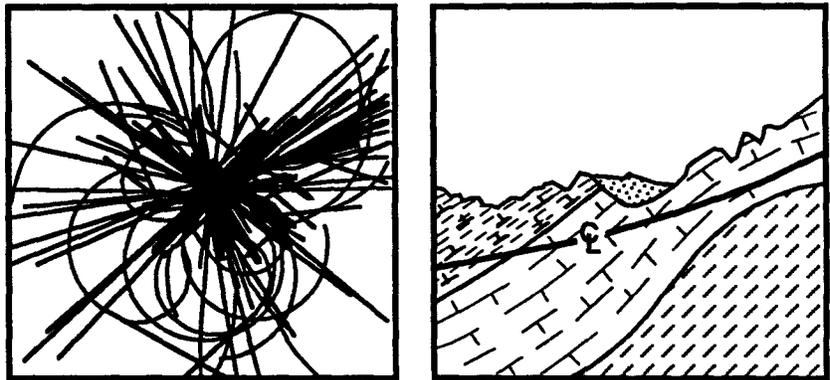


Data Report for Corehole BF 4



Prepared by:  **The Earth Technology Corporation**
Long Beach, California

Prepared for: **RTK** a joint venture
Oakland, California

FOREWORD

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

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

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

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

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

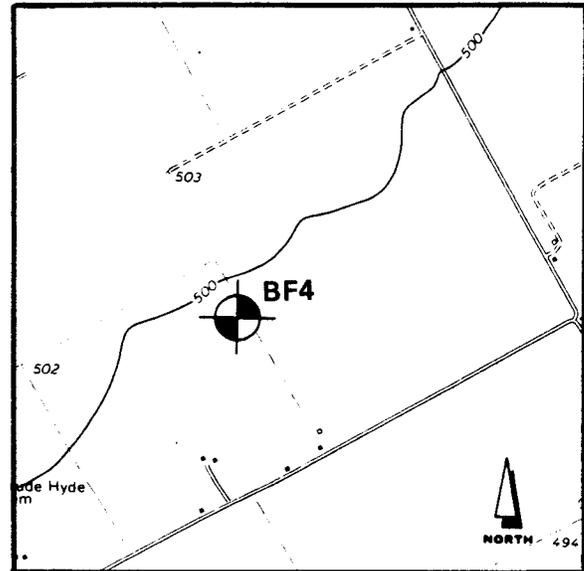
DATA REPORT

Site Designator: BF 4

Objective: Drill a corehole at the proposed shaft location and determine geotechnical conditions through in-situ hydrological testing and laboratory geomechanical testing.

Location: North 290,237 feet
East 2,236,629 feet
Surface Elevation 501.7 feet

BF 4 is located on the northeastern section of the proposed tunnel alignment, approximately 4.5 miles northwest of Palmer, Texas.



SCALE 1:24,000

0 1000 2000 3000 4000 Feet

CONTOUR INTERVAL 10 FEET

Scope and Schedule:	Coring (full depth)	March 23 to April 4, 1990
	Wire-line Logging	April 4, 1990
	Hydrologic Testing	April 6, 1990
	Laboratory Testing	April 11 to 26, 1990
	Well Construction	April 9 to 18, 1990

Conditions Encountered: (see lithologic log, Appendix A)

Total Hole Depth:	310.0 feet
Soil:	0.0 to 50.5 feet
Weathered Austin Chalk:	50.5 to 54.0 feet
Fresh Austin Chalk:	54.0 to 310.0 feet
Static Water Level:	Measured at 497.6 feet above MSL (4.1 feet below ground surface) on June 25, 1990, 68 days after the well was air-lifted to approximately 217.7 feet above MSL.

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

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

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

Vertical Depth (ft)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/Lithology	Hydraulic Conductivity (cm/sec)
132.0-152.0	160	15	Austin Chalk	1.8×10^{-7}

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

Vertical Depth (ft)	Formation/Lithology	Moisture Content (%)	Dry Density (pcf)	*Compressive Strength (psi)	Tangent Young's Modulus E ₅₀ (psi x 10 ⁵)	Brazil Tensile Strength (psi)
36-49	Silty Clay	19-30	94-111	5-19		
57-58	Austin Chalk	12-13	123-140	1535-2123	1.5-3.2	
97	Austin Chalk	10-12	127	2695	4.9	285
140	Austin Chalk	11	130			
150-152	Austin Chalk	9-13	124-133	2029-3296 ⁽²⁰⁰⁾	1.9-8.0 ⁽²⁰⁰⁾	230
201	Austin Chalk	8-10	130	614	1.1	314
261	Austin Chalk	8-9	136	1841	3.0	
303	Austin Chalk	8-9	134	3497	5.4	314

*UU triaxial test indicated by confining pressure in parentheses.

Hole Status: A monitoring well was installed in the boring between April 9 and 18, 1990 (see Appendix E).

APPENDIX A
LITHOLOGIC LOG

LOG OF BORING

BORING NO: BF 4 PG 2 OF 8

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

LOCATION: N 290,237 ft.
 E 2,236,629 ft.
 GROUND EL: 501.7 ft.

DATE: 3/23-4/4/90 TYPE: NX Core CASED TO: 20.0' CONTRACTOR: SwL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					See p. 1 of 8	
DESCRIPTION OF STRATUM										
45										CLAY, fine sandy to silty, tan with traces of medium to coarse rounded gravel fragments and occasional iron oxide stains.
50										49.5
55		C1	55.0		90	90				50.5
60			60.0							LIMESTONE (Austin Chalk) severely weathered, moderately fractured, light tan.
65		C2			89	89				54.0
70			70.0							LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light tan to dark gray with 0.5' thick moderately argillaceous limestone interbeds 0.6' to 8' apart. Also bentonitic clay layers.
75		C3			97	97				-weathered tan layer, sharp contact at 56.3' to gradational contact at 56.9' -moderately argillaceous layer, gradational contacts at 57.5'-58.3' -moderately argillaceous layer, soft, fresh, medium to light gray, gradational contacts at 66.5'-67.1' -moderately argillaceous layer, soft, medium gray, gradational contacts at 67.7'-68.2' -trace bentonitic clay at 69.4' -moderately argillaceous layer, soft, medium gray, gradational contacts at 74.6'-75.3'
80		C4	80.0		95	95				

DRILLING GEOLOGIST Alan Dover ASSISTANT Gary White CHECKED BY Shawn Wood

LOG OF BORING

PROJECT:

CLIENT: Superconducting Supercollider
The Earth Technology Corporation

TASK NO.: 17

BORING NO: BF 4 PG 3 OF 8

LOCATION: N 290,237 ft.
E 2,236,629 ft.

GROUND EL: 501.7 ft.

DATE: 3/23-4/4-90 TYPE: NX Core CASED TO: 20.0' CONTRACTOR: SwL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 8
DESCRIPTION OF STRATUM										
-85	C4		80.0		95	95				<p>LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 1.5' thick slightly to moderately argillaceous limestone interbeds 9' apart. Also shale layers 0.1' thick, fossil partings, medium angle fractures.</p> <p>-fossil parting at 80.6'</p> <p>-pyrite nodule at 90.3'</p> <p>-shale layer (1"), soft, dark gray at 91.1'</p> <p>-65°, smooth, tight, slickensided fracture at 91.5'-91.8'</p> <p>-45°, smooth, tight, slickensided fracture at 91.9'-92.2'</p> <p>-45°, smooth, tight, slickensided fracture at 95.2'</p> <p>-fossil parting at 95.7'</p> <p>-50°, smooth, tight, slickensided fracture at 99.3'</p> <p>-fossil parting at 102.7'</p> <p>-fossil parting at 103.1'</p> <p>-moderately argillaceous layer, gradational contacts at 102.0'-102.6'</p> <p>-moderately argillaceous layer, medium gray, soft, sharp contact at 111.0' to gradational contact at 112.5'</p> <p>-shale layer, medium gray, soft, sharp contacts at 114.4'-114.5'</p> <p>-fossil parting at 118.55'</p>
-90			90.0							
-95	C5		90.0		100	100				
-100			100.0							
-105	C6		100.0		100	100				
-110			110.0							
-115	C7		110.0		100	100				
-120			120.0							

DRILLING GEOLOGIST Alan Dover ASSISTANT Gary White CHECKED BY Shawn Wood

LOG OF BORING

BORING NO: BF 4 PG 4 OF 8

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

LOCATION: N 290,237 ft.
 E 2,236,629 ft.
 GROUND EL: 501.7 ft.

DATE: 3/23-4/4-90 TYPE: NX Core CASED TO: 20.0' CONTRACTOR: SwL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT RQD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 8
DESCRIPTION OF STRATUM										
125		C8	120.0		96	96				LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 0.5' to 1' thick moderately argillaceous to shaly limestone interbeds 0.4' to 7' apart. Also fossil partings and medium, high angle fractures. -75°, tight, calcite filled, healed fracture at 120.3'-120.7' -fossil parting at 120.9' -75°, tight, healed fracture at 121.2'-121.6' -fossil parting at 124.1' -shaly limestone layer, soft, dark gray, sharp contacts at 127.2'-127.4' -shaly limestone layer, soft, dark gray, gradational contacts at 127.8'-128.3' -shaly limestone layer, soft, dark gray, sharp contact at 134.7' to gradational contact at 135.1' -moderately argillaceous layer, soft to medium, medium gray, gradational contacts at 142.2'-143.3' -50°, smooth, tight, slickensided fracture at 155.0'
130			130.0							
135		C9	130.0		100	100				
140			140.0							
145		C10	140.0		100	100				
150			150.0							
155		C11	150.0		100	100				
160			160.0							

DRILLING GEOLOGIST Alan Dover ASSISTANT Dale Brown Gary White CHECKED BY Shawn Wood

LOG OF BORING

BORING NO: BF 4 PG 5 OF 8

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

LOCATION: N 290,237 ft.
 E 2,236,629 ft.
 GROUND EL: 501.7 ft.

DATE: 3/23-4/4-90 TYPE: NX Core CASED TO: 20.0' CONTRACTOR: SwL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 8
DESCRIPTION OF STRATUM										
			160.0							LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 0.5' to 1' thick moderately argillaceous to shaly limestone interbeds 3' to 13' apart. Also bentonitic shale and fossiliferous layers 0.2' to 9' thick.
-165		C12			98	98				-moderately argillaceous layer, soft, medium gray, highly fossiliferous, sharp contact at 160.1' to gradational contact at 161.2' -fossil parting at 161.7'
-170			170.0							-moderately argillaceous layer, soft, medium gray, highly fossiliferous, gradational contact at 164.6' to sharp contact at 165.1' -highly fossiliferous from 160.0'-169.4'
-175		C13			98	98				-bentonitic shale layer, soft, dark gray, gradational contact at 174.1' to sharp contact at 174.4' -fossil parting at 176.9'
-180			180.0							-fossil partings at 180.5', 182.1', and 182.6' -moderately argillaceous layer, medium gray, soft sharp contact at 182.8' to gradational contact at 183.3' -fossil parting at 183.3'
-185		C14			99	99				-highly fossiliferous layer, sharp contacts at 186.4'-186.6'
-190			190.0							-shaly limestone layer, soft, dark gray, gradational contacts at 190.7'-191.1' -fossil partings at 191.3', 192.9', 193.6', and 194.7'
-195		C15			97	97				
-200			200.0							

DRILLING GEOLOGIST Alan Dover ASSISTANT Dale Brown CHECKED BY Shawn Wood

LOG OF BORING										BORING NO: BF 4 PG 6 CF 8	
PROJECT: Superconducting Supercollider										LOCATION: N 290,237 ft.	
CLIENT: The Earth Technology Corporation										E 2,236,629 ft.	
TASK NO.: 17										GROUND EL: 501.7 ft.	
DATE: 3/23-4/4/90 TYPE: NX Core					CASED TO: 20.0'		CONTRACTOR: SwL (89-192)				
DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION	
			TOP	BOT.					S = SPLIT SPOON TUBE T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 8	
DESCRIPTION OF STRATUM											
			200.0							LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 1' thick slightly argillaceous to shaly limestone interbeds 20' apart. Also fossiliferous layers 1.5' thick, fossil partings.	
-205		C16			100	100				-fossil partings at 201.2', 206.1, and 209.45'	
-210			210.0							-slightly argillaceous layers, light to medium gray, gradational contacts at 206.2'-207.5'	
-215		C17	210.0		100	100				-fossil partings at 213.2' and 216.0'	
-220			220.0							-fossil partings at 220.6', 223.0', and 224.3'	
-225		C18	220.0		100	100				-shaly limestone layer, soft to medium, medium gray to dark gray, gradational contacts at 227.0'-228.0'	
-230			230.0							-fossil partings at 226.4' and 228.8'	
-235		C19	230.0		100	100				-highly fossiliferous layer, gradational contact at 230.4' to sharp contact at 231.9'	
-240			240.0							-fossil partings at 231.9', 232.1' and 234.3'	
										-pyrite nodule at 235.8'	

DRILLING GEOLOGIST Alan Dover ASSISTANT Dale Brown CHECKED BY Shawn Wood

LOG OF BORING

PROJECT: CLIENT: Superconducting Supercollider The Earth Technology Corporation TASK NO.: 17	BORING NO: BF 4 PG 7 OF 8 LOCATION: N 290,237 ft. E 2,236,629 ft. GROUND EL: 501.7 ft.
--	---

DATE: 3/23-4/4-90 TYPE: NX Core CASED TO: 20.0' CONTRACTOR: SwL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					See p. 1 of 8	
DESCRIPTION OF STRATUM										
245	C20		240.0		99	99				LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray gray with 0.3' to 2' thick moderately argillaceous to shaly limestone interbeds 0.5' to 10' apart. Also fossil partings, bentonite seam. -shaly limestone layer, soft, medium gray, sharp contacts at 214.2'-241.7' -fossil partings at 240.5', 243.4', 244.0', and 245.6' -shaly limestone layer, soft, fissile, gradational contacts at 246.1'-246.6' -fossil partings at 248.0'-248.5' -moderately argillaceous layer, medium gray, sharp contact at 250.0' to gradational contact at 250.3' -fossil parting at 250.8' -moderately argillaceous layer, soft, medium gray, gradational contacts at 253.0'-255.0' -fossil partings at 255.5', 257.1' and 258.4' -pyrite nodule (1½"), at 260.6' -shaly limestone layers, soft, fissile, dark gray, sharp contacts at 265.4'-266.0' and gradational contact at 266.5' to sharp contact at 266.8' -bentonite seam, soft, light gray at 266.8' -fossil partings at 271.0', 271.8' and 273.2' -moderately argillaceous layer, soft, dark gray, gradational contacts at 273.8'-274.7'
250			250.0							
255	C21		250.0		100	100				
260			260.0							
265	C22		260.0		94	94				
270			270.0							
275	C23		270.0		100	100				
280			280.0							

DRILLING GEOLOGIST Alan Dover ASSISTANT Dale Brown CHECKED BY Shawn Wood

LOG OF BORING

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

BORING NO: BF 4 PG 8 OF 8
 LOCATION: N 290,237 ft.
 E 2,236,629 ft.
 GROUND EL: 501.7 ft.

