264.8
190.0	136.33	-1.43	-124.99	125.0	269.3	44.9	264.8
191.0	137.04	-1.48	-125.69	125.7	269.3	45.0	266.3
192.0	137.75	-1.54	-126.40	126.4	269.3	44.9	265.1
193.0	138.46	-1.60	-127.10	127.1	269.3	45.0	265.3
194.0	139.17	-1.66	-127.80	127.8	269.3	44.9	265.2
195.0	139.87	-1.72	-128.51	128.5	269.2	45.0	265.5
196.0	140.58	-1.78	-129.21	129.2	269.2	45.0	265.3
197.0	141.29	-1.83	-129.92	129.9	269.2	45.1	265.4
198.0	141.99	-1.89	-130.62	130.6	269.2	45.2	265.6
199.0	142.70	-1.95	-131.33	131.3	269.1	45.2	265.8
200.0	143.40	-2.00	-132.04	132.1	269.1	45.2	265.8
201.0	144.10	-2.06	-132.75	132.8	269.1	45.3	265.9
202.0	144.81	-2.11	-133.46	133.5	269.1	45.1	265.6
203.0	145.51	-2.16	-134.16	134.2	269.1	45.2	265.6
204.0	146.22	-2.21	-134.87	134.9	269.1	45.3	265.3
205.0	146.92	-2.29	-135.58	135.6	269.0	45.4	267.9
206.0	147.63	-2.37	-136.28	136.3	269.0	44.8	265.1
207.0	148.34	-2.43	-136.98	137.0	269.0	45.0	264.9
208.0	149.04	-2.49	-137.69	137.7	269.0	44.9	265.2
209.0	149.75	-2.55	-138.39	138.4	268.9	44.9	265.0
210.0	150.46	-2.62	-139.09	139.1	268.9	44.7	264.3

* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : BIR 12 TASK
DATE OF LOG : 09/16/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 4

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
211.0	151.17	-2.68	-139.80	139.8	268.9	44.9	265.2
212.0	151.88	-2.75	-140.50	140.5	268.9	44.8	264.4
213.0	152.59	-2.81	-141.20	141.2	268.9	44.9	264.8
214.0	153.30	-2.86	-141.90	141.9	268.8	45.0	264.5
215.0	154.00	-2.95	-142.60	142.6	268.8	44.9	265.1
216.0	154.71	-3.01	-143.31	143.3	268.8	45.0	265.2
217.0	155.42	-3.07	-144.01	144.0	268.8	44.8	264.7
218.0	156.13	-3.14	-144.71	144.7	268.8	44.9	264.6
219.0	156.84	-3.20	-145.42	145.5	268.7	44.9	264.7
220.0	157.55	-3.26	-146.12	146.2	268.7	44.8	264.9
221.0	158.26	-3.33	-146.82	146.9	268.7	44.9	265.0
222.0	158.96	-3.41	-147.52	147.6	268.7	44.6	262.5
223.0	159.68	-3.47	-148.22	148.3	268.7	44.8	265.0
224.0	160.39	-3.54	-148.92	149.0	268.6	44.5	264.8
225.0	161.10	-3.61	-149.62	149.7	268.6	44.8	265.0
226.0	161.81	-3.68	-150.32	150.4	268.6	44.5	264.7
227.0	162.52	-3.75	-151.02	151.1	268.6	44.5	264.3
228.0	163.23	-3.82	-151.72	151.8	268.6	44.7	264.8
229.0	163.94	-3.89	-152.42	152.5	268.5	44.4	261.5
230.0	164.65	-3.98	-153.12	153.2	268.5	44.2	262.2
231.0	165.37	-4.06	-153.81	153.9	268.5	44.4	264.0
232.0	166.08	-4.13	-154.51	154.6	268.5	44.5	264.1
233.0	166.80	-4.21	-155.20	155.3	268.4	44.5	263.9
234.0	167.51	-4.28	-155.90	156.0	268.4	44.5	264.0
235.0	168.22	-4.35	-156.60	156.7	268.4	44.5	263.6
236.0	168.94	-4.43	-157.29	157.4	268.4	44.3	263.4
237.0	169.65	-4.51	-157.99	158.1	268.4	44.5	264.0
238.0	170.37	-4.58	-158.68	158.7	268.3	44.5	263.5
239.0	171.08	-4.66	-159.38	159.4	268.3	44.5	263.6
240.0	171.79	-4.74	-160.08	160.1	268.3	44.5	263.7
241.0	172.51	-4.81	-160.77	160.8	268.3	44.3	263.4
242.0	173.22	-4.89	-161.47	161.5	268.3	44.0	262.5
243.0	173.94	-4.97	-162.16	162.2	268.2	44.2	263.1
244.0	174.65	-5.05	-162.85	162.9	268.2	44.3	263.7
245.0	175.37	-5.13	-163.55	163.6	268.2	44.3	264.5
246.0	176.09	-5.20	-164.24	164.3	268.2	44.1	264.2
247.0	176.80	-5.29	-164.93	165.0	268.2	43.8	263.0
248.0	177.52	-5.37	-165.63	165.7	268.1	45.1	264.1
249.0	178.23	-5.45	-166.33	166.4	268.1	44.6	263.4
250.0	178.94	-5.52	-167.03	167.1	268.1	45.5	266.5
251.0	179.64	-5.57	-167.74	167.8	268.1	45.0	266.1
252.0	180.35	-5.64	-168.44	168.5	268.1	44.8	265.2
253.0	181.07	-5.73	-169.13	169.2	268.1	44.0	261.2
254.0	181.79	-5.83	-169.82	169.9	268.0	43.8	263.9
255.0	182.51	-5.94	-170.50	170.6	268.0	43.4	264.6
256.0	183.21	-6.01	-171.19	171.3	268.0	55.3	282.1
257.0	183.92	-6.15	-171.85	172.0	268.0	50.1	276.4
258.0	184.64	-6.32	-172.52	172.6	267.9	48.1	246.3
259.0	185.32	-6.40	-173.22	173.3	267.9	46.4	262.2
260.0	186.03	-6.48	-173.93	174.0	267.9	45.7	261.8
261.0	186.73	-6.53	-174.63	174.8	267.9	44.2	266.2
262.0	187.43	-6.53	-175.33	175.5	267.9	43.7	280.3

* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : BIR 12 TASK
DATE OF LOG : 09/16/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 4

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
263.0	188.13	-6.61	-175.93	176.1	267.8	48.4	283.2
264.0	188.85	-6.72	-176.61	176.7	267.8	44.6	263.3
265.0	189.56	-6.81	-177.30	177.4	267.8	44.4	263.2
266.0	190.28	-6.88	-178.00	178.1	267.8	44.7	263.7
267.0	190.99	-6.97	-178.69	178.8	267.8	43.9	262.8
268.0	191.70	-7.04	-179.39	179.5	267.8	44.3	263.0
269.0	192.42	-7.13	-180.08	180.2	267.7	44.4	263.2
270.0	193.13	-7.21	-180.78	180.9	267.7	44.5	263.9
271.0	193.85	-7.33	-181.46	181.6	267.7	41.3	247.8
272.0	194.57	-7.46	-182.13	182.3	267.7	43.0	251.9
273.0	195.29	-7.59	-182.80	183.0	267.6	43.9	257.5
274.0	196.00	-7.69	-183.50	183.7	267.6	44.7	263.2
275.0	196.72	-7.77	-184.20	184.4	267.6	44.8	264.3
276.0	197.43	-7.87	-184.89	185.1	267.6	44.2	263.9
277.0	198.14	-8.00	-185.57	185.7	267.5	44.9	265.0
278.0	198.85	-8.11	-186.27	186.4	267.5	44.8	261.9
279.0	199.56	-8.19	-186.97	187.1	267.5	44.9	266.6
280.0	200.27	-8.26	-187.67	187.9	267.5	44.7	257.5
281.0	200.98	-8.40	-188.34	188.5	267.4	46.3	242.7
282.0	201.68	-8.46	-189.04	189.2	267.4	44.0	269.6
283.0	202.39	-8.57	-189.74	189.9	267.4	45.1	260.4
284.0	203.10	-8.62	-190.44	190.6	267.4	45.1	267.1
285.0	203.81	-8.71	-191.14	191.3	267.4	44.8	262.0
286.0	204.52	-8.82	-191.84	192.0	267.4	44.8	261.4
287.0	205.23	-8.91	-192.53	192.7	267.4	44.8	264.1
288.0	205.93	-9.02	-193.23	193.4	267.3	44.7	263.8
289.0	206.64	-9.10	-193.93	194.1	267.3	45.9	259.8
290.0	207.34	-9.18	-194.64	194.9	267.3	46.1	262.5
291.0	208.04	-9.26	-195.35	195.6	267.3	45.8	262.5
292.0	208.74	-9.33	-196.07	196.3	267.3	46.3	264.3
293.0	209.43	-9.40	-196.78	197.0	267.3	46.5	270.2
294.0	210.13	-9.46	-197.49	197.7	267.3	46.3	267.4
295.0	210.84	-9.53	-198.20	198.4	267.2	46.4	265.1
296.0	211.54	-9.58	-198.91	199.1	267.2	43.8	261.1
297.0	212.23	-9.64	-199.62	199.9	267.2	46.0	265.9
298.0	212.93	-9.71	-200.34	200.6	267.2	45.8	265.7
299.0	213.63	-9.77	-201.05	201.3	267.2	45.6	263.8
300.0	214.34	-9.85	-201.75	202.0	267.2	45.5	262.6
301.0	215.04	-9.93	-202.46	202.7	267.2	45.9	263.3
302.0	215.73	-10.00	-203.17	203.4	267.2	46.0	266.2
303.0	216.43	-10.07	-203.88	204.1	267.2	45.4	265.1
304.0	217.13	-10.14	-204.59	204.8	267.2	45.9	266.0
305.0	217.83	-10.18	-205.31	205.6	267.2	46.7	271.0
306.0	218.53	-10.24	-206.02	206.3	267.2	43.1	260.6
307.0	219.23	-10.30	-206.73	207.0	267.1	45.1	266.4
308.0	219.92	-10.35	-207.44	207.7	267.1	44.8	269.0
309.0	220.62	-10.39	-208.16	208.4	267.1	45.3	267.9
310.0	221.32	-10.41	-208.87	209.1	267.1	44.1	269.3
311.0	222.02	-10.49	-209.58	209.8	267.1	45.6	264.3
312.0	222.72	-10.57	-210.28	210.5	267.1	46.3	261.8
313.0	223.42	-10.64	-211.00	211.3	267.1	46.4	267.6
314.0	224.11	-10.64	-211.72	212.0	267.1	45.6	263.8

* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : TEXAS SSC SITE
FIELD OFFICE : CORSICANA
DATA FROM :
MAG. DECL. : 7.000

HOLE ID. : BIR 12 TASK
DATE OF LOG : 09/16/89
PROBE : 9055A , 135
DEPTH UNITS : FEET LOG 4

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
315.0	224.81	-10.69	-212.43	212.7	267.1	44.9	262.4
316.0	225.52	-10.76	-213.13	213.4	267.1	44.4	258.0
317.0	226.22	-10.84	-213.83	214.1	267.1	45.6	263.7
318.0	226.94	-10.94	-214.53	214.8	267.1	40.3	252.3
319.0	227.64	-11.08	-215.22	215.5	267.1	45.1	261.9
320.0	228.33	-11.13	-215.94	216.2	267.0	46.5	265.9
321.0	229.03	-11.24	-216.63	216.9	267.0	46.3	252.1
322.0	229.73	-11.35	-217.33	217.6	267.0	45.8	263.8
323.0	230.43	-11.42	-218.04	218.3	267.0	45.8	262.7
324.0	231.13	-11.48	-218.75	219.1	267.0	44.5	265.9
325.0	231.83	-11.57	-219.45	219.8	267.0	44.9	265.6
326.0	232.53	-11.64	-220.16	220.5	267.0	45.7	266.5
327.0	233.23	-11.73	-220.87	221.2	267.0	45.8	261.6
328.0	233.92	-11.80	-221.58	221.9	267.0	44.3	264.9
329.0	234.62	-11.84	-222.30	222.6	267.0	45.7	268.3
330.0	235.33	-11.96	-222.99	223.3	266.9	46.4	267.5
331.0	236.04	-12.07	-223.68	224.0	266.9	45.2	259.2
332.0	236.74	-12.17	-224.39	224.7	266.9	45.5	261.3
333.0	237.44	-12.24	-225.10	225.4	266.9	45.3	267.1
334.0	238.14	-12.29	-225.81	226.1	266.9	45.5	267.8
335.0	238.84	-12.35	-226.52	226.9	266.9	45.9	261.6
336.0	239.54	-12.44	-227.22	227.6	266.9	45.2	262.1
337.0	240.25	-12.49	-227.93	228.3	266.9	45.4	262.3
338.0	240.94	-12.54	-228.65	229.0	266.9	44.8	268.9
339.0	241.64	-12.57	-229.36	229.7	266.9	45.5	265.3
340.0	242.33	-12.60	-230.09	230.4	266.9	45.9	262.8
341.0	243.02	-12.64	-230.80	231.1	266.9	46.5	269.0
342.0	243.72	-12.69	-231.52	231.9	266.9	46.9	268.8
343.0	244.48	-12.73	-232.09	232.4	266.9	0.0	0.0
343.1	244.38	-12.73	-232.09	232.4	266.9	0.0	0.0

WIRE-LINE LOGGING PARAMETERS

Hole No. BIR 13 **Log Measured From:** Ground Level

Drilling Parameters

Depth 304.0 feet

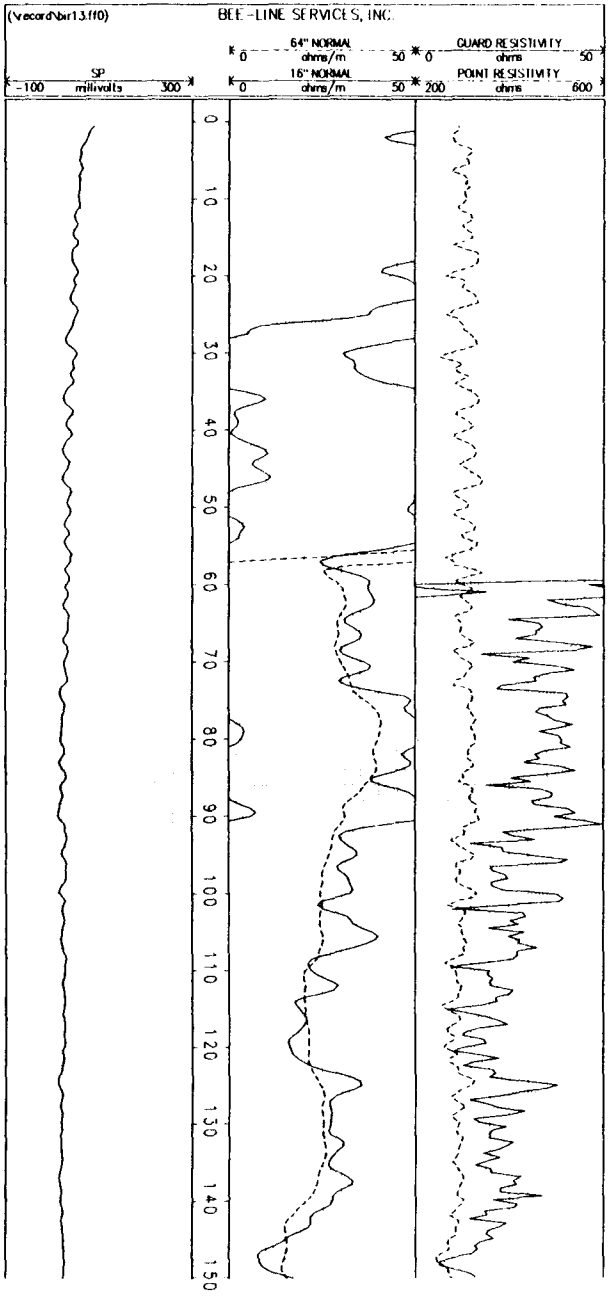
Bit Diameter 4.75 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	March 2, 1990	March 2, 1990	March 2, 1990
Bottom Log Interval	302.5 feet	302.5 feet	298.5 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

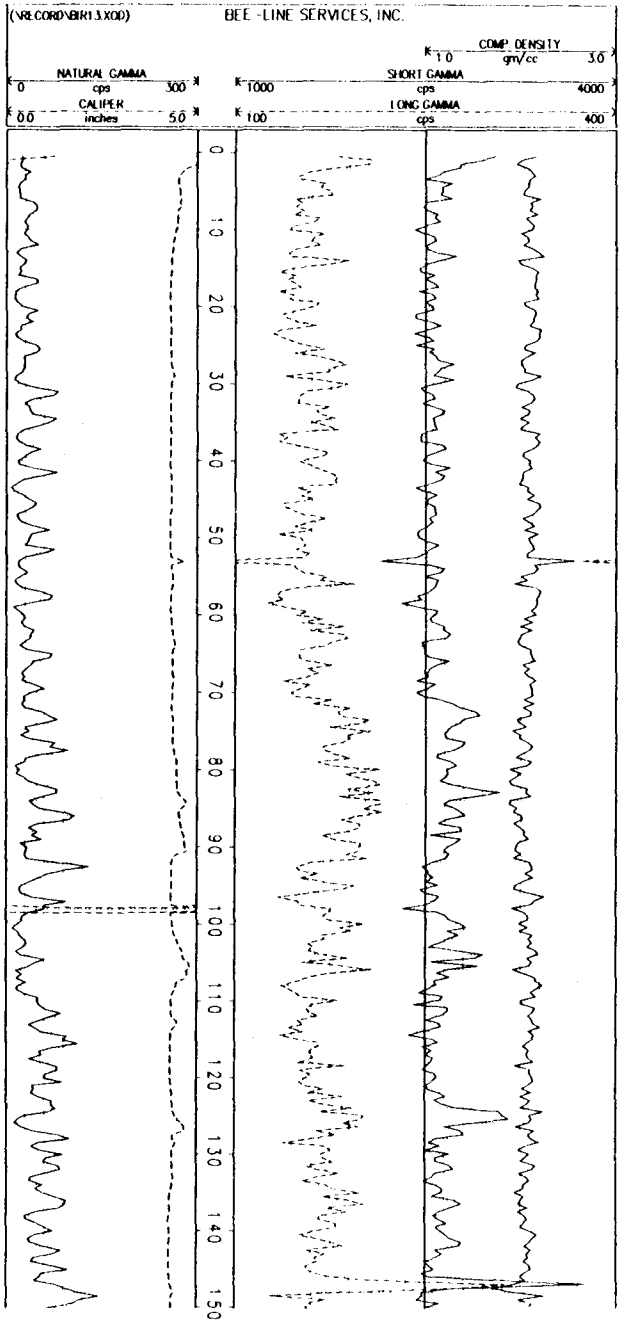
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

BIR 13 Wire-line logs run March 2, 1990. Surface elevation 669.9 feet.

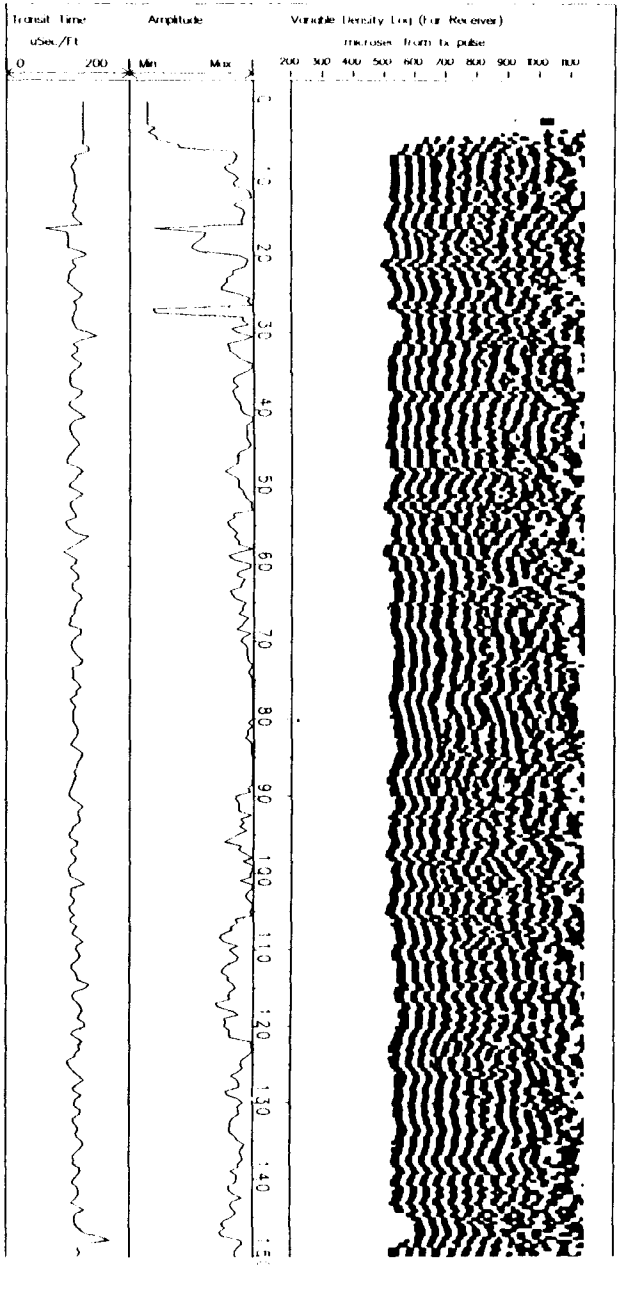
ELECTRICAL LOG



GAMMA LOG

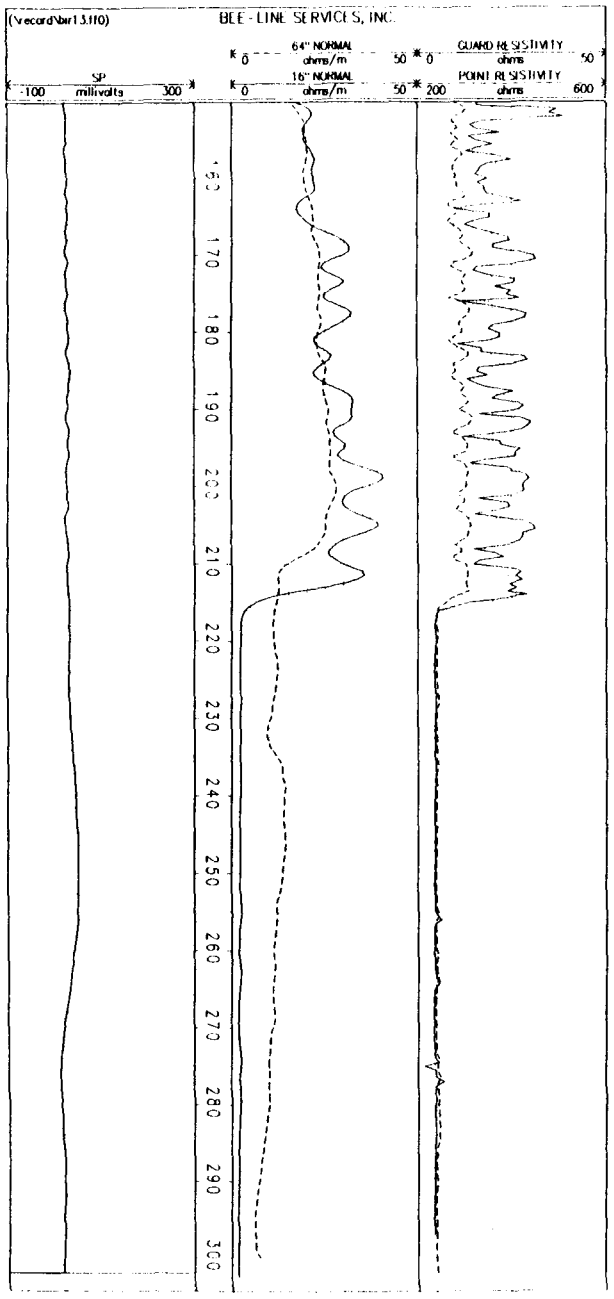


SONIC LOG

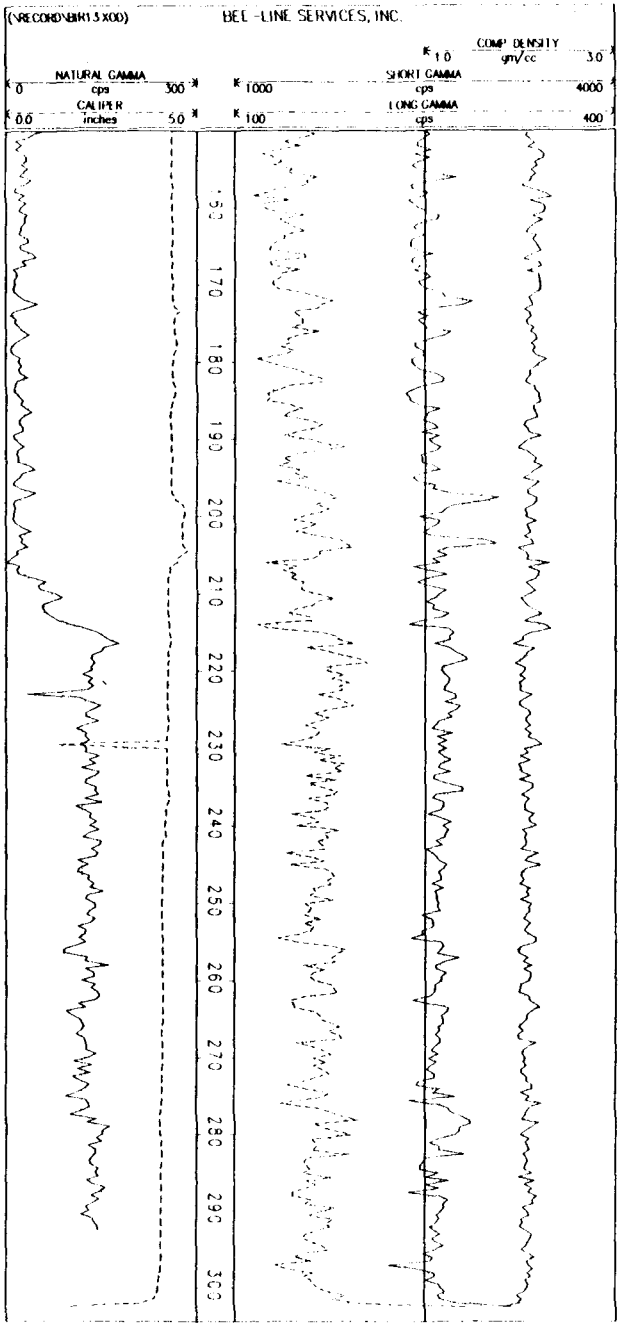


BIR 13 Wire-line logs run March 2, 1990 (Continued). Surface elevation 669.9 feet.

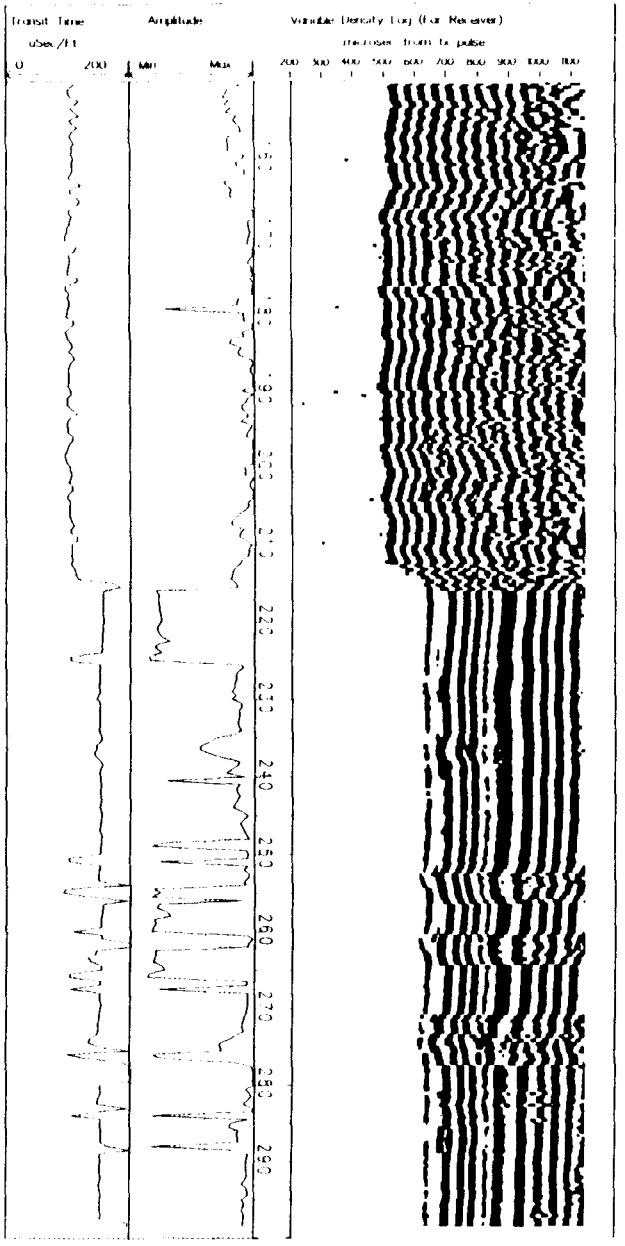
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



WIRE-LINE LOGGING PARAMETERS

Hole No. BIR 14 **Log Measured From:** Ground Level

Drilling Parameters

Depth 303.0 feet

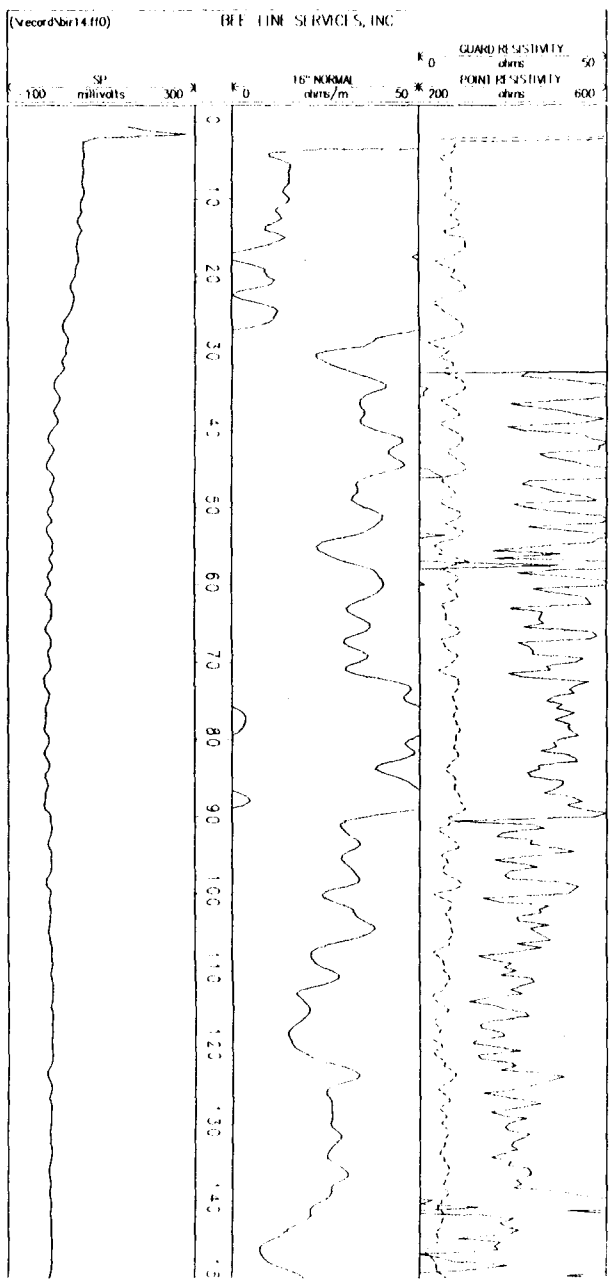
Bit Diameter 4.75 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	March 2, 1990	March 2, 1990	March 2, 1990
Bottom Log Interval	301.0 feet	300.5 feet	296.5 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	35 minutes	35 minutes	35 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

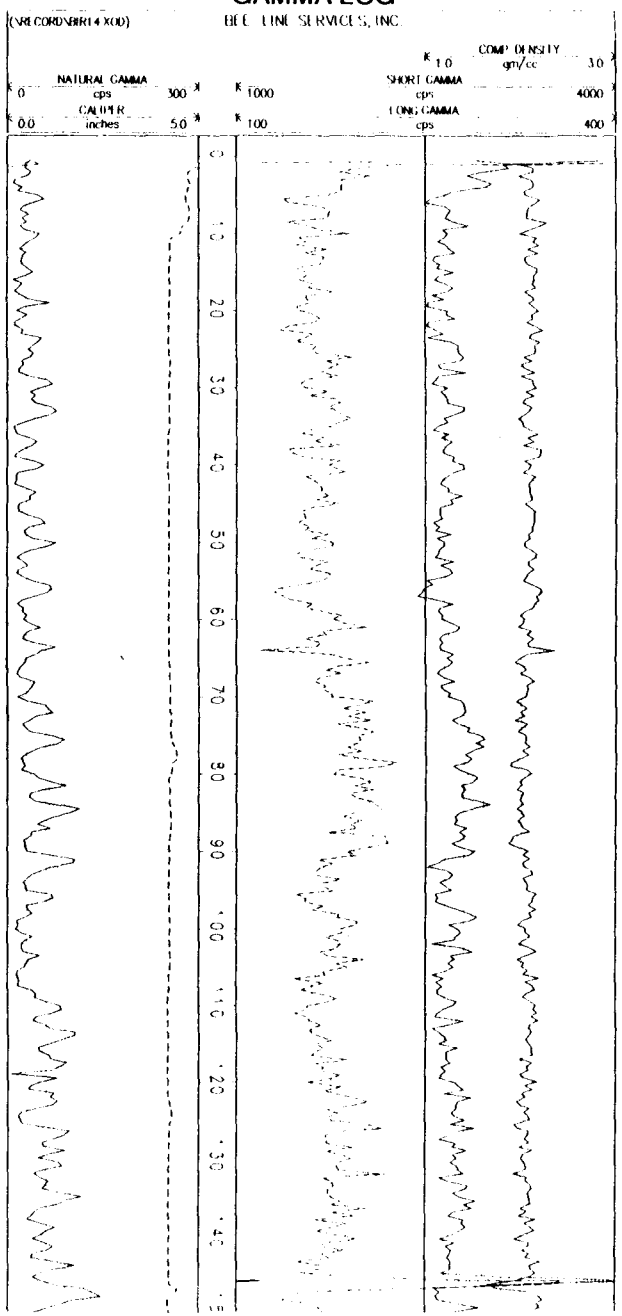
Logged by: BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

BIR 14 Wire-line logs run March 2, 1990. Surface elevation 667.5 feet.

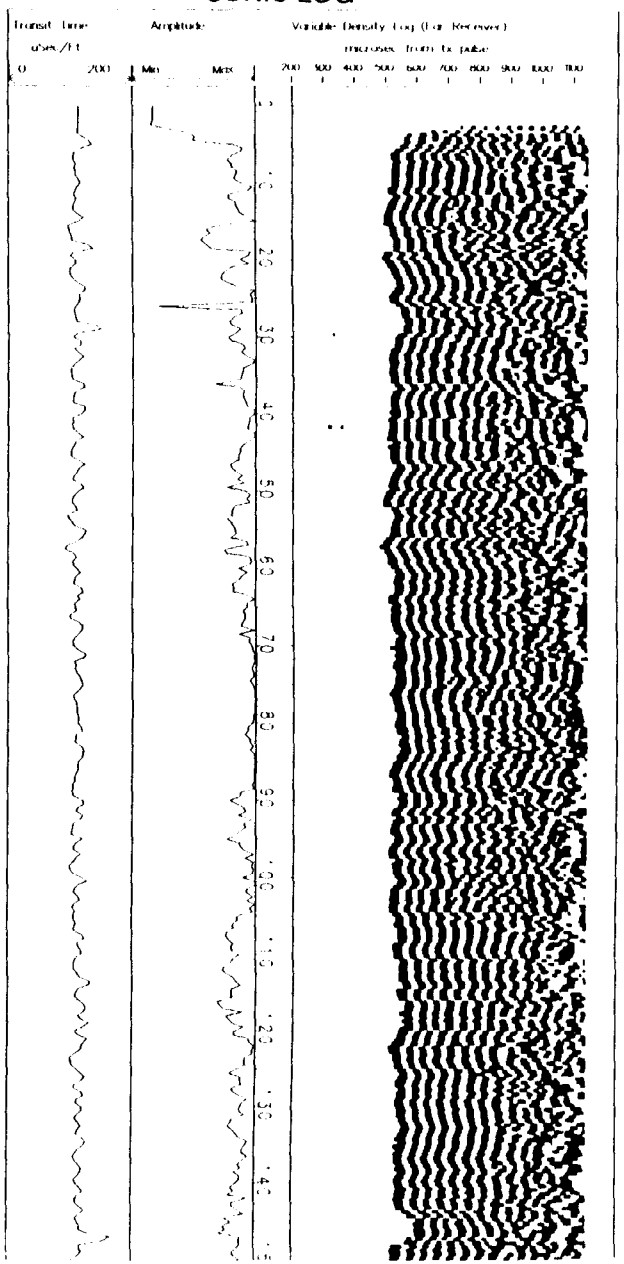
ELECTRICAL LOG



GAMMA LOG

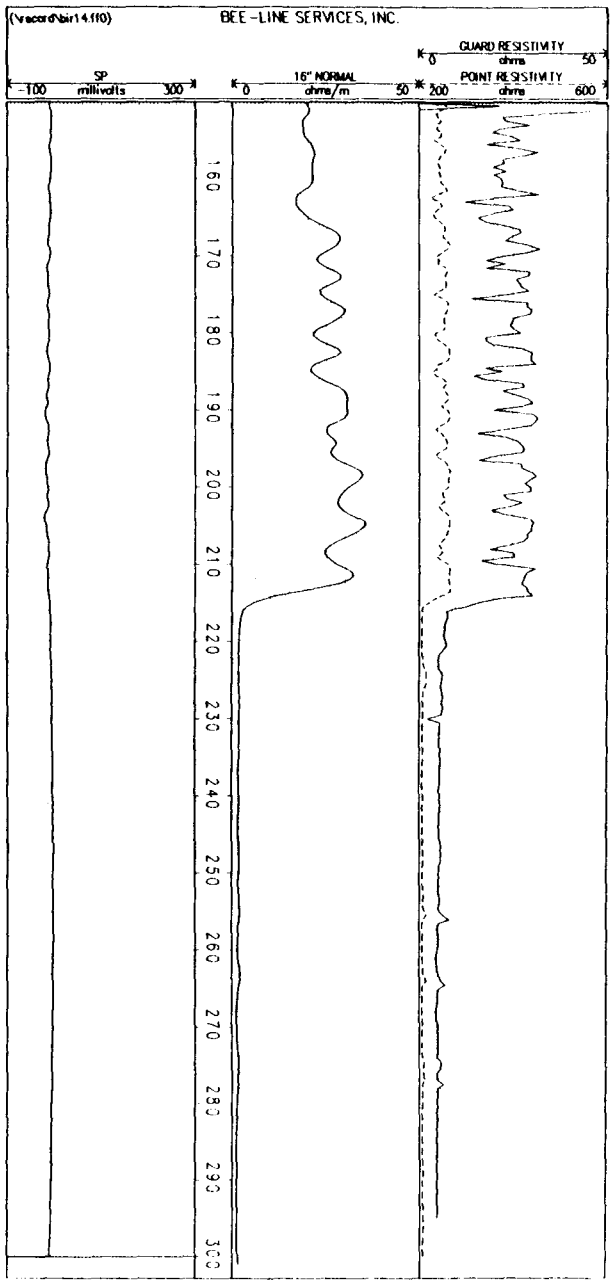


SONIC LOG

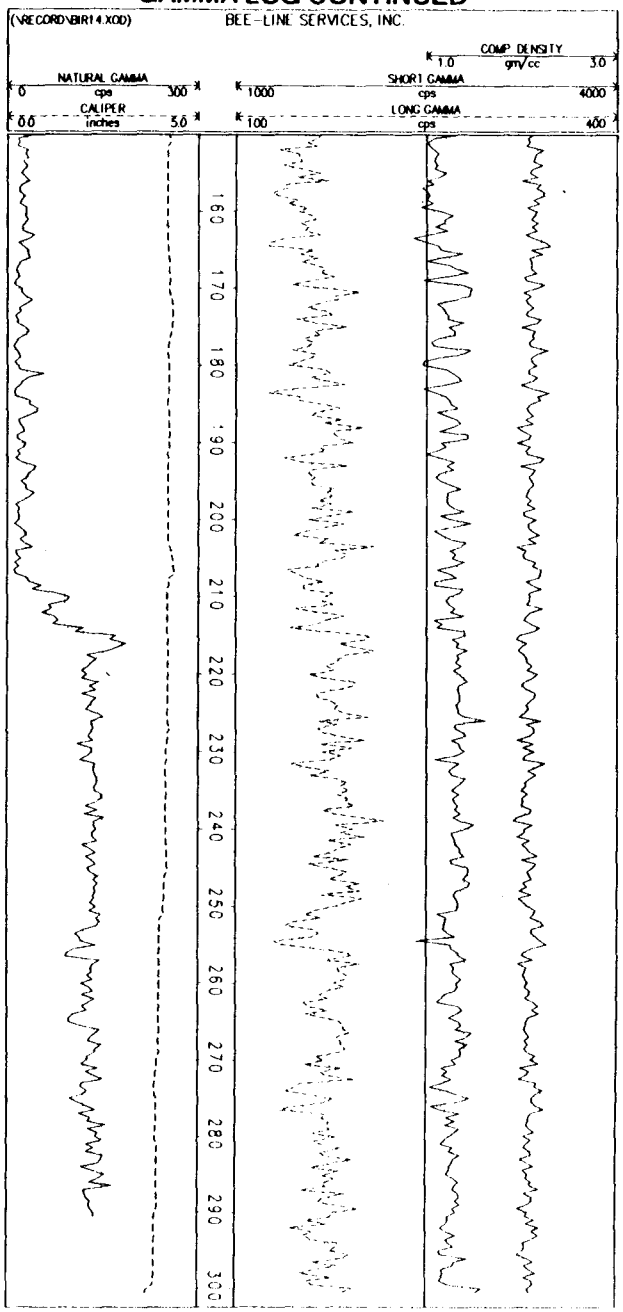


BIR 14 Wire-line logs run March 2, 1990 (Continued). Surface elevation 667.5 feet.

