

APPENDIX F.6

UNCONFINED COMPRESSIVE STRENGTH TESTS ON ROCK CORE WITH STRESS STRAIN MEASUREMENTS

NORTH ANNA COL

**DATA REPORT REV. 0
JANUARY 23, 2007**

MACTEC PROJECT NO. 6468-06-1472

Tice, Al

From: Davie, John [jdavie@bechtel.com]
Sent: Wednesday, November 29, 2006 8:08 AM
To: Tice, Al
Cc: Baker, Richard
Subject: RE: Rock cores

Al,

For the chipped cores, I would go ahead and test them, and make a note about the chipping somewhere in the results sheet. If you think the fracture in the one core will significantly impact the result, then I would not test it.

John

From: Tice, Al [mailto:JATICE@mactec.com]
Sent: Wednesday, November 29, 2006 7:31 AM
To: Davie, John
Subject: Rock cores

The lab has noted the following cores that were damaged in the preparation process. The cores are weathered rock, and during the end preparation process, they developed chips on the core edge and one was fractured. Due to the nature of this rock, any rock resubmitted of the same type, would probably yield the same results. Please advise.

B907 90.0 UCSS

B920 90.15 UC

B910 91.1 UCSS

B907 51.85 UC

B901 117.45 UCSS *fractured; not tested JAT 1-19-07*

J. Allan Tice, P. E.

Senior Principal/Assistant Vice President

MACTEC

919-831-8052 office

919-349-7579 cell

919-831-8137 fax

1/20/2007



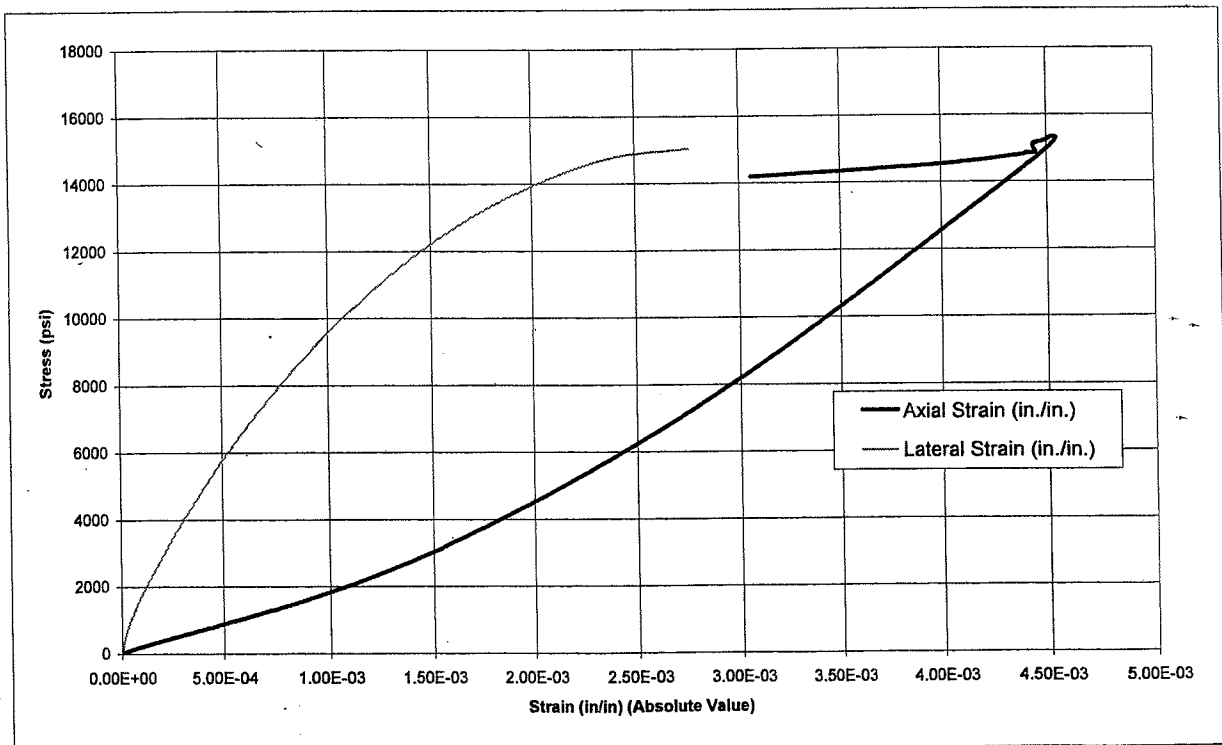
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 901
Sample Depth (ft): 60.3
Tested By: Jacob B. Mock
Test Date: 12/1/2006

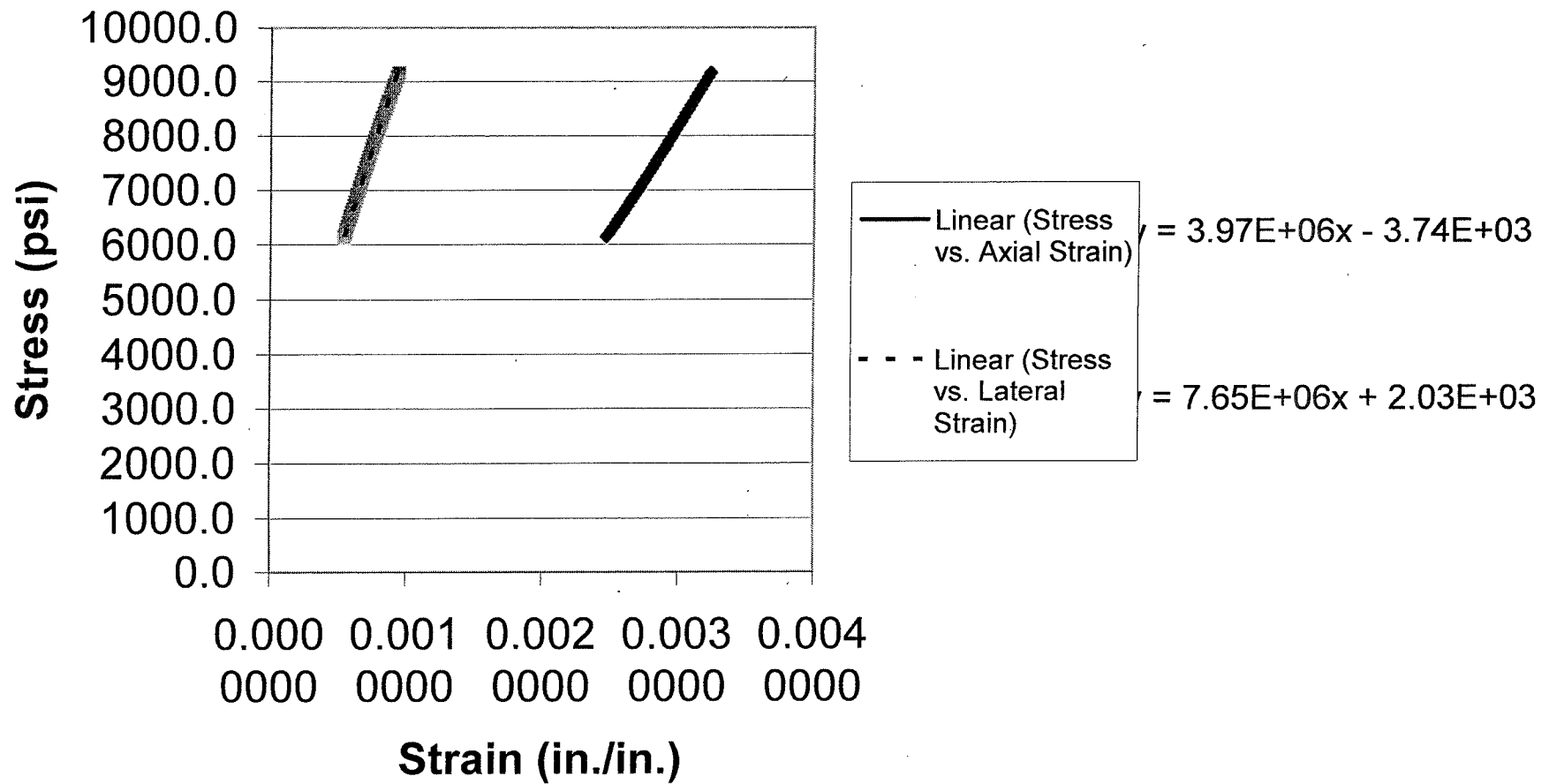
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.490
Specimen Length, inch	5.275
Length/Diameter Ratio	2.12
Unit Weight (lbs/ft ³)	162
Test Duration (Time to Failure in Minutes)	7.1
Unconfined Compressive Strength, psi (from test)	15,322
Unconfined Compressive Strength, psi (with L/D correction)	15,425
Type of Break	Columnar
Young's Modulus, psi	3,970,000
Poisson's Ratio	*



Comments: Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive. * = Value of Poisson's ratio is greater than 0.5 which indicates inelastic behavior probably due to presence of fractures or discontinuities affecting lateral strain.

40%-60% Stress vs. Strain B-901 60.3'





Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

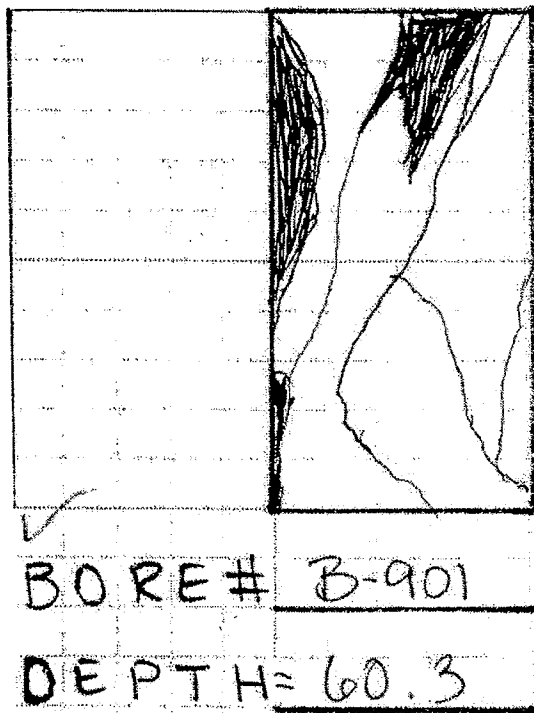
ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
901
60.3
Jacob B. Mock
12/1/2006

Reviewed By:
Review Date:

DSC
12/12/2006



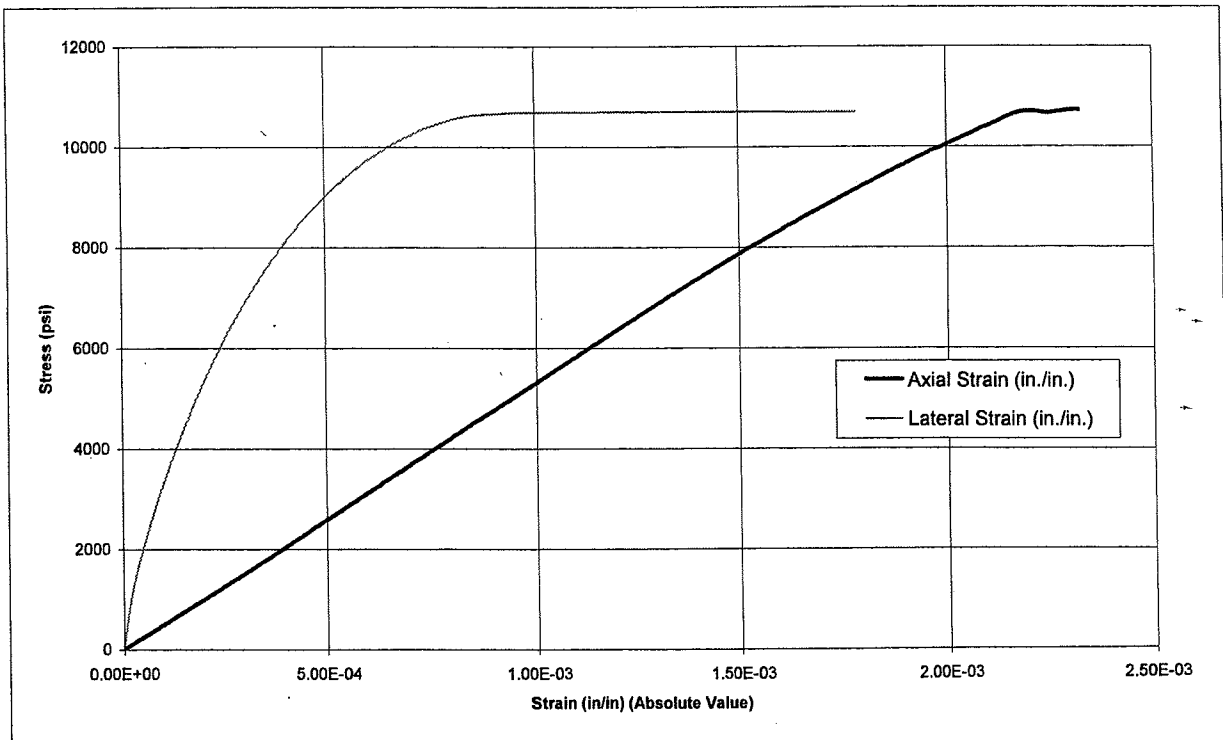


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 901
Sample Depth (ft): 170.5
Tested By: Jacob B. Mock
Test Date: 12/5/2006

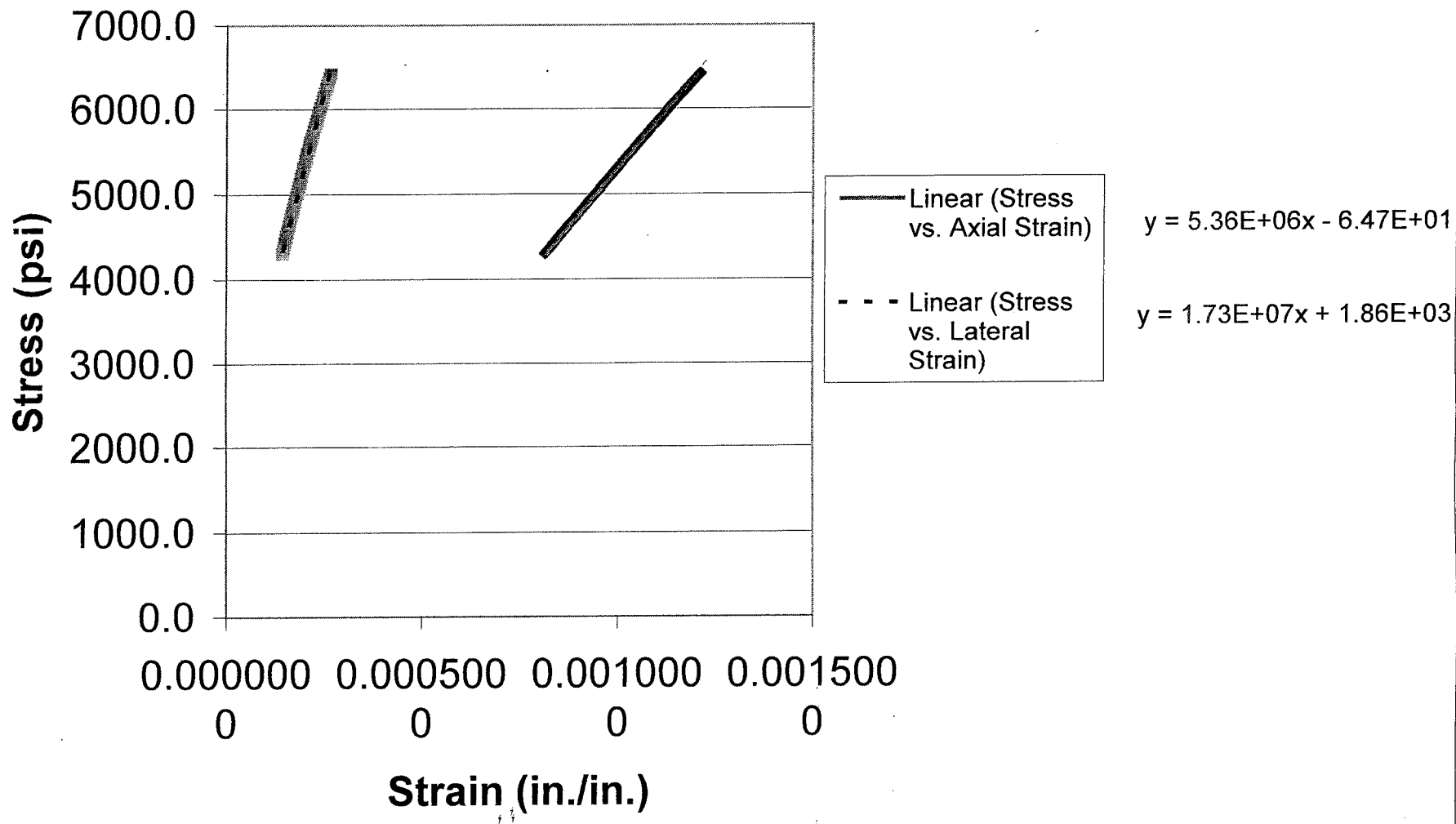
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.398
Specimen Length, inch	5.332
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft ³)	168
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	10,734
Unconfined Compressive Strength, psi (with L/D correction)	10,865
Type of Break	Shear
Young's Modulus, psi	5,360,000
Poisson's Ratio	0.31



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-901 170.5'

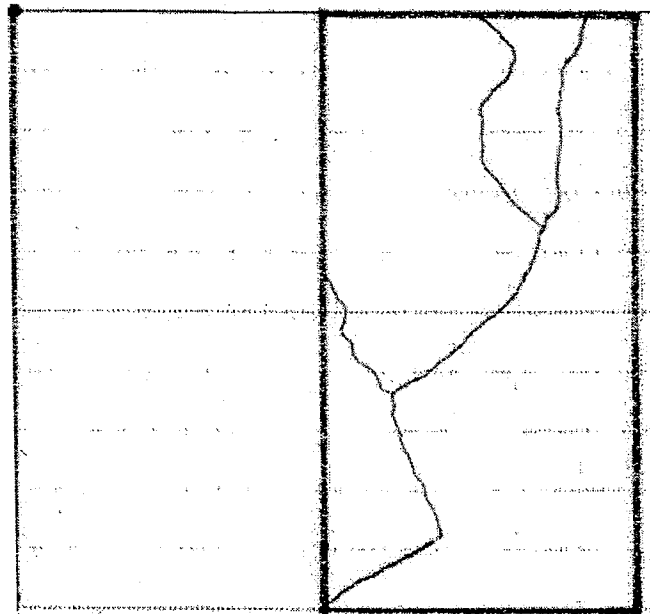




Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:	North Anna	Reviewed By:	DSC
Project Number:	6468061472	Review Date:	12/12/2006
Boring Number:	901		
Sample Depth (ft):	170.5		
Tested By:	Jacob B. Mock		
Test Date:	12/5/2006		



BORE# B-901

DEPTH= 170.5 ✓



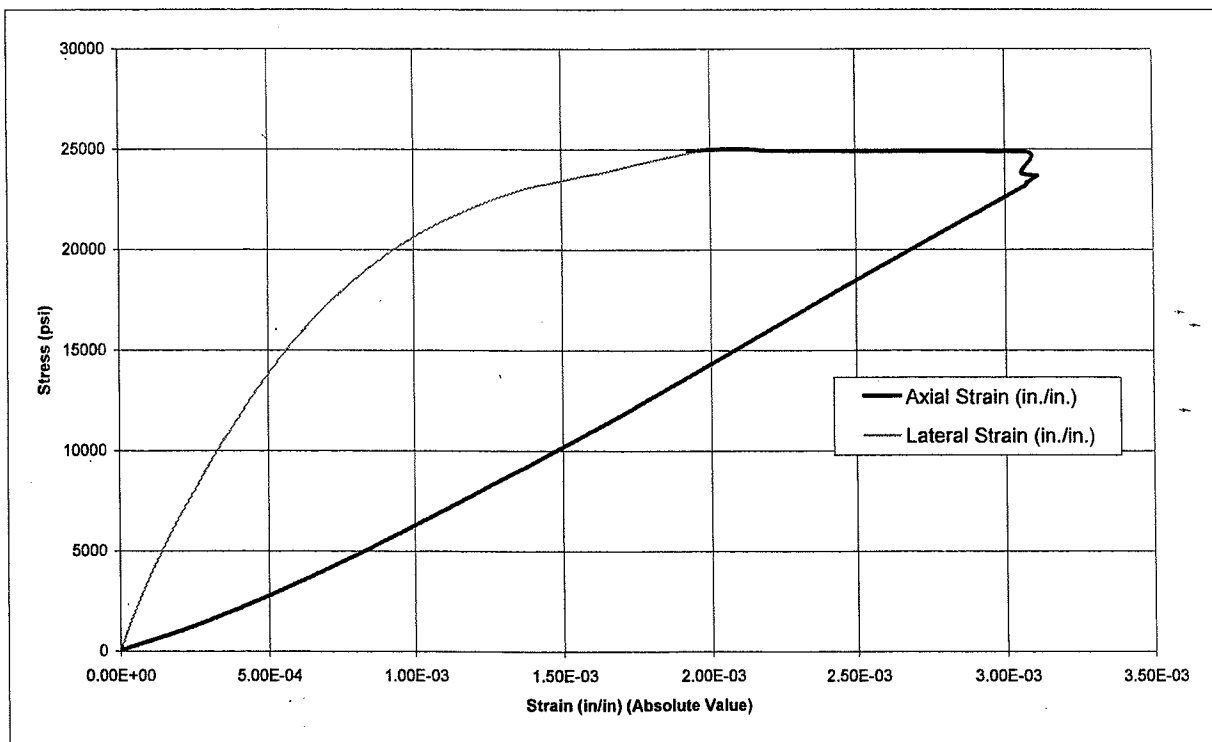
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 901
Sample Depth (ft): 280.45
Tested By: Jacob B. Mock
Test Date: 12/5/2006

