

SSCL-SR-1200
SGR-14



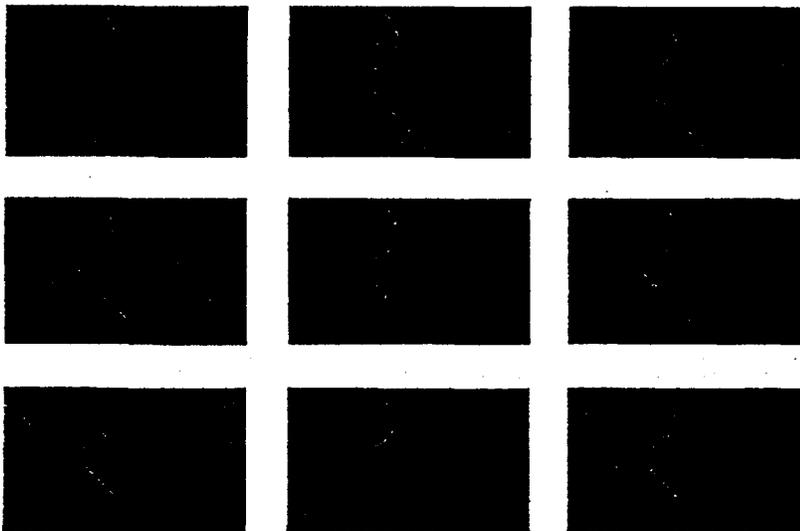
Raba-Kistner Consultants, Inc.

Engineers, Geologists, Chemists, Water Planners
Hygienists and Environmental Scientists

GEOTECHNICAL REPORT

FOR

N15 (E1) MAGNET DELIVERY SHAFT
SUPERCONDUCTING SUPER COLLIDER



Project No. ASA91-020-00
June 26, 1991



7002 Commerce, El Paso, TX 79915
(915) 778-5233 • FAX (915) 779-8301

Mr. Charles Daugherty
The PB/MK Team
Redbird Business Center, Building 5
5610 Redbird Center Drive, Suite 400
Dallas, Texas 75237

Re.: Geotechnical Report
N15 (E1) Magnet Delivery Shaft
Superconducting Super Collider

Dear Mr. Daugherty:

Submitted here is a report of shallow subsurface conditions at the site of the Magnet Delivery Shaft at the E1 Site of the Superconducting Super Collider in Ellis County, Texas. This report has been prepared for the use of The PB/MK Team for design purposes in accordance with accepted Geotechnical Engineering practices.

FIELD EXPLORATION AND LABORATORY TESTS

Borings Subsurface conditions at the site were evaluated by six borings drilled at the locations shown on the Plan of Borings, Plate 1. The number of borings included in this study, their field locations, and their termination depths were selected by The PB/MK Team. Grid coordinates and surface elevations for the boring locations were provided by PB/MK, and are shown on the individual boring logs. The borings were drilled in accordance with ASTM D 420 procedures to depths ranging from 17 to 20 ft below existing grades using a rotary drilling rig.

A field log was prepared for each boring by a staff geologist. Each log contains information concerning the boring method, drill crew, time of drilling, samples attempted and recovered, indications of the presence of various materials such as silt, clay, gravel, sand or rock, recovery ratios and rock quality designations (RQD) for core runs performed, and observations of ground water.

The final logs represent our interpretation of the contents of the field logs for the purpose delineated by our client. The final logs are included in the Illustrations section of this report, Plates 2 through 7. A key to classification terms and symbols used on the logs appears on Plate 8.

Sampling The following samples were collected as a part of our subsurface exploration procedures:

<u>Type of Sample</u>	<u>ASTM Procedure</u>	<u>Number Collected</u>
Auger	D 1452	1
Split Spoon (with Standard Penetration Test)	D 1586	8
NX Core, feet	D 2113	104

Representative portions of all soil samples, as well as all rock core recovered, were sealed to reduce moisture loss, placed in protective containers or core boxes, and transported to our laboratory for testing.

Standard penetration test results are noted as "blows per foot" on the boring logs. Where hard or dense materials were encountered, the tests were terminated at 50 blows even if one foot of penetration had not been achieved. These data are conservatively reported as 50 blows per ft in this report. Individual blow counts recorded during sampling in the test borings are tabulated on Plate 26.

Laboratory Testing In the laboratory, each sample was inspected and classified by a geotechnical engineer. The geotechnical engineering properties of the strata were evaluated by the following tests:

<u>Type of Test</u>	<u>ASTM Procedure</u>	<u>Number Conducted</u>
Natural Moisture Content	D 2216	18
Unconfined Compression	D 2938	18

The results of all laboratory tests are presented in graphical or numerical form on the appropriate boring log and Plates 9 through 25. For ease of reference, the results have been tabulated on Plate 26.

GENERAL SITE AND SUBSURFACE CONDITIONS

Existing Conditions The project site consists of an open, native grass-covered tract of land most recently used for agricultural and livestock grazing purposes. The topography in the site vicinity is described as rolling, with the ground surface at the E1 Site sloping gently downward in an east-southeasterly direction. Existing site drainage is considered to be fair to poor.

Stratigraphy The soils/rock encountered at this site can be divided into three generalized strata that possess similar physical and engineering characteristics, as described below.

Stratum I consists of dark brown clays and extends to depths ranging from 1 to 1.7 ft below existing grades. Previous testing at the El Site has shown these clays to be highly plastic, with measured plasticity indices generally in the order of 40 to 50. Designated as CH soils under the Unified Soil Classification System (USCS), clays of this plasticity are generally recognized to possess high shrink/swell potential. The results of Standard Penetration Tests conducted in this stratum indicate stiff to very stiff clay consistencies.

Stratum II consists of tan, weathered limestone of the Austin Chalk Formation and extends to depths varying from 8.2 to 12.2 ft below existing grades. Intermittent argillaceous seams are common within this formation. Recovery ratios and rock quality designations (RQD) measured for core runs performed in this stratum substantiate the weathered nature of the limestone, with RQD values varying from 0 to 92 percent. Unconfined compressive strengths measured for specimens of the weathered limestone vary from 10 to 169 tsf, indicating soft to moderately hard induration.

Stratum III consists of gray, unweathered limestone of the Austin Chalk Formation and extends to at least the 17 to 20 ft termination depths of the borings. Argillaceous seams are common on an intermittent basis within this formation. In general, recovery ratios were excellent for core runs performed in this formation. However, poor in situ rock quality was measured in two core runs performed in the upper reaches of this formation. Unconfined compressive strengths measured for specimens of the unweathered limestone vary from approximately 6 tsf to in excess of 150 tsf.

Ground Water Ground water was not observed in the test borings prior to the introduction of drilling fluids for rock coring operations.

FOUNDATION RECOMMENDATIONS

Foundation engineering analyses for the Magnet Delivery Shaft were limited to evaluating design bearing capacities for the upper collar of the shaft. Details concerning the delivery shaft collar were provided in the 30% drawings transmitted May 16, 1991, and the June 14 facsimile of revised Drawing No. S-800. Summarizing, the shaft collar consists of an angled protrusion of the concrete shaft wall at an approximate depth of 28 to 30 ft below finished grade. Details concerning structural loads to be carried by the collar footing have not been finalized at this time.

As discussed, boring depths selected by PB/MK for the Magnet Delivery Shaft study were not of sufficient depth to allow evaluation of bearing materials at the proposed founding depth of the shaft collar. For preliminary design considerations, we have based our recommendations on information provided by the single deep boring R-KCI drilled at the El Site (Boring AST-13), and several deeper borings drilled by Mason-Johnston and Associates for the surface facilities.

A review of the deeper borings drilled at the El Site reveals that the delivery shaft collar will likely bear in unweathered limestone of the Austin Chalk Formation. At this site, the unweathered portion of this formation is characterized as gray limestone of moderate induration. Softer, argillaceous partings and layers are common on an intermittent basis within the upper reaches of the unweathered limestone. Based on recovery ratios and rock quality designations (RQD) measured in core runs performed in this formation, the unweathered limestone generally appears to become harder and more competent with depth. Unconfined compressive strengths measured in core specimens of the unweathered limestone recovered at this site vary from 6 tsf in the clayey, shaley upper reaches of the formation, to in excess of 150 tsf in the lower reaches of the borings.

Based on the above discussion, we recommend that the N15 magnet delivery shaft collar be preliminarily designed using an allowable bearing capacity of up to 53,000 psf. This bearing capacity was evaluated assuming the shaft collar will bear in the harder, unweathered limestone exhibiting RQD's in excess of 90 percent and unconfined compressive strengths in excess of 130 tsf. A factor of safety in excess of 5 was used in evaluating the above bearing capacity.

In our opinion, supplemental borings and laboratory analyses will be required in the vicinity of the delivery shaft to verify the nature and engineering characteristics of the limestone at the proposed bearing stratum, unless deeper borings and laboratory strength testing unknown to us are available as a result of previous studies. Regardless, field inspections will be necessary at the time of construction to verify that the collar is founded in the harder, more competent unweathered limestone, and not an argillaceous or jointed zone within the rock.

* * * * *

The following illustrations are attached and complete this report:

Plate 1	Plan of Borings
Plates 2 through 7	Logs of Borings
Plate 8	Key to Terms and Symbols
Plates 9 through 25	Unconfined Compression Tests
Plate 26	Results of Laboratory Analyses

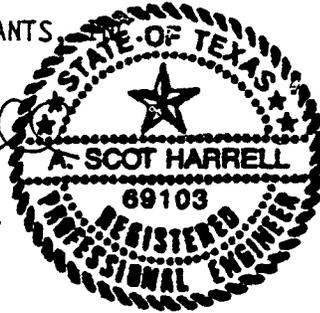
We appreciate the opportunity to be of service to you on this project. Please call should you have questions concerning the contents of this report, or other aspects of the project.

Very truly yours,

RABA-KISTNER CONSULTANTS

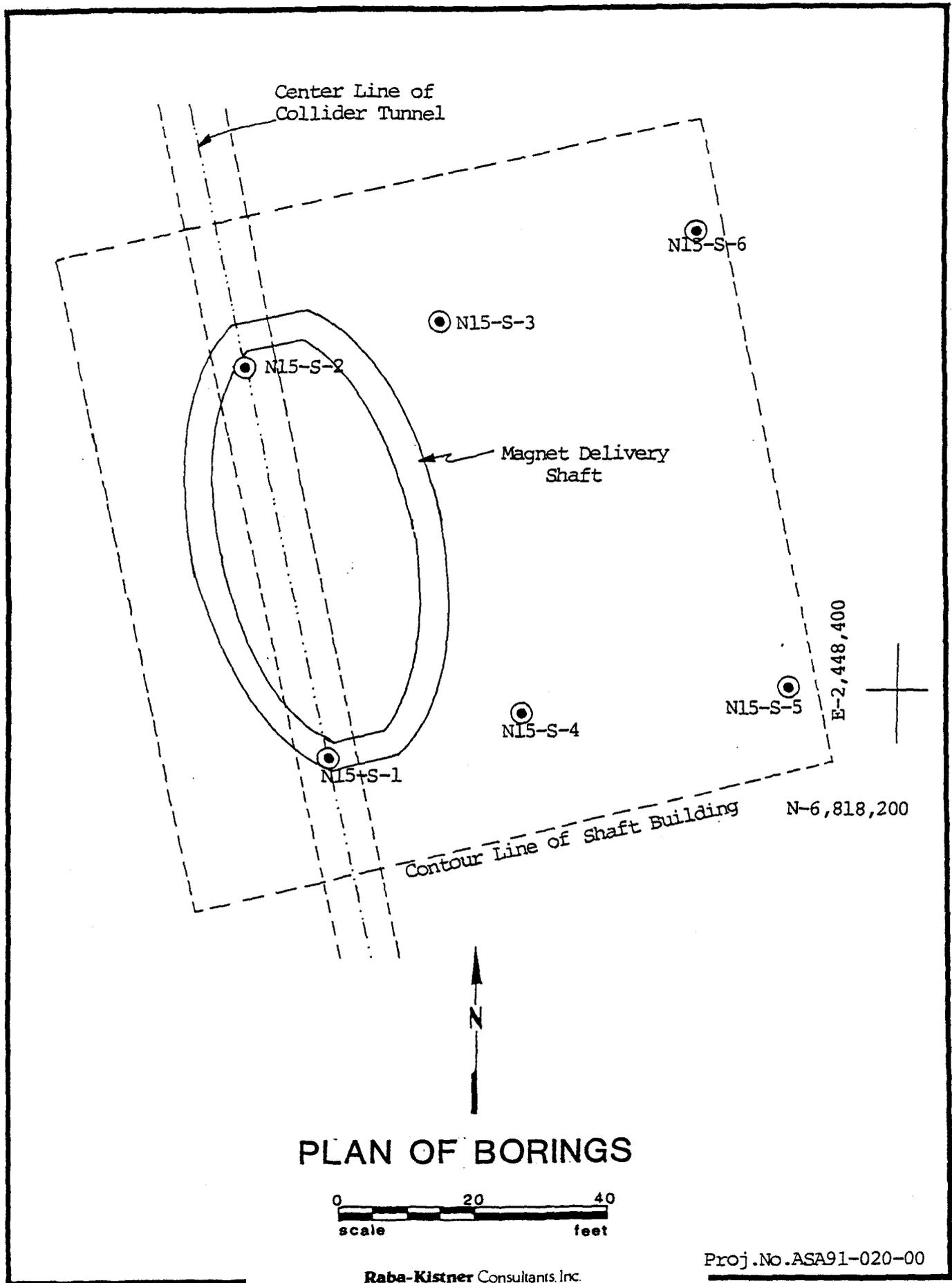
A. Scot Harrell

A. Scot Harrell, P.E.
Project Manager



ASH/cad
Copies submitted: Above (4)

I L L U S T R A T I O N S



PLAN OF BORINGS

Raba-Kistner Consultants, Inc.