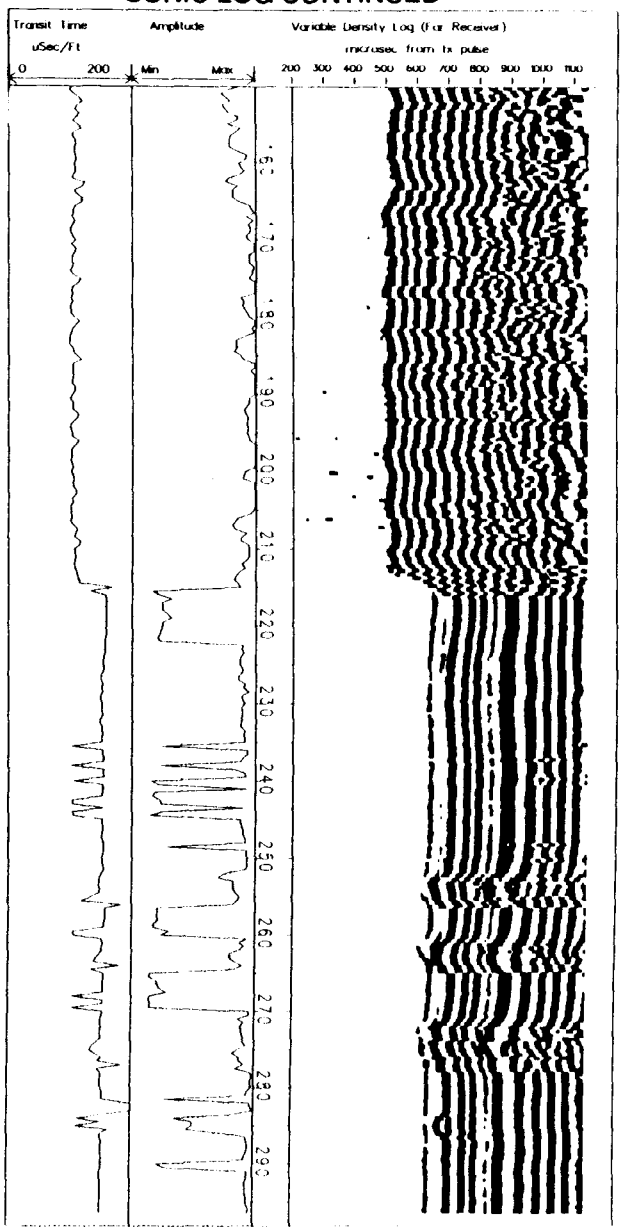
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



APPENDIX C

GEOLOGIC MAPPING

SITE GEOLOGY – INTERACTION REGION 1

Field mapping at IR1 consisted primarily of locating and measuring the bearing of joints and locating and identifying the presence of faults within the area. Over 100 joints were measured along a nearby drainage and in an L-shaped trench (Trench IR1) excavated at the site. The depth of the trench was 4.5 feet. Three joint sets were recognized and each was characterized according to the roughness of the joint surfaces and the degree of alteration. Faults were identified by photo interpretation and the presence of crystalline or slickensided calcite along joints and in float. The nearest mappable faults are over 700 feet to the east of the IR1 site. The locations of the borings and the trench are shown in Drawing GP-1 (in pocket). Geologic profiles are shown in Drawing GS-3 (in pocket).

- **Setting:** See Drawing GP-1 (in pocket).
- **Location and Topographic Setting:** IR 1 is approximately 1 mile north-northwest of Boz, Texas, on gently sloping, slightly undulating, topography.
- **Surface Slope:** Approximately 1° to the southeast.
- **Current and Prior Use:** Current use is pastureland; prior use was probably cultivated cropland and pastureland.
- **Cultural Features and Structures within 50 feet of the IR:** See Drawing GP-1. IR 1 is situated astride a rural asphalt road approximately 14 feet wide. Parallel to the road are overhead power lines on the southwest side and underground telephone cables (Southwestern Bell) along both sides of the road. A buried water line may also be adjacent to the road, although no signs are posted to indicate this. A water line is suspected because the site is located between a municipal water storage tank approximately 1,800 feet to the northwest and a metered livestock watering tank approximately 350 feet to the southeast. Four-strand barbed wire fences parallel both sides of the road.
- **Surface Soil Type:** The topsoil is approximately 0.8 foot thick and consists of black to dark brown silty clay with low to medium plasticity. Desiccation cracks 0.5 inch to 2 inches wide are common throughout the site and extend to a depth of approximately 1 foot (top of weathered Austin Chalk).
- **Erosional and Drainage Features:** One primary drainage is located approximately 600 feet east of the site. There are no incised drainages at the site.
- **Vegetation:** Vegetation is dominated by short grasses and wildflowers. There are a few scattered trees in the fields and along portions of drainages.
- **Surface Geology:** IR 1 is in the Austin Chalk. Bedrock is exposed in a drainage 650 feet east of the IR, and consists of alternating beds of massive, slightly fossiliferous, white chalk and

thin-bedded, nonfossiliferous, argillaceous chalk. Bed thickness ranges from less than 0.1 foot to approximately 0.8 foot thick. Bedding is locally smooth and undulating but planar overall. Approximately 0.8 foot of clayey soil overlies approximately 2.0 feet of weathered chalk. The chalk is moderately fractured.

- **Subsurface Geology:** Drawing GS-3 (Geologic Profiles, in pocket) illustrates the subsurface geologic conditions that are expected to be encountered at the IR. These profiles were compiled using the data collected from the borings around the IR.

- **Joint Characterization (in Austin Chalk):** (based on surface exposures)

The table below summarizes the joint characteristics observed in drainages near IR 1 where bedrock was exposed (see Drawing GP-1). Samples were collected from site IR 1A and direct shear tests were performed on the fracture surfaces. See Appendix E for direct shear test results.

Joint Set	I	II	III
Orientation[1]	N38° to N46°E dips 70°SE to 70°NW	N12°W to N4°E dips 1° to 10°	N0° to N20°W dips 26° to 87°SW
Joint Spacing[2]	2.2 ft (± 1.1) n = 20	0.35 ft (± 0.3) n = 28	2.5 ft (± 1.3) n = 33
Joint Roughness[3]	smooth, planar; JRC[4] = 8-18	smooth and undulating locally, planar overall; JRC[4] = 8-12	irregular, undulating locally, discontinuous overall; JRC[4] = 4-12
Joint Alteration	wall rock to wall rock contact; unaltered, surface staining only	wall rock to wall rock contact; unaltered, surface staining only	wall rock to wall rock contact; unaltered, surface staining only
Comments		Bedding	

1. See stereographic plots of poles to fractures on Drawing GP-1, in pocket.
2. n = the number of fracture spacing measurements made in the field for that fracture set.
3. Descriptions refer to small-scale features and intermediate-scale features, in that order.
4. JRC = Joint Roughness Coefficient.

APPENDIX D

HYDROLOGIC TEST RESULTS

APPENDIX D

HYDROLOGIC TEST RESULTS

The objectives of the hydrogeologic (packer) tests were to provide estimates of the hydraulic conductivity at the Austin Chalk/Eagle Ford Shale contact and within fractured or other suspected water-bearing zones. 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 encountered in most of these tests, water was often 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, were 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

Boring	Test Depth (feet)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/ Lithology	Hydraulic Conductivity* (cm/sec)
BIR 11	140.0-160.0	125	20	Austin Chalk (fractured)	$<4.6 \times 10^{-8}$
BIR 12	189.75-210.85 (vertical depth 136.2-151.1)	110	30	Austin Chalk (fractured)	9.2×10^{-7}
	295.25-316.35 (vertical depth 211.9-225.8)	200	40	Austin Chalk/ Eagle Ford Shale Contact	1.5×10^{-5}

* Based on a static water level of 3.0 feet below ground surface.

At boring BIR 11, one test interval was selected based on an inspection of the rock core and a review of the boring and wire-line logs. The selected interval for this boring was from 140.0 to 160.0 feet and encompassed a zone in the Austin Chalk that contained several minor tight fractures and two 1- to 2-inch-wide, calcite-filled fractures. Hydrogeologic (packer) testing in BIR 11 followed the standard procedures outlined above. Flow volumes were derived from flow meter readings and beginning/end readings from a calibrated container (approximately 3-foot length of 8-inch-diameter steel casing).

At boring BIR 12 (the angled boring), two intervals were selected based on an inspection of the rock core and review of the boring and wire-line logs. The first interval was selected at 189.75 to 210.85 feet (boring depth) (vertical depth 136.2 to 151.1 feet) and encompassed a zone with a moderate degree of fracturing in the Austin Chalk. The second interval selected was from 295.25 to 316.35 feet (boring depth) (vertical depth 211.9 to 225.8 feet) and encompassed the contact between the Austin Chalk and Eagle Ford Shale. This interval also included minor fractures in the uppermost few feet of the shale. Hydrogeologic (packer) testing in BIR 12 followed the standard procedures as outlined above. The deeper zone was tested first followed by the shallower zone. Packer pressures and the gauge pressures for the tests used in the calculation of hydraulic conductivity are listed in the table. Flow volumes were derived from flow meter readings. A calibrated container was not used for these tests.

BULK AND CLAY MINERALOGY

TEST RESULTS

TABLE E-1. BULK AND CLAY MINERALOGY TEST RESULTS (continued)

BORING BIR 11

Formation: Austin Chalk **Depth:** 52.4 ft.

Whole Rock Composition:

Mineral	Percent
quartz	2
calcite	97
pyrite	1
total clay	0
Total	100

Relative Clay Abundance:

Mineral	Percent
Not Analyzed	

Formation: Austin Chalk **Depth:** 152.5 ft

Whole Rock Composition:

Mineral	Percent
quartz	1
calcite	98
pyrite	1
total clay	0
Total	100

Relative Clay Abundance:

Mineral	Percent
Not Analyzed	

Formation: Eagle Ford Shale **Depth:** 225.0 ft

Whole Rock Composition:

Mineral	Percent
quartz	27
K-feldspar	3
plagioclase	1
calcite	2
pyrite	2
total clay	65
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	6
kaolinite	18
Fe-chlorite	2
mixed layer (illite/smectite)	74
Total	100

Formation: Eagle Ford Shale **Depth:** 245.6 ft

Whole Rock Composition:

Mineral	Percent
quartz	4
K-feldspar	3
plagioclase	3
calcite	<1
siderite	1
pyrite	1
total clay	88
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	10
kaolinite	33
Fe-chlorite	<1
mixed layer (illite/smectite)	57
Total	100

TABLE E-1. BULK AND CLAY MINERALOGY TEST RESULTS (continued)

Formation: Eagle Ford Shale **Depth:** 261.1 ft

Whole Rock Composition:

Mineral	Percent
quartz	19
K-feldspar	3
plagioclase	2
calcite	1
pyrite	4
total clay	71
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	21
kaolinite	23
Fe-chlorite	<1
mixed layer (illite/smectite)	56
Total	100

BORING BIR 13

Formation: Austin Chalk **Depth:** 148.6 ft

Whole Rock Composition:

Mineral	Percent
total clay	95
others (not analyzed)	5
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	5
kaolinite	1
smectite	94
Total	100

Formation: Eagle Ford Shale **Depth:** 293.9 ft

Whole Rock Composition:

Mineral	Percent
total clay	80
others (not analyzed)	20
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	19
kaolinite	11
Fe-chlorite	<1
mixed layer (illite/smectite)	70
Total	100

BORING BIR 14

Formation: Austin Chalk **Depth:** 147.8 ft

Whole Rock Composition:

Mineral	Percent
total clay	81
others (not analyzed)	19
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	5
smectite	95
Total	100

Formation: Eagle Ford Shale **Depth:** 253.1 ft

Whole Rock Composition:

Mineral	Percent
total clay	70
others (not analyzed)	30
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	54
kaolinite	16
Fe-chlorite	3
mixed layer (illite/smectite)	27
Total	100

TABLE E-1. BULK AND CLAY MINERALOGY TEST RESULTS (continued)

BORING BIR 14

Formation: Eagle Ford Shale **Depth:** 282.9-283.1 ft

Whole Rock Composition:

Mineral	Percent
total clay	100
Total	100

Relative Clay Abundance:

Mineral	Percent
montmorillonite	18
illite	34
kaolinite	48
Total	100

Formation: Eagle Ford Shale **Depth:** 295.3 ft

Whole Rock Composition:

Mineral	Percent
total clay	62
others (not analyzed)	38
Total	100

Relative Clay Abundance:

Mineral	Percent
illite	45
kaolinite	13
mixed layer (illite/smectite)	42
Total	100

APPENDIX E

LABORATORY RESULTS

DIRECT SHEAR TEST RESULTS

TABLE E-2. DIRECT SHEAR TEST RESULTS SUMMARY

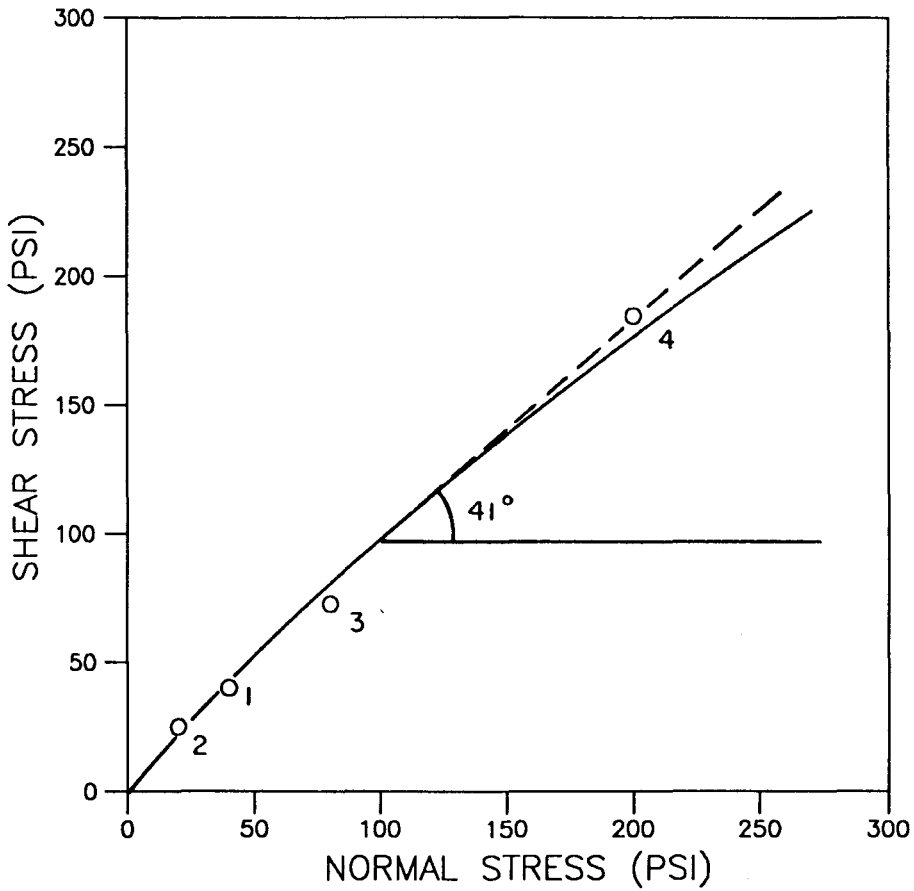
TEST NUMBER	NORMAL LOAD (lbs.)	AREA (in.^{2})	SHEAR FORCE (lbs.)		DISPLACEMENT (in.)		NORMAL STRESS (psi)		SHEAR STRESS (psi)		FRICTION ANGLE* (deg)
			PEAK	MIN.	PEAK SHEAR STRESS	MINIMUM SHEAR STRESS	PEAK	MIN.	PEAK	MIN.	
IR1A2CNI	332	8.30	331	---	0.408	---	40	---	39.9	---	41
IR1A2AX2	166	8.30	210	---	0.404	---	20	---	25.3	---	
IR1A2AX3	664	8.30	607	---	0.394	---	80	---	73.1	---	
IR1A2AX4	1660	8.30	1531	---	0.422	---	200	---	184.5	---	
IR1A3CNI	490	12.24	911	250	0.044	0.411	40	---	74.4	51.9	50
IR1A3AX2	245	12.24	409	---	0.071	---	20	---	33.4	---	
IR1A3AX3	979	12.24	1519	---	0.146	---	80	---	124.1	---	
IR1A3AX4	2448	12.24	2650	---	0.389	---	200	---	216.5	---	
IR1A4CN1	346	8.64	320	---	0.406	---	40	---	37.1	---	38
IR1A4AX2	173	8.64	185	---	0.37	---	20	---	21.4	---	
IR1A4AX3	691	8.64	773	---	0.379	---	80	---	89.5	---	
IR1A4AX4	1728	8.64	1408	---	0.216	---	200	---	163	---	

NOTES:

1) Samples were cut and aligned so that a constant shear was maintained during the tests.

2) Shear and normal loads have been corrected for piston packing friction.

* Friction angle calculated using tangent line at 100 psi normal stress.



SAMPLE NO.: IR1A2
DEPTH: SURFACE
SHEAR AREA (SQ. IN.): 8.30
LITHOLOGY: AUSTIN CHALK LIMESTONE
DESCRIPTION: SURFACE IS WEATHERED AND IS ROUGH

STAGE:	1	2	3	4
NORMAL STRESS (PSI)	40	20	80	200

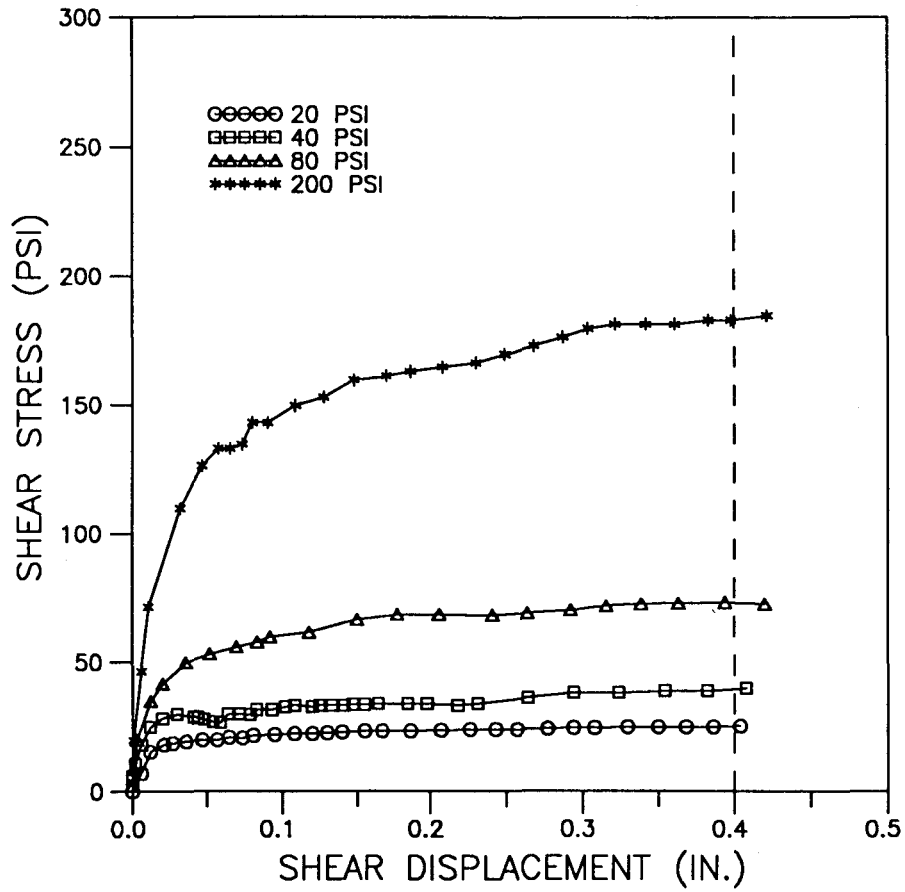
TEST PROCEDURE: ISRM

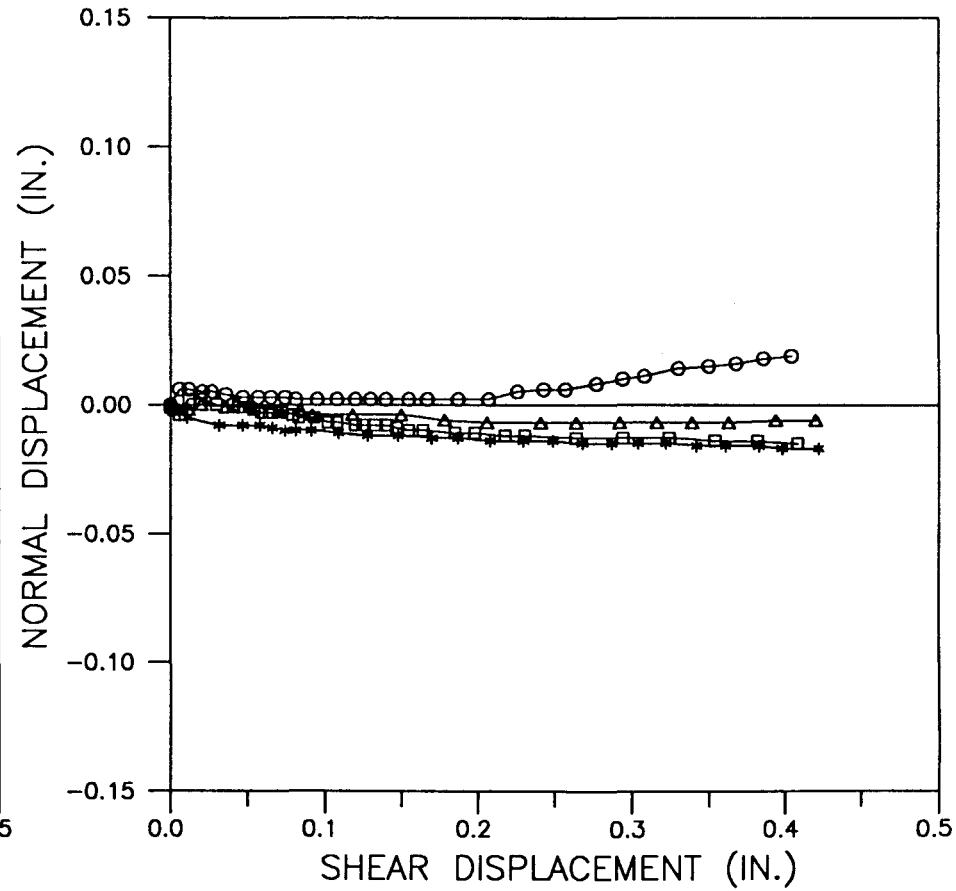
TEXAS SSC SITE

DISCONTINUITY SHEAR

MASON–JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS–ENGINEERS

JOB NO.: 5530.15 | FIGURE





SAMPLE NO.: IR1A2
DEPTH: SURFACE
SHEAR AREA (SQ. IN.): 8.30
LITHOLOGY: AUSTIN CHALK LIMESTONE
DESCRIPTION: SURFACE IS WEATHERED AND IS ROUGH

STAGE:	1	2	3	4
NORMAL STRESS (PSI)	40	20	80	200

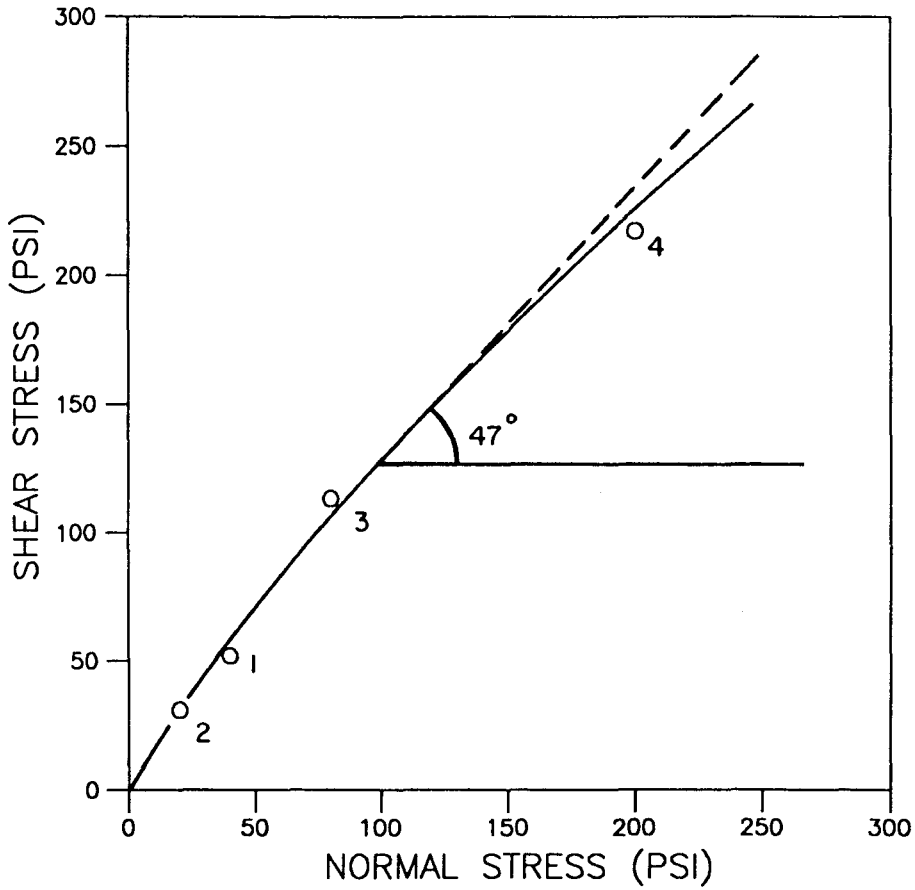
TEST PROCEDURE: ISRM

TEXAS SSC SITE

DISCONTINUITY SHEAR

MASON–JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS–ENGINEERS

JOB NO.: 5530.15 | FIGURE



SAMPLE NO.: IR1A3
DEPTH: SURFACE
SHEAR AREA (SQ. IN.): 12.2
LITHOLOGY: AUSTIN CHALK LIMESTONE
DESCRIPTION: SURFACE IS WEATHERED AND IS VERY ROUGH

STAGE:	1	2	3	4
NORMAL STRESS (PSI)	40	20	80	200

TEST PROCEDURE: ISRM

TEXAS SSC SITE

DISCONTINUITY SHEAR

MASON–JOHNSTON & ASSOCIATES,INC.
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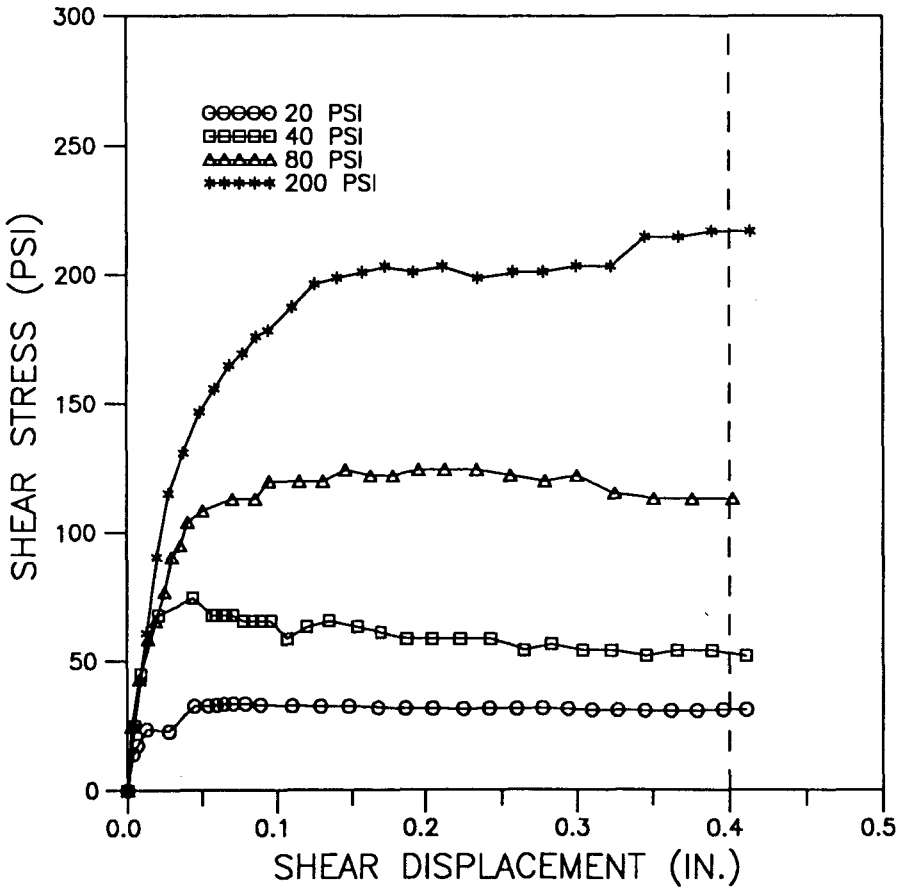
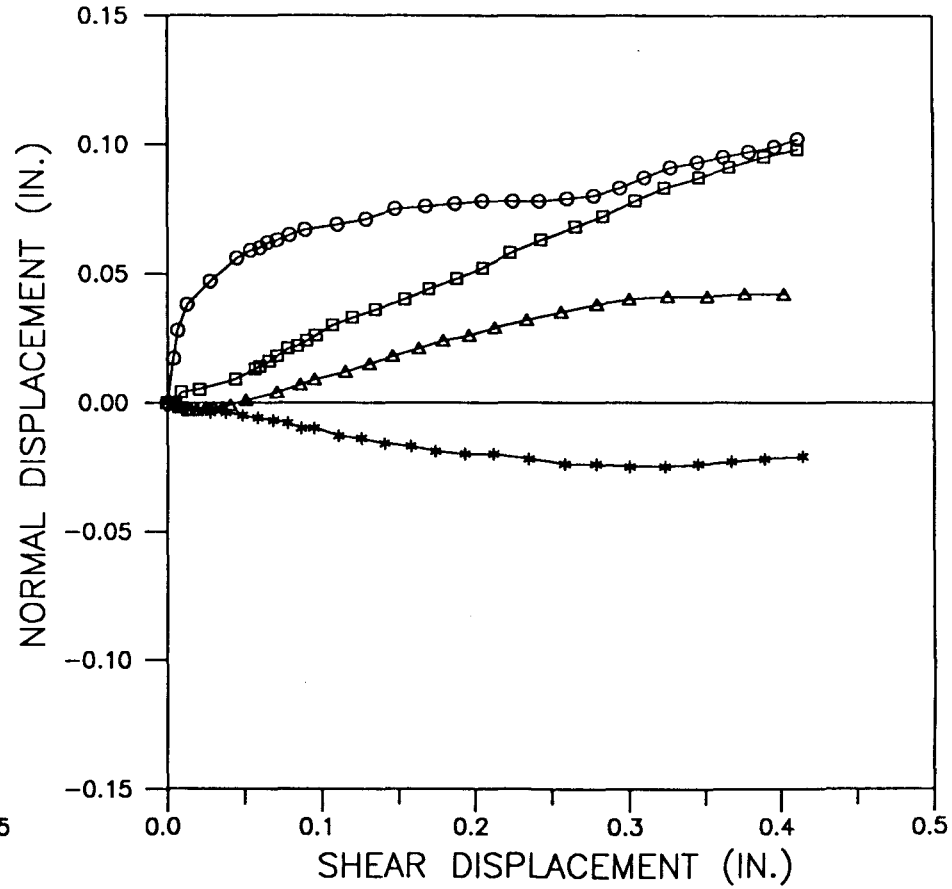
JOB NO.: 5530.15 | FIGURE





SAMPLE NO.: IR1A3
DEPTH: SURFACE
SHEAR AREA (SQ. IN.): 12.2
LITHOLOGY: AUSTIN CHALK LIMESTONE
DESCRIPTION: SURFACE IS WEATHERED AND IS VERY ROUGH

STAGE:	1	2	3	4
NORMAL STRESS (PSI)	40	20	80	200

TEST PROCEDURE: ISRM

TEXAS SSC SITE

DISCONTINUITY SHEAR

MASON–JOHNSTON & ASSOCIATES,INC.
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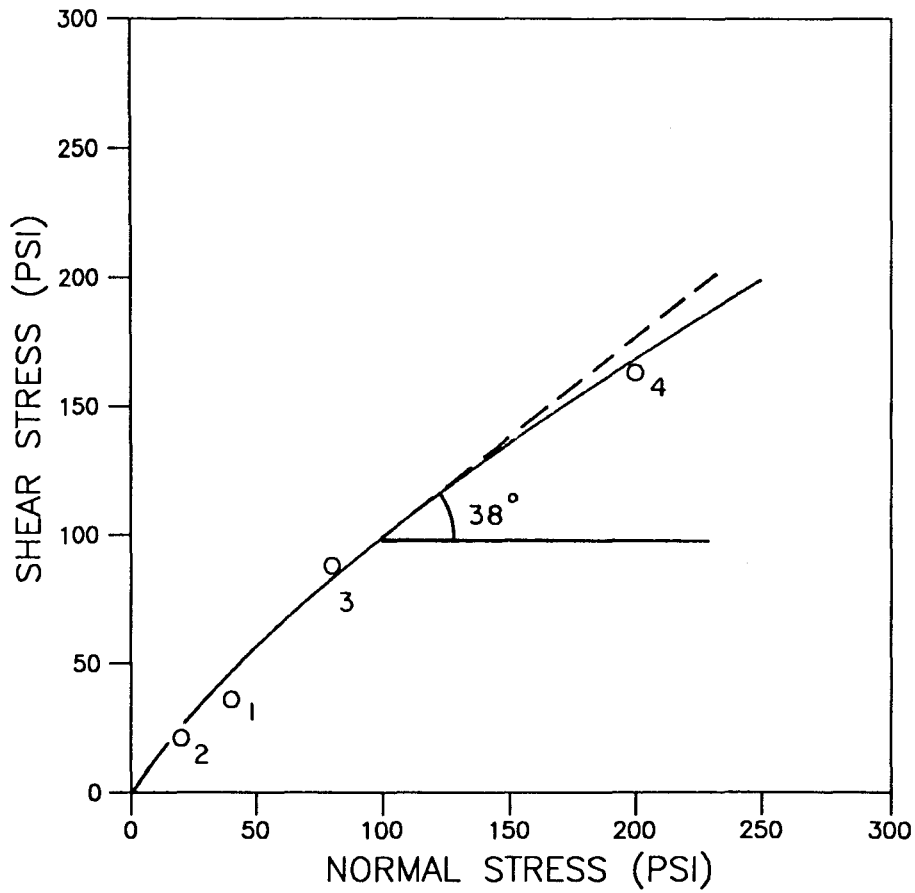
JOB NO.: 5530.15 | FIGURE



SAMPLE NO.: IR1A4
DEPTH: SURFACE
SHEAR AREA (SQ. IN.): 8.64
LITHOLOGY: AUSTIN CHALK LIMESTONE
DESCRIPTION: SURFACE IS WEATHERED AND IS ROUGH

STAGE:	1	2	3	4
NORMAL STRESS (PSI)	40	20	80	200

TEST PROCEDURE: ISRM

TEXAS SSC SITE

DISCONTINUITY SHEAR

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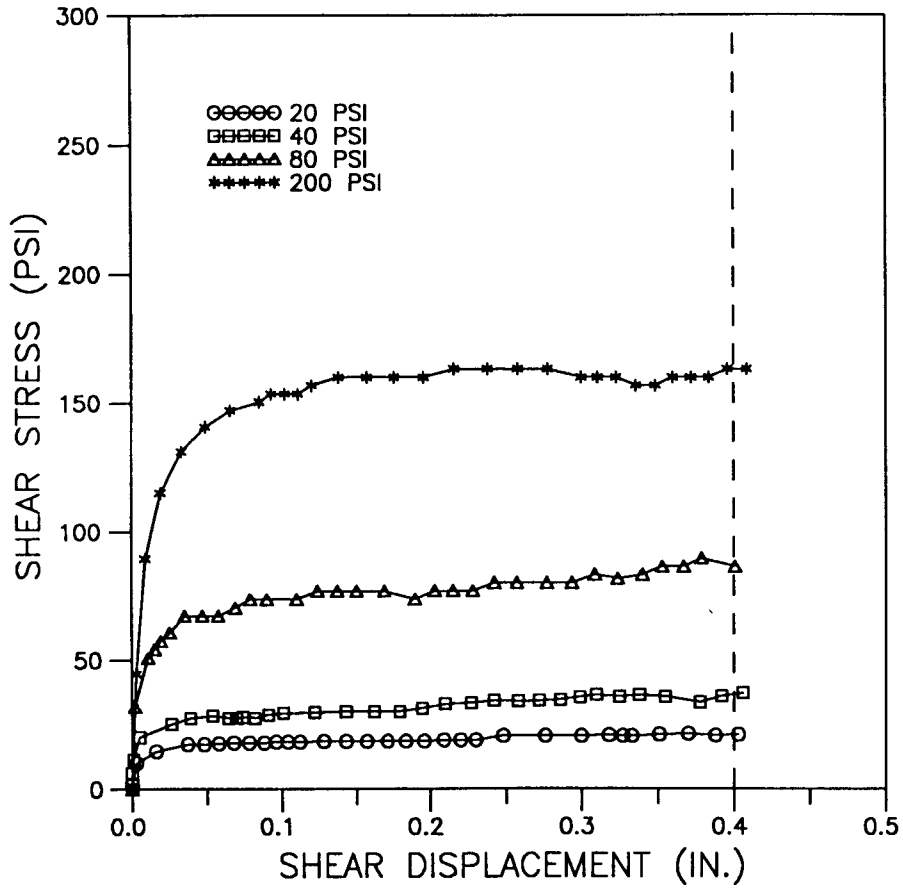
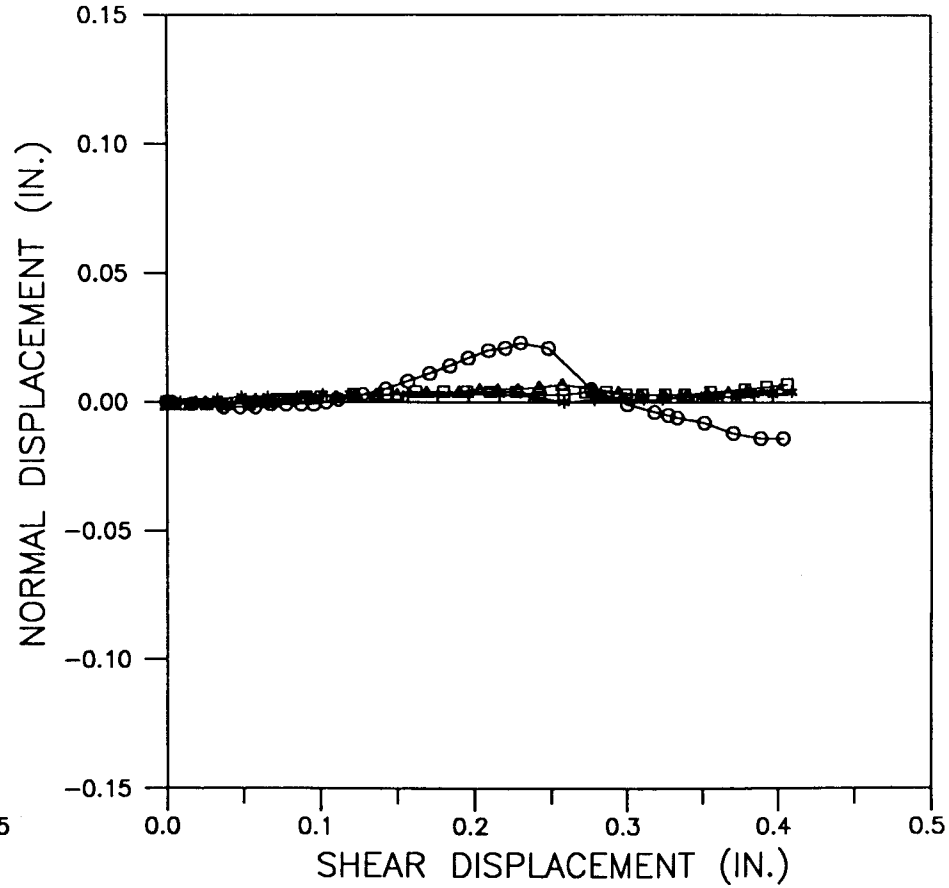
JOB NO.: 5530.15 | FIGURE





SAMPLE NO.: IR1A4
DEPTH: SURFACE
SHEAR AREA (SQ. IN.): 8.64
LITHOLOGY: AUSTIN CHALK LIMESTONE
DESCRIPTION: SURFACE IS WEATHERED AND IS ROUGH