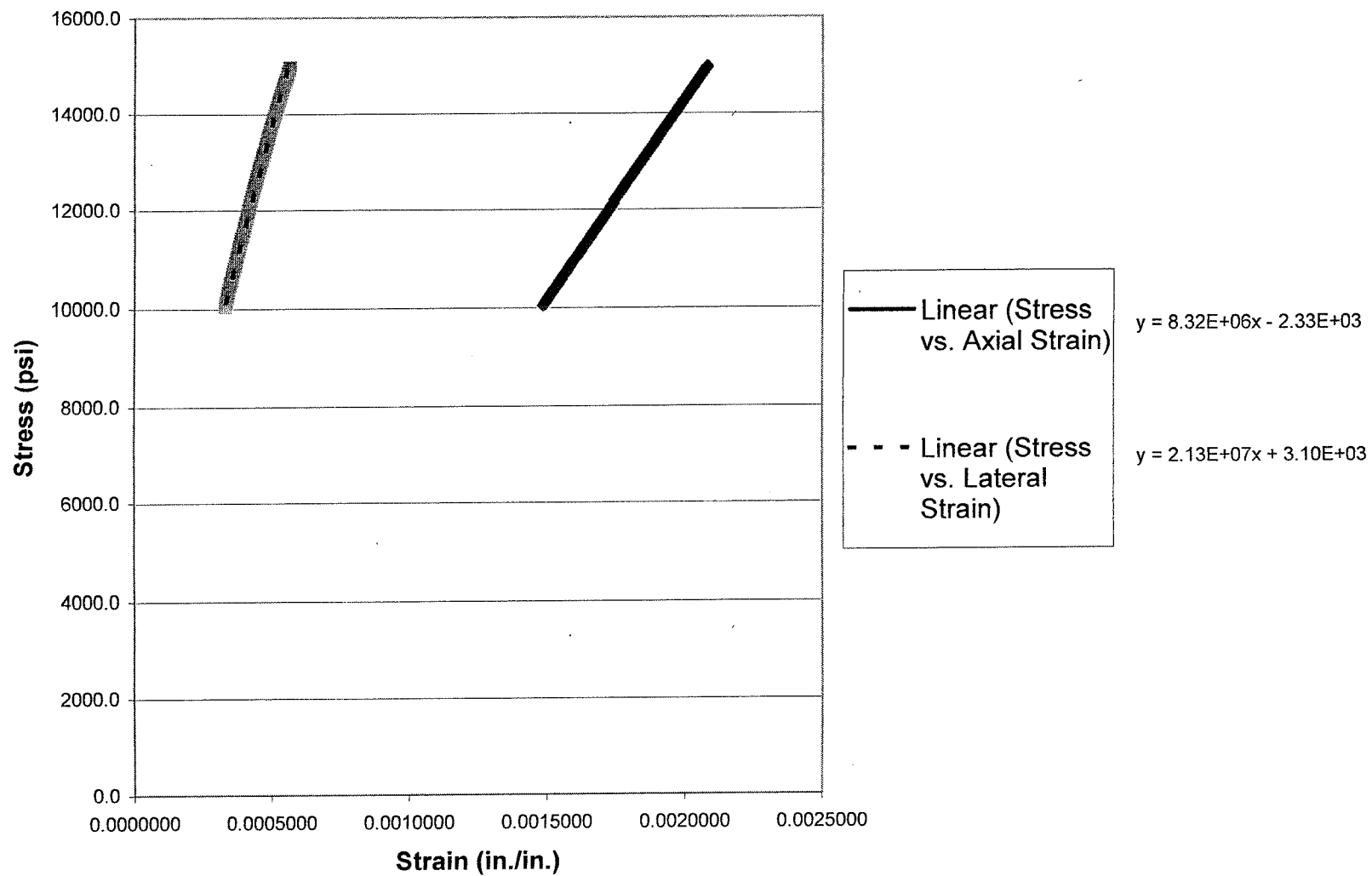
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.394
Specimen Length, inch	5.357
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	164
Test Duration (Time to Failure in Minutes)	10.6
Unconfined Compressive Strength, psi (from test)	25,013
Unconfined Compressive Strength, psi (with L/D correction)	25,335
Type of Break	Cone & Shear
Young's Modulus, psi	8,320,000
Poisson's Ratio	0.39



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value; Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-901 280.45'





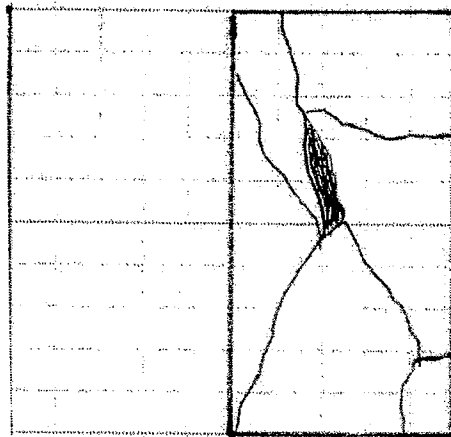
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
901
280.45
Jacob B. Mock
12/5/2006

Reviewed By: DSC
Review Date: 12/12/2006



BORE # B-901
DEPTH = 280.45



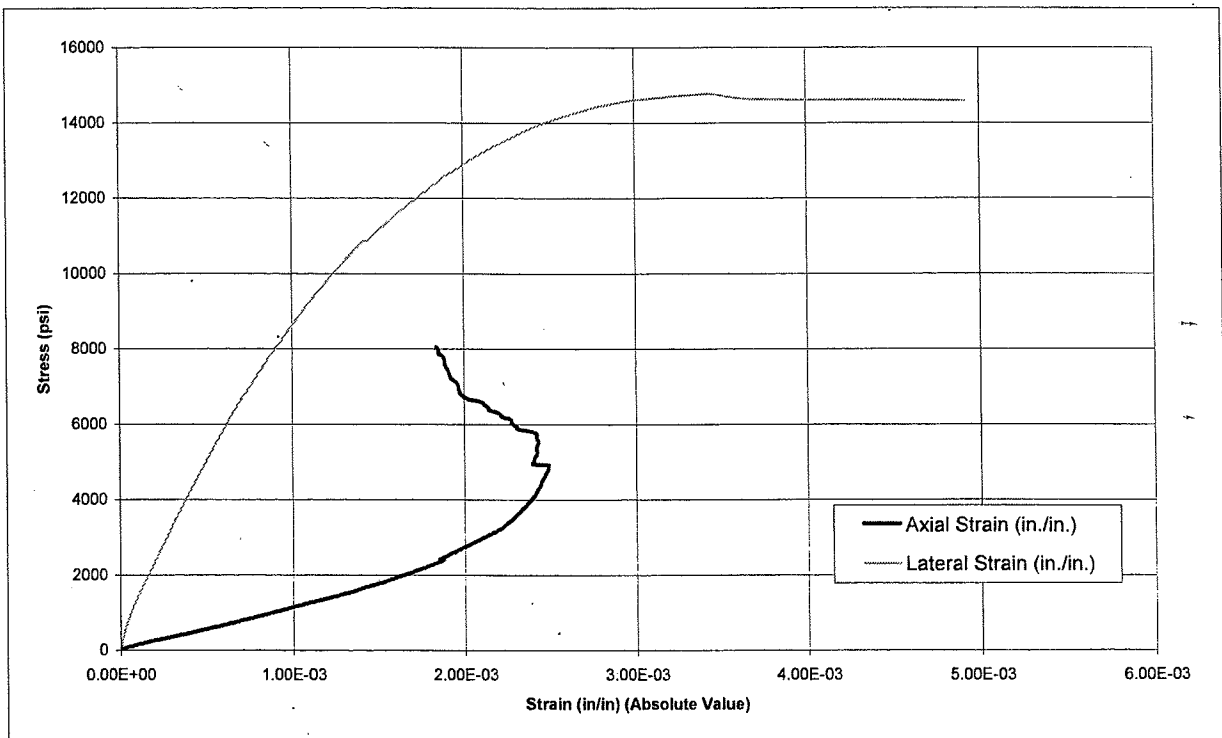
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 902
Sample Depth (ft): 27.25
Tested By: Jacob B. Mock
Test Date: 12/7/2006

Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.384
Specimen Length, inch	5.288
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft ³)	162
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	14,771
Unconfined Compressive Strength, psi (with L/D correction)	14,947
Type of Break	Shear
Young's Modulus, psi	ND
Poisson's Ratio	ND



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.
ND = Axial strain gages failed prematurely during lab testing ; Young's modulus and Poisson's ratio not determined.



Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

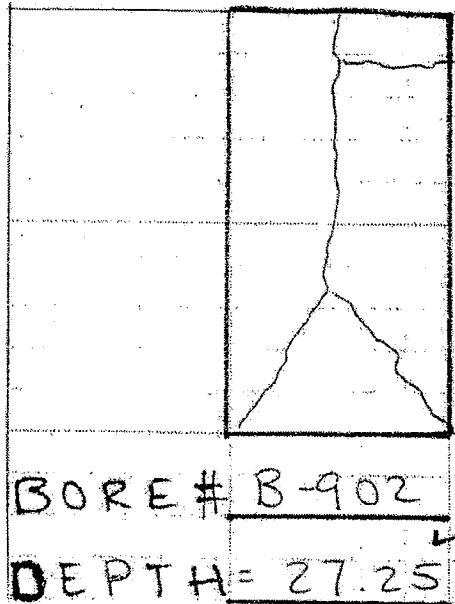
ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
902
27.25
Jacob B. Mock
12/7/2006

Reviewed By:
Review Date:

DSC
12/12/2006



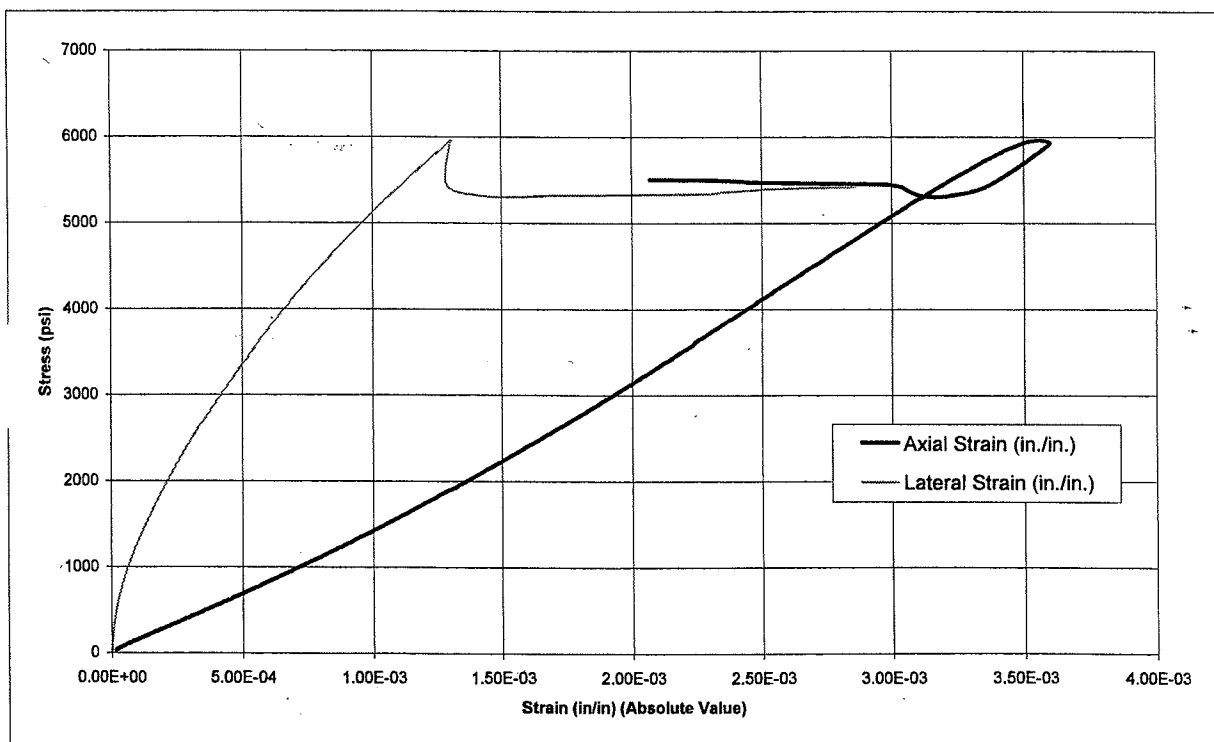


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
 Project Number: 6468061472
 Boring Number: 902
 Sample Depth (ft): 92.8
 Tested By: Jacob B. Mock
 Test Date: 12/1/2006

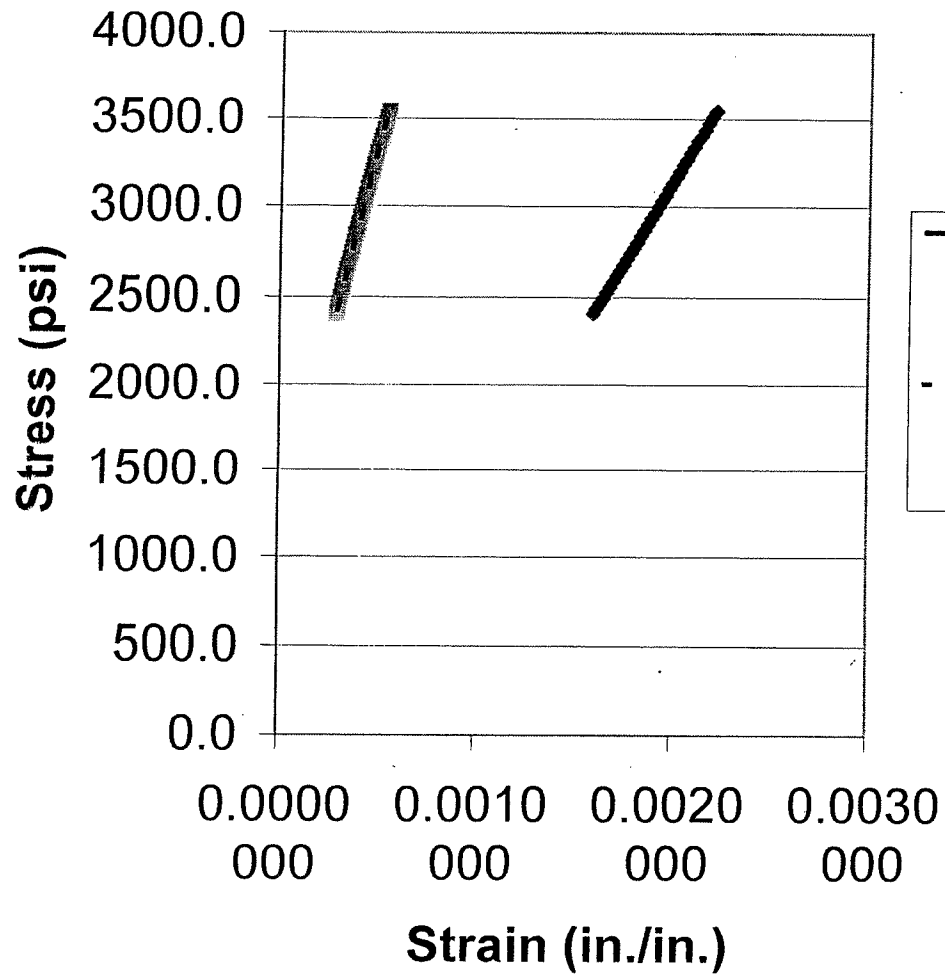
Reviewed By: DSC
 Review Date: 1-19-07

Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.398
Specimen Length, inch	5.321
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft³)	164
Test Duration (Time to Failure in Minutes)	6.3
Unconfined Compressive Strength, psi (from test)	5,958
Unconfined Compressive Strength, psi (with L/D correction)	6,030
Type of Break	Shear
Young's Modulus, psi	1,840,000
Poisson's Ratio	0.42



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
 Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-902 92.8'



$$y = 1.84E+06x - 5.54E+02$$

$$y = 4.41E+06x + 1.14E+03$$



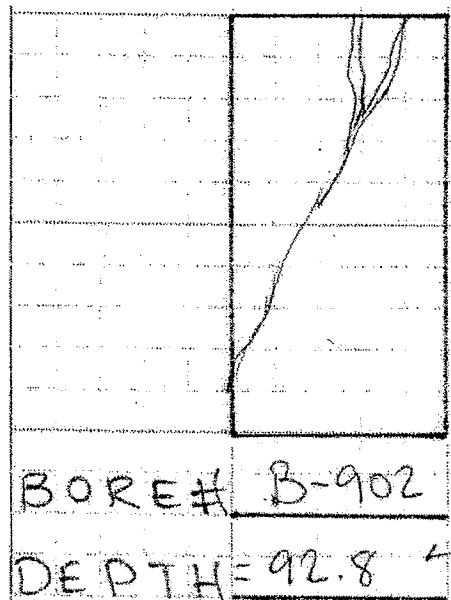
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
902
92.8
Jacob B. Mock
12/1/2006

Reviewed By:
Review Date:
DSC
12/12/2006





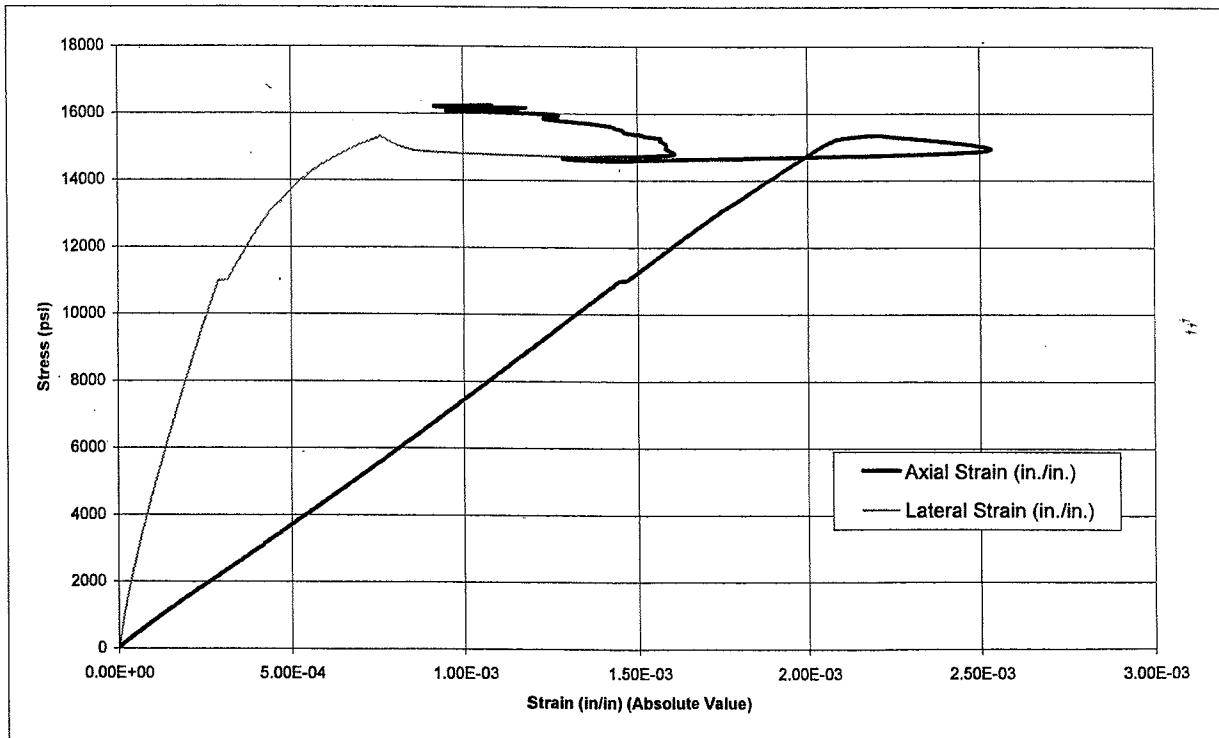
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 907
Sample Depth (ft): 160.75
Tested By: Jacob B. Mock
Test Date: 12/1/2006