LOG OF BORING NO. N15-S-1
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Raba-Kistner
Consultants, Inc.

DRILLING

METHOD: Hollow Stem Auger/NX Core Barrel

LOCATION: N6818270.00 / E2448367.00

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	UNCONF. COMPRESSION, tsf							X-200																					
						10	20	30	40	50	60	70																						
						PLASTIC LIMIT			WATER CONTENT		LIQUID LIMIT																							
			SURFACE ELEVATION: 761.19'																															
			CLAY, Very Stiff, Dark Brown, Moist with limestone fragments and roots 1.0'	16 50																														
5			LIMESTONE, Weathered, Soft to Medium Hard, Whitish-Tan with intermittent argillaceous seams 8.2'		123																													
10			LIMESTONE, Unweathered, Medium Hard, Massive, Gray - dark gray, argillaceous layer from 11.1' to 12' and 13.2' to 13.4'		124								138	⊗																				
15			- dark gray, slightly argillaceous from 15' to 15.5'		113								130	⊗																				
20			START: 7:00 AM END: 8:45 AM																															
25			GEOLOGIST: MICHAEL A. GILES																															
30			DRILL CREW: LARRY TAYLOR JAMES STUBBS JOHN SALMON																															
35																																		
40																																		
45																																		
50																																		
			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Core Run #</th> <th>Core Depth (ft)</th> <th>% Rec.</th> <th>% RQD</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2-5</td> <td>66</td> <td>0</td> </tr> <tr> <td>2</td> <td>5-10</td> <td>86</td> <td>83</td> </tr> <tr> <td>3</td> <td>10-15</td> <td>98</td> <td>90</td> </tr> <tr> <td>4</td> <td>15-18</td> <td>100</td> <td>100</td> </tr> </tbody> </table>	Core Run #	Core Depth (ft)	% Rec.	% RQD	1	2-5	66	0	2	5-10	86	83	3	10-15	98	90	4	15-18	100	100											
Core Run #	Core Depth (ft)	% Rec.	% RQD																															
1	2-5	66	0																															
2	5-10	86	83																															
3	10-15	98	90																															
4	15-18	100	100																															

DEPTH DRILLED: 18.0'	DEPTH TO WATER:	PROJ. No. ASA91-020-00
DATE DRILLED: 5-21-91	DATE MEASURED:	PLATE 2

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT.

LOG OF BORING NO. N15-S-2
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Raba-Kistner
 Consultants, Inc.

DRILLING METHOD: Hollow Stem Auger/NX Core Barrel

LOCATION: N6818249.00 / E2448300.00

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	UNCONF. COMPRESSION, tsf							X-200
						10	20	30	40	50	60	70	
						PLASTIC LIMIT		WATER CONTENT			LIQUID LIMIT		
			SURFACE ELEVATION: 761.23'			+-----+ 10 20 30 40 50 60 70							
0			CLAY, Very Stiff, Dark Brown, Moist with small limestone fragments and roots 1.7'	16									
5			LIMESTONE, Weathered, Soft to Medium Hard, Tan - argillaceous from 6' to 6.5' - argillaceous from 10' to 10.5' 12.2'	50									
10					120								
15			LIMESTONE, Unweathered, Medium Hard, Gray - argillaceous from 12.2' to 13.2' - dark gray from 14' to 14.7' and 17' to 18.1'		114								
20													
25			START: 12:30 PM END: 2:00 PM										
30			GEOLOGIST: MICHAEL A. GILES DRILL CREW: LARRY TAYLOR JAMES STUBBS JOHN SALMON										
35													
40													
45													
50			Core Run # Core Depth (ft) % Rec. % RQD										
			1 2-5 77 47										
			2 5-10 98 78										
			3 10-15 78 50										
			4 15-20 100 100										

DEPTH DRILLED: 20.0'	DEPTH TO WATER:	PROJ. No. ASA91-020-00
DATE DRILLED: 5-21-91	DATE MEASURED:	PLATE 3

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT.

**LOG OF BORING NO. N15-S-3
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS**



Raba-Kistner
Consultants, Inc.

DRILLING METHOD: Hollow Stem Auger/NX Core Barrel

LOCATION: N6818256.00 / E2448330.00

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	UNCONF. COMPRESSION, tsf							X-200	
						10	20	30	40	50	60	70		
						PLASTIC LIMIT			WATER CONTENT		LIQUID LIMIT			
			SURFACE ELEVATION: 760.68'											
0			CLAY, Very Stiff, Dark Brown, Moist with roots 1.6'	18										
5			LIMESTONE, Weathered, Soft to Medium Hard, Whitish-Tan - argillaceous from 4.4' to 4.7 and from 9.7' to 10'		121									
10														
11.2			LIMESTONE, Unweathered, Medium Hard, Gray - dark gray, argillaceous from 11.2' to 11.8' and 16.8' to 18.2'		122									
15					118									
20														
25			START: 10:30 AM END: 12:15 PM											
30			GEOLOGIST: MICHAEL A. GILES DRILL CREW: LARRY TAYLOR JAMES STUBBS JOHN SALMON											
35														
40														
45														
50			Core Run # Core Depth (ft) % Rec. % RQD											
			1 2-5 90 60											
			2 5-10 96 80											
			3 10-15 99 92											
			4 15-20 100 100											

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT.

DEPTH DRILLED: 20.0'	DEPTH TO WATER:	PROJ. No. ASA91-020-00
DATE DRILLED: 5-21-91	DATE MEASURED:	PLATE 4

LOG OF BORING NO. N15-S-4
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Raba-Kistner
 Consultants, Inc.

DRILLING METHOD: Hollow Stem Auger/NX Core Barrel

LOCATION: N6818196.00 / E2448344.00

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	UNCONF. COMPRESSION, tsf							% -200																					
						10	20	30	40	50	60	70																						
						PLASTIC LIMIT		WATER CONTENT			LIQUID LIMIT																							
			SURFACE ELEVATION: 760.70'																															
5			CLAY, Very Stiff, Dark Brown, Moist with small limestone pebbles 1.5'	18																														
10			LIMESTONE, Weathered, Soft to Medium Hard, Whitish-Tan with intermittent argillaceous seams 11.9'																															
15			LIMESTONE, Unweathered, Medium Hard, Light Gray to Gray with intermittent argillaceous seams to 16'																															
20																																		
25			START: 4:00 PM END: 5:45 PM																															
30			GEOLOGIST: MICHAEL A. GILES																															
35			DRILL CREW: LARRY TAYLOR JAMES STUBBS JOHN SALMON																															
45																																		
50			<table border="1"> <thead> <tr> <th>Core Run #</th> <th>Core Depth (ft)</th> <th>% Rec.</th> <th>% RQD</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2-6</td> <td>90</td> <td>55</td> </tr> <tr> <td>2</td> <td>6-11</td> <td>100</td> <td>92</td> </tr> <tr> <td>3</td> <td>11-16</td> <td>80</td> <td>0</td> </tr> <tr> <td>4</td> <td>16-21</td> <td>100</td> <td>90</td> </tr> </tbody> </table>	Core Run #	Core Depth (ft)	% Rec.	% RQD	1	2-6	90	55	2	6-11	100	92	3	11-16	80	0	4	16-21	100	90											
Core Run #	Core Depth (ft)	% Rec.	% RQD																															
1	2-6	90	55																															
2	6-11	100	92																															
3	11-16	80	0																															
4	16-21	100	90																															

DEPTH DRILLED: 21.0'	DEPTH TO WATER:	PROJ. No. ASA91-020-00
DATE DRILLED: 5-21-91	DATE MEASURED:	PLATE 5

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT.

**LOG OF BORING NO. N15-S-5
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS**



Raba-Kistner
Consultants, Inc.

DRILLING METHOD: Hollow Stem Auger/NX Core Barrel

LOCATION: N6818200.00 / E2448383.00

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	⊗ UNCONF. COMPRESSION, tsf						X-200	
						10	20	30	40	50	60		70
						PLASTIC LIMIT			WATER CONTENT		LIQUID LIMIT		
			SURFACE ELEVATION: 759.78'										
0			CLAY, Very Stiff, Moist with rock fragments and roots 1.0'	50									
5			LIMESTONE, Weathered, Soft to Medium Hard, Whitish-Tan with intermittent argillaceous seams		121								120 ⊗
10					120								
12			LIMESTONE, Unweathered, Hard, Gray with abundant horizontal interclast - thinly bedded, dark gray from 13.7' to 15'		122								86 ⊗
20													
25			START: 1:45 PM END: 4:00 PM										
30			GEOLOGIST: MICHAEL A. GILES										
35			DRILL CREW: LARRY TAYLOR JAMES STUBBS JOHN SALMON										
40													
45													
50			Core Run # Core Depth (ft) % Rec. % RQD										
			1 1-6 80 26										
			2 6-11 86 73										
			3 11-16 96 96										
			4 16-18 100 100										

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT.

DEPTH DRILLED: 18.0'	DEPTH TO WATER:	PROJ. No. ASA91-020-00
DATE DRILLED: 5-20-91	DATE MEASURED:	PLATE 6

LOG OF BORING NO. N15-S-6
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Raba-Kistner
 Consultants, Inc.

DRILLING

METHOD: Hollow Stem Auger/NX Core Barrel

LOCATION: N6818270.00 / E2448367.00

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	UNCONF. COMPRESSION, tsf							N-200	
						10	20	30	40	50	60	70		
						PLASTIC LIMIT			WATER CONTENT		LIQUID LIMIT			
			SURFACE ELEVATION: 760.04'											
5			CLAY, Stiff, Dark Brown with small limestone fragments and roots 1.0'	50										
10			LIMESTONE, Weathered, Soft to Medium Hard, Whitish-Tan - with yellowish-tan layer from 2.5' to 3.8' - argillaceous from 5.9' to 7.1' - argillaceous from 8.9' to 9.2' 10.8'	114									169	
15			LIMESTONE, Unweathered, Medium Hard, Gray - dark gray from 12.3' to 13.4' - argillaceous from 16.2' to 17'	122										
15				119										158
25			START: 9:05 AM END: 10:20 AM											
30			GEOLOGIST: MICHAEL A. GILES DRILL CREW: LARRY TAYLOR JAMES STUBBS JOHN SALMON											
45			Core Run # Core Depth (ft) % Rec. % RQD											
50			1 1-5 79 35											
			2 5-10 96 40											
			3 10-15 100 100											
			4 15-17 95 95											

DEPTH DRILLED: 17.0'
 DATE DRILLED: 5-21-91

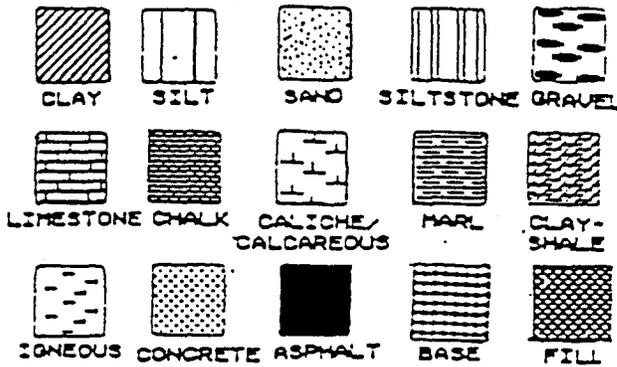
DEPTH TO WATER:
 DATE MEASURED:

PROJ. No. ASA91-020-00
 PLATE 7

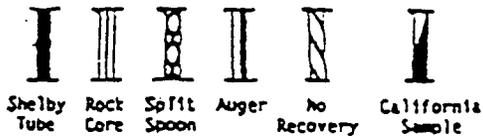
NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT.