DATE: 3/23-4/4-90 TYPE: NX Core CASED TO: 20.0' CONTRACTOR: SwL (89-192)

DEPTH IN FEET	SYMBOL	SAMPLE TYPE & NUMBER	DEPTH RANGE		PERCENT REC.	PERCENT ROD.	STANDARD PENETRATION TEST PER 6 INCHES	HAND PEN. TSF.	SAMPLE LEGEND	WATER INFORMATION
			TOP	BOT.					S = SPLIT SPOON T = 2" THIN WALL TUBE U = 3" THIN WALL TUBE C = NX ROCK CORE	See p. 1 of 8
DESCRIPTION OF STRATUM										
285		C24	280.0		100	100				LIMESTONE (Austin Chalk), moderately to medium hard, fresh, light gray to dark gray with 0.2' to 0.4' thick moderately argillaceous limestone interbeds 12' apart. Also shale layers 0.1' thick, fossil partings, and pyrite nodules. -pyrite nodule at 290.7' -pyrite nodule at 293.3' -moderately argillaceous layer, soft, medium gray, at 294.0'-294.4' -fossil parting at 296.6'
290			290.0							
295		C25	290.0		99	99				
300			300.0							-shale layer, soft, dark gray, sharp contacts at 305.0'-305.1' -fossil parting at 305.7' -moderately argillaceous layer, soft, medium gray, gradational contacts at 308.0'-308.2' -pyrite nodule (1") at 308.6'
305		C26	300.0		100	100				
310			310.0							
315										Bottom of Exploration at 310.0 feet
320										

DRILLING GEOLOGIST Alan Dover ASSISTANT Dale Brown CHECKED BY Shawn Wood

APPENDIX B
WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BF 4

Log Measured From: Ground Level

Drilling Parameters

Depth 310.0 feet

Bit Diameter 4.0 inches

Logging Parameters

Electrical Log

Gamma Log

Sonic Log

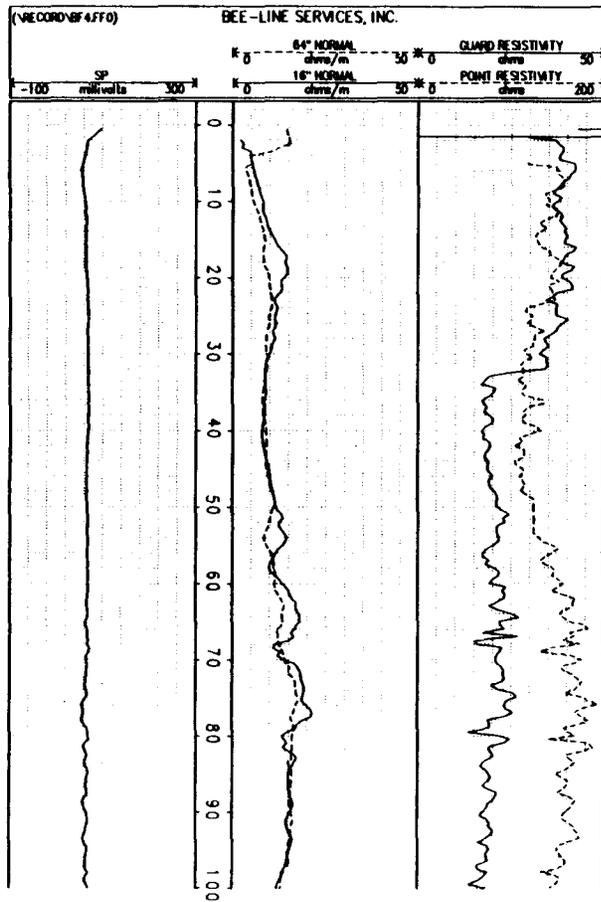
Date	April 4, 1990	April 4, 1990	April 4, 1990
Bottom Log Interval	304.5 feet	304.5 feet	293.0 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	drilling mud	drilling mud	drilling mud
Time Since Circulation Stop	1.5 hours	1.5 hours	1.5 hours
Probe Type/S.N.	ALP-4979	XAP-4383	CLP-4877A
Module Type/S.N.	ALM-4979	XAM-4383	CLM-4877A
Logging Speed	40 feet/min.	20 feet/min.	20 feet/min.
Sample Interval	0.5 foot	0.5 foot	0.5 foot

Logged by:

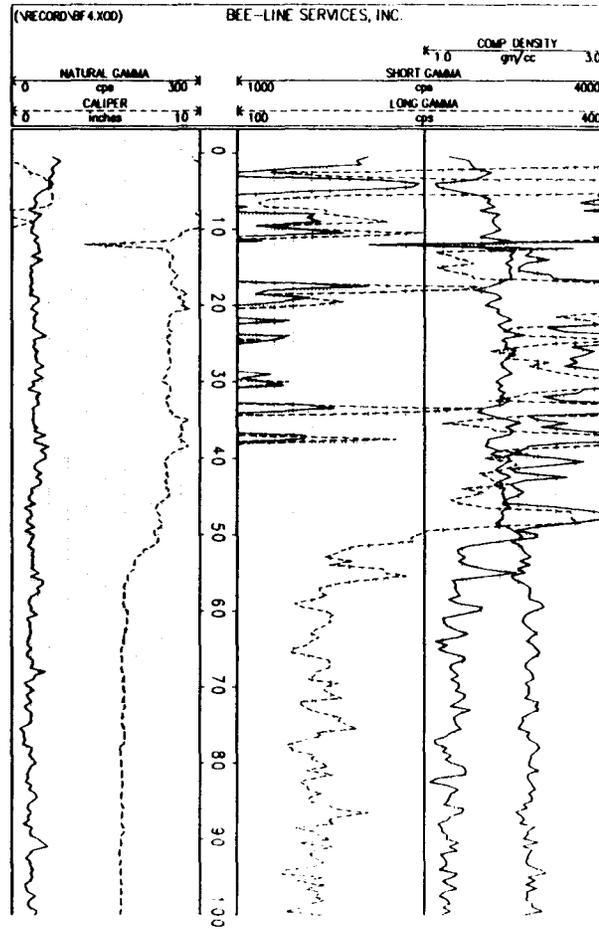
BEE-LINE SERVICES, INC.
P. O. Box 2096
Corsicana, TX 75151

BF 4 Wire-line logs run April 4, 1990. Surface elevation 501.7 feet.

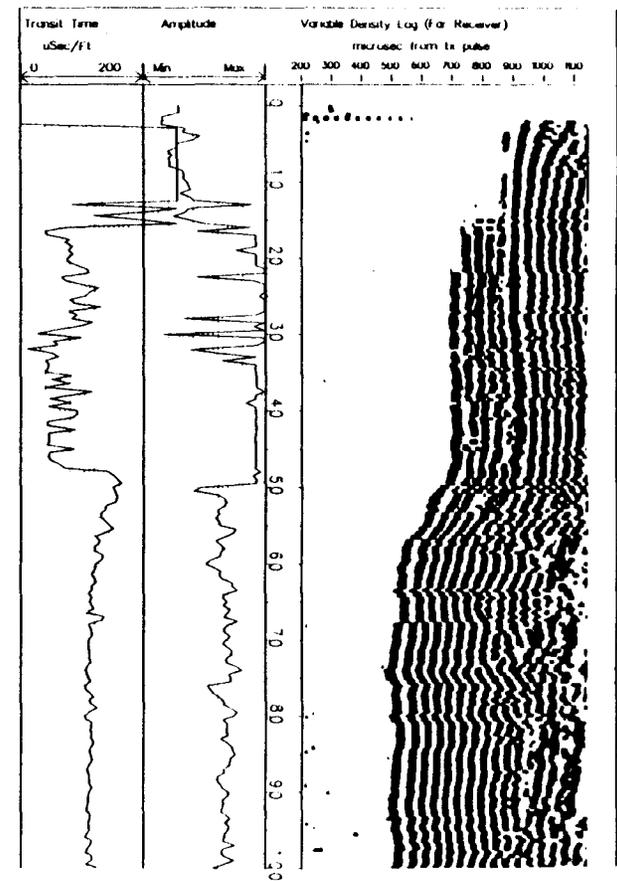
ELECTRICAL LOG



GAMMA LOG

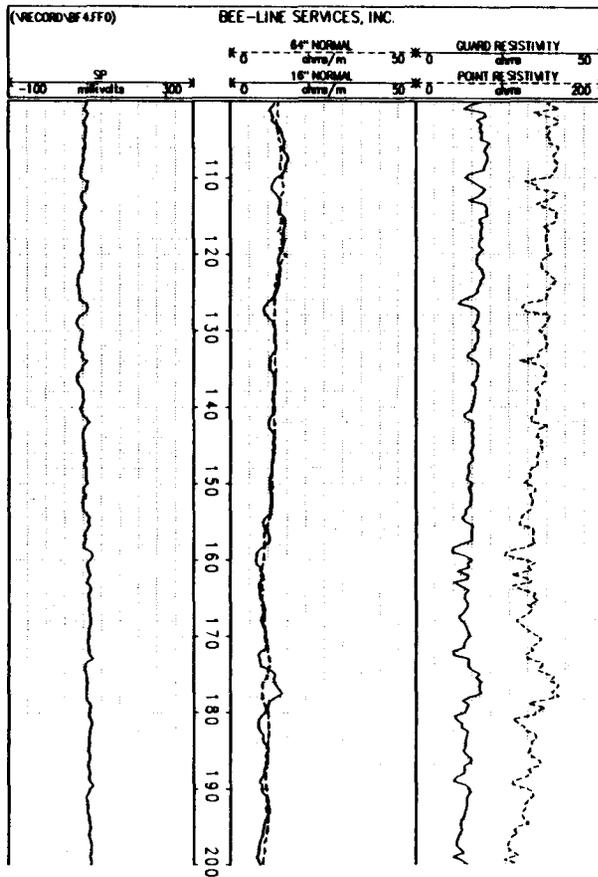


SONIC LOG

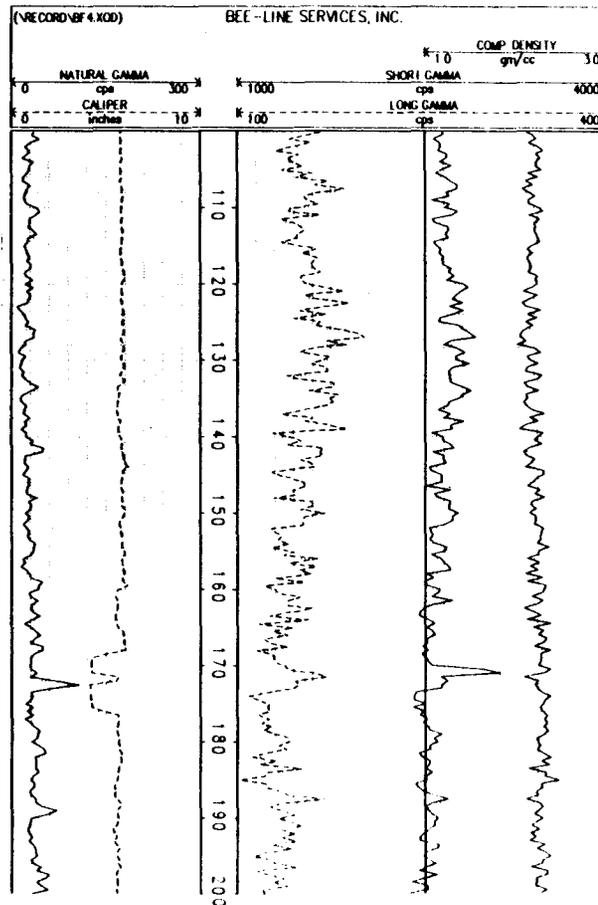


BF 4 Wire-line logs run April 4, 1990 (Continued). Surface elevation 501.7 feet.

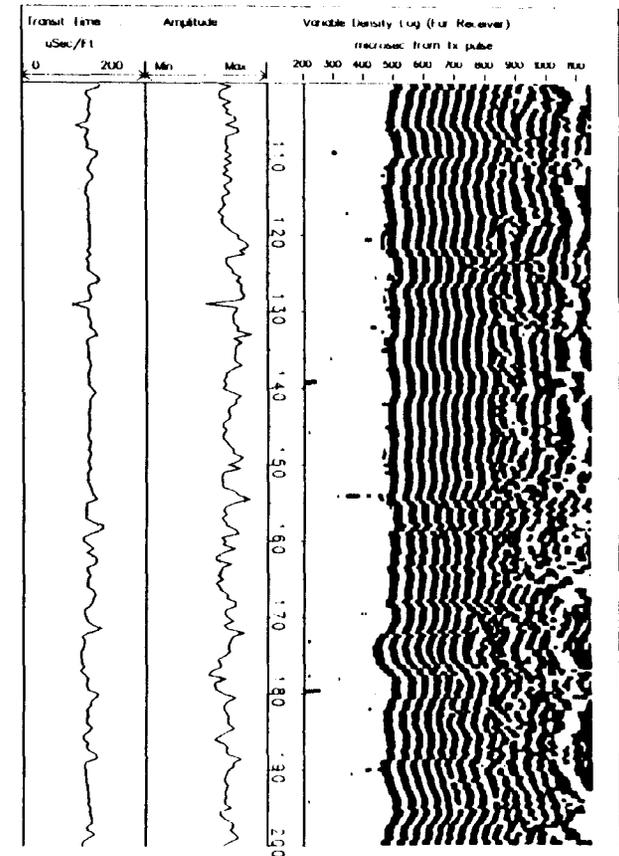
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED

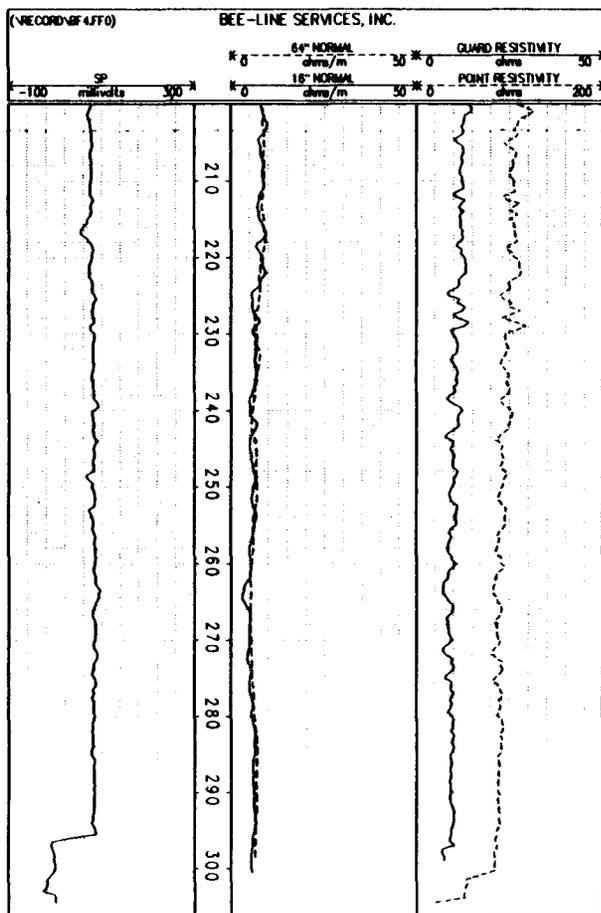


SONIC LOG CONTINUED

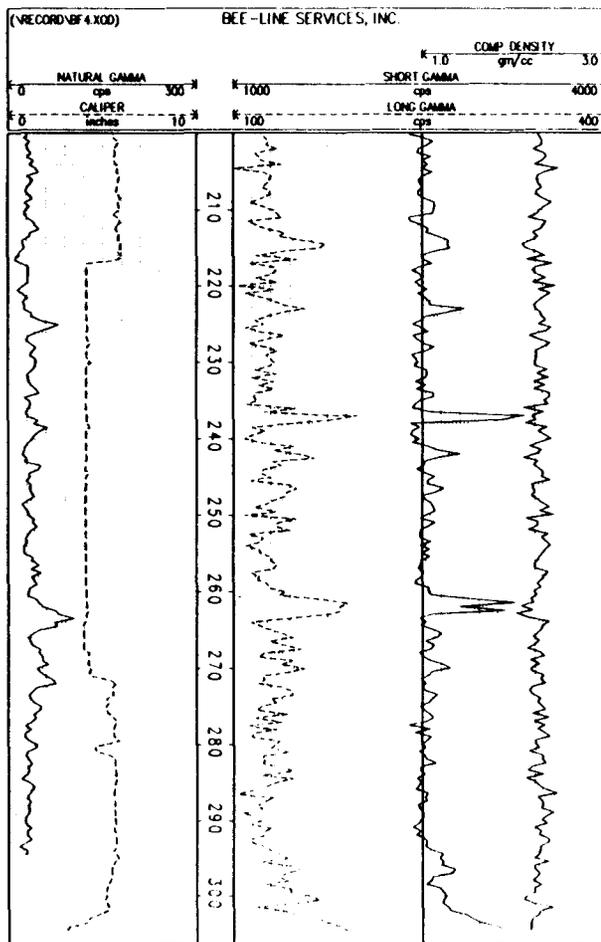


BF 4 Wire-line logs run April 4, 1990 (Continued). Surface elevation 501.7 feet.

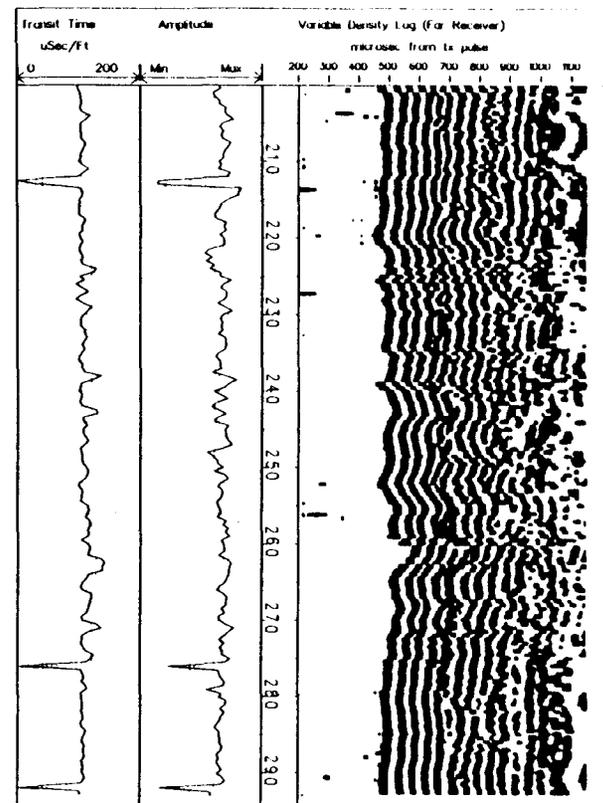
ELECTRICAL LOG CONTINUED



GAMMA LOG CONTINUED



SONIC LOG CONTINUED



APPENDIX C
HYDROLOGIC TEST RESULTS

APPENDIX C

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

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

Test Depth (feet)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/ Lithology	Hydraulic Conductivity (cm/sec)	Approximate Depth to Static Water Level (feet)
132.0-152.0	160	15	Austin Chalk	1.8×10^{-7}	4.1

At boring BF 4 one test interval was selected based on a review of the lithologic and wire-line logs. The test interval was selected to provide hydrologic data for unfractured Austin Chalk. Hydrologic (packer) testing followed the general procedures outlined above. Packer and gauge pressures are given in the table above, along with the calculated hydraulic conductivity based on an approximate static water level. Flow volumes were measured using a calibrated container.