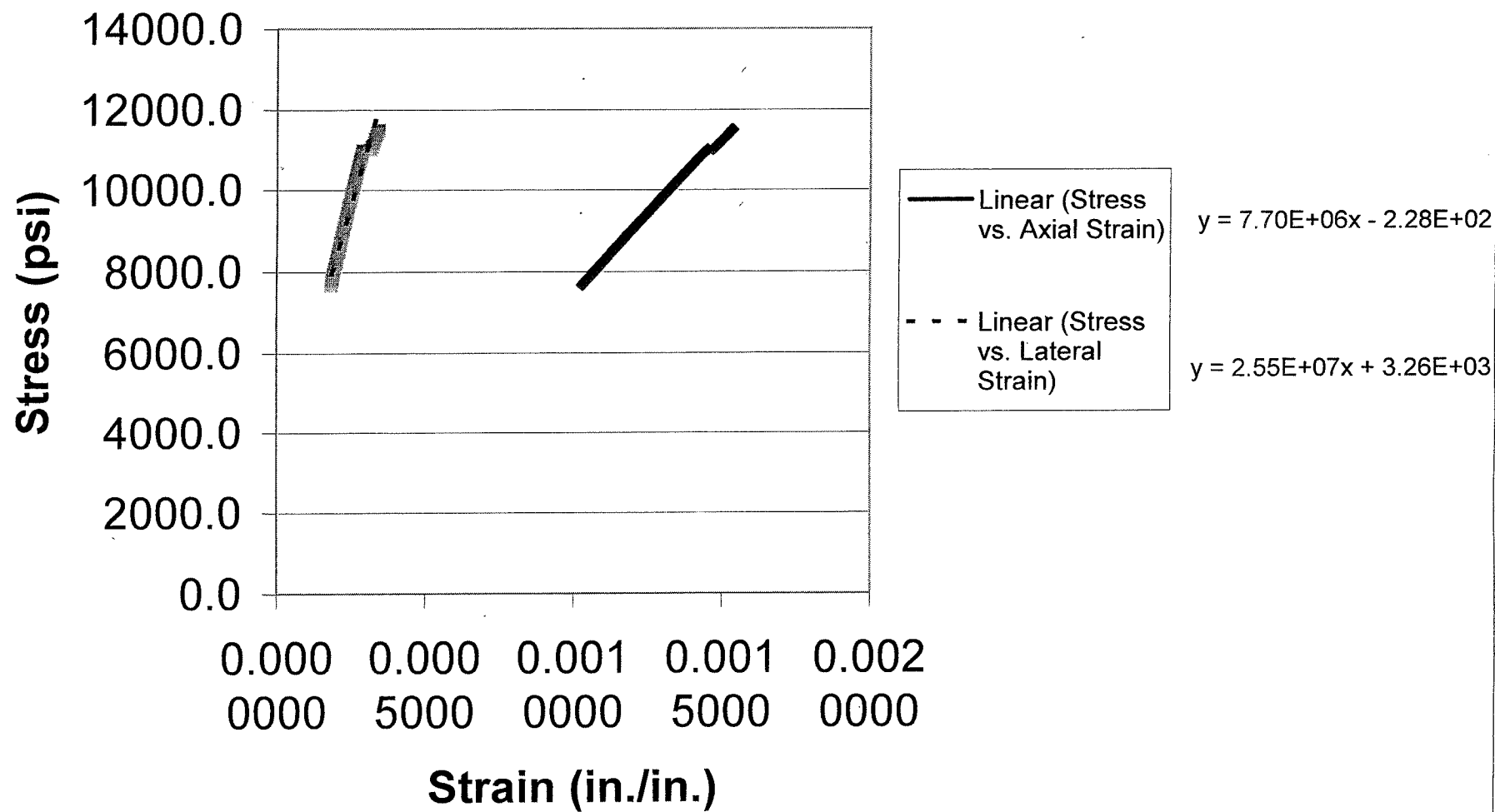
Reviewed By: DJS
Review Date: 1-19-07

Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.498
Specimen Length, inch	5.318
Length/Diameter Ratio	2.13
Unit Weight (lbs/ft ³)	163
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	19,192
Unconfined Compressive Strength, psi (with L/D correction)	19,333
Type of Break	Columnar
Young's Modulus, psi	7,700,000
Poisson's Ratio	0.30



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-907 160.75'





Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

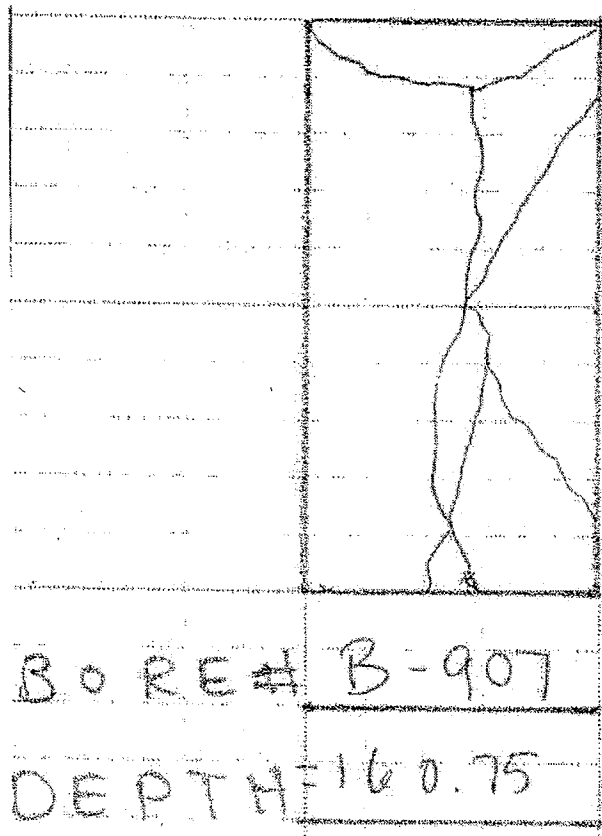
ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
907
160.75
Jacob B. Mock
12/1/2006

Reviewed By:
Review Date:

DSC
12/12/2006





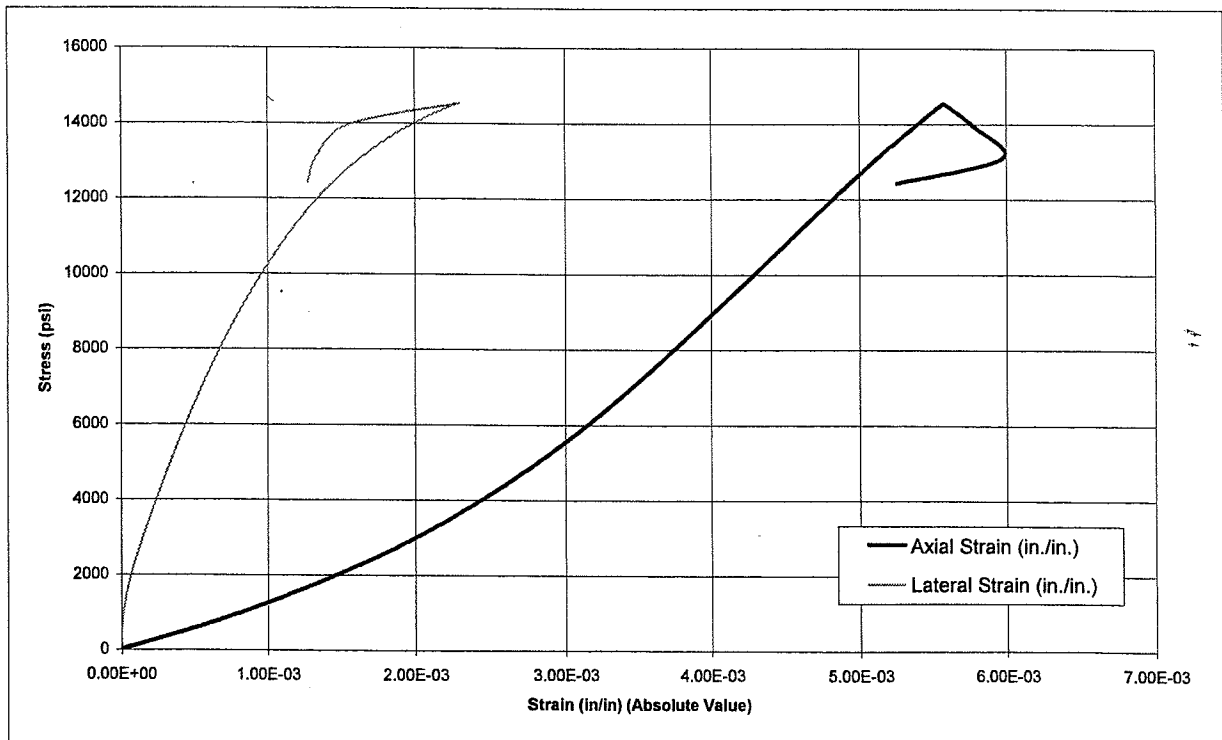
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna COL
Project Number: 6468061472
Boring Number: 908
Sample Depth (ft): 79.35
Tested By: Jacob B. Mock
Test Date: 12/13/2006

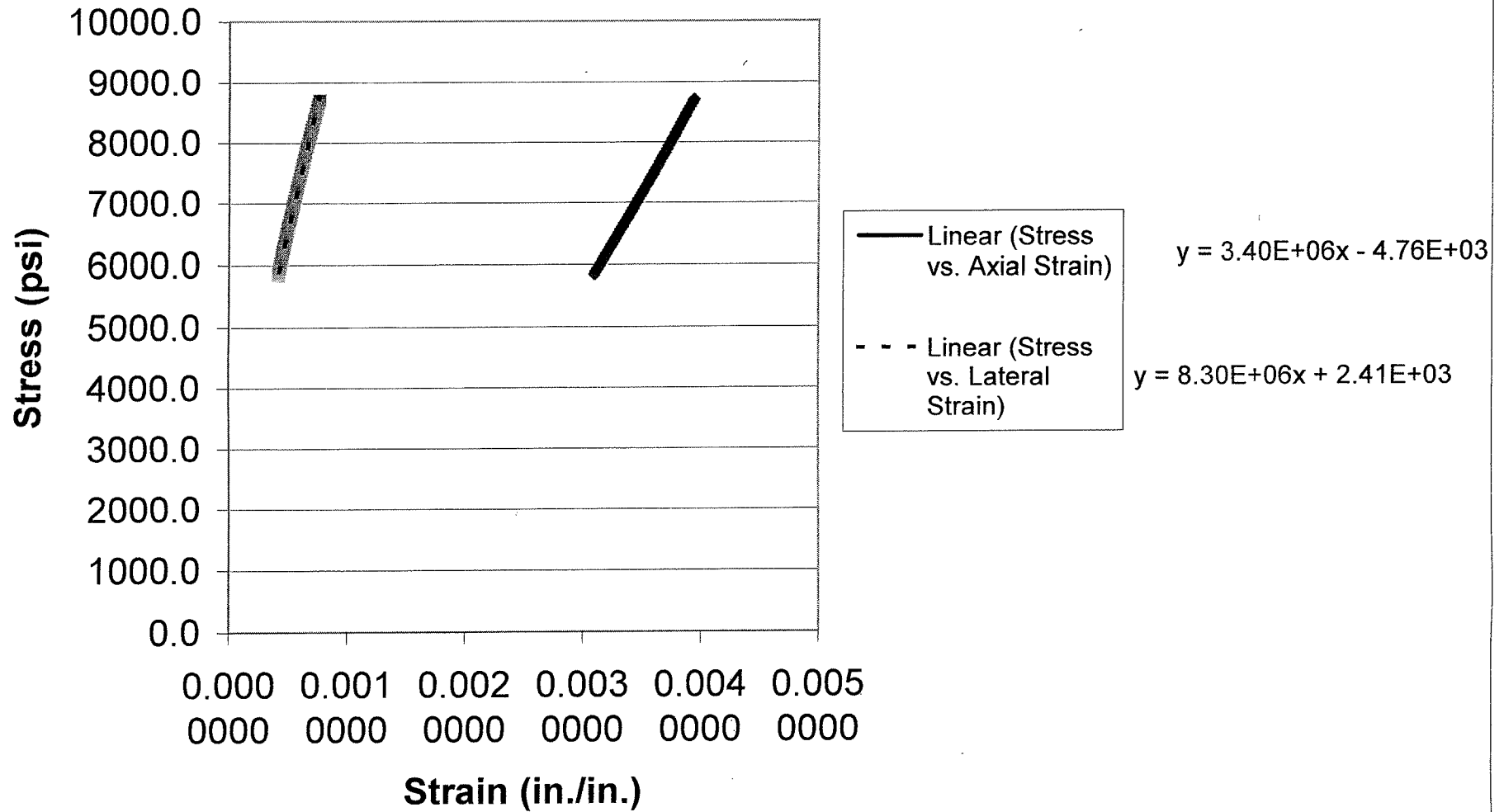
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.391
Specimen Length, inch	5.248
Length/Diameter Ratio	2.20
Unit Weight (lbs/ft ³)	164
Test Duration (Time to Failure in Minutes)	9.1
Unconfined Compressive Strength, psi (from test)	14,538
Unconfined Compressive Strength, psi (with L/D correction)	14,695
Type of Break	Cone & Shear
Young's Modulus, psi	3,400,000
Poisson's Ratio	0.41



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-908 79.35'





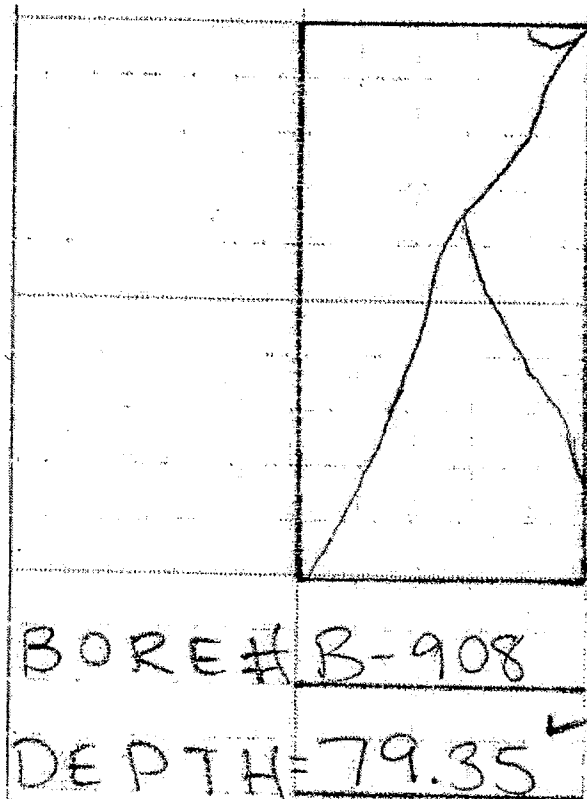
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna COL
6468061472
908
79.35
Jacob B. Mock
12/13/2006

Reviewed By: DSC
Review Date: 12/12/2006





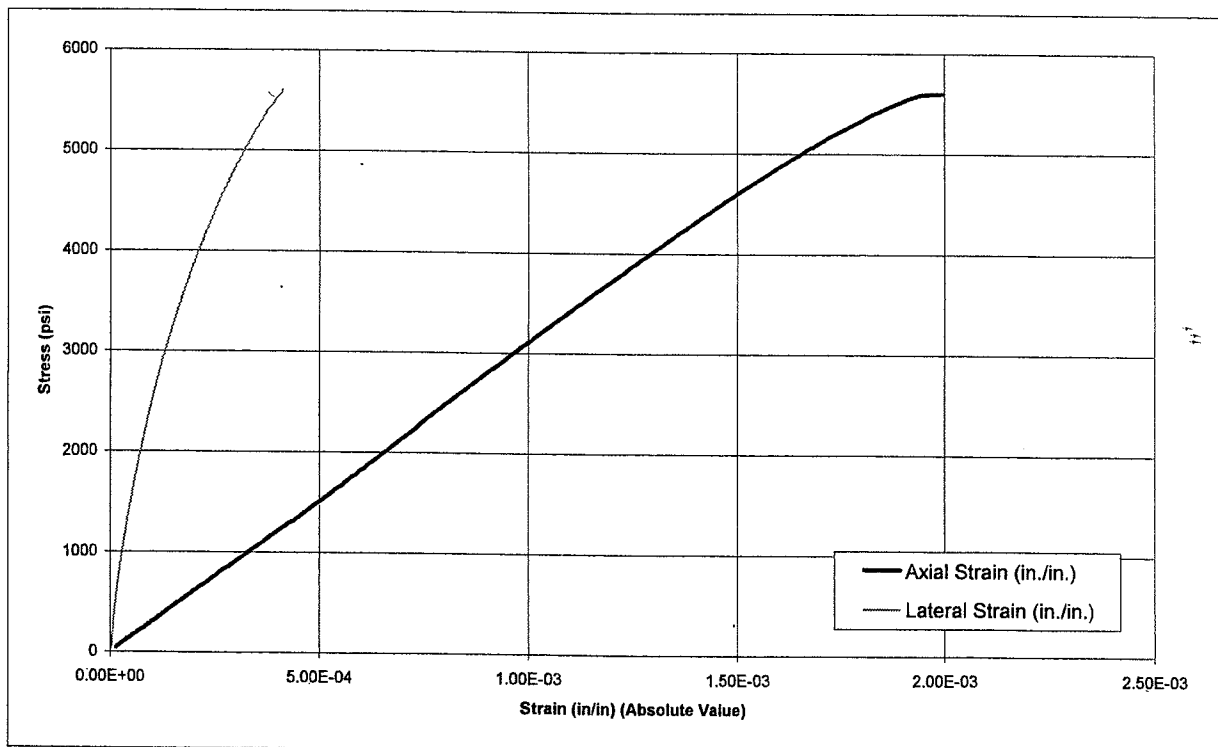
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna COL
Project Number: 6468061472
Boring Number: 908
Sample Depth (ft): 135.7
Tested By: Jacob B. Mock
Test Date: 12/13/2006

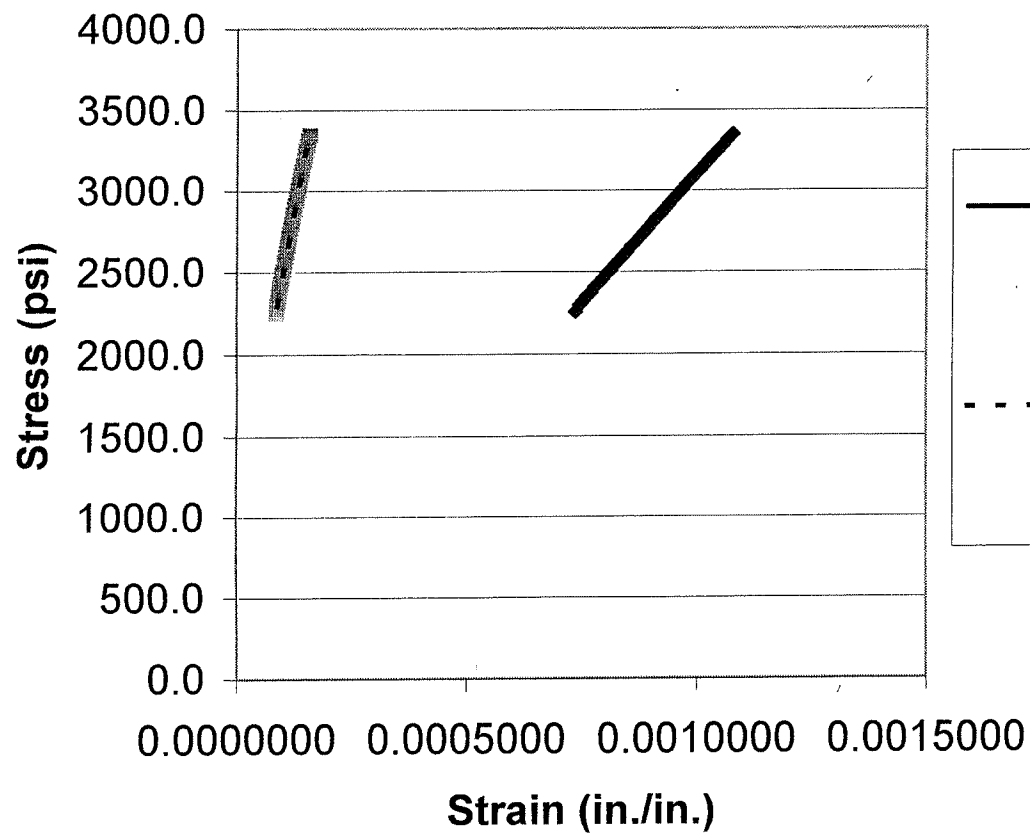
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.377
Specimen Length, inch	5.282
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft ³)	187
Test Duration (Time to Failure in Minutes)	5.2
Unconfined Compressive Strength, psi (from test)	5,602
Unconfined Compressive Strength, psi (with L/D correction)	5,670
Type of Break	Shear
Young's Modulus, psi	3,180,000
Poisson's Ratio	0.21



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from
approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-908 135.7'



— Linear (Stress
vs. Axial
Strain)

$$y = 3.18E+06x - 7.91E+01$$

- - - Linear (Stress
vs. Lateral
Strain)

$$y = 1.52E+07x + 9.69E+02$$



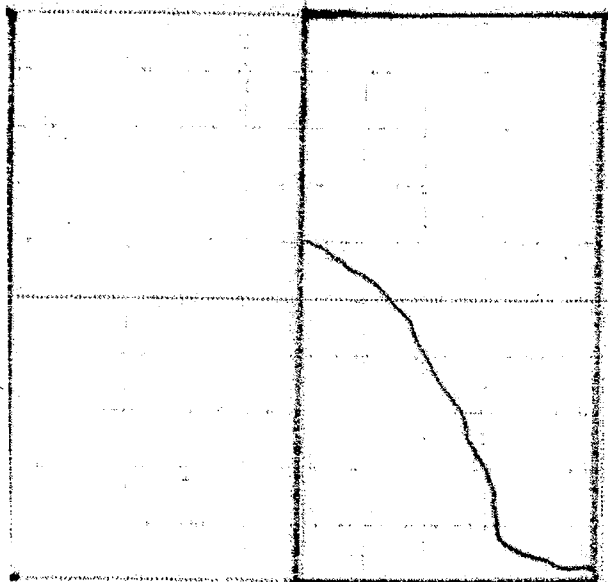
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna COL
6468061472
908
135.7
Jacob B. Mock
12/13/2006