SYMBOLS AND TERMS USED ON BORING LOGS

SOIL OR ROCK TYPES (shown in symbols column)



SAMPLER TYPES (shown in sample column)



STRENGTH TEST RESULTS

- Pocket Penetrometer
- Torvane
- Unconfined Compression

TRIAxIAL COMPRESSION

- Unconsolidated-undrained
- Consolidated-undrained
- Cohesion (Total)
- Angle of Internal Friction (Total)
- Cohesion (Effective)
- Angle of Internal Friction (Effective)

NOTE: Values symbolized on boring logs represent shear strengths unless otherwise noted.

TERMS DESCRIBING CONSISTENCY, CONDITION OR TEXTURE

Terms used in this report to describe soils with regard to their consistency or conditions are in general accordance with the discussion presented in Article 45 of SOIL MECHANICS IN ENGINEERING PRACTICE, Terzaghi and Peck, John Wiley & Sons, Inc. 1967, using the most reliable information available from the field and laboratory investigations. Terms used for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.

TERMS CHARACTERIZING SOIL STRUCTURE

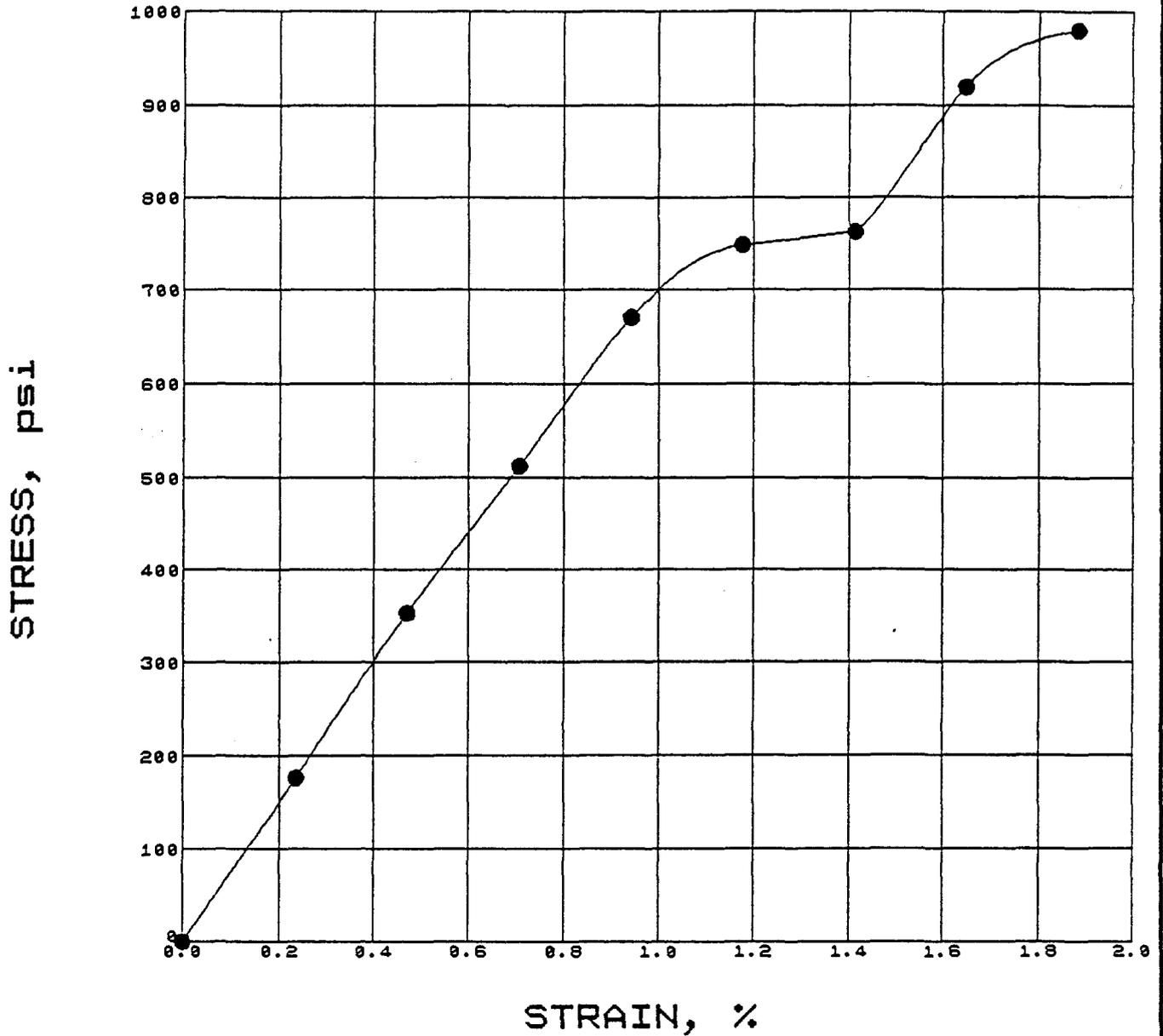
Slickensided	having inclined planes of weakness that are slick and glossy in appearance
Fissured	containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical
Laminated	composed of thin layers of varying colors and texture
Interbedded	composed of alternate layers of different soil types
Calcareous	containing appreciable quantities of calcium carbonate
Well graded	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Poorly graded	predominantly of one grain size, or having a range of sizes with some intermediate size missing

TERMS DESCRIBING CONSISTENCY OR CONDITION

RELATIVE DENSITY		COHESIVE STRENGTH			PLASTICITY	
Penetration Resistance, blows per ft	Relative Density	Penetration Resistance, blows per ft	Consistency	Cohesion TSf	Plasticity Index	Degree of Plasticity
0-4	Very loose	0-2	Very Soft	0-0.125	0-5	None
4-10	Loose	2-4	Soft	0.125-0.25	5-10	Low
10-30	Medium Dense	4-8	Firm	0.25-0.5	10-20	Moderate
30-50	Dense	8-15	Stiff	0.5-1.0	20-40	Plastic
>50	Very Dense	15-30	Very Stiff	1.0-2.0	>40	Highly Plastic
		>30	Hard	>2.0		

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

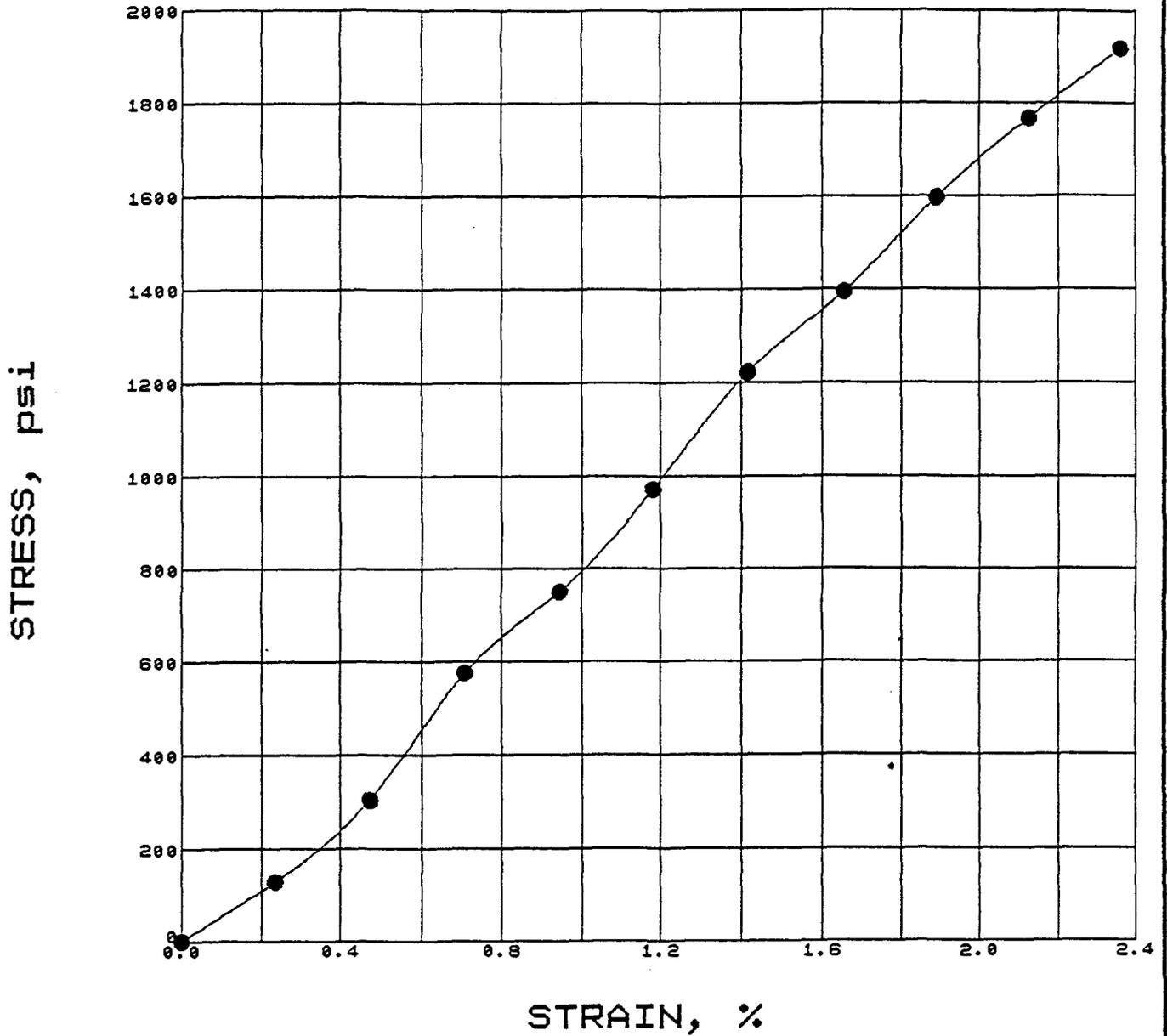
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-1
Depth: 2.50 ft
Material Description: LIMESTONE, Weathered (Austin Chalk)
Moisture Content: 12.91 %
Dry Unit Weight: 123.29 pcf
Stress at Failure: 980 psi
Strain at Failure: 1.88 %
Secant Modulus: 52052 psi

Project No. ASA91-020-00

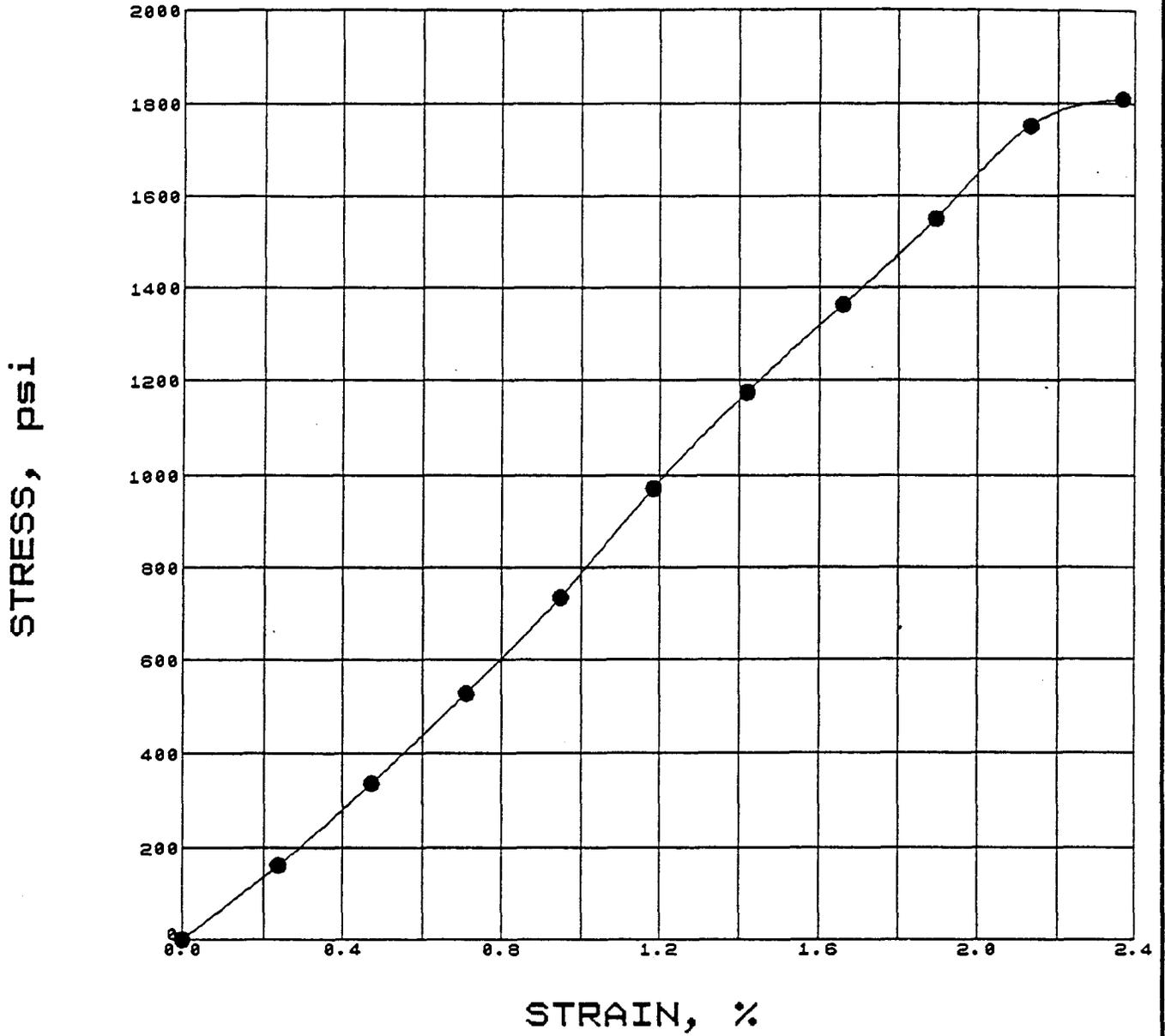
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-1
Depth: 12.00 ft
Material Description: LIMESTONE, Unweathered (Austin Chalk)
Moisture Content: 13.57 %
Dry Unit Weight: 124.46 pcf
Stress at Failure: 1919 psi
Strain at Failure: 2.36 %
Secant Modulus: 81245 psi

