SSCL-SR-1101

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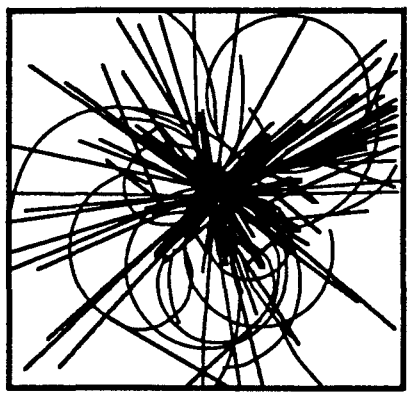
Project No. 87-888-0017

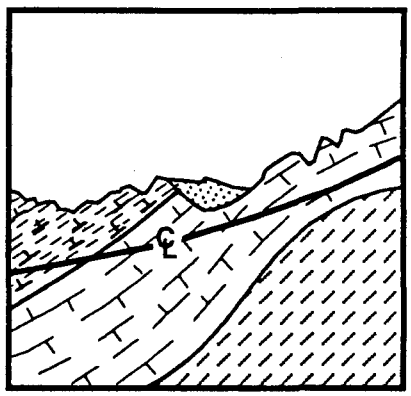
Report No. SSC-GR-42

June 1990

GR-42

Data Report for Corehole BE 9





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: BE 9

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

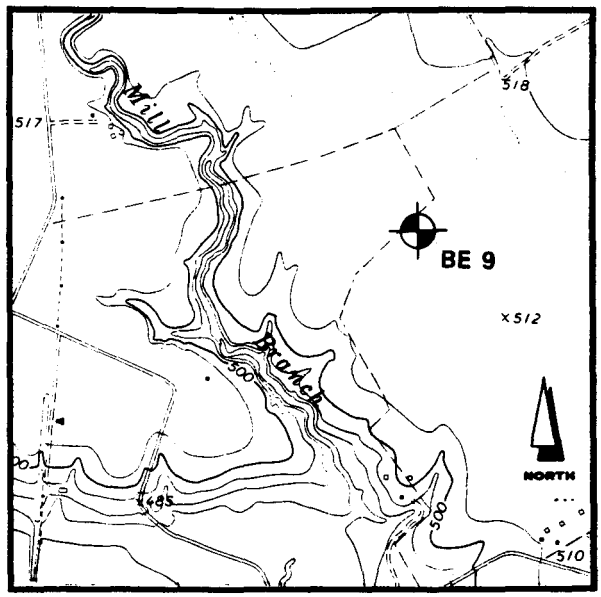
Location:

North 207,540 feet

East 2,200,560 feet

Surface Elevation 512.0 feet

BE 9 is located on the south-western end of the ring, about 2.0 miles east of Highway 77.



SCALE 1:24,000

0 1000 2000 3000 4000 Feet

CONTOUR INTERVAL 10 FEET

Scope and Schedule:		
	Coring (full depth)	January 15 to February 14, 1990
	Wire-line Logging	February 14, 1990
	Hydrologic Testing	February 15, 1990
	Laboratory Testing	February 17 to April 2, 1990
	Well Construction	February 19 to 20, 1990

Conditions Encountered: (see lithologic log, Appendix A)

Total Hole Depth:	162.3 feet
Soil:	0.0 to 37.5 feet
Weathered Austin Chalk:	37.5 to 41.8 feet
Fresh Austin Chalk:	41.8 to 162.3 feet (bottom of hole)
Static Water Level:	Measured at 380.3 feet above MSL (131.7 feet below ground surface) on April 5, 1990, 44 days after the well was bailed to 377.5 feet. Water level in the boring has probably reached static condition.

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

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

Hydrologic Test Results Summary: (see also Appendix C)

Vertical Depth (ft)	Packer Pressure (psi)	Gauge Pressure (psi)	Formation/ Lithology	Hydraulic Conductivity (cm/sec)
115.0-136.1	200	10.0	Austin Chalk	4.9×10^{-8}

Bulk and Clay Mineralogy Test Results:

Formation: Austin Chalk **Depth: 153.5 - 153.8 feet**

Whole Rock Composition:

Mineral	Percent
quartz	2
calcite	98
Total	100

Relative Clay Abundance:

Mineral	Percent
Not applicable	

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)
67-68	Austin Chalk	9-13	125-133	1401		
92-93	Austin Chalk	8	135-136	1812	1.54	167
108	Austin Chalk	13-24	100-124	366	0.39	
114-116	Austin Chalk	7-9	135-140	719-3633 (200)	1.13-4.68 (200)	
143	Austin Chalk	10-11	130	2662	7.29	
153	Austin Chalk	10	130-131	1767	1.32	
157	Austin Chalk	10-11	129-132	2193	1.72	

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

Hole Status: A monitoring well was installed in the boring on February 20, 1990 (see Appendix E).

APPENDIX A

LITHOLOGIC LOG

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BE 9 PG 1 OF 5

LOCATION: N 207,540 feet
E 2,200,560 feet

GROUND EL: 512.0 feet

DATE: 1/15/90 TYPE: Nx Core CASED TO: 3.5' 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
Observation well installed for continued monitoring of water level

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
		U1	0.0	1.5					CLAY, stiff, organic near surface, silty, w/occ. fine sand size limestone particles, dk. gray (CL/CH)
5		U2	5.0	6.5					5.8g CLAY, med.-stiff, sandy, tan to brown (CL)
									9.0g
10		U3	10.0	11.5					CLAY, med.-stiff, sandy w/limestone particles (small gravel), mottled tan and gray (CL)
									14.7g
15		U4	15.0	16.5					CLAY, med-stiff, very sandy, mottled tan, orange and gray (CL)
20		U5	20.0	21.5					
									24.0g
25		U6	25.0	26.5					CLAY, very stiff, silty, mottled tan, orange and gray (CL)
									30.0g
30		U7	30.0	31.5		Stopped Drilling 1/15/90			CLAY, stiff, sandy, mottled tan to reddish-brown (CL) 32.0g
						Started Drilling 2/13/90			SAND, dense, fine to med.grained, silty, w/clay orange to tan (SM)
35		U8	35.0	35.7					35.4g SAND, med.grained, silty, w/gravel, orange to tan (SM/SP)
									37.5s LIMESTONE, (Austin Chalk), highly to mod. weathered, soft to med. hard, fractured, tan w/a v. soft, v. argillaceous interbed from 40.5' - 40.6'
40		C1	40.0	42.5	80	40			41.8s

(see page 2)

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

LOG OF BORING

BORING NO: BE 9 PG 2 OF 5

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

LOCATION: N 207,540 feet
E 2,200,560 feet

GROUND EL: 512.0 feet

DATE: 2/13/90 TYPE: Nx Core CASED TO: 40.5'(1) 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
		C1	40.0	42.5	80	40				41.8 s (see page 1)
45		C2	42.5	52.5	100	100				LIMESTONE, (Austin Chalk), fresh, med.to mod.hard, sli. argillaceous, mod.fossiliferous, lt.to med. gray with 0.1 to 7.5' thick mod.argillaceous to shaly interbeds spaced 0.7 to 7.3' apart 45.3g - 46.1s thin,mod. argill.,med.hard, med. gray bed 46.1s - 46.3g thin, shaly, soft, dk. gray bed
50										
55		C3	52.5	62.5	100	100				53.6g - 53.7g v.thin, shaly, soft, dk. gray bed 57.6g - 58.1g thin, v.argill.to shaly,med.to dk.gray bed
60										62.5g - 62.7g thin, mod.argill., med.gray bed
65		C4	62.5	72.5	98	98				64.0g - 64.2g thin, mod.argill., med.gray bed 64.2g - 65.6g med.thick, v.argill.,med.to dk.gray bed 65.6g - 65.8g thin,mod.argill., med.gray bed 69.4g - 70.5g med.thick,mod.argill.,med.gray bed
70										
75		C5	72.5	82.5	100	100				73.5g - 81.0g thick,mod.to v.argill.,med.to dk.gray bed
80										81.7g - 83.1g med.thick, mod.argill., med. gray bed

SAMPLE LEGEND

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

WATER INFORMATION

Wet Rotary Core Hole
Water level not determinable
Observation well installed for continued monitoring of water level

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

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BE 9 PG 3 OF 5

LOCATION: N 207,540 feet
E 2,200,560 feet

GROUND EL: 512.0 feet

DATE: 2/13/90 TYPE: Nx Core CASED TO: 40.5' 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
Observation well installed for continued monitoring of water level

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.
				82.5				
85		C6	82.5	92.5	99	99		
90								
95		C7	92.5	102.5	100	100		
100								
105		C8	102.5	112.5	98	98	Stopped Drilling 2/13/90	
110								
115		C9	112.5	122.5	100	100	Started Drilling 2/14/90	
120								
			122.5					

DESCRIPTION OF STRATUM

LIMESTONE, (Austin Chalk),fresh,med. to mod. hard sli. fossiliferous,lt.gray w/0.05 to 3.0 ft. thick sli. argillaceous to shaly and bentonitic interbeds spaced 0.2 to 1.5 ft. apart

83.5s very thin (~1/2") shaly,soft dk.gray bed
84.0g-85.1g med.thick,mod.argill.,med.gray bed
86.0g-86.9g thin,mod.argill.,med.gray bed
87.4g-88.1s thin,shaly and bentonitic,soft,med.gray bed
88.8g-89.6g thin,v.argill.,med.gray bed
89.6g-89.9g thin, mod.argill.,med.gray bed
89.9g-90.5g thin,v.argill., med.to dk.gray bed

91.6g-92.1g thin, shaly, soft, dk.gray bed

92.8g-93.5g thin,sli.,argill.,med.gray bed
94.3g-94.5g thin, mod.argill., med.gray bed
94.7g very thin, mod.argill.,med.gray bed
94.9g-95.2g thin,v.argill., med.to dk.gray bed

96.4g-97.1g thin,sli.to mod. argill.,med.gray bed
97.4g-97.5g thin, mod.argill., med.gray bed
98.3g-98.4g thin, mod.argill., med.gray bed
99.4g-99.5g very thin, v.argill.,dk.gray bed