APPENDIX D
LABORATORY RESULTS

GEOMECHANICAL TEST RESULTS - BORING BF 4

GENERAL LITHOLOGY	BORING DEPTH feet	MOISTURE CONTENT percent	DRY DENSITY pcf	SPECIFIC GRAVITY	ATTENBERG LIMITS		FRACTION FINER THAN # 200 SIEVE percent	CARBONATE CONTENT percent	SAMPLE DIMENSION RATIO L/D	SAMPLE FAILURE MODE/ DEGREES*	UNCONFINED COMPRESSIVE STRENGTH psi	TRIAXIAL COMPRESSION		FAILURE STRAIN percent	TANGENT E50 (psi)x10E5	YOUNG'S MODULUS UNLOAD/RELOAD (psi)x10E5	POISSON'S RATIO	BRAZIL TENSILE STRENGTH psi	2ND CYCLE SLAKE DURABILITY INDEX percent	MODIFIED TABER ABRASION INDEX	SWELL PRESSURE INDEX psi	COMMENTS	
					LL	PI						CONFINING PRESSURE σ_3 psi	DEVIATOR STRESS $\sigma_1 - \sigma_3$ psi										σ_3 psi
SILTY CLAY	36.1	22.5	102.8		39	21	95.8																
SILTY CLAY	37.2	22.3	104.8		40	22	95.4		2.0	C	19			5.56									
SILTY CLAY	38.0	23.0	106.8		42	23	95.5																
SILTY CLAY	38.4	23.8	97.3																			3.6	
SILTY CLAY	38.6	23.3	99.7																			3.6	
SILTY CLAY	41.0	29.8	94.3		44	26	91.8																
SILTY CLAY	42.0	25.5	96.7																				
SILTY CLAY	42.3				41	23	94.0																
SILTY CLAY	44.2	23.4	99.9		39	21	91.3																
SILTY CLAY	44.8	26.1	103.8						2.2	C	5	100	11.5	13.40									
SILTY CLAY	44.8	26.1	103.8											5.07									
SILTY CLAY	45.1	24.1	104.4		43	25	92.4																
SILTY CLAY	49.0	19.3	111.2																				
AUSTIN CHALK	57.0	12.9	123.1						2.2	B-4/30	2123			0.84	3.20		0					Note 1	
AUSTIN CHALK	58.0	12.3																					
AUSTIN CHALK	58.2	11.6	139.6						2.2	B-1/30	1535			1.12	1.51		0						
AUSTIN CHALK	96.8	11.6																					
AUSTIN CHALK	96.9	9.8							0.5									285					
AUSTIN CHALK	97.1	11.6	127.2						2.2	B-1/45	2695			0.62	4.89		0						
AUSTIN CHALK	140.1	10.7	130.3																				
AUSTIN CHALK	140.3																				0.742		
AUSTIN CHALK	150.4	10.9	129.9																				
AUSTIN CHALK	150.8	9.5	133.2						2.2	E/30	2029			1.15	1.67		0						
AUSTIN CHALK	151.2	12.0	126.0	2.68					2.2	D&E/20		100	3104	0.95	4.48		100						
AUSTIN CHALK	151.6	13.1	123.7						2.3	B-1/30		200	3296	0.60	6.98	8.3	200					Note 2	
AUSTIN CHALK	151.6													8.03	11.07		0.16(2)					Notes 3 and 4	
AUSTIN CHALK	152.0	12.4	124.4						0.5									230					
AUSTIN CHALK	201.2	9.1																					
AUSTIN CHALK	201.3	8.1							0.5									314					
AUSTIN CHALK	201.4	10.3	130.5						2.2	D	614			0.74	1.07		0					Shaly	
AUSTIN CHALK	261.0	9.4																					
AUSTIN CHALK	261.3	8.3	136.3						2.3	D	1641			0.70	3.00		0						
AUSTIN CHALK	303.0	8.7																					
AUSTIN CHALK	303.3	8.3							0.5									314					
AUSTIN CHALK	303.4	9.1	134.3	2.62					2.2	D	3497			0.83	5.41		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318	ASTM-D1140					ASTM-D2938		ASTM-D2664			ASTM-D3148		ASTM-3148	ASTM-D3967	ISRM	ISRM	ISRM	

BF4PRT21.WK1
REVISION: 2.1
DATE: 07/13/90

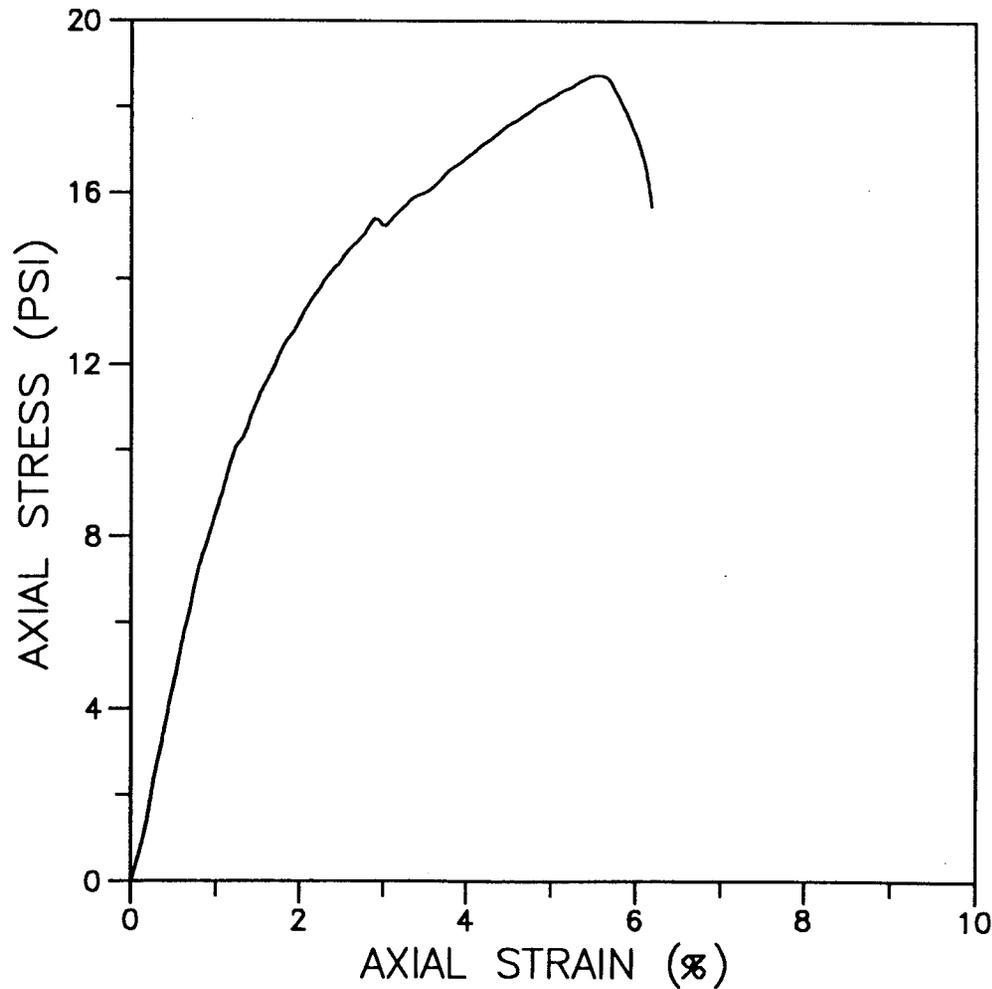
* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

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

- NOTES: 1) All moduli calculated from axial strains using a dial micrometer except where noted. Axial gage length is the sample length.
- 2) Triaxial compression test is cyclic with one unload/reload cycle.
- 3) Modulus and Poisson's ratio calculated from axial and lateral strains measured using LVDTs. Axial gage length is 2.8 inches.
- 4) For Poisson's ratio values: the value within parenthesis indicates the number of LVDTs recording lateral strains. Otherwise all 3 LVDTs recorded strains.

BORING NO: BF-4
DEPTH (FT): 37.2
TAN SILTY CLAY

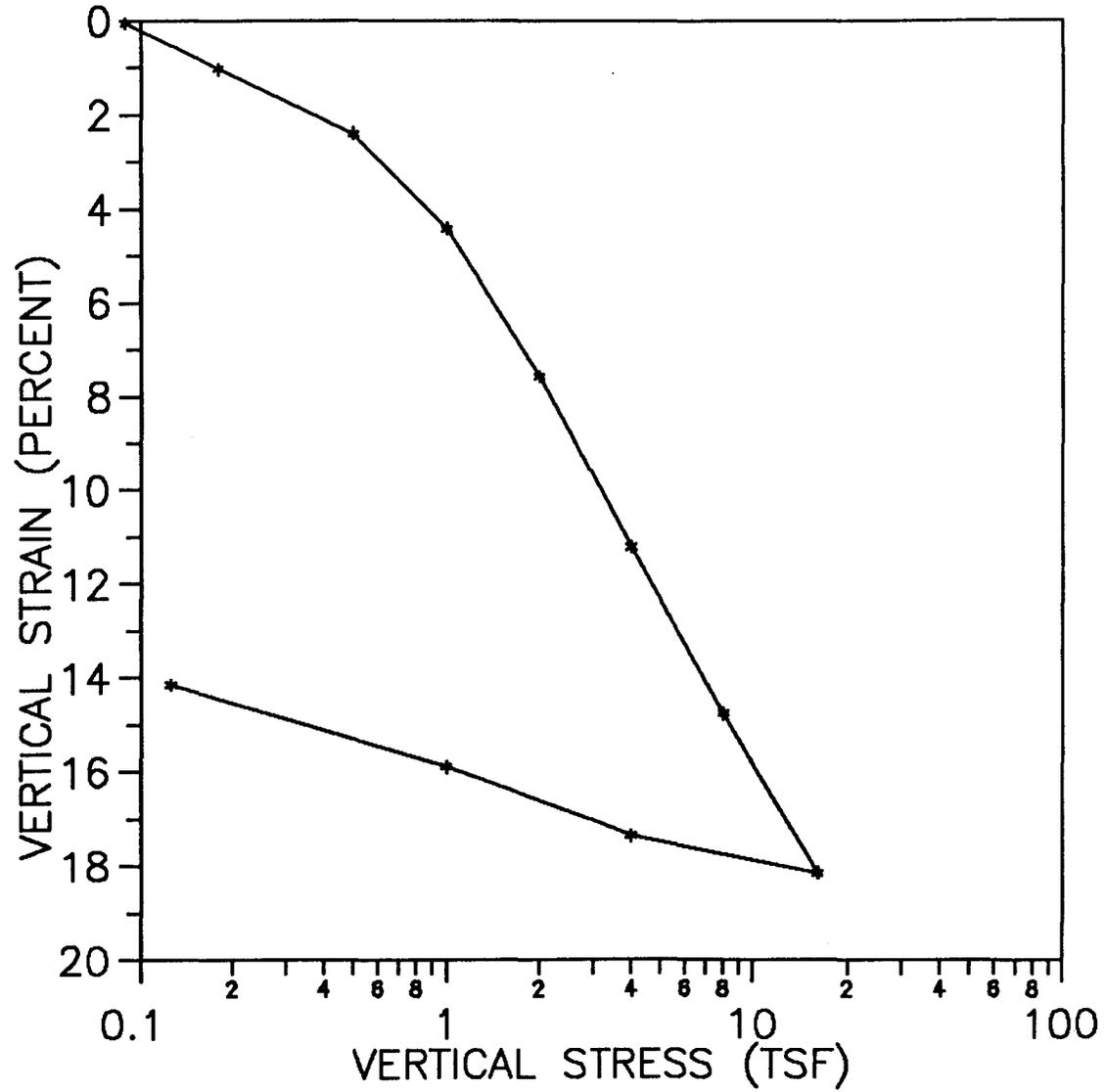
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 22.3
DRY UNIT WEIGHT (PCF): 104.8
DEG. OF SATURATION (%): 99.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D-2938)



FAILURE MODE:
DUCTILE FAILURE

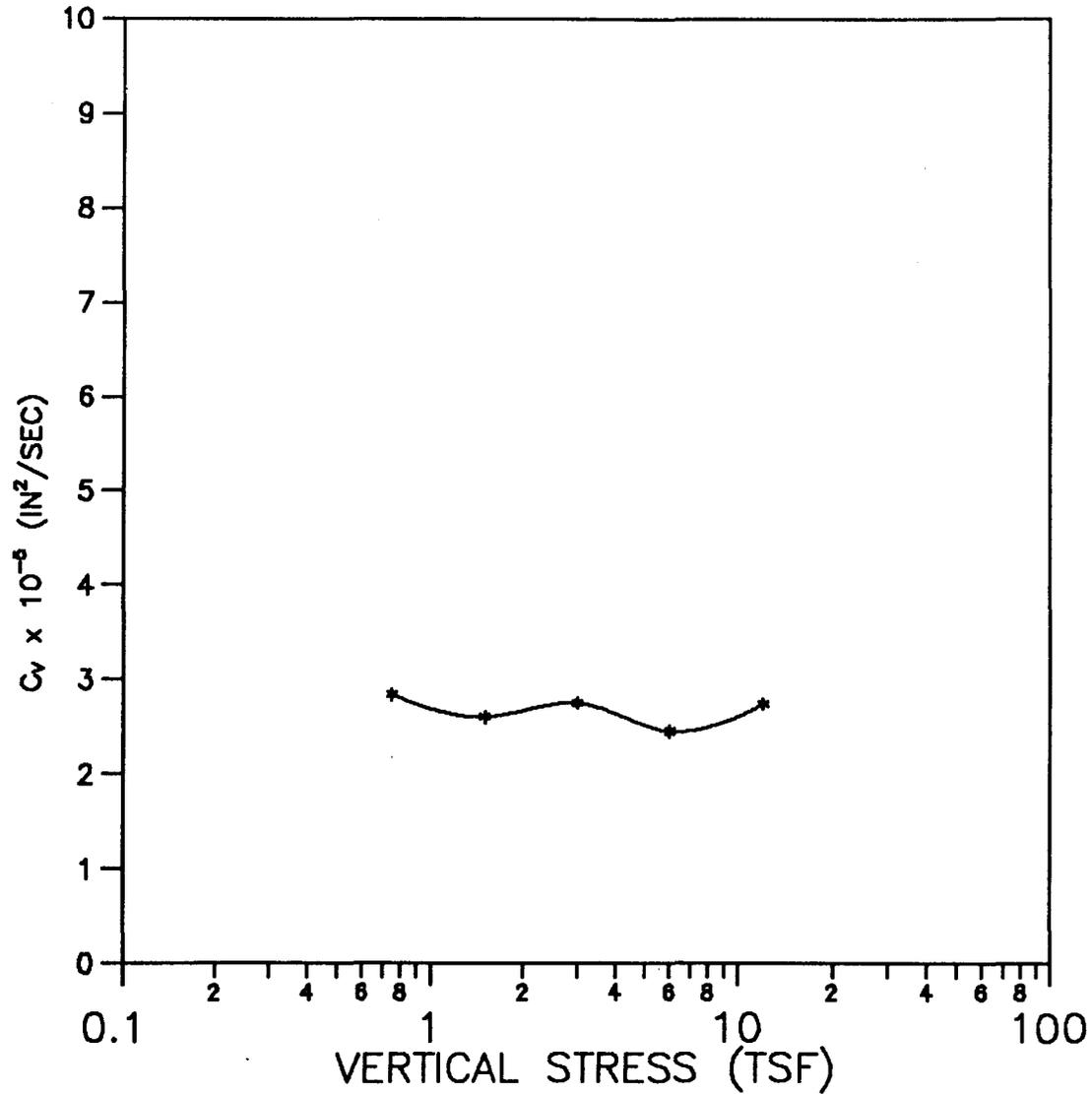
TEXAS SSC SITE
UNCONFINED COMPRESSION
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS
JOB NO.: 89-192
FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY



TEXAS SSC SITE
CONSOLIDATION TEST
SOUTHWESTERN LABORATORIES DALLAS, TEXAS
JOB NO.: 89-192
FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY



TEXAS SSC SITE

C_v vs. PRESSURE

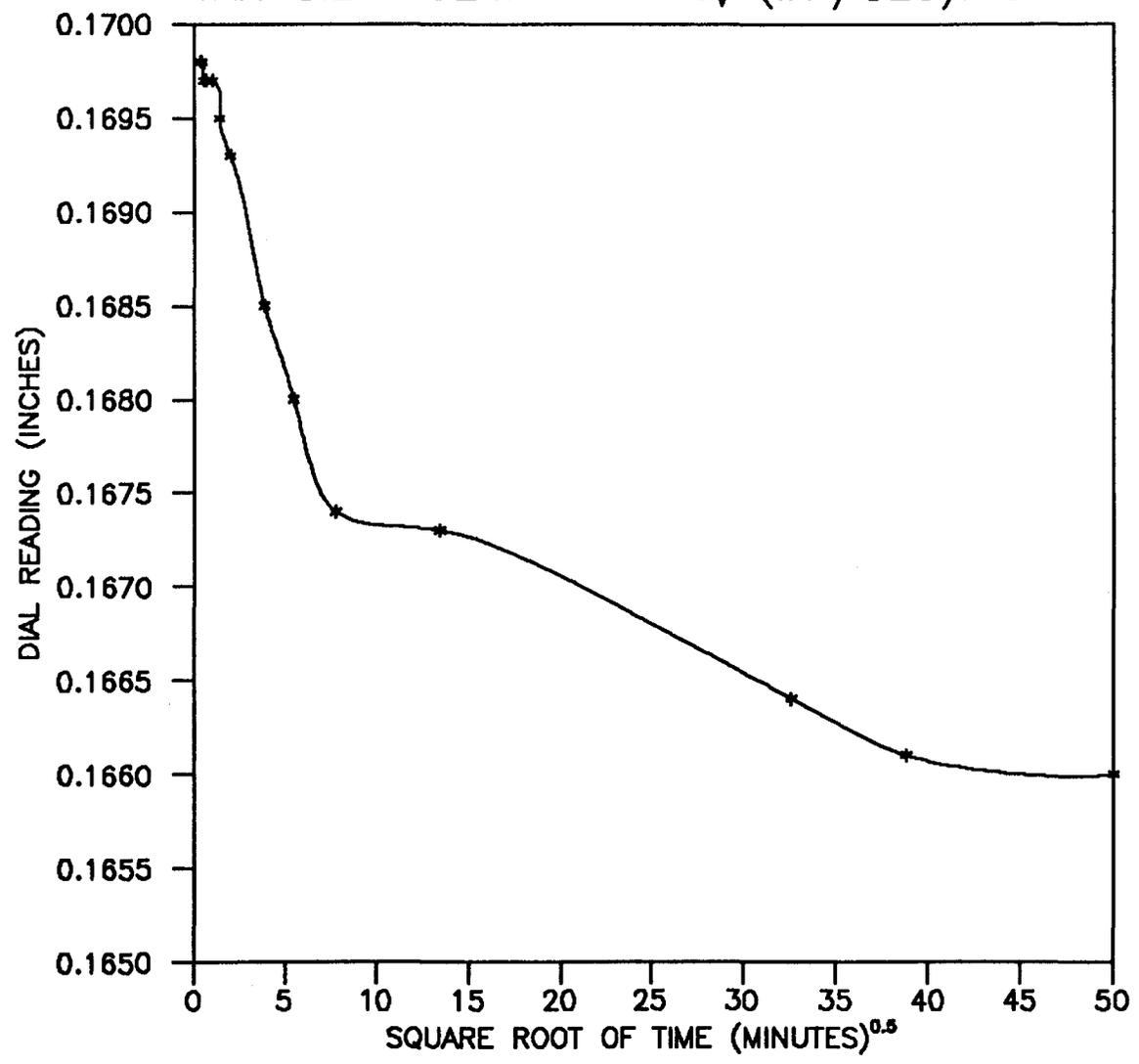
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

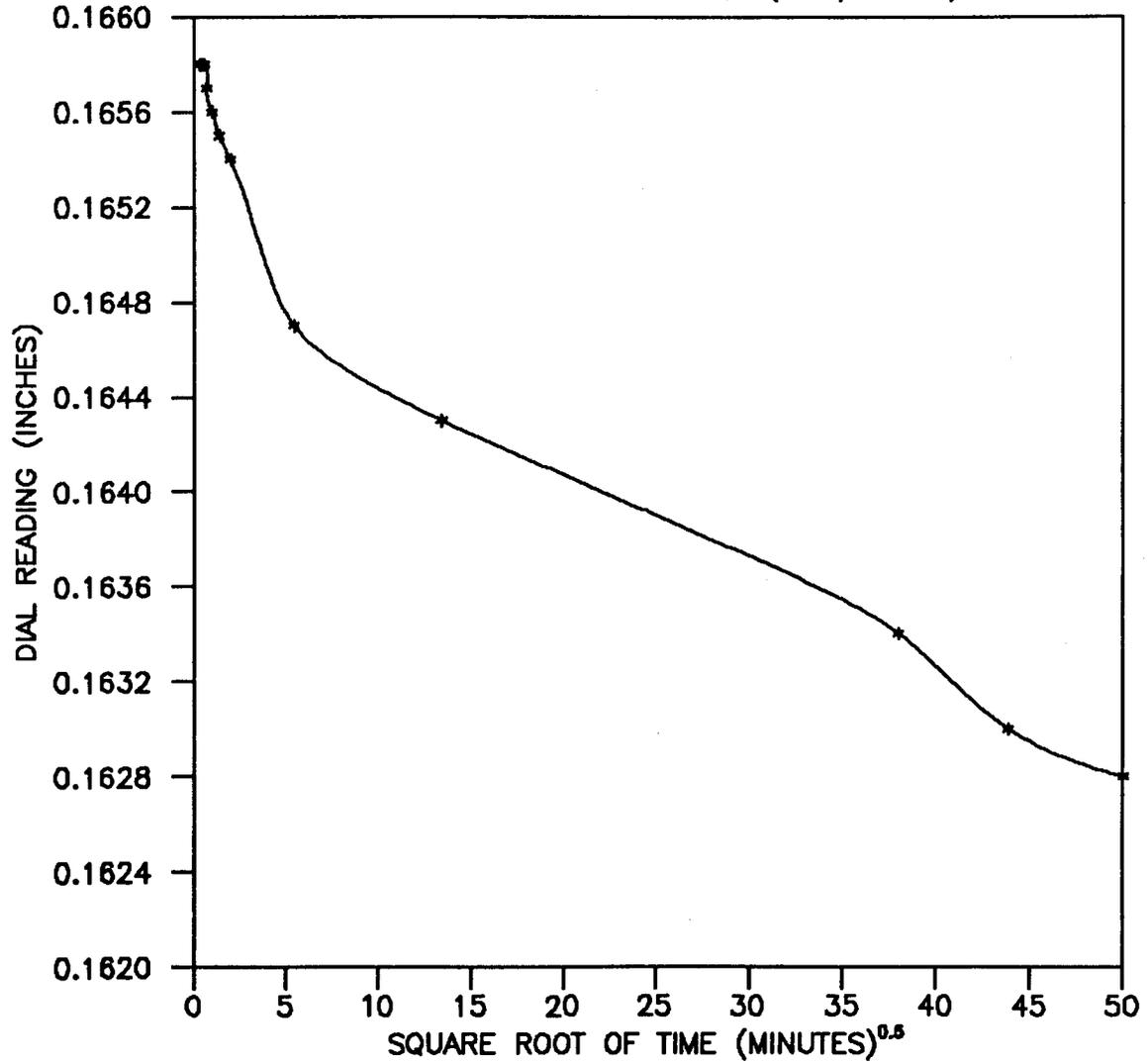
LOAD (TSF): 0.089
 C_v (IN²/SEC): 3.0×10^{-5}



TEXAS SSC SITE	
SQUARE ROOT OF TIME	
SOUTHWESTERN LABORATORIES	
DALLAS, TEXAS	
JOB NO.: 89-192	FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