STAGE:	1	2	3	4
NORMAL STRESS (PSI)	40	20	80	200

TEST PROCEDURE: ISRM

TEXAS SSC SITE

DISCONTINUITY SHEAR

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JOB NO.: 5530.15 | FIGURE

GEOMECHANICAL TEST RESULTS

GEOMECHANICAL TEST RESULTS

BORING BIR 11

TABLE E-3. GEOMECHANICAL TEST RESULTS-BORING BIR11

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	DIRECT SHEAR NORMAL STRESS psi	DIRECT SHEAR PEAK SHEAR STRESS psi	BRAZIL TENSILE STRENGTH psi	2ND CYCLE SLAKE DURABILITY INDEX percent	MODIFIED TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX psi	COMMENTS
AUSTIN CHALK	3.7	13.5																							
AUSTIN CHALK	4.3	13.8	119.7						2.3	B-1/30	2073			0.76			0								
AUSTIN CHALK	50.8	15.0																							
AUSTIN CHALK	51.2	13.1	122.7	2.71					2.2	E	2392			0.68			0								
AUSTIN CHALK	51.2	13.3																				96.9			
AUSTIN CHALK	52.7	15.5							0.5												146				
AUSTIN CHALK	53.0																						0.427		
AUSTIN CHALK	100.2								0.5												264				
AUSTIN CHALK	100.4	14.6																							
AUSTIN CHALK	102.0	15.4	118.1	2.71					1.9	B-1/30	2338			0.76			0								
AUSTIN CHALK	102.3	17.2																							
AUSTIN CHALK	102.6	16.9	115.6						1.9	D		100	1710	1.88			100								
AUSTIN CHALK	103.1	17.1	113.1						1.9	A		500	2780	4.09			500								SEE NOTE 1
AUSTIN CHALK	103.1	17.1	112.1						1.9	D	1095			0.41	3.23		0								SEE NOTE 2
AUSTIN CHALK	133.3																		100	92					
AUSTIN CHALK	133.3																		200	151					
AUSTIN CHALK	133.3																		400	354					
BENTONITE	149.0	32.3																							
AUSTIN CHALK	150.3	11.3																				97.3			
AUSTIN CHALK	151.9								0.5												267				
AUSTIN CHALK	152.0																						0.563		
AUSTIN CHALK	152.5	13.0	122.7						2.0	E	2655			0.70			0								
AUSTIN CHALK	152.9	12.9																							
AUSTIN CHALK	200.0	15.2																							
AUSTIN CHALK	200.1	16.3	117.1						2.3	E	2474			0.64			0								
AUSTIN CHALK	200.4	16.3							0.5												256				
EAGLE FORD SHALE	220.2	17.6	115.2																						
EAGLE FORD SHALE	220.4	17.5	113.4																					50.6	
EAGLE FORD SHALE	220.5	17.5	111.9																					65.0	
EAGLE FORD SHALE	220.6	17.8	112.7																					21.7	
EAGLE FORD SHALE	221.3	17.1																				13.6			
EAGLE FORD SHALE	225.0	17.2																							
EAGLE FORD SHALE	225.2	16.8	116.5																					28.9	
EAGLE FORD SHALE	225.3	18.2	112.7																					28.8	
EAGLE FORD SHALE	225.4	17.0	116.2																					36.3	
EAGLE FORD SHALE	229.3	15.6	119.1	2.76				5.0	2.2	B-1/45	278			0.52			0								
EAGLE FORD SHALE	232.9	15.9																							
EAGLE FORD SHALE	232.9	14.9	119.7						2.0	B-1/13		100	390	0.44	1.18		100								SEE NOTE 3
EAGLE FORD SHALE	232.9														2.00			0.47							SEE NOTE 4
EAGLE FORD SHALE	233.4	15.7	118.3						2.0	B-1/60		500	434	1.03			500								
EAGLE FORD SHALE	235.0	15.6																				46.2			
EAGLE FORD SHALE	236.0	16.0	118.4						2.3	E	446			0.75			0								
EAGLE FORD SHALE	236.5	16.2																							
EAGLE FORD SHALE	236.5	16.3	119.1																					57.8	
EAGLE FORD SHALE	236.8	17.9	111.3																					86.9	
EAGLE FORD SHALE	245.8			2.76																					
EAGLE FORD SHALE	245.9	17.6	115.5																					64.8	
EAGLE FORD SHALE	246.0	16.6	117.1																					79.8	
EAGLE FORD SHALE	246.1	16.5	120.0																					43.4	
EAGLE FORD SHALE	253.3	15.5																							
EAGLE FORD SHALE	253.3	14.6	121.0						2.0	B-1/34		100	473	0.45	1.29		100								SEE NOTE 3
EAGLE FORD SHALE	253.3														1.04			0.33							SEE NOTE 4
EAGLE FORD SHALE	253.7	14.3	121.2						2.0	B-1/45		300	467	0.88	1.14		300								SEE NOTE 3
EAGLE FORD SHALE	253.7														1.90			0.46							SEE NOTE 4
EAGLE FORD SHALE	254.1	15.0	119.0						1.9	A		600	585	0.88			600								
EAGLE FORD SHALE	256.1	16.8	116.0																						
EAGLE FORD SHALE	256.1	12.0																				51.9			
EAGLE FORD SHALE	260.9	15.6																							

TABLE E–3. GEOMECHANICAL TEST RESULTS–BORING BIR11 (CONTINUED)

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	DIRECT SHEAR NORMAL STRESS psi	DIRECT SHEAR PEAK SHEAR STRESS psi	BRAZIL TENSILE STRENGTH psi	2ND CYCLE SLAKE DURABILITY INDEX percent	MODIFIED TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX psi	COMMENTS
EAGLE FORD SHALE	261.2	16.7	116.2																					36.0	
EAGLE FORD SHALE	261.3	16.6	115.0																					86.7	
EAGLE FORD SHALE	261.4	16.9	115.2																					43.5	
EAGLE FORD SHALE	261.8	15.8	118.0						2.0	B–1/45		500	528	1.15			500								
EAGLE FORD SHALE	262.0			2.73				5.6																	
EAGLE FORD SHALE	262.2	15.8																							
EAGLE FORD SHALE	262.5	15.0	119.6						2.0	B–4		100	472	0.76	0.88		100								
EAGLE FORD SHALE	262.6	16.4	117.2																					28.8	
EAGLE FORD SHALE	262.9	16.7	114.7																					43.2	
EAGLE FORD SHALE	263.0	16.1	118.2																					43.5	
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ISRM		ISRM	ISRM	ISRM	ISRM	

BIR11PRT.WK1
REVISION:1.1
DATE: 4/20/90

PRELIMINARY
(Subject to Revision)

* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

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

NOTES:

1) CAPACITY OF LOADING FRAME EXCEEDED IN THE TRIAXIAL TEST (UU) @ 103.1 FT

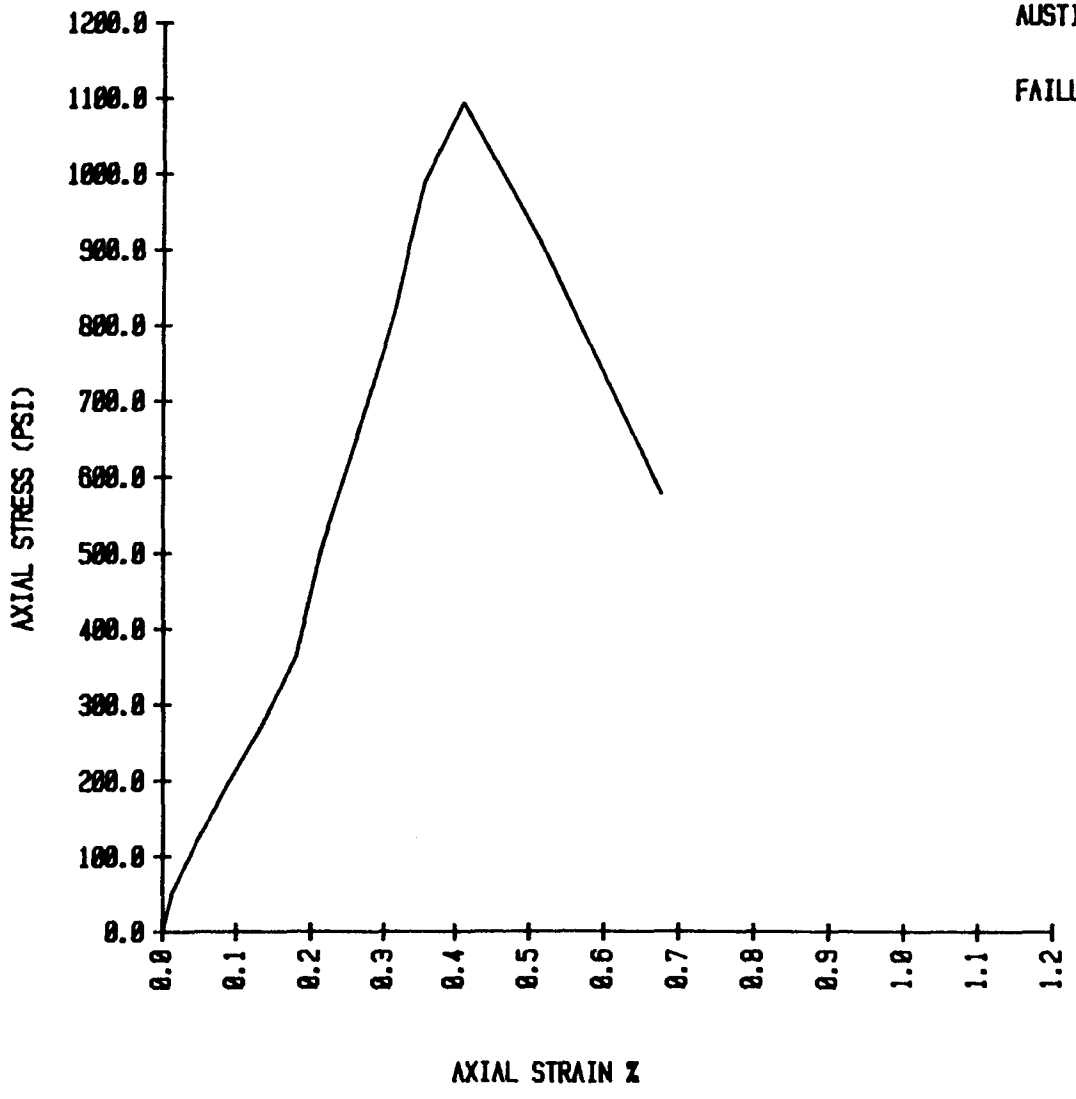
2) UNCONFINED COMPRESSIVE STRENGTH @ 103.1 FT WAS RUN REUSING THE UU TEST SAMPLE @ 103.1 FT SAMPLE DIMENSIONS HAVE CHANGED AFTER THE UU TEST.

3) MODULUS WAS CALCULATED FROM AXIAL STRAINS MEASURED USING DIAL MICROMETER. AXIAL LENGTH IS THE SAMPLE LENGTH.

4) MODULII AND POISSON'S RATIO WERE CALCULATED FROM AXIAL AND LATERAL STRAINS MEASURED USING 3 AXIAL AND 3 LATERAL LVDTS OFFSET @ 120 DEGREES APART. AXIAL LENGTH IS 2.8 INCHES.

BORING #: BIR 11
DEPTH: 103.1
INCLINATION : VERTICAL
DRY UNIT WEIGHT (PCF) = 112.1
MOISTURE CONTENT % = 17.1
AUSTIN CHALK LIMESTONE

FAILURE MODE : AXIAL SPLITTING



MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS
DALLAS, TEXAS

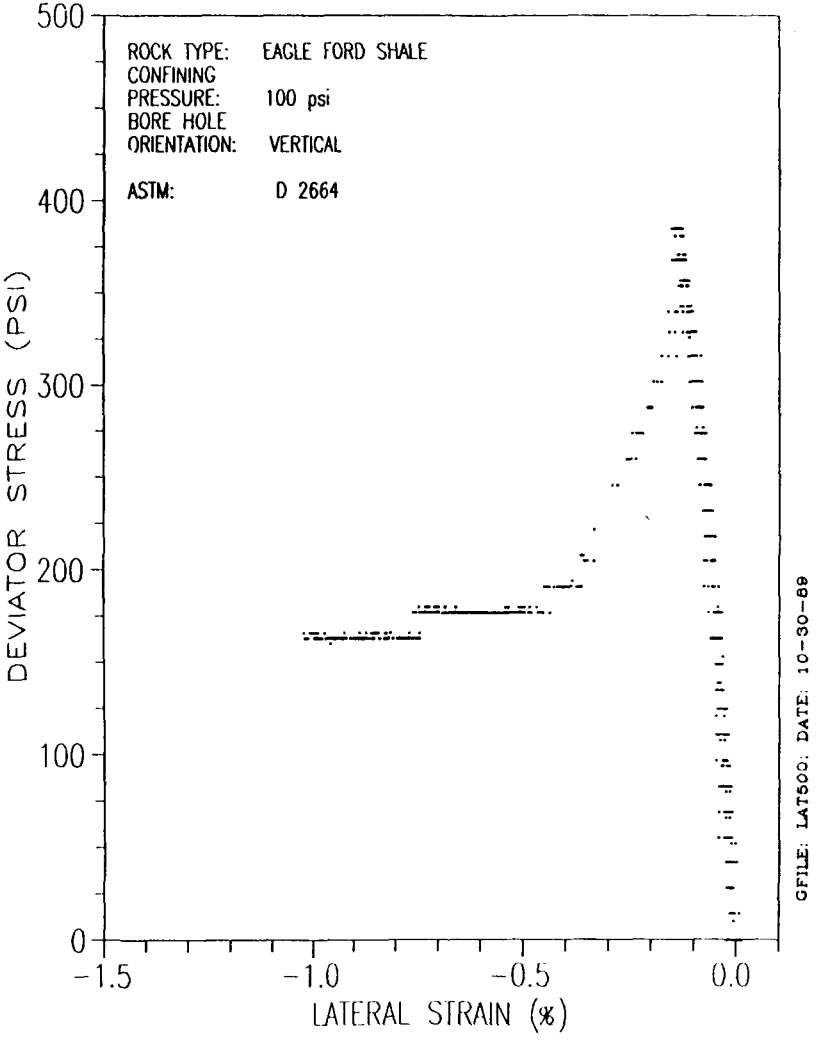
TEXAS SSC SITE

UNCONFINED COMPRESSIVE STRENGTH ASTM D-2938

DATE: 9-22-89 | JOB # 5530.15

DEVIATOR STRESS vs LATERAL STRAIN

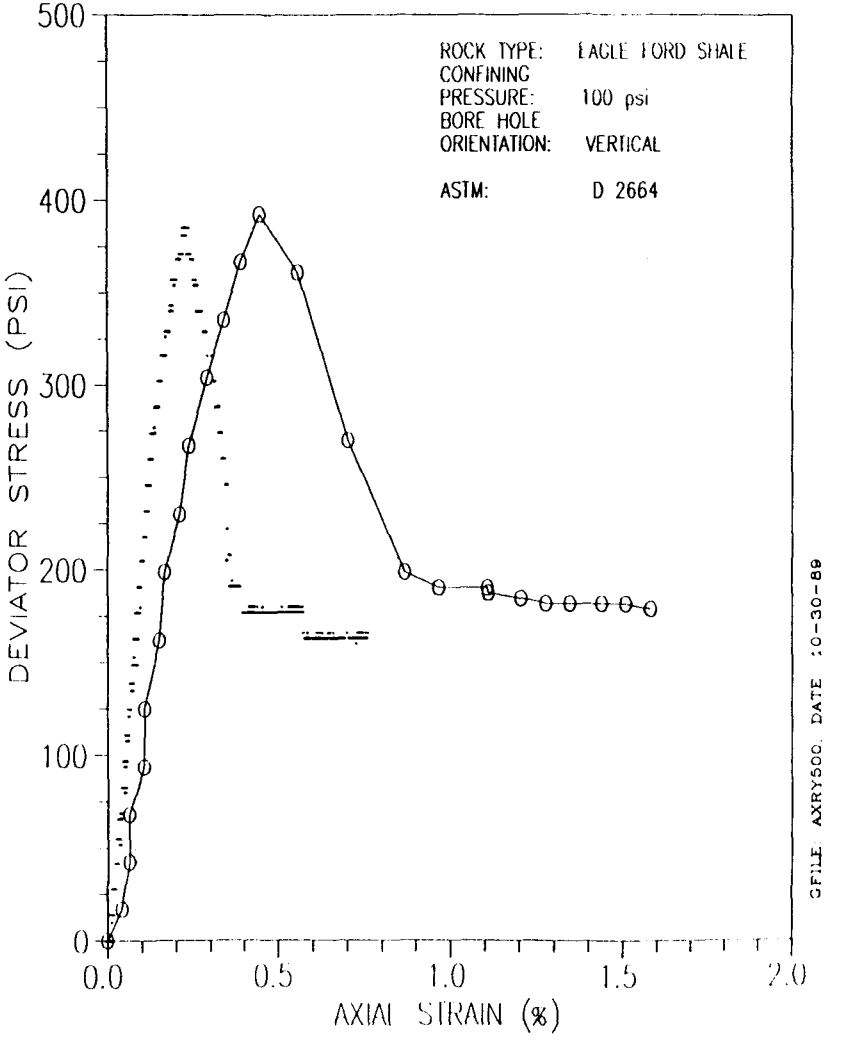
BORING: BIR 11 DEPTH: 232.9 ft



····· JACKET-LVDT (3)

DEVIATOR STRESS vs AXIAL STRAIN

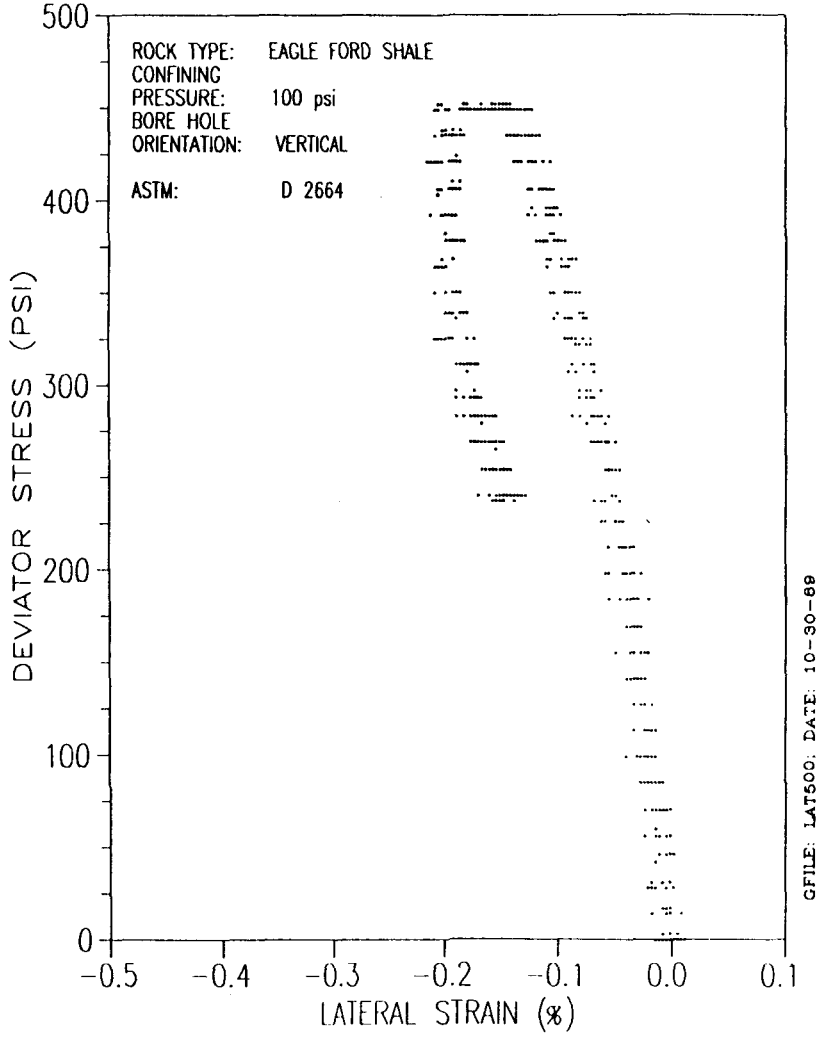
BORING: BIR 11 DEPTH: 232.9 ft



····· JACKET-LVDT (2) ○○○○ PLATEN DIAL GAUGE

DEVIATOR STRESS vs LATERAL STRAIN

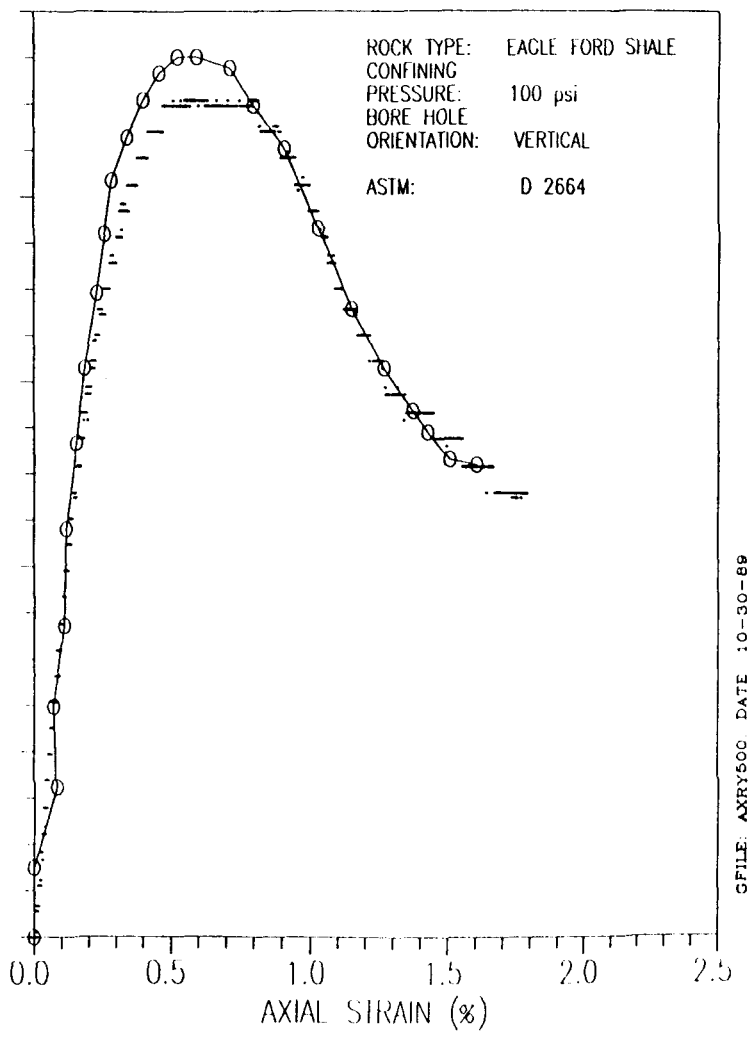
BORING: BIR 11 DEPTH: 253.3 ft



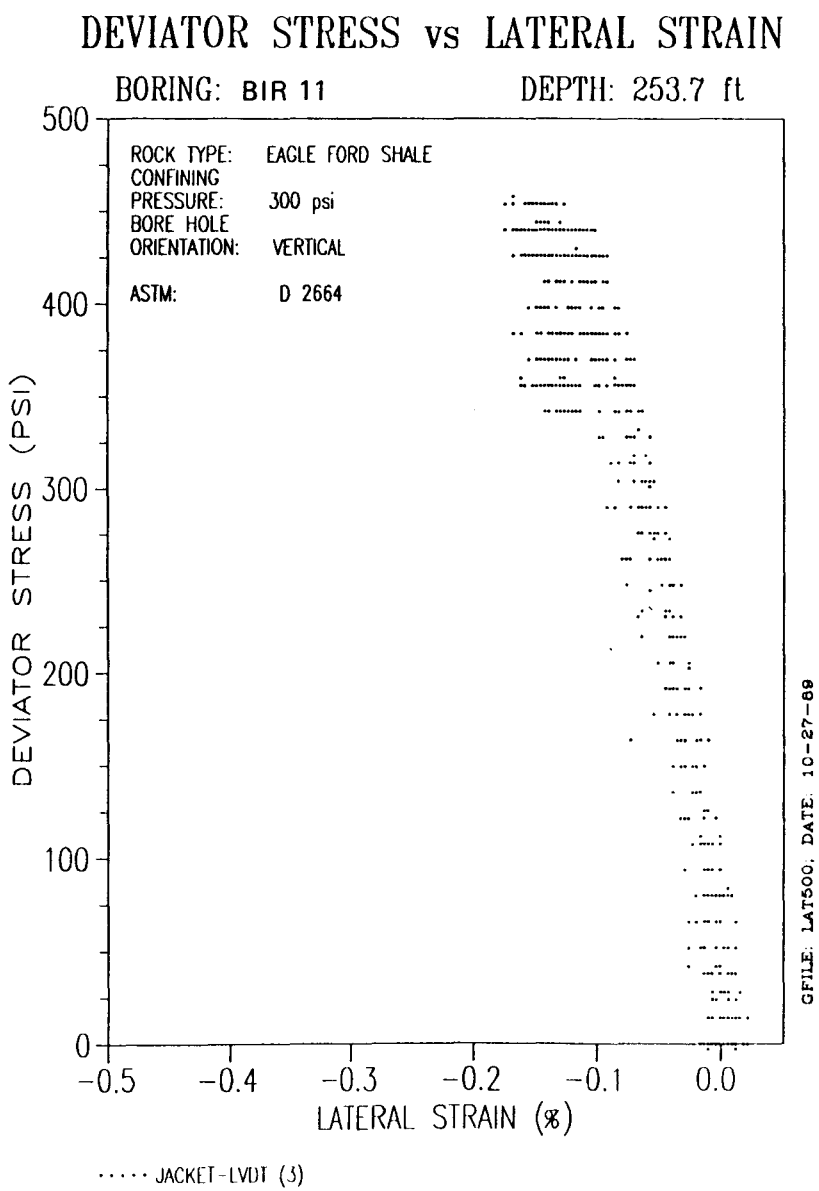
····· JACKET-LVDT (3)

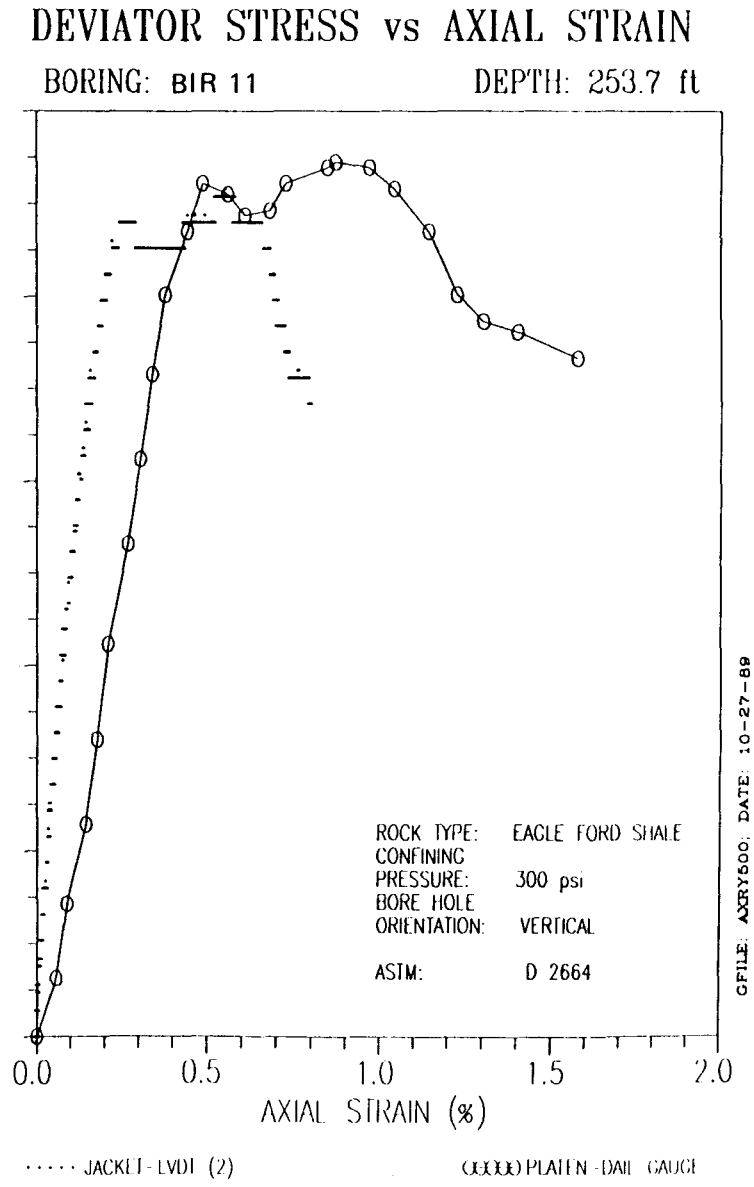
DEVIATOR STRESS vs AXIAL STRAIN

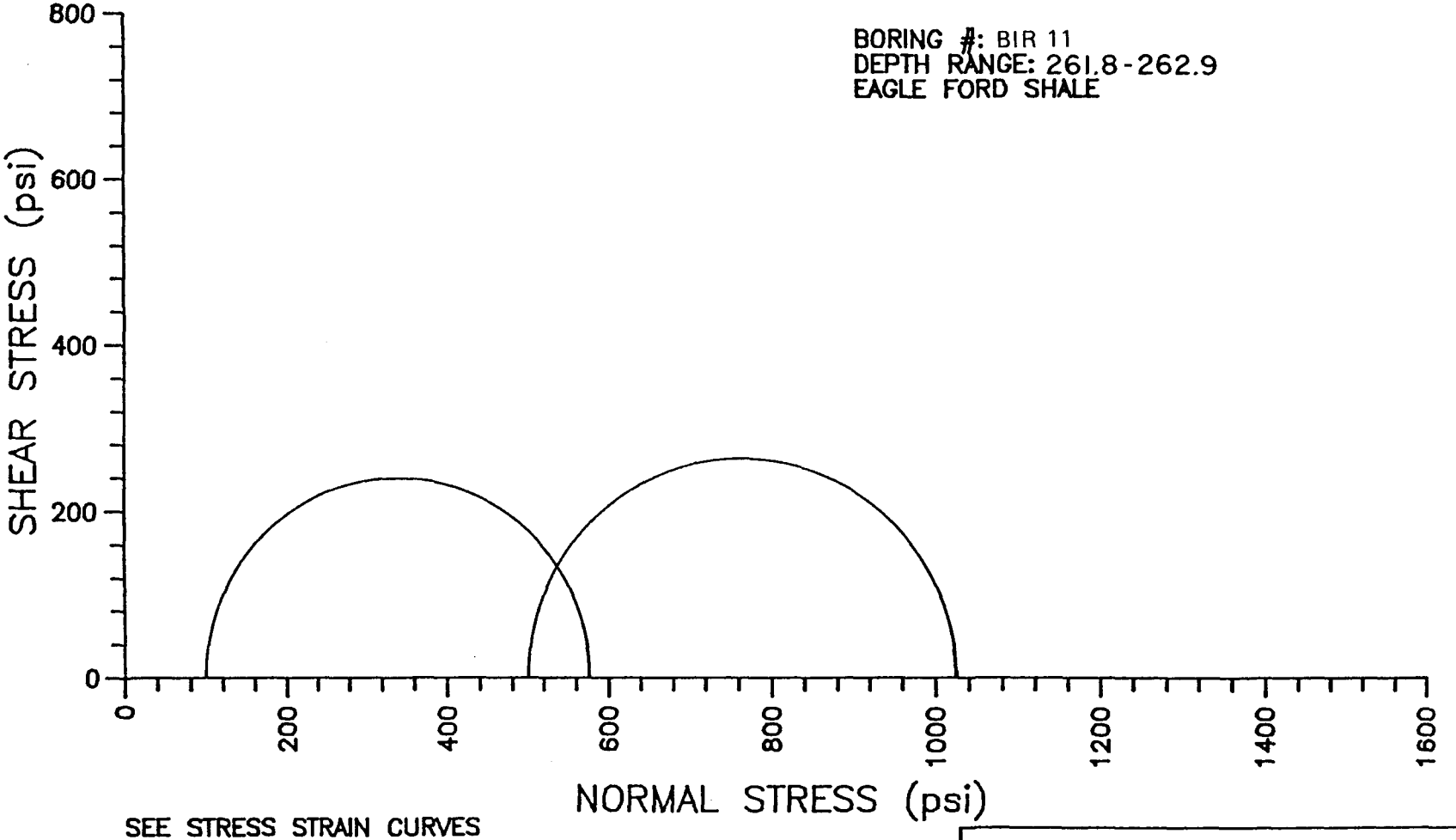
BORING: BIR 11 DEPTH: 253.3 ft



····· JACKET-LVDT (2) (OOOO) PLATEN DIAL GAUGE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BIR 11
DEPTH: 253.7 ft
ROCK TYPE: EAGLE FORD SHALE
CONFINING PRESSURE: 300 psi
BORE HOLE ORIENTATION: VERTICAL
ASTM: D 2664
DEVIATOR STRESS (PSI)
500
400
300
200
100
0
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
LATERAL STRAIN (%)
GFILE: LAT500, DATE: 10-27-89
JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BIR 11
DEPTH: 253.7 ft
ROCK TYPE: EAGLE FORD SHALE
CONFINING PRESSURE: 300 psi
BORE HOLE ORIENTATION: VERTICAL
ASTM: D 2664
0.0
0.5
1.0
1.5
2.0
AXIAL STRAIN (%)
GFILE: AXRY500, DATE: 10-27-89
JACKET-LVDT (2)
PLATEN-DIAL GAUGE



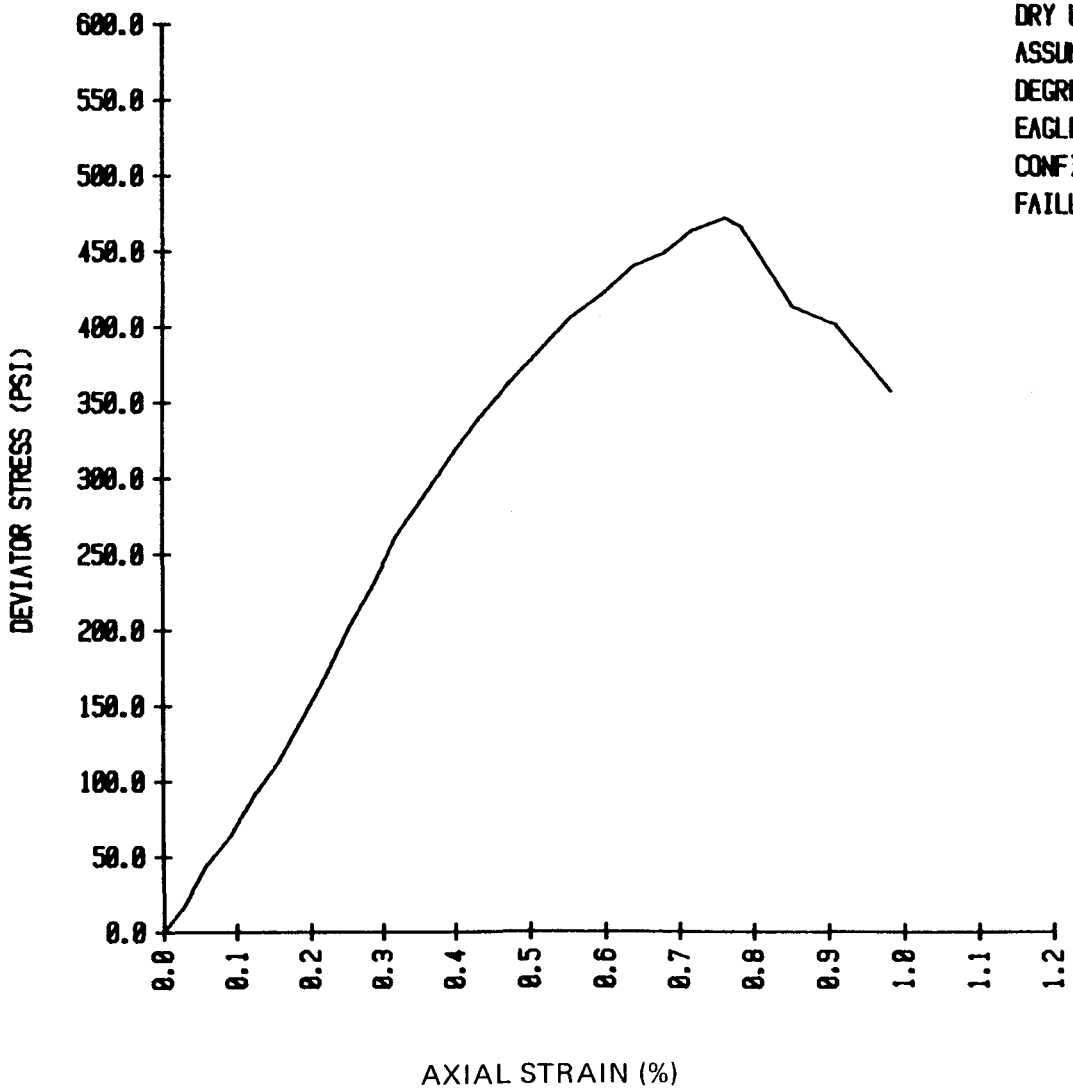
SEE STRESS STRAIN CURVES
FOR SAMPLE DATA

MASON–JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS–ENGINEERS
DALLAS, TEXAS

TEXAS SSC SITE
MOHR CIRCLE PLOT

DATE: 11–9–89 | JOB #: 5530.15

BORING #: BIR 11
DEPTH: 262.5
INCLINATION : VERTICAL
MC TRIMMINGS,(%) = 15.8
MC AS TESTED (%) = 15.0
DRY UNIT WEIGHT (PCF) = 119.7
ASSUMED SPECIFIC GRAVITY, G_s = 2.7
DEGREE OF SATURATION, (%) = 99.7
EAGLE FORD SHALE
CONFINING PRESSURE PSI = 100
FAILURE MODE : SHEAR PLANES



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DALLAS, TEXAS

TEXAS SSC SITE
TRIAXIAL COMPRESSION ASTM D-2664

DATE: 10-19-89 | JOB # 5530.15

GEOMECHANICAL TEST RESULTS

BORING BIR 12

TABLE E-4. GEOMECHANICAL TEST RESULTS-BORING BIR 12

GENERAL LITHOLOGY	VERTICAL DEPTH	MOISTURE CONTENT	DRY DENSITY	SPECIFIC GRAVITY	ATTERBERG LIMITS		FRACTION FINER THAN # 200 SIEVE	CARBONATE CONTENT	SAMPLE DIMENSION RATIO	SAMPLE FAILURE MODE/ DEGREES*	UNCONFINED COMPRESSIVE STRENGTH	TRIAXIAL COMPRESSION		FAILURE STRAIN	TANGENT YOUNG'S MODULUS			POISSON'S RATIO	BRAZIL TENSILE STRENGTH	2ND CYCLE SLAKE DURABILITY INDEX	MODIFIED TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX	COMMENTS
					LL	PI						CONFINING PRESSURE σ_3	DEVIATOR STRESS $\sigma_1-\sigma_3$		E50	UNLOAD/ RELOAD	σ_3						
	feet	percent	pcf				percent	percent	L/D		psi	psi	psi	percent	(psi)x10E6	(psi)x10E6	psi		psi	percent		percent	
AUSTIN CHALK	24.2	13.5	117.2																				
AUSTIN CHALK	50.6	15.2																					
AUSTIN CHALK	50.7	13.9	121.8						2.0	D	1930			0.44	5.40		0						
AUSTIN CHALK	51.0								0.7										184				
AUSTIN CHALK	77.1	16.7	113.0																				
BENTONITE	147.3	38.5																					
BENTONITE	147.4	39.5			106	56		10.4															
BENTONITE	147.7	40.3	81.3																			9.5	
BENTONITE	147.8	39.9	82.9																			9.5	
BENTONITE	147.9	39.6																					
AUSTIN CHALK	148.8	12.3																					
AUSTIN CHALK	149.0	11.7	125.8						2.1	D	927			0.32	3.23		0						
AUSTIN CHALK	149.3								0.5										238				
EAGLE FORD SHALE	226.2	16.9																					
EAGLE FORD SHALE	226.3	16.4	115.9						2.1	B-2/40	112			0.27	0.50		0						
EAGLE FORD SHALE	226.6	16.4	116.6						2.1	B-2/47		100	208	0.25	1.05		100						NOTE 1
EAGLE FORD SHALE	226.6														0.91			0.33					NOTE 2
EAGLE FORD SHALE	226.8	16.6	116.8						2.1	B-2/45		500	323	1.40	0.83		500						
EAGLE FORD SHALE	239.3	16.8																					
EAGLE FORD SHALE	239.4	16.1	116.9						2.1	B-2/45	141			0.42	0.40		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ISRM	ISRM	ISRM	ISRM	

BIR12PRT.WK1
REVISION: 1.1
DATE: 4/23/90

PRELIMINARY
(Subject to Revision)

* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

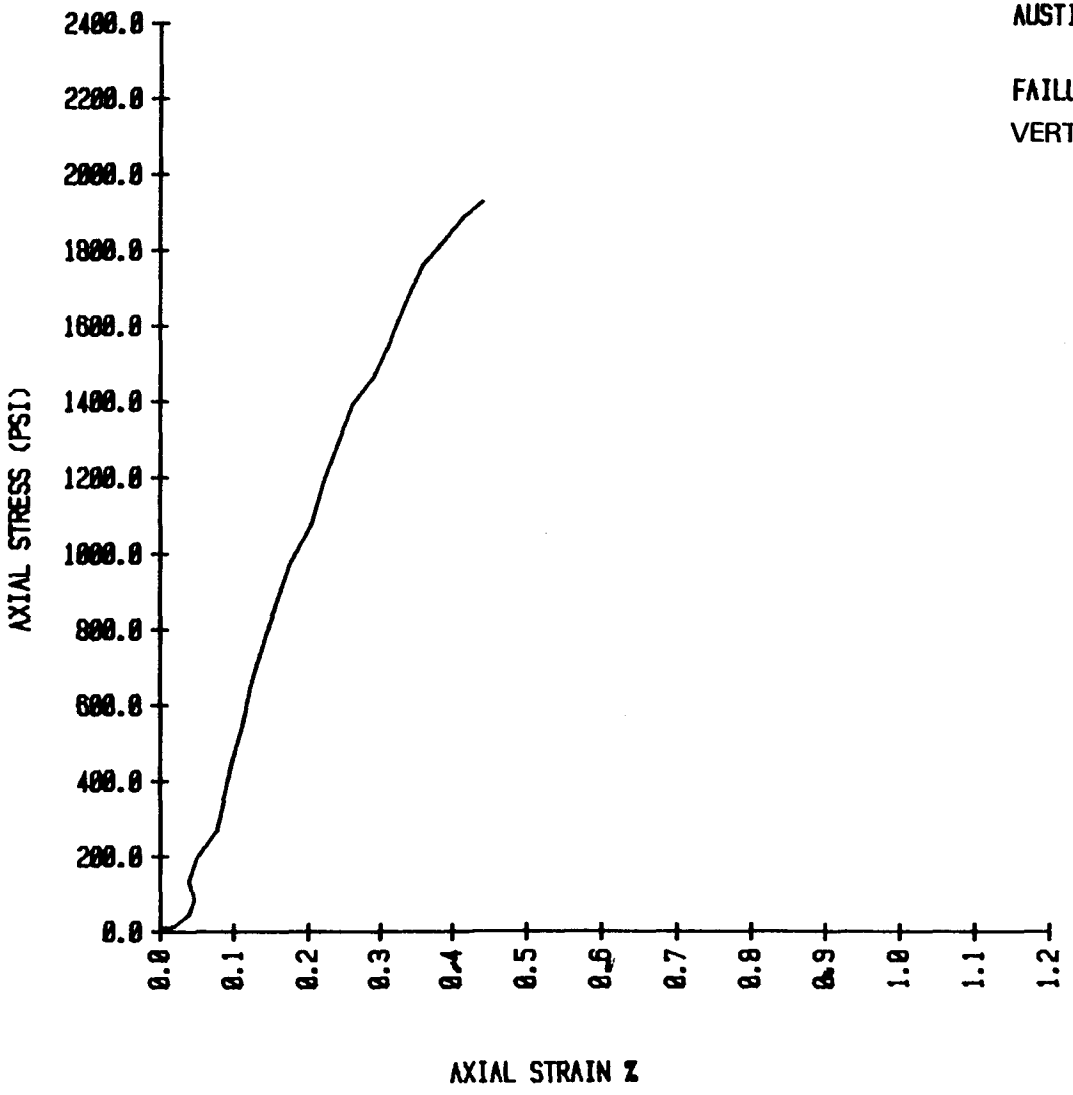
Symbol	Failure Type	Symbol	Failure Type
A	No discernible failure plane	B-4	Combination
(B)	Well defined shear plane @ "X" angle (deg) to vertical or to long axis of core	C	Barreling/Bulging
B-1	Shear plane	D	Longitudinal (axial) splitting
B-2	Bedding plane shear	E	Conical
B-3	Shear plane along pre-existing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

NOTES: 1) MODULUS WAS CALCULATED FROM AXIAL STRAINS MEASURED USING DIAL MICROMETER. AXIAL LENGTH IS THE SAMPLE LENGTH.