Project No. ASA91-020-00

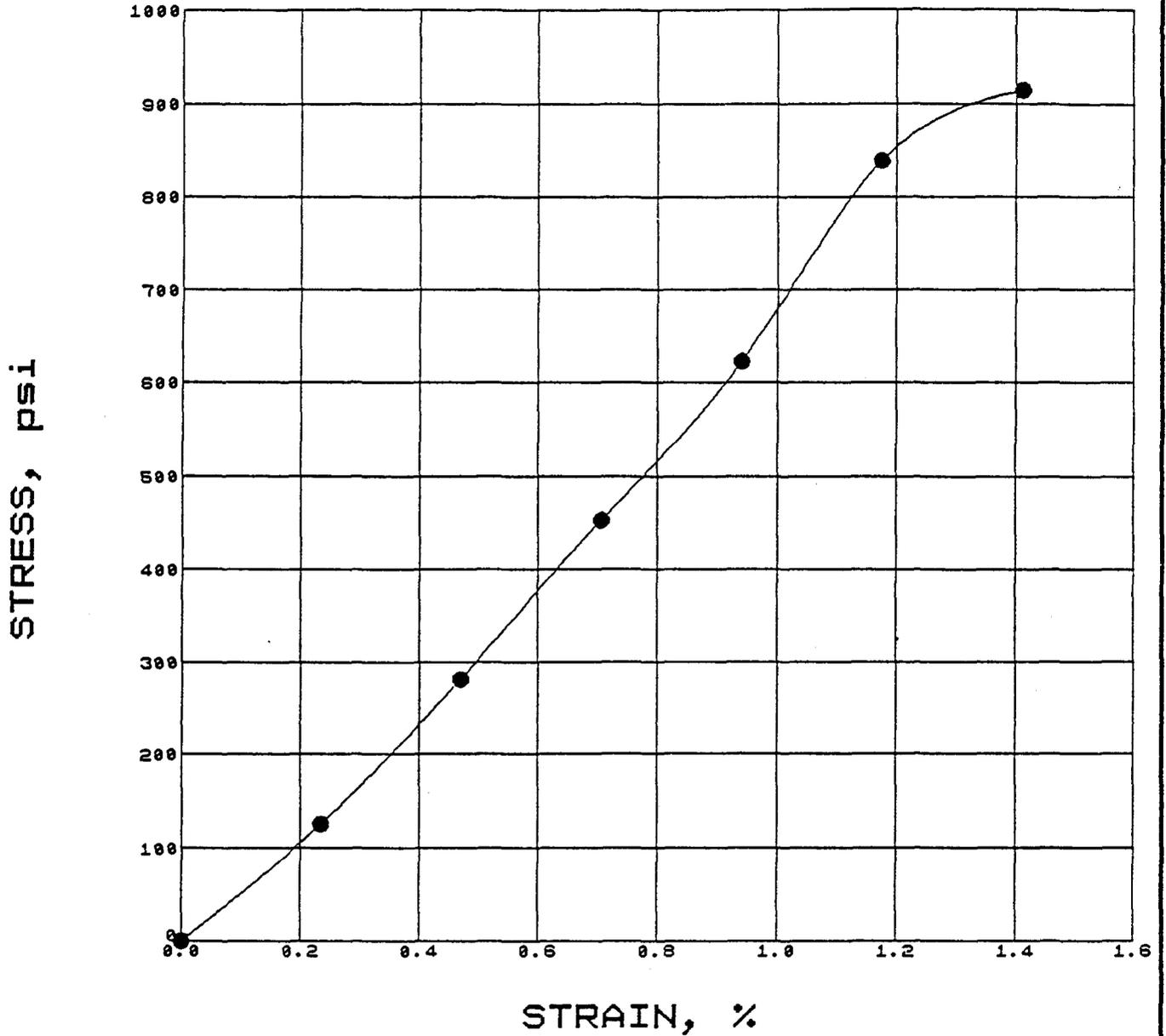
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - EI SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-1
Depth: 16.00 ft
Material Description: LIMESTONE, Unweathered (Austin Chalk)
Moisture Content: 15.70 %
Dry Unit Weight: 113.42 pcf
Stress at Failure: 1808 psi
Strain at Failure: 2.37 %
Secant Modulus: 76401 psi

Project No. ASA91-020-00

UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS

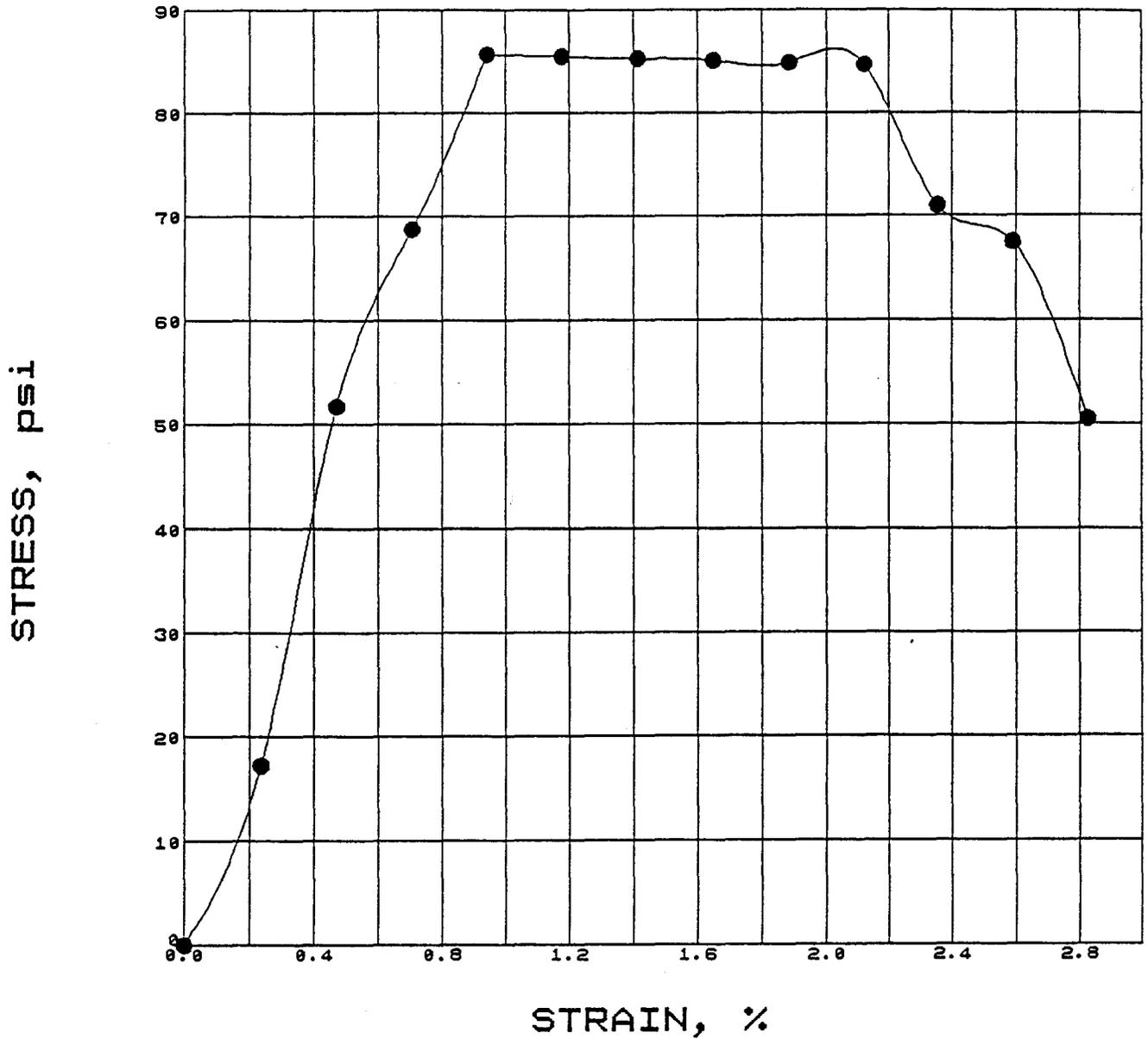


Boring No. N15-S-2
Depth: 5.00 ft
Material Description: LIMESTONE, Weathered (Austin Chalk)
Moisture Content: 15.40 %
Dry Unit Weight: 119.59 pcf
Stress at Failure: 914 psi
Strain at Failure: 1.41 %
Secant Modulus: 64837 psi