100.1g-100.5g thin,sli.to mod.argill.,med.gray bed
102.0g-103.0g med.thick,sli.to mod.argill., med. gray bed
103.5g-104.0g thin, mod.argill., med.gray bed
104.2g-105.1g thin, mod.argill., med. gray bed
106.0g-109.0g thick, sli.argill., becoming shaly(107.4' to 109.0')soft,med.to dk. gray bed

110.8g-112.7g med.thick, sli.to v.argill., med.to dk. gray bed

113.5g-114.1g thin, v.argill.to shaly,soft dk.gray bed
114.1g-115.0g thin,sli.to mod.argill.,med.gray bed

116.3g-117.2g thin, mod. to v.argill., med.gray bed
117.8g-118.1g thin, mod.argill., med.gray bed
118.5g-120.5g med.thick, sli.to mod.argill., lt.to med. gray bed

121.5g-122.0g thin, sli.to mod.argill., med.gray bed

122.0 -122.5 60° fracture, incipient, multiple w/6 very closely spaced planes, up to 1/2" calcite filled

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

LOG OF BORING

PROJECT: SSC - Texas Site

CLIENT: The Earth Technology Corporation

TASK NO.: 17

BORING NO: BE9 PG 4 OF 5

LOCATION: N 207,540 feet
E 2,200,560 feet

GROUND EL: 512.0 feet

DATE: 2/14/90 TYPE: Nx Core CASED TO: 40.5' 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
Observation well installed for continued monitoring of water level

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
				122.5						LIMESTONE (Austin Chalk), fresh,med.to mod.hard, sli. fossiliferous,lt.gray w/0.2 to 3.4 ft. thick slightly argillaceous to shaly and bentonitic inter-beds spaced 0.3 to 2.0 ft. apart
		C10	122.5	132.5	100	100				123.0-123.2 45° incipient fracture, clean, closed 123.1g-126.5g thick,sli.to mod. argill., med.gray bed 127.1g-129.5g med.thick,sli. to mod.argill., med. gray bed 131.5g-132.5g med.thick, mod.argill.,med.gray bed 132.5g-134.9g thin,sli.argill., lt.to med.gray bed
125										
130										
		C11	132.5	142.5	99	99				135.2g-135.4g thin,sli.argill., lt.to med.gray bed 136.0g-136.6g thin,mod.argill., med.gray bed 137.9g-139.2g med.thick, sli.to mod.argill., lt.to med. gray bed 139.7g-142.4g med.thick, sli.to mod.argill., med. gray bed
135										
140										
		C12	142.5	152.5	100	100				143.4g-144.2g thin, mod.argill., med.gray bed 145.0g-145.6g thin, sli.argill., lt.to med.gray bed 145.7g-147.2g med.thick, mod.to v.argill., med.gray bed 148.1g-148.4g thin,sli.argill., lt.to med.gray bed 149.0g-150.5g med.thick, sli.to mod.argill,med.gray bed 151.1g-151.7g thin,sli.to mod.argill., med.gray bed 152.5g-152.6g very thin, bentonitic, soft,med.gray bed
145										
150										
		C13	152.5	162.3	100	100				153.0g-154.0g med.thick,mod.argill., med.gray bed 155.7g-158.6g med.thick, mod.argill., med.gray bed 159.5g-161.7g med.thick, sli.to mod.argill.,med. gray bed
155										
160										
										Total Depth 162.3' 2/14/90

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

LOG OF BORING

BORING NO: BE 9 PG 5 OF 5

PROJECT: SSC - Texas Site

CLIENT: The earth Technology Corporation

TASK NO.: 17

LOCATION: N 207,540 feet
E 2,200,560 feet

GROUND EL: 512.0 feet

DATE: 2/14/90 TYPE: Nx Core CASED TO: 40.5' 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
									(see page 4)
				162.3					Total Depth 162.3' 2/14/90 (1) Drill casing extended from 3.5' to 40.5' 2/13/90 (2) Wireline logged 2-14-90 (3) Hydrotested 2-15-90 (4) Borehole reamed to 10"(0-38'),7"(38-50') and 6.75"(50-138.5') 2-19-90 & 2-20-90 (5) Well construction completed 2-20-90
165									
170									
175									
180									
185									
190									
195									
200									

SAMPLE LEGEND

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

WATER INFORMATION

Wet Rotary Core Hole
Water level not determinable
Observation well installed for continued monitoring of water level

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

APPENDIX B

WIRE-LINE LOGS

WIRE-LINE LOGGING PARAMETERS

Hole No. BE 9 **Log Measured From:** Ground Level

Drilling Parameters

Depth 162.3 feet

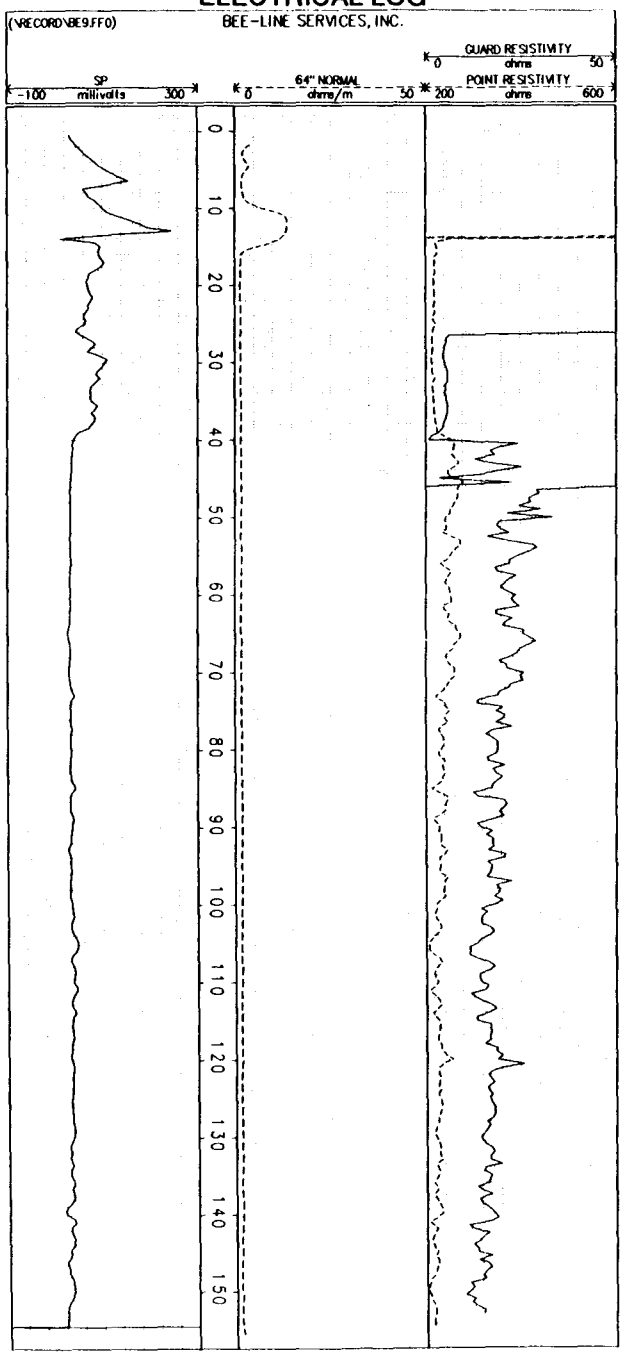
Bit Diameter 3.125 inches

Logging Parameters	Electrical Log	Gamma Log	Sonic Log
Date	February 14, 1990	February 14, 1990	February 14, 1990
Bottom Log Interval	155.5 feet	158.5 feet	154.3 feet
Top Log Interval	surface	surface	surface
Type of Fluid in Hole	none	drilling fluid	none
Time Since Circulation Stop	2.75 hours	2.75 hours	2.75 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

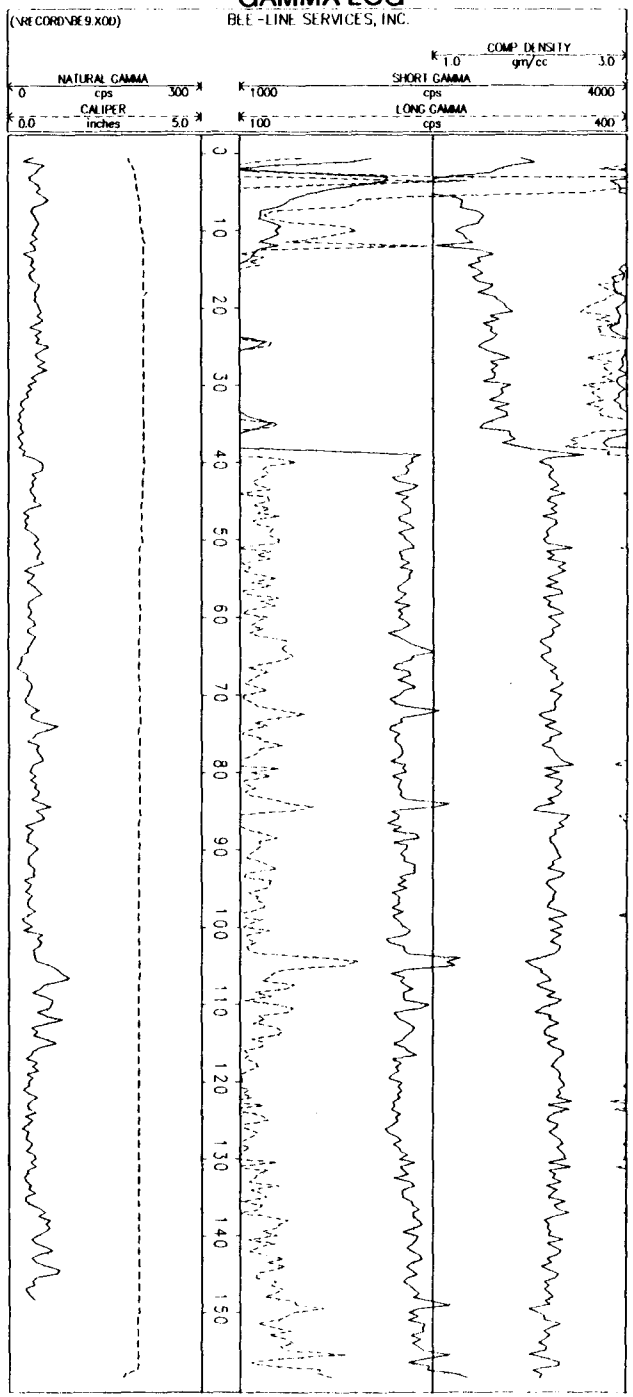
Logged by: **BEE-LINE SERVICES, INC.**
P. O. Box 2096
Corsicana, TX 75151

BE 9 Wire-line logs run February 14, 1990. Surface elevation 512.0 feet.