2) MODULII AND POISSON'S RATIO WERE CALCULATED FROM AXIAL AND LATERAL STRAINS MEASURED USING 3 AXIAL AND 3 LATERAL LVDTS OFFSET @ 120 DEGREES APART. AXIAL LENGTH IS 2.8 INCHES.

BORING #: BIR 12
BORING DEPTH: 69.1 FEET
INCLINATION : 45 DEGREES
DRY UNIT WEIGHT (PCF) = 121.8
MOISTURE CONTENT % = 13.9
AUSTIN CHALK LIMESTONE

FAILURE MODE : AXIAL SPLITTING
VERTICAL DEPTH: 50.7 FEET



MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS
DALLAS, TEXAS

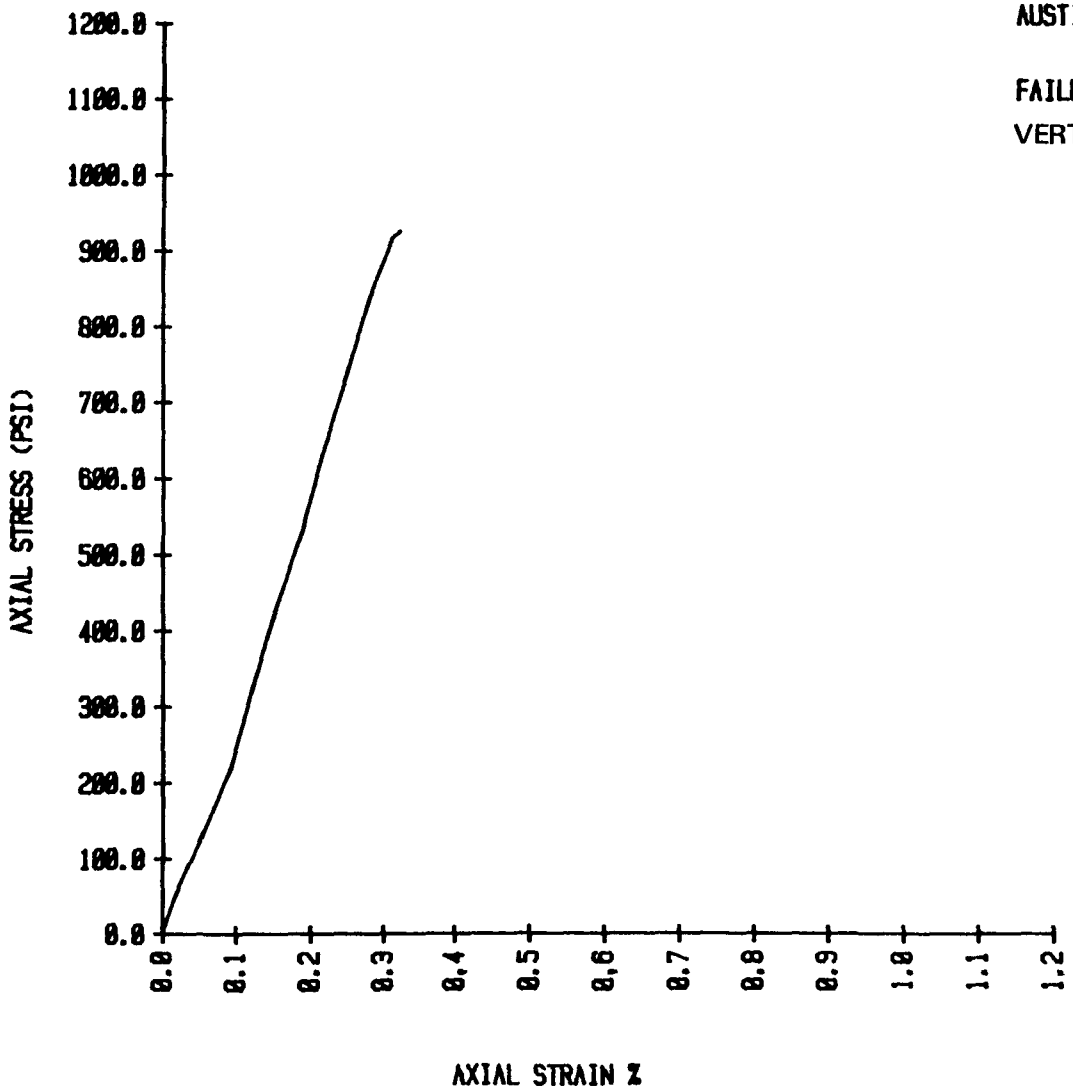
TEXAS SSC SITE

UNCONFINED COMPRESSIVE STRENGTH ASTM D-2938

DATE: 9-21-89 | JOB # 5530.15

BORING #: BIR 12
BORING DEPTH: 207.9 FEET
INCLINATION : 45 DEGREES
DRY UNIT WEIGHT (PCF) = 125.8
MOISTURE CONTENT % = 11.7
AUSTIN CHALK LIMESTONE

FAILURE MODE : AXIAL SPLITTING
VERTICAL DEPTH : 149.0 FEET



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TEXAS SSC SITE

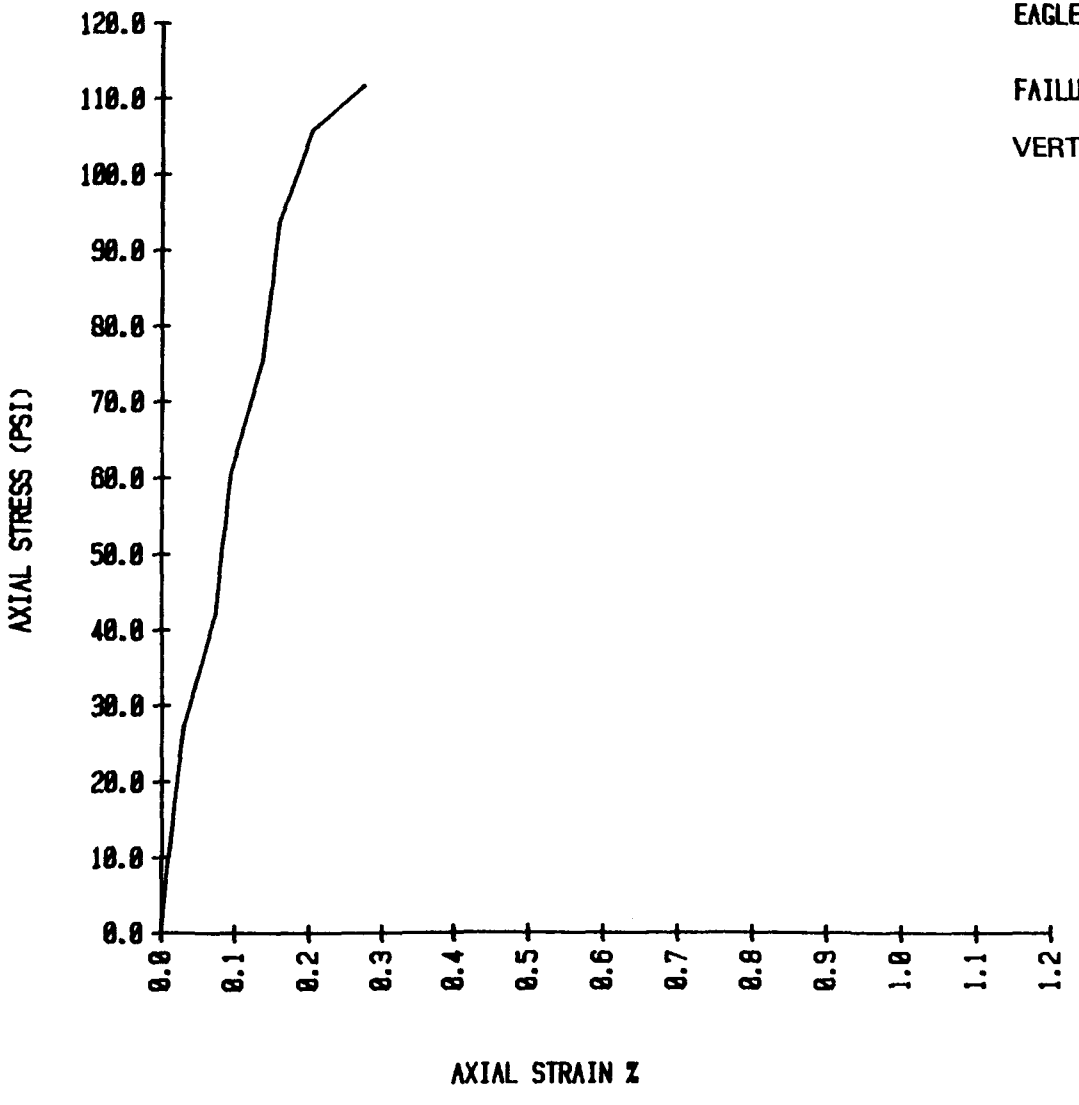
UNCONFINED COMPRESSIVE STRENGTH ASTM D-2938

DATE: 9-24-89 | JOB # 5530.15

BORING #: BIR 12
BORING DEPTH: 317.1 FEET
INCLINATION : 45 DEGREES
DRY UNIT WEIGHT (PCF) = 115.9
MOISTURE CONTENT % = 16.4
EAGLE FORD SHALE

FAILURE MODE : BEDDING PLANE SHEAR AT 40 DEG.

VERTICAL DEPTH: 226.3 FEET



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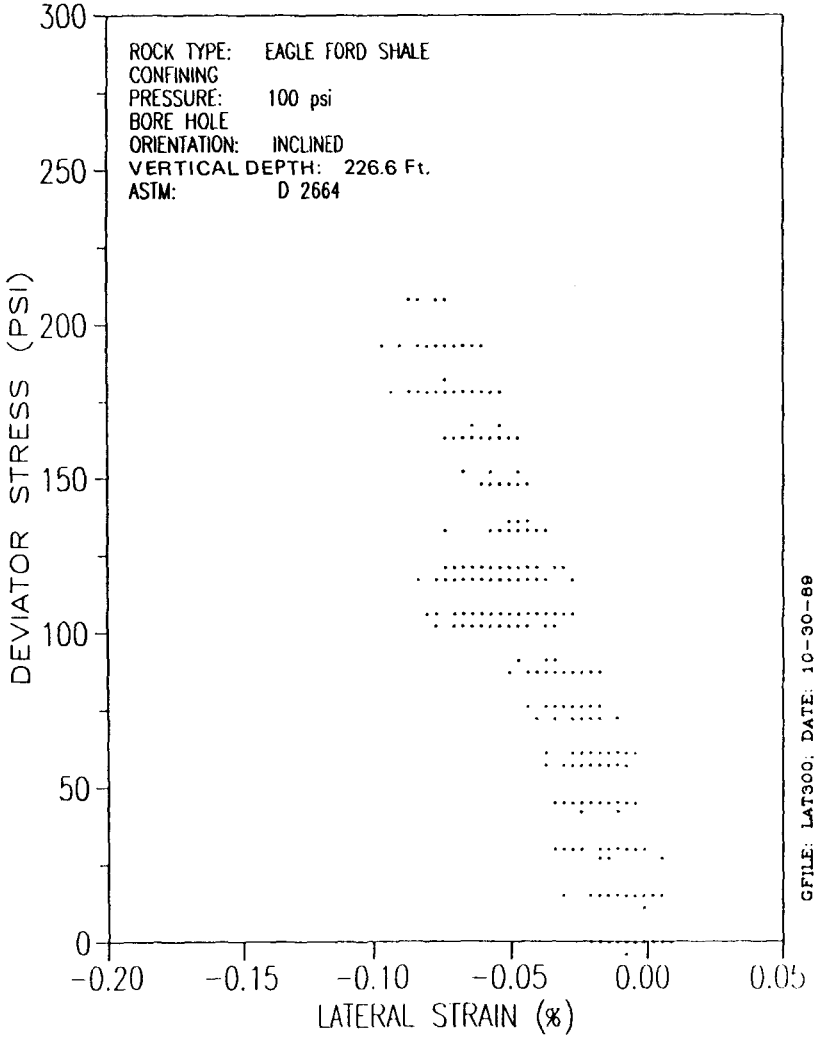
TEXAS SSC SITE

UNCONFINED COMPRESSIVE STRENGTH ASTM D-2938

DATE: 9-21-89 | JOB # 5530.15

DEVIATOR STRESS vs LATERAL STRAIN

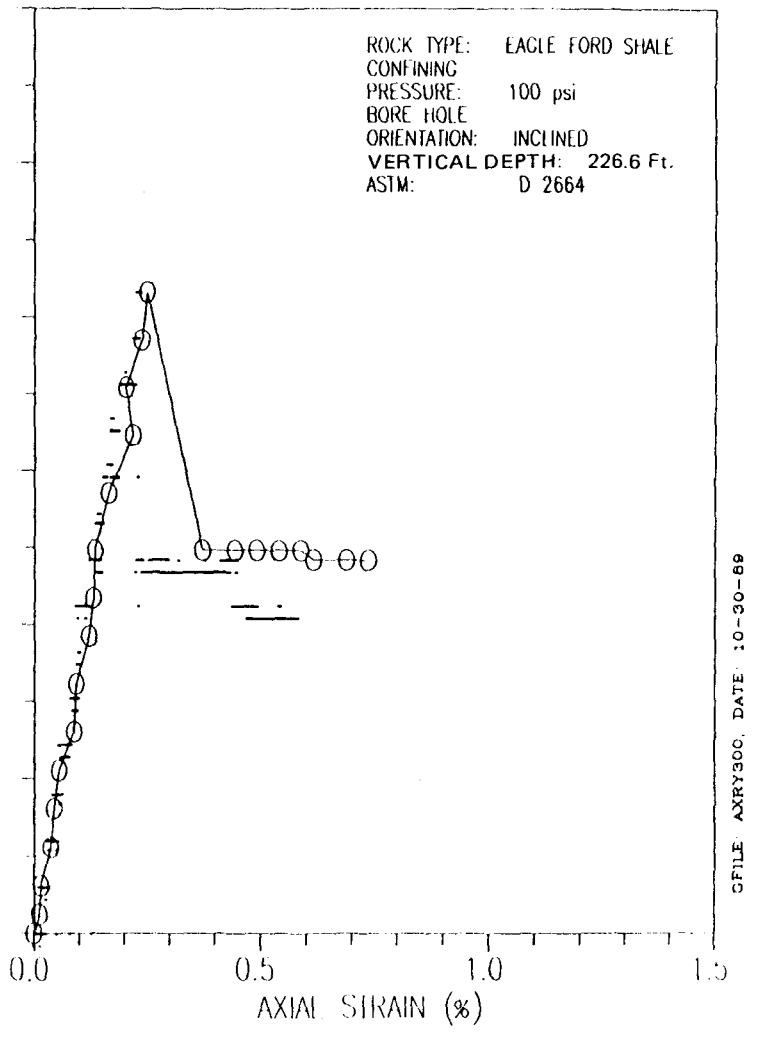
BORING: BIR 12 BORING DEPTH: 317.5 ft



····· JACKET-LVDT (3)

DEVIATOR STRESS vs AXIAL STRAIN

BORING: BIR 12 BORING DEPTH: 317.5 ft

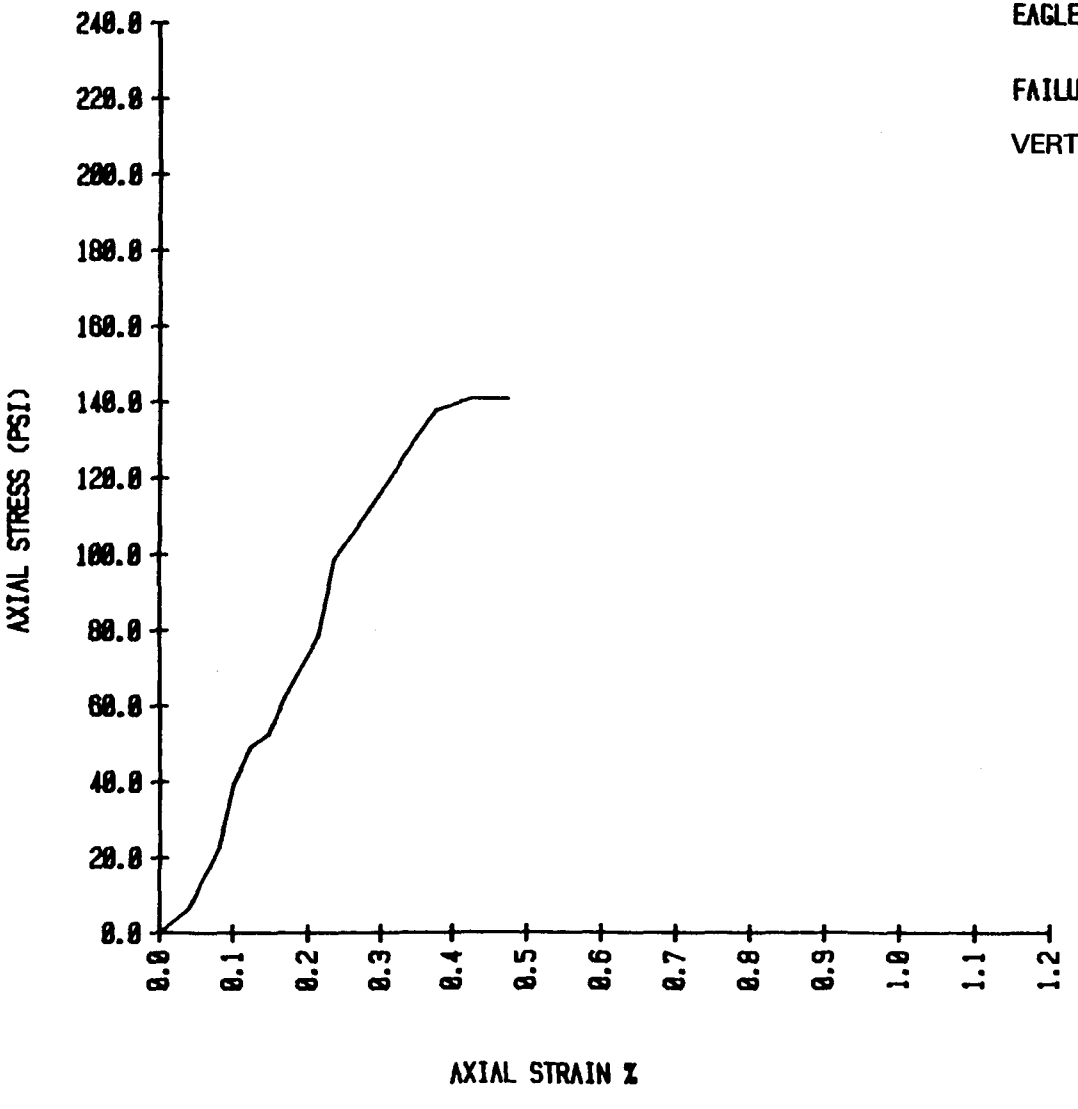


····· JACKET-LVDT (2) PLATEN DIAL GAUGE

BORING #: BIR 12
BORING DEPTH: 335.8 FEET
INCLINATION : 45 DEGREES
DRY UNIT WEIGHT (PCF) = 116.9
MOISTURE CONTENT % = 16.1
EAGLE FORD SHALE

FAILURE MODE : BEDDING PLAN SHEAR AT 45 DEG.

VERTICAL DEPTH: 239.4 FEET



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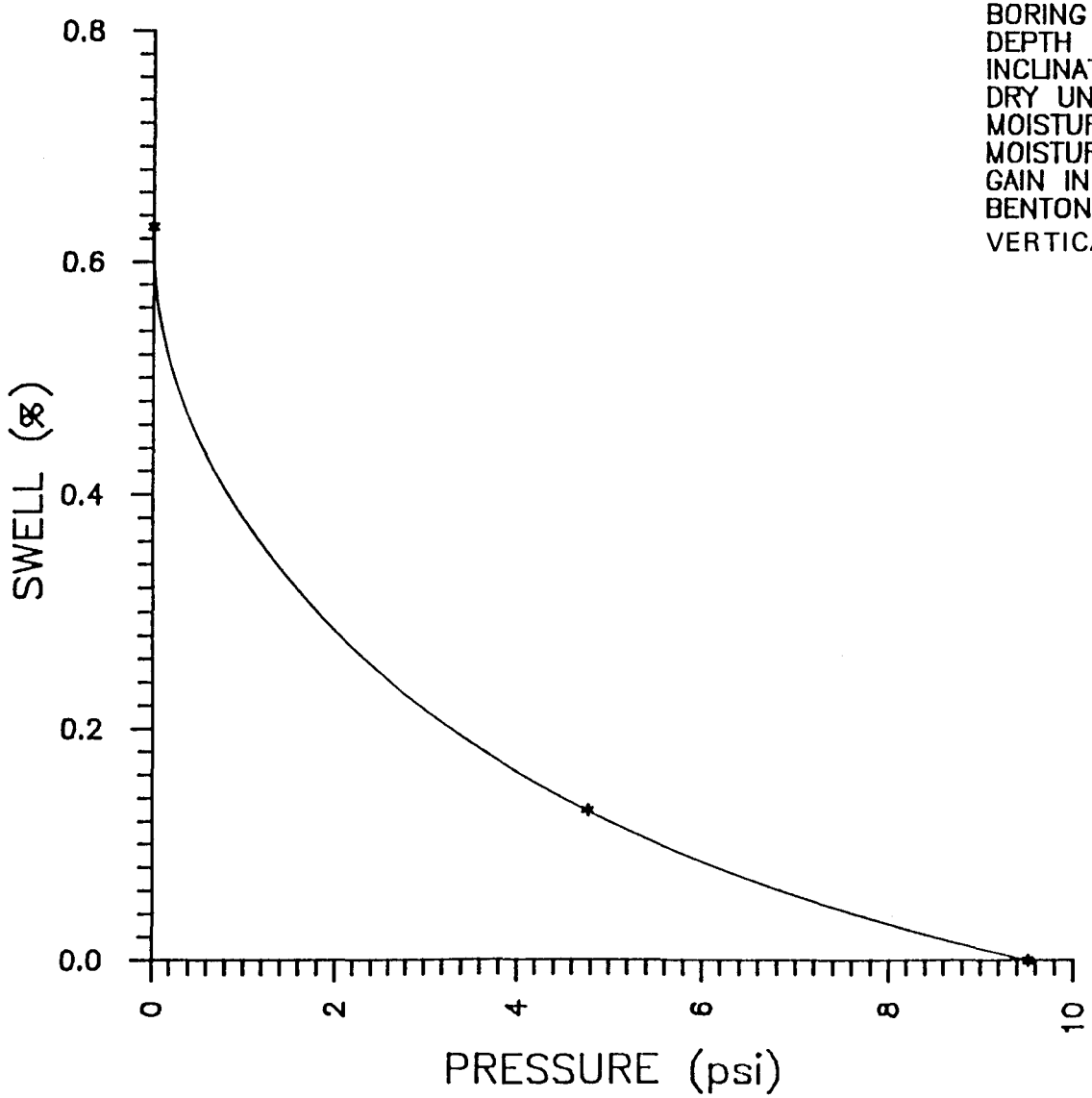
TEXAS SSC SITE

UNCONFINED COMPRESSIVE STRENGTH ASTM D-2938

DATE: 9-21-89 | JOB # 5530.15



BORING #: BIR 12
DEPTH : 206.1
INCLINATION : 45 DEGREE
DRY UNIT WEIGHT : 81.3 pcf
MOISTURE BEFORE : 40.3 %
MOISTURE AFTER : 44.8 %
GAIN IN MOISTURE : 4.5 %
BENTONITE IN AUSTIN CHALK
VERTICAL DEPTH: 147.7 Feet

MASON–JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS–ENGINEERS
DALLAS, TEXAS

TEXAS SSC SITE
SWELL POTENTIAL – ISRM

DATE: 10–31–89 | JOB #: 5530.15

GEOMECHANICAL TEST RESULTS

BORING BIR 13

TABLE E-5. GEOMECHANICAL TEST RESULTS–BORING BIR 13

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 Eso (psi)x10Es	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 psi	COMMENTS
CLAY	0.5	24.9																				
CLAY	0.7				42	24	82.0															
AUSTIN CHALK	4.0	13.0																				
AUSTIN CHALK	4.2	12.6							0.4									205				
AUSTIN CHALK	4.3	13.1	123.4						2.2	B-1/30	2365			0.36	8.33	0						
AUSTIN CHALK	5.0																			0.464		
AUSTIN CHALK	48.0	12.8	122.5																			
AUSTIN CHALK	48.4	12.2	125.1						2.2	D	1314			0.86	1.71	0						
AUSTIN CHALK	49.0	13.1	123.9	2.68					2.3	D		50	2099	0.59	3.70	50						NOTE 1
AUSTIN CHALK	49.0														5.63		0.09					NOTE 2
AUSTIN CHALK	49.4	14.3	120.6						2.2	D		100	2424	0.59	5.56	100						NOTE 1
AUSTIN CHALK	49.4														8.78		0.16					NOTE 2
AUSTIN CHALK	49.8								0.6									192				
AUSTIN CHALK	99.0	17.6																				
AUSTIN CHALK	99.1	16.0							0.5									274				
AUSTIN CHALK	99.7																			0.658		
AUSTIN CHALK	121.0	15.2																				
AUSTIN CHALK	121.1	15.0							0.4									264				
AUSTIN CHALK	121.2	15.2	118.6						2.1	B-1/30	2051			0.47	7.26	0						
AUSTIN CHALK	134.9	13.6																				
AUSTIN CHALK	135.6	12.5							0.5									339				
AUSTIN CHALK	138.6	13.0																				
AUSTIN CHALK	138.7	14.7	116.9	2.68					2.1	B-1/30	2979			1.06	3.43	0						
AUSTIN CHALK	139.5																			0.559		
AUSTIN CHALK	144.6	13.3																				
AUSTIN CHALK	144.7	12.5							0.5									327				
BENTONITE	148.0	37.6	84.0																			
BENTONITE	148.3	38.5		2.32	132	93	98.5	8.5														
AUSTIN CHALK	168.8																			0.387		
AUSTIN CHALK	169.4	14.5																				
AUSTIN CHALK	169.5	13.6							0.5									197				
AUSTIN CHALK	169.6	14.3	121.1						2.1	B-1/30	2940			0.51	7.90	0						
AUSTIN CHALK	186.2	10.9	129.6																			
AUSTIN CHALK	186.6	12.4	125.0						2.3	B-1/60	1334			0.38	3.64	0						
AUSTIN CHALK	187.0	14.3	120.1						2.3	D		100	2190	0.72	4.71	100						NOTE 1
AUSTIN CHALK	187.0														6.79		0.15					NOTE 2
AUSTIN CHALK	187.4	12.9	124.4						2.2	D		200	3337	0.97	4.29	200						NOTE 1
AUSTIN CHALK	187.4														5.93		0.12					NOTE 2
AUSTIN CHALK	212.6	13.9																				
AUSTIN CHALK	212.7	13.7	124.6						2.3	D	2540			0.88	4.35	0						
TRANSITION	214.3	11.3																				SHALEY LIMESTONE
TRANSITION	214.6	11.8	127.9						2.2	D	73			1.67	0.05	0						SHALEY LIMESTONE
EAGLE FORD SHALE	242.4	17.3																				
EAGLE FORD SHALE	242.6	17.3	114.8	2.57	105	69	94.2	5.4	2.1	C	114			1.65	0.11	0						
EAGLE FORD SHALE	259.0	17.7	119.0																			
EAGLE FORD SHALE	259.4	17.2	116.7						2.3	D	98			0.41	0.37	0						
EAGLE FORD SHALE	260.0	16.6	116.4	2.72	79	45	97.2	6.4													19.0	
EAGLE FORD SHALE	260.2	17.1	114.7																		16.0	
EAGLE FORD SHALE	261.0	16.8	118.9						2.4	B-1/40		200	245	1.69	0.61	200						NOTE 1
EAGLE FORD SHALE	261.0														0.38		0.11					NOTE 2
EAGLE FORD SHALE	261.4	15.5	120.5						2.3	D		300	321	1.46	0.60	300						NOTE 1
EAGLE FORD SHALE	261.4														0.43		0.04					NOTE 2
EAGLE FORD SHALE	286.0																		4.9			
EAGLE FORD SHALE	287.8	16.8	115.4		82	51	99.9	5.9	2.3	B-4/70	149			0.93	0.26	0						
EAGLE FORD SHALE	288.1	17.2																				
EAGLE FORD SHALE	292.4																		14.9			
EAGLE FORD SHALE	292.9	17.2																				
EAGLE FORD SHALE	293.0	14.8	117.4		82	47	99.0	7.4	2.4	B-3/45	128			1.19	0.16	0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664				ASTM-D	ASTM-D3148	ISRM	ISRM	ISRM	ISRM	

BIR13PRT WK1
REVISION 1.2
DATE 4/23/90

PRELIMINARY
(Subject to Revision)

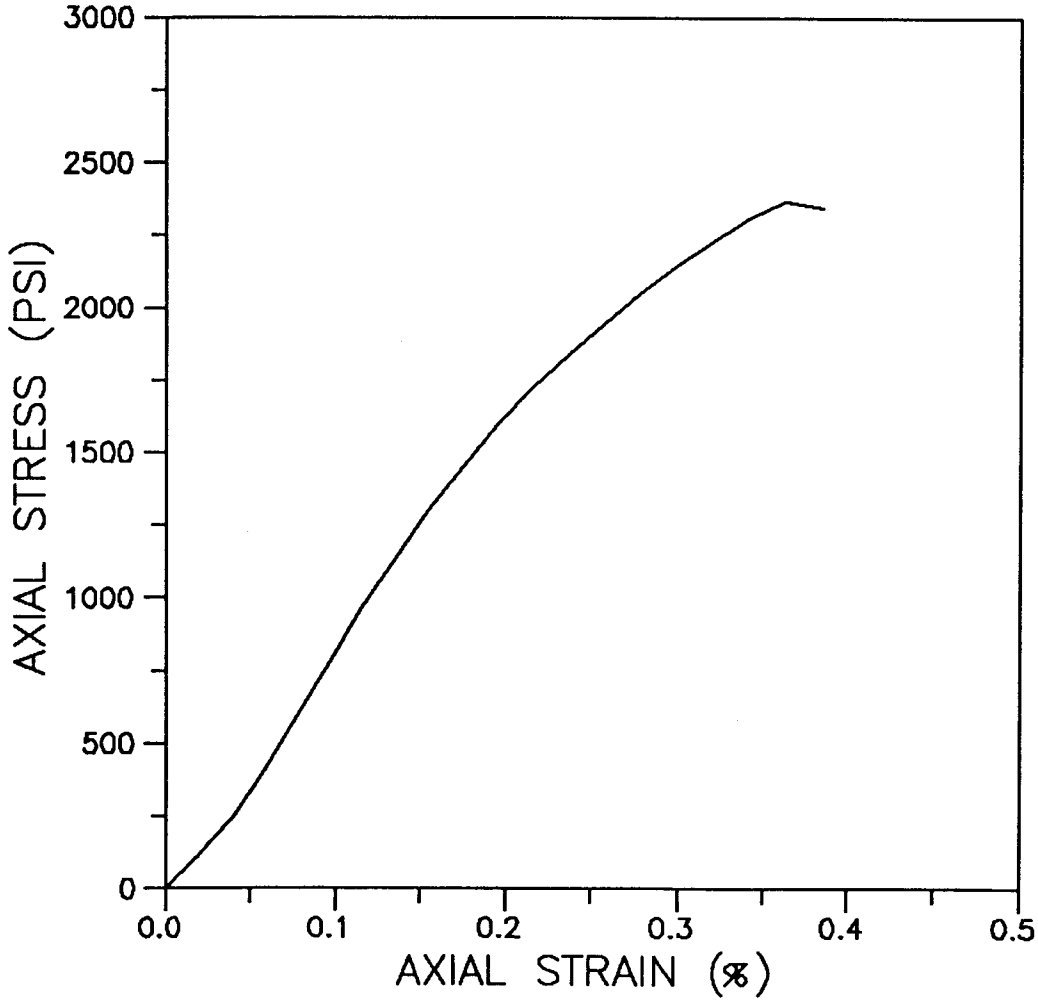
* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

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

NOTES: 1) MODULUS WAS CALCULATED FROM AXIAL STRAINS MEASURED USING DIAL MICROMETER.
AXIAL LENGTH IS THE SAMPLE LENGTH.

2) MODULII AND POISSON'S RATIO WERE CALCULATED FROM AXIAL AND LATERAL STRAINS MEASURED USING 3 AXIAL AND 3 LATERAL LVDTS OFFSET @ 120 DEGREES APART.
AXIAL LENGTH IS 2.8 INCHES.

BORING NO: BIR13
DEPTH (FT): 4.3
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.1
DRY UNIT WEIGHT (PCF): 123.4
DEG. OF SATURATION (%): 96.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

STRESS-STRAIN PLOT

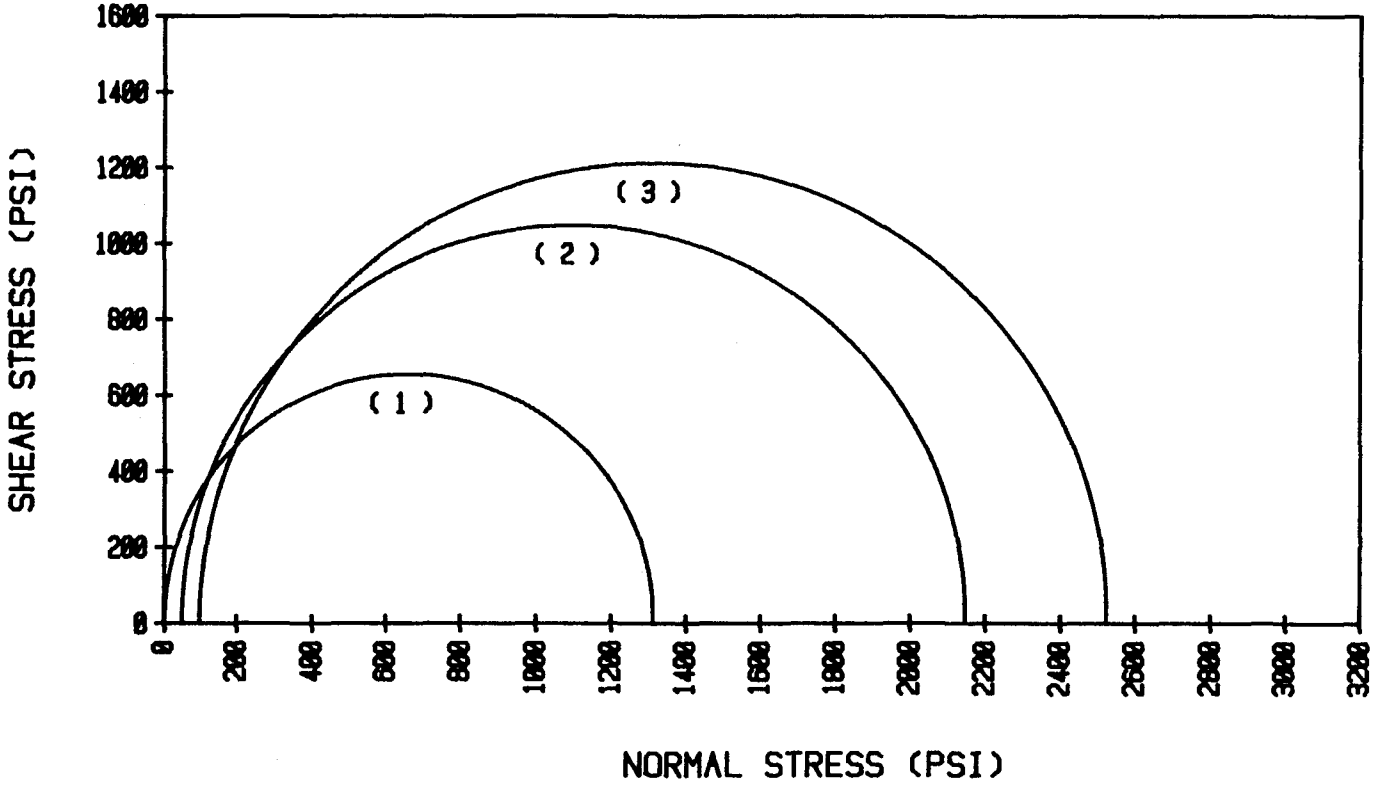
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BIR13
DEPTH RANGE (FT): 48.4-49.8
AUSTIN CHALK LIMESTONE

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



SEE STRESS - STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 48.4
(2) DEPTH (FT): 49.0
(3) DEPTH (FT): 49.4

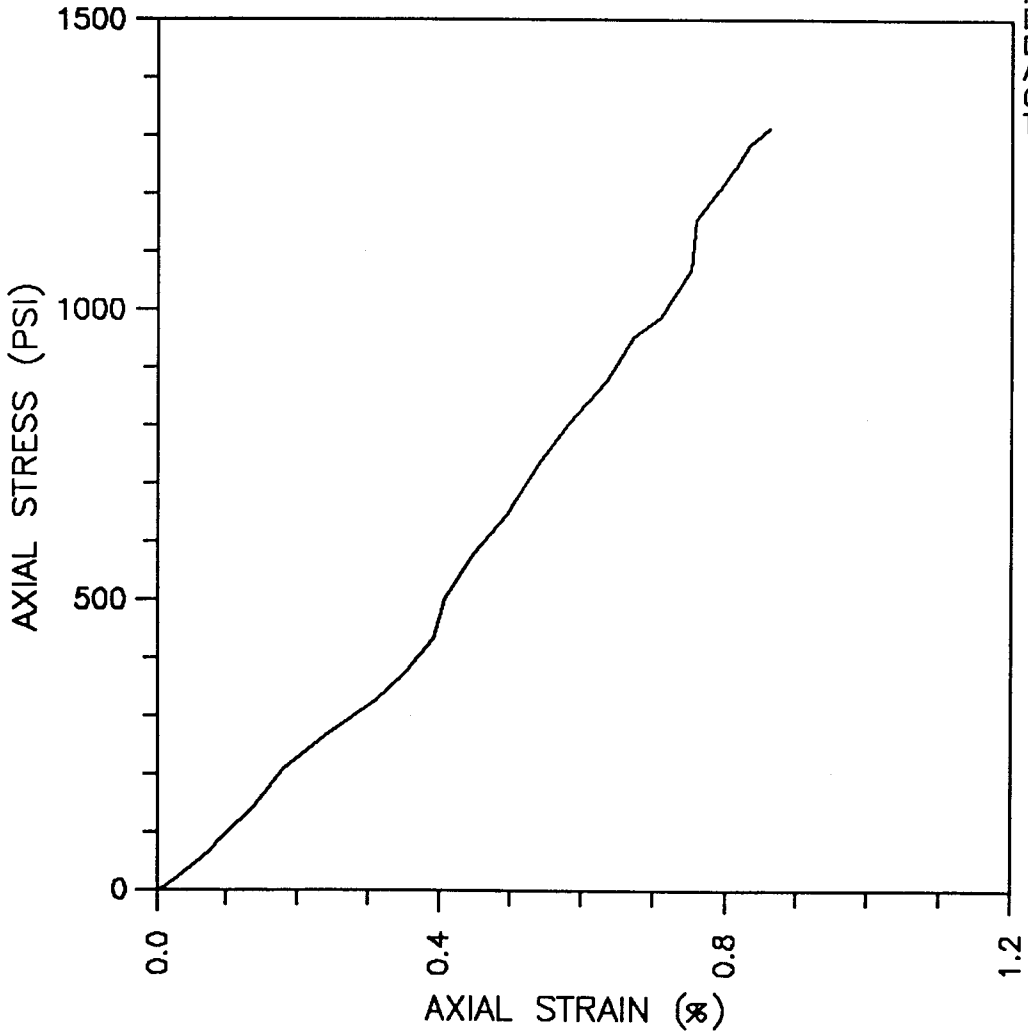
TEXAS SSC SITE

MOHR CIRCLE PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15 | FIGURE

BORING NO.: BIR13
DEPTH (FT): 48.4
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.2
DRY UNIT WEIGHT (PCF): 125.1
DEG. OF SATURATION (%): 94.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.707 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