Reviewed By: DSC
Review Date: 12/12/2006



BORE # R-908
DEPTH = 135.7

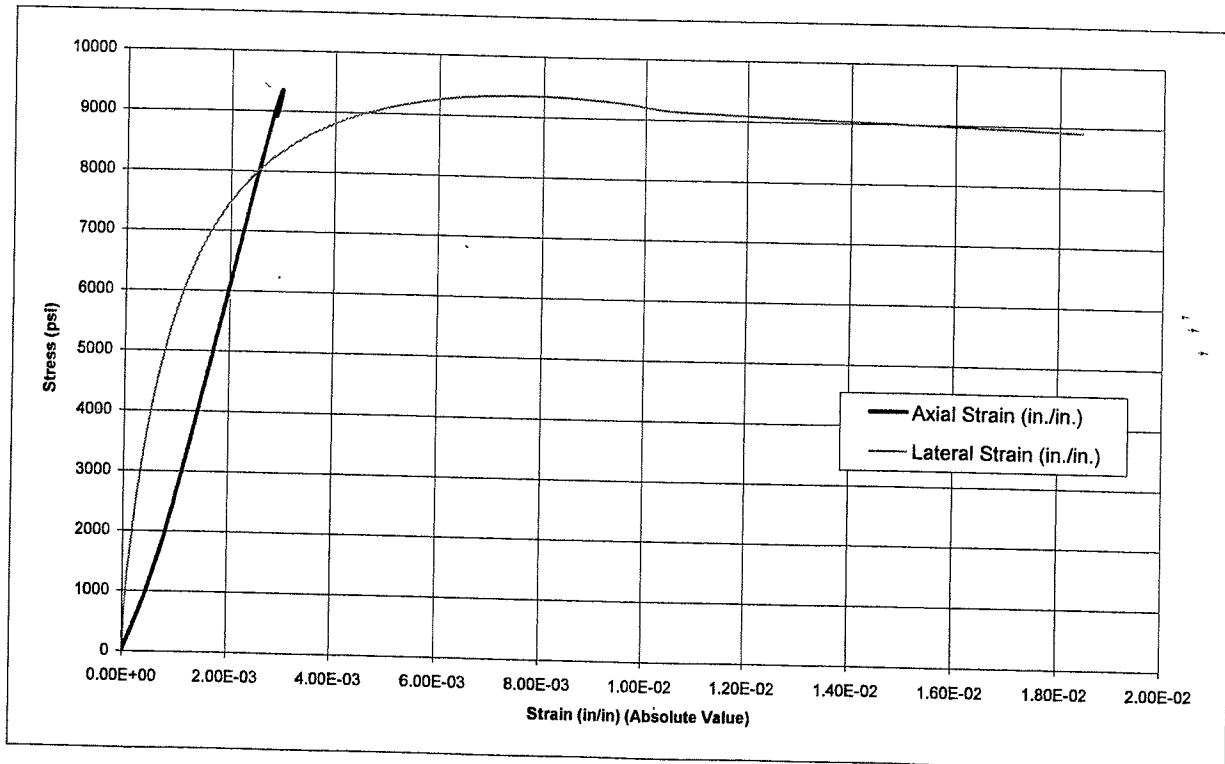


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 909
Sample Depth (ft): 82.35
Tested By: Jacob B. Mock
Test Date: 12/1/2006

Reviewed By: DSC
Review Date: 1-19-07

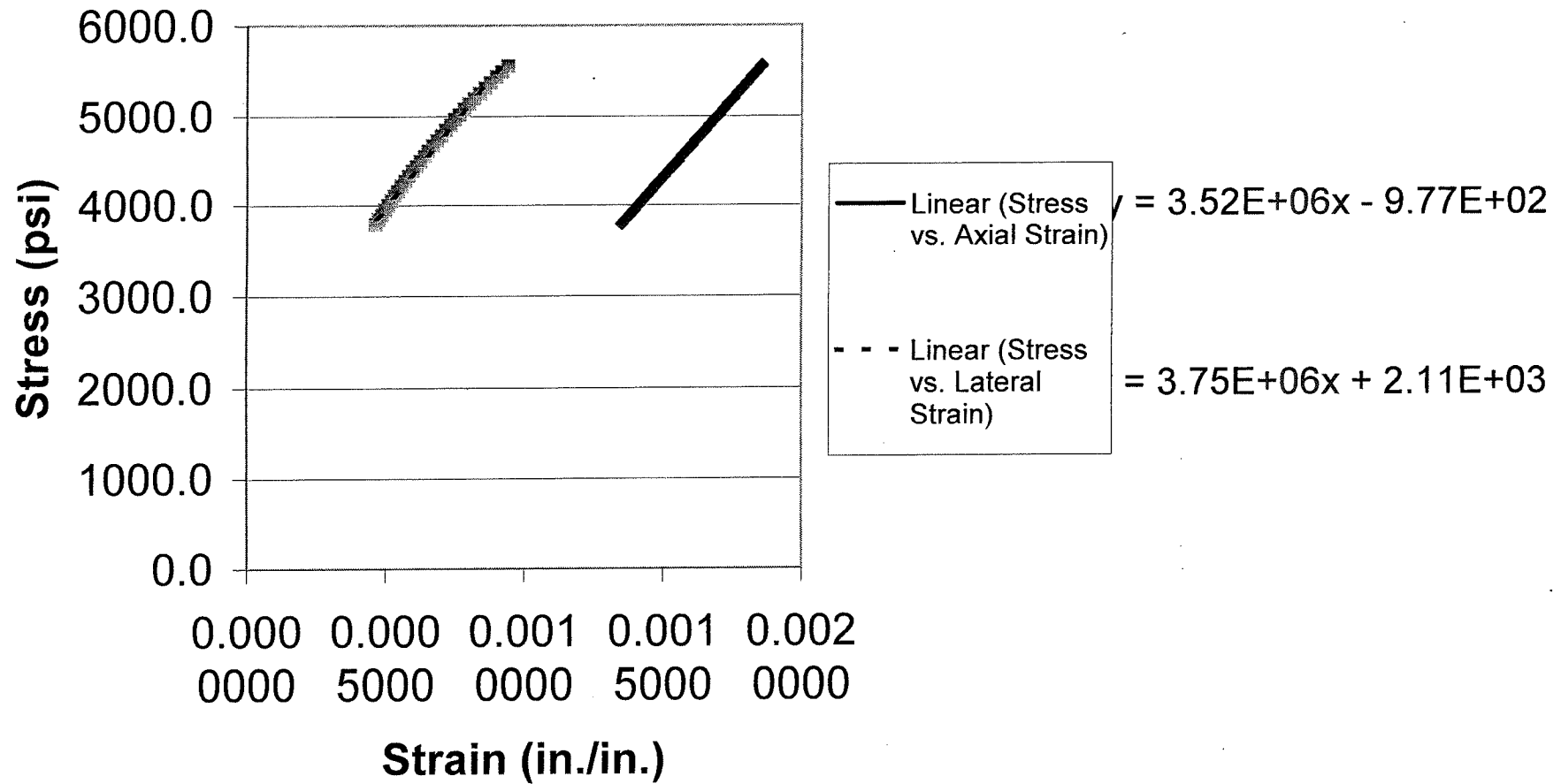
Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.391
Specimen Length, inch	5.319
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft³)	176
Test Duration (Time to Failure in Minutes)	7.7
Unconfined Compressive Strength, psi (from test)	9,349
Unconfined Compressive Strength, psi (with L/D correction)	9,464
Type of Break	Cone & Shear
Young's Modulus, psi	3,520,000
Poisson's Ratio	*



Comments: Strain values shown are in terms of absolute value: Axial Strain is negative,
Lateral Strain is positive.

* = Value of Poisson's ratio is greater than 0.5 which indicates inelastic behavior probably due to
presence of fractures or discontinuities affecting lateral strain.

40%-60% Stress vs. Strain B-909 82.35'





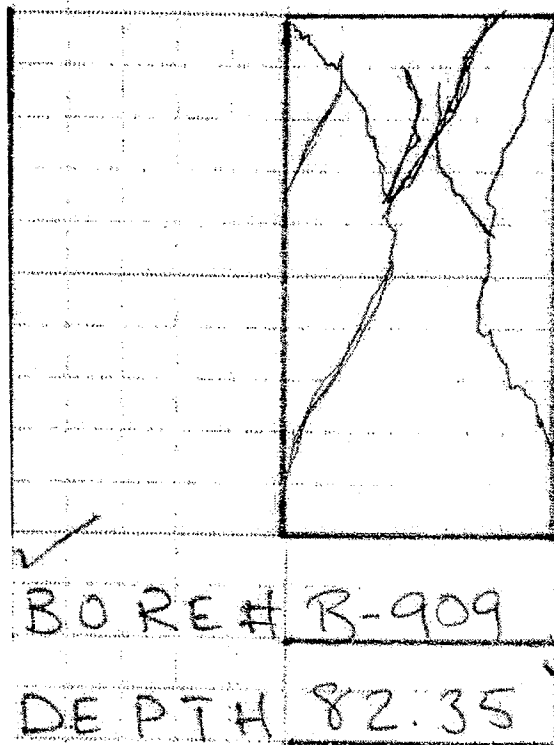
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
909
82.35
Jacob B. Mock
12/1/2006

Reviewed By: DSC
Review Date: 12/12/2006



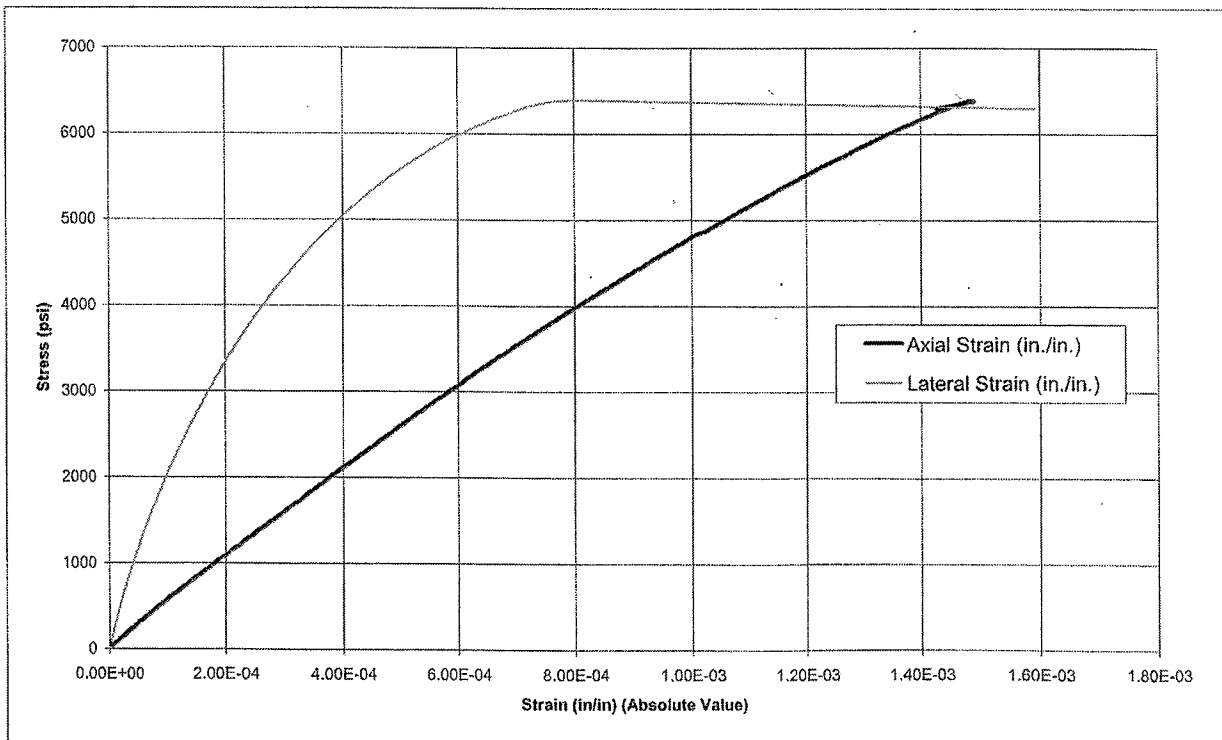


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 909
Sample Depth (ft): 152.25
Tested By: Jacob B. Mock
Test Date: 12/5/2006

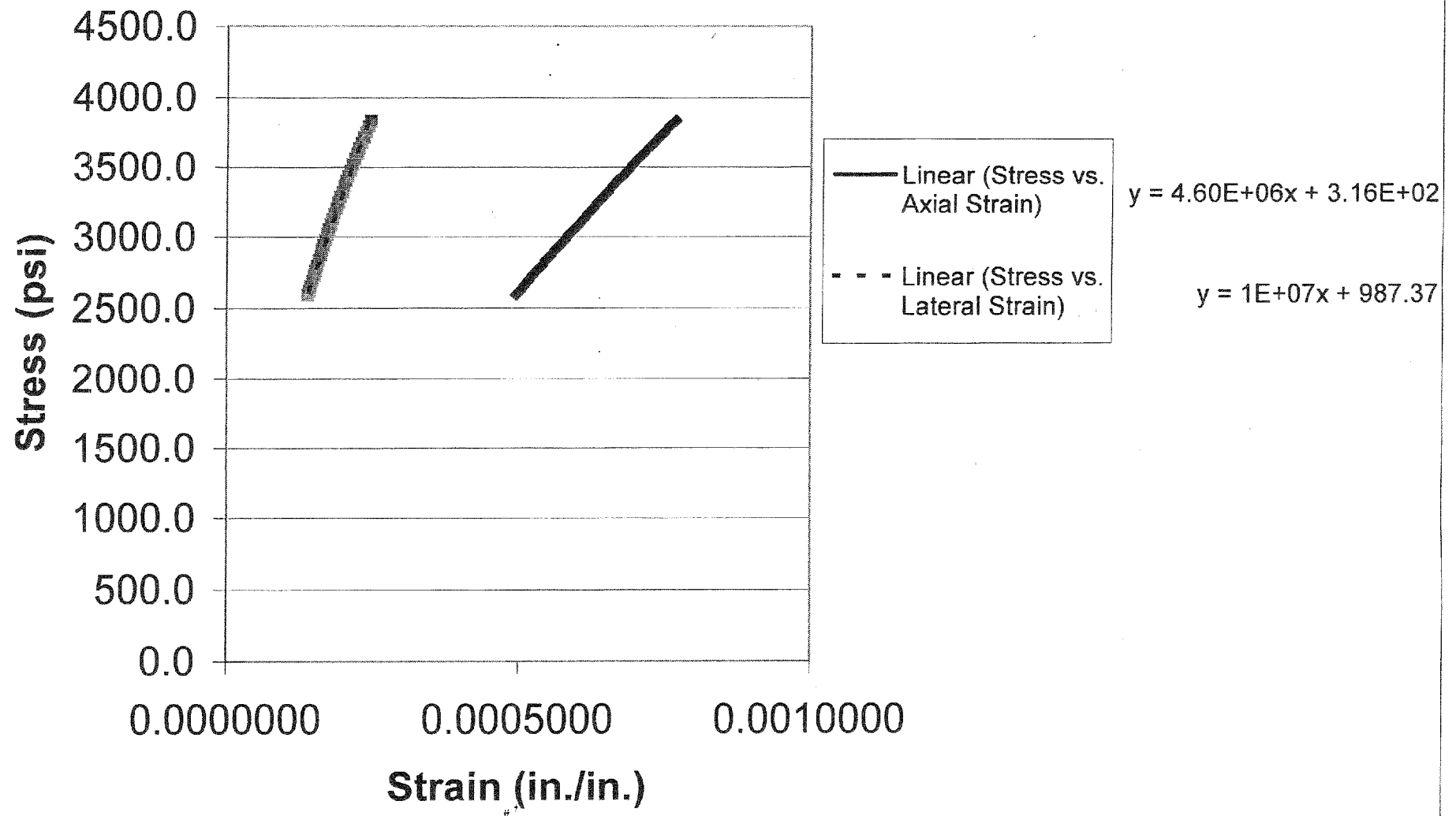
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.383
Specimen Length, inch	5.274
Length/Diameter Ratio	2.21
Unit Weight (lbs/ft ³)	184
Test Duration (Time to Failure in Minutes)	5.5
Unconfined Compressive Strength, psi (from test)	6,392
Unconfined Compressive Strength, psi (with L/D correction)	6,467
Type of Break	Cone & Shear
Young's Modulus, psi	4,600,000
Poisson's Ratio	0.39



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-909 152.25'





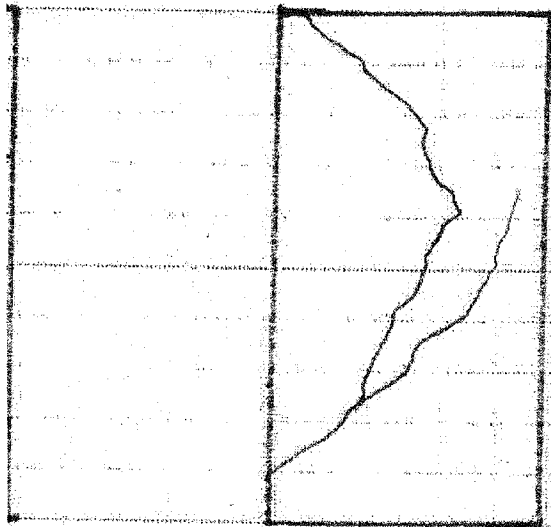
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
909
152.25
Jacob B. Mock
12/5/2006

Reviewed By: DSC
Review Date: 12/12/2006



BORE # B-909
DEPTH = 152.25

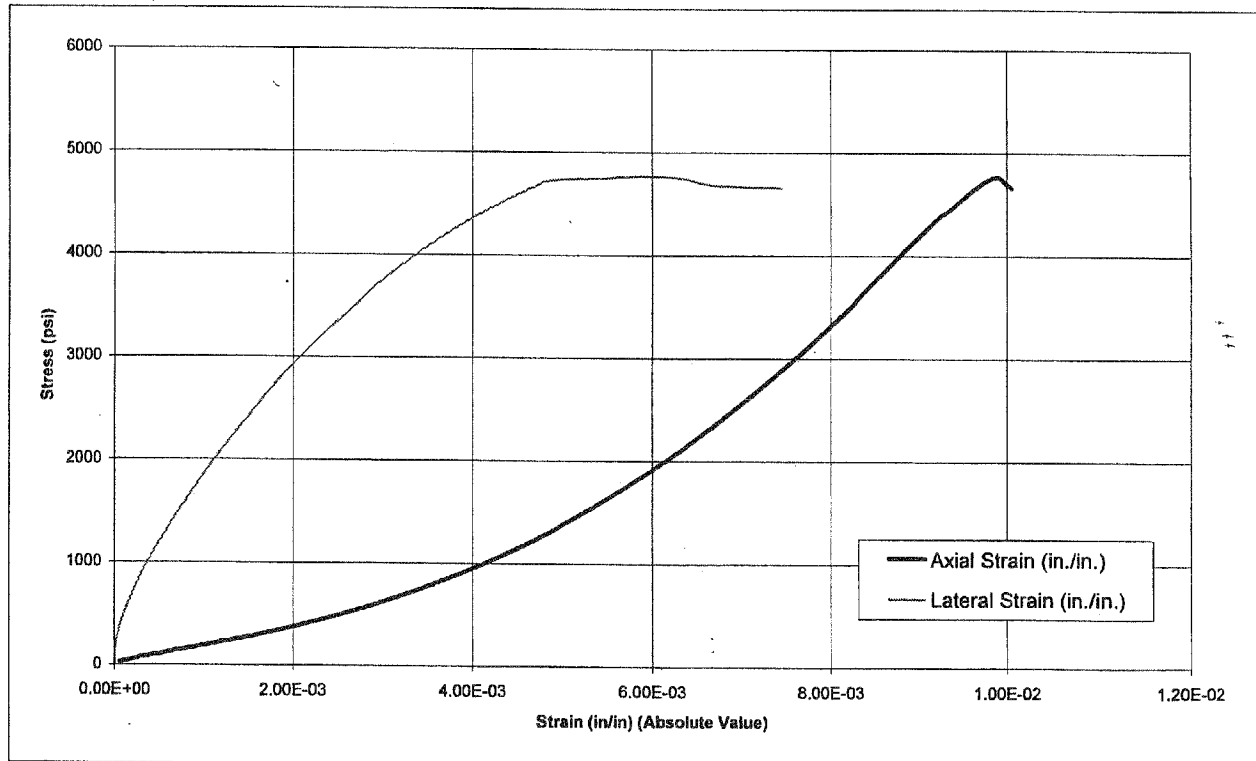


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
 Project Number: 6468061472
 Boring Number: 910
 Sample Depth (ft): 91.1
 Tested By: Jacob B. Mock
 Test Date: 12/7/2006