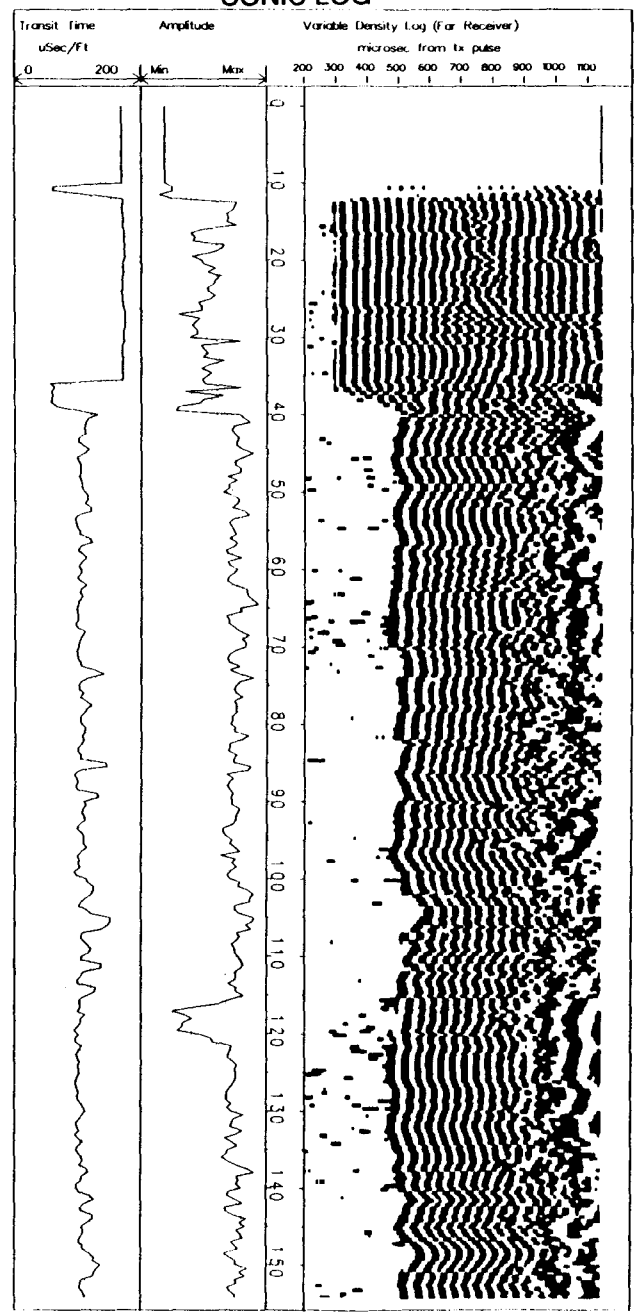
ELECTRICAL LOG



GAMMA LOG



SONIC LOG



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)	Estimated Depth to Static Water Level*
115.0-136.1	200	10.0	Austin Chalk (fractured)	4.9×10^{-8}	7.4

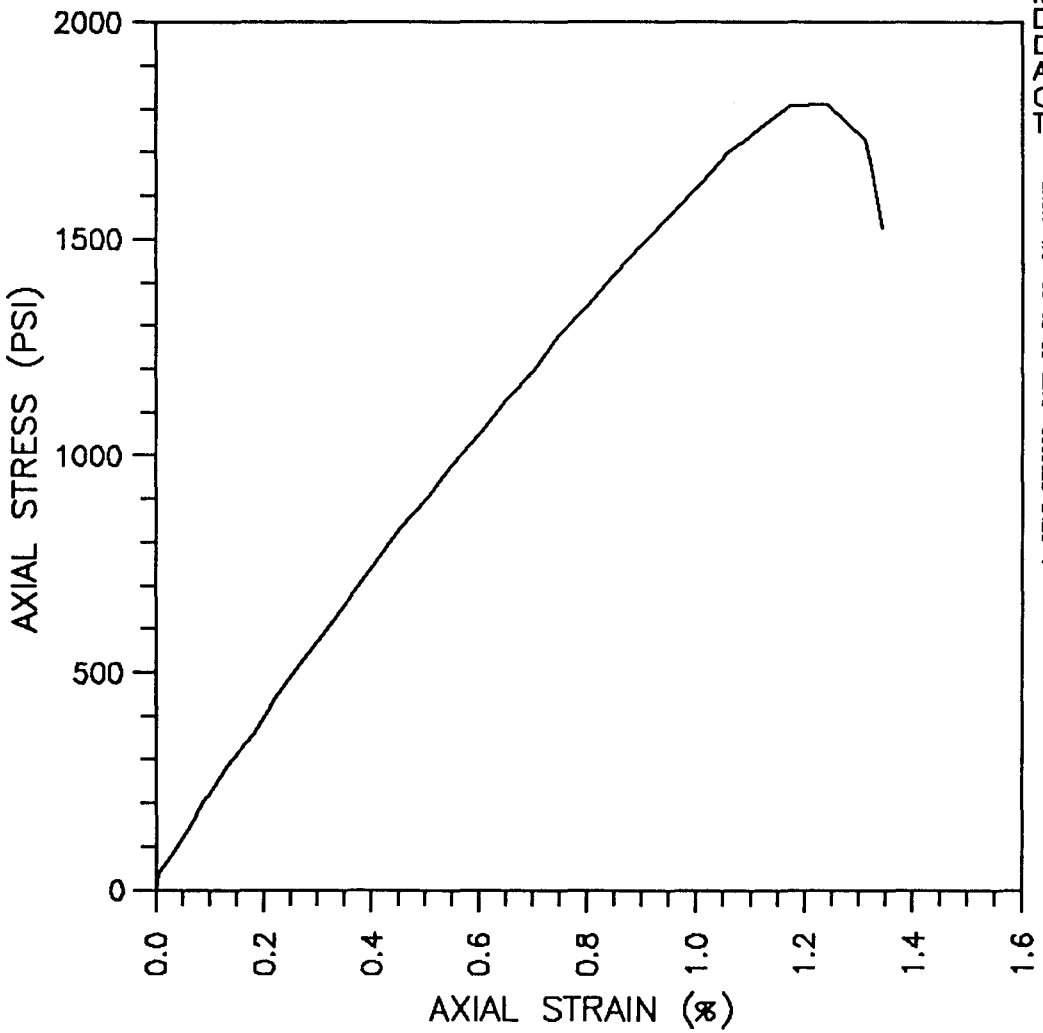
At boring BE 9 one test interval was selected based on a review of the lithologic and wire-line logs. This interval encompassed an area of fractured Austin Chalk at the potential tunnel elevation. Hydrologic (packer) testing followed the general procedures outlined above. Packer and gauge pressures used during the testing along with the calculated hydraulic conductivities are listed in the table above. Flow volumes were measured using a flow meter; no calibrated container was used for the test.

* The hydraulic conductivity values presented are based on an estimated static water level 7.4 feet below ground surface. When last measured, the water level was 131.7 feet below ground surface. Hydraulic conductivity values from the test data would be lower for a static water level less than the estimated value.

APPENDIX D

LABORATORY RESULTS

BORING NO.: BE9
DEPTH (FT): 92.9
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 8.3
DRY UNIT WEIGHT (PCF): 134.7
DEG. OF SATURATION (%): 89.1
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GTLE: BE90929 DATE: 05-30-90 CAL: MCLS

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.538 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

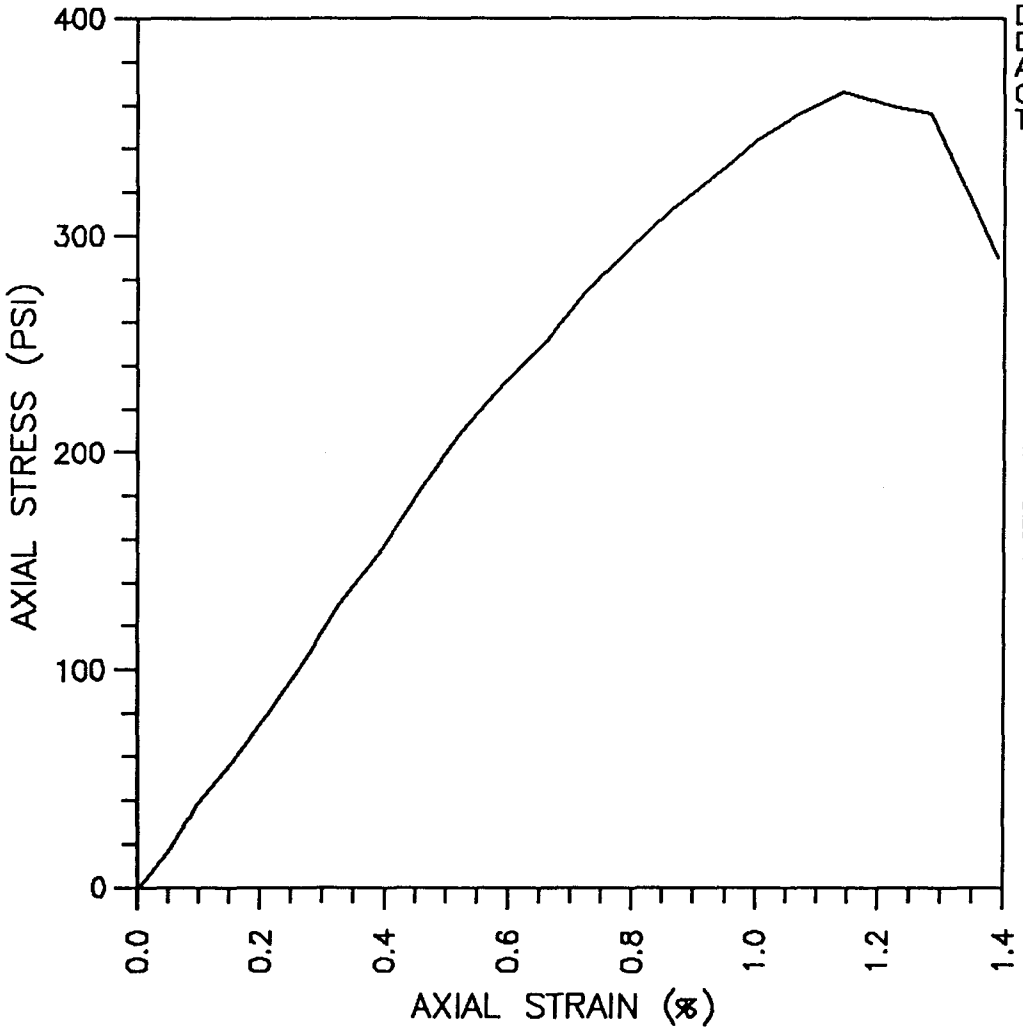
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BE9
DEPTH (FT): 108.1
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 12.7
DRY UNIT WEIGHT (PCF): 123.6
DEG. OF SATURATION (%): 94.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: BE91081 DATE: 06-30-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
0.392 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