LOAD (TSF): 0.1785
 C_v (IN²/SEC): 4.3×10^{-5}



TEXAS SSC SITE

SQUARE ROOT OF TIME

SOUTHWESTERN LABORATORIES

DALLAS, TEXAS

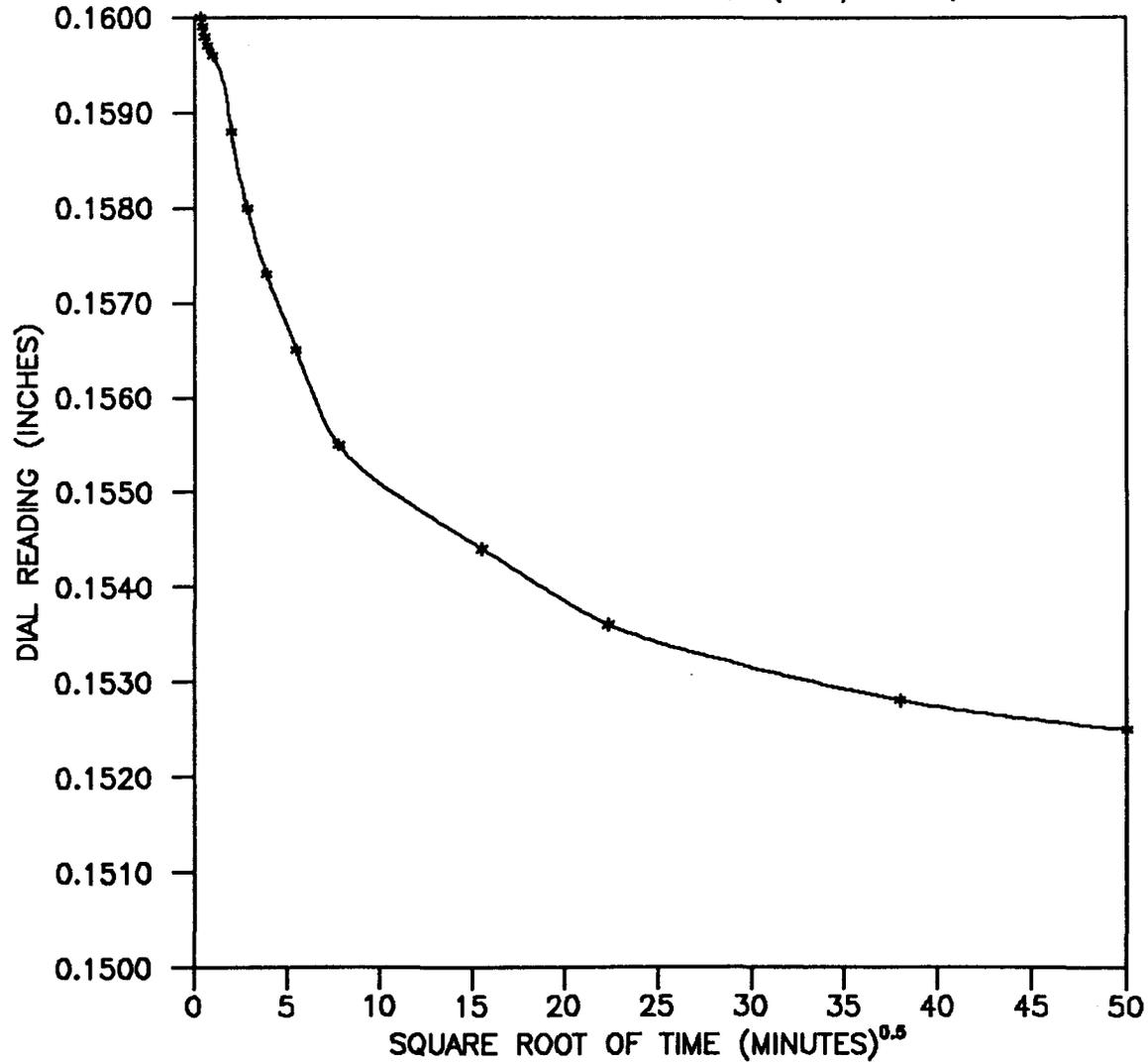
JOB NO.: 89-192

FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

LOAD (TSF): 0.5

C_v (IN²/SEC): 8.5×10^{-5}



TEXAS SSC SITE

SQUARE ROOT OF TIME

SOUTHWESTERN LABORATORIES

DALLAS, TEXAS

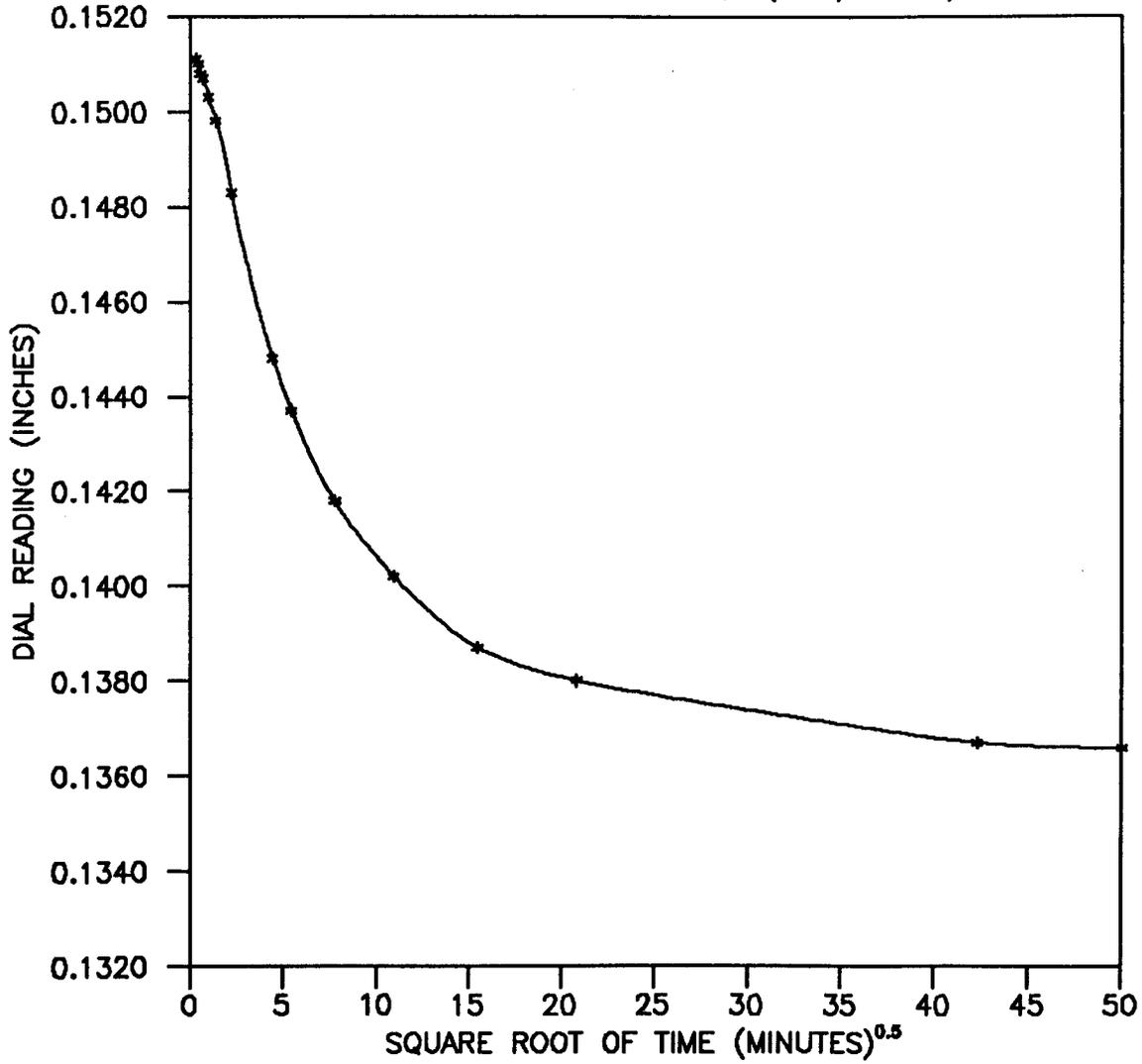
JOB NO.: 89-192

FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

LOAD (TSF): 1.0

C_v (IN²/SEC): 2.8×10^{-5}



TEXAS SSC SITE

SQUARE ROOT OF TIME

SOUTHWESTERN LABORATORIES

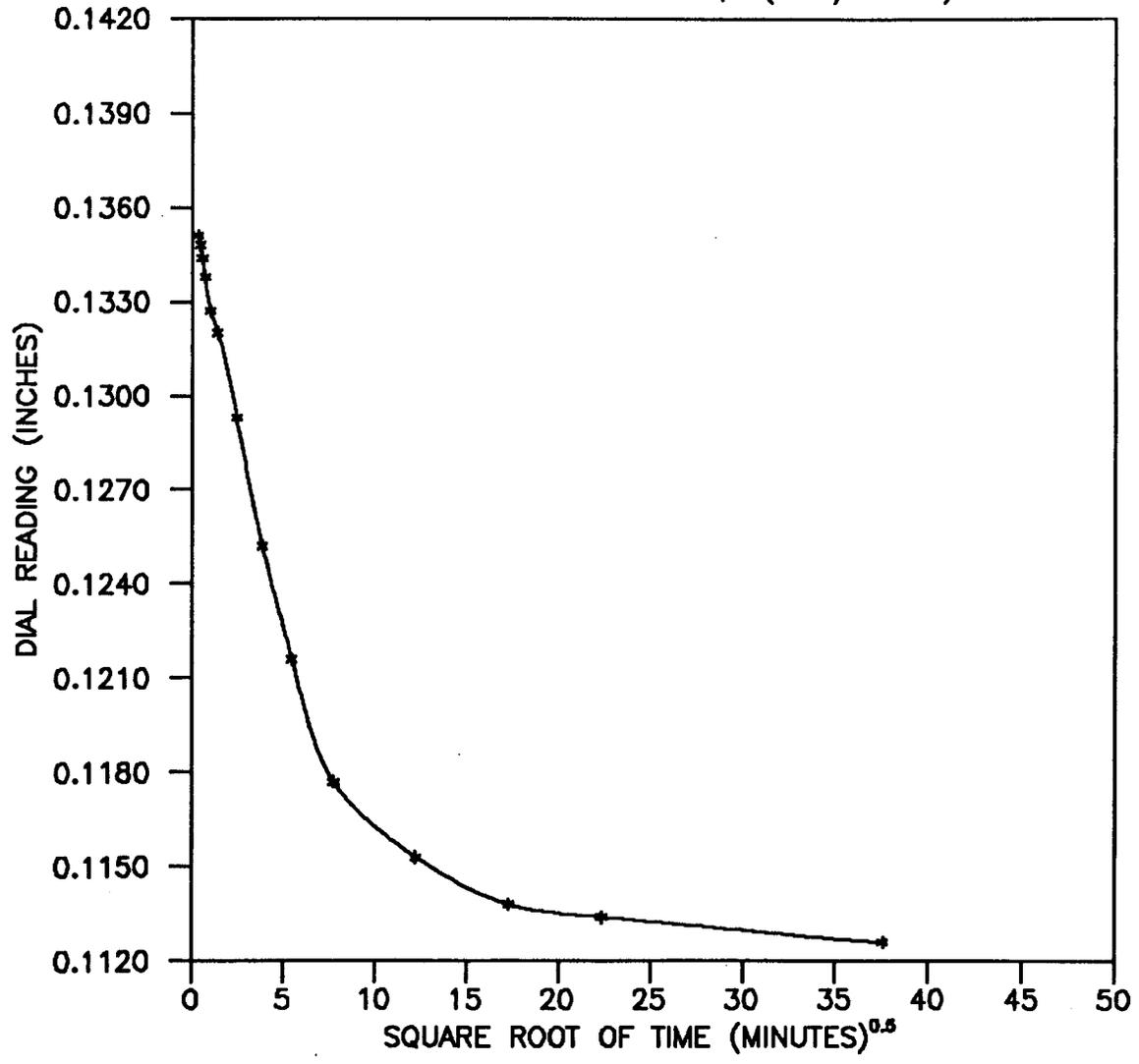
DALLAS, TEXAS

JOB NO.: 89-192

FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

LOAD (TSF): 2.0
 C_v (IN²/SEC): 2.6×10^{-5}

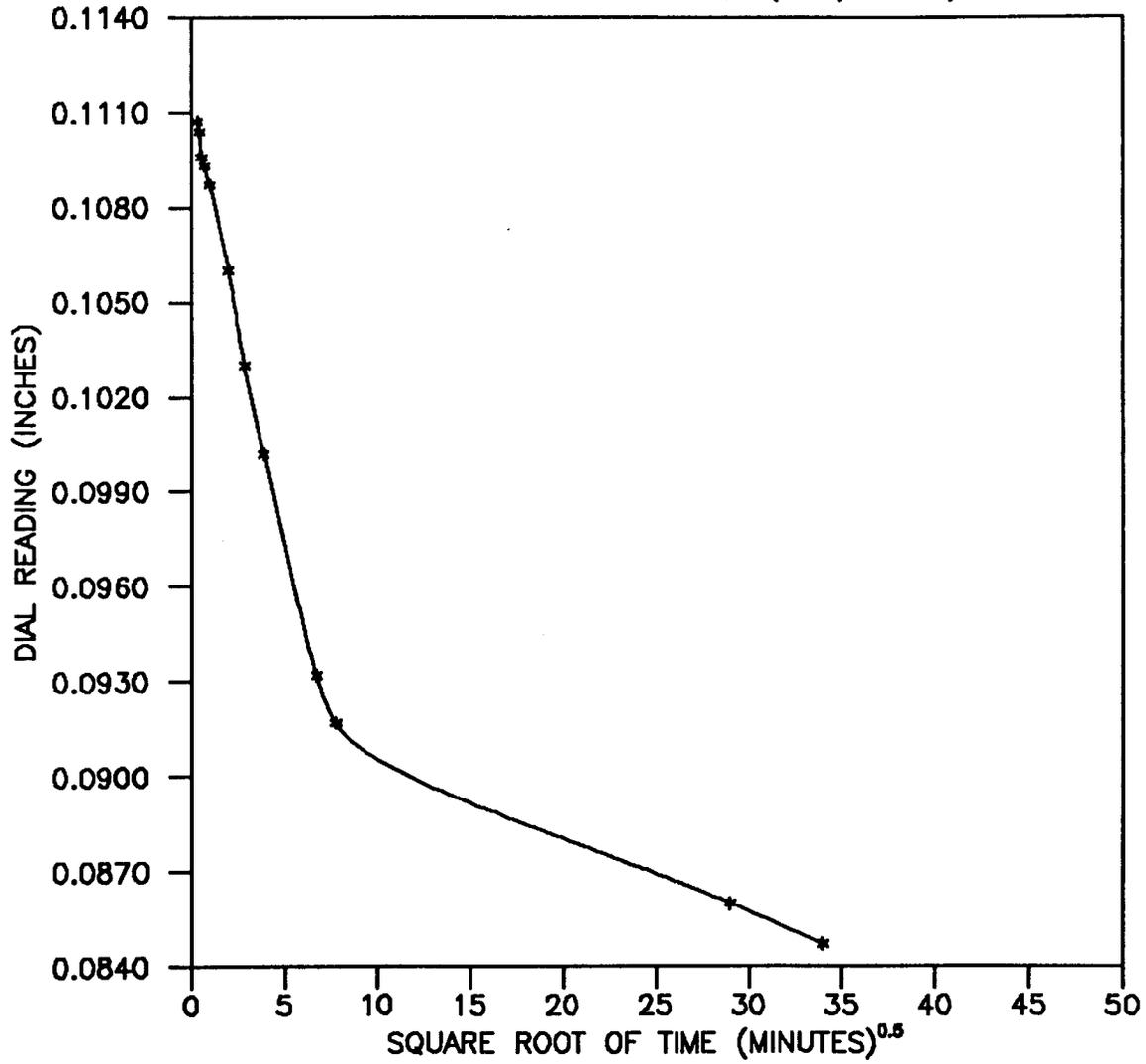


TEXAS SSC SITE
SQUARE ROOT OF TIME
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS
JOB NO.: 89-192
FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

LOAD (TSF): 4.0

C_v (IN²/SEC): 3.5×10^{-3}

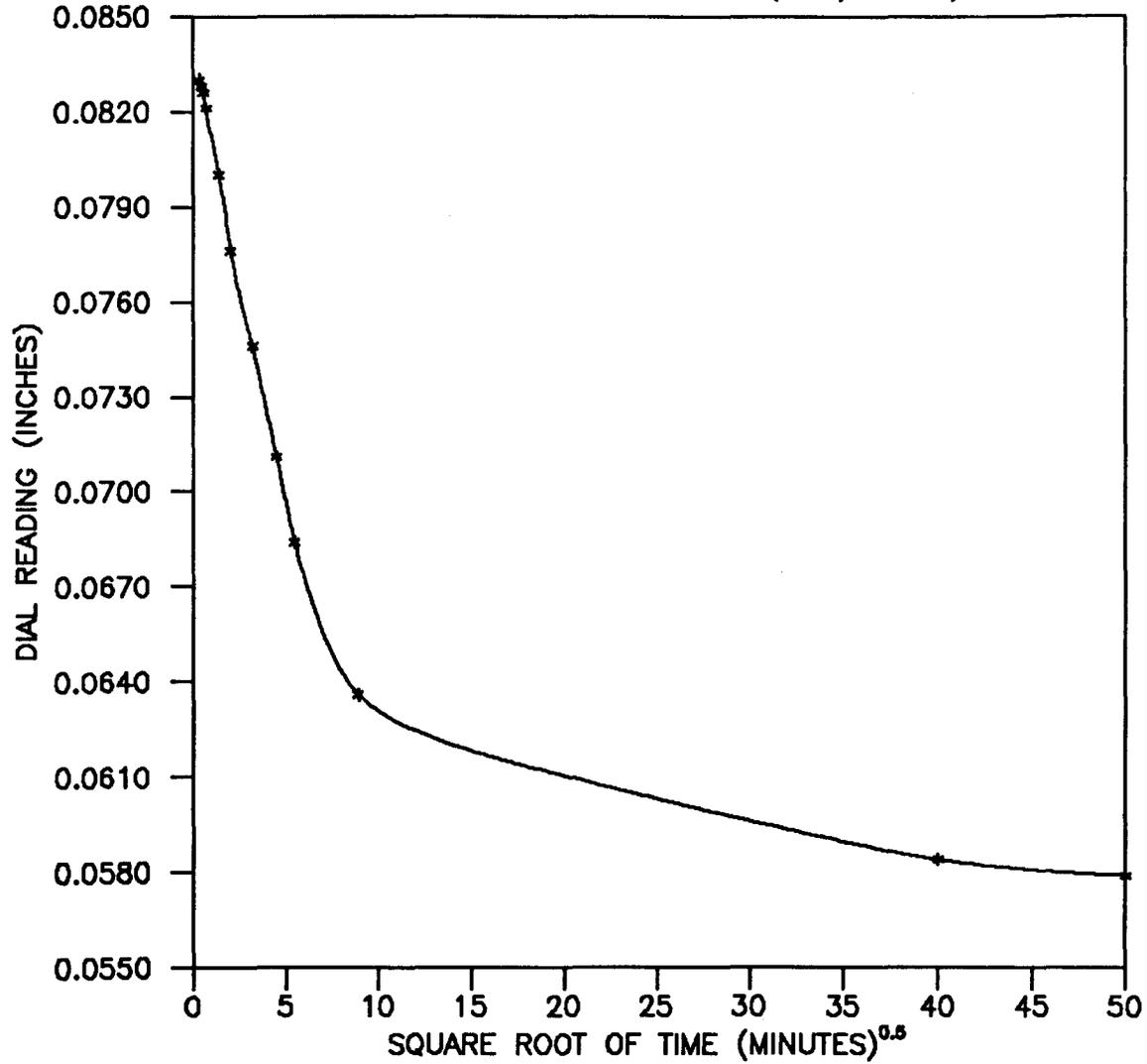


TEXAS SSC SITE
SQUARE ROOT OF TIME
SOUTHWESTERN LABORATORIES
DALLAS, TEXAS
JOB NO.: 89-192
FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

LOAD (TSF): 8.0

C_v (IN²/SEC): 2.5×10^{-5}

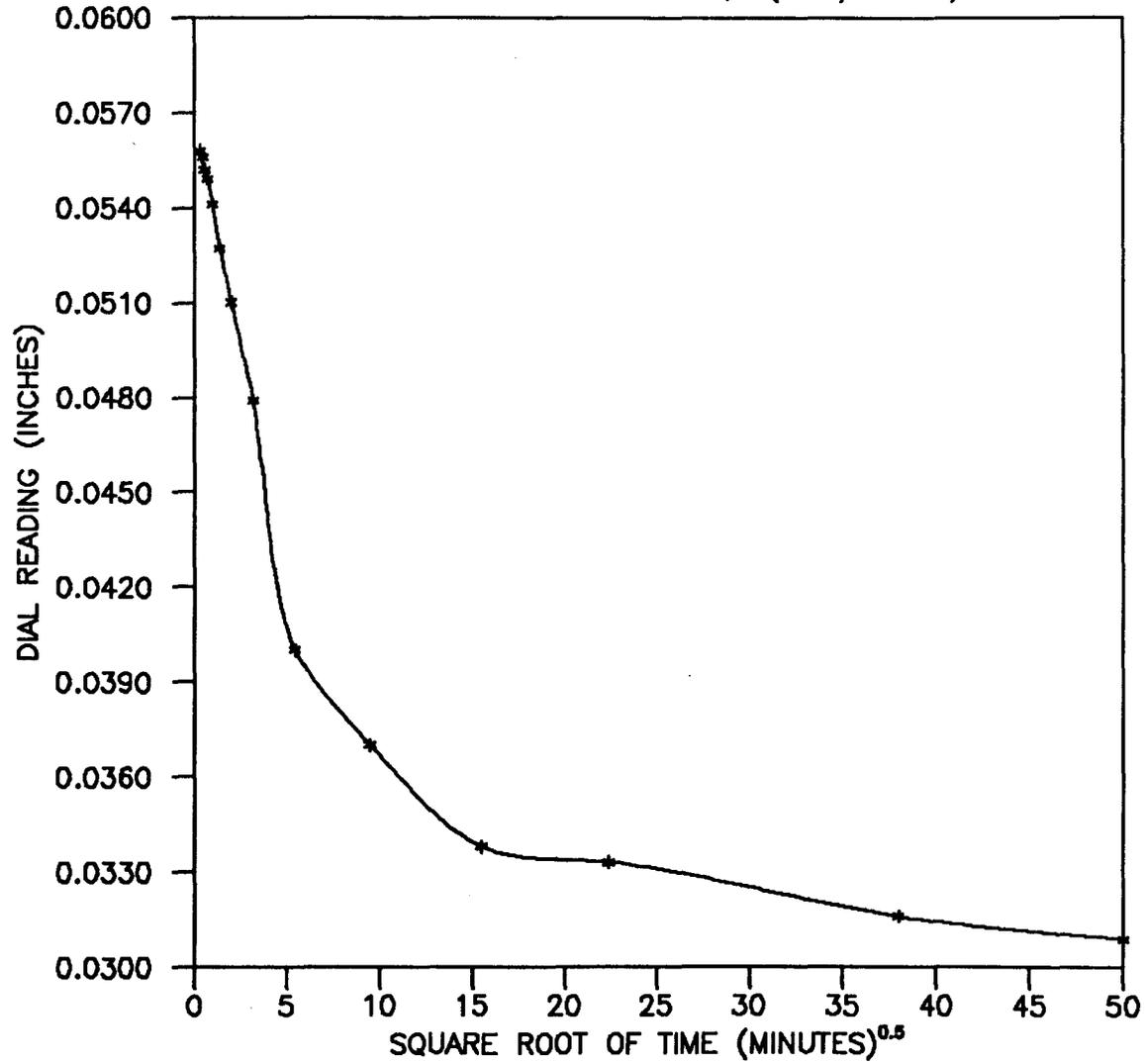


TEXAS SSC SITE	
SQUARE ROOT OF TIME	
SOUTHWESTERN LABORATORIES	
DALLAS, TEXAS	
JOB NO.: 89-192	FIGURE

BORING NO: BF4
DEPTH (FT): 41.0
TAN SILTY CLAY

LOAD (TSF): 16.0

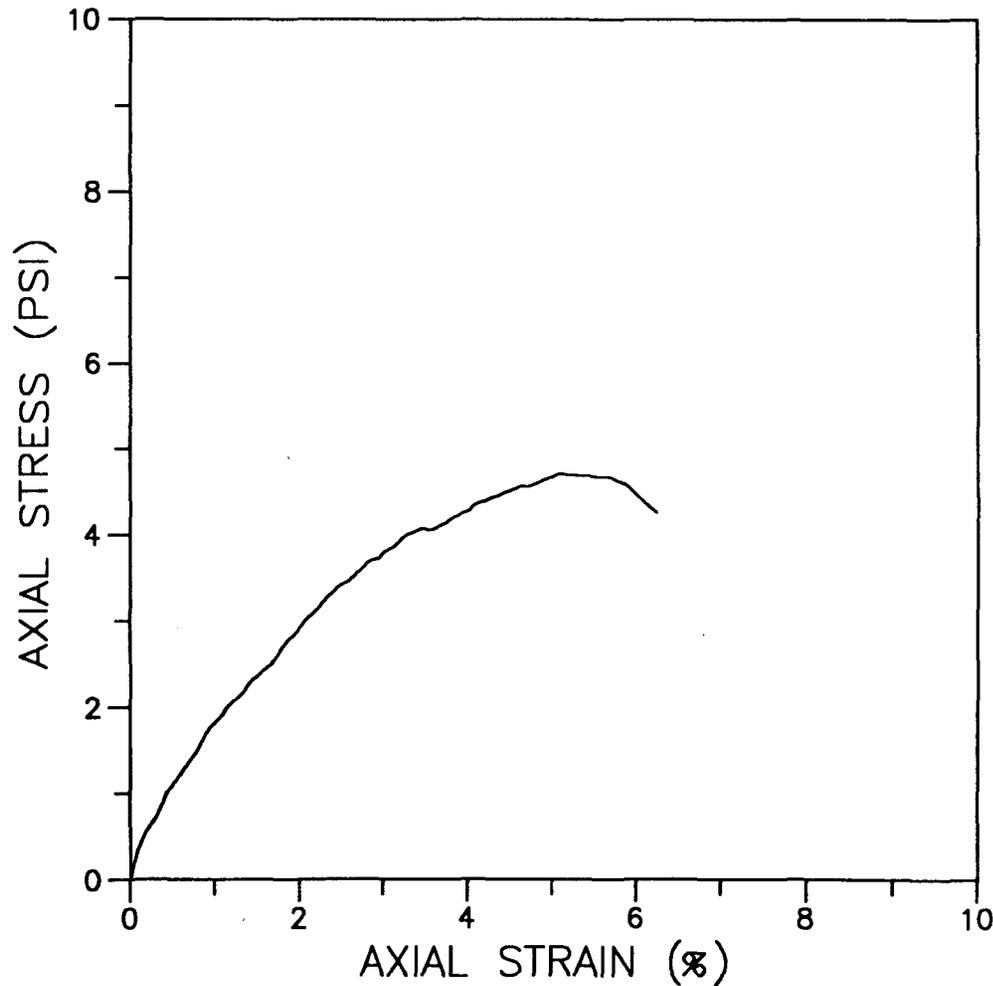
C_v (IN²/SEC): 2.7×10^{-5}



TEXAS SSC SITE	
SQUARE ROOT OF TIME	
SOUTHWESTERN LABORATORIES	
DALLAS, TEXAS	
JOB NO.: 89-192	FIGURE

BORING NO: BF-4
DEPTH (FT): 44.8
TAN SILTY CLAY

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 26.1
DRY UNIT WEIGHT (PCF): 103.8
DEG. OF SATURATION (%): 113
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D-2938)