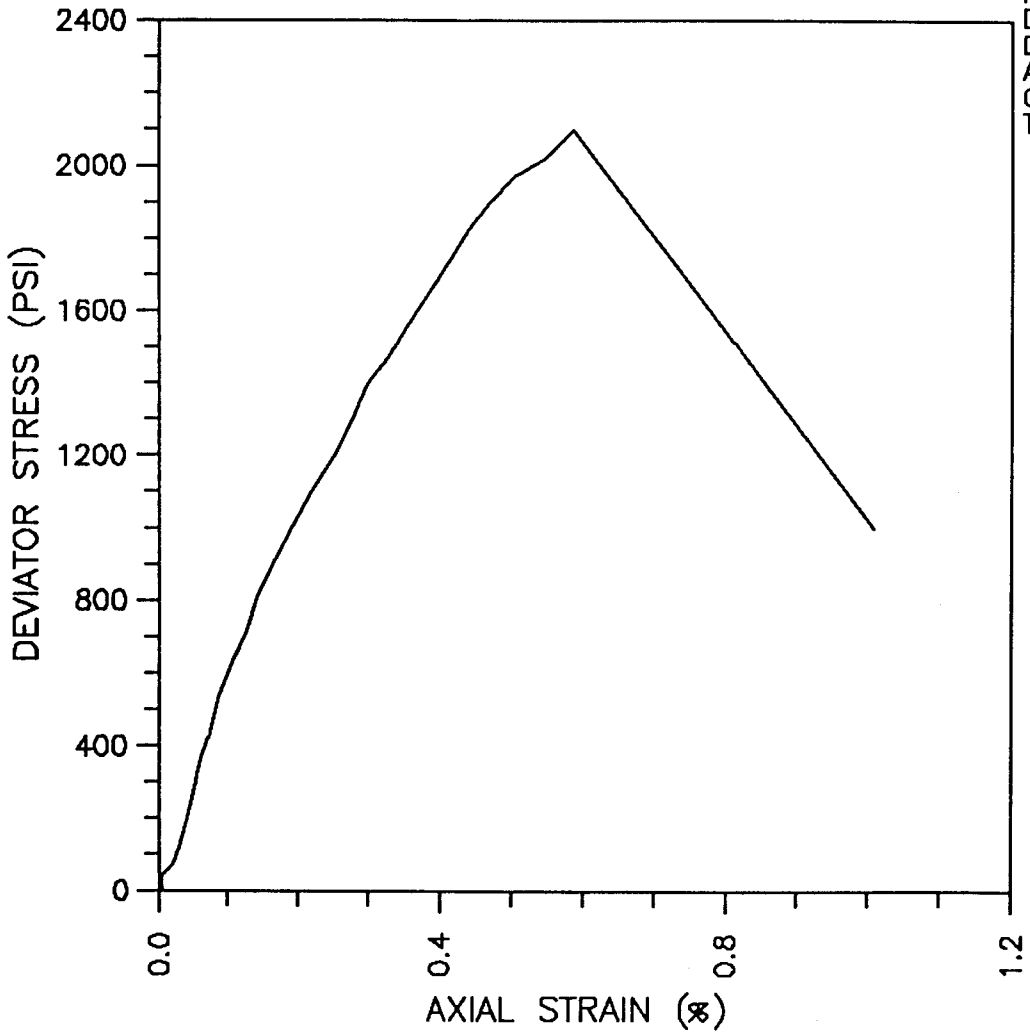
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR13
DEPTH (FT): 49.0
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.1
DRY UNIT WEIGHT (PCF): 123.9
DEG. OF SATURATION (%): 98.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 50
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.704 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

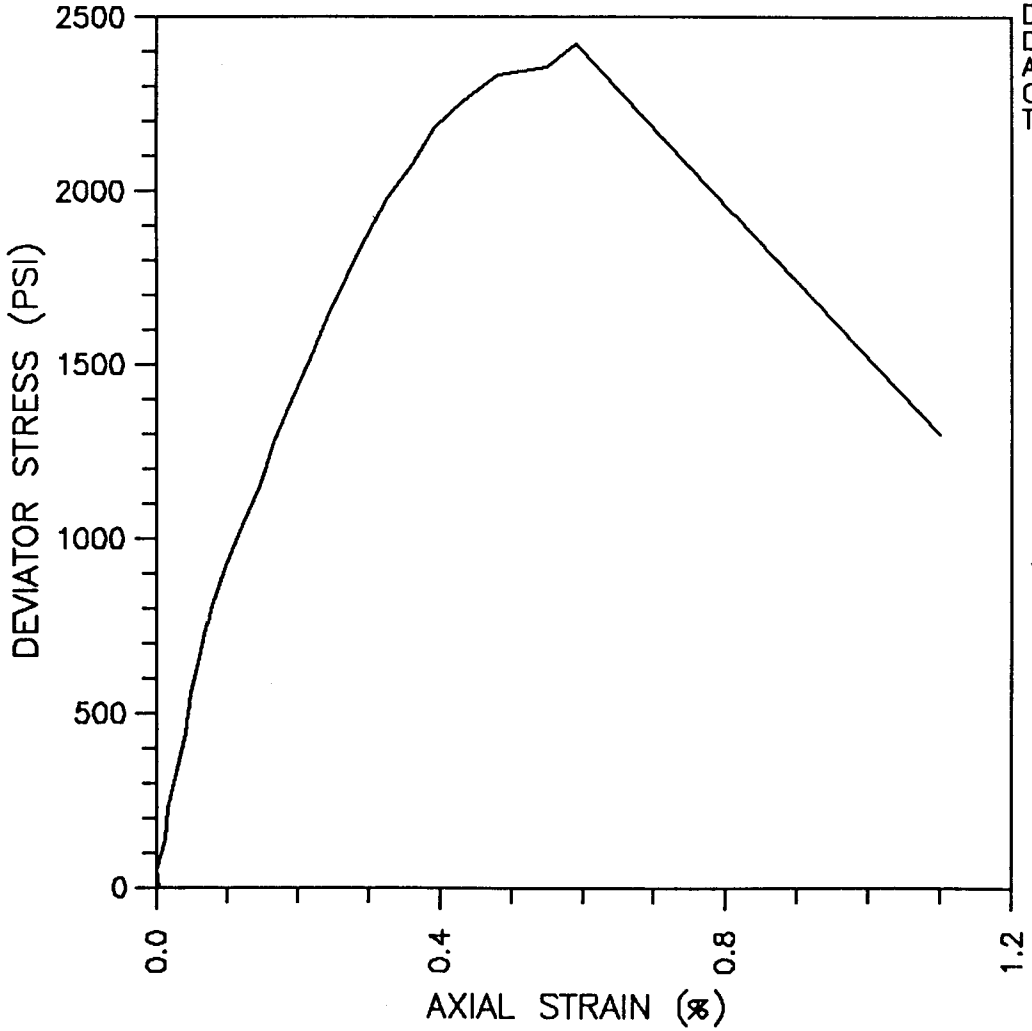
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR13
DEPTH (FT): 49.4
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.3
DRY UNIT WEIGHT (PCF): 120.6
DEG. OF SATURATION (%): 97.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.556 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

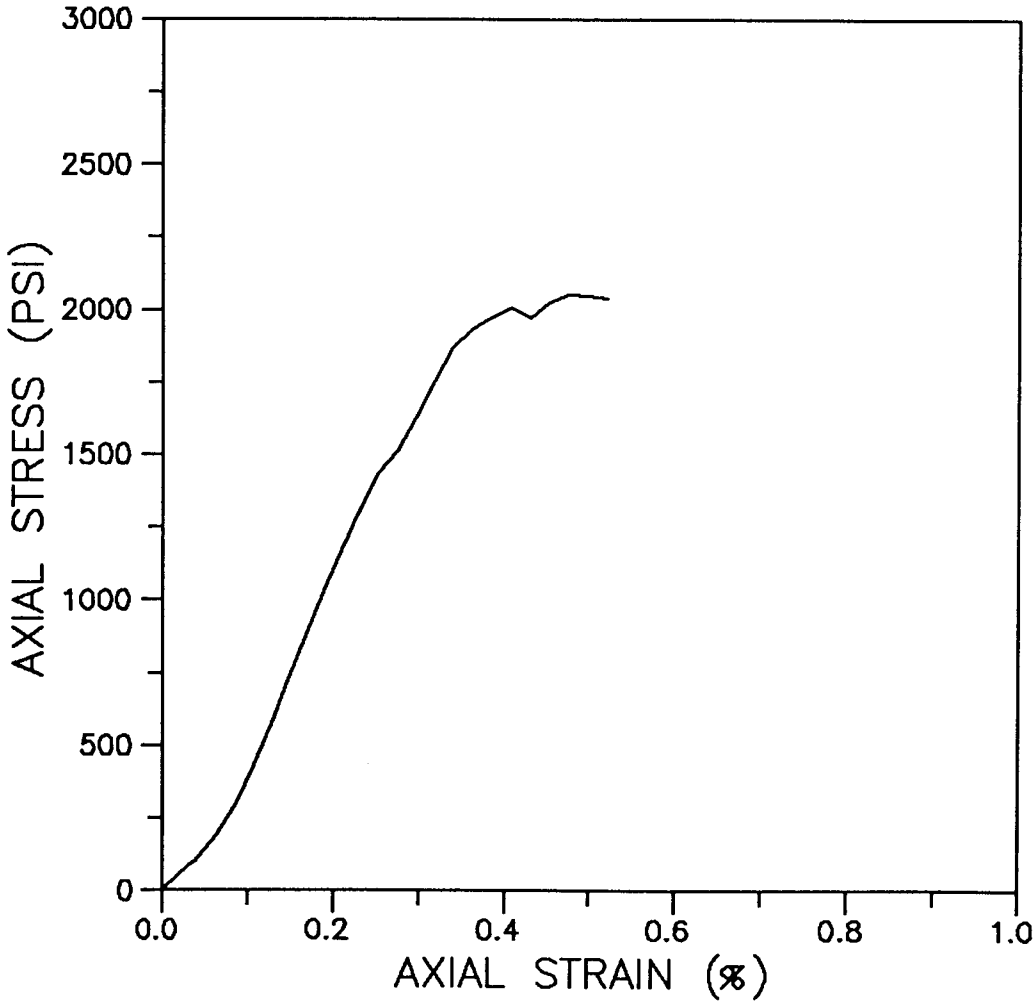
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO: BIR13
DEPTH (FT): 121.2
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.2
DRY UNIT WEIGHT (PCF): 118.6
DEG. OF SATURATION (%): 97.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

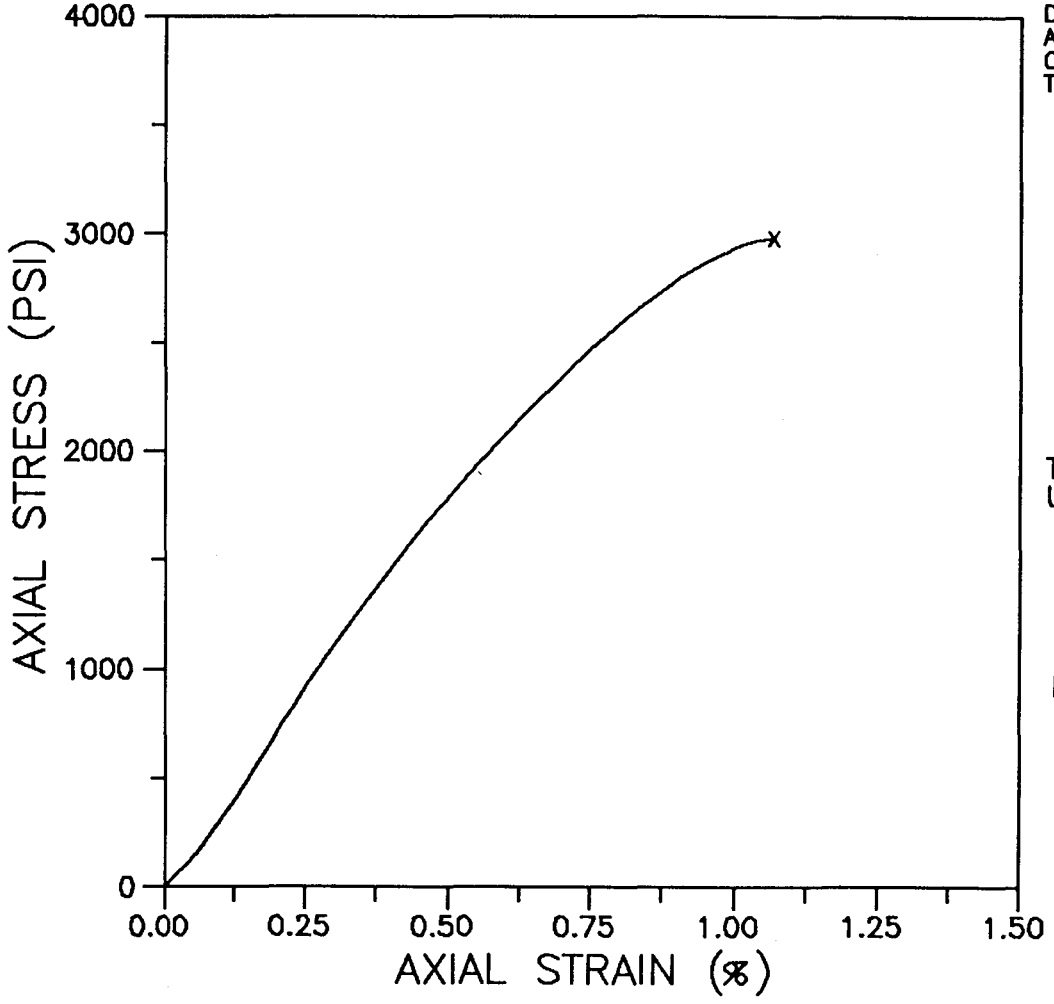
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR13
DEPTH (FT): 138.7
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.7
DRY UNIT WEIGHT (PCF): 116.9
DEG. OF SATURATION (%): 90.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

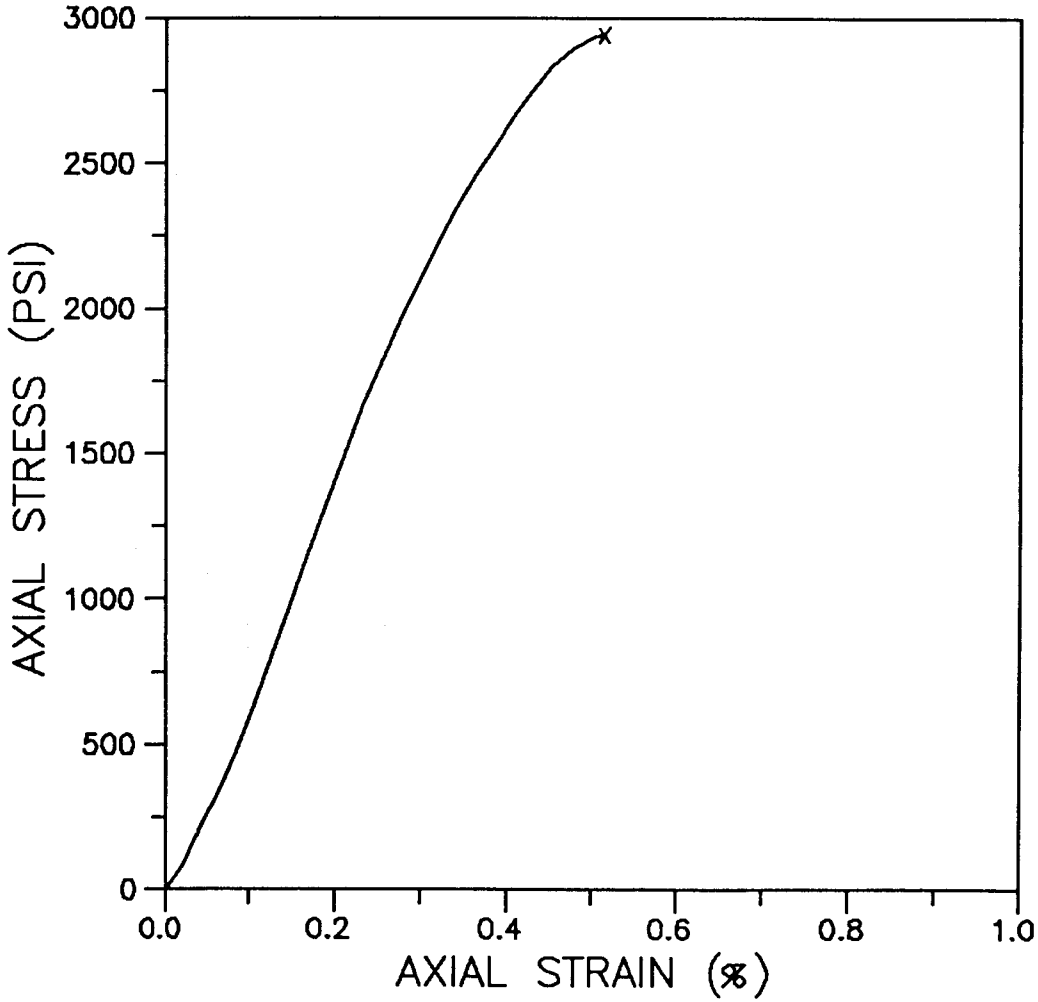
STRESS–STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89–192

FIGURE

BORING NO: BIR13
DEPTH (FT): 169.6
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.3
DRY UNIT WEIGHT (PCF): 121.1
DEG. OF SATURATION (%): 98.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

STRESS–STRAIN PLOT

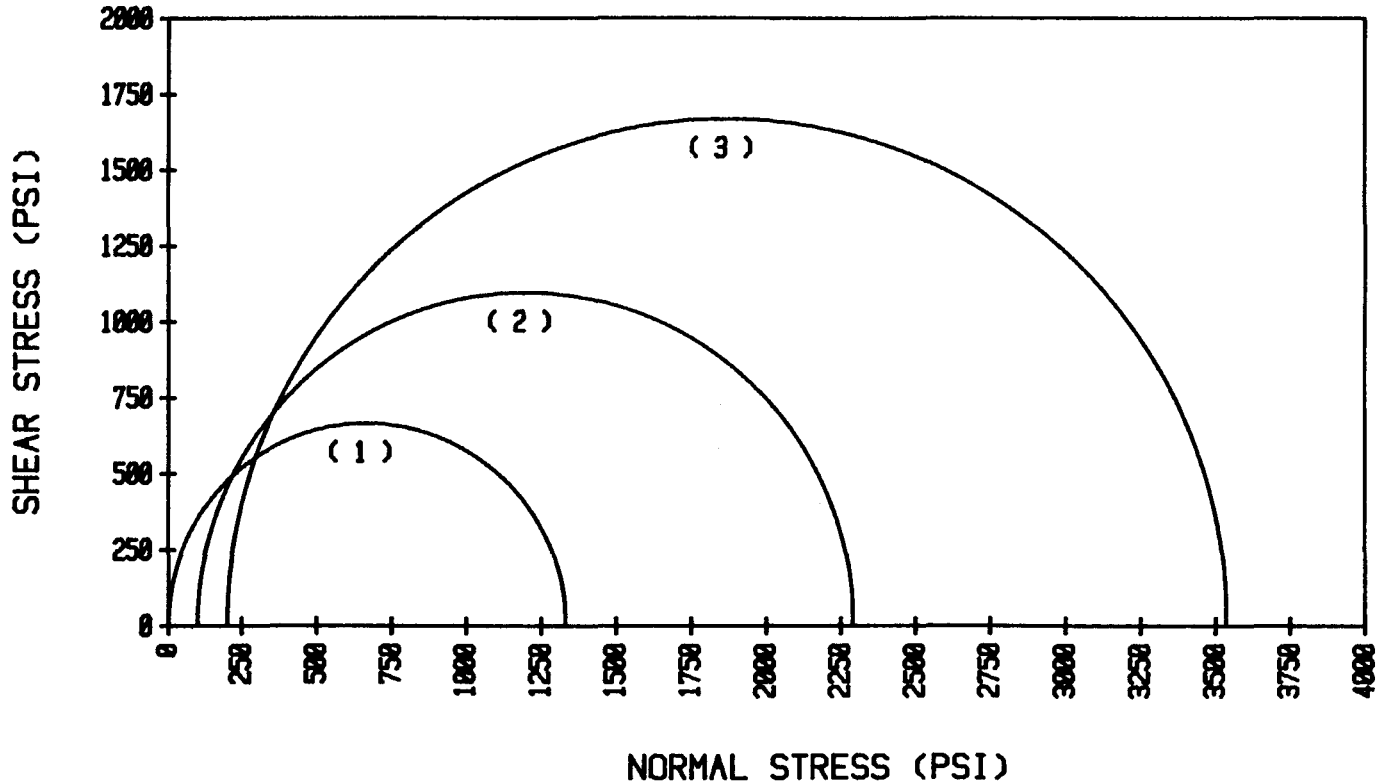
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89–192

FIGURE

BORING NO.: BIR13
DEPTH RANGE (FT): 186.6-187.8
AUSTIN CHALK LIMESTONE

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

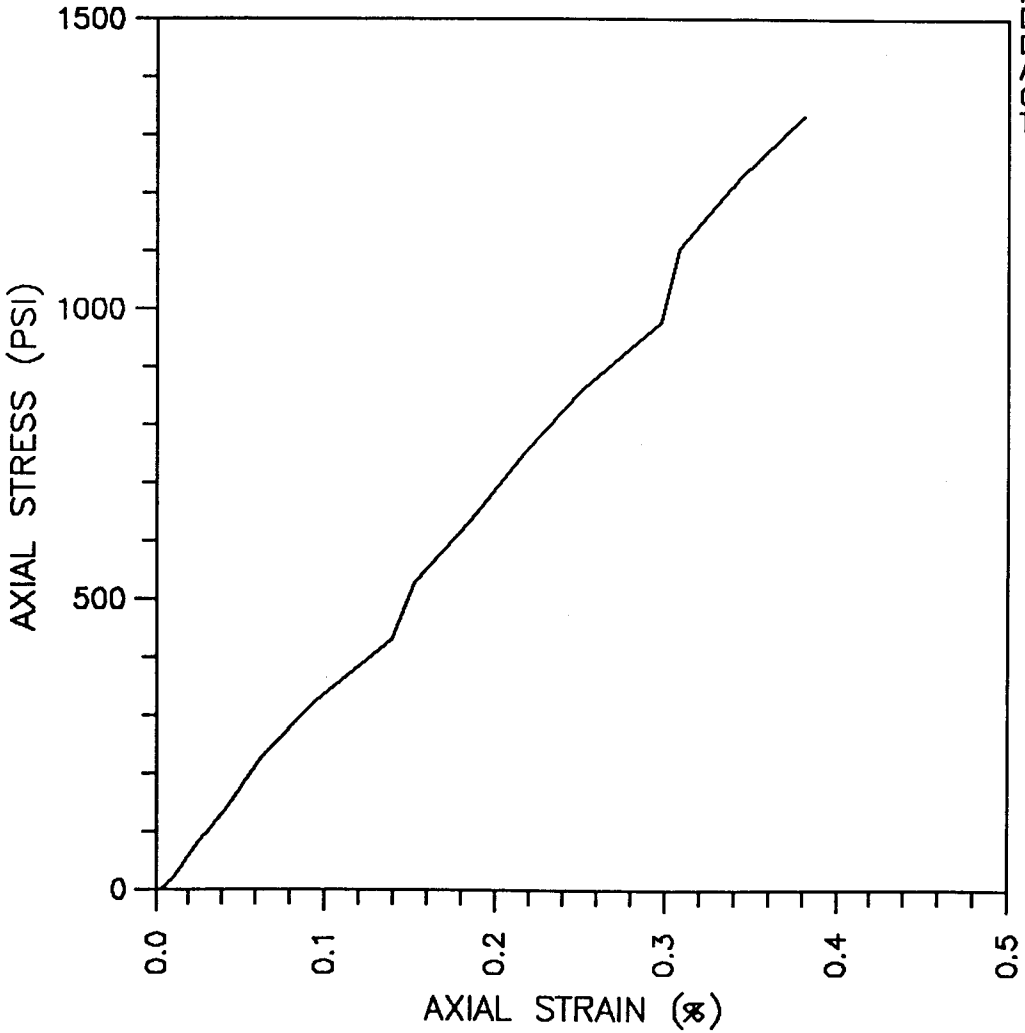


SEE STRESS - STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 186.6
(2) DEPTH (FT): 187.0
(3) DEPTH (FT): 187.4

TEXAS SSC SITE	
MOHR CIRCLE PLOT	
MASON-JOHNSTON & ASSOCIATES, INC. GEOLOGISTS-ENGINEERS	
JOB NO.: 5530.15	FIGURE

BORING NO.: BIR13
DEPTH (FT): 186.6
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.4
DRY UNIT WEIGHT (PCF): 125.0
DEG. OF SATURATION (%): 96.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.636 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 60 DEG.

TEXAS SSC SITE

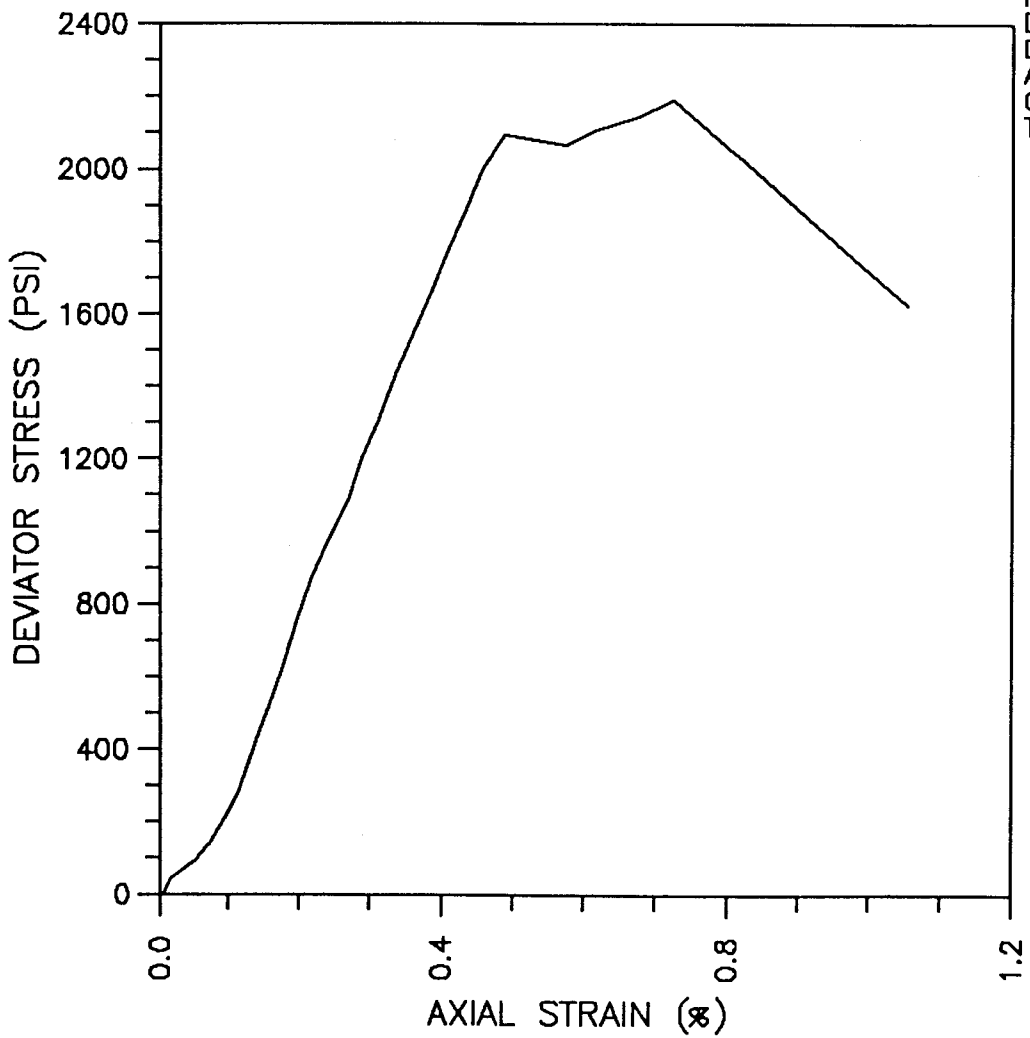
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR13
DEPTH (FT): 187.0
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.3
DRY UNIT WEIGHT (PCF): 120.1
DEG. OF SATURATION (%): 95.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.706 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

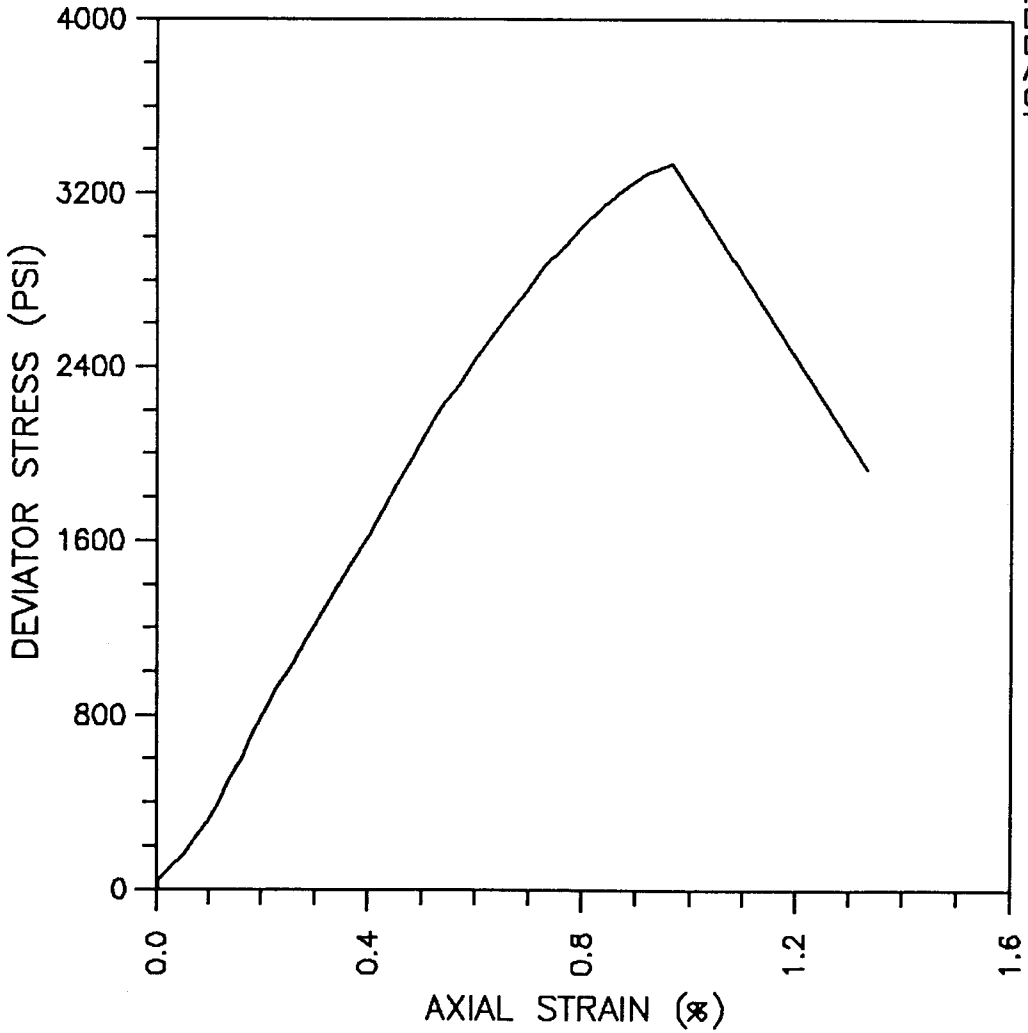
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR13
DEPTH (FT): 187.4
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.9
DRY UNIT WEIGHT (PCF): 124.4
DEG. OF SATURATION (%): 98.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.286 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

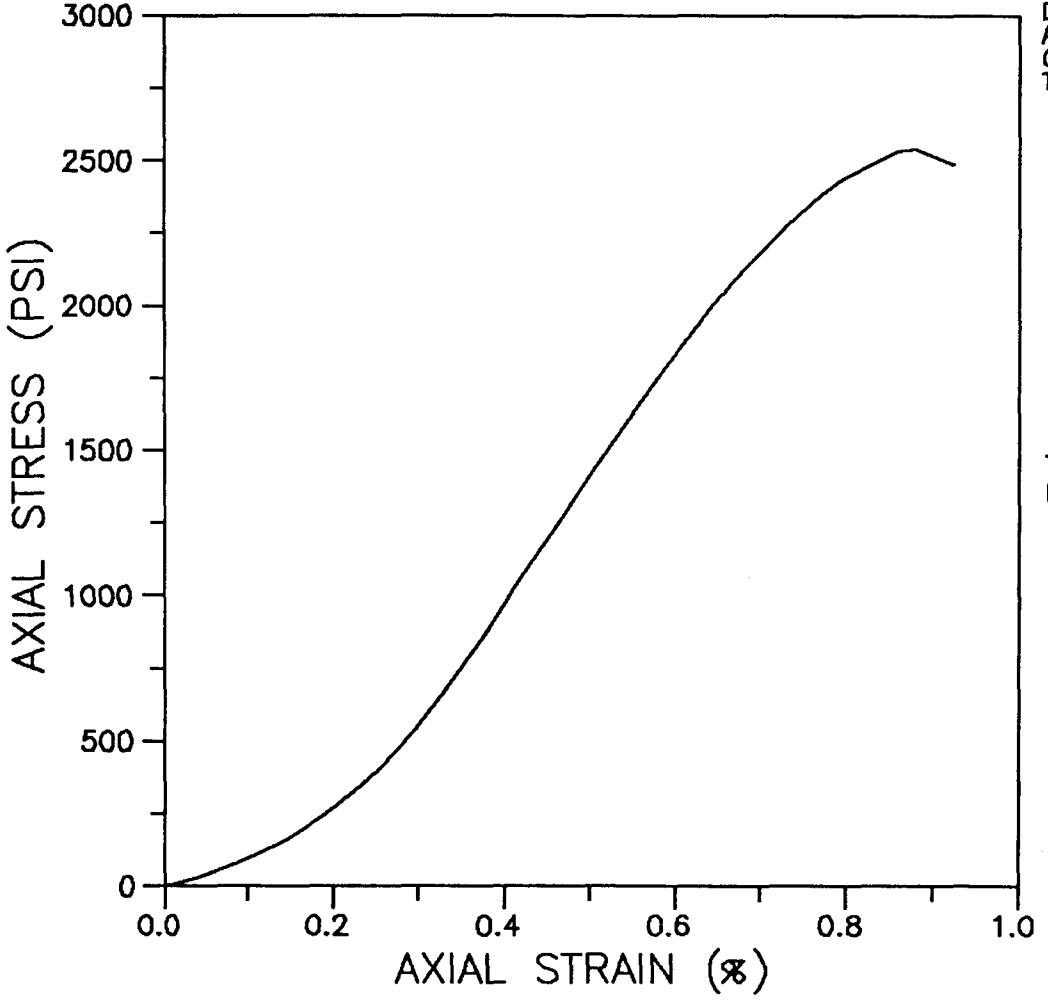
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO: BIR13
DEPTH (FT): 212.7
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.7
DRY UNIT WEIGHT (PCF): 124.6
DEG. OF SATURATION (%): 105.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

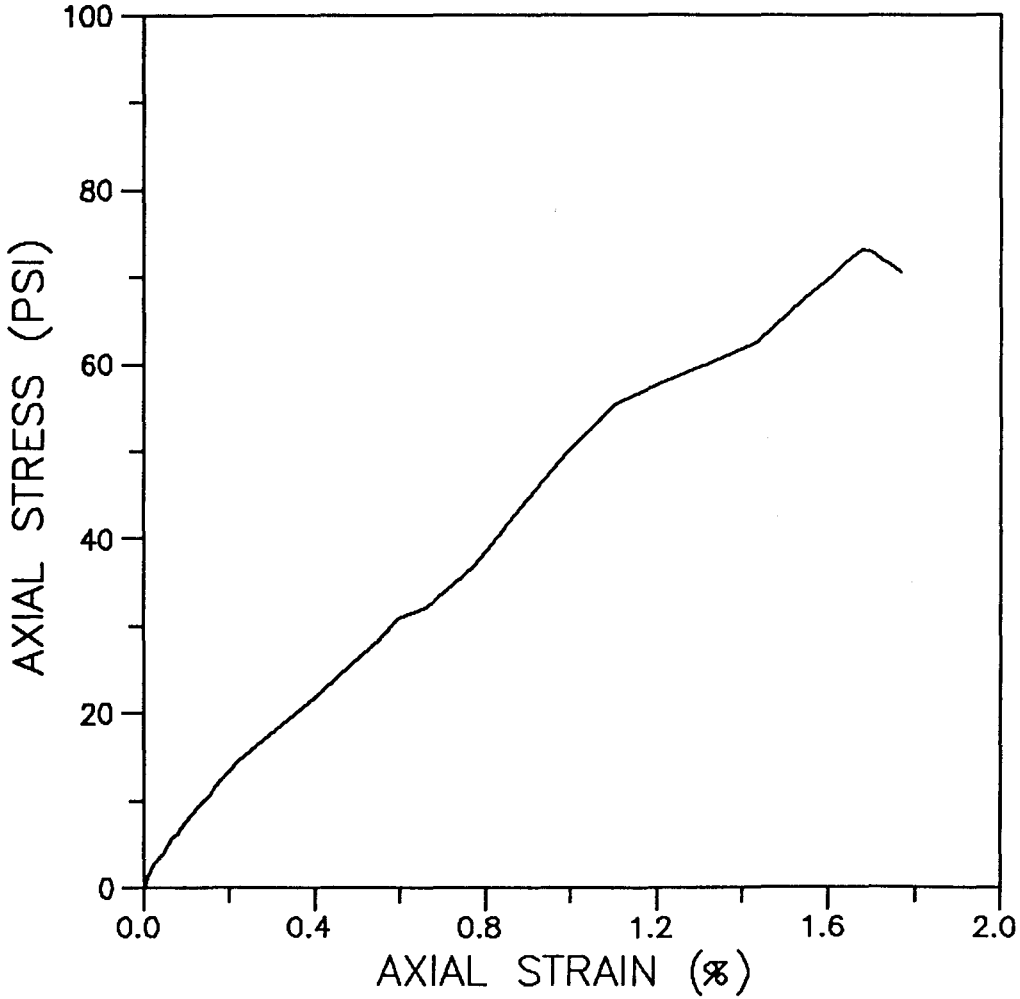
STRESS–STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89–192

FIGURE

BORING NO: BIR13
DEPTH (FT): 214.6
TRANSITION



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 11.8
DRY UNIT WEIGHT (PCF): 127.9
DEG. OF SATURATION (%): 100.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.025 x 10E3 PSI

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

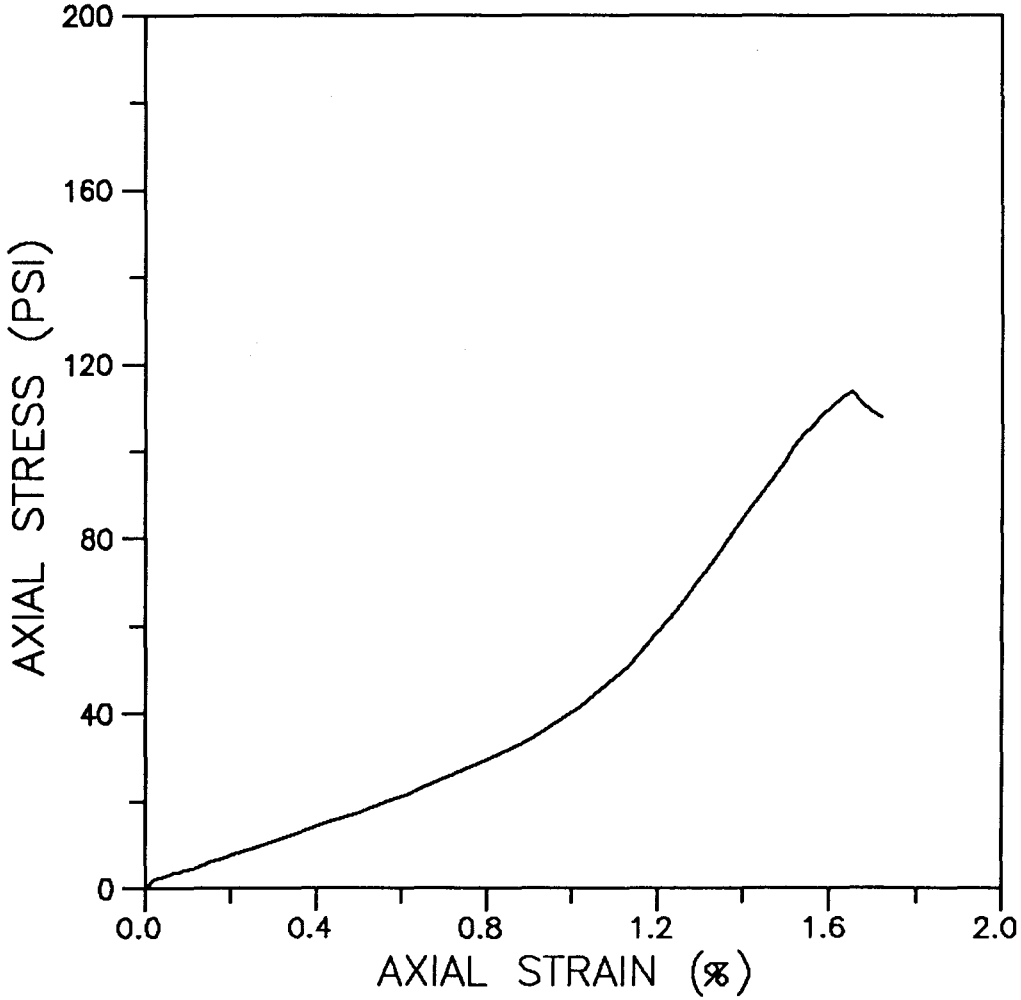
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR13
DEPTH (FT): 242.6
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 17.3
DRY UNIT WEIGHT (PCF): 114.8
DEG. OF SATURATION (%): 99.9
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
BARRELING / BULGING