Reviewed By: DSC
 Review Date: 1-22-07

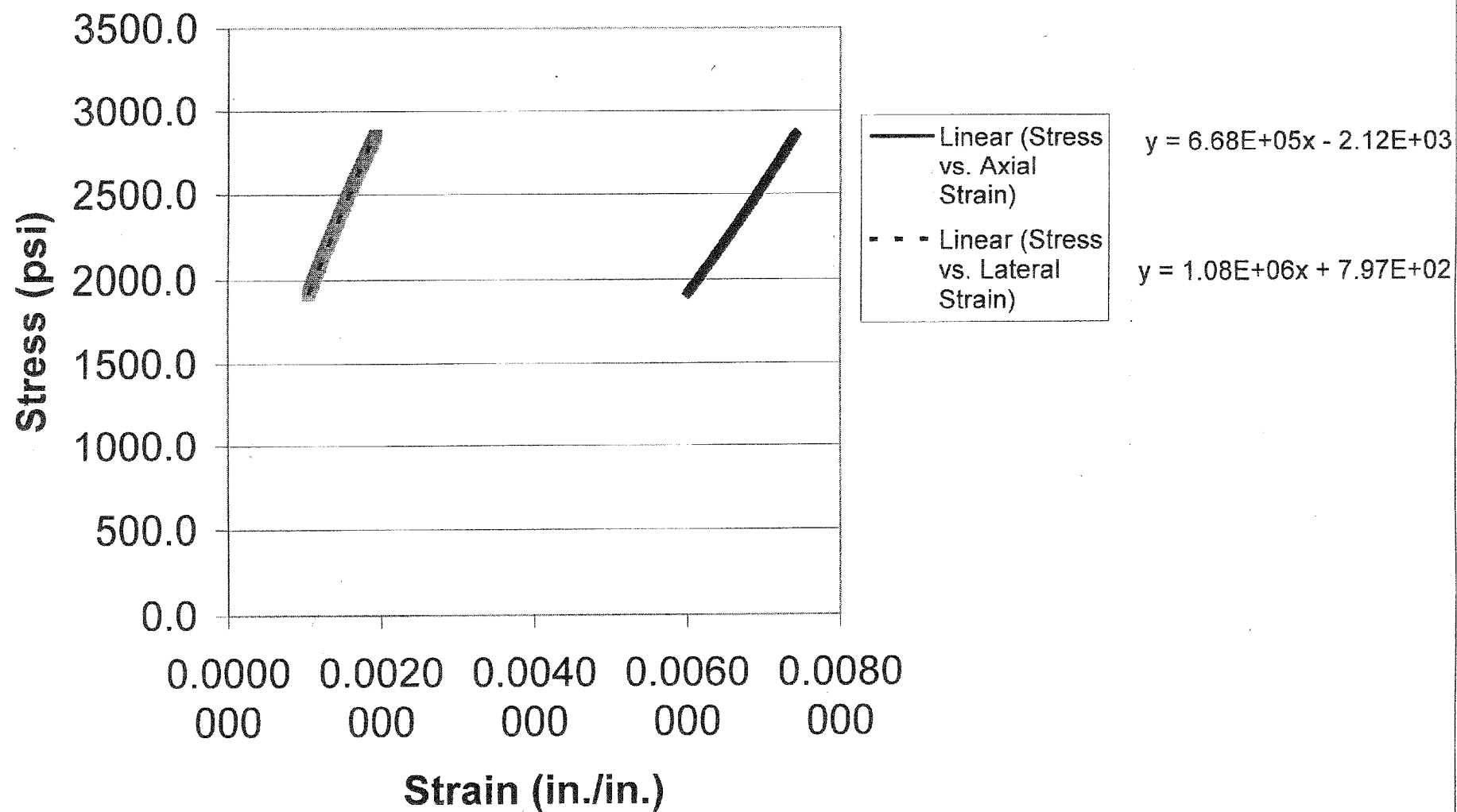
Rock Type	Biotite Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.386
Specimen Length, inch	5.237
Length/Diameter Ratio	2.19
Unit Weight (lbs/ft ³)	159
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	4,769
Unconfined Compressive Strength, psi (with L/D correction)	4,821
Type of Break	Shear
Young's Modulus, psi	670,000
Poisson's Ratio	*



Comments: Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive. * = Value of Poisson's ratio is greater than 0.5 which indicates inelastic behavior probably due to presence of fractures or discontinuities affecting lateral strain.

Sample had chips on end. Tested "as is" with approval by Bechtel.

40%-60% Stress vs. Strain B-910 91.1'





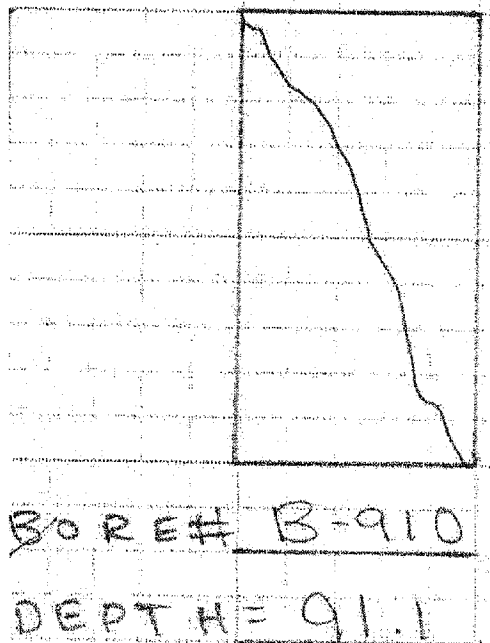
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
910
91.1
Jacob B. Mock
12/7/2006

Reviewed By: **DSC**
Review Date: **12/12/2006**





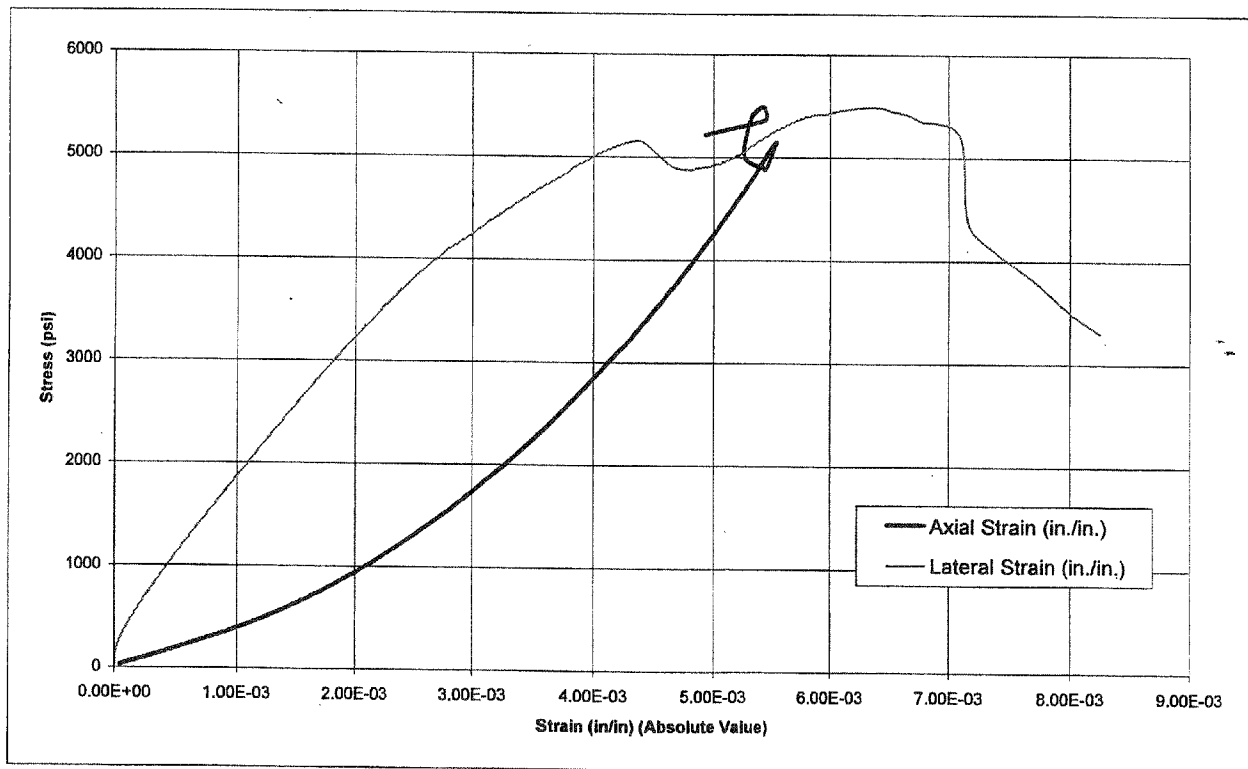
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 911
Sample Depth (ft): 34.25
Tested By: Jacob B. Mock
Test Date: 12/1/2006

Reviewed By: DSC
Review Date: 1-19-07

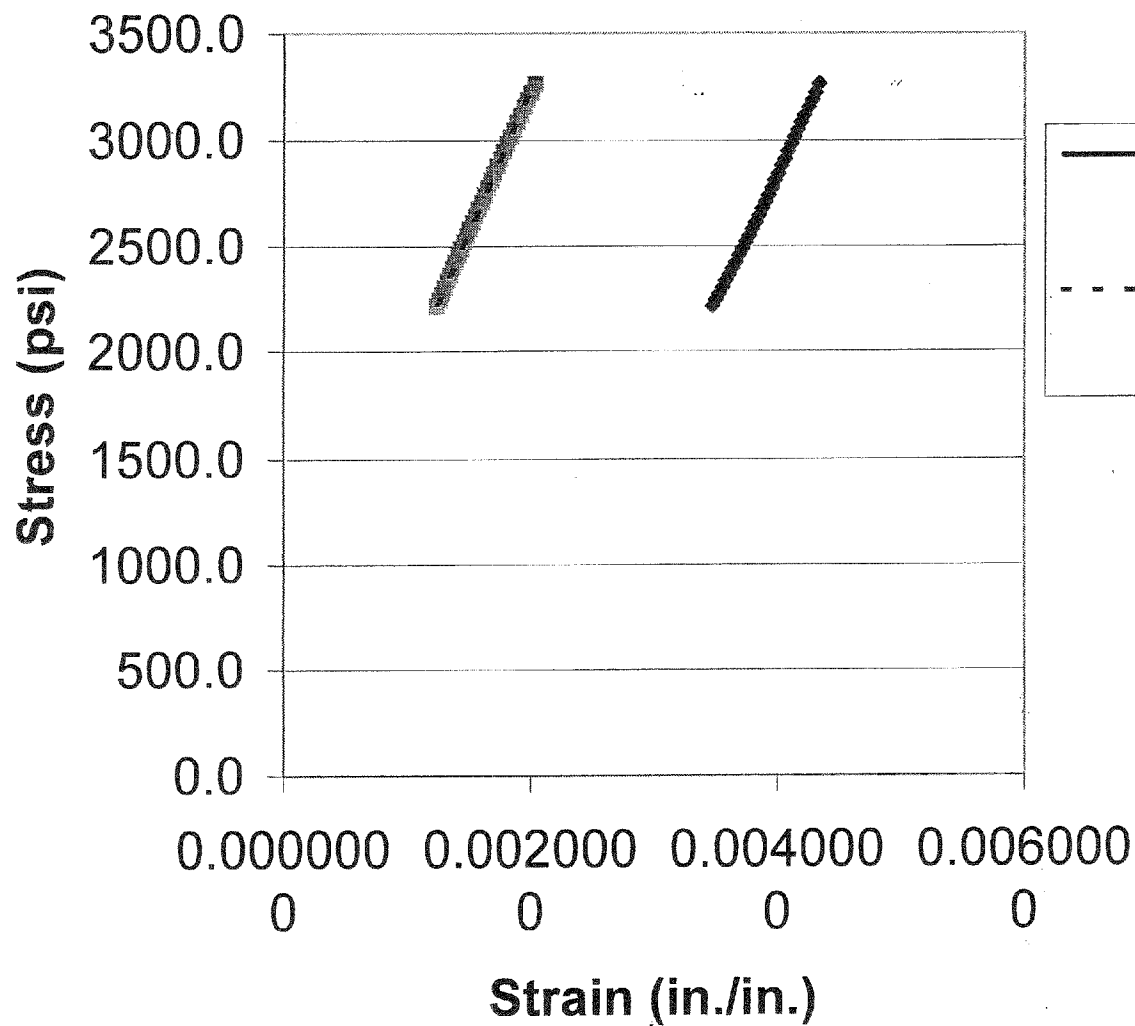
Rock Type	Quartz Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.371
Specimen Length, inch	5.275
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft ³)	161
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	5,491
Unconfined Compressive Strength, psi (with L/D correction)	5,558
Type of Break	Shear
Young's Modulus, psi	1,230,000
Poisson's Ratio	*



Comments: Strain values shown are in terms of absolute value: Axial Strain is negative,
Lateral Strain is positive.

* = Value of Poisson's ratio is greater than 0.5 which indicates inelastic behavior probably due to
presence of fractures or discontinuities affecting lateral strain.

40%-60% Stress vs. Strain B-911 34.25'





Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

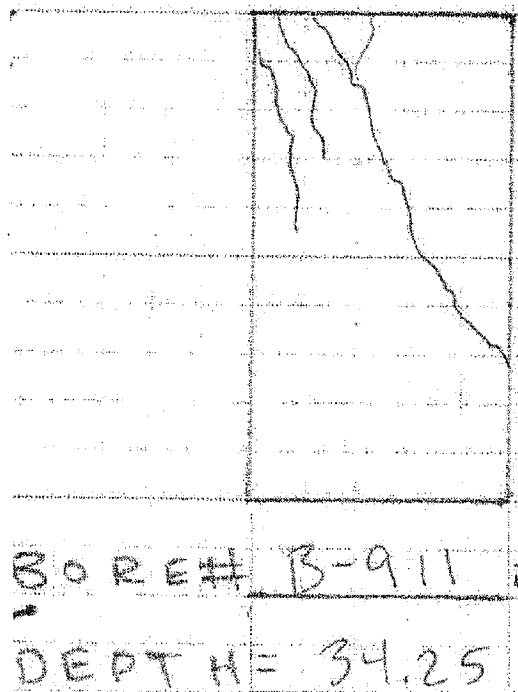
ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:

North Anna
6468061472
911
34.25
Jacob B. Mock
12/1/2006

Reviewed By:
Review Date:

DSC
12/12/2006



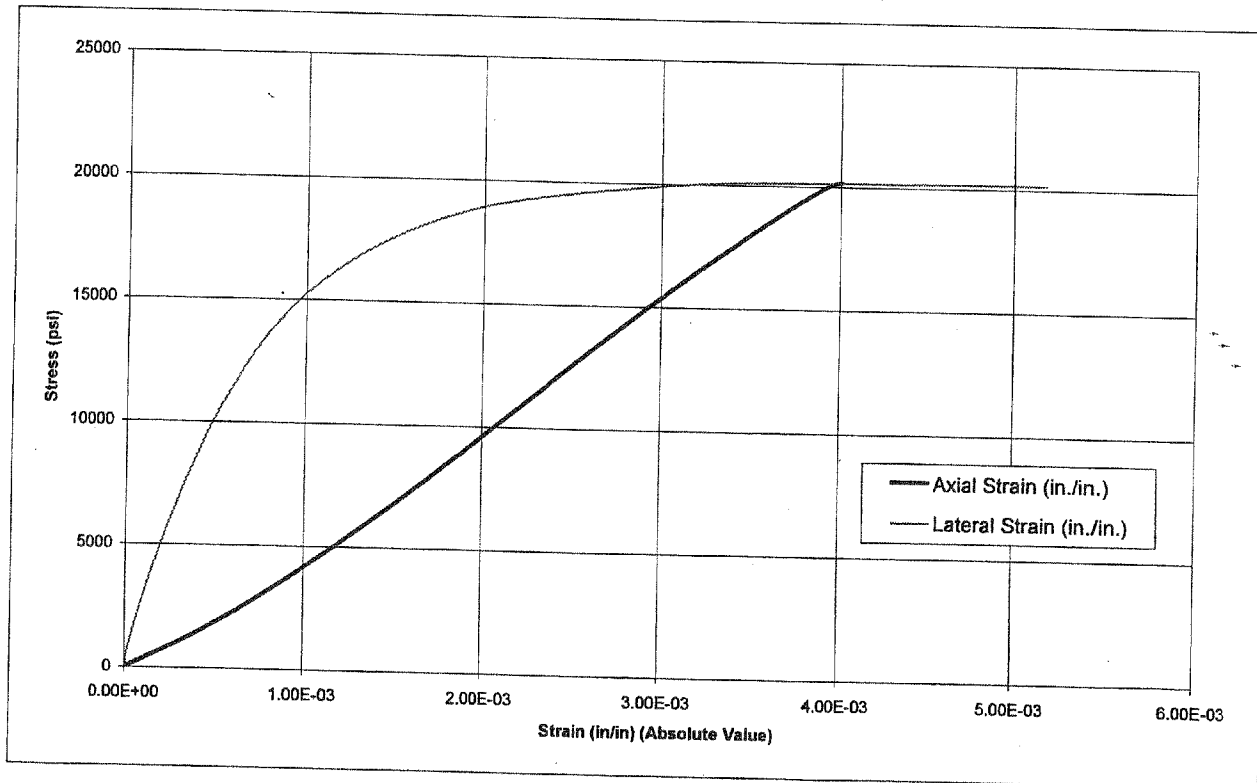


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 911
Sample Depth (ft): 82.05
Tested By: Jacob B. Mock
Test Date: 12/1/2006

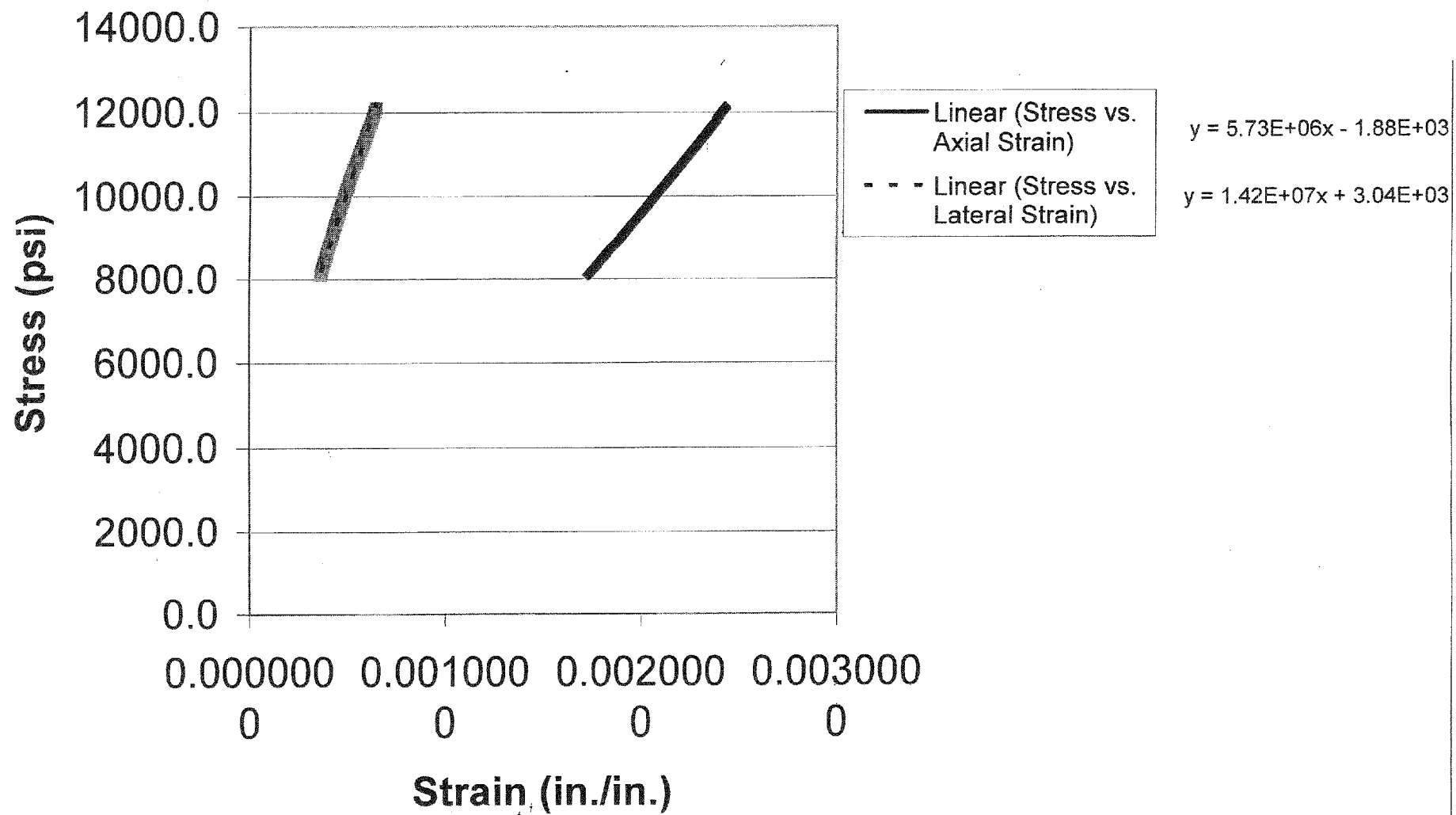
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.397
Specimen Length, inch	5.361
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	164
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	20,172
Unconfined Compressive Strength, psi (with L/D correction)	20,431
Type of Break	Cone & Shear
Young's Modulus, psi	5,730,000
Poisson's Ratio	0.40