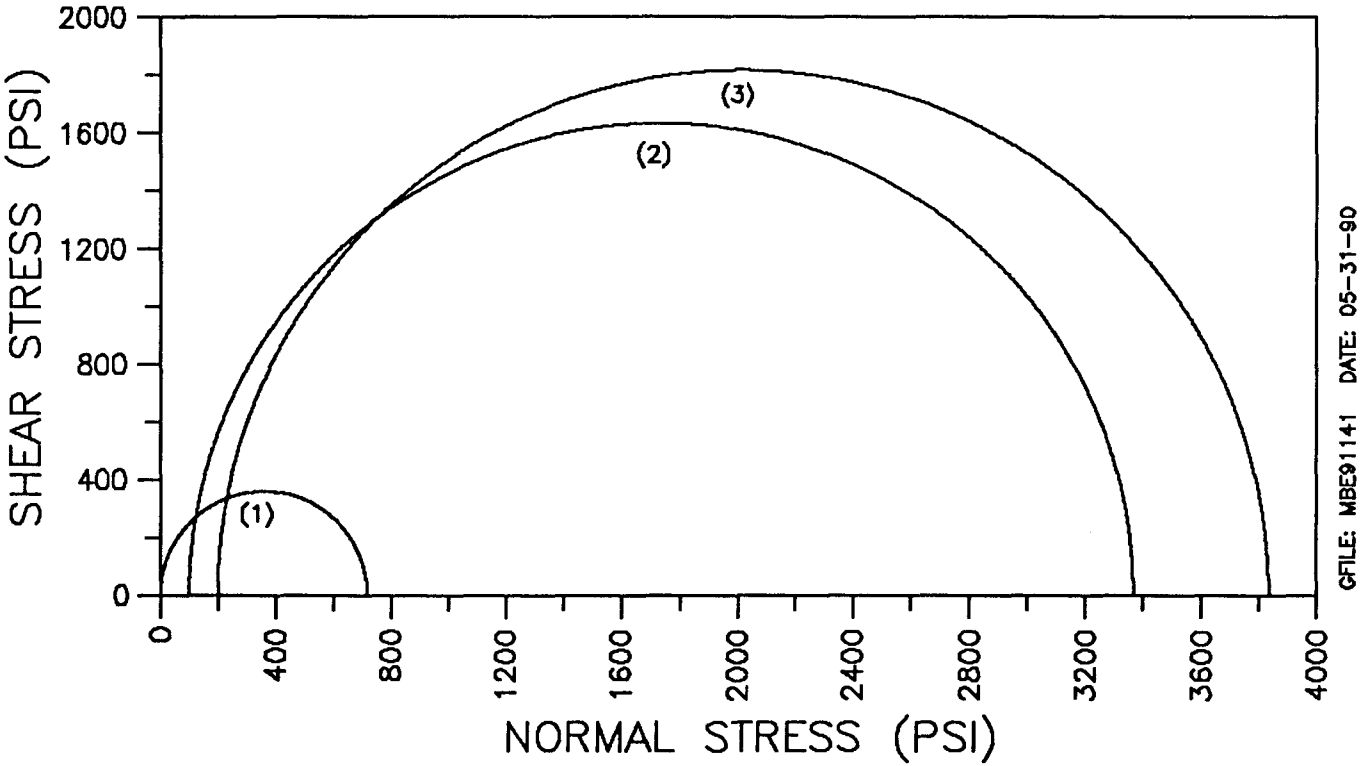
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BE9
DEPTH RANGE (FT): 114.1–116.1
AUSTIN CHALK LIMESTONE



GFILE: MBE91141 DATE: 05-31-90

SEE STRESS–STRAIN PLOTS
FOR INDIVIDUAL SAMPLE DATA

(1) DEPTH (FT): 114.1
(2) DEPTH (FT): 115.3
(3) DEPTH (FT): 115.7

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

TEXAS SSC SITE

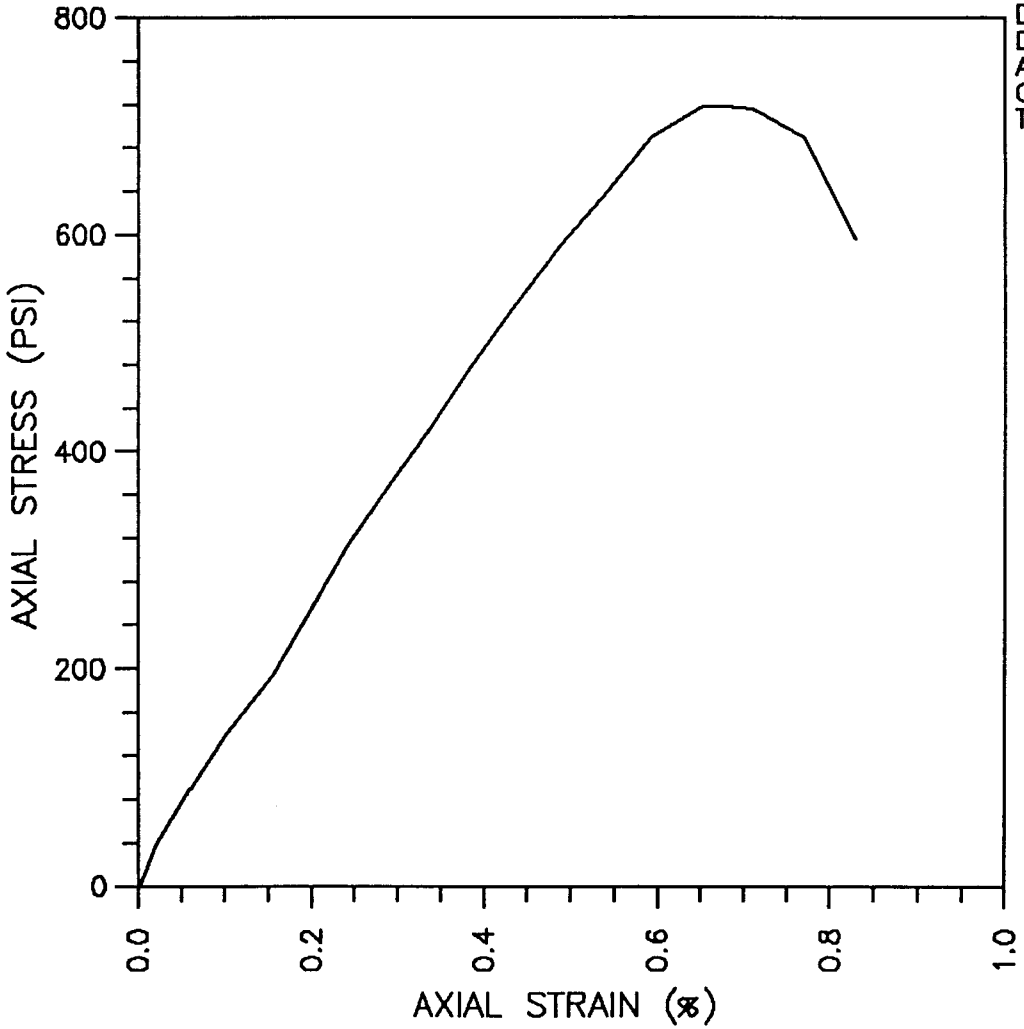
MOHR CIRCLE PLOT

MASON–JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS–ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BE9
DEPTH (FT): 114.1
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 9.5
DRY UNIT WEIGHT (PCF): 134.8
DEG. OF SATURATION (%): 103.2
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: BE91141 DATE: 05-30-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.128 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