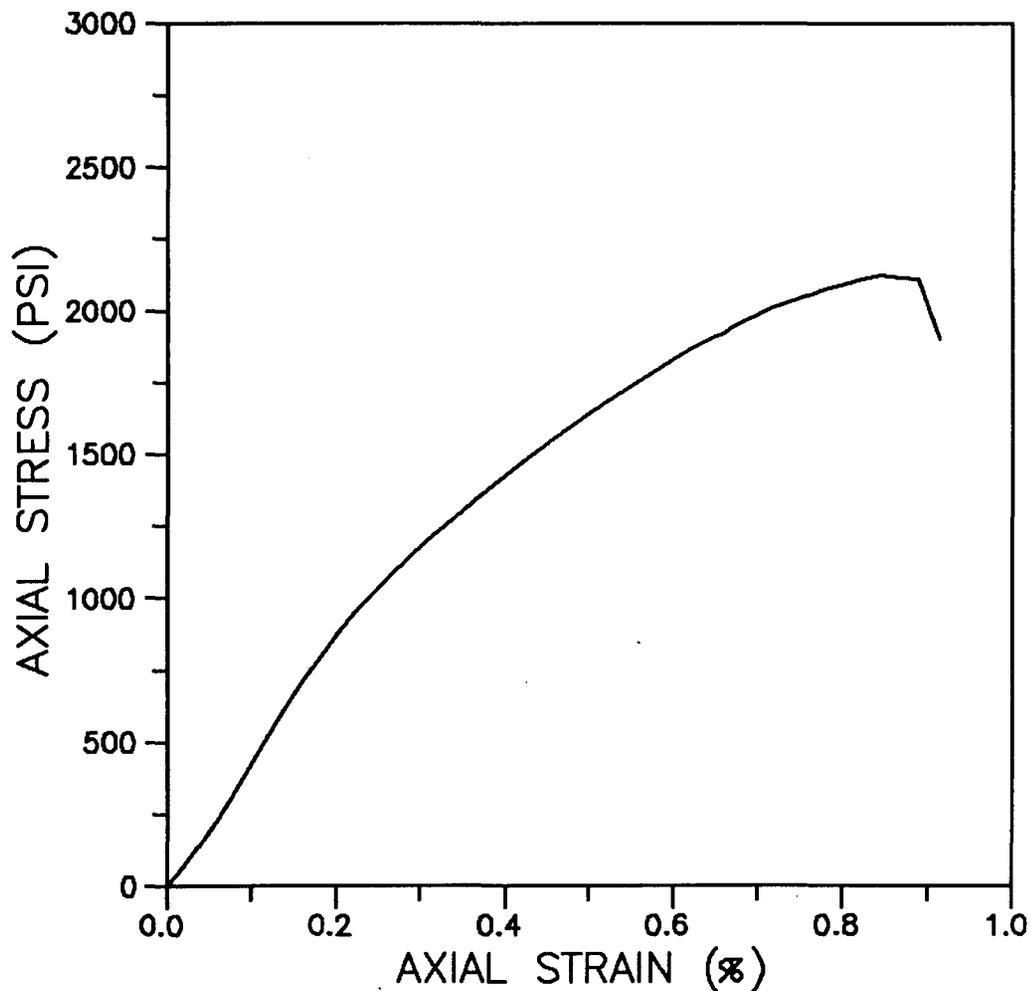


FAILURE MODE:
DUCTILE FAILURE

TEXAS SSC SITE
UNCONFINED COMPRESSION
SOUTHWESTERN LABORATORIES DALLAS, TEXAS
JOB NO.: 89-192
FIGURE

BORING NO: BF4
DEPTH (FT): 57.0
AUSTIN CHALK

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.9
DRY UNIT WEIGHT (PCF): 123.1
DEG. OF SATURATION (%): 94.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)



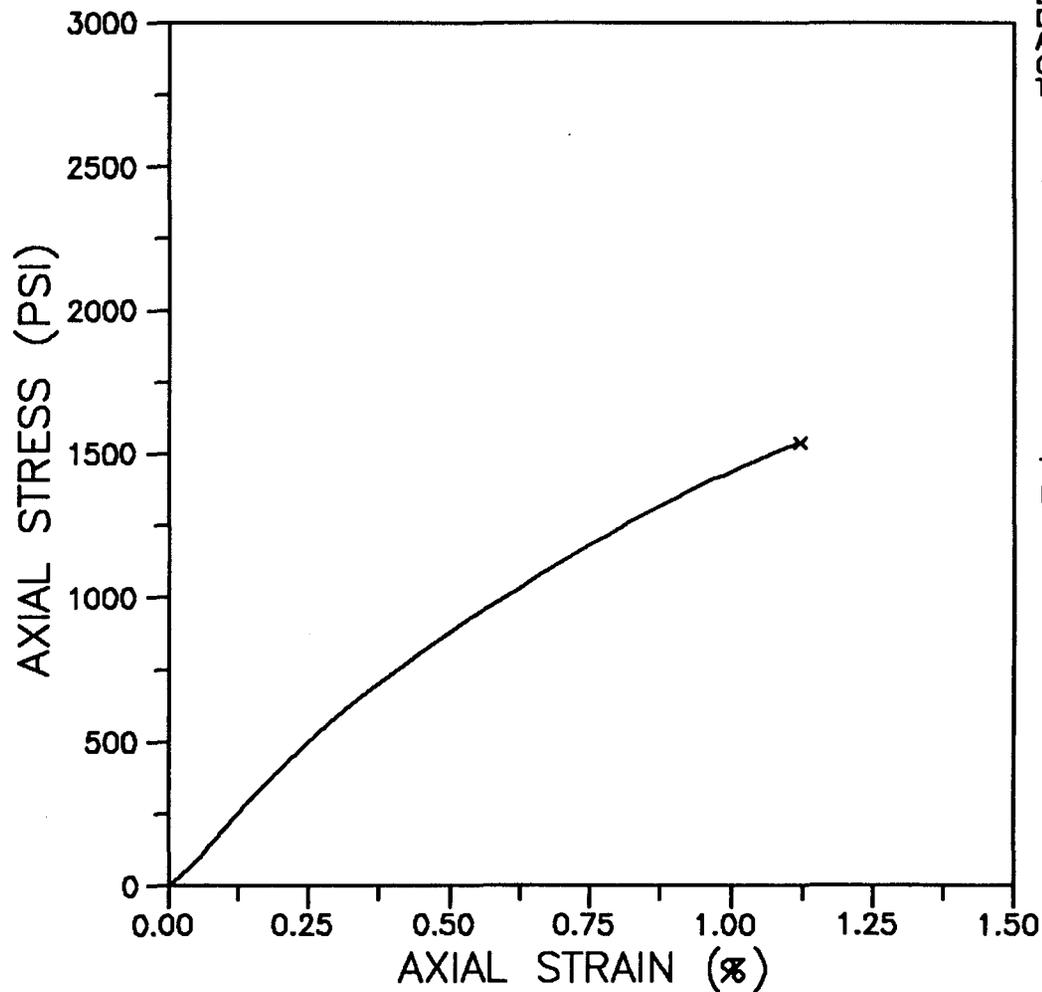
TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.20 x 10E5 PSI

FAILURE MODE:
COMBINATION LONGITUDINAL
(AXIAL) SPLITTING & SHEAR
PLANE AT 30 DEG

TEXAS SSC SITE
STRESS-STRAIN PLOT
SOUTHWESTERN LABORATORIES DALLAS, TEXAS
JOB NO.: 89-192
FIGURE

BORING NO: BF4
DEPTH (FT): 58.2
AUSTIN CHALK

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 11.6
DRY UNIT WEIGHT (PCF): 139.6
DEG. OF SATURATION (%): 151.4
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)



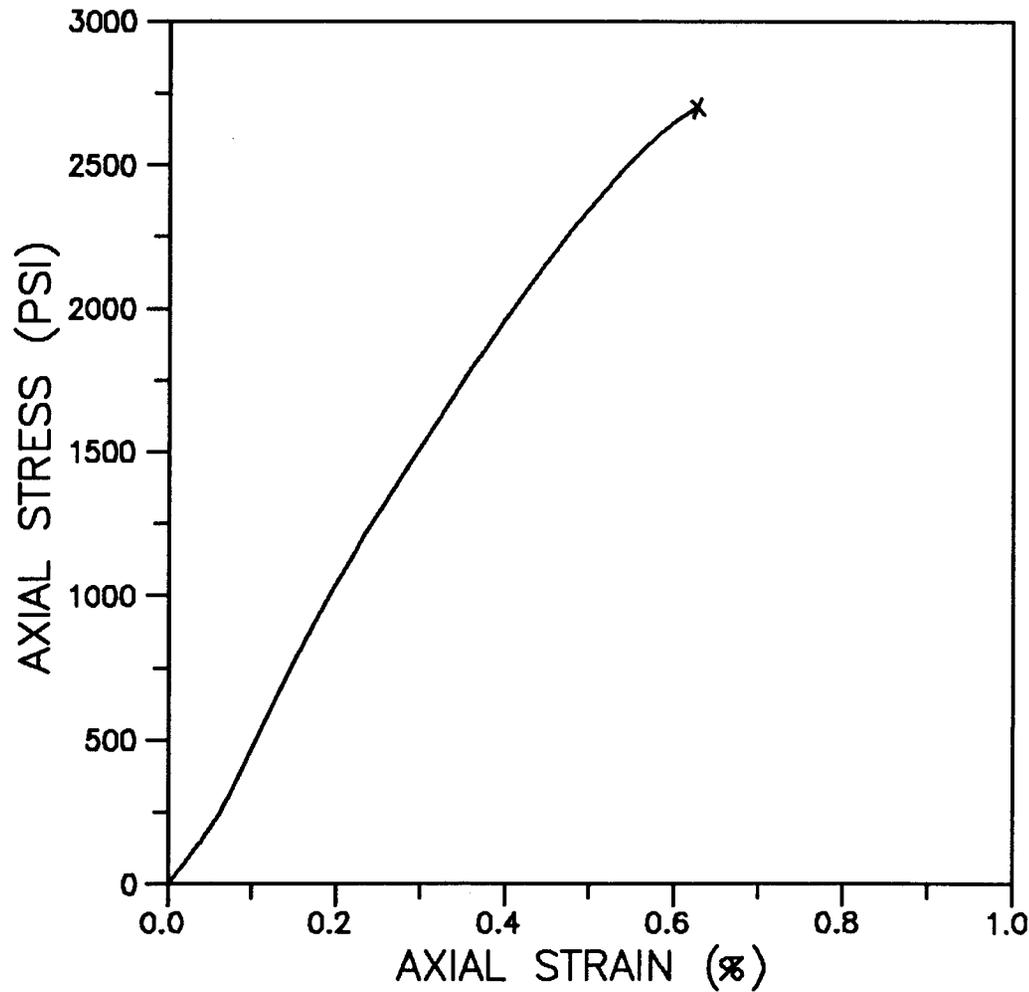
TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.51 x 10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 30 DEG

JOB NO.: 89-192	TEXAS SSC SITE
FIGURE	STRESS-STRAIN PLOT
	SOUTHWESTERN LABORATORIES
	DALLAS, TEXAS

BORING NO: BF4
DEPTH (FT): 97.1
AUSTIN CHALK

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 11.6
DRY UNIT WEIGHT (PCF): 127.2
DEG. OF SATURATION (%): 96.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