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from
approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-911 82.05'





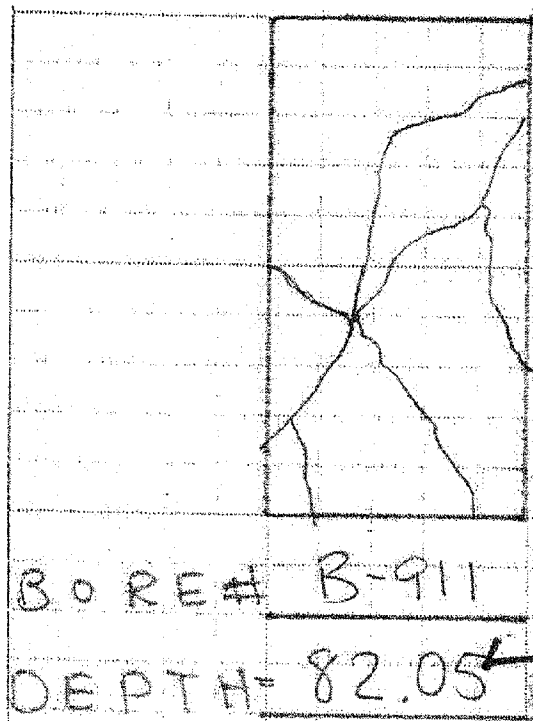
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
911
82.05
Jacob B. Mock
12/1/2006

Reviewed By: **DSC**
Review Date: **12/12/2006**



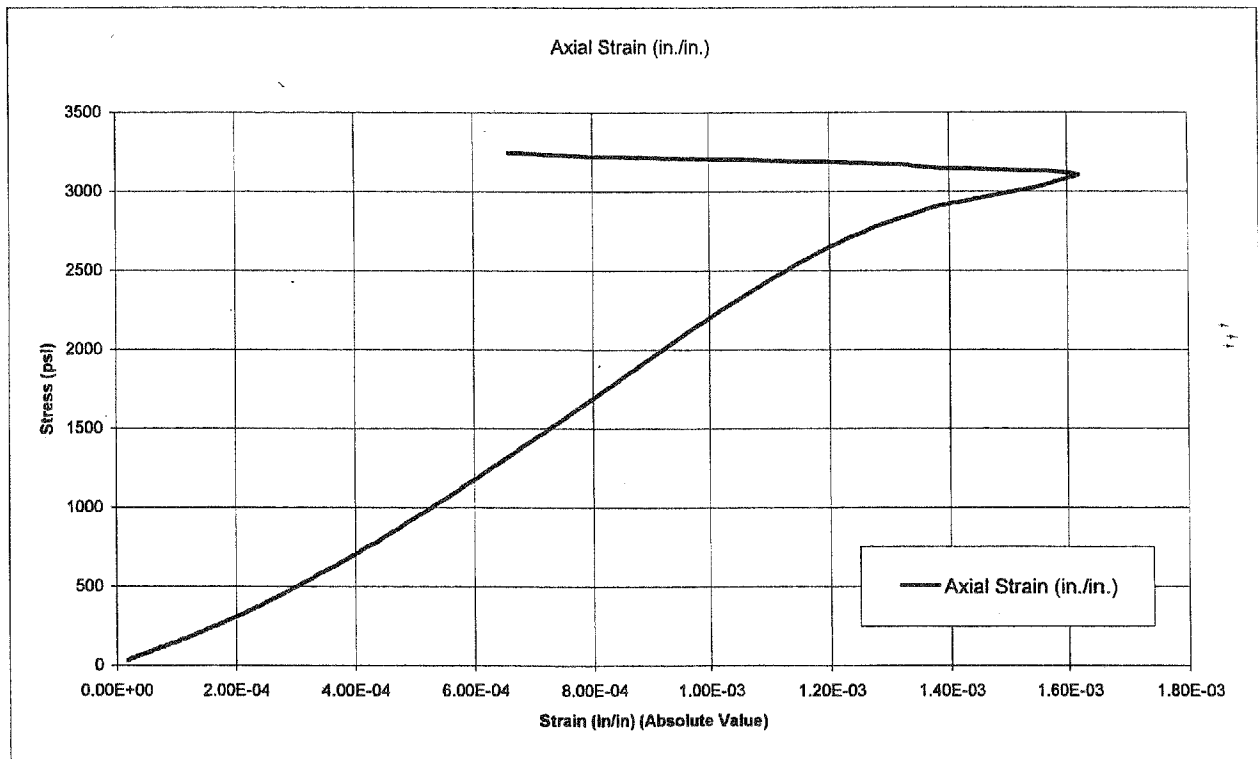


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna COL
Project Number: 6468061472
Boring Number: 912
Sample Depth (ft): 37.1
Tested By: Jacob B. Mock
Test Date: 12/13/2006

Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.390
Specimen Length, inch	5.317
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft ³)	170
Test Duration (Time to Failure in Minutes)	5.7
Unconfined Compressive Strength, psi (from test)	3,482
Unconfined Compressive Strength, psi (with L/D correction)	3,524
Type of Break	Cone & Shear
Young's Modulus, psi	2,570,000
Poisson's Ratio	N/A

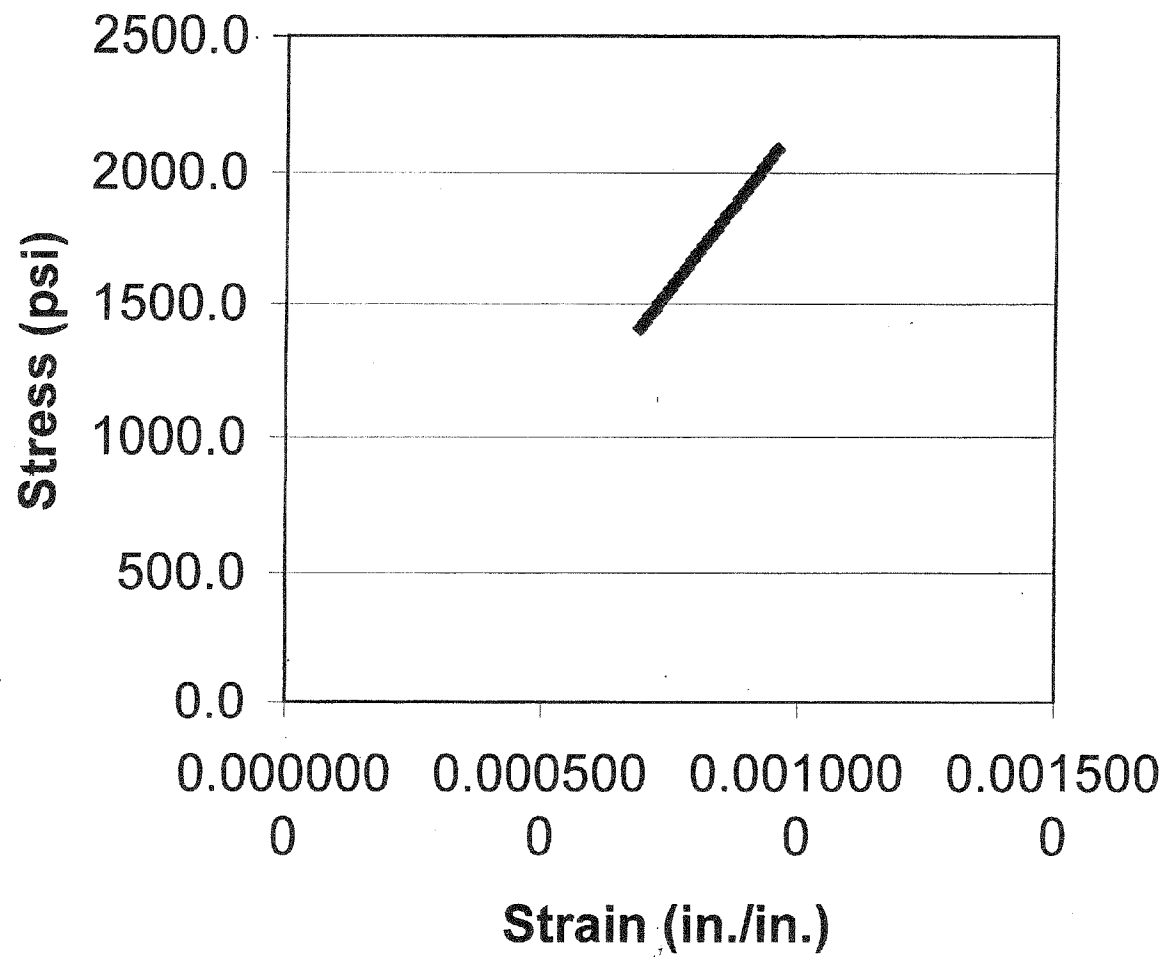


Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.

Strain values shown are in terms of absolute value: Axial Strain is negative.

Poisson's Ratio is not given due to lateral strain gage failure during testing.

40%-60% Stress vs. Strain B-912 37.1'



— Linear (Stress
vs. Axial Strain)

$$y = 2.57E+06x - 3.72E+02$$

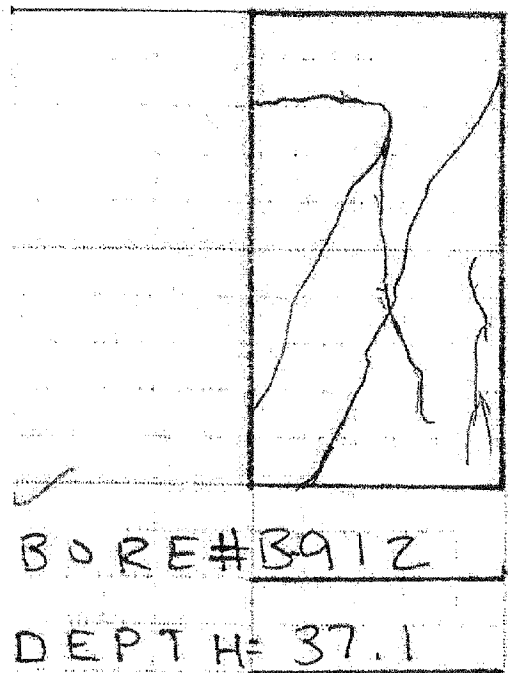


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna COL
Project Number: 6468061472
Boring Number: 912
Sample Depth (ft): 37.1
Tested By: Jacob B. Mock
Test Date: 12/13/2006

Reviewed By: DSC
Review Date: 1-19-07



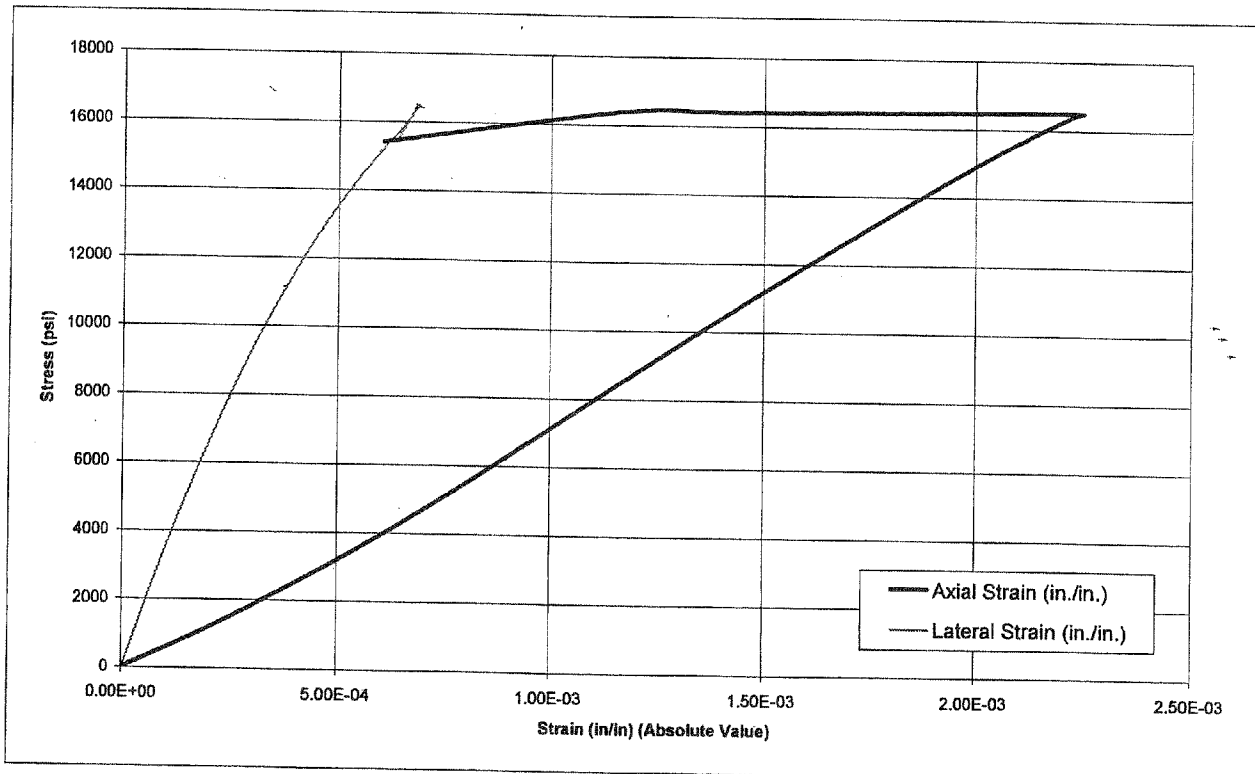


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna COL
Project Number: 6468061472
Boring Number: 912
Sample Depth (ft): 111.35
Tested By: Jacob B. Mock
Test Date: 12/13/2006

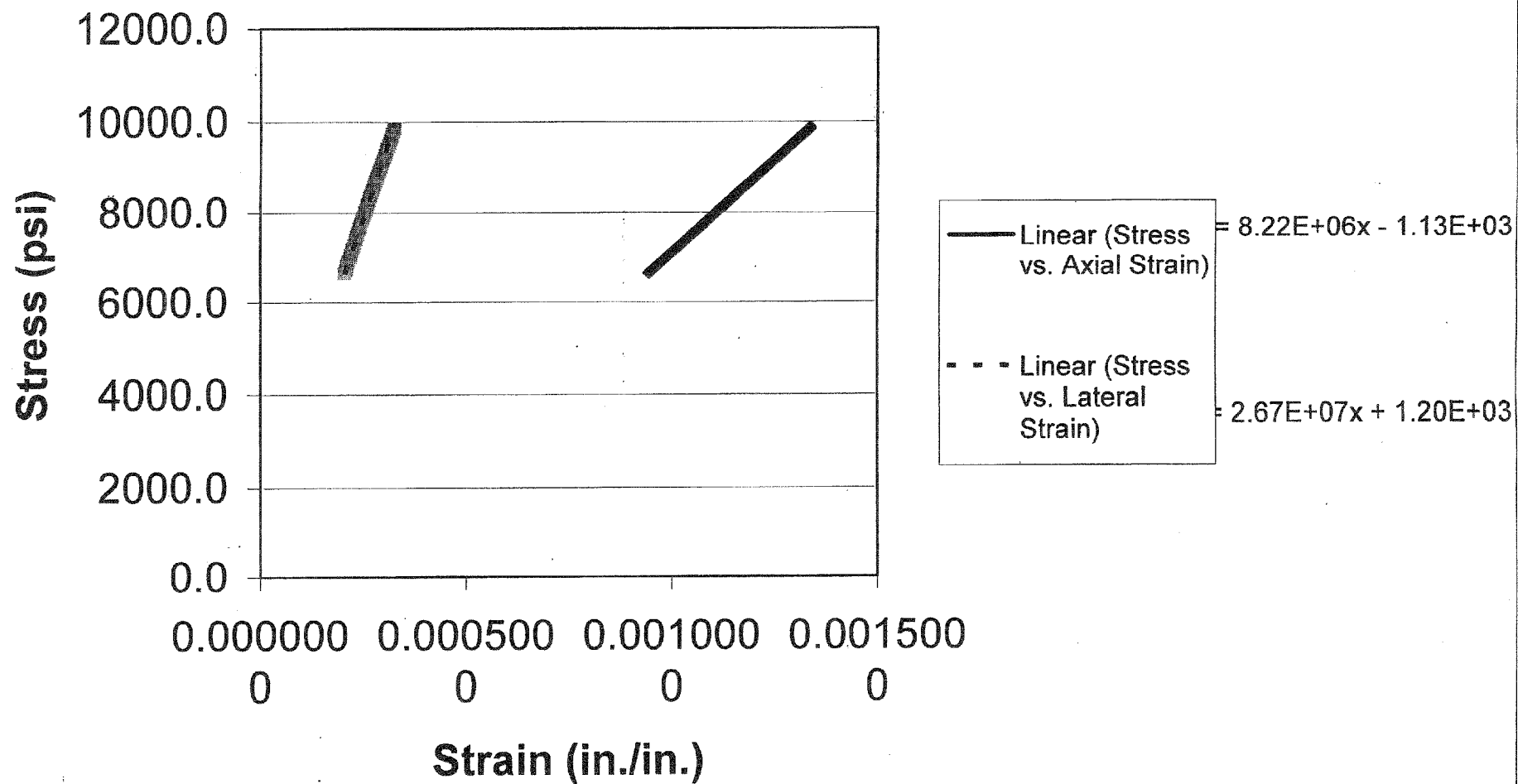
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.402
Specimen Length, inch	5.315
Length/Diameter Ratio	2.21
Unit Weight (lbs/ft ³)	163
Test Duration (Time to Failure in Minutes)	7.3
Unconfined Compressive Strength, psi (from test)	16,509
Unconfined Compressive Strength, psi (with L/D correction)	16,702
Type of Break	Shear
Young's Modulus, psi	8,220,000
Poisson's Ratio	0.31



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-912 111.35'





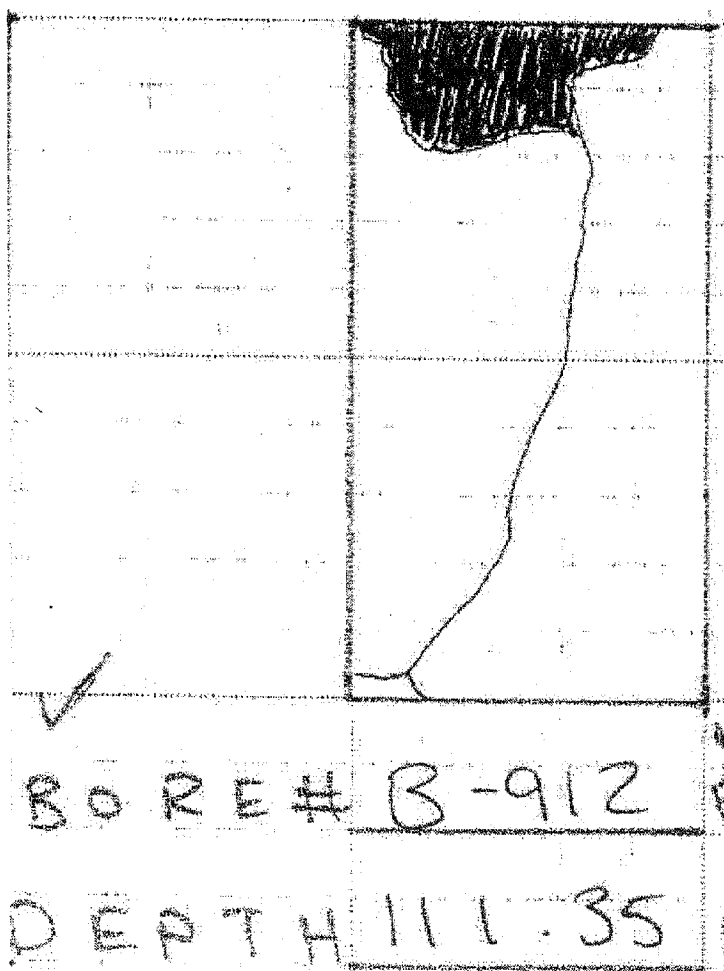
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna COL
6468061472
912
111.35
Jacob B. Mock
12/13/2006