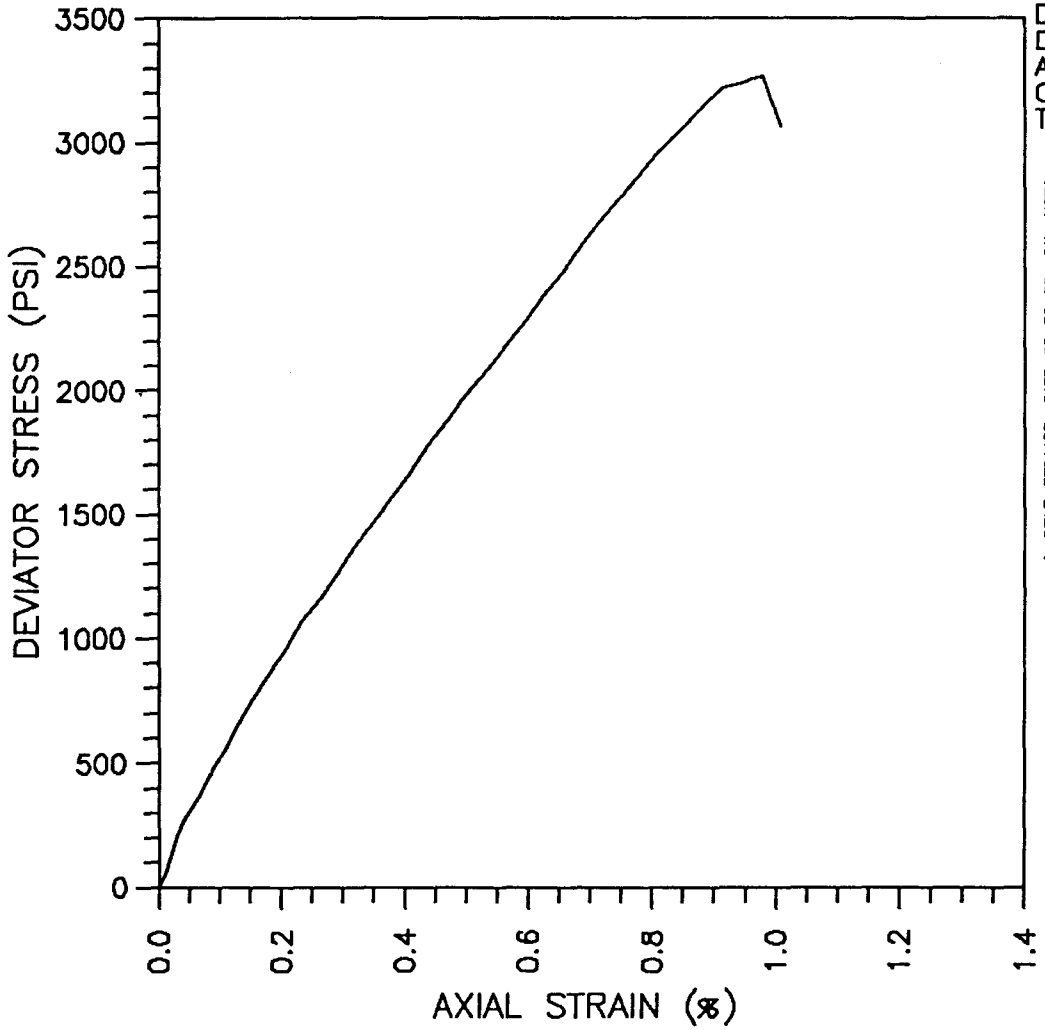
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BE9
DEPTH (FT): 115.3
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 7.4
DRY UNIT WEIGHT (PCF): 140.5
DEG. OF SATURATION (%): 100.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

GFILE: BE91153 DATE: 06-30-90 CAL: MCT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
3.409 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

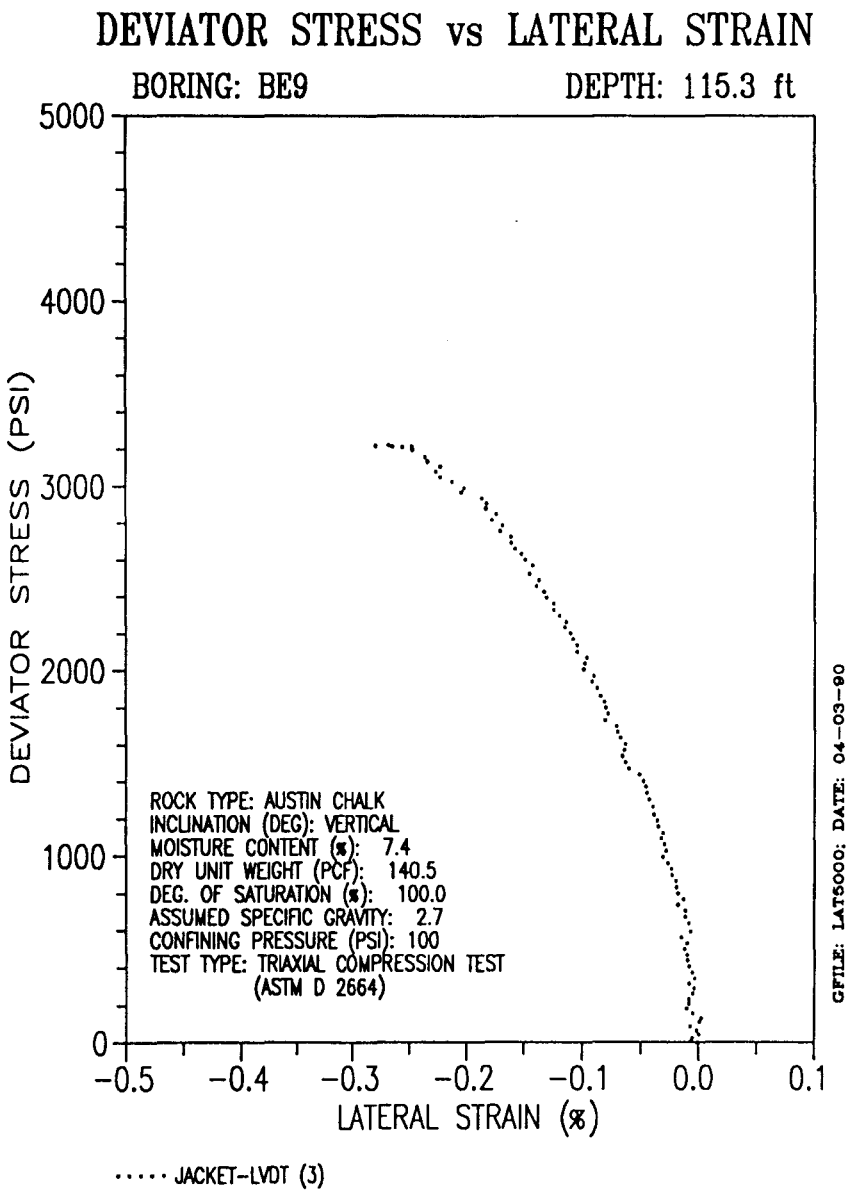
TEXAS SSC SITE

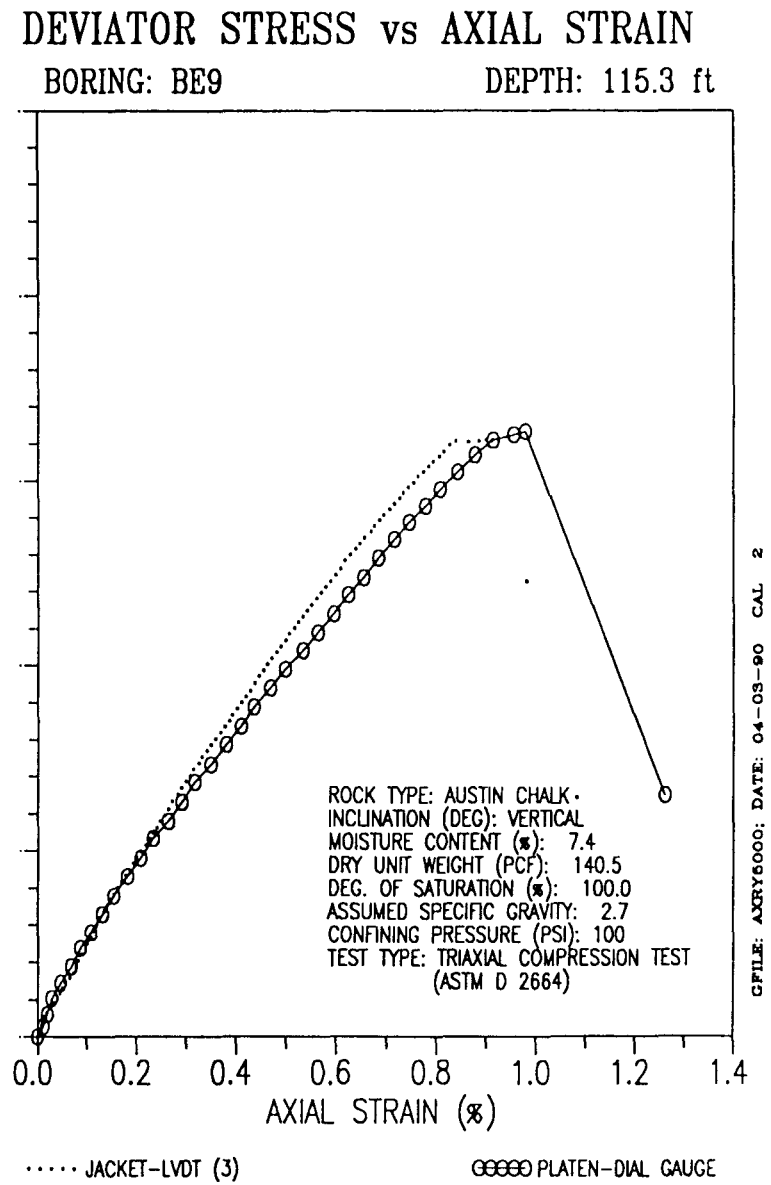
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