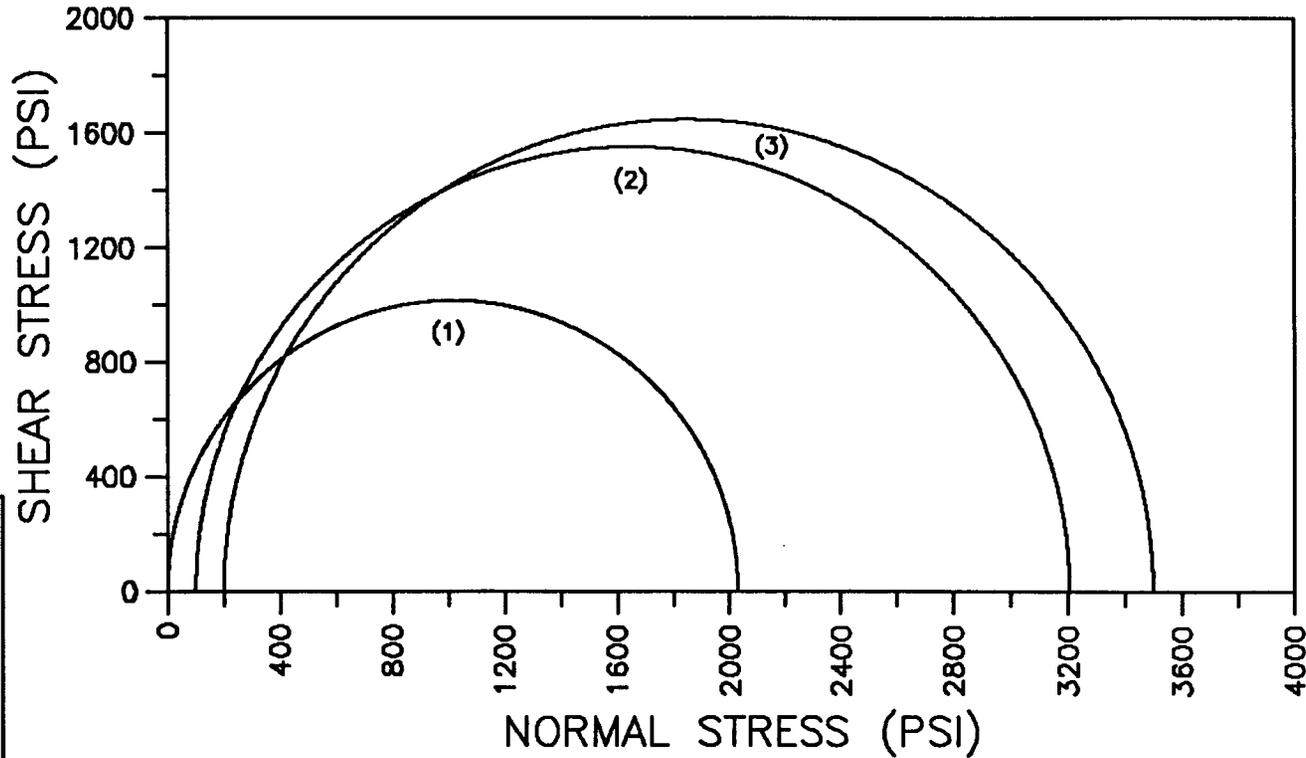


TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.89 x 10E5 PSI

FAILURE MODE:
SHEAR PLANE AT 45 DEG

JOB NO.: 89-192	TEXAS SSC SITE
	STRESS-STRAIN PLOT
	SOUTHWESTERN LABORATORIES
	DALLAS, TEXAS
FIGURE	

BORING NO.: BF4
DEPTH RANGE (FT): 150.8-152.0
AUSTIN CHALK LIMESTONE



CFILE: MBF41508 DATE: 04-28-90

SEE STRESS-STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

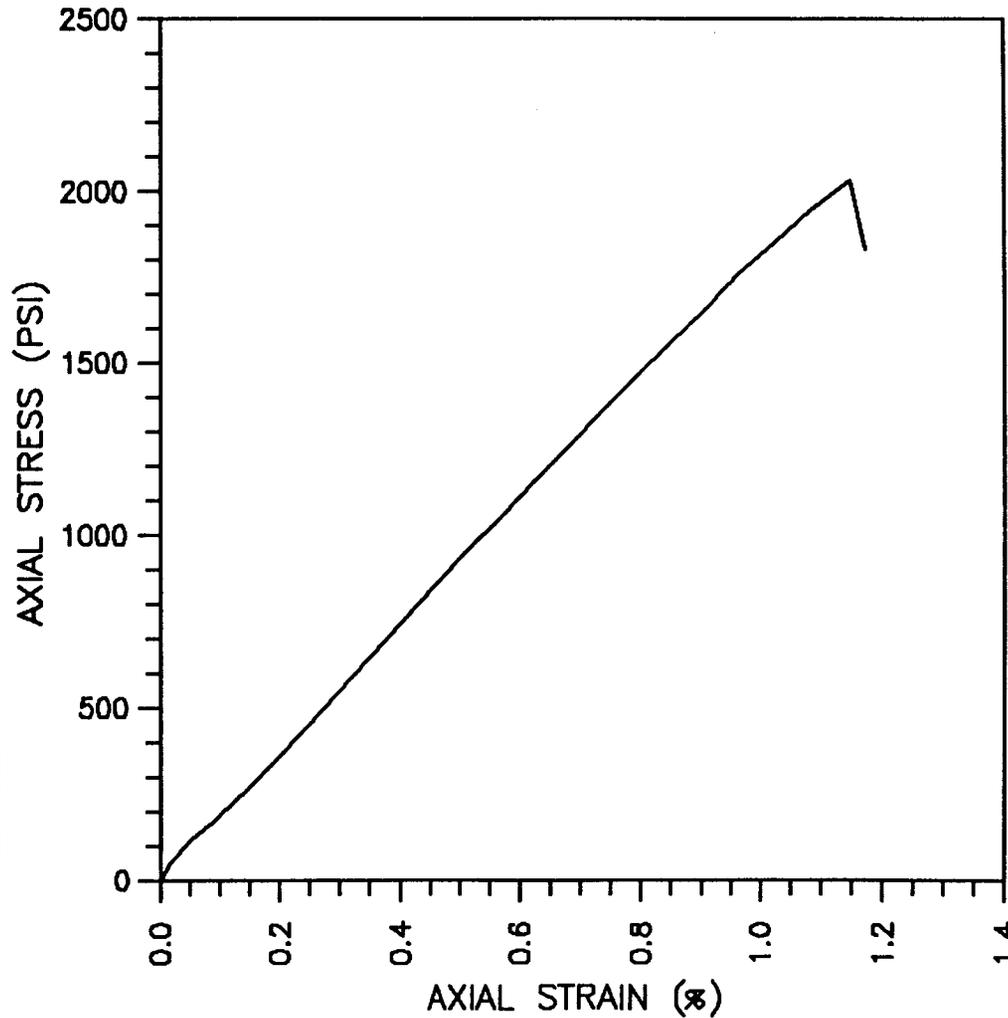
INCLINATION (DEG): VERTICAL
TEST TYPE: UNCONFINED COMPRESSION (ASTM D2938)
TRIAXIAL COMPRESSION (ASTM D2664)

- (1) DEPTH (FT): 150.8
- (2) DEPTH (FT): 151.2
- (3) DEPTH (FT): 151.6

TEXAS SSC SITE	
STRESS-STRAIN PLOT	
MASON-JOHNSTON & ASSOCIATES, INC.	
GEOLOGISTS-ENGINEERS	
JOB NO.: 5530.17	FIGURE

BORING NO.: BF4
DEPTH (FT): 150.8
AUSTIN CHALK LIMESTONE

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 9.5
DRY UNIT WEIGHT (PCF): 133.2
DEG. OF SATURATION (%): 97.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)



ORLE: BF41808 DATE: 08-07-90 CAL: MCMH

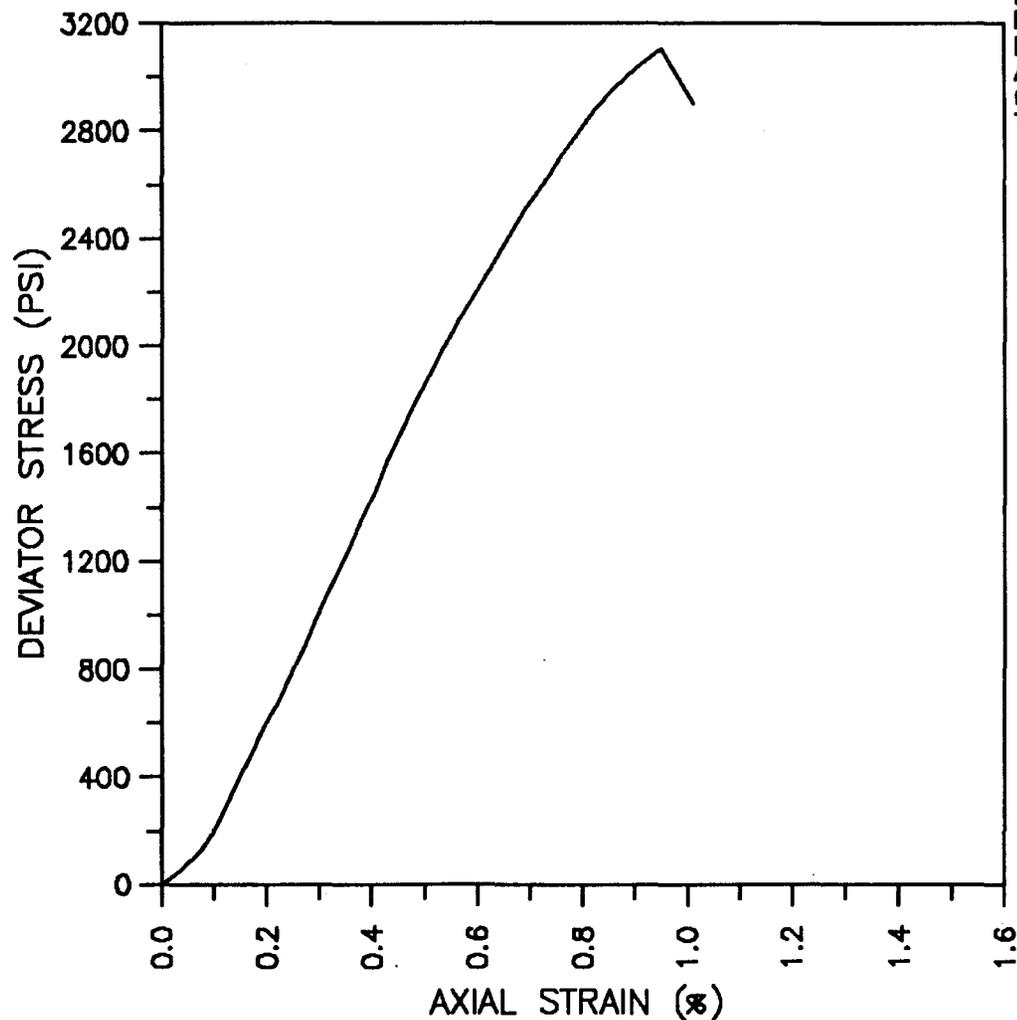
TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.865 x10E5 PSI

FAILURE MODE:
CONICAL FAILURE
AT TOP AT 30 DEG.

TEXAS SSC SITE
STRESS-STRAIN PLOT
MASON-JOHNSTON & ASSOCIATES, INC. GEOLOGISTS-ENGINEERS
JOB NO.: 5530.17
FIGURE

BORING NO.: BF4
DEPTH (FT): 151.2
AUSTIN CHALK LIMESTONE

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.0
DRY UNIT WEIGHT (PCF): 126.0
DEG. OF SATURATION (%): 98.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2884)



FILE: BF41B12 DATE: 08-07-90 CAL: MCTB

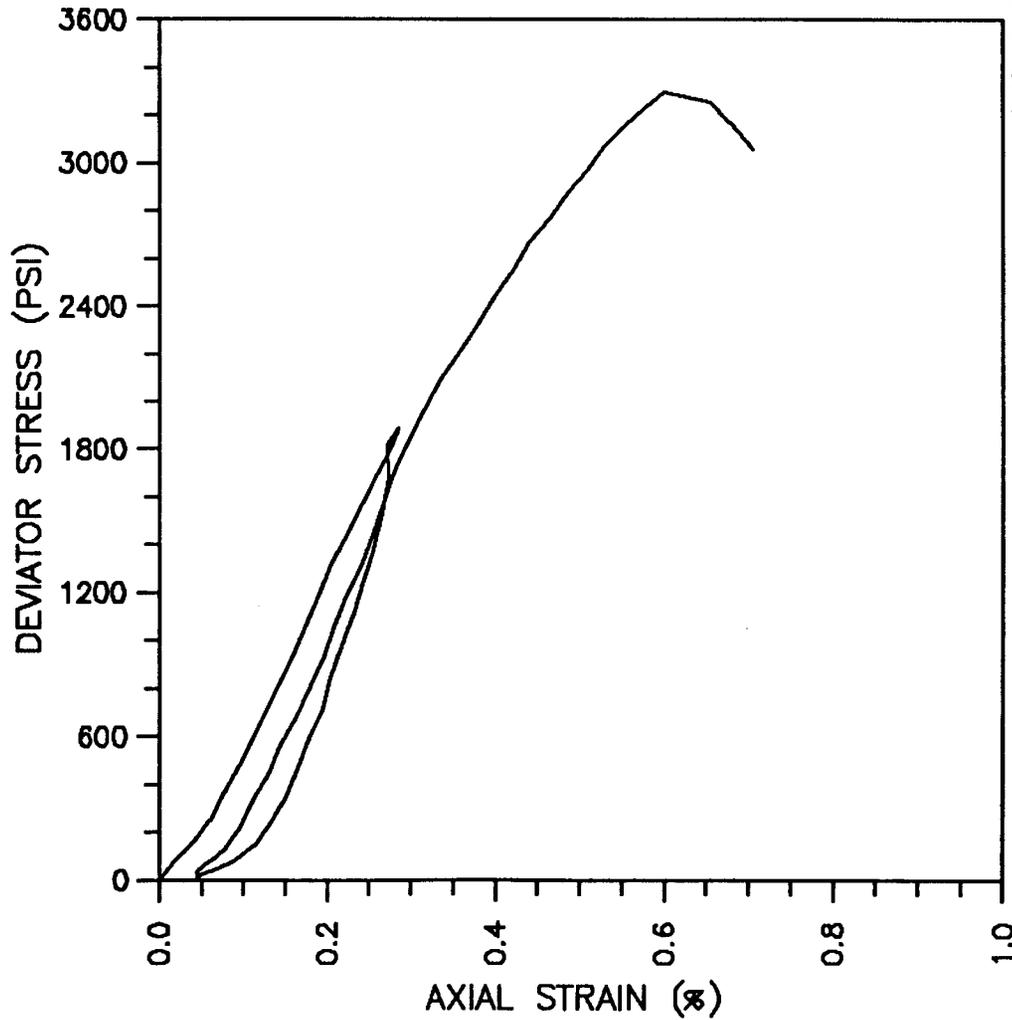
TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.480 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING W/
CONICAL FAILURE

TEXAS SSC SITE
STRESS-STRAIN PLOT
MASON-JOHNSTON & ASSOCIATES, INC. GEOLOGISTS-ENGINEERS
JOB NO.: 5530.17
FIGURE

BORING NO.: BF4
DEPTH (FT): 151.6
AUSTIN CHALK LIMESTONE

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 13.1
DRY UNIT WEIGHT (PCF): 123.7
DEG. OF SATURATION (%): 97.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2864)



DTLE: BF41516 DATE: 00-07-90 CAL: MCTB

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
6.977 x10E5 PSI

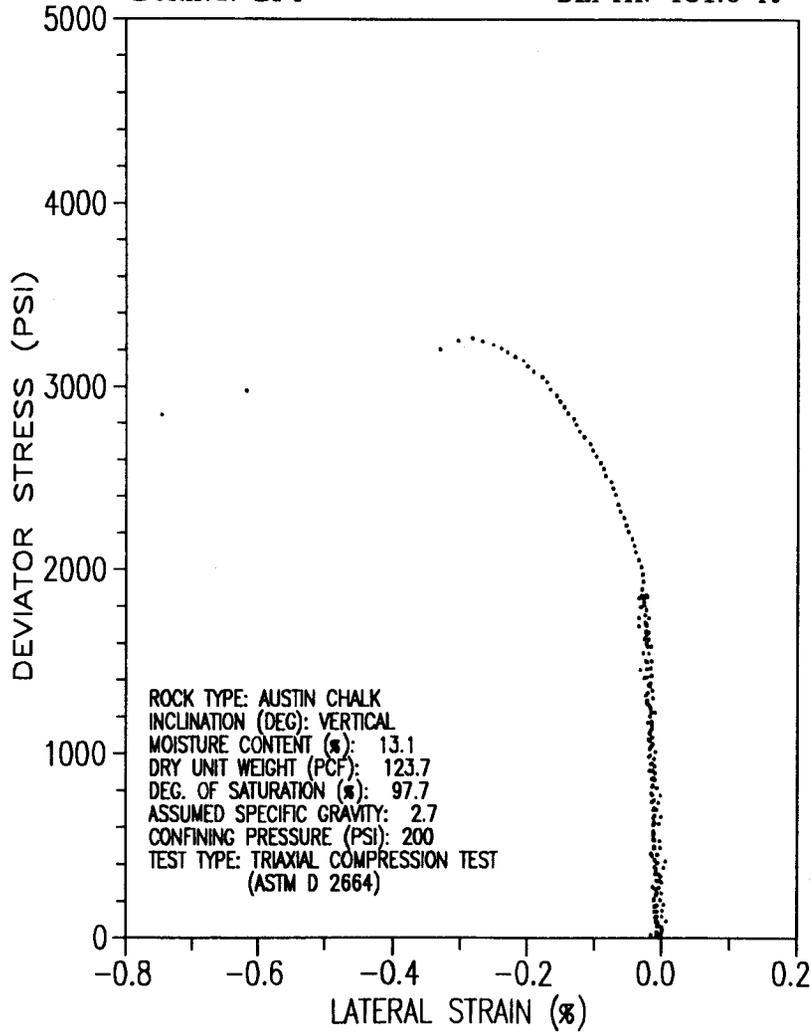
FAILURE MODE:
SHEAR PLANE
AT 30 DEG.