TEXAS SSC SITE

STRESS-STRAIN PLOT

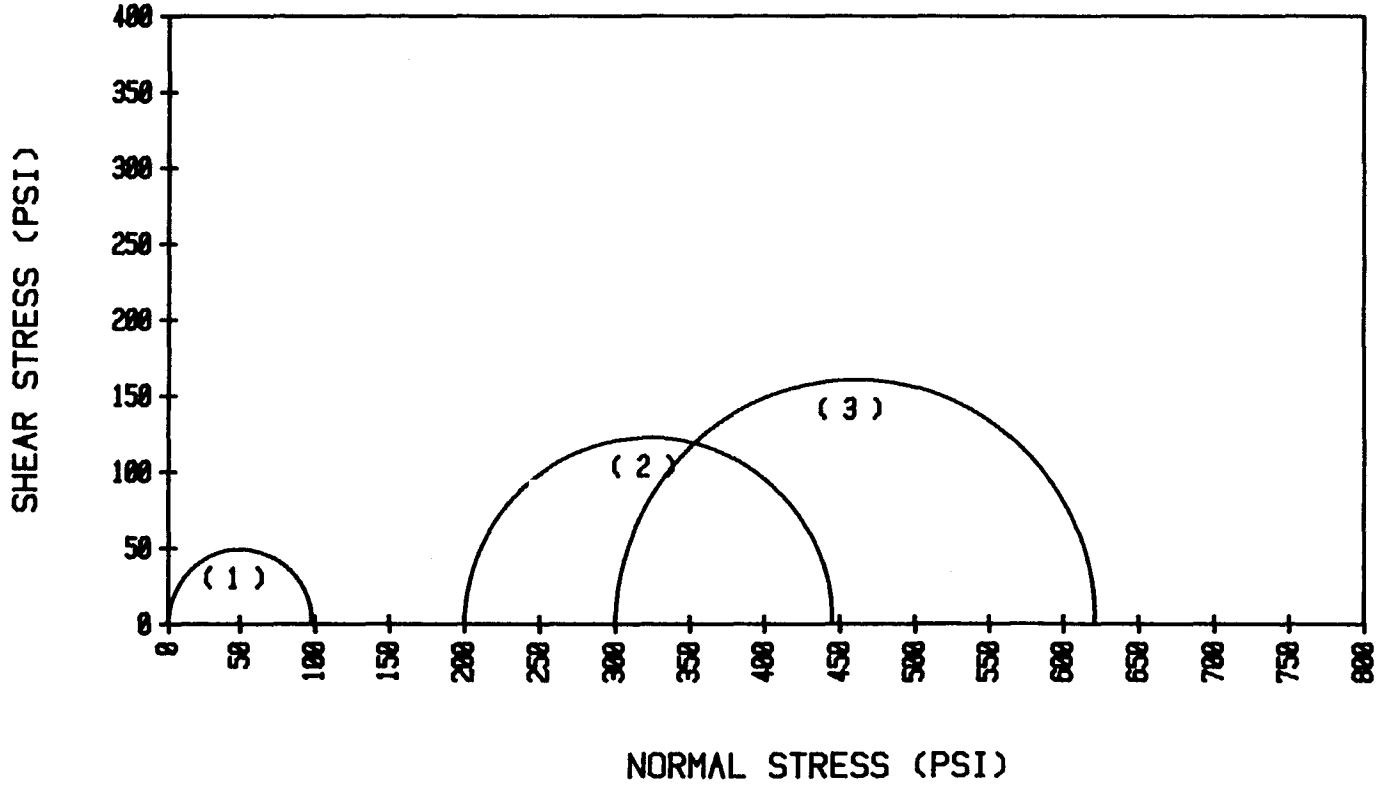
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BIR13
DEPTH RANGE (FT): 259.4-261.8
EAGLE FORD SHALE

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



SEE STRESS - STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 259.4
(2) DEPTH (FT): 261.0
(3) DEPTH (FT): 261.4

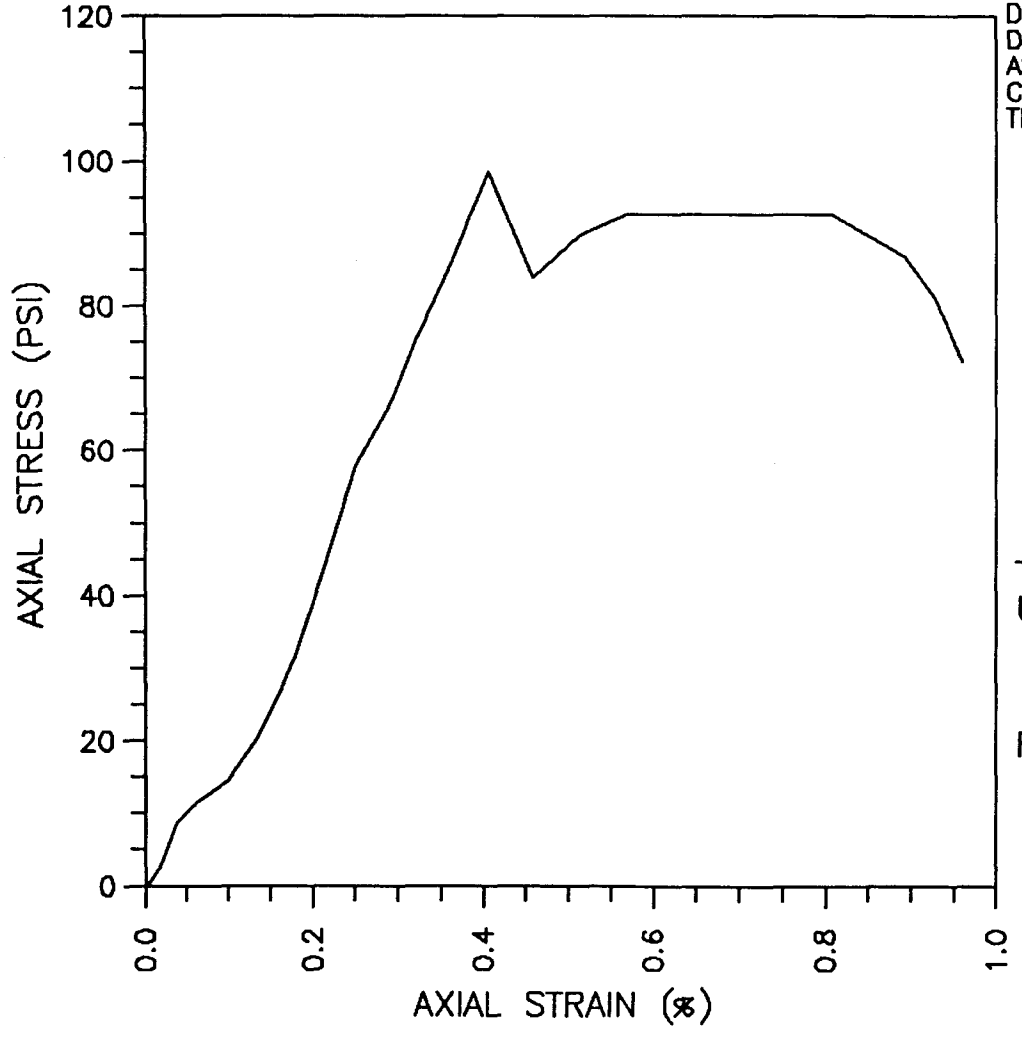
TEXAS SSC SITE

MOHR CIRCLE PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO : 5520 15 FIGURE

BORING NO.: BIR13
DEPTH (FT): 259.4
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 17.2
DRY UNIT WEIGHT (PCF): 116.7
DEG. OF SATURATION (%): 105.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.372 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

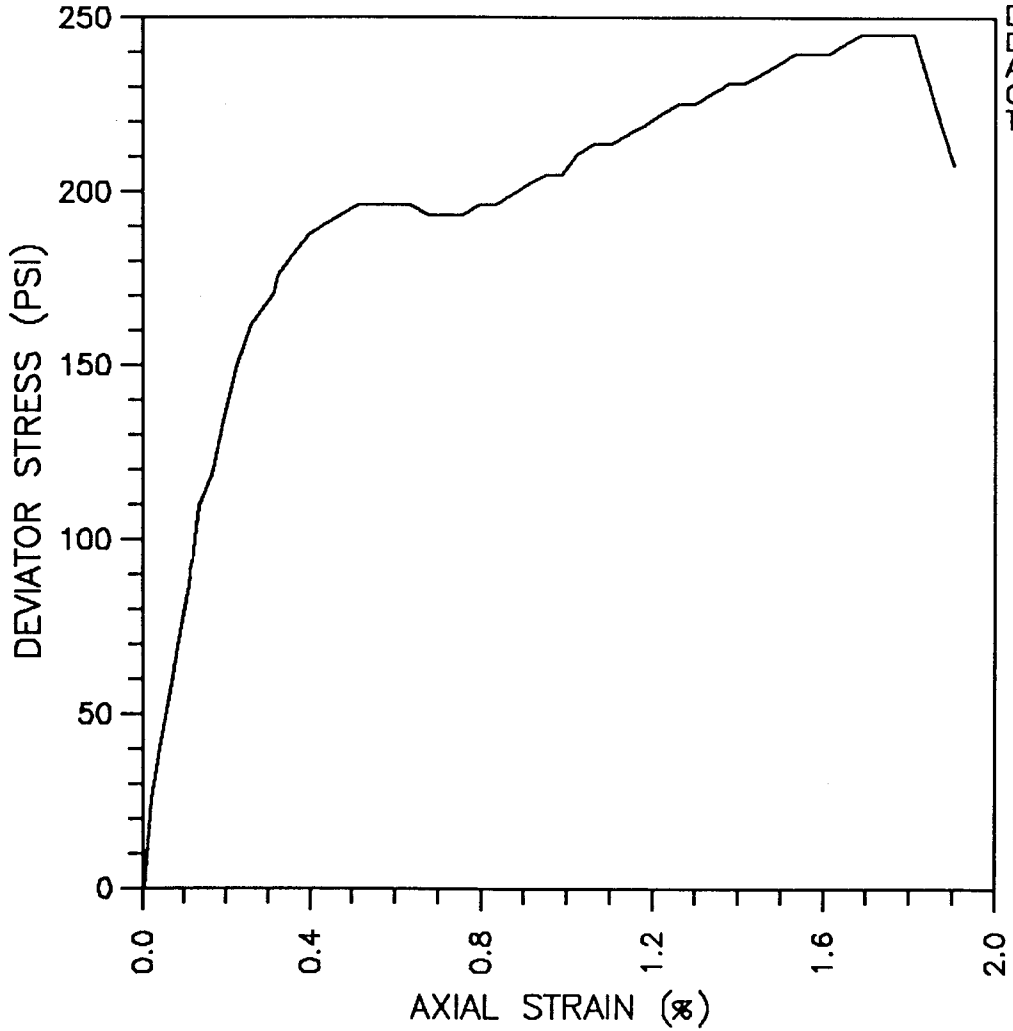
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR13
DEPTH (FT): 261.0
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 16.8
DRY UNIT WEIGHT (PCF): 118.9
DEG. OF SATURATION (%): 108.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.610 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 40 DEG

TEXAS SSC SITE

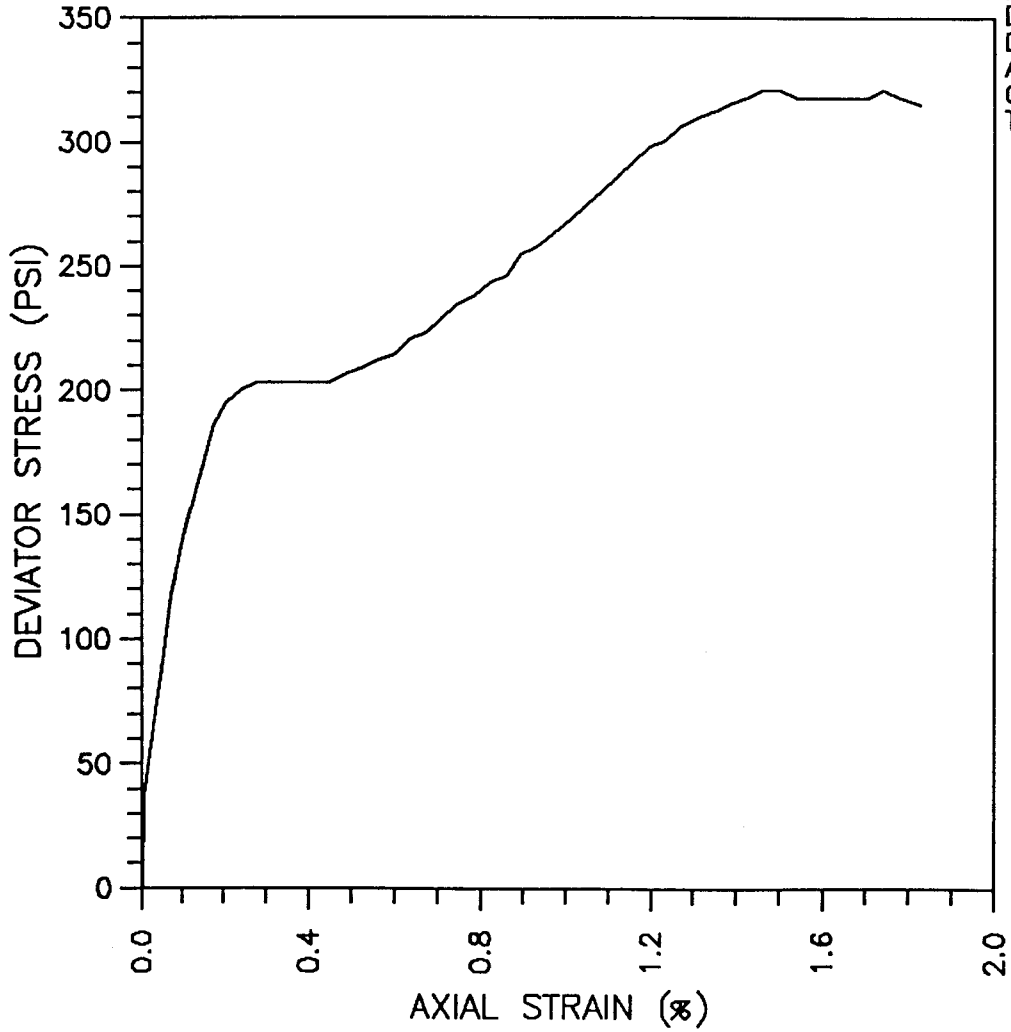
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR13
DEPTH (FT): 261.4
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.5
DRY UNIT WEIGHT (PCF): 120.5
DEG. OF SATURATION (%): 105.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 300
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.600 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

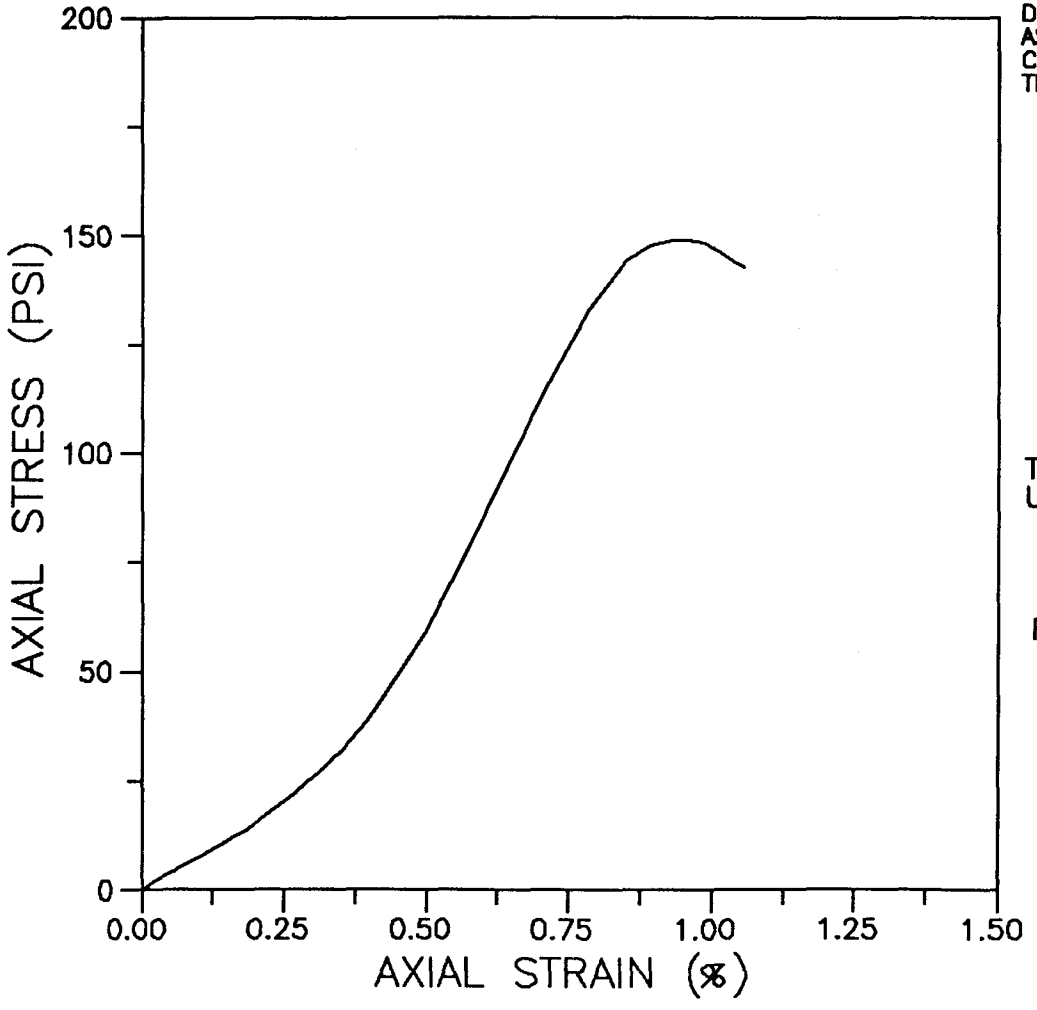
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO: BIR13
DEPTH (FT): 287.8
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 16.8
DRY UNIT WEIGHT (PCF): 115.4
DEG. OF SATURATION (%): 98.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
COMBINATION BEDDING
PLANE / SHEAR PLANE
AT 70 DEG.

TEXAS SSC SITE

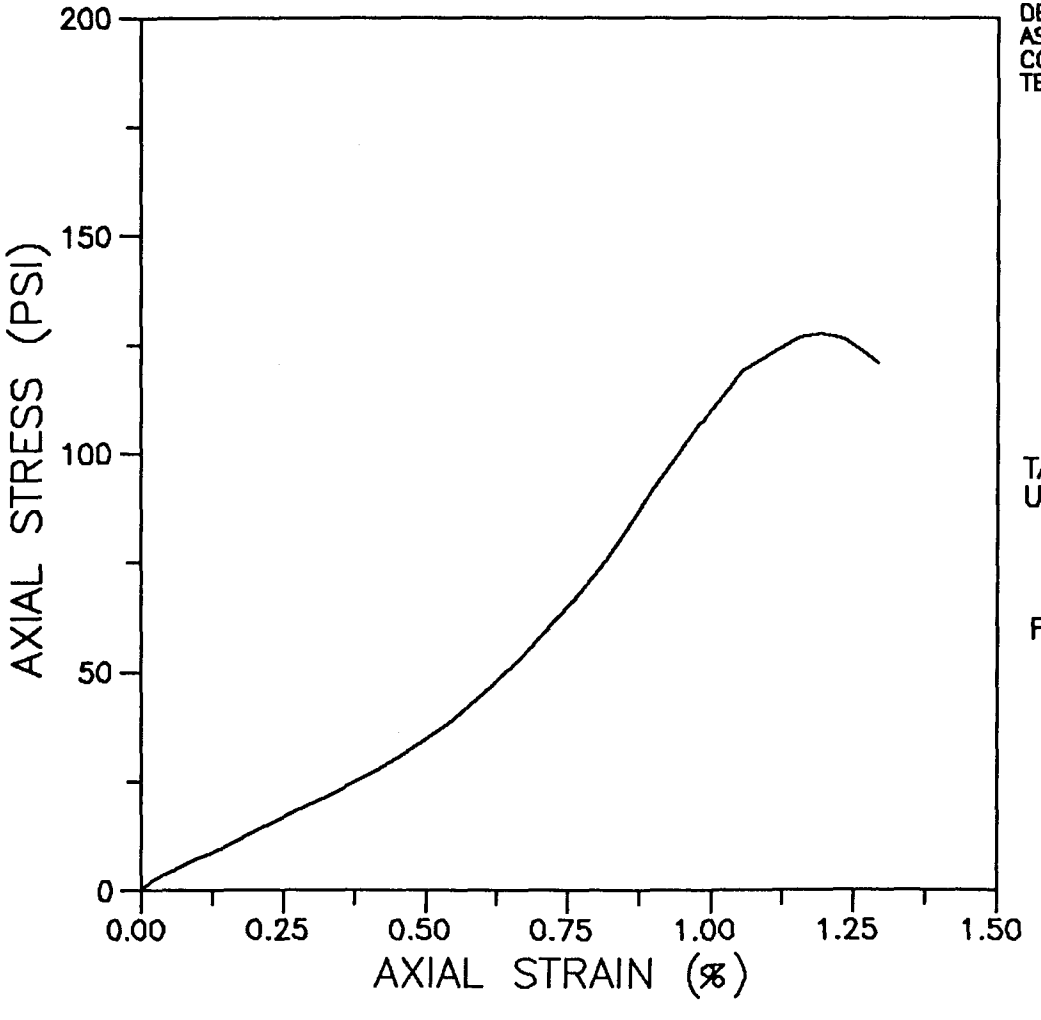
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR13
DEPTH (FT): 293.0
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.8
DRY UNIT WEIGHT (PCF): 117.4
DEG. OF SATURATION (%): 91.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE ALONG
PRE-EXISTING FRACTURE
AT 45 DEG.

TEXAS SSC SITE

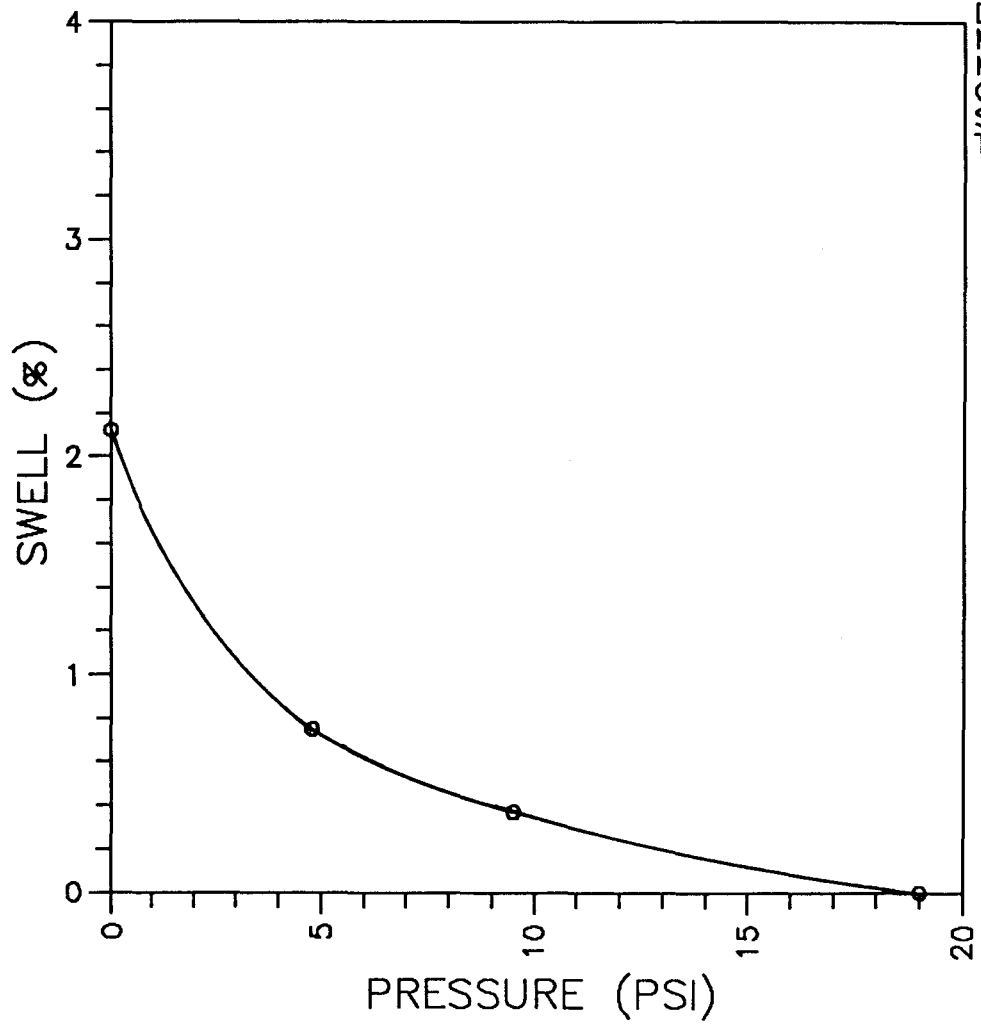
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BIR13
DEPTH (FT): 260.0
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
DRY UNIT WEIGHT (PCF): 116.4
M.C. BEFORE TEST (%): 16.6
M.C.AFTER TEST (%): 20.6
GAIN IN MOISTURE (%): 4.0
SWELLING PRESSURE INDEX (PSI): 19
TEST TYPE: SWELLING PRESSURE INDEX (ISRM)

TEXAS SSC SITE

SWELLING PRESSURE INDEX

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

GEOMECHANICAL TEST RESULTS

BORING BIR 14

TABLE E-6. GEOMECHANICAL TEST RESULTS-BORING BIR 14

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 σ_3 psi	POISSON'S RATIO	BRAZIL TENSILE STRENGTH psi	2ND CYCLE SLAKE DURABILITY INDEX percent	MODIFIED TABOR ABRASION/ HARDNESS INDEX	SWELL PRESSURE INDEX psi	COMMENTS
SILTY CLAY	0.0	22.8			46	28	80.5															
AUSTIN CHALK	23.0	11.6																				
AUSTIN CHALK	23.1	10.0							0.5									192				
AUSTIN CHALK	23.2	9.9	129.3						2.2	B-1/30	2054			1.15	1.90	0						
AUSTIN CHALK	29.7	13.1	127.5																			
AUSTIN CHALK	29.9	13.3	122.6	2.67					2.3	D		25	1735	0.51	4.23	25						NOTE 1
AUSTIN CHALK	29.9														7.48		0.26					NOTE 2
AUSTIN CHALK	30.3	13.0	121.0						2.3	D		100	2365	0.62	4.44	100						NOTE 1
AUSTIN CHALK	30.3														6.00		0.07					NOTE 2
AUSTIN CHALK	41.0	13.1	120.1																			
AUSTIN CHALK	41.2	13.5							0.5									249				
AUSTIN CHALK	41.3																			0.402		
AUSTIN CHALK	75.0	14.6																				
AUSTIN CHALK	75.2	15.2							0.4									225				
AUSTIN CHALK	75.3	13.2	119.4						2.2	E	2319			0.67	3.80	0						
AUSTIN CHALK	84.6	17.5	112.9																			
AUSTIN CHALK	85.1																			1.091		
AUSTIN CHALK	117.0	12.4																				
AUSTIN CHALK	117.1	12.6							0.5									279				
AUSTIN CHALK	117.2	12.5	122.5						2.2	E	1970			1.38	1.50	0						
AUSTIN CHALK	119.9	13.1																				
AUSTIN CHALK	120.1	12.4	123.6						2.2	D	1648			0.62	3.20	0						
AUSTIN CHALK	120.6	13.3							0.4									277				
AUSTIN CHALK	122.0	13.3																				
AUSTIN CHALK	122.1	12.6							0.5									184				
AUSTIN CHALK	122.2	14.5	119.4						2.2	D	2829			0.67	5.20	0						
AUSTIN CHALK	134.3	14.6																				
AUSTIN CHALK	134.4	13.7	116.8						2.1	C	419			2.53	0.27	0						
AUSTIN CHALK	135.0	13.1							0.5									237				
AUSTIN CHALK	137.2	17.1	114.0																			
AUSTIN CHALK	137.4																			0.503		
AUSTIN CHALK	138.9	14.8																				
AUSTIN CHALK	142.5	14.8																				
AUSTIN CHALK	142.6	13.3							0.5									226				
AUSTIN CHALK	142.7	14.8	117.4						2.1	B-1/30	2163			0.21	14.00	0						
BENTONITE	147.6	18.0	106.1																			
BENTONITE	148.0			2.68	125	88		4.9														
AUSTIN CHALK	157.4	16.1																				
AUSTIN CHALK	157.5	15.1	120.2						2.2	B-1/30	2559			0.50	7.30	0						
AUSTIN CHALK	165.9	10.8	132.0																			
AUSTIN CHALK	181.1	12.5																				
AUSTIN CHALK	181.2	11.1	127.3						2.1	D	1317			0.95	1.70	0						
AUSTIN CHALK	184.8	10.9																				
AUSTIN CHALK	184.9	9.4	131.6						2.2	B-1/30	2881			0.89	4.50	0						
AUSTIN CHALK	214.5	12.0																				
AUSTIN CHALK	214.6	14.6	116.2						2.2	B-1/30	2697			0.68	5.70	0						
EAGLE FORD SHALE	246.4	17.1	114.9																			
EAGLE FORD SHALE	246.6	13.4			106	71	96.7	8.9														
EAGLE FORD SHALE	253.2	10.4			83	50	99.7	12.1														
EAGLE FORD SHALE	253.3	14.2	122.2						2.0	D	441			1.09	0.76	0						
EAGLE FORD SHALE	254.1																		34.8			
EAGLE FORD SHALE	255.2	15.2																				
EAGLE FORD SHALE	275.2	8.9																				
EAGLE FORD SHALE	275.4	10.7	130.3						2.2	B-1/45	542			0.75	0.96	0						
EAGLE FORD SHALE	282.7	14.6																				
EAGLE FORD SHALE	283.1	14.1	122.9						2.1	D	242			1.37	0.24	0						
EAGLE FORD SHALE	283.9	14.6	122.0	2.73	59	34	98.9	5.0	2.4	B-1/40		200	505	0.67	1.15	200						
EAGLE FORD SHALE	284.3	14.5	121.8						2.2	B-1/40		300	546	0.75	1.18	300						NOTE 1
EAGLE FORD SHALE	284.3														1.47		0.42					NOTE 2
EAGLE FORD SHALE	287.0	15.1	120.0																			
EAGLE FORD SHALE	287.3	12.5			84	51	99.8	5.8														
EAGLE FORD SHALE	287.5																		31.5			
EAGLE FORD SHALE	294.8	14.8																				
EAGLE FORD SHALE	295.6	17.6	117.5		82	48	98.6	7.5	2.1	D	425			0.72	1.20	0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148		ASTM-D3148	ISRM	ISRM	ISRM		

BIR14PRT.WK1
REVISION 1.1
DATE 4/23/96

PRELIMINARY
(Subject to Revision)

* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

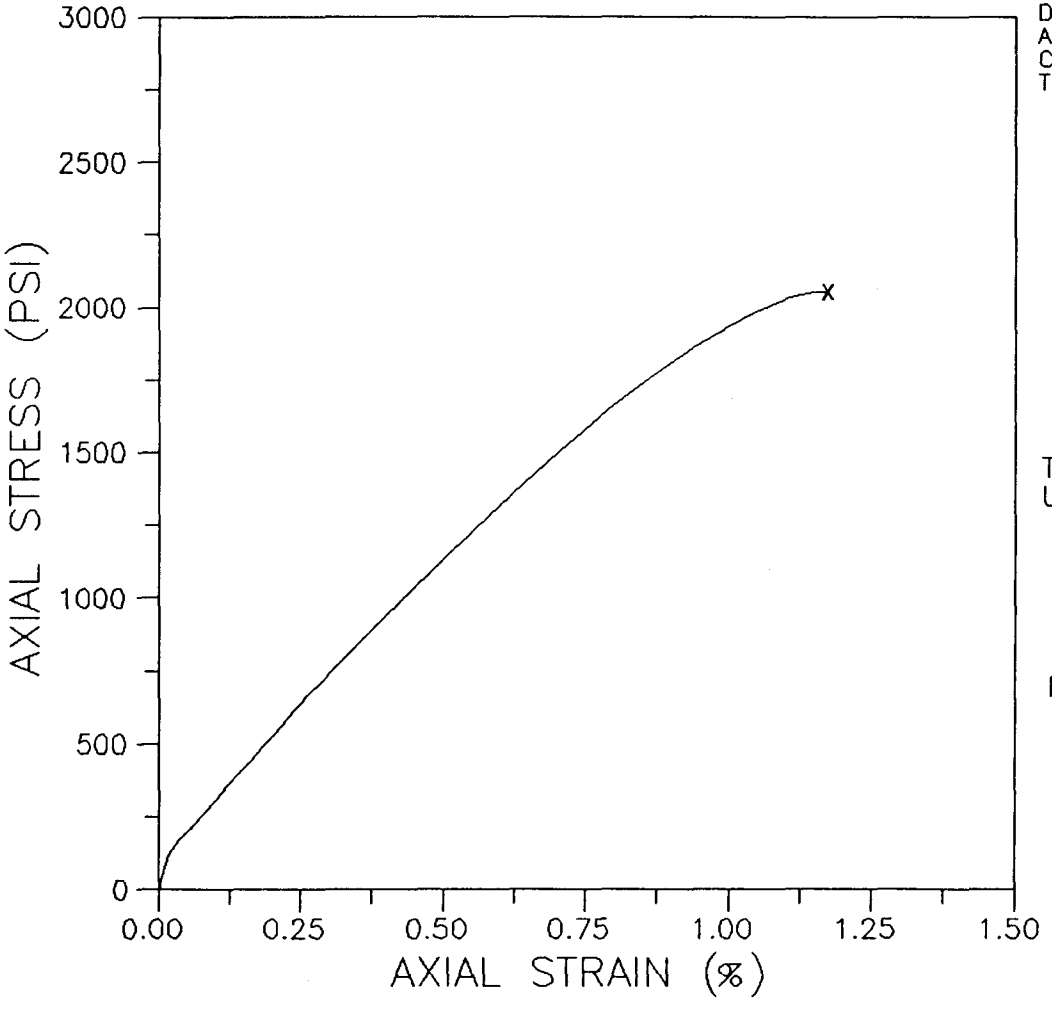
Symbol	Failure Type
A	No discernible failure plane
(B)	Well defined shear plane @ "X" angle (deg) to vertical or to long axis of core
B-1	Shear plane
B-2	Bedding plane shear
B-3	Shear plane along pre-existing fracture, shear zone, etc.
B-4	Combination
C	Barreling/Bulging
D	Longitudinal (axial) splitting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

NOTES:

1) MODULUS WAS CALCUTED FROM AXIAL STRAINS MEASURED USING DIAL MICROMETER. AXIAL LENGTH IS THE SAMPLE LENGTH.

2) MODULUI AND POISSON'S RATIO WERE CALCULATED FROM AXIAL AND LATERAL STRAINS MEASURED USING 3 AXIAL AND 3 LATERAL LVDTS OFFSET @ 120 DEGREES APART. AXIAL LENGTH IS 2.8 INCHES.

BORING NO: BIR14
DEPTH (FT): 23.2
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 9.9
DRY UNIT WEIGHT (PCF): 129.3
DEG. OF SATURATION (%): 88.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.9 X 10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

STRESS-STRAIN PLOT

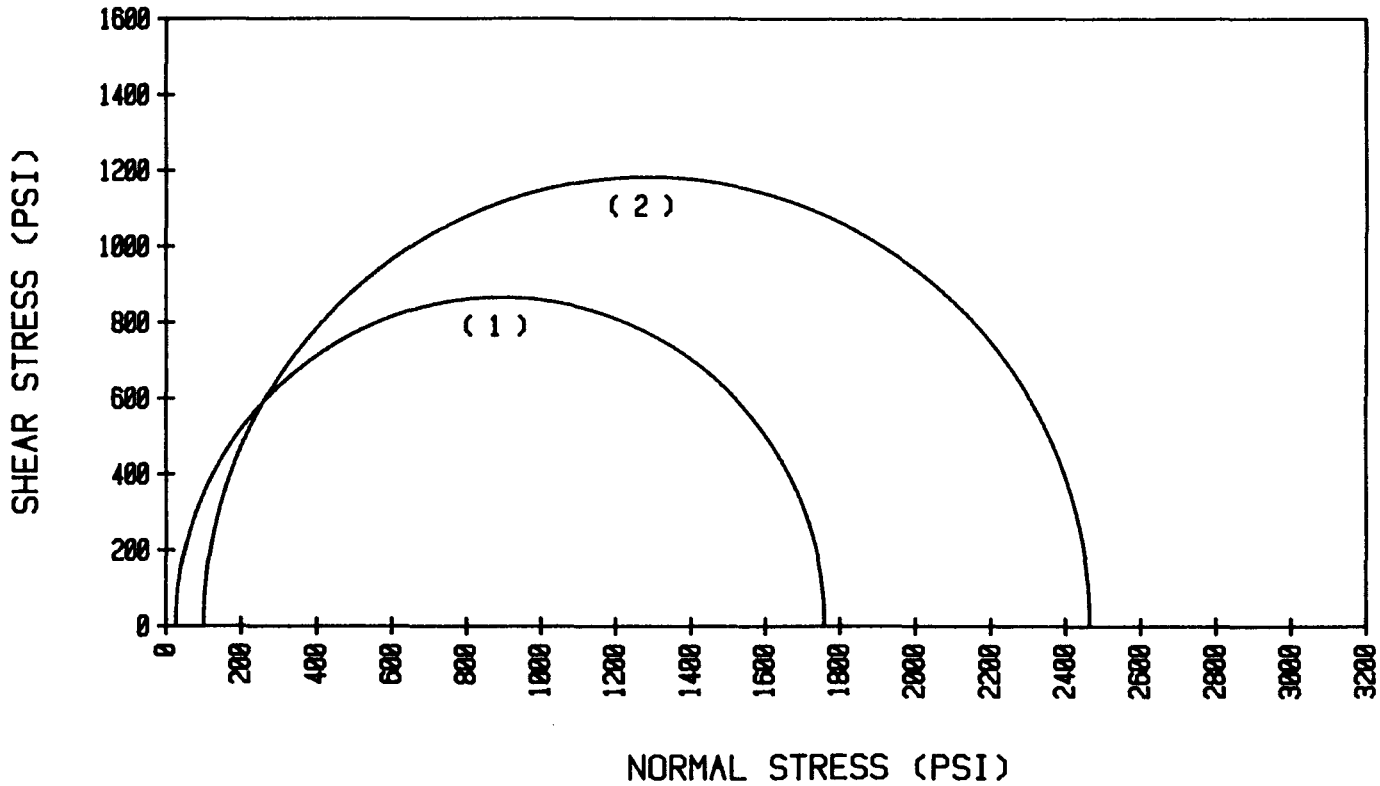
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO.: BIR14
DEPTH RANGE (FT): 29.9-30.7
AUSTIN CHALK LIMESTONE

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



SEE STRESS - STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 29.9
(2) DEPTH (FT): 30.3

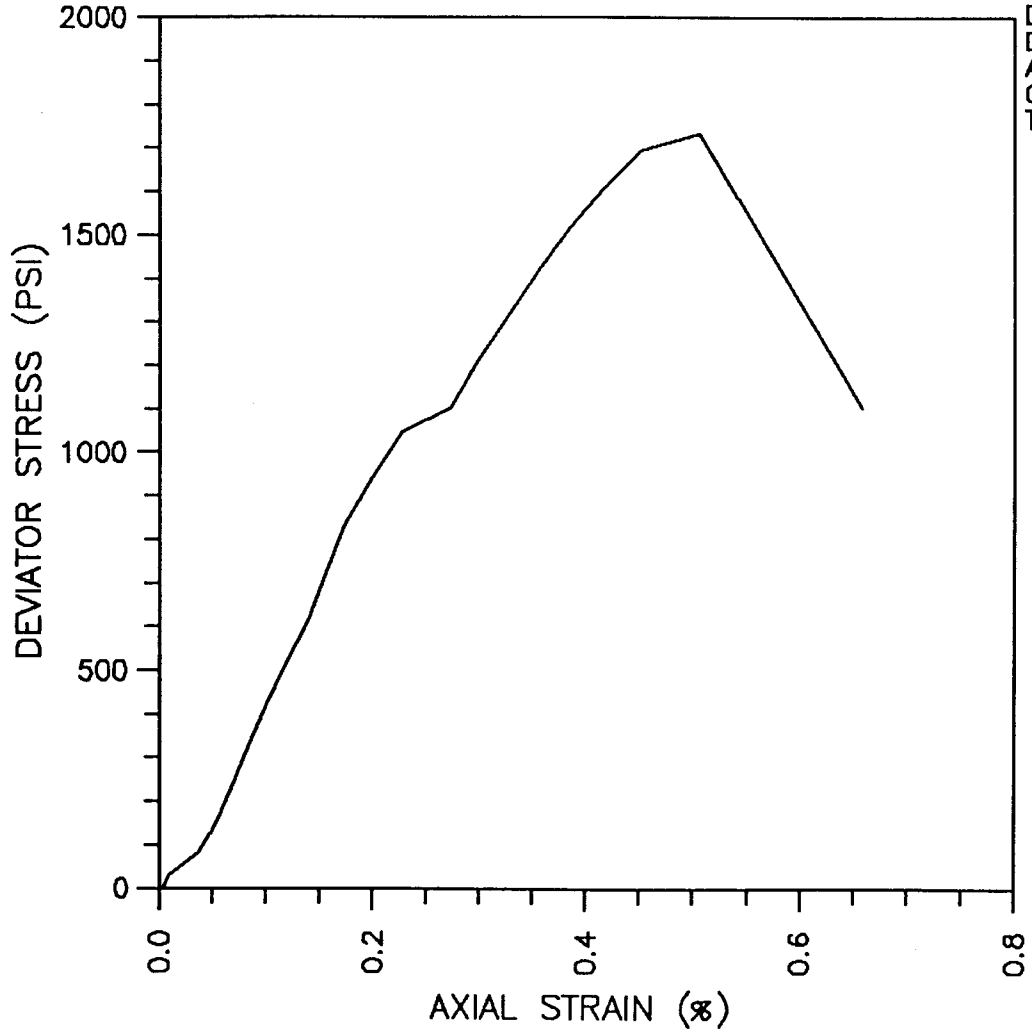
TEXAS SSC SITE

MOHR CIRCLE PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15 | FIGURE

BORING NO.: BIR14
DEPTH (FT): 29.9
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.3
DRY UNIT WEIGHT (PCF): 122.6
DEG. OF SATURATION (%): 96.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 25
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.225 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