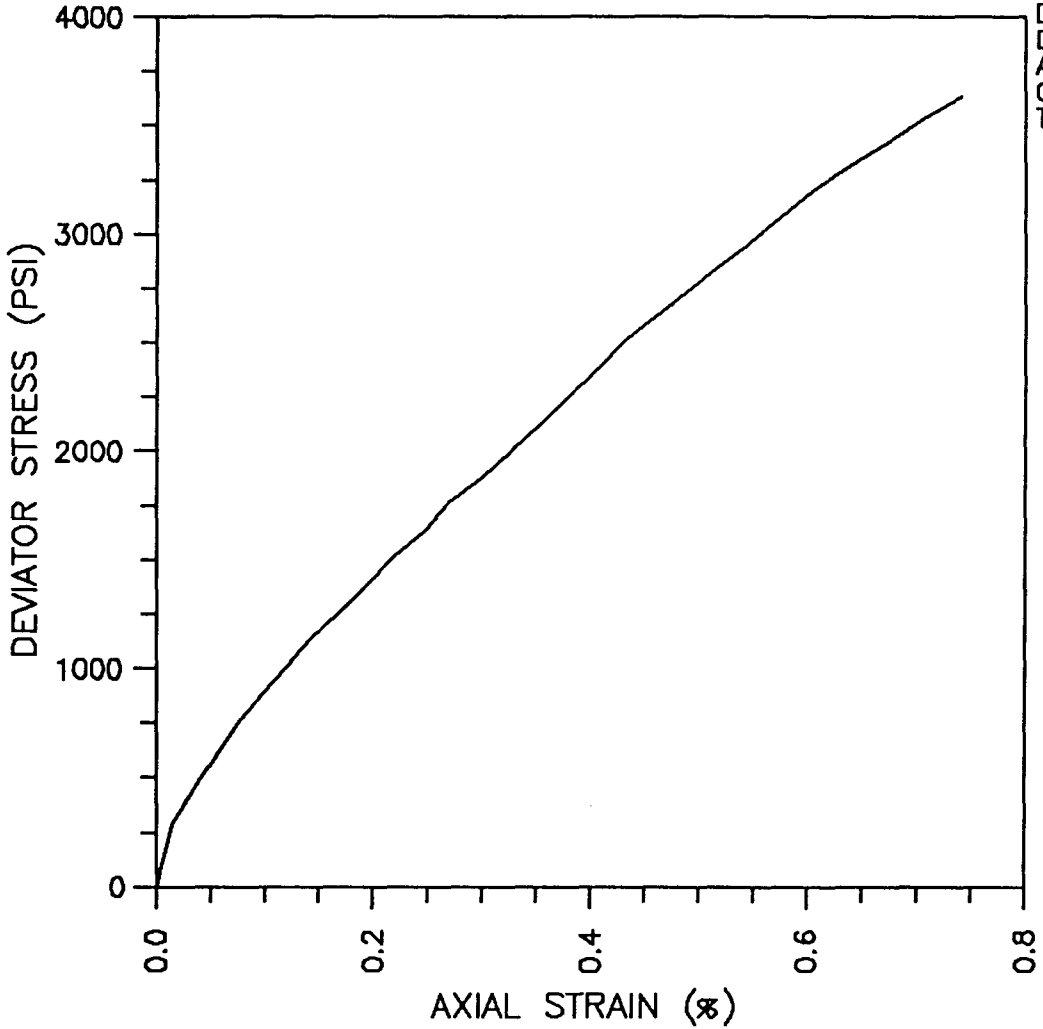
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BE9
DEPTH: 115.3 ft
DEVIATOR STRESS (PSI)
5000
4000
3000
2000
1000
0
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
LATERAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 7.4
DRY UNIT WEIGHT (PCF): 140.5
DEG. OF SATURATION (%): 100.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT5000; DATE: 04-03-90
····· JACKET-LVDT (3)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BE9
DEPTH: 115.3 ft
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
AXIAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 7.4
DRY UNIT WEIGHT (PCF): 140.5
DEG. OF SATURATION (%): 100.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 100
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY6000; DATE: 04-03-90 CAL 2
····· JACKET-LVDT (3)
ooooo PLATEN-DIAL GAUGE

BORING NO.: BE9
DEPTH (FT): 115.7
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 8.2
DRY UNIT WEIGHT (PCF): 139.7
DEG. OF SATURATION (%): 107.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION
(ASTM D 2664)

GFILE: BE91157 DATE: 05-30-90 CAL: MCT4

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
4.678 x10E5 PSI

FAILURE MODE:
LOADED TO 3633 PSI
W/O FAILURE

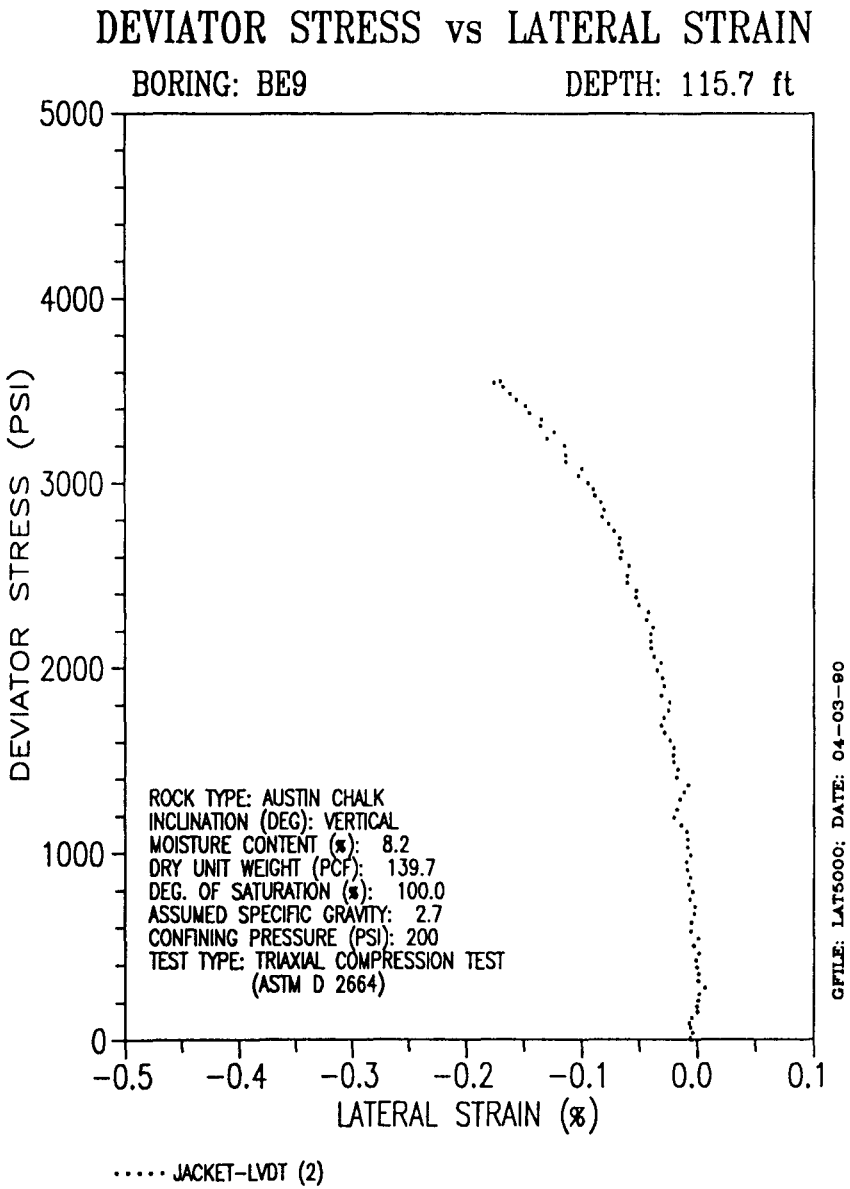
TEXAS SSC SITE

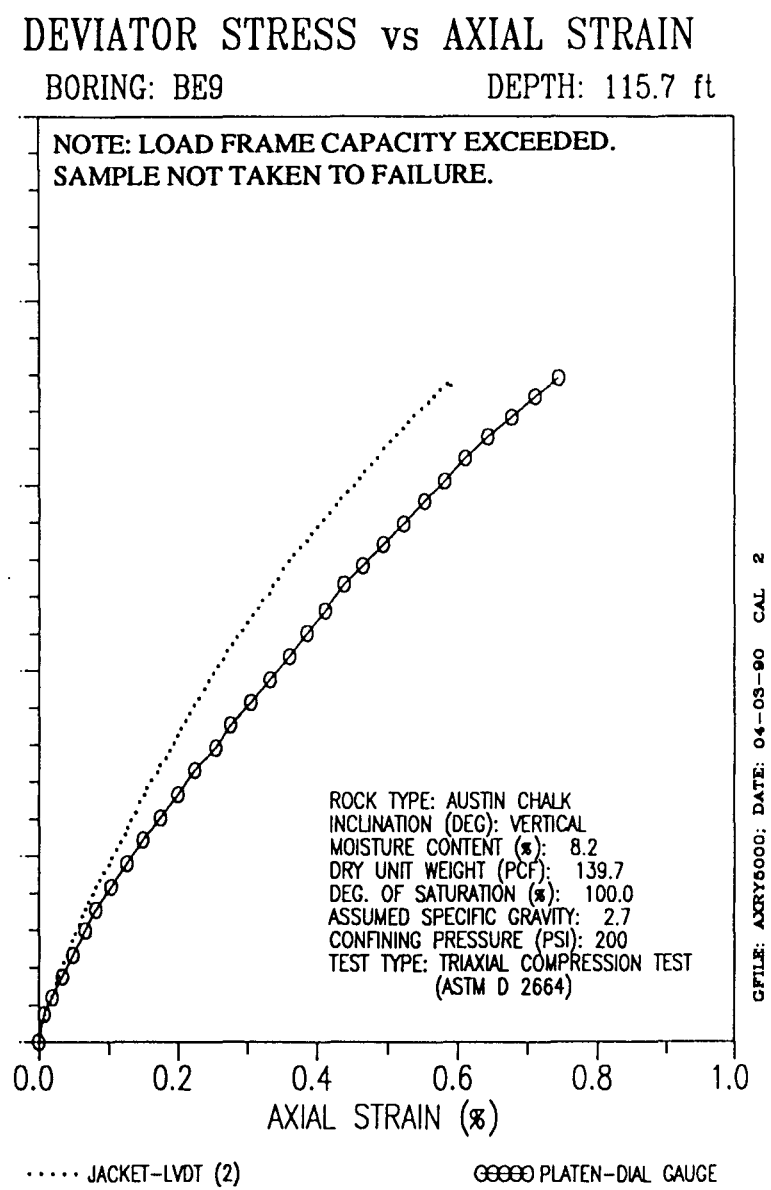
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