Project No. ASA91-020-00

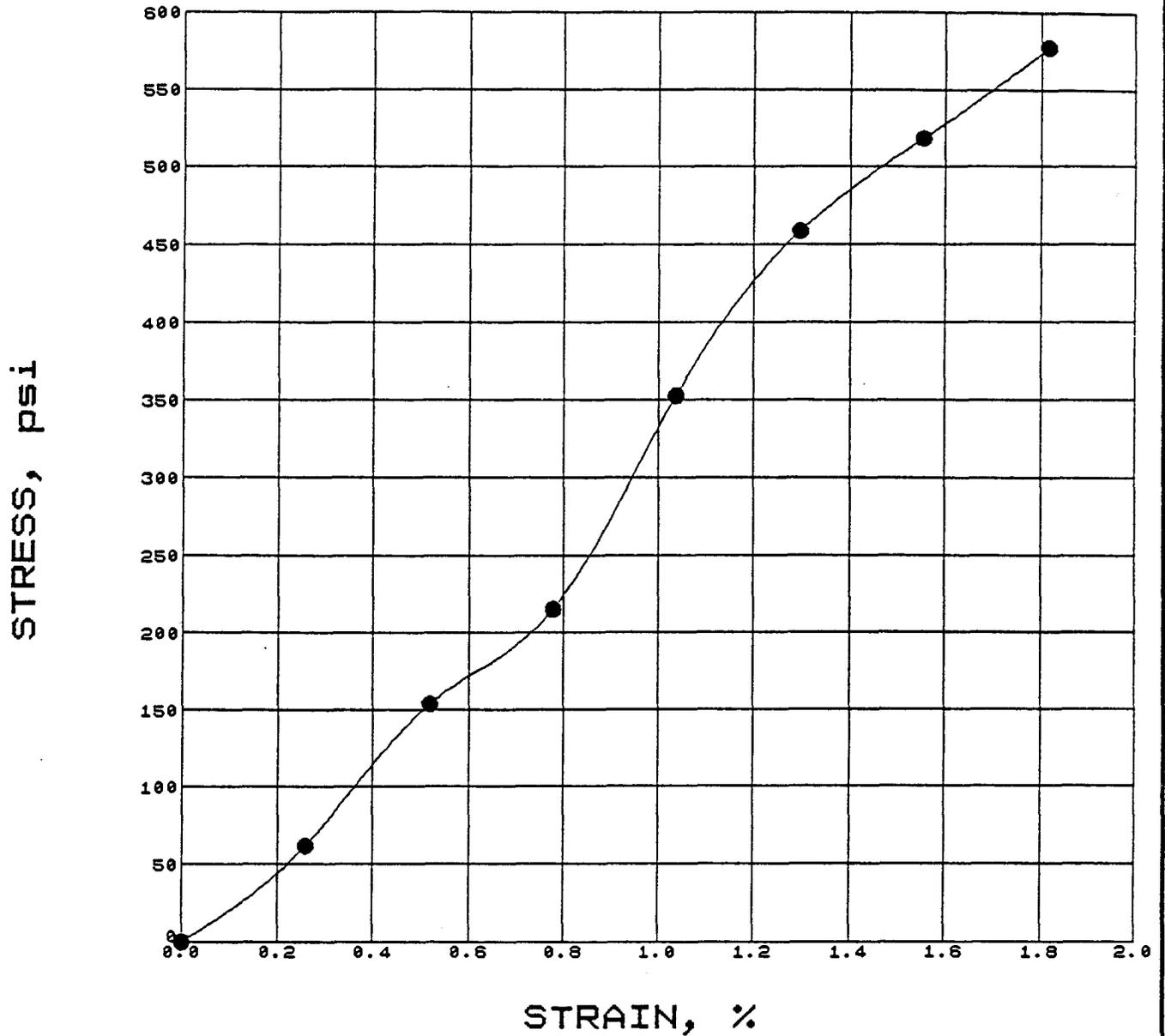
PLATE 12

UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-2
Depth: 12.50 ft
Material Description: LIMESTONE, Unwea., V. Arg. (Austin Chalk)
Moisture Content: 18.34 %
Dry Unit Weight: 114.44 pcf
Stress at Failure: 86 psi
Strain at Failure: 0.94 %
Secant Modulus: 9103 psi

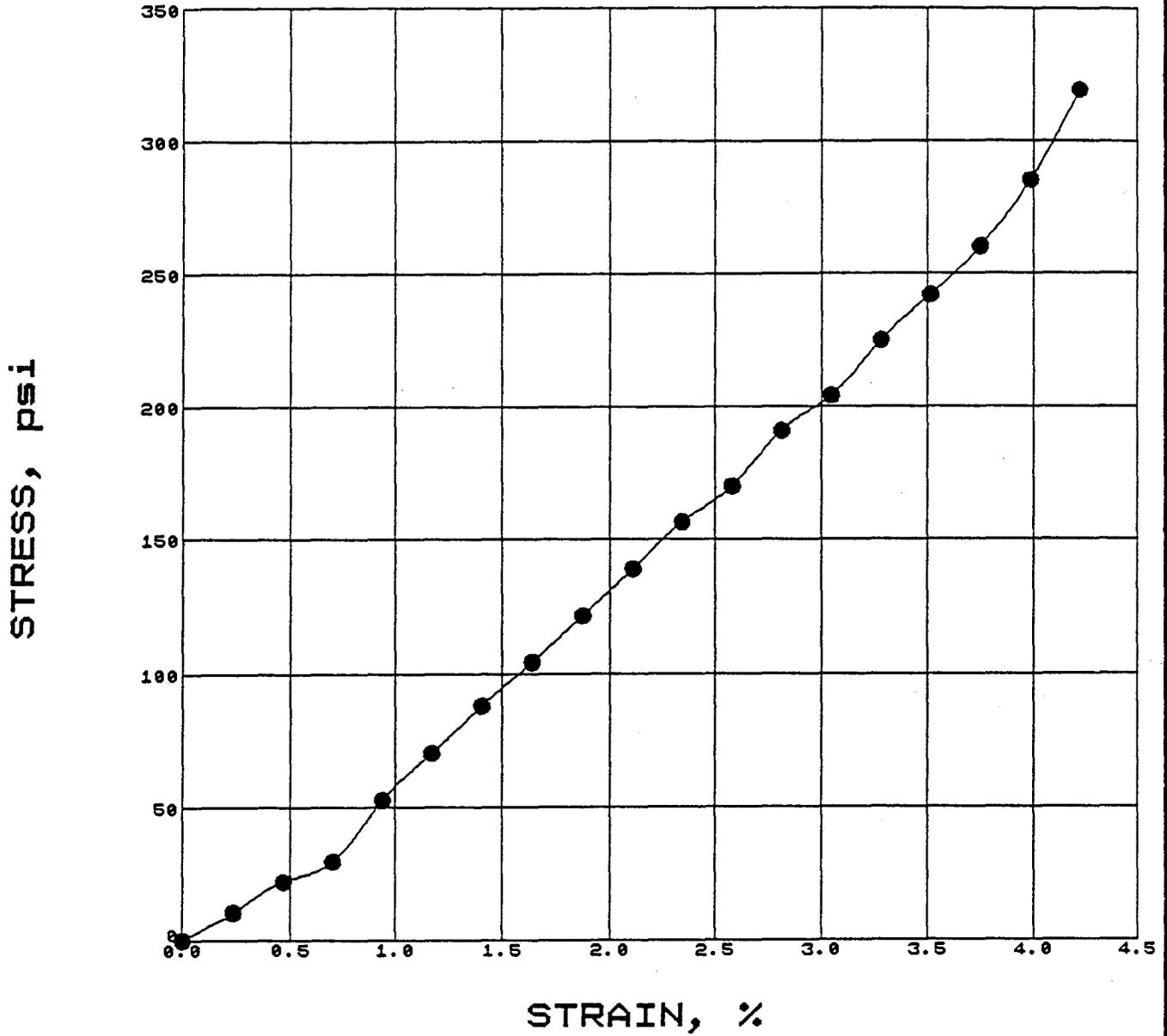
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-3
Depth: 3.90 ft
Material Description: LIMESTONE, Weathered (Austin Chalk)
Moisture Content: 14.29 %
Dry Unit Weight: 120.82 pcf
Stress at Failure: 578 psi
Strain at Failure: 1.81 %
Secant Modulus: 31845 psi

Project No. ASA91-020-00

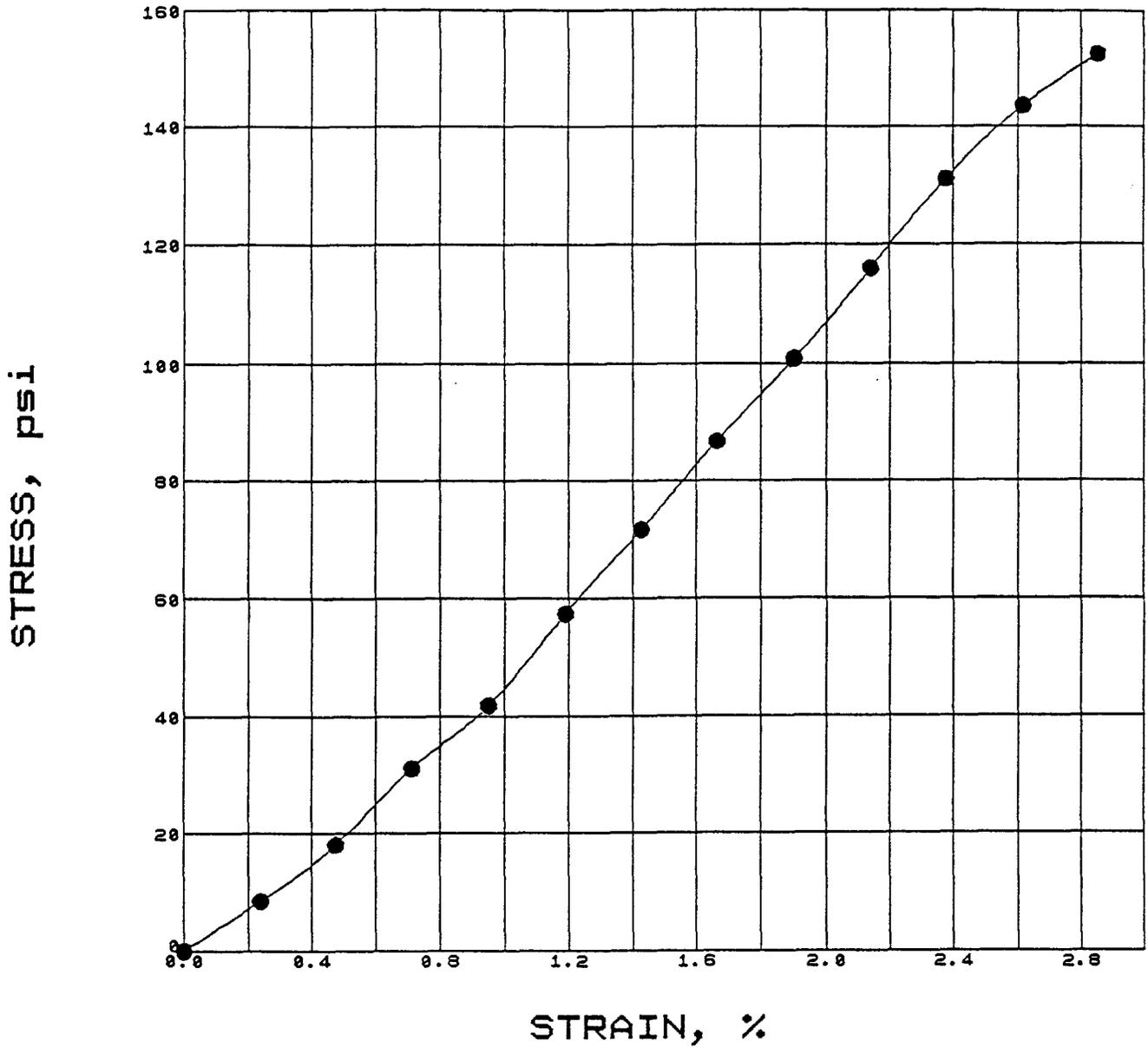
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-3
Depth: 11.50 ft
Material Description: LIMESTONE, Unwea., Arg. (Austin Chalk)
Moisture Content: 14.61 %
Dry Unit Weight: 122.17 pcf
Stress at Failure: 319 psi
Strain at Failure: 4.22 %
Secant Modulus: 7575 psi

Project No. ASA91-020-00

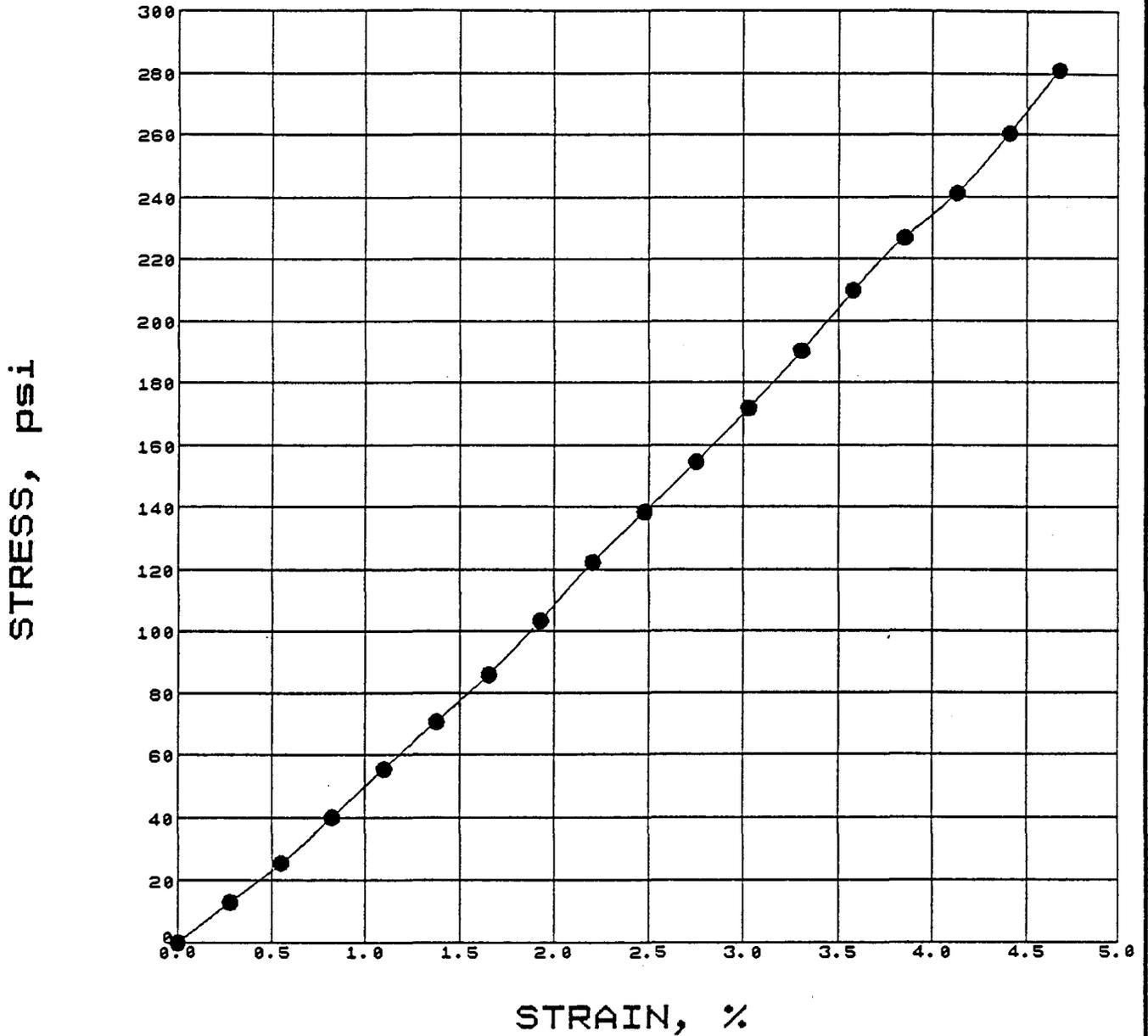
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-3
Depth: 13.50 ft
Material Description: LIMESTONE, Unwea., V. Arg. (Austin Chalk)
Moisture Content: 13.60 %
Dry Unit Weight: 118.07 pcf
Stress at Failure: 153 psi
Strain at Failure: 2.85 %
Secant Modulus: 5353 psi