TEXAS SSC SITE
STRESS-STRAIN PLOT
MASON-JOHNSTON & ASSOCIATES, INC. GEOLOGISTS-ENGINEERS
JOB NO.: 5530.17
FIGURE

DEVIATOR STRESS vs LATERAL STRAIN

BORING: BF4

DEPTH: 151.6 ft



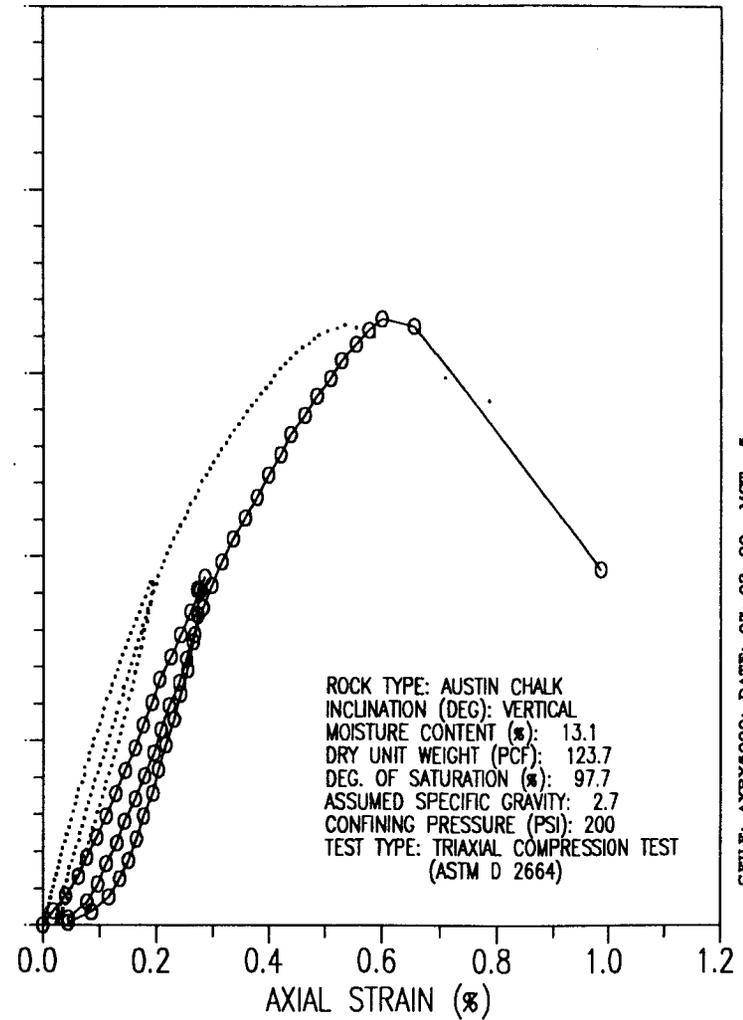
GFILE: LAT5000; DATE: 07-08-90

..... JACKET-LVDT (2)

DEVIATOR STRESS vs AXIAL STRAIN

BORING: BF4

DEPTH: 151.6 ft



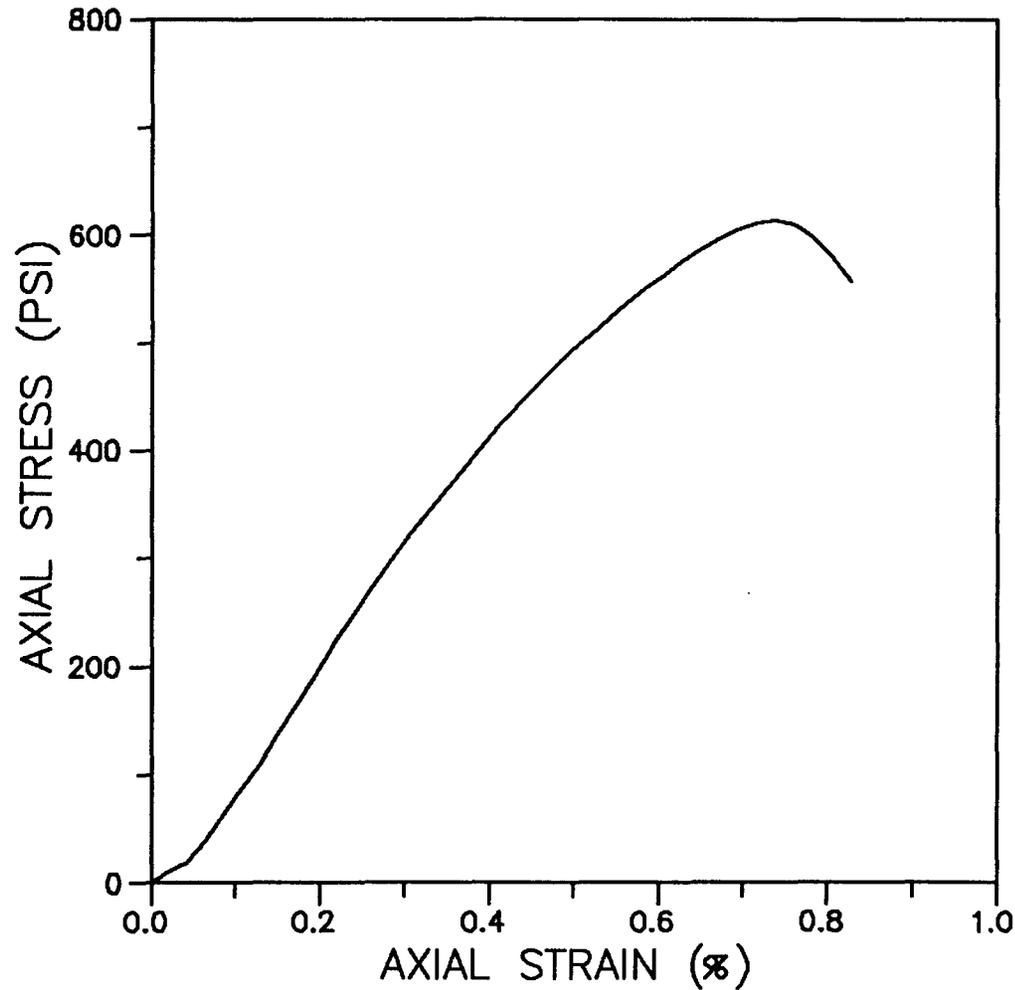
GFILE: AXRY8000; DATE: 07-02-90 MCT 6

..... JACKET-LVDT (3)

OOOOO PLATEN-DIAL GAUGE

BORING NO: BF4
DEPTH (FT): 201.4
AUSTIN CHALK

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.3
DRY UNIT WEIGHT (PCF): 130.5
DEG. OF SATURATION (%): 95.6
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)



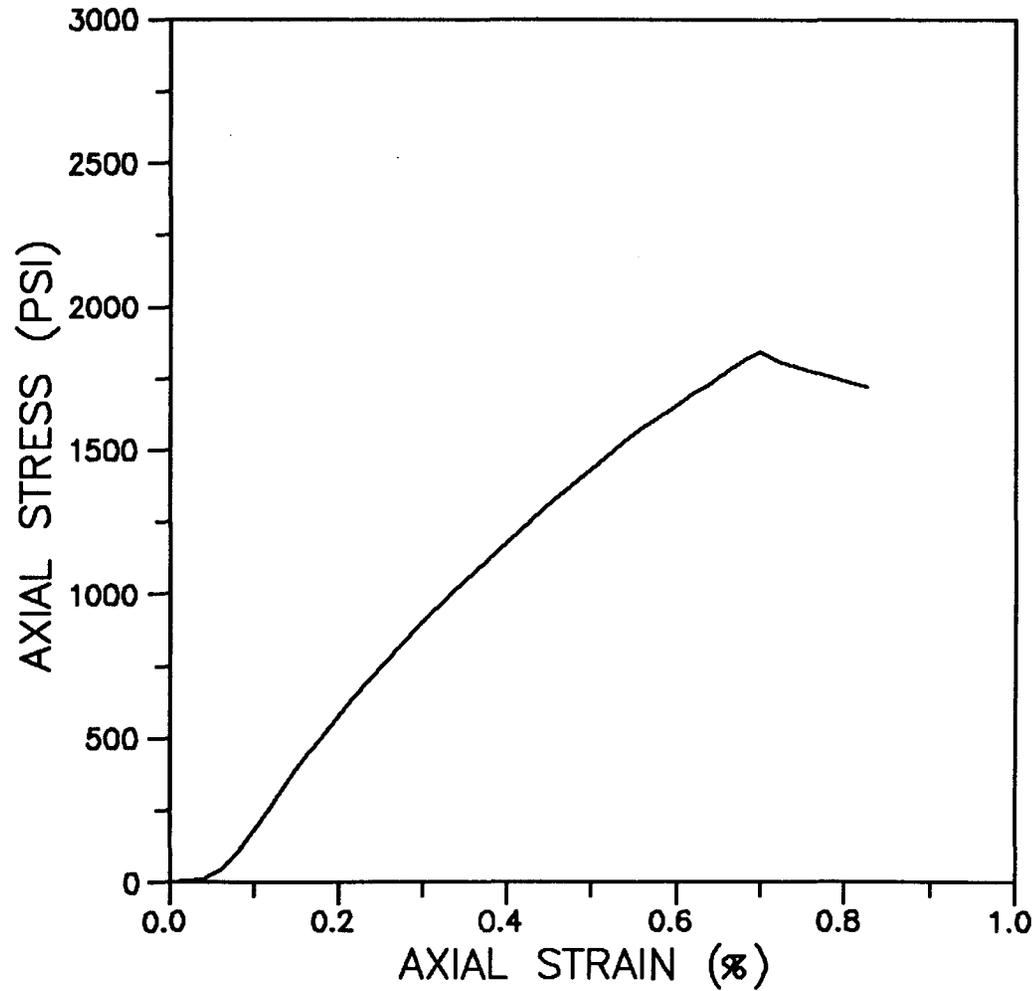
TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.07 x 10⁵ PSI

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

JOB NO.: 89-192	TEXAS SSC SITE
FIGURE	STRESS-STRAIN PLOT
	SOUTHWESTERN LABORATORIES
	DALLAS, TEXAS

BORING NO: BF4
DEPTH (FT): 261.3
AUSTIN CHALK

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 8.3
DRY UNIT WEIGHT (PCF): 136.3
DEG. OF SATURATION (%): 94.9
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)



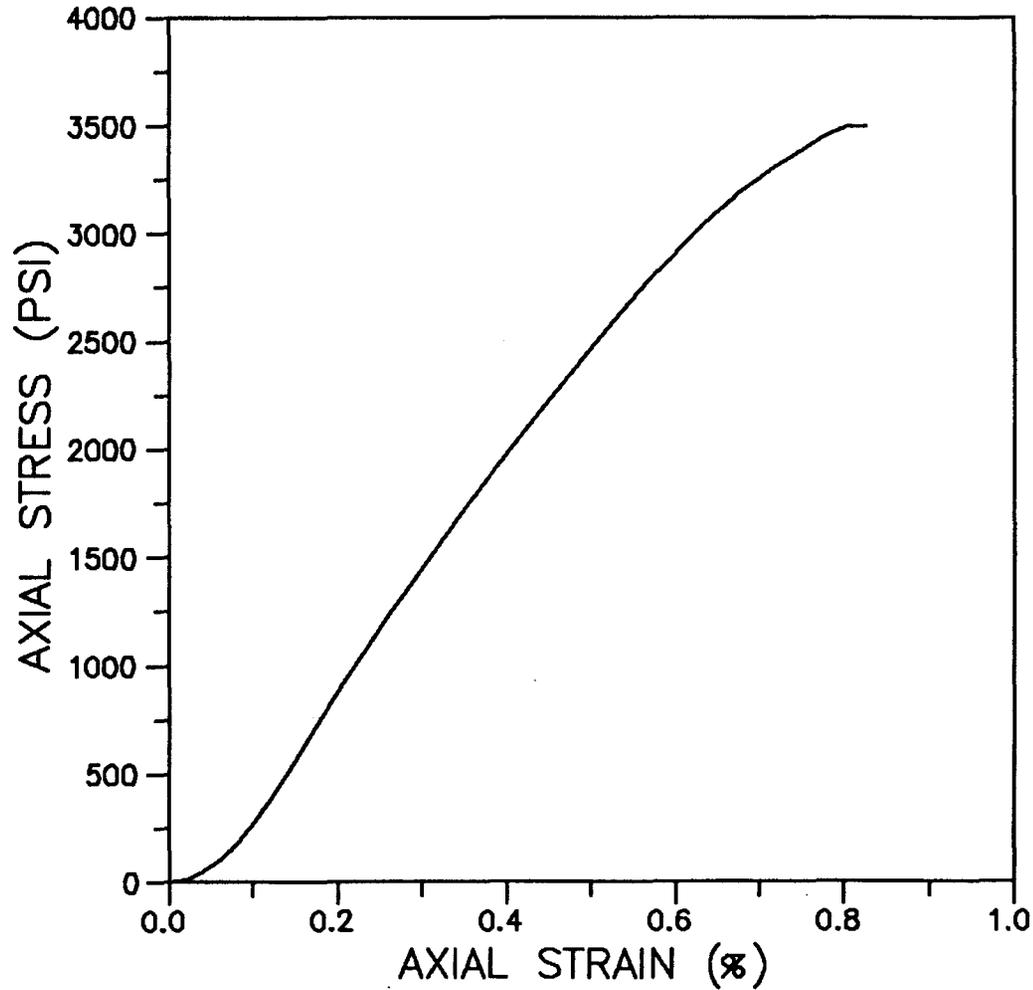
TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.00 x 10E5 PSI

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

JOB NO.: 89-192	TEXAS SSC SITE
	STRESS-STRAIN PLOT
	SOUTHWESTERN LABORATORIES
	DALLAS, TEXAS
FIGURE	

BORING NO: BF4
DEPTH (FT): 303.4
AUSTIN CHALK

INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 9.1
DRY UNIT WEIGHT (PCF): 134.3
DEG. OF SATURATION (%): 96.5
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

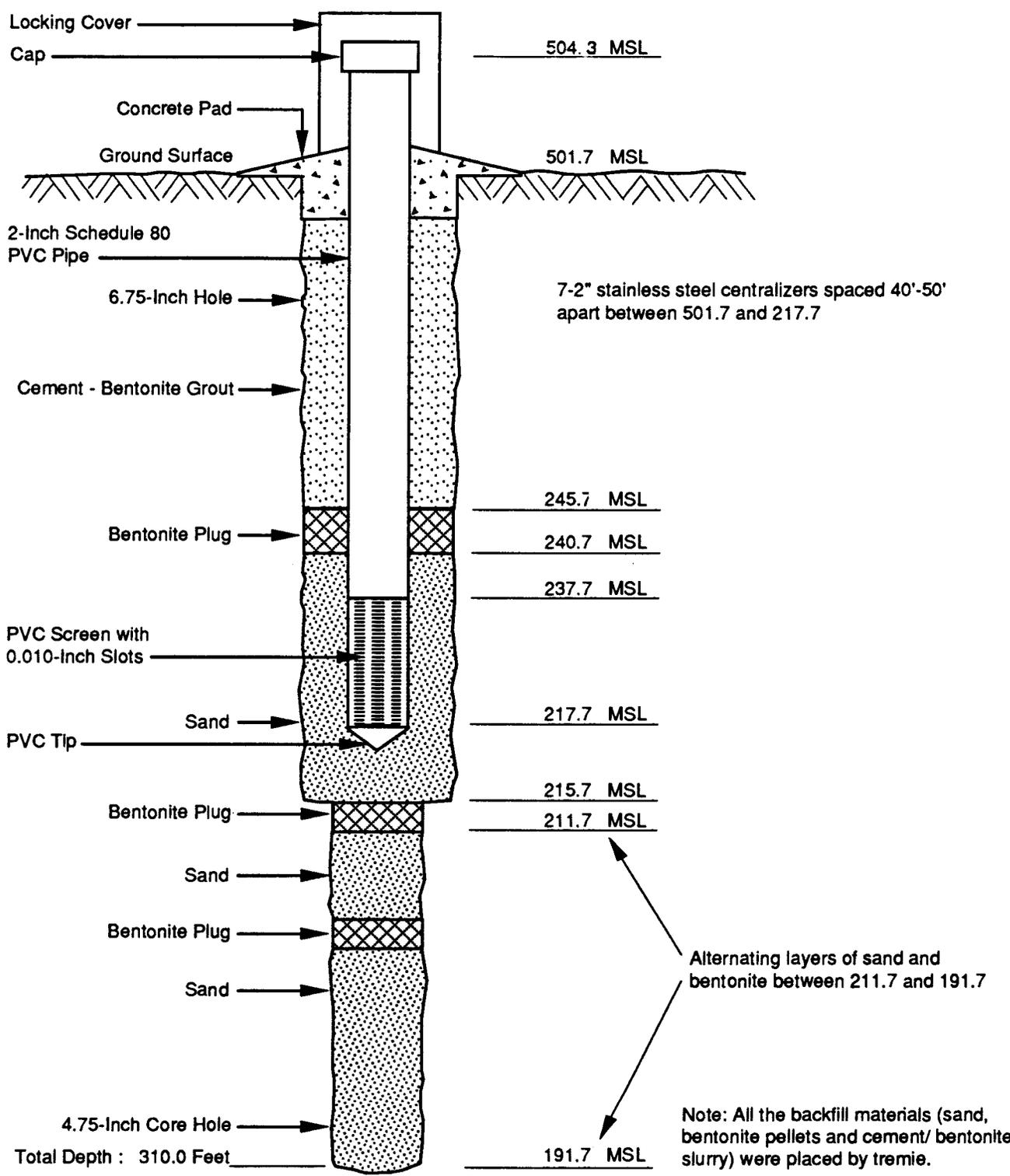


TANGENT MODULUS AT 50%
ULTIMATE STRESS:
5.41 x 10E5 PSI

FAILURE MODE:
LONGITUDINAL (AXIAL)
SPLITTING

JOB NO.: 89-192	TEXAS SSC SITE
FIGURE	STRESS-STRAIN PLOT
	SOUTHWESTERN LABORATORIES
	DALLAS, TEXAS

APPENDIX E
WELL AS-BUILT DIAGRAM



NOT TO SCALE

Boring: BF 4
 Location: N 290,237
 E 2,236,629
 Date(s) Installed: 4/16/90
 Well Construction
 Supervising Geologist: Alan Dover
 Approved By: Shawn Wood
 Date: 5/22/90

"As Built"
 Well Construction Diagram
 Observation Well
 No. BF 4

5/90

Figure