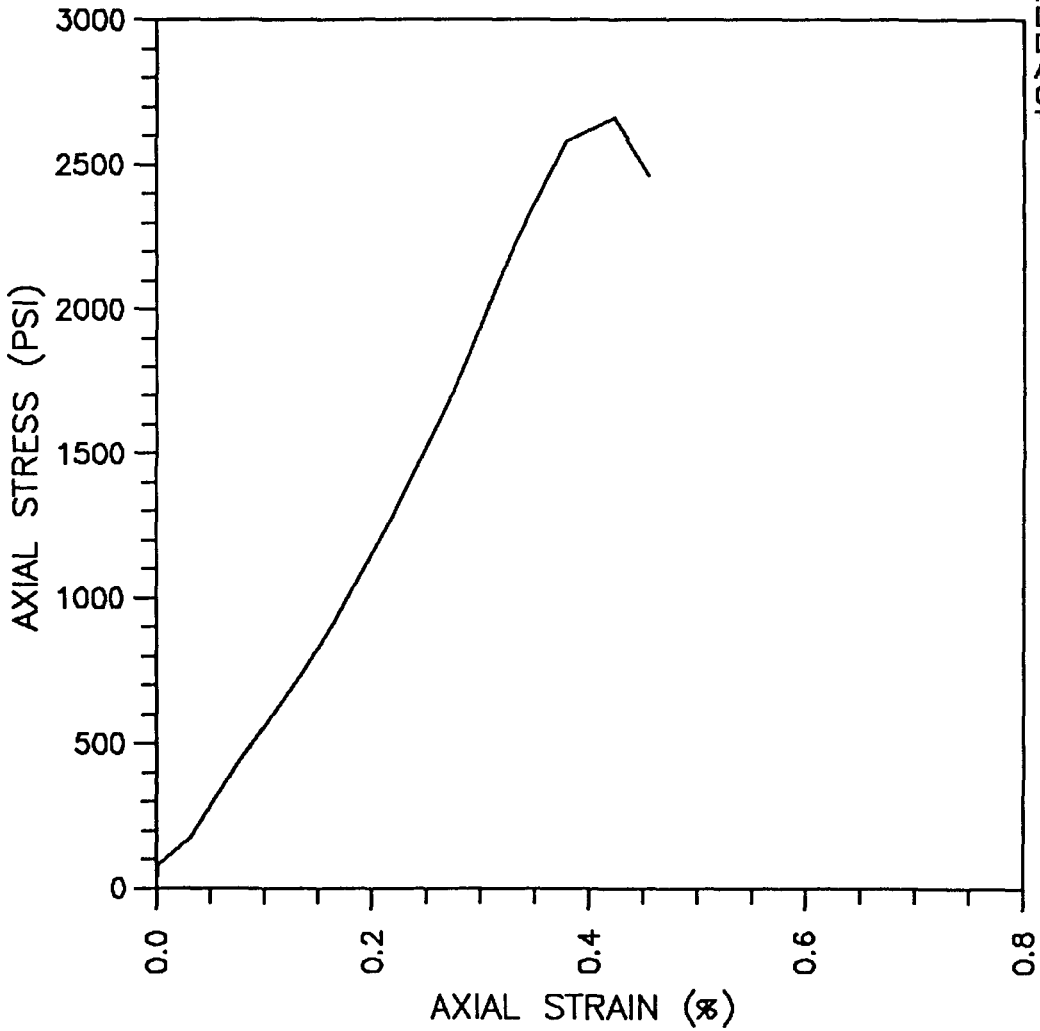
JOB NO.: 5530.17

FIGURE


DEVIATOR STRESS vs LATERAL STRAIN
BORING: BE9
DEPTH: 115.7 ft
DEVIATOR STRESS (PSI)
5000
4000
3000
2000
1000
0
-0.5
-0.4
-0.3
-0.2
-0.1
0.0
0.1
LATERAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 8.2
DRY UNIT WEIGHT (PCF): 139.7
DEG. OF SATURATION (%): 100.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: LAT5000; DATE: 04-03-90
JACKET-LVDT (2)


DEVIATOR STRESS vs AXIAL STRAIN
BORING: BE9
DEPTH: 115.7 ft
NOTE: LOAD FRAME CAPACITY EXCEEDED.
SAMPLE NOT TAKEN TO FAILURE.
0.0
0.2
0.4
0.6
0.8
1.0
AXIAL STRAIN (%)
ROCK TYPE: AUSTIN CHALK
INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 8.2
DRY UNIT WEIGHT (PCF): 139.7
DEG. OF SATURATION (%): 100.0
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 200
TEST TYPE: TRIAXIAL COMPRESSION TEST
(ASTM D 2664)
GFILE: AXRY5000; DATE: 04-03-90 CAL 2
JACKET-LVDT (2)
PLATEN-DIAL GAUGE

BORING NO.: BE9
DEPTH (FT): 143.0
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.4
DRY UNIT WEIGHT (PCF): 130.4
DEG. OF SATURATION (%): 95.8
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

FILE: BE91430 DATE: 05-29-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
7.294 x10E5 PSI

FAILURE MODE:
CONICAL FAILURE

TEXAS SSC SITE

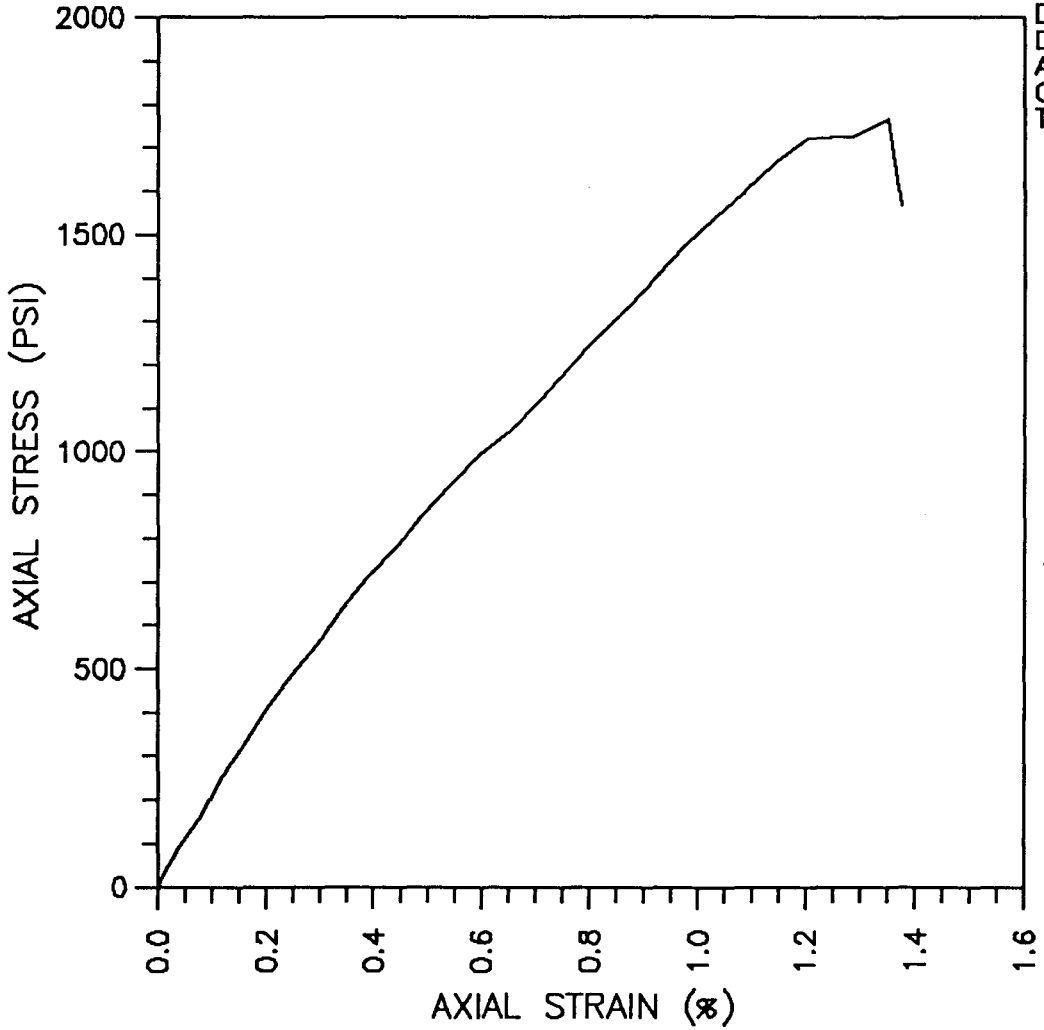
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BE9
DEPTH (FT): 153.1
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.3
DRY UNIT WEIGHT (PCF): 131.2
DEG. OF SATURATION (%): 98.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: BE91531 DATE: 05-30-90 CAL: MCJ3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.316 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING