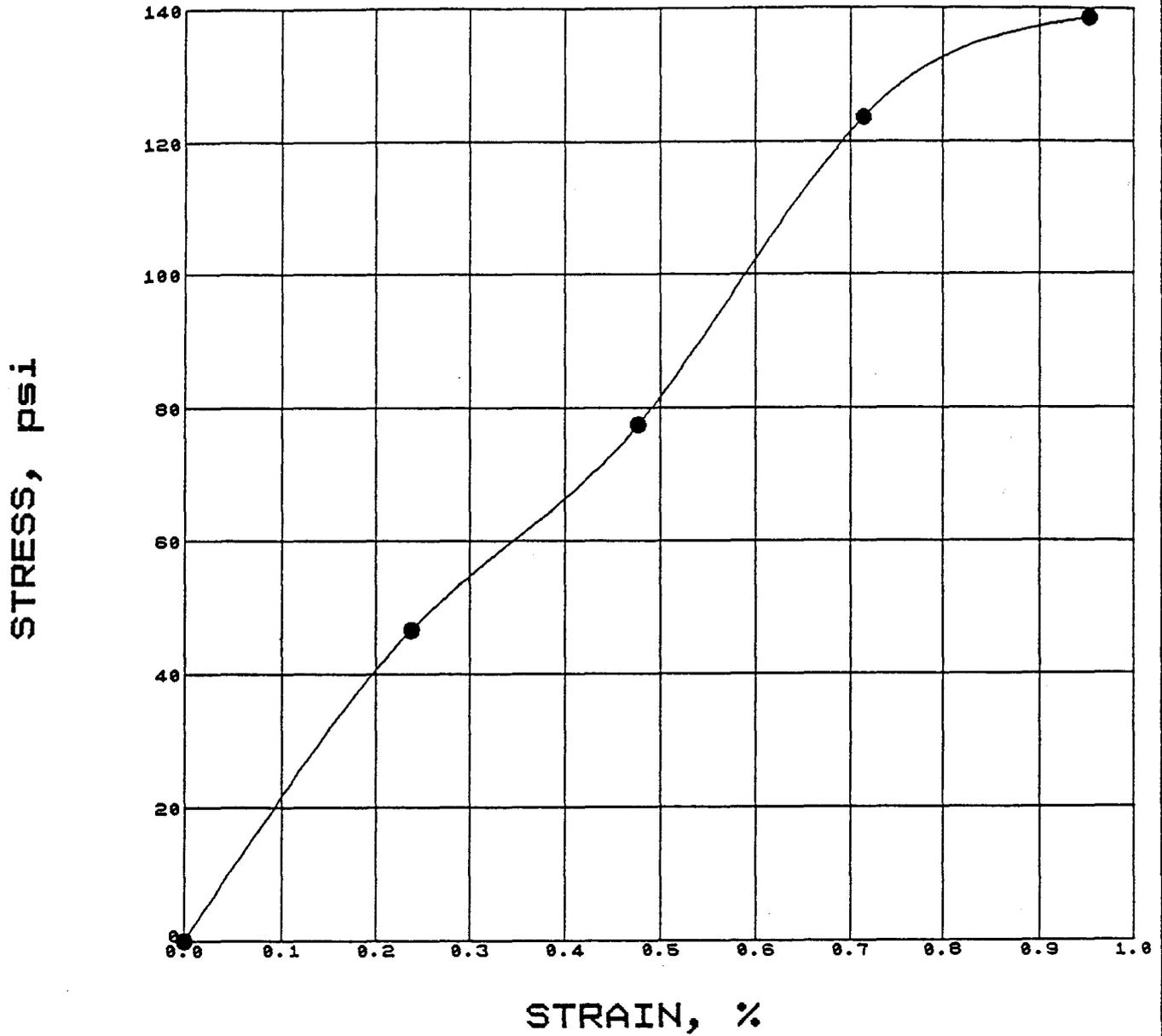
Project No. ASA91-020-00

UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-4
Depth: 3.00 ft
Material Description: LIMESTONE, Wea., Arg. (Austin Chalk)
Moisture Content: 15.30 %
Dry Unit Weight: 114.11 pcf
Stress at Failure: 281 psi
Strain at Failure: 4.68 %
Secant Modulus: 6010 psi

UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS

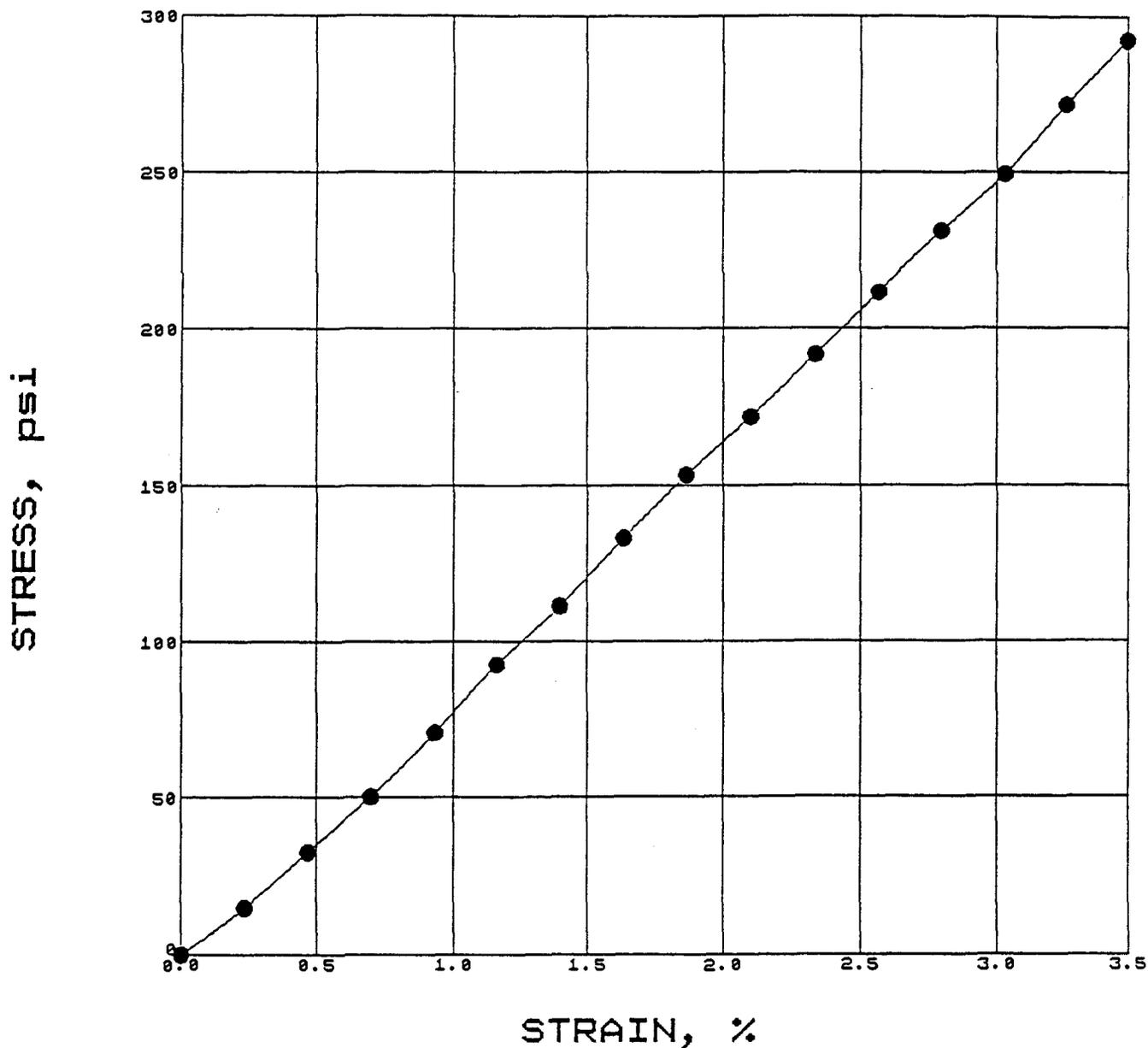


Boring No. N15-S-4
Depth: 11.00 ft
Material Description: LIMESTONE, Wea., V. Arg. (Austin Chalk)
Moisture Content: 16.90 %
Dry Unit Weight: 116.42 pcf
Stress at Failure: 139 psi
Strain at Failure: 0.95 %
Secant Modulus: 14564 psi

Project No. ASA91-020-00

PLATE 18

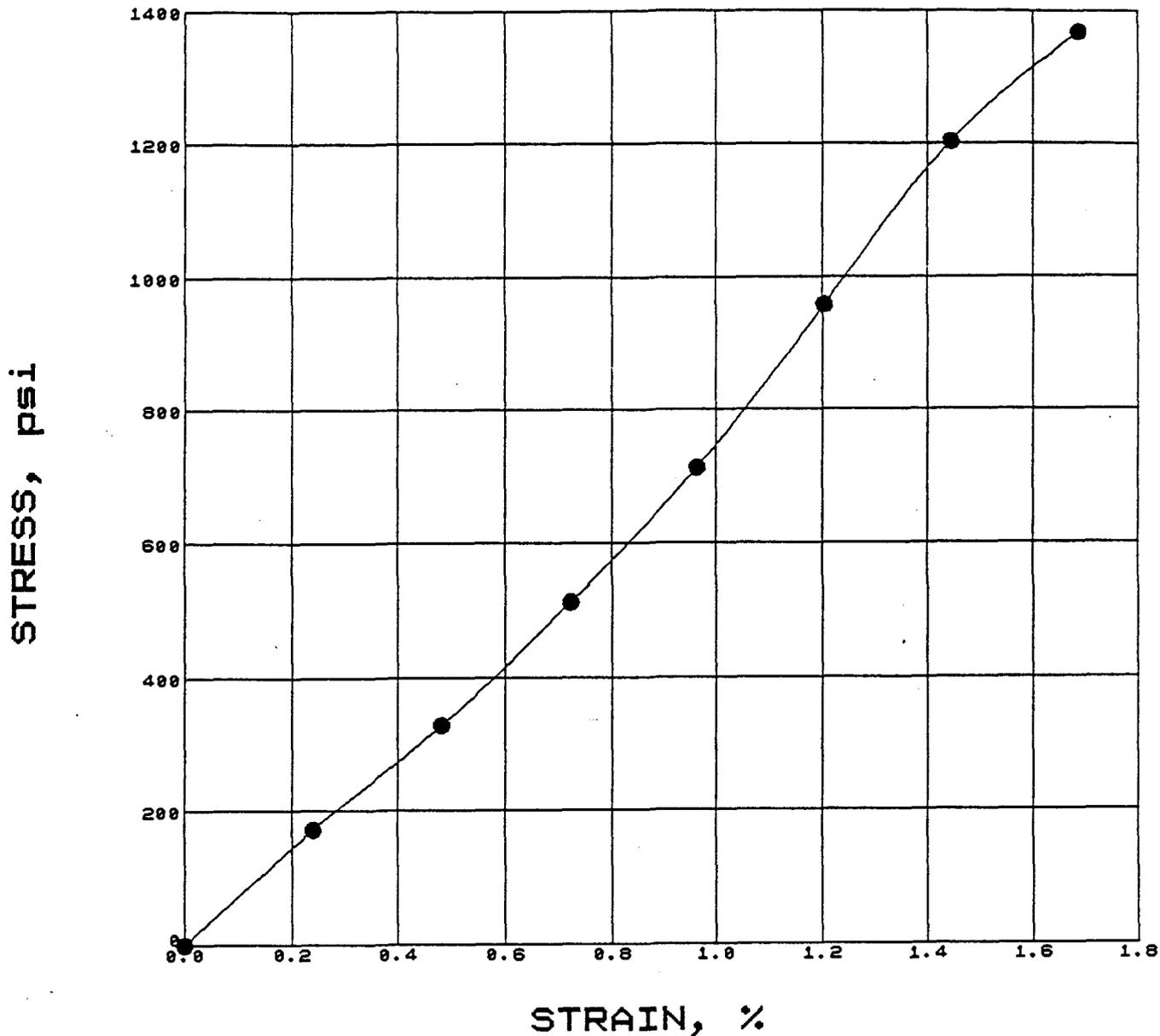
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-4
Depth: 13.00 ft
Material Description: LIMESTONE, Unwea., Arg. (Austin Chalk)
Moisture Content: 12.00 %
Dry Unit Weight: 120.00 pcf
Stress at Failure: 293 psi
Strain at Failure: 3.50 %
Secant Modulus: 8367 psi