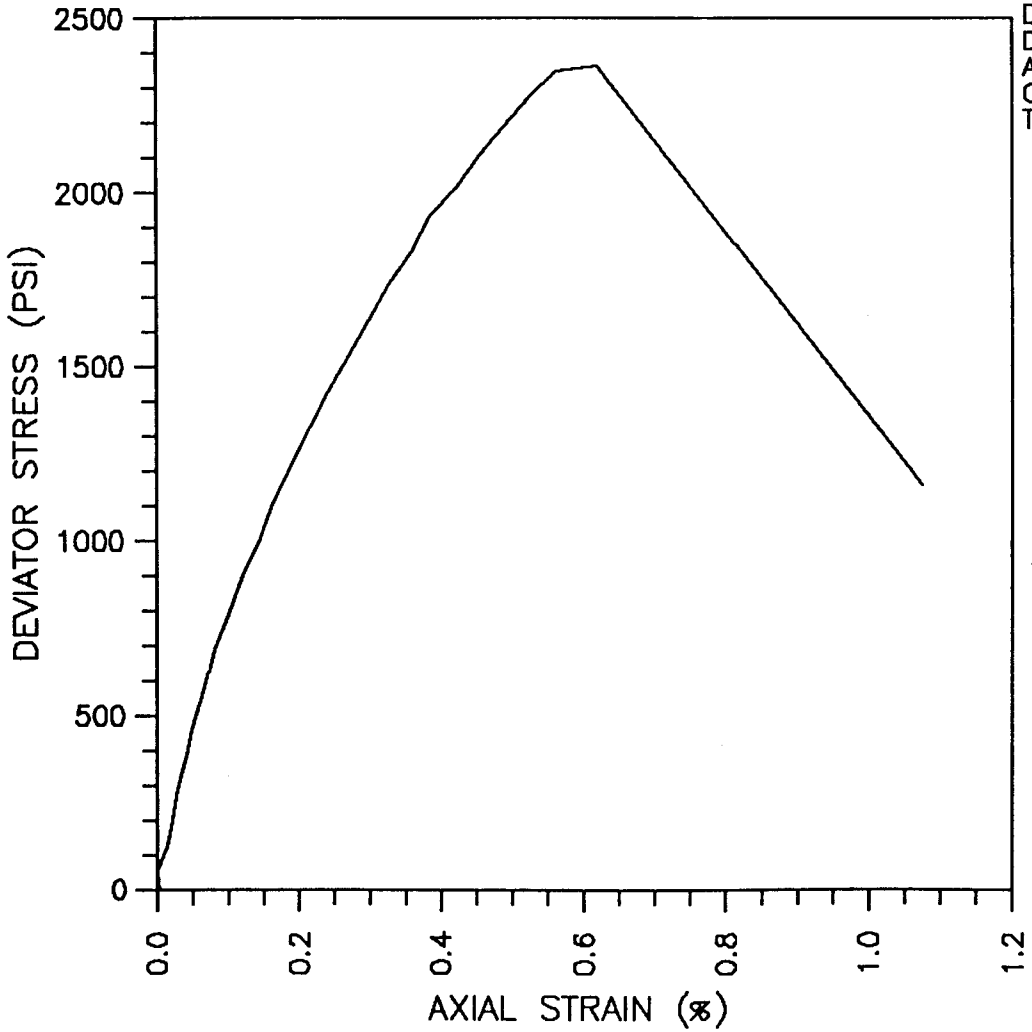
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR14
DEPTH (FT): 30.3
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.0
DRY UNIT WEIGHT (PCF): 121.6
DEG. OF SATURATION (%): 89.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.444 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

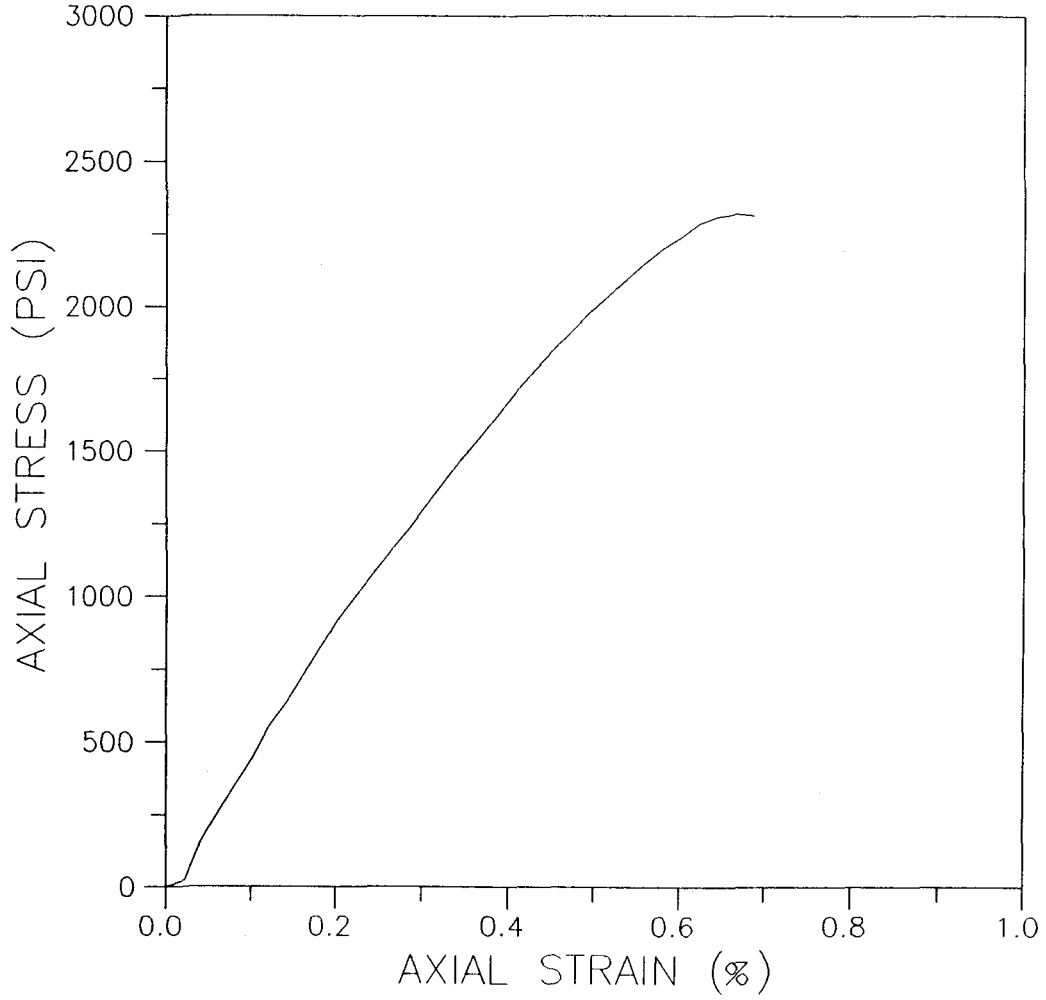
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO: BIR14
DEPTH (FT): 75.3
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.2
DRY UNIT WEIGHT (PCF): 119.4
DEG. OF SATURATION (%): 86.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
CONICAL BREAK

TEXAS SSC SITE

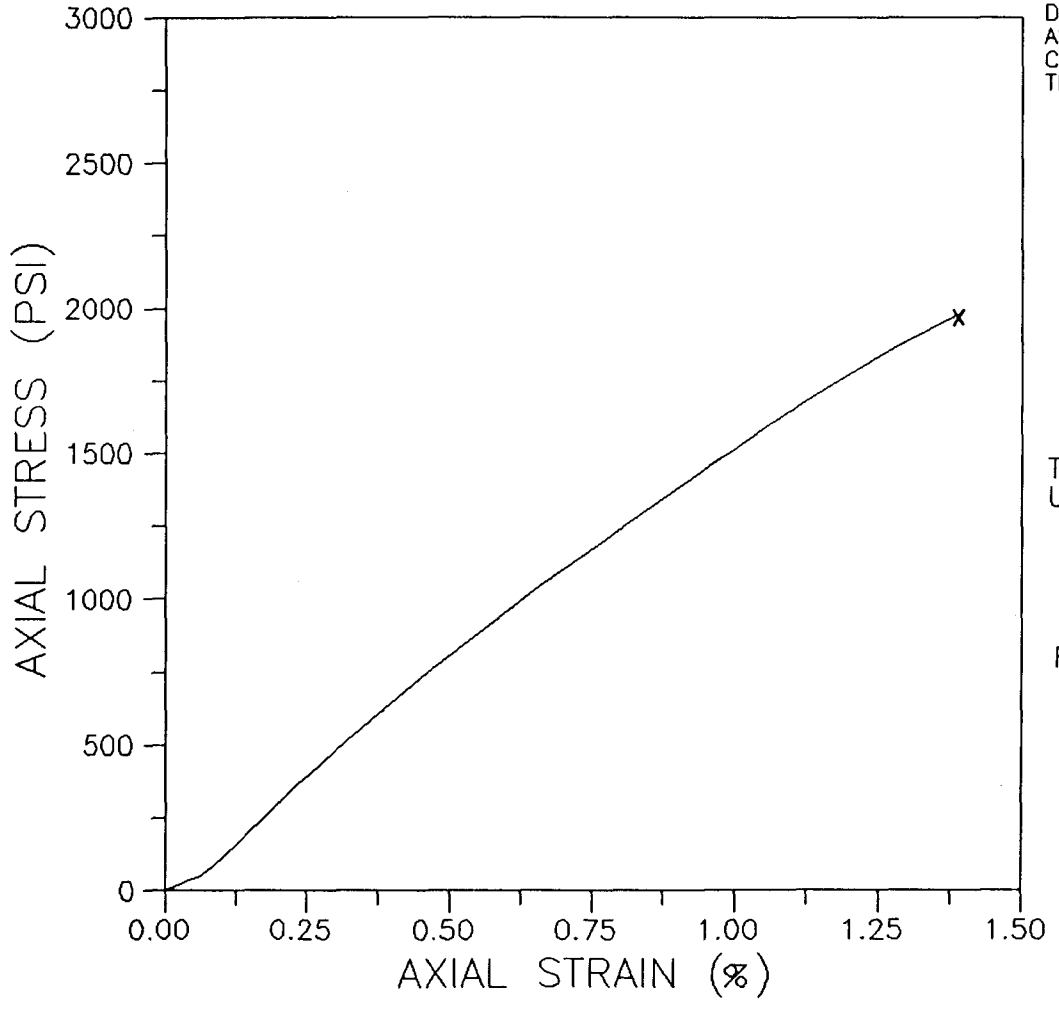
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 117.2
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.5
DRY UNIT WEIGHT (PCF): 122.5
DEG. OF SATURATION (%): 89.9
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
CONICAL BREAK

TEXAS SSC SITE

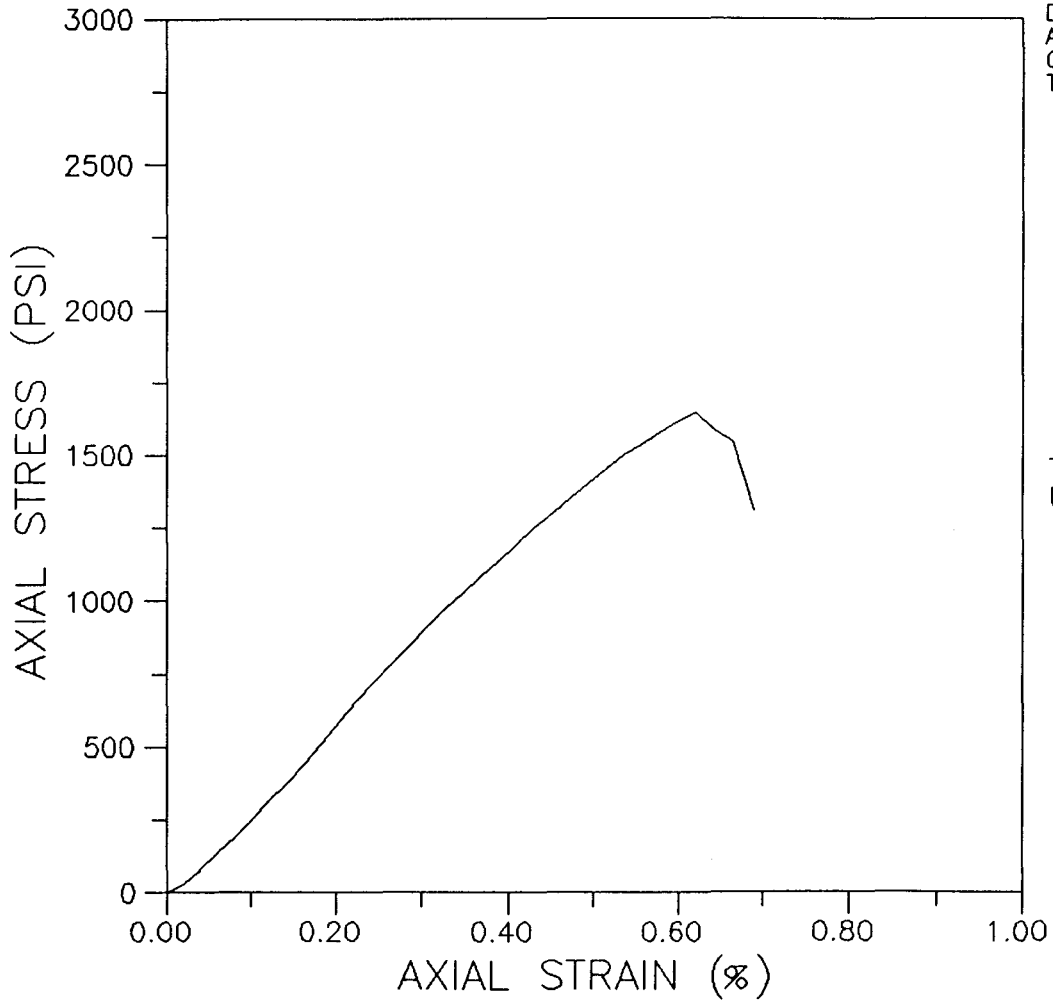
STRESS–STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89–192

FIGURE

BORING NO: BIR14
DEPTH (FT): 120.1
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.4
DRY UNIT WEIGHT (PCF): 123.6
DEG. OF SATURATION (%): 92.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

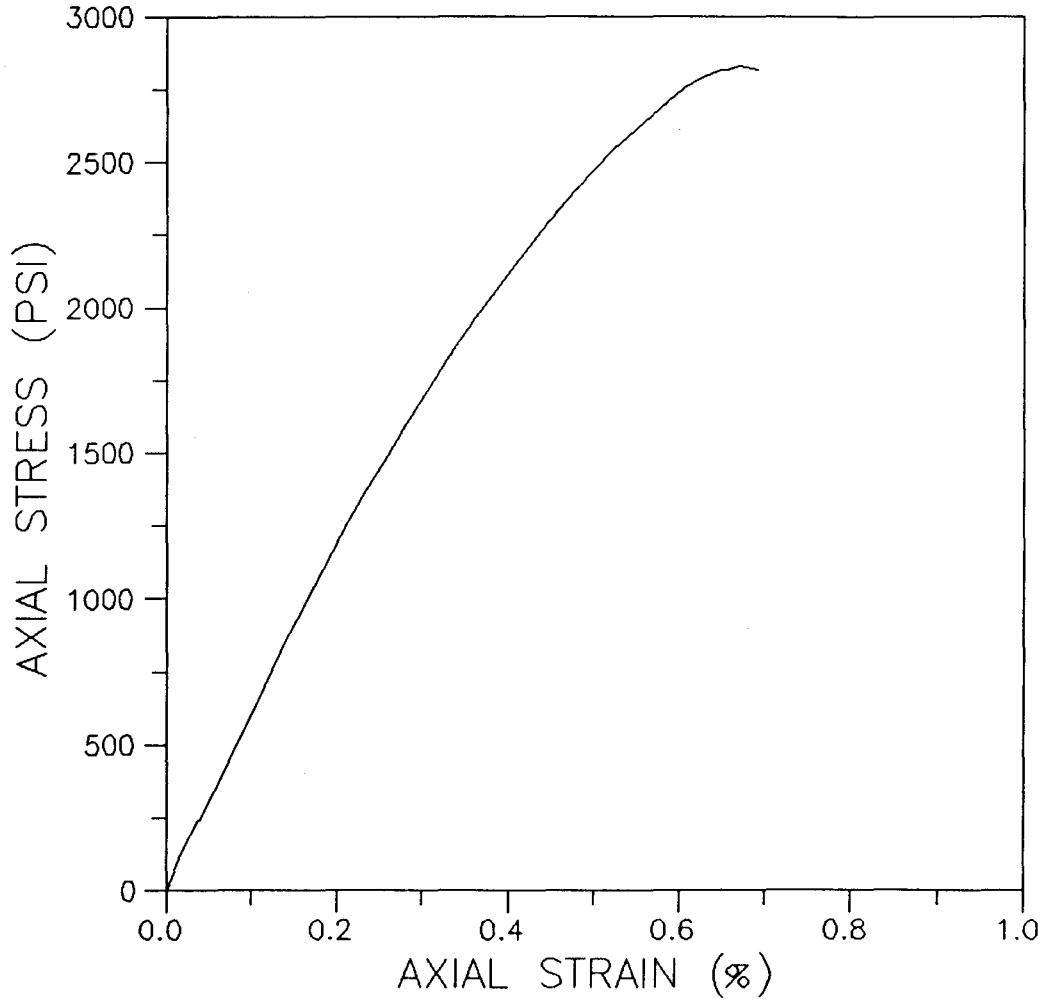
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 122.2
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.5
DRY UNIT WEIGHT (PCF): 119.4
DEG. OF SATURATION (%): 95.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

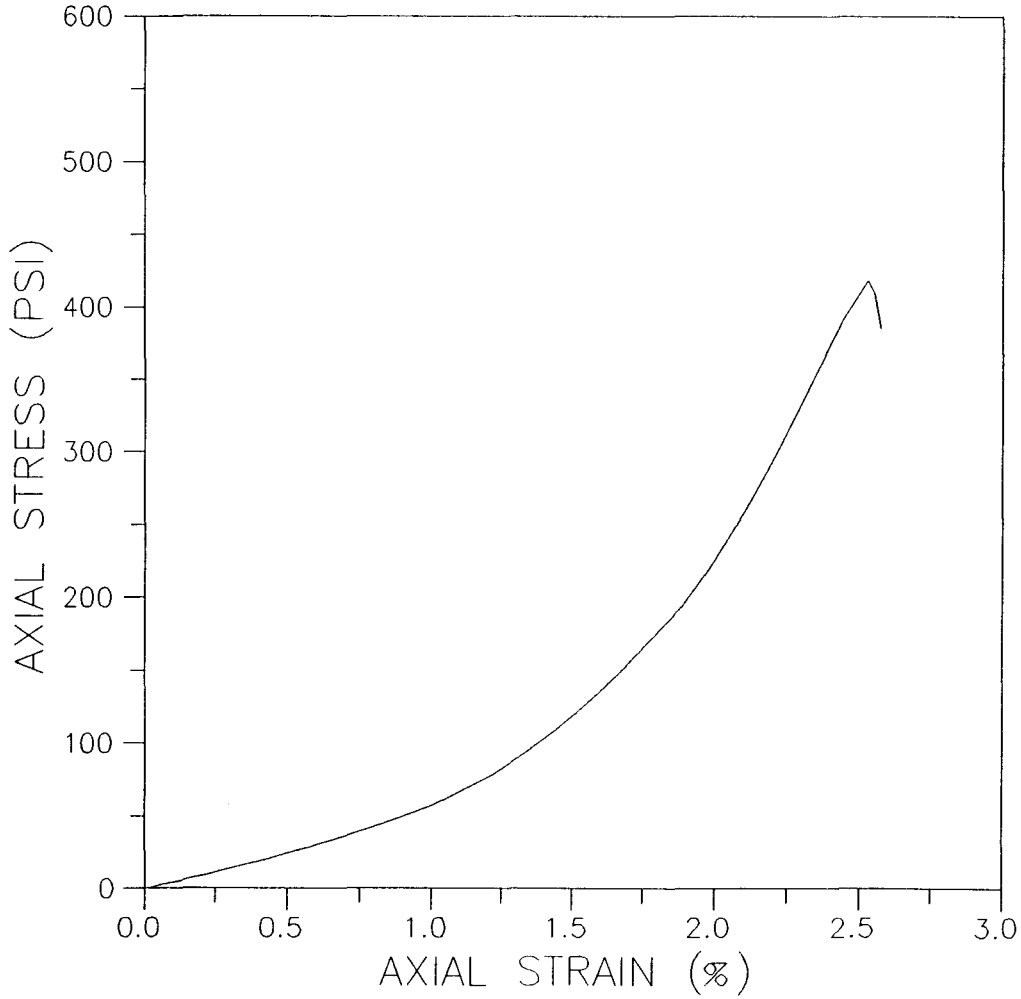
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): **134.4**
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.7
DRY UNIT WEIGHT (PCF): 116.8
DEG. OF SATURATION (%): 83.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

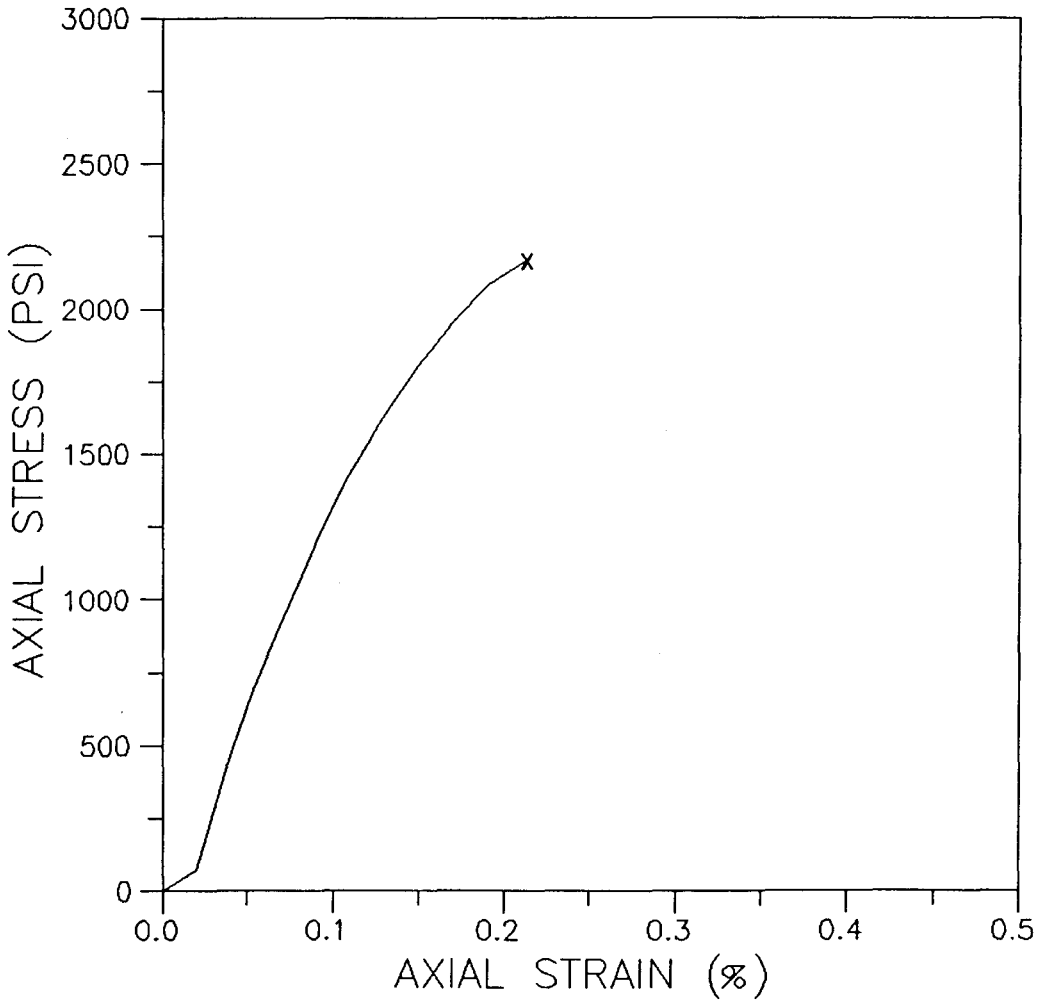
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 142.7
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.8
DRY UNIT WEIGHT (PCF): 117.4
DEG. OF SATURATION (%): 91.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.4 x 10E6 PSI

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

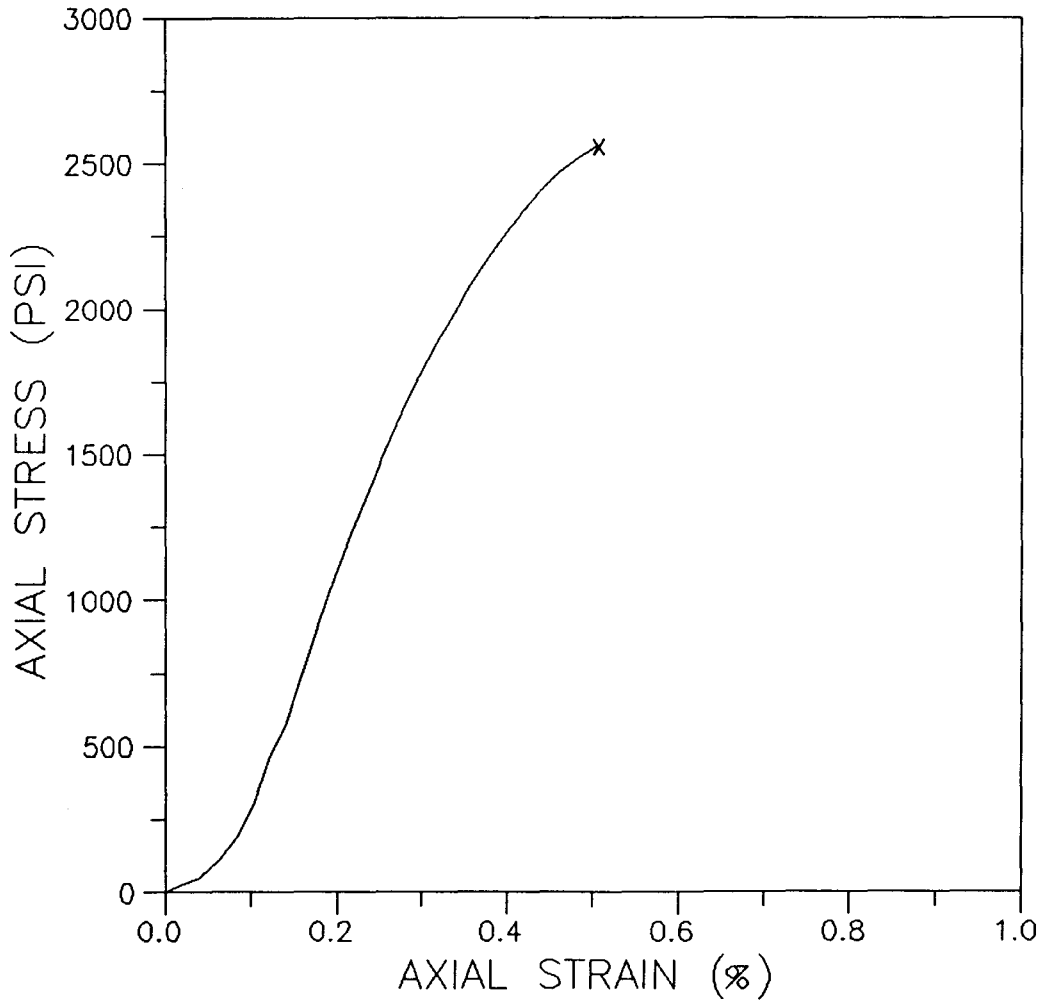
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 157.5
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 15.1
DRY UNIT WEIGHT (PCF): 120.2
DEG. OF SATURATION (%): 101.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

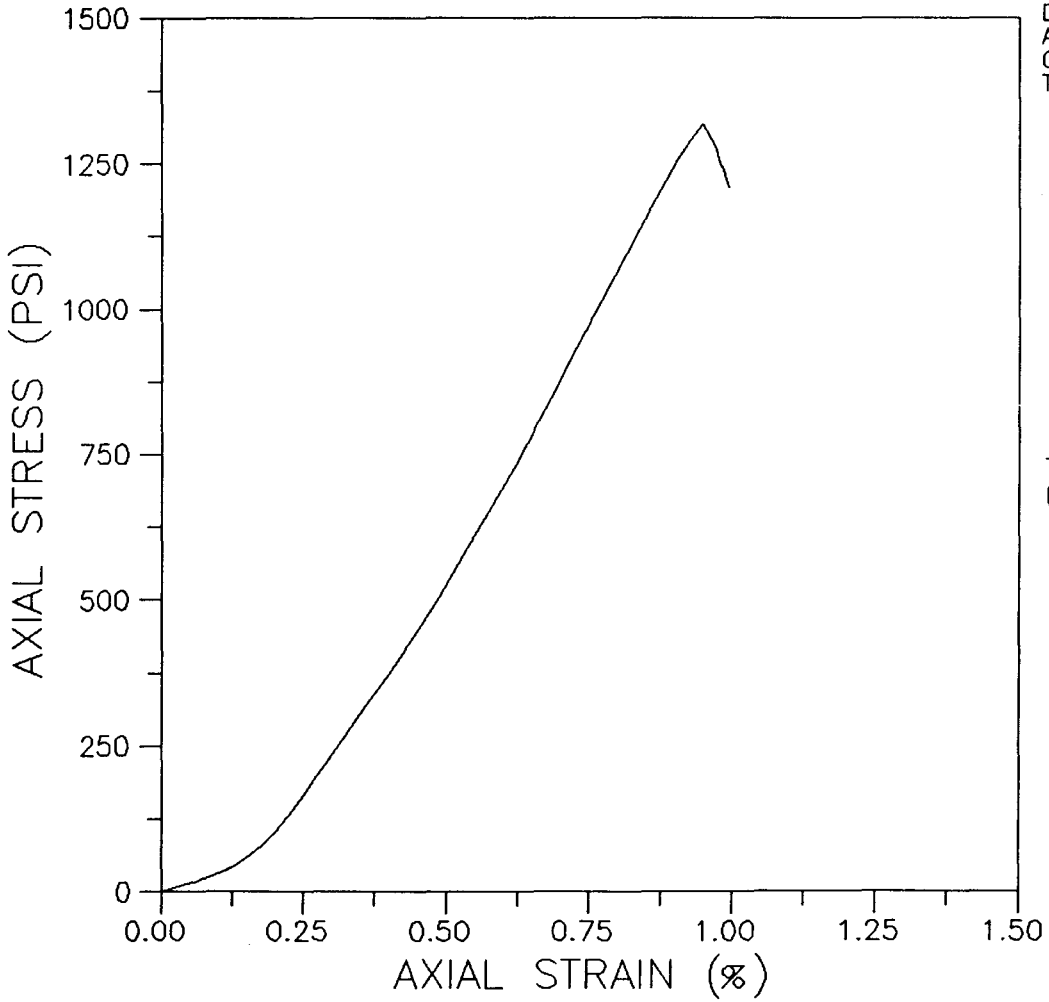
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 181.2
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 11.1
DRY UNIT WEIGHT (PCF): 127.3
DEG. OF SATURATION (%): 92.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

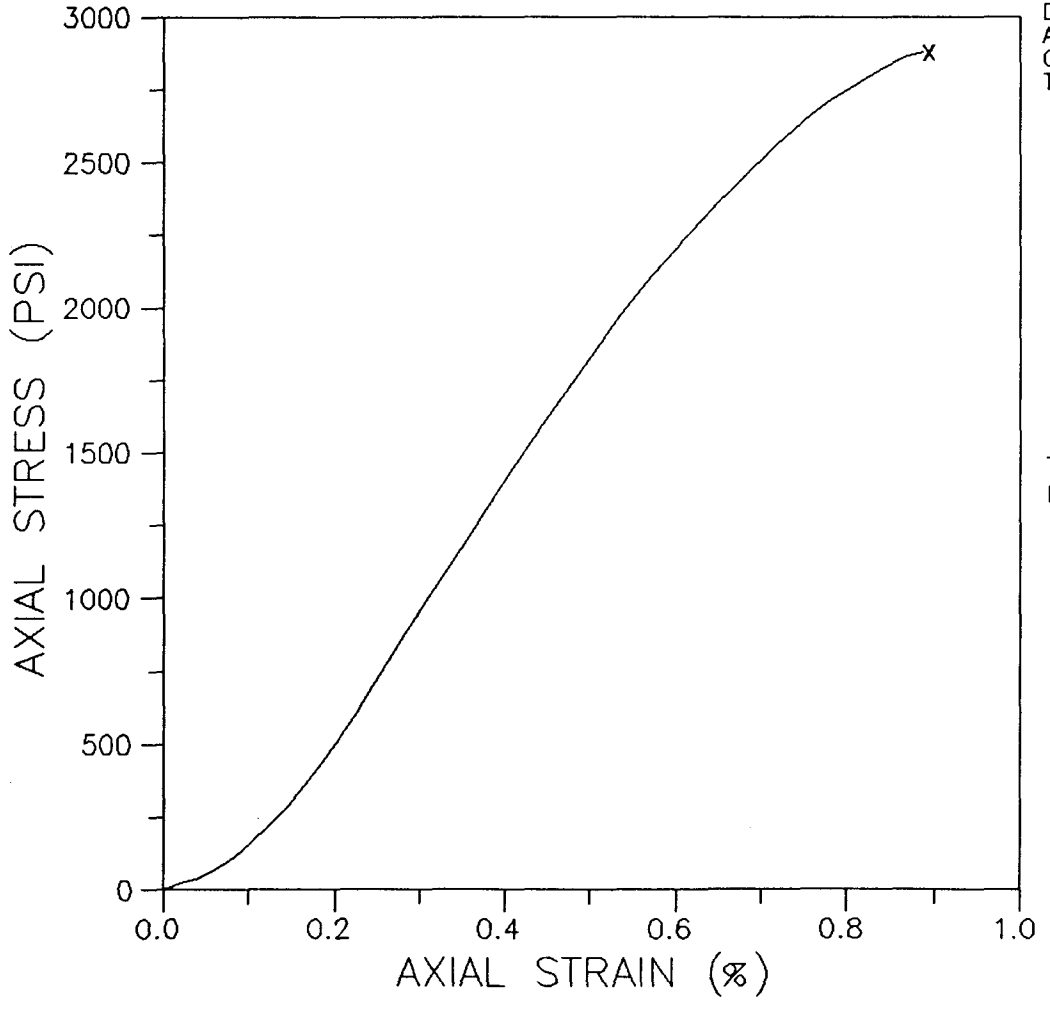
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 184.9
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 9.4
DRY UNIT WEIGHT (PCF): 131.6
DEG. OF SATURATION (%): 90.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

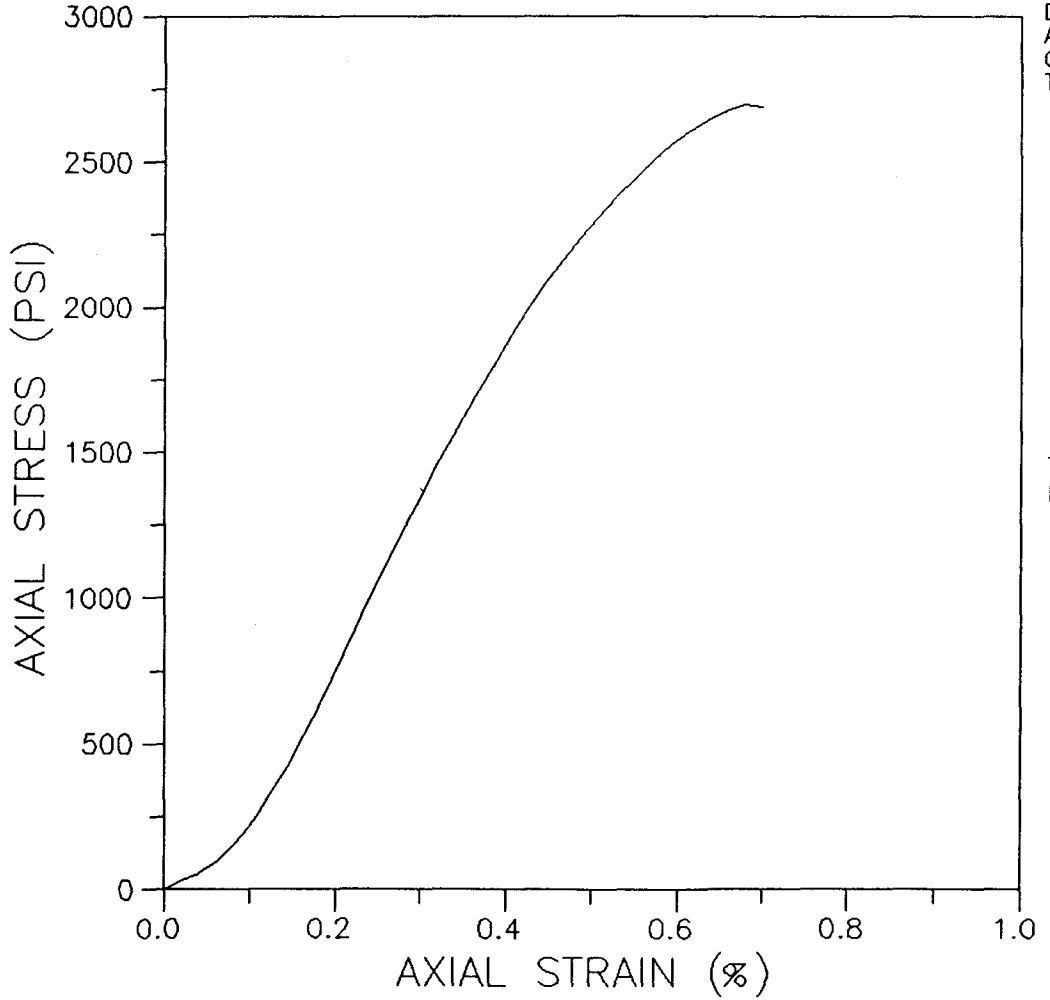
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 214.6
AUSTIN CHALK



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.6
DRY UNIT WEIGHT (PCF): 116.2
DEG. OF SATURATION (%): 87.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 30 DEG

TEXAS SSC SITE

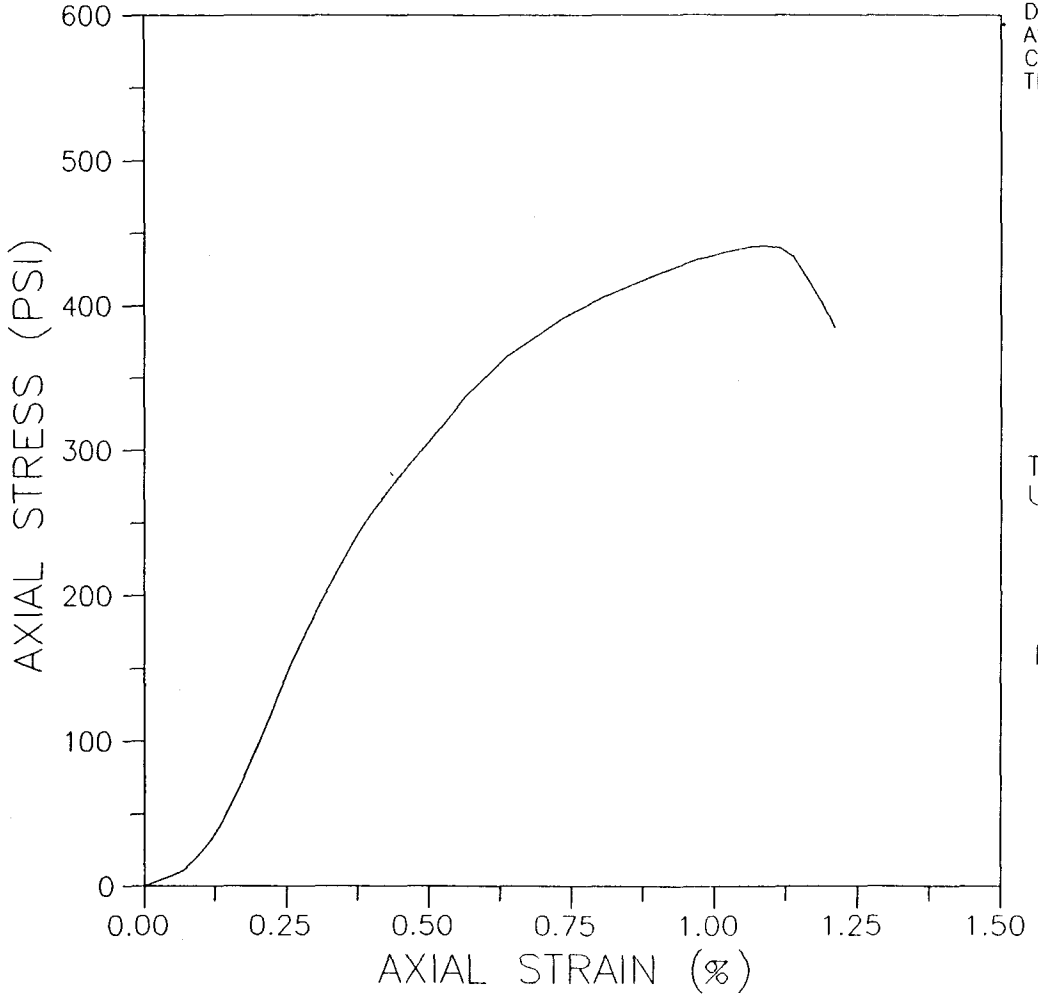
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 253.3
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.2
DRY UNIT WEIGHT (PCF): 122.2
DEG. OF SATURATION (%): 101.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

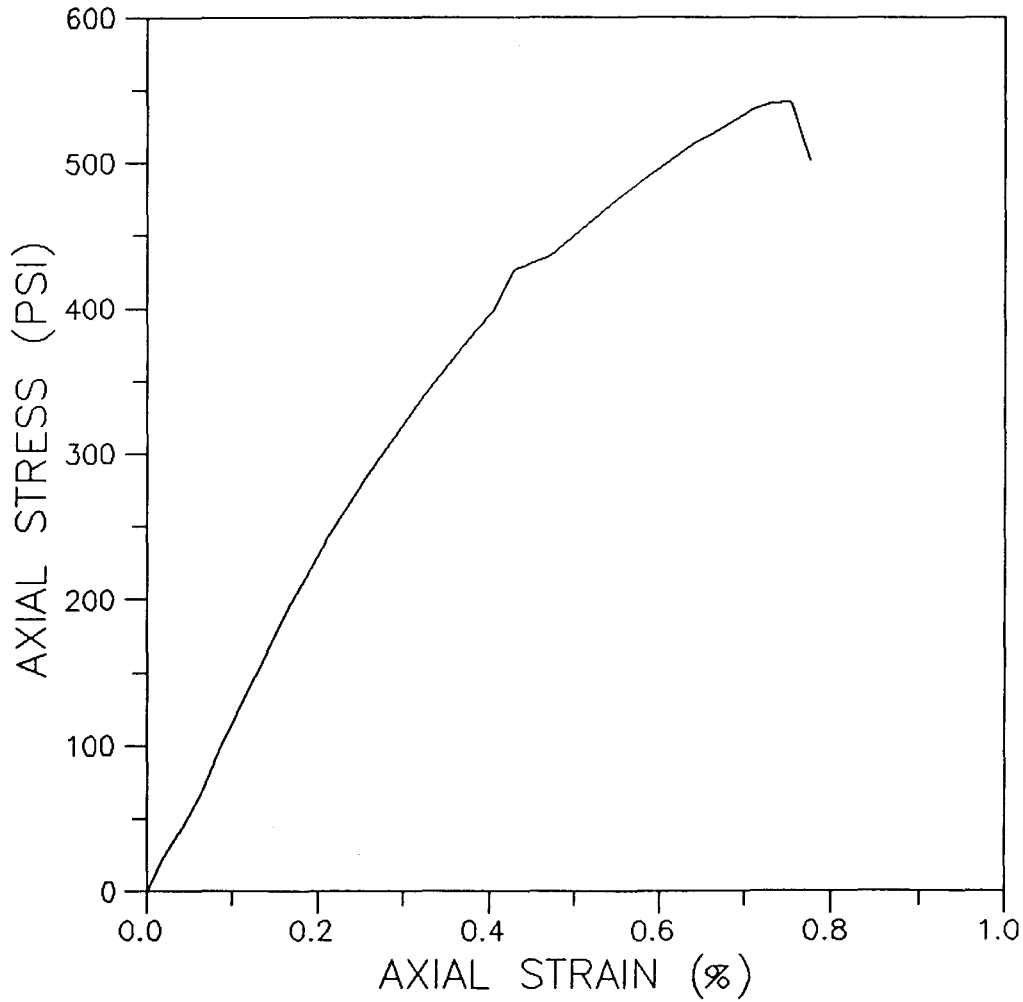
STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BIR14
DEPTH (FT): 275.4
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.7
DRY UNIT WEIGHT (PCF): 130.3
DEG. OF SATURATION (%): 93.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
SHEAR PLANE AT 45 DEG