Reviewed By: DSC
Review Date: 1-19-07



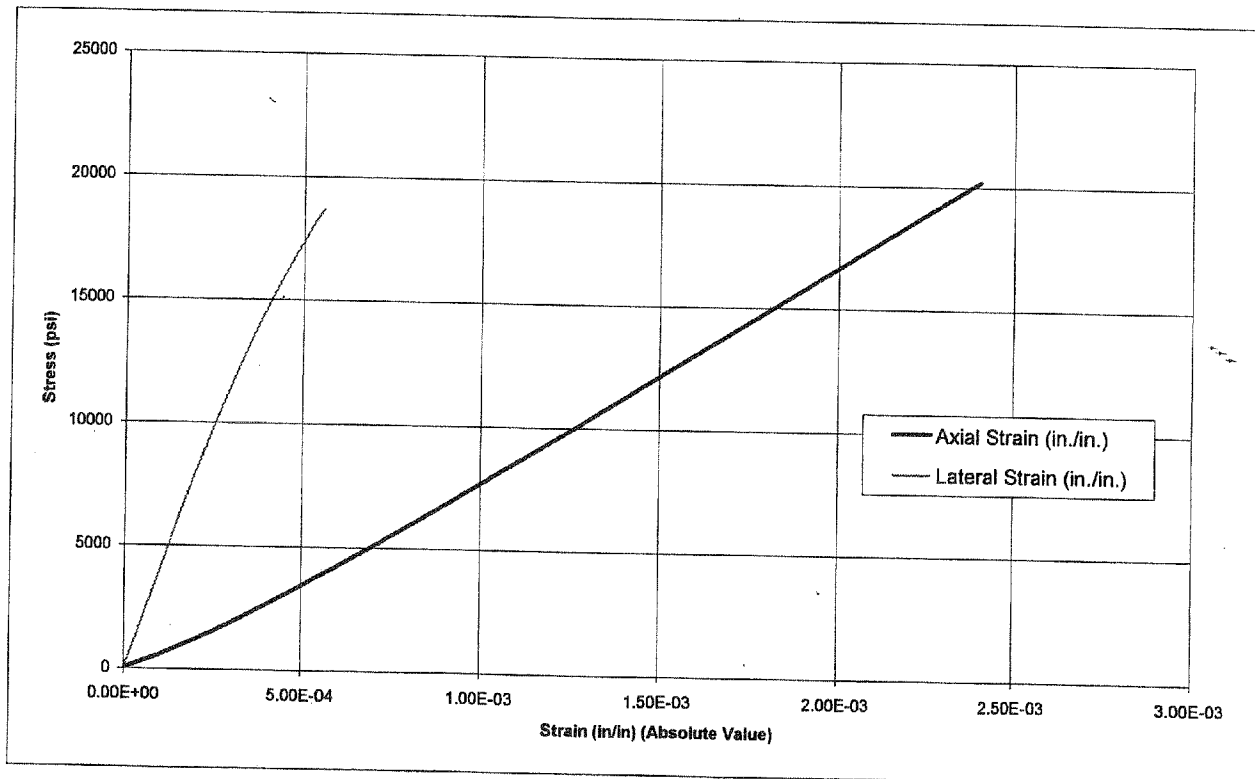


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 914
Sample Depth (ft): 95.8
Tested By: Jacob B. Mock
Test Date: 12/1/2006

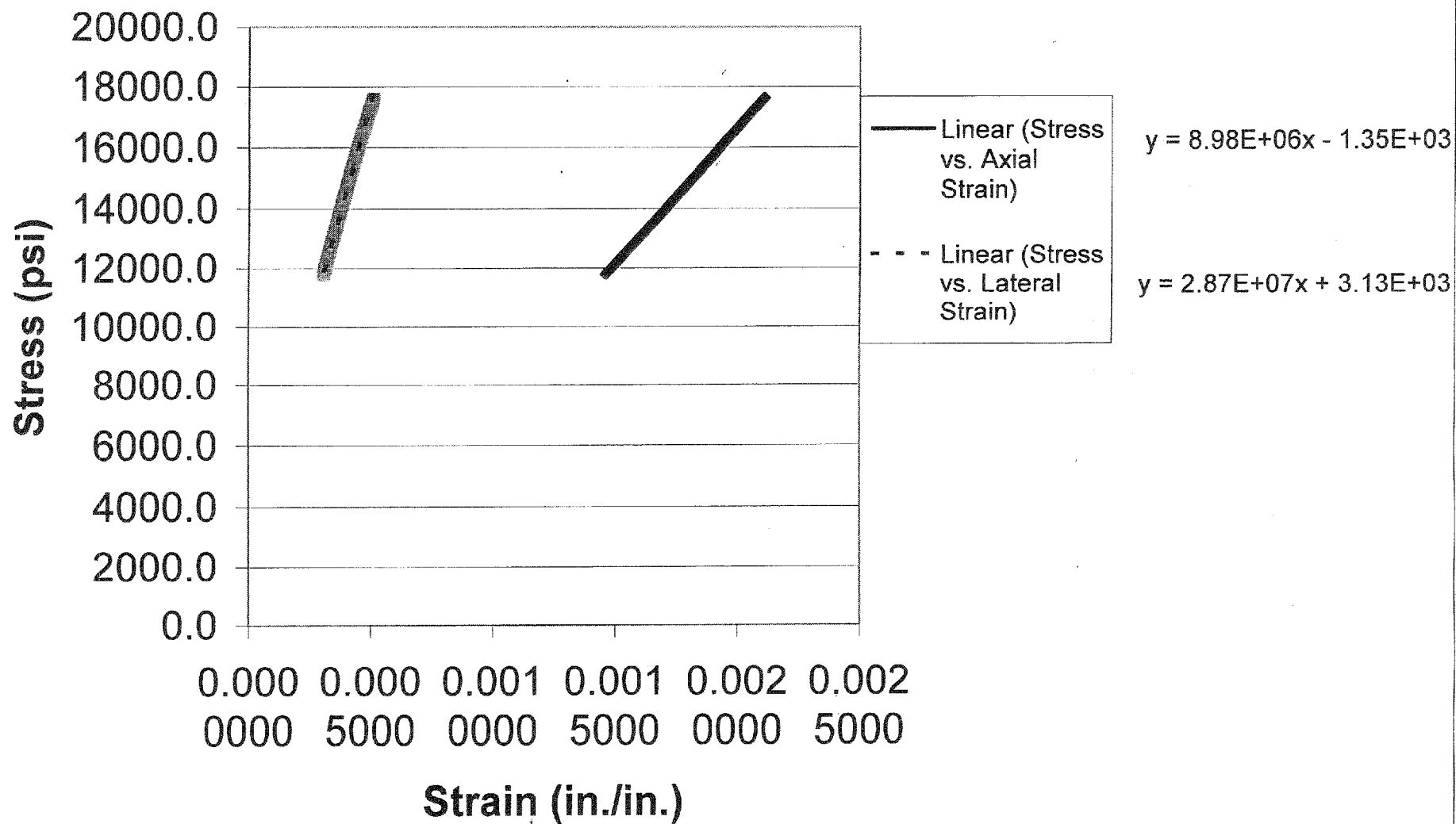
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.400
Specimen Length, inch	5.368
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	164
Test Duration (Time to Failure in Minutes)	8.9
Unconfined Compressive Strength, psi (from test)	29,398
Unconfined Compressive Strength, psi (with L/D correction)	29,776
Type of Break	Cone & Shear
Young's Modulus, psi	8,980,000
Poisson's Ratio	0.31



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-914 95.8'





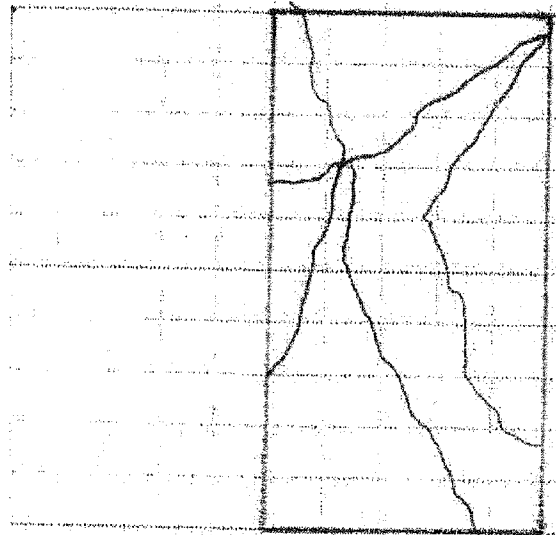
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
914
95.8
Jacob B. Mock
12/1/2006

Reviewed By: DSC
Review Date: 12/12/2006



BORE# B-914

DEPTH = 95.8

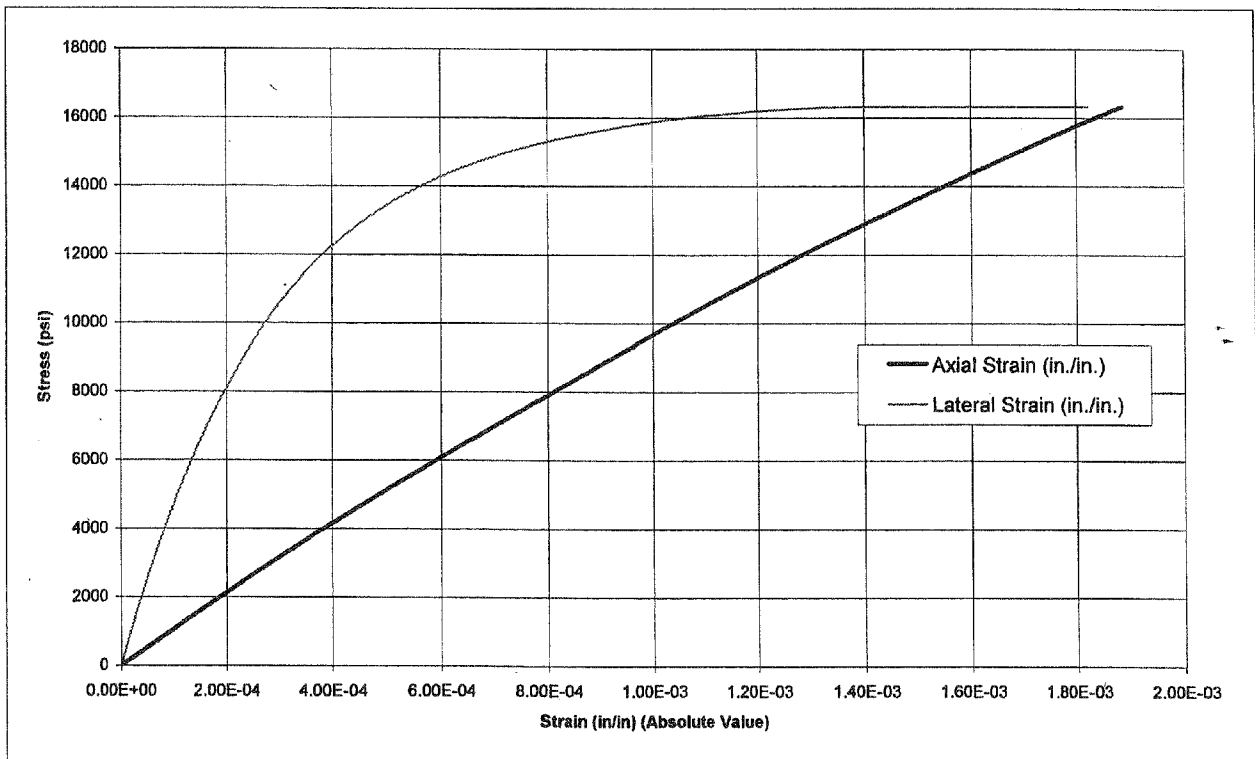


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 914
Sample Depth (ft): 151.4
Tested By: Jacob B. Mock
Test Date: 12/5/2006

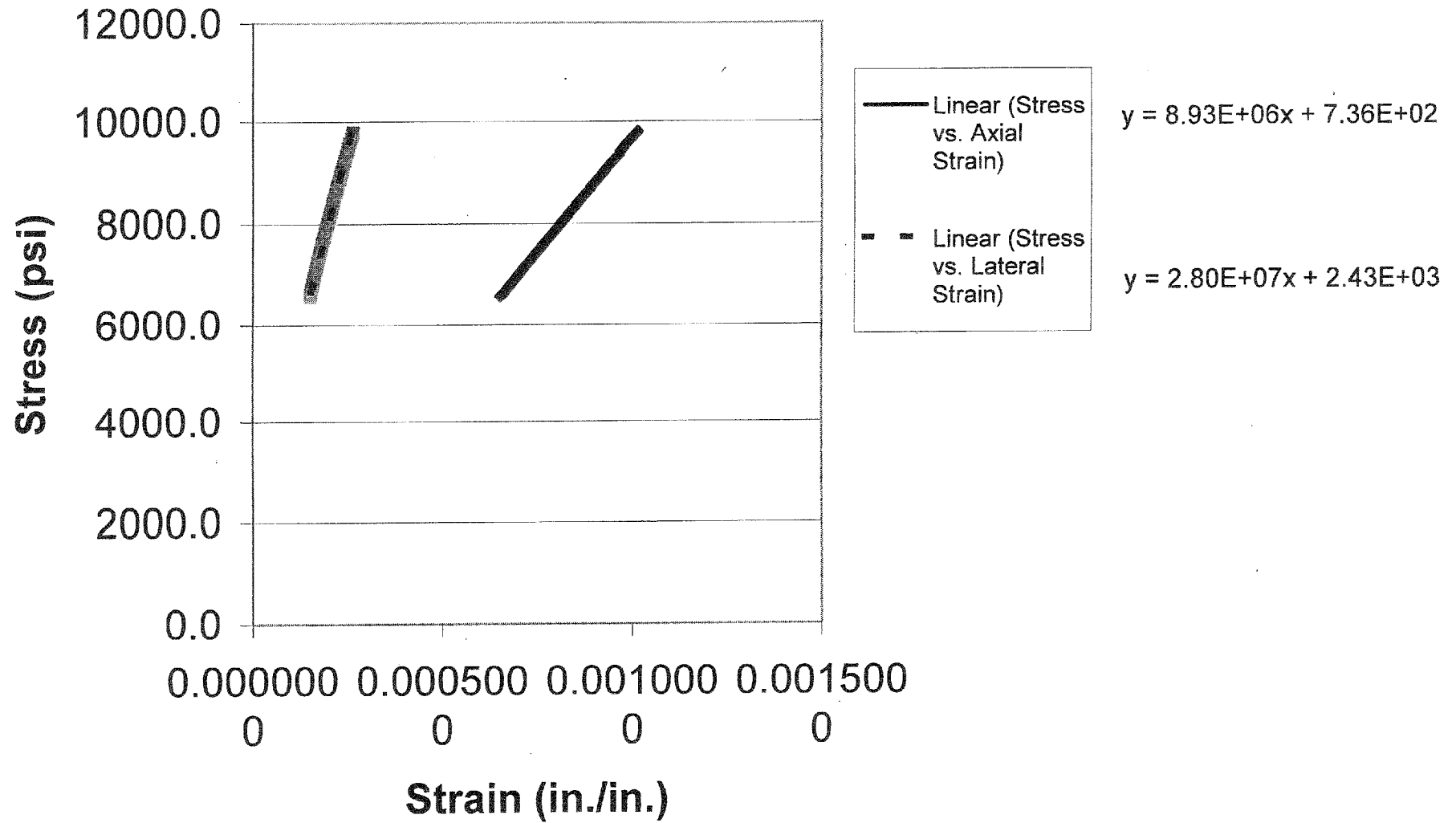
Reviewed By: DJC
Review Date: 1-19-07

Rock Type	Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.396
Specimen Length, inch	5.312
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft ³)	166
Test Duration (Time to Failure in Minutes)	8.7
Unconfined Compressive Strength, psi (from test)	16,324
Unconfined Compressive Strength, psi (with L/D correction)	16,517
Type of Break	Cone & Shear
Young's Modulus, psi	8,930,000
Poisson's Ratio	0.32



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from
approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-914 151.4'

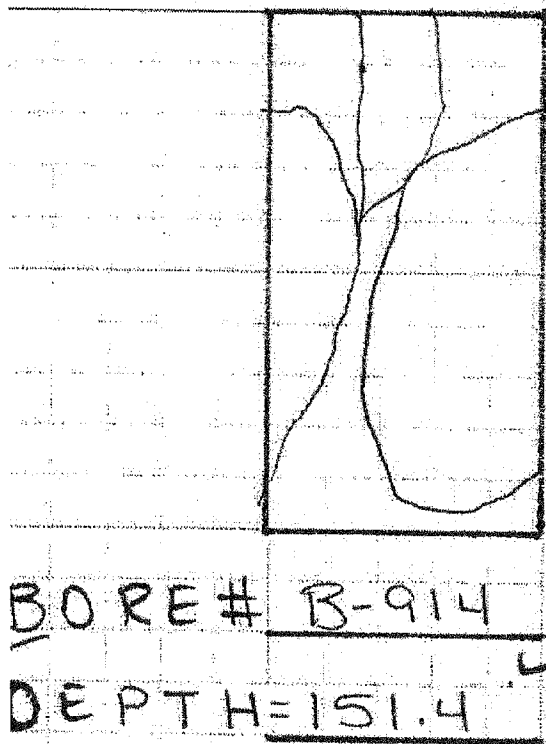




Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:	North Anna	Reviewed By:	DSC
Project Number:	6468061472	Review Date:	12/12/2006
Boring Number:	914		
Sample Depth (ft):	151.4		
Tested By:	Jacob B. Mock		
Test Date:	12/5/2006		



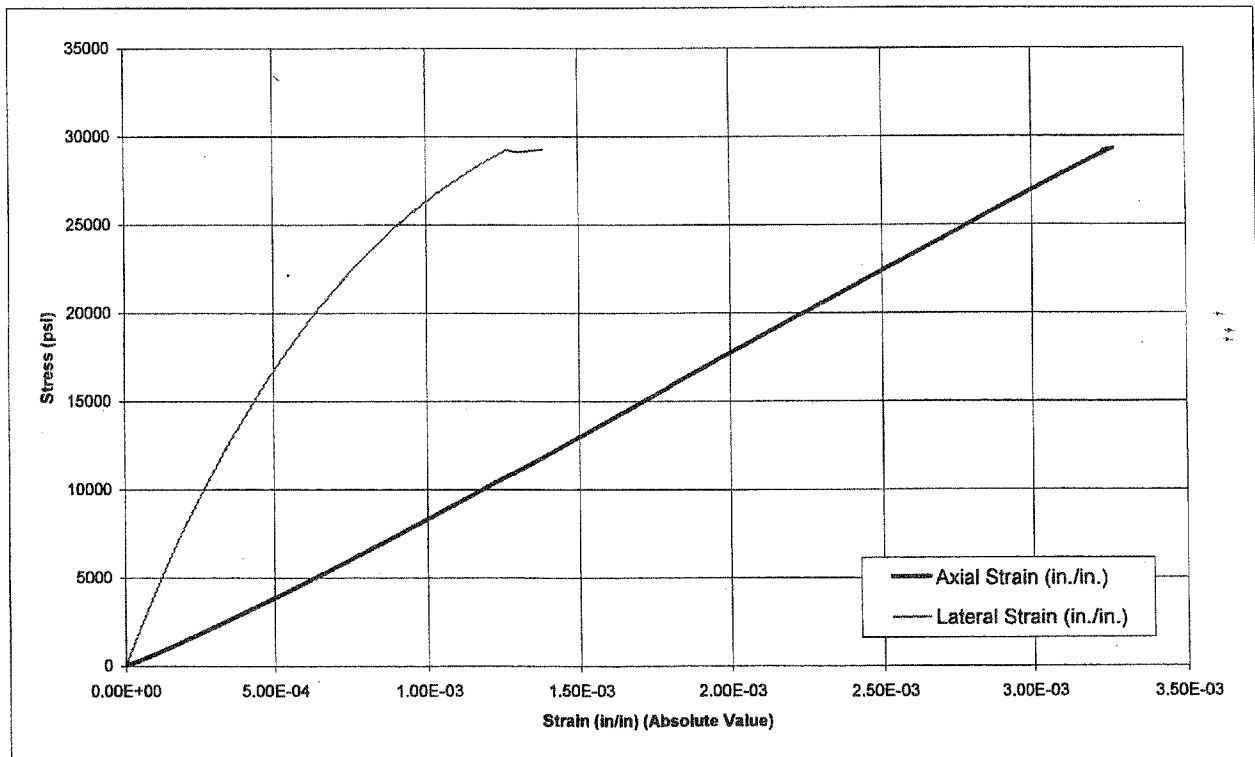


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna COL
Project Number: 6468061472
Boring Number: 918
Sample Depth (ft): 37.05
Tested By: Jacob B. Mock
Test Date: 12/13/2006