Project No. ASA91-020-00

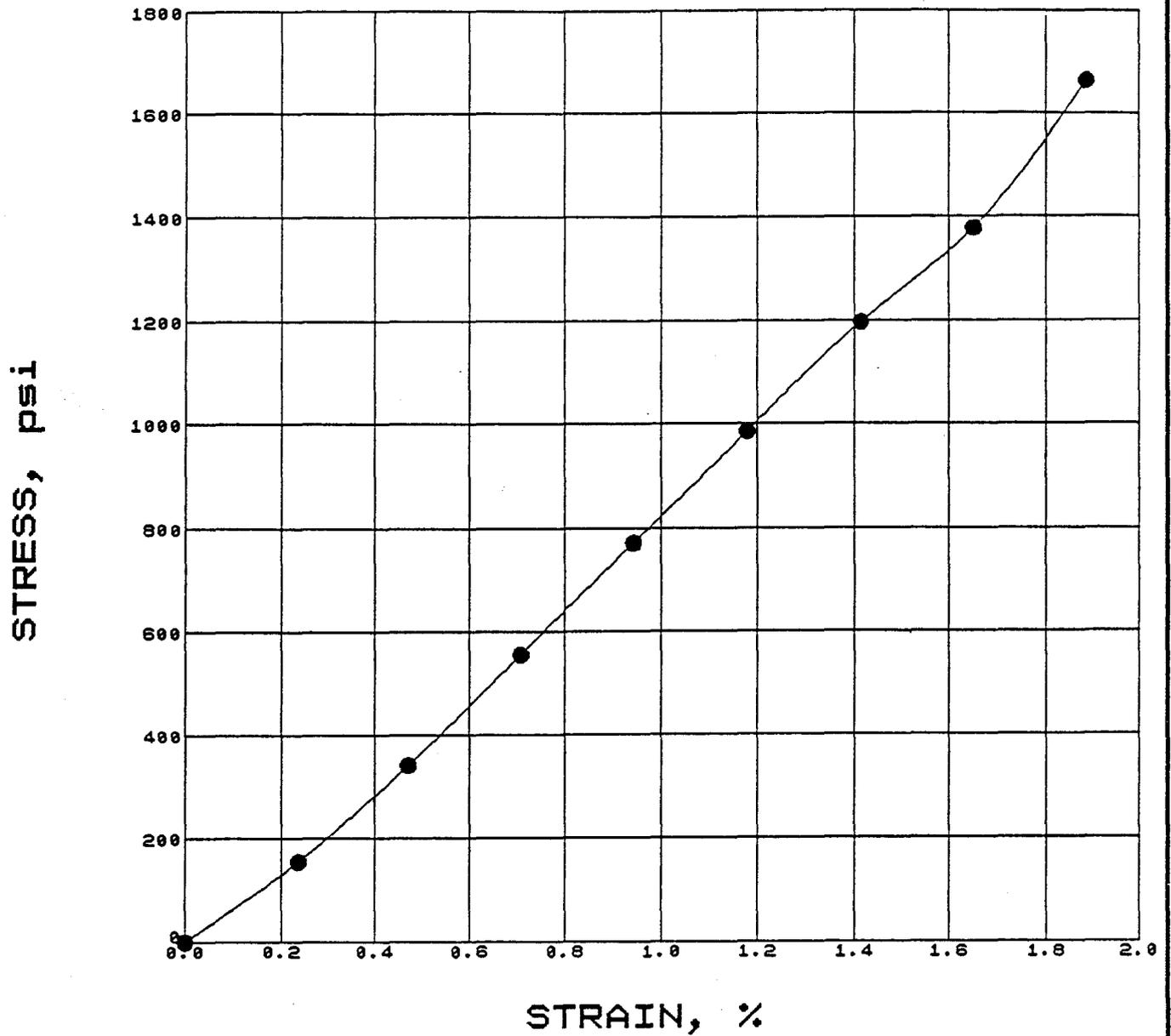
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-4
Depth: 16.00 ft
Material Description: LIMESTONE, Unweathered, (Austin Chalk)
Moisture Content: 15.59 %
Dry Unit Weight: 117.15 pcf
Stress at Failure: 1368 psi
Strain at Failure: 1.68 %
Secant Modulus: 81208 psi

Project No. ASA91-020-00

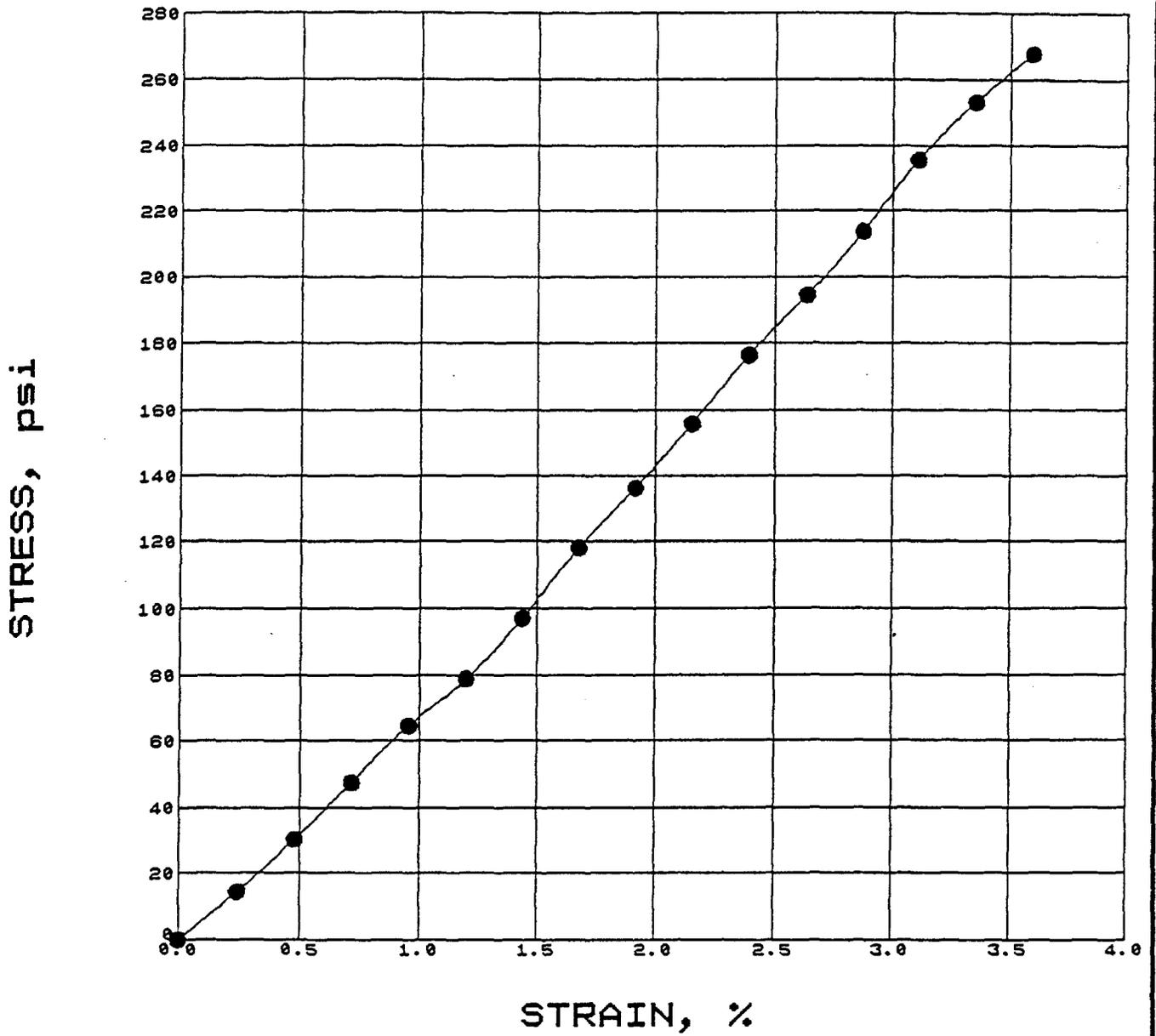
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-5
Depth: 3.00 ft
Material Description: LIMESTONE, Weathered (Austin Chalk)
Moisture Content: 13.75 %
Dry Unit Weight: 120.88 pcf
Stress at Failure: 1664 psi
Strain at Failure: 1.88 %
Secant Modulus: 88278 psi

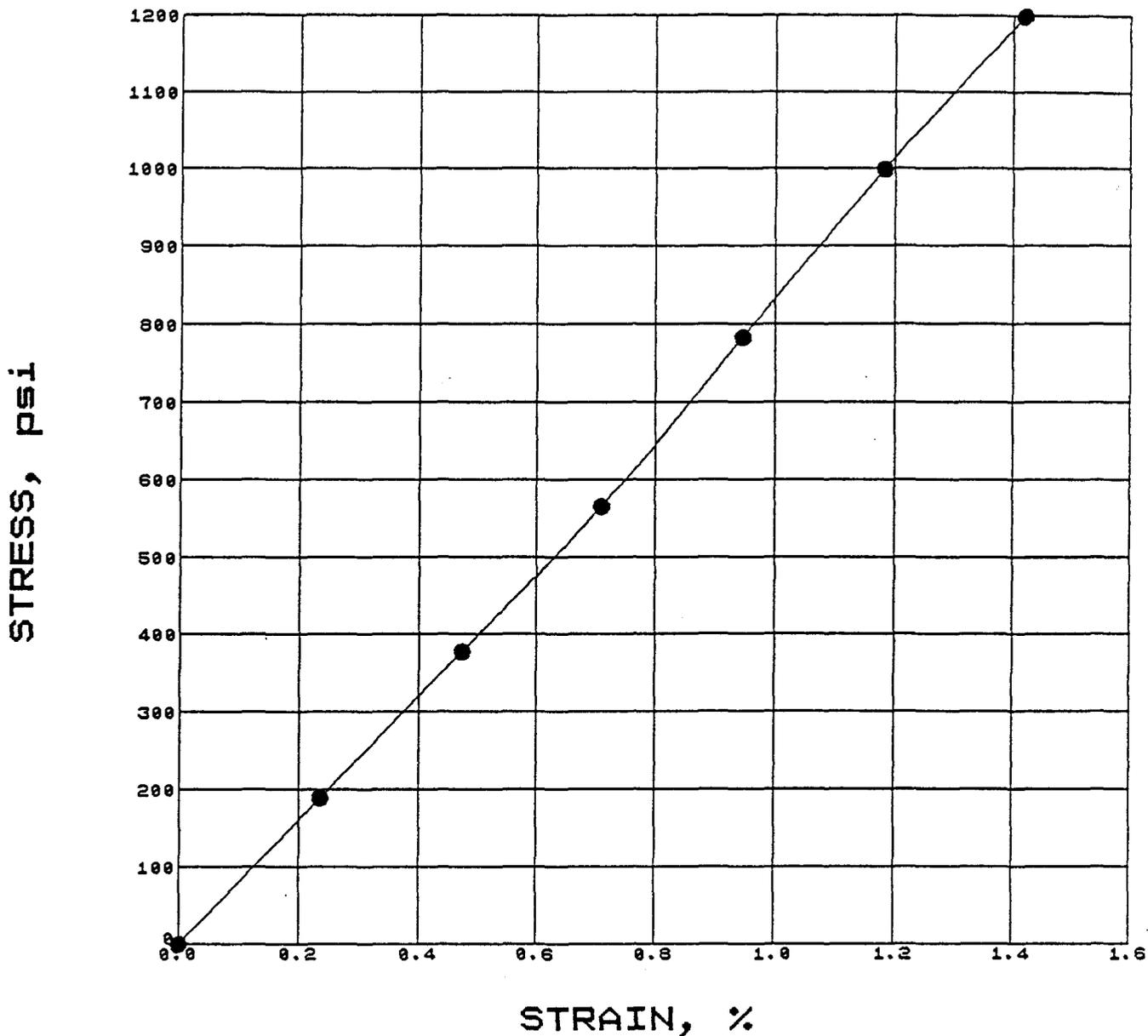
Project No. ASA91-020-00

UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-5
Depth: 8.50 ft
Material Description: LIMESTONE, Wea., Arg. (Austin Chalk)
Moisture Content: 14.80 %
Dry Unit Weight: 119.61 pcf
Stress at Failure: 268 psi
Strain at Failure: 3.59 %
Secant Modulus: 7462 psi