TEXAS SSC SITE

STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

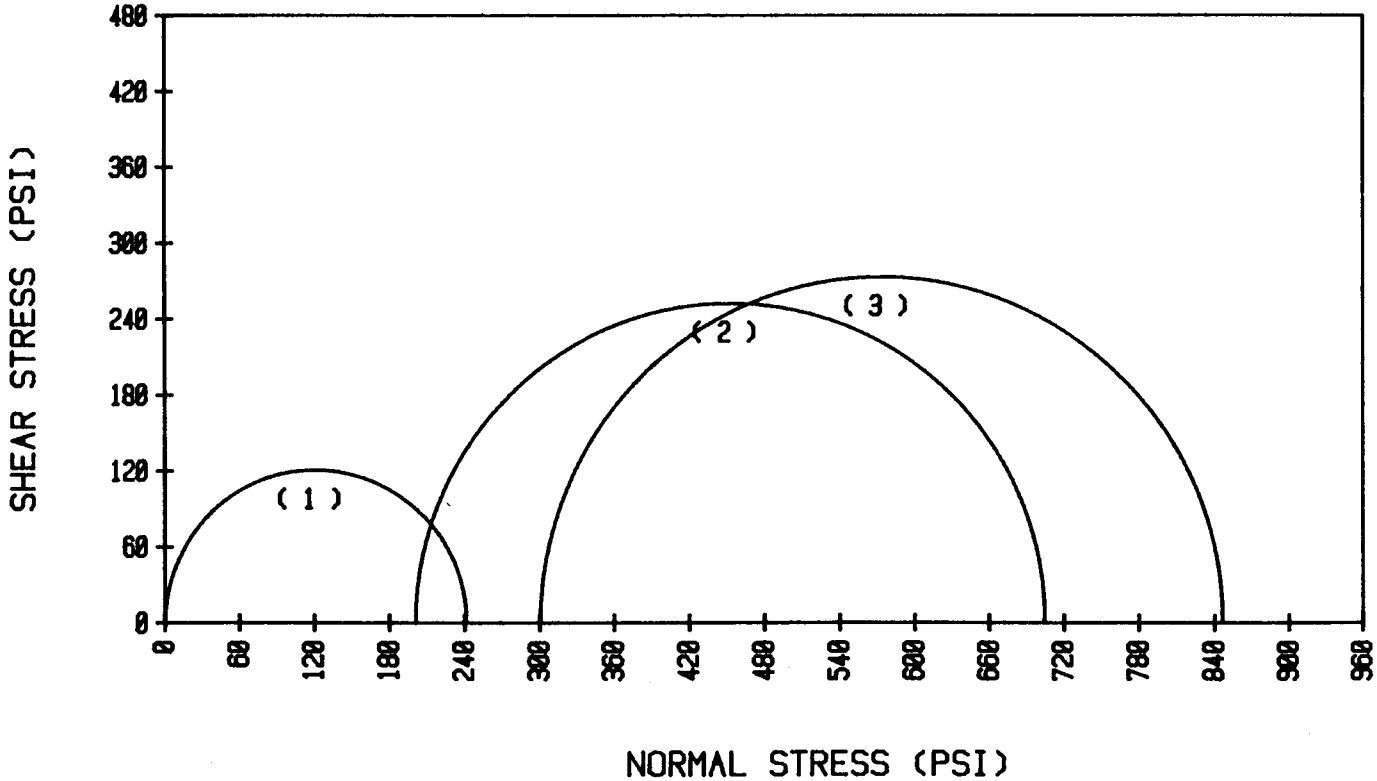
BORING NO.: BIR14

DEPTH RANGE (FT): 283.1-284.7

EAGLE FORD SHALE

BORING INCLINATION (DEG): VERTICAL

TEST TYPE: UNCONFINED COMPRESSION (ASTM D2938)
TRIAXIAL COMPRESSION (ASTM D2664)



SEE STRESS - STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 283.1
(2) DEPTH (FT): 283.9
(3) DEPTH (FT): 284.3

TEXAS SSC SITE

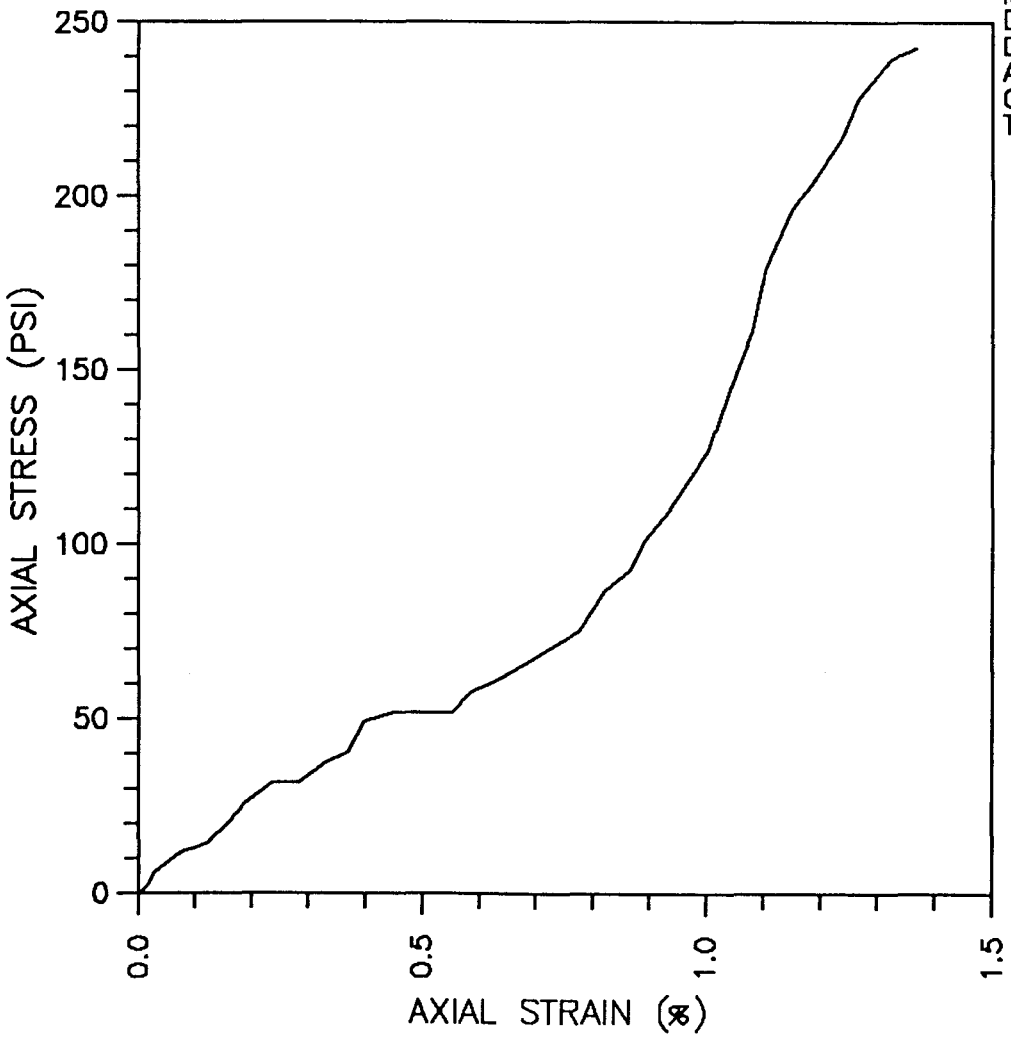
MOHR CIRCLE PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR14
DEPTH (FT): 283.1
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.1
DRY UNIT WEIGHT (PCF): 122.9
DEG. OF SATURATION (%): 102.7
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.244 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

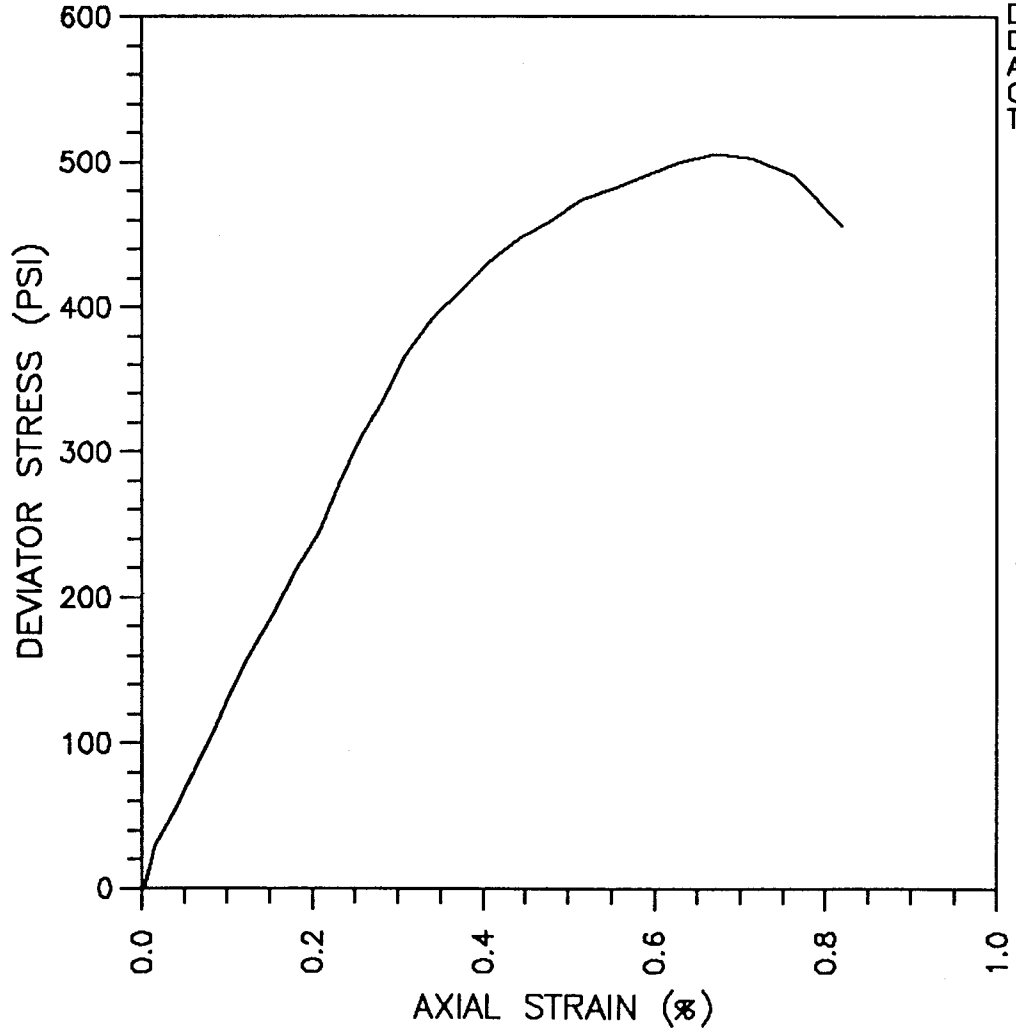
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR14
DEPTH (FT): 283.9
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.6
DRY UNIT WEIGHT (PCF): 122.0
DEG. OF SATURATION (%): 103.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.154 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 40 DEG

TEXAS SSC SITE

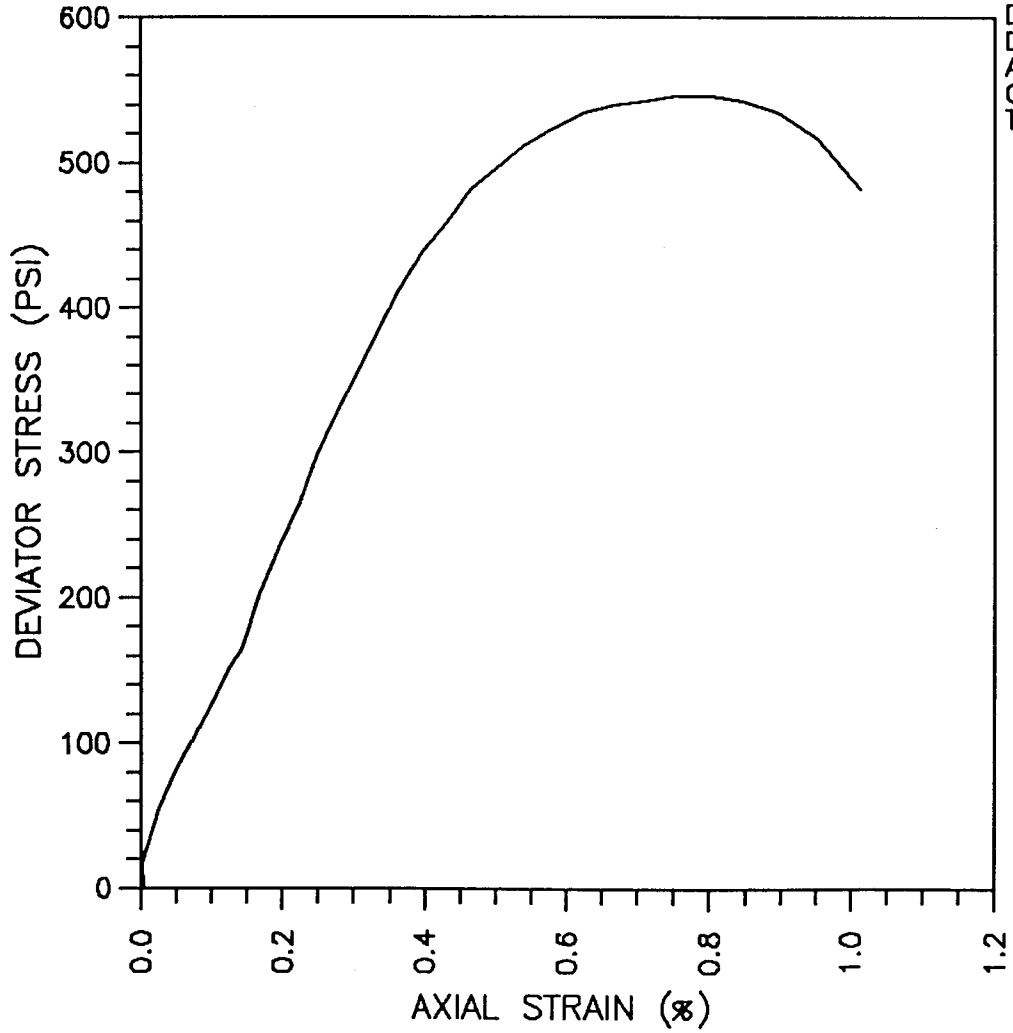
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO.: BIR14
DEPTH (FT): 284.3
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 14.5
DRY UNIT WEIGHT (PCF): 121.8
DEG. OF SATURATION (%): 102.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 300
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.184 x10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 40 DEG

TEXAS SSC SITE

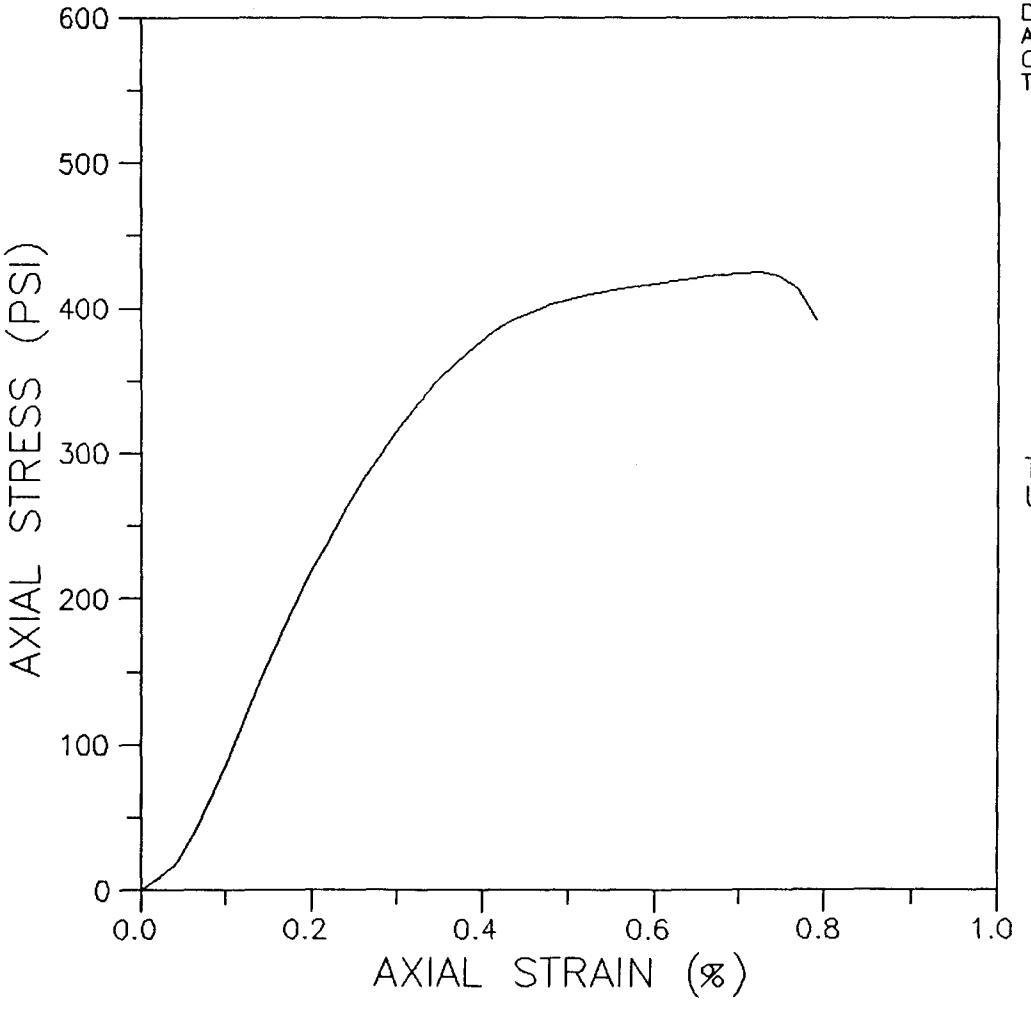
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.15

FIGURE

BORING NO: BIR14
DEPTH (FT): 295.6
EAGLE FORD SHALE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 17.6
DRY UNIT WEIGHT (PCF): 117.5
DEG. OF SATURATION (%): 109.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE:UNCONFINED COMPRESSION
(ASTM D 2938)

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

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

TEXAS SSC SITE

STRESS-STRAIN PLOT

SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

APPENDIX F

DOWNHOLE VELOCITY SURVEYS

APPENDIX F

DOWNHOLE VELOCITY SURVEYS

Downhole seismic velocity surveys in boring BIR11 were completed on November 20 and 21, 1989. The survey objectives were to determine the in-situ compressional (P) and shear (S) wave velocity profiles of subsurface materials. Dynamic elastic moduli were estimated using interpreted velocities from these surveys and densities obtained from laboratory testing of boring samples.

Seismic waves were generated at the surface and recorded at a number of depths in the boring. The waves were detected with a downhole package of three mutually perpendicular geophones (Mark Products model L-10-3WD, 28 Hz resonant frequency) with one geophone oriented vertically. Spring-loaded steel wedges were used to hold the geophone package against the casing. The package diameter was increased by wrapping with duct tape until a tight fit was obtained. The tape also minimized mechanical resonance of the spring.

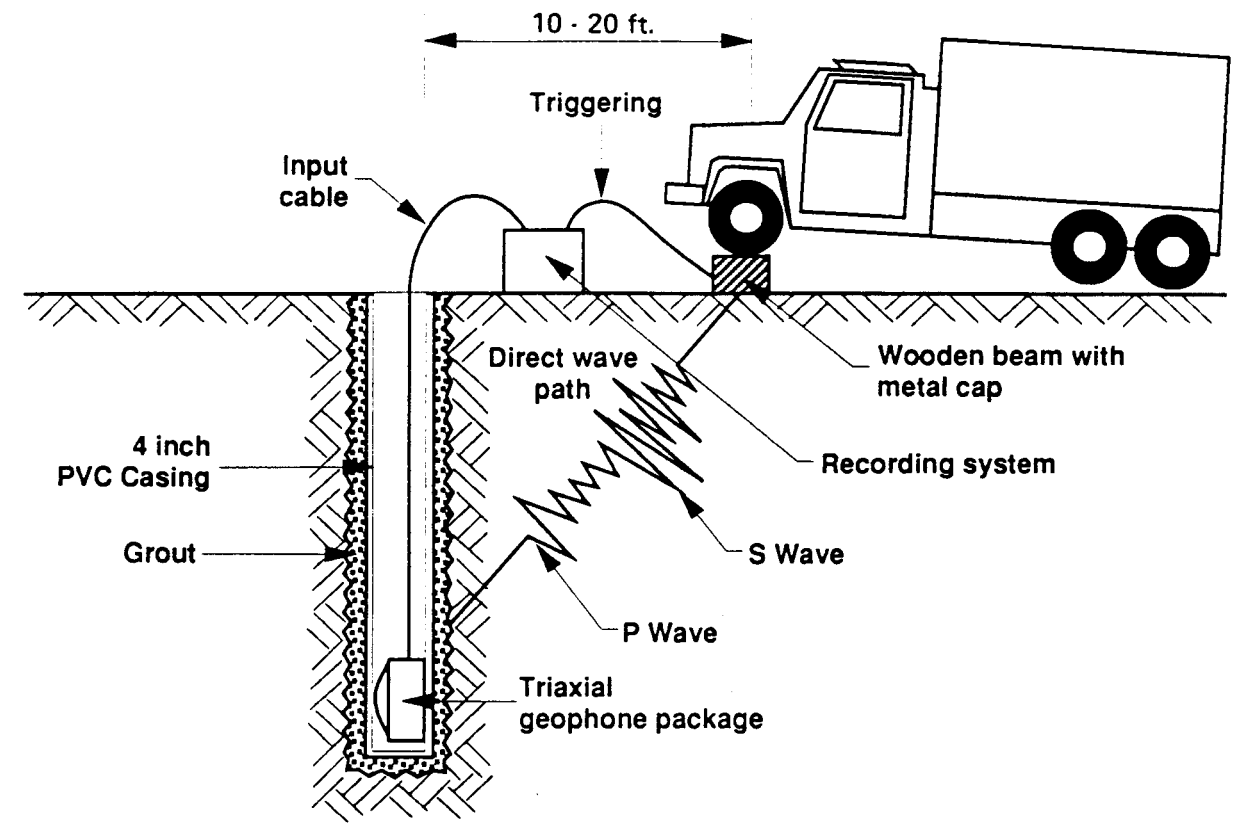
Geophone output signals were recorded with a 12-channel, signal enhancement seismograph (EG&G Geometrics model ES-1210F, S/N 19186). The seismograph was triggered at the instant of energy generation by a transistor switch attached to the source. For a given measurement depth, waveforms from several impacts were stacked (added together) and the sum stored in memory. Stacking often permits building a weak seismic waveform to a recognizable level even in 'noisy' environments. No filtering was used in recording the data. During acquisition, seismic waves were displayed on an oscilloscope. When the proper sequence of data traces was developed, a hard copy record was made with full-width timing lines (0.5-millisecond intervals). Travel times are accurate to ± 0.25 milliseconds.

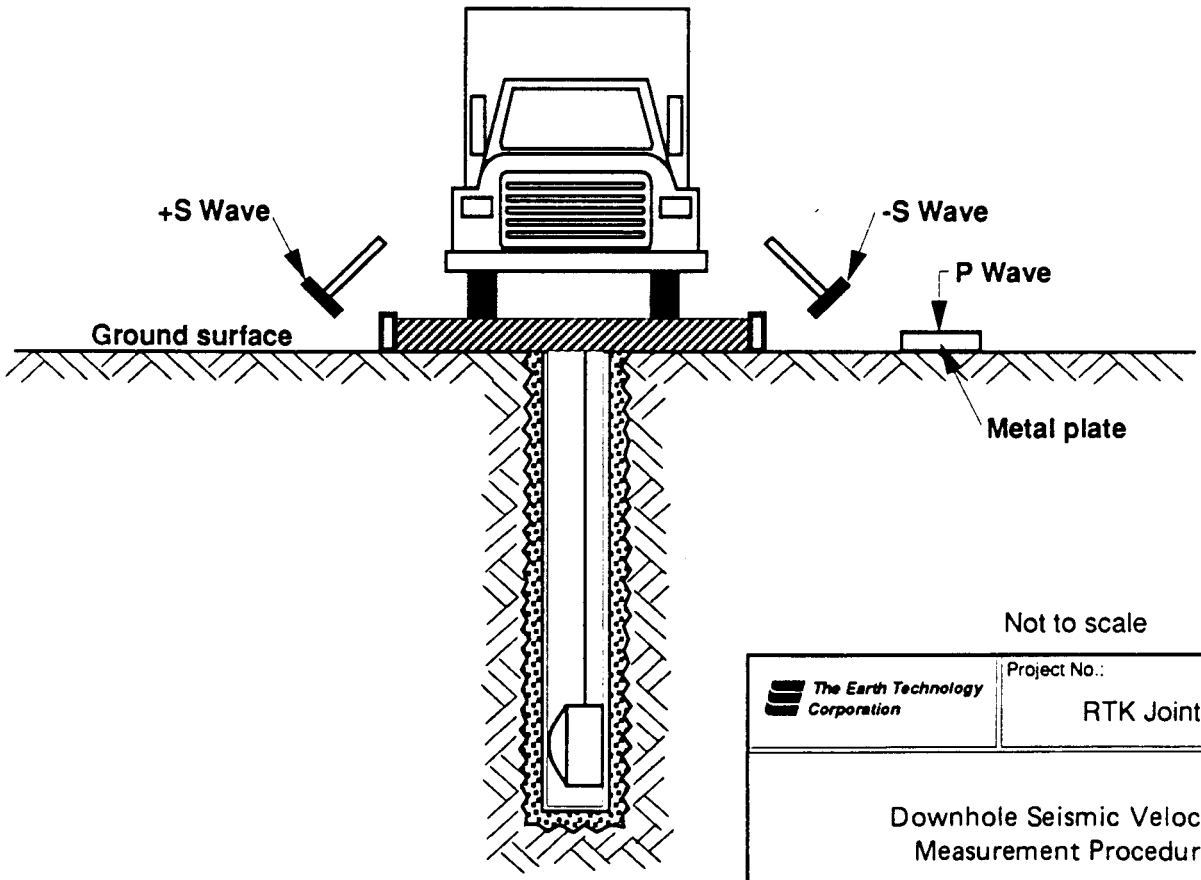
The layout for measuring seismic velocity is shown in Figure F-1. Measurement depths are accurate to ± 0.1 foot. The quality of P and S wave arrivals was judged to be generally good to fair.

RESULTS

Downhole velocity survey results in boring BIR 11 (Figure F-2) correlate well with conditions determined by boring and wire-line logs. Interpreted subsurface velocity zones are similar to those determined by the velocity survey at boring BIR 21 (482 feet to the south). Dynamic elastic moduli and Poisson's ratio were calculated using interpreted subsurface velocities and measured densities of samples from borings. All P and S wave arrivals to a depth of 130 feet were judged to have good to very good clarity. Both wave arrivals below 130 feet were found to have only fair quality and produced scatter on the data graph. No data were recorded within the screened interval, at depths of 205 to 225 feet. The interpreted velocities and moduli are accurate to ± 10 percent.

The boring log indicates that the surficial clayey overburden (1 foot thick) is underlain by weathered Austin Chalk (2 feet thick). Seismic velocities were not determined for these thin layers. Austin Chalk was identified between depths of 3 and 217 feet. The average P velocity of the chalk, as interpreted from





Not to scale

The Earth Technology Corporation

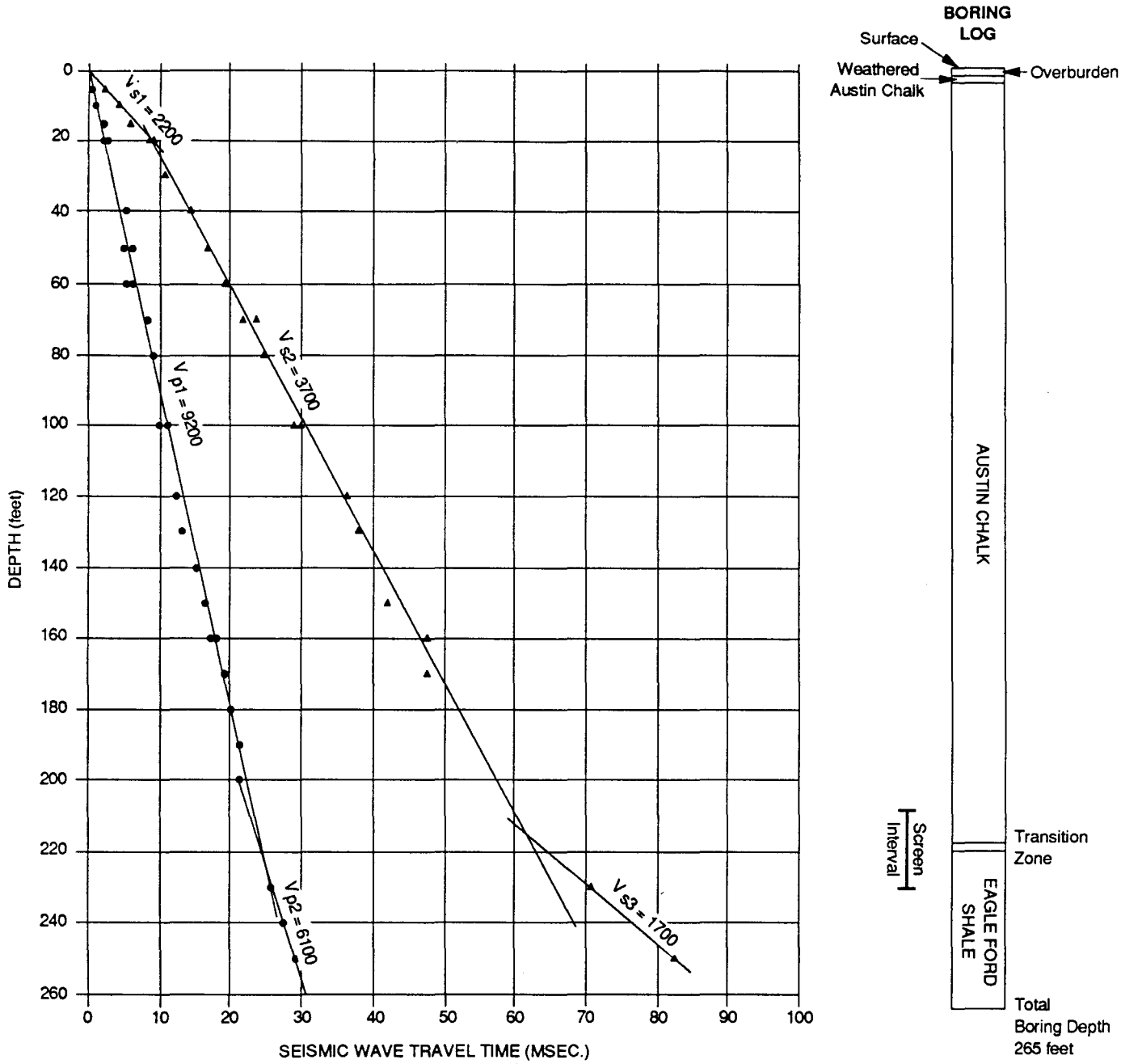
Project No.: 87-888-0015

RTK Joint Venture

Downhole Seismic Velocity Measurement Procedure

12-89

Figure F-1



EXPLANATION

▲ P WAVE ARRIVAL TIMES

● S WAVE ARRIVAL TIMES

NOTES

1. Vp - Compressional Wave Velocity (fps)
2. Vs - Shear Wave Velocity (fps)
3. Energy source to boring distance was 15-20 feet.

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Boring BIR 11
Downhole Velocity Survey
Data and Interpreted Results

1-90 Figure F-2

full-wave sonic logging, is 8,900 fps (feet/second). The downhole velocity survey identified a P velocity of 9,200 fps, about 3 percent greater than the sonic logging value. Two S wave velocity zones, 2,200 fps and 3,700 fps, were also identified. The 70-percent increase in S wave velocity below a depth of 20 feet probably indicates the more competent fresh Austin Chalk. This S wave velocity change is the result of stiffness and density changes within the chalk; it is not a formation change because the P velocity is constant.

The boring log indicates Eagle Ford Shale from depths of 217 to 265 feet (boring termination). The measured sonic logging P velocity for the shale is 6,400 fps. The downhole velocity survey identified a large P and S wave velocity inversion below an average depth of 218 feet. The shale P velocity is 6,100 fps (5 percent less than the sonic logging value) and the S velocity is 1,700 fps. Both shale velocities are at least 30 percent lower than velocities in the overlying chalk. All shale moduli are approximately half the corresponding chalk values.

A summary of seismic velocities and estimated dynamic elastic moduli are as follows:

Depth (ft)	Vp (fps)	Vs (fps)	Average Bulk Density (pcf)	Poisson's Ratio*	Shear Modulus* ($x10^5$ psi)	Constrained Modulus* ($x10^5$ psi)	Young's Modulus* ($x10^5$ psi)	Bulk Modulus* ($x10^5$ psi)
0-20	9200	2200	137.6	0.46	1.44	25.11	4.15	23.20
20-218	9200	3700	137.4	0.37	4.06	25.07	11.12	19.67
218-250	6100	1700	136.2	0.44	0.85	10.92	2.45	9.80

*Equations used to calculate Poisson's ratio and dynamic elastic moduli are listed below.

Poisson's Ratio, u (dimensionless) $$u = \frac{Vp^2 - 2Vs^2}{2(Vp^2 - Vs^2)}$$

Shear Modulus, G (psi) $$G = CDVs^2$$

Constrained Modulus, M (psi) $$M = CDVp^2$$

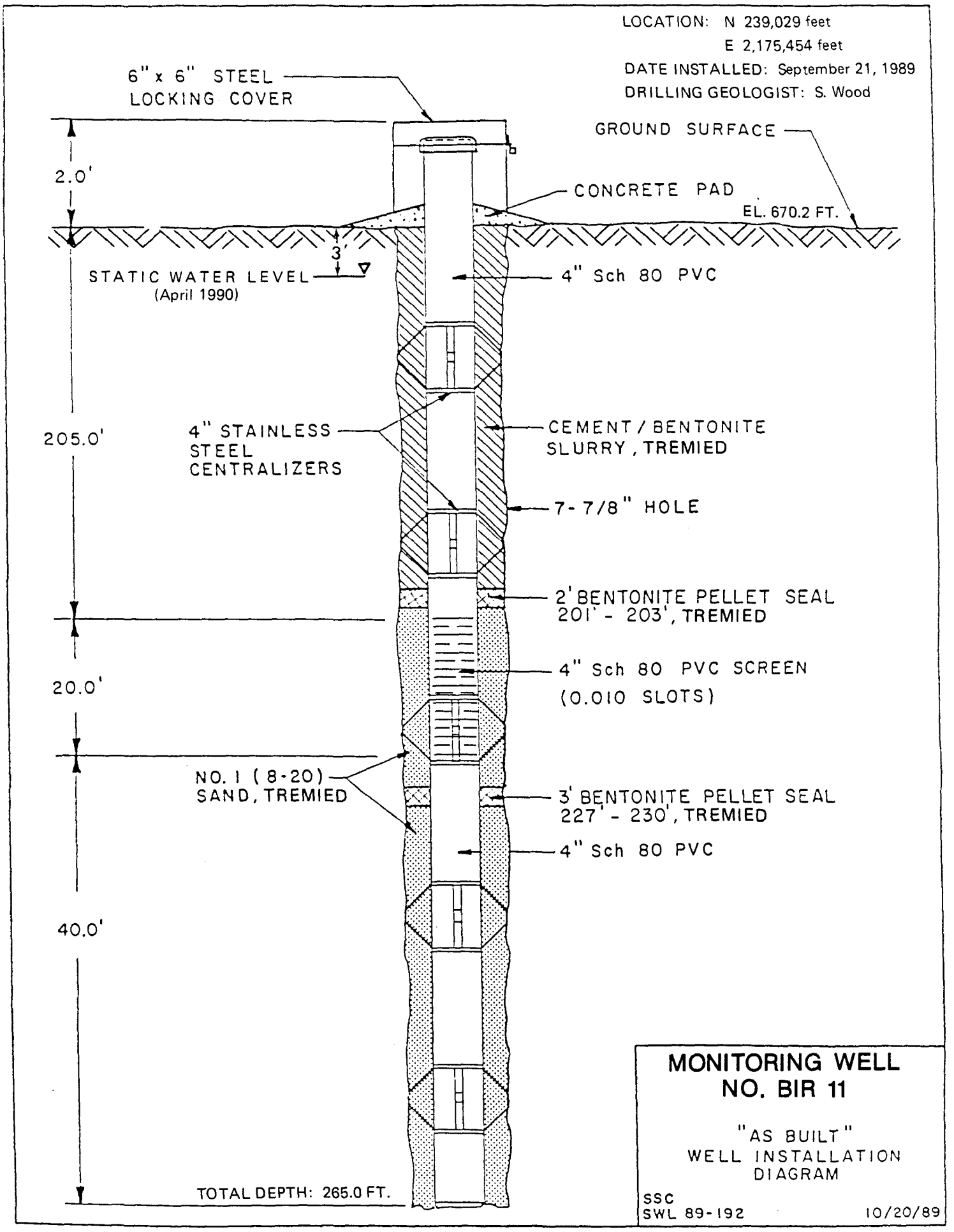
Young's Modulus, E (psi) $$E = 2G(1 + u)$$

Bulk Modulus, K (psi) $$K = CD(Vp^2 - 4/3Vs^2)$$

where: Vp = P wave velocity (fps)
Vs = S wave velocity (fps)
D = Bulk (wet) density (pcf)
C = 2.156×10^{-4} (units conversion)

APPENDIX G

WELL CONSTRUCTION AND ABANDONMENT


LOCATION: N 239,029 feet
E 2,175,454 feet
DATE INSTALLED: September 21, 1989
DRILLING GEOLOGIST: S. Wood
6" x 6" STEEL LOCKING COVER
GROUND SURFACE
2.0'
CONCRETE PAD
EL. 670.2 FT.
3'
STATIC WATER LEVEL
(April 1990)
4" Sch 80 PVC
205.0'
4" STAINLESS STEEL CENTRALIZERS
CEMENT / BENTONITE SLURRY, TREMIED
7-7/8" HOLE
2' BENTONITE PELLET SEAL 201' - 203', TREMIED
20.0'
4" Sch 80 PVC SCREEN (0.010 SLOTS)
NO. 1 (8-20) SAND, TREMIED
3' BENTONITE PELLET SEAL 227' - 230', TREMIED
4" Sch 80 PVC
40.0'
TOTAL DEPTH: 265.0 FT.
MONITORING WELL NO. BIR 11
"AS BUILT" WELL INSTALLATION DIAGRAM
SSC
SWL 89-192
10/20/89

SSC BOREHOLE PLUGGING REPORT

TETC Project No. 87-888-0015

Task No. 15

Boring No. BIR 12

Texas Coordinate Location: N 239,008 feet E 2,175,582 feet

Surface Elevation: 667.5 feet

Total Boring Depth: 341.5 feet

Plugging Remarks:

Boring grouted with cement/bentonite mixture @ 16 gallons water: 1 sack cement: 2 pounds bentonite. Grout mixture placed with PVC tremie pipe. 12 bags of cement used. Surface casing removed on completion of grouting.

Date Plugged: 9-19-89

Time Completed: 2:00 pm

Drilling Geologist: Scott E. Lesikar

MJA Coordinator: W. D. Flanigan

MJA No.: 5530.15

SSC BOREHOLE PLUGGING REPORT

Project No. 87-888

Task No. 15

Boring No. BIR 13

Texas Coordination Location: N 238,844 feet
E 2,175,494 feet

Surface Elevation: 669.9 feet

Total Boring Depth: 304.0 feet

Date Drilled: 1/23/90-3/1/90

Date Plugged: 3/3/90

Time Completed: 10:30 a.m.

Remarks:

323 gallons of grout (tremie placed) was used to completely cement boring from bottom to top. Water/cement ratio was approximately 7 gallons per sack.

Drilling geologist: Mike Granger
Coordinator: Shawn Wood
SwL Report No. 89-192

SSC BOREHOLE PLUGGING REPORT

Project No. 87-888

Task No. 15

Boring No. BIR 14

Texas Coordination Location: N 239,199 feet
E 2,175,518 feet

Surface Elevation: 667.5 feet

Total Boring Depth: 303.0 feet

Date Drilled: 2/26/90-3/2/90

Date Plugged: 3/3/90

Time Completed: 10:30 a.m.

Remarks:

323 gallons of grout (tremie placed) was used to completely cement boring from bottom to top. Water/cement ratio was approximately 7 gallons per sack.

Drilling geologist: Dale Brown
Coordinator: Shawn Wood
SwL Report No. 89-192