TEXAS SSC SITE

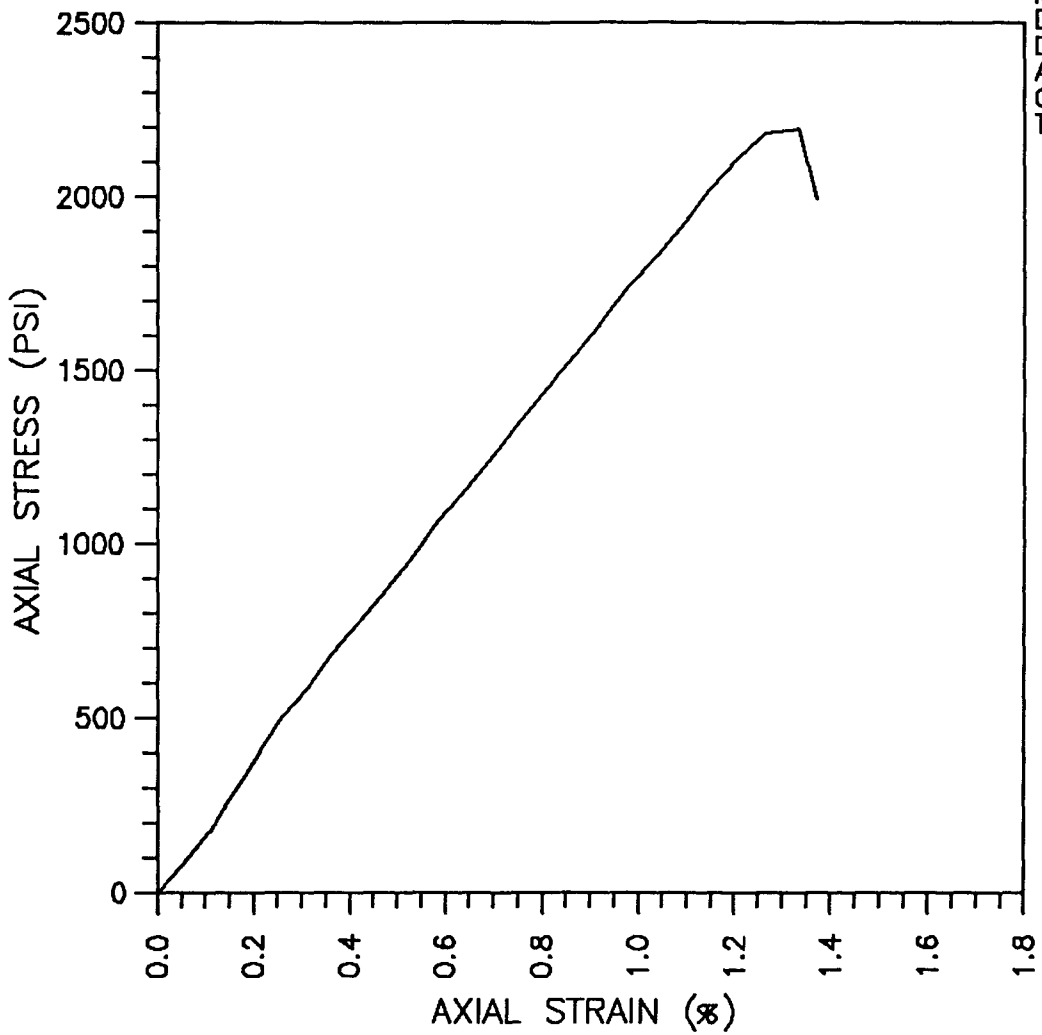
STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES,INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

BORING NO.: BE9
DEPTH (FT): 157.3
AUSTIN CHALK LIMESTONE



INCLINATION (DEG): VERTICAL
MOISTURE CONTENT (%): 10.2
DRY UNIT WEIGHT (PCF): 131.7
DEG. OF SATURATION (%): 98.3
ASSUMED SPECIFIC GRAVITY: 2.7
CONFINING PRESSURE (PSI): 0
TEST TYPE: UNCONFINED COMPRESSION
(ASTM D 2938)

GFILE: BE91573 DATE: 06-30-90 CAL: MCU3

TANGENT MODULUS AT 50%
ULTIMATE STRESS:
1.724 x10E5 PSI

FAILURE MODE:
AXIAL SPLITTING W/
CONICAL FAILURE AT TOP

TEXAS SSC SITE

STRESS-STRAIN PLOT

MASON-JOHNSTON & ASSOCIATES, INC.
GEOLOGISTS-ENGINEERS

JOB NO.: 5530.17

FIGURE

APPENDIX E

WELL AS-BUILT DIAGRAM

GEOMECHANICAL TEST RESULTS – BORING BE 9

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	SAMPLE DIMENSION RATIO L/D	SAMPLE FAILURE MODE/ DEGREES *	UNCONFINED COMPRESSIVE STRENGTH psi	TRIAXIAL COMPRESSION CONFINING PRESSURE σ_3 psi	TRIAXIAL COMPRESSION DEVIATOR STRESS $\sigma_1-\sigma_3$ psi	FAILURE STRAIN percent	TANGENT YOUNG'S MODULUS E50 (psi)x10E5	TANGENT YOUNG'S MODULUS UNLOAD/ RELOAD (psi)x10E5	TANGENT YOUNG'S MODULUS σ_3 psi	POISSON'S RATIO	BRAZIL TENSILE STRENGTH psi	2ND CYCLE SLAKE DURABILITY INDEX percent	MODIFIED TABER ABRASION INDEX	SWELL PRESSURE INDEX psi	COMMENTS
AUSTIN CHALK	66.9	9.4	133.5																				
AUSTIN CHALK	67.8	12.8	124.8	2.66					2.5	D	1401												
AUSTIN CHALK	92.5	8.5	136.3																				
AUSTIN CHALK	92.9	8.3	134.7						2.3	D	1812			1.24	1.54		0						NOTE 1
AUSTIN CHALK	93.3								0.5										167				
AUSTIN CHALK	107.6	24.1	100.0																				SHALY
AUSTIN CHALK	108.1	12.7	123.6						2.0	D	366			1.14	0.39		0						SHALY
AUSTIN CHALK	114.1	9.5	134.8						2.4	D	719			0.65	1.13		0						
AUSTIN CHALK	114.5	8.0	138.1																				
AUSTIN CHALK	115.3	7.4	140.5	2.66					2.3	D		100	3266	0.98	3.41		100						
AUSTIN CHALK	115.3														3.90			0.28					NOTE 2
AUSTIN CHALK	115.7	8.2	139.7						2.4	A		200	3633	0.74	4.68		200						NOTE 3
AUSTIN CHALK	115.7														6.10			0.17					NOTE 2
AUSTIN CHALK	142.6	10.6	130.5																				
AUSTIN CHALK	143.0	10.4	130.4						2.3	E	2662			0.42	7.29		0						
AUSTIN CHALK	152.7	10.4	129.9																				
AUSTIN CHALK	153.1	10.3	131.2						2.3	D	1767			1.35	1.32		0						
AUSTIN CHALK	156.9	11.3	129.5																				
AUSTIN CHALK	157.3	10.2	131.7						2.3	D & E	2193			1.33	1.72		0						
PROCEDURE		ASTM-D2216		ASTM-D854	ASTM-D4318		ASTM-D422				ASTM-D2938	ASTM-D2664			ASTM-D3148			ASTM-D3148	ASTM-D3967	ISRM	ISRM	ISRM	

BE9PRT21.WK1
REVISION: 2.1
DATE: 06/05/90

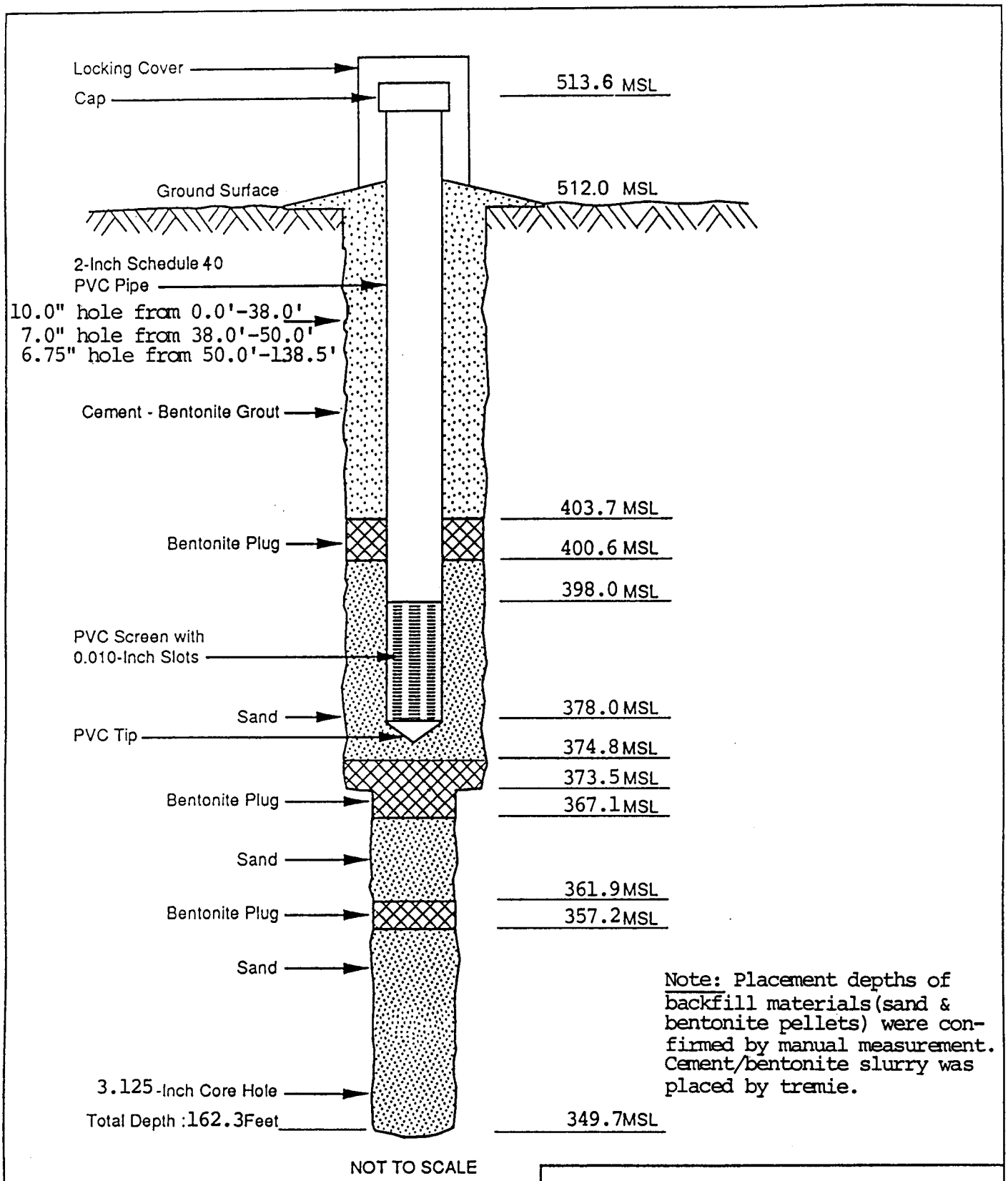
* EXPLANATION OF SAMPLE FAILURE MODE AS FOLLOWS.

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

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

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

3) Load frame capacity exceeded. Sample not taken to failure. Modulus taken at 50 % of maximum stress.



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

Boring: BE 9
Location: N 207,540
E 2,200,560
Date(s) Installed: 2/19/90-2/20/90
Well Construction
Supervising Geologist: W.D. Flanigan
Approved By: Scott Lesikar Date: 5/15/90

Observation Well
No. BE 9

5/90 Figure