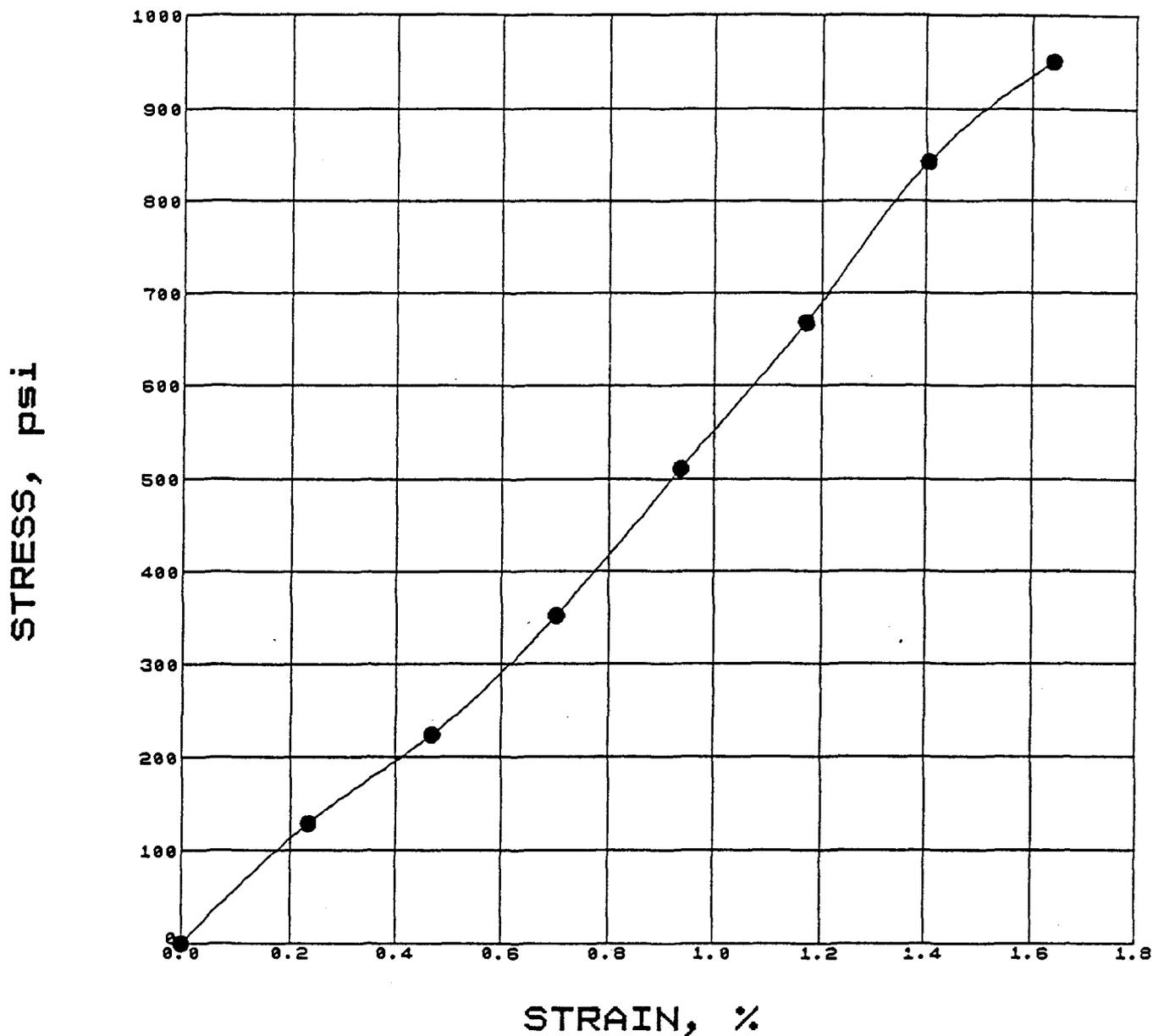
UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-5
Depth: 12.00 ft
Material Description: LIMESTONE, Unweathered (Austin Chalk)
Moisture Content: 14.61 %
Dry Unit Weight: 122.39 pcf
Stress at Failure: 1198 psi
Strain at Failure: 1.42 %
Secant Modulus: 84487 psi

Project No. ASA91-020-00

UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS

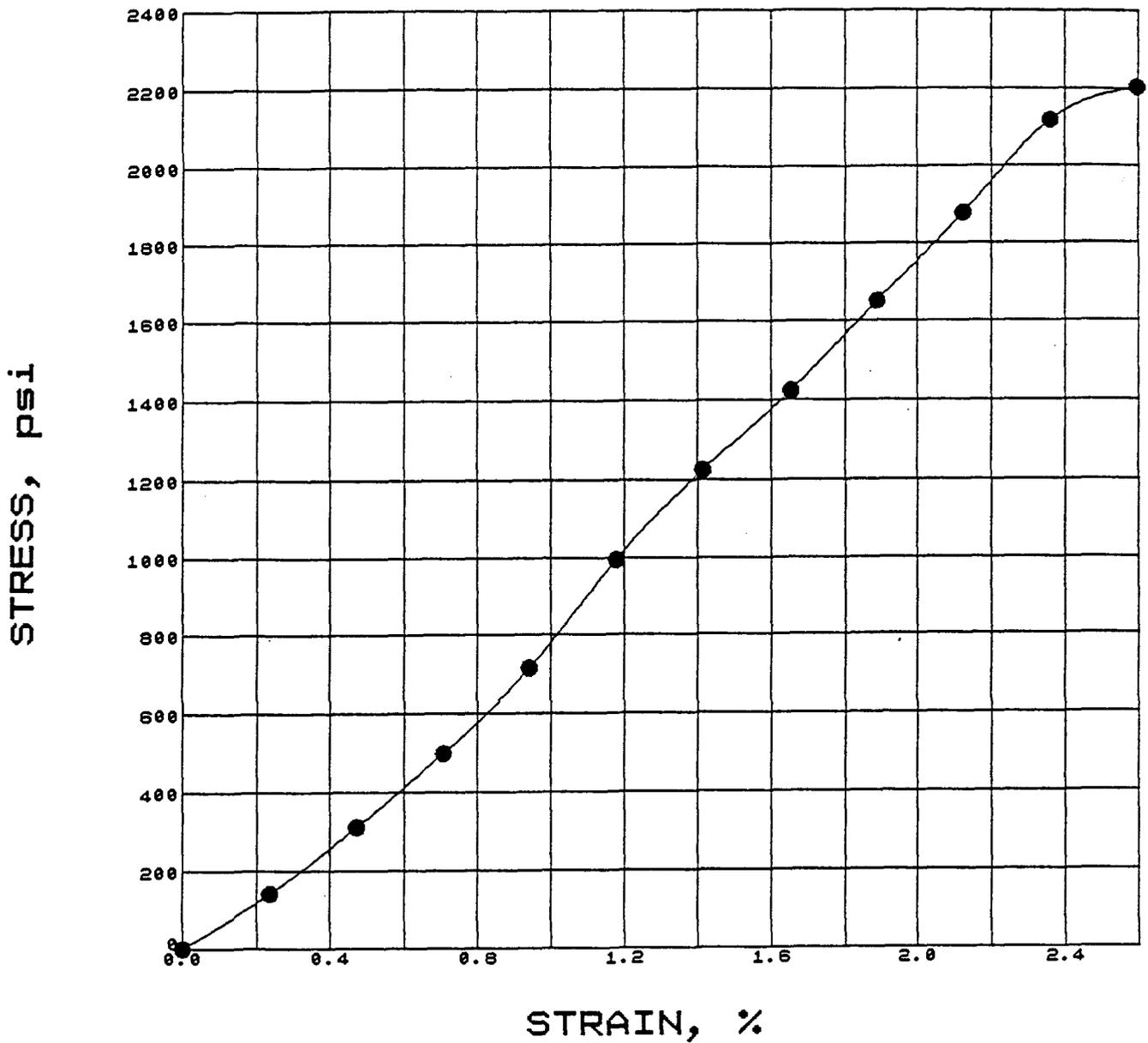


Boring No. N15-S-6
Depth: 9.75 ft
Material Description: LIMESTONE, Weathered (Austin Chalk)
Moisture Content: 14.05 %
Dry Unit Weight: 122.44 pcf
Stress at Failure: 951 psi
Strain at Failure: 1.64 %
Secant Modulus: 58050 psi

Project No. ASA91-020-00

PLATE 24

UNCONFINED COMPRESSION TEST
MAGNET DELIVERY SHAFT - E1 SITE - SSC PROJECT
WAXAHACHIE, TEXAS



Boring No. N15-S-6
Depth: 14.00 ft
Material Description: LIMESTONE, Unweathered (Austin Chalk)
Moisture Content: 15.34 %
Dry Unit Weight: 119.04 pcf
Stress at Failure: 2204 psi
Strain at Failure: 2.59 %
Secant Modulus: 84963 psi

Project No. ASA91-020-00

RESULTS OF LABORATORY ANALYSIS

BORING NO.	DEPTH (ft)	SAMPLE TYPE	STANDARD PENETRATION TESTS BLOWS PER 6 in.	UNIT DRY WEIGHT (PCF)	MOISTURE CONTENT (%)	UNCONFINED COMPRESSION (TSF)	DESCRIPTION
N15-S-1	0 - 1.5	Spoon	4/8/8				CLAY, Dark Brown
	1.5 - 1.8	Spoon	50+				LIMESTONE, Weathered, Tan
	2.5	Core		123	13	71	LIMESTONE, Weathered
	12.0	Core		124	14	138	LIMESTONE, Unweathered
	16.0	Core		113	16	130	LIMESTONE, Unweathered
N15-S-2	0 - 1.5	Spoon	3/7/9				CLAY, Dark Brown
	1.5 - 1.7	Spoon	50+				LIMESTONE, Weathered, Tan
	5.0	Core		120	15	66	LIMESTONE, Weathered
	12.5	Core		114	18	6	LIMESTONE, Unweathered
N15-S-3	0 - 1.5	Spoon	3/7/11				CLAY, Dark Brown
	1.5 - 2.0	Auger					LIMESTONE, Weathered, Tan
	3.9	Core		121	14	42	LIMESTONE, Weathered
	11.5	Core		122	15	23	LIMESTONE, Unweathered
	13.5	Core		118	14	11	LIMESTONE, Unweathered
N15-S-4	0 - 1.5	Spoon	1/3/15				CLAY, Dark Brown
	3.0	Core		114	15	20	LIMESTONE, Weathered
	11.0	Core		116	17	10	LIMESTONE, Weathered
	13.0	Core		120	13	21	LIMESTONE, Unweathered
	16.0	Core		117	16	99	LIMESTONE, Unweathered
N15-S-5	0 - 1.5	Spoon	2/22/28+				CLAY, Dark Brown
	3.0	Core		121	14	120	LIMESTONE, Weathered
	8.5	Core		120	15	19	LIMESTONE, Weathered
	12.0	Core		122	15	86	LIMESTONE, Unweathered
N15-S-6	0 - 1.5	Spoon	3/6/44+				CLAY, Dark Brown
	5.5	Core		114	14	169	LIMESTONE, Weathered
	9.75	Core		122	14	69	LIMESTONE, Weathered
	14.0	Core		119	15	158	LIMESTONE, Unweathered