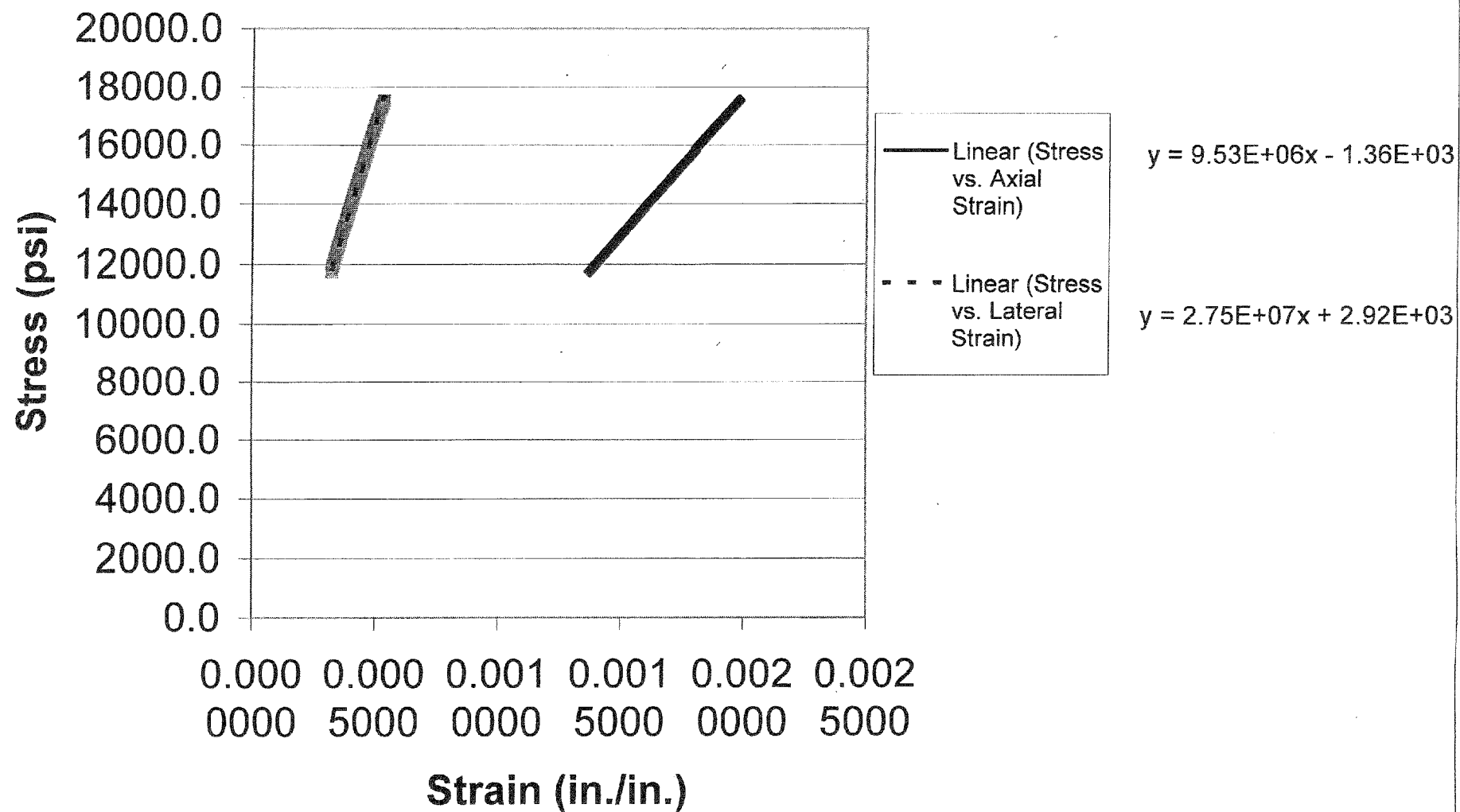
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.397
Specimen Length, inch	5.316
Length/Diameter Ratio	2.22
Unit Weight (lbs/ft ³)	164
Test Duration (Time to Failure in Minutes)	9.1
Unconfined Compressive Strength, psi (from test)	29,287
Unconfined Compressive Strength, psi (with L/D correction)	29,636
Type of Break	Cone & Shear
Young's Modulus, psi	9,530,000
Poisson's Ratio	0.35



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-918 37.05'





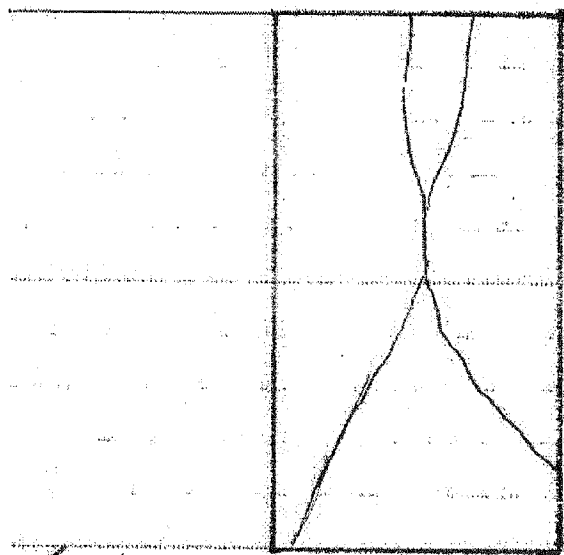
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna COL
6468061472
918
37.05
Jacob B. Mock
12/13/2006

Reviewed By:
Review Date:
DSC
12/12/2006



BORE # B-918

DEPTH = 37.05 ft

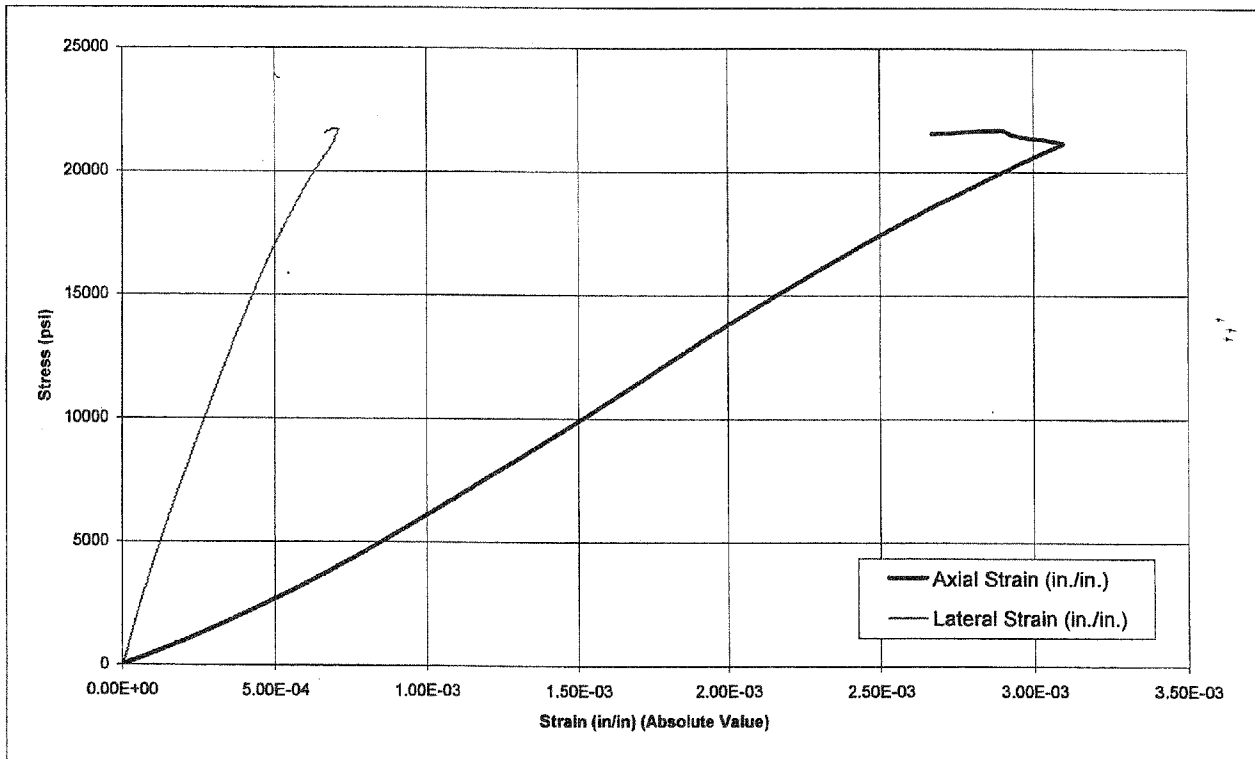


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 918
Sample Depth (ft): 88.1
Tested By: Jacob B. Mock
Test Date: 12/13/2006

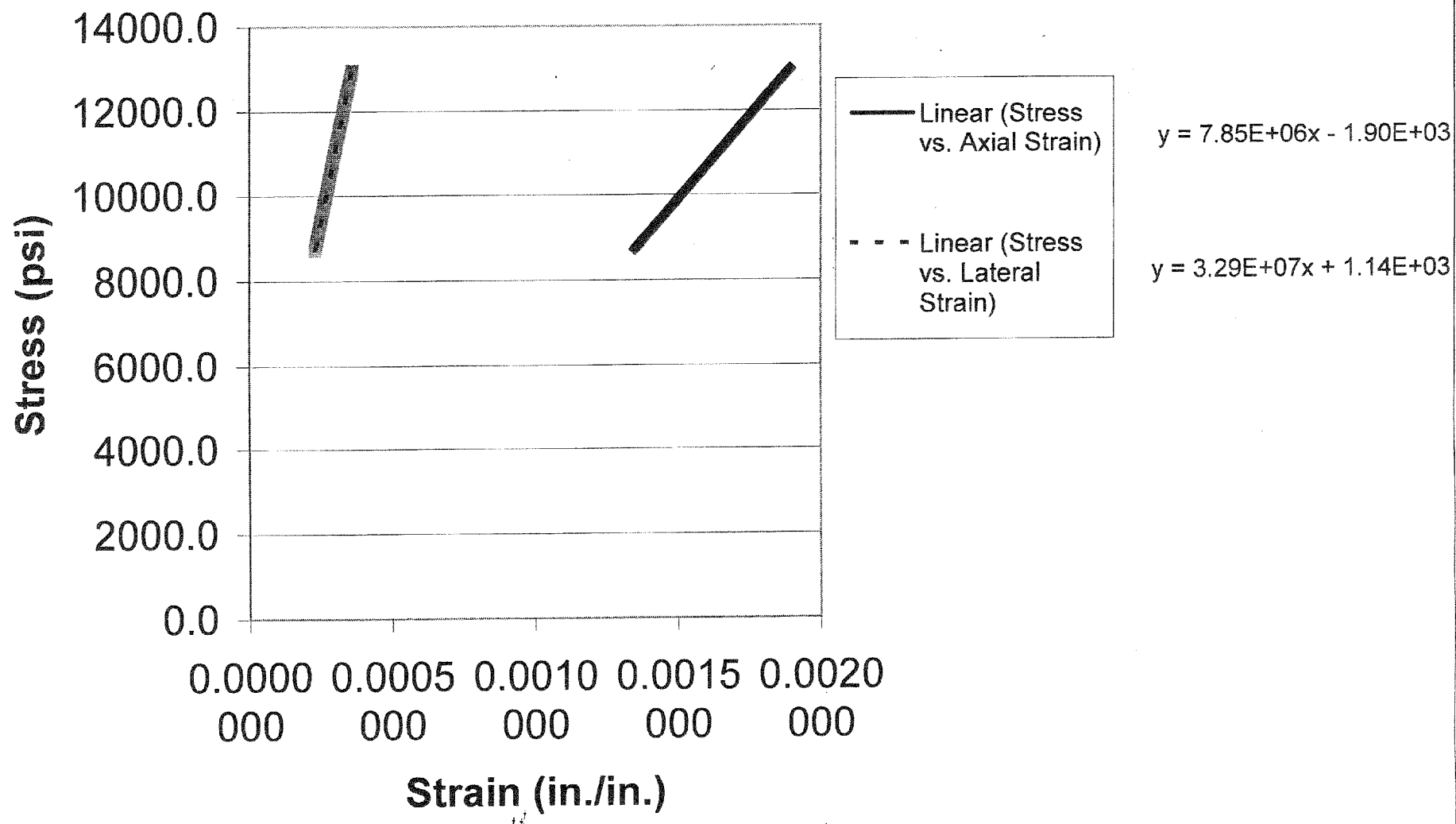
Reviewed By: DSS
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.398
Specimen Length, inch	5.283
Length/Diameter Ratio	2.20
Unit Weight (lbs/ft ³)	165
Test Duration (Time to Failure in Minutes)	10.3
Unconfined Compressive Strength, psi (from test)	21,701
Unconfined Compressive Strength, psi (with L/D correction)	21,944
Type of Break	Shear
Young's Modulus, psi	7,850,000
Poisson's Ratio	0.24



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-918 88.1'



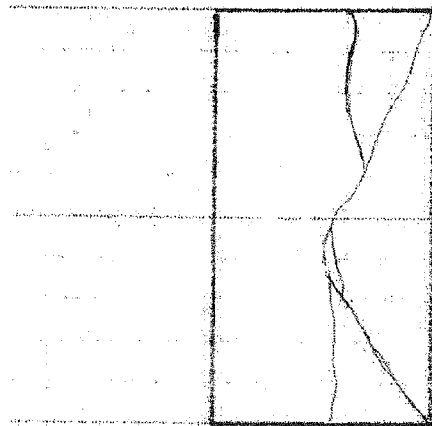


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 918
Sample Depth (ft): 88.1
Tested By: Jacob B. Mock
Test Date: 12/13/2006

Reviewed By: DSR
Review Date: 1-19-07



BORE # B-918
DEPTH = 88.1 ✓

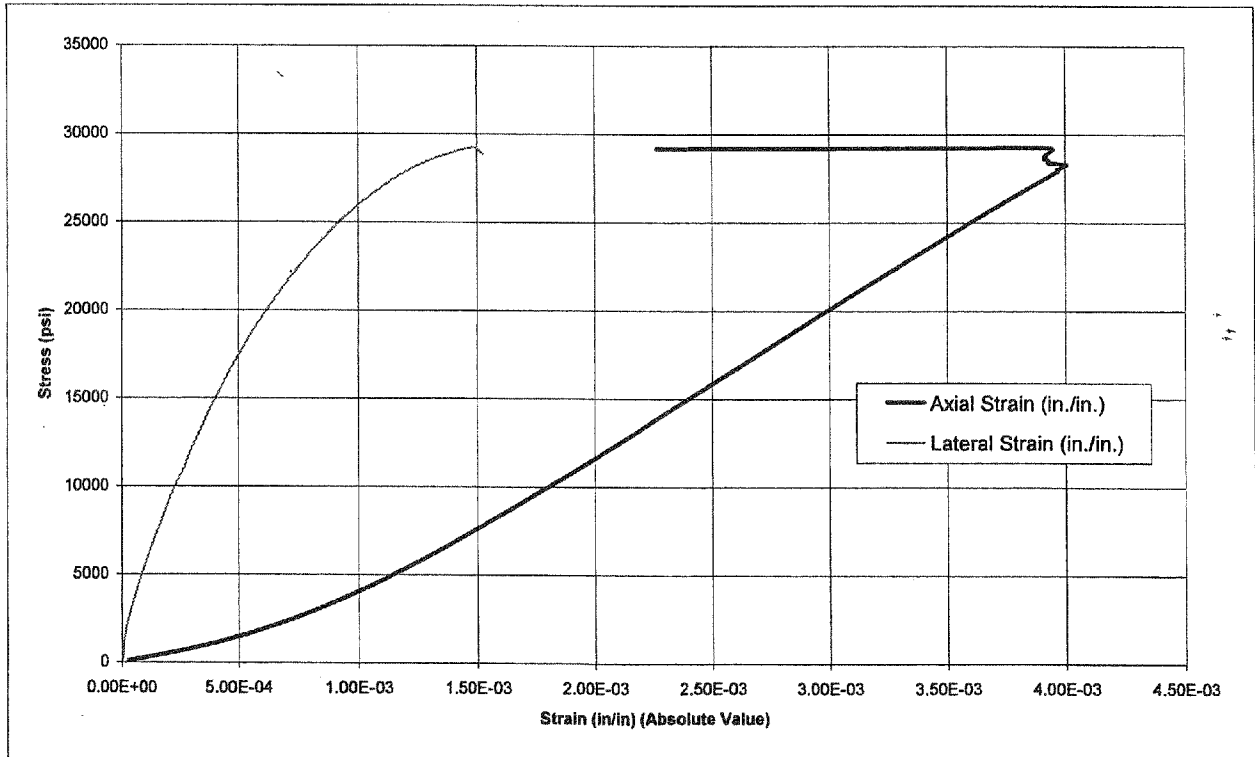


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 920
Sample Depth (ft): 107.7
Tested By: Jacob B. Mock
Test Date: 12/1/2006

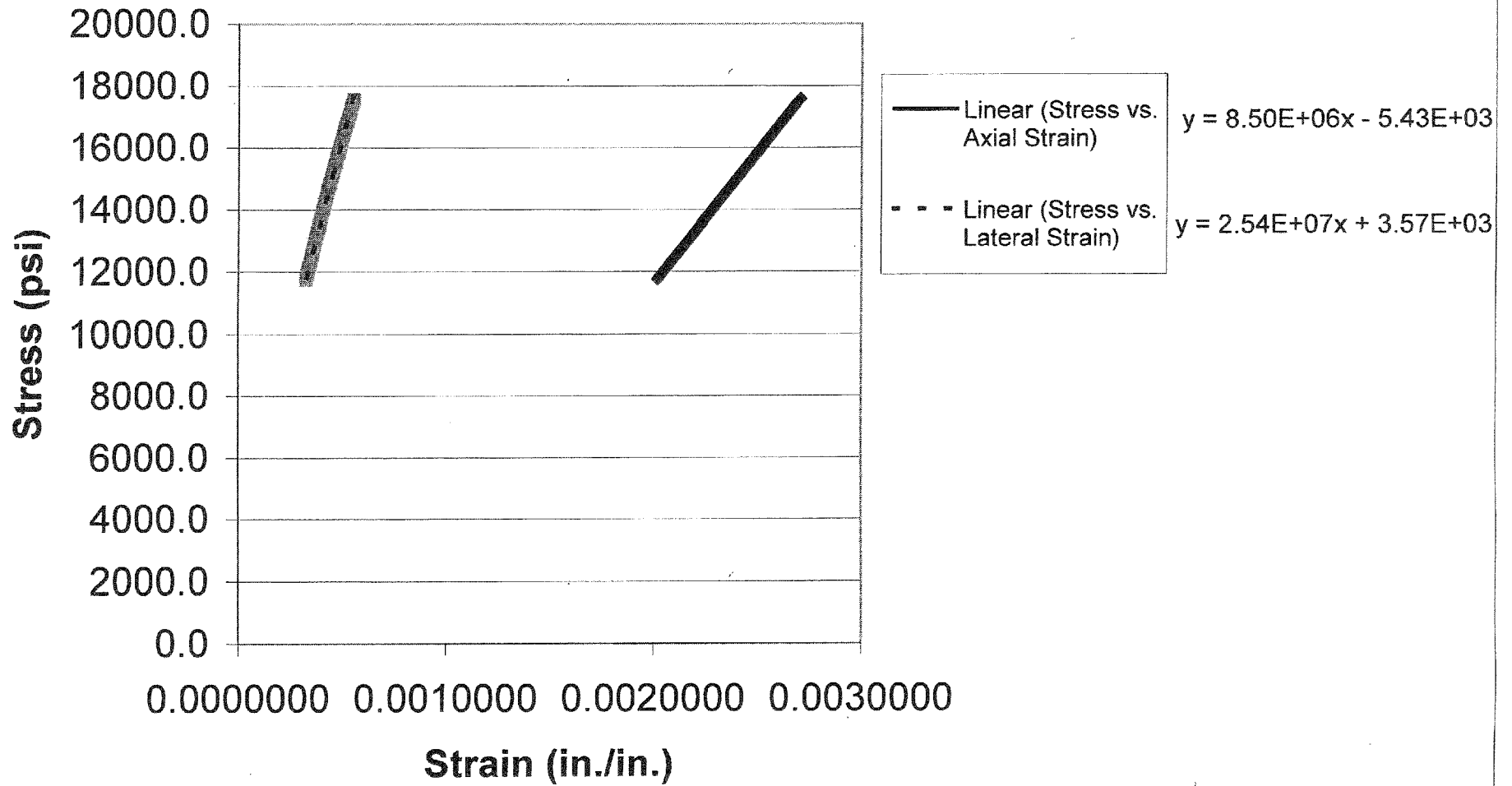
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.392
Specimen Length, inch	5.322
Length/Diameter Ratio	2.23
Unit Weight (lbs/ft ³)	163
Test Duration (Time to Failure in Minutes)	12.8
Unconfined Compressive Strength, psi (from test)	29,262
Unconfined Compressive Strength, psi (with L/D correction)	29,621
Type of Break	Cone
Young's Modulus, psi	8,500,000
Poisson's Ratio	0.34



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-920 107.7'





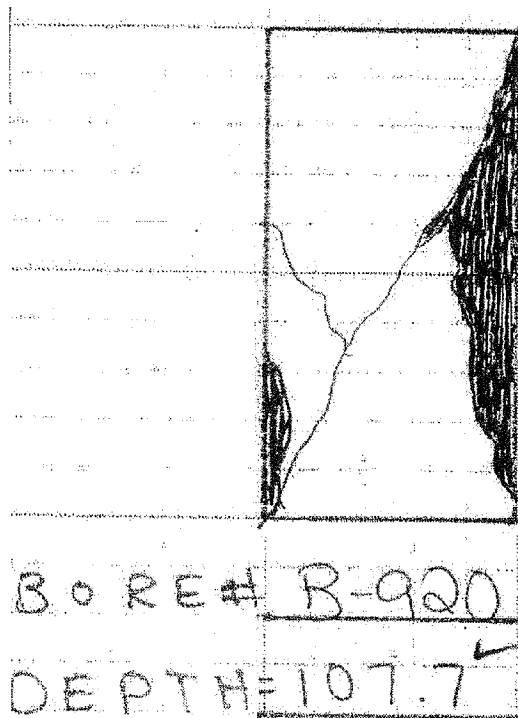
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
920
107.7
Jacob B. Mock
12/1/2006

Reviewed By: **DSC**
Review Date: **12/12/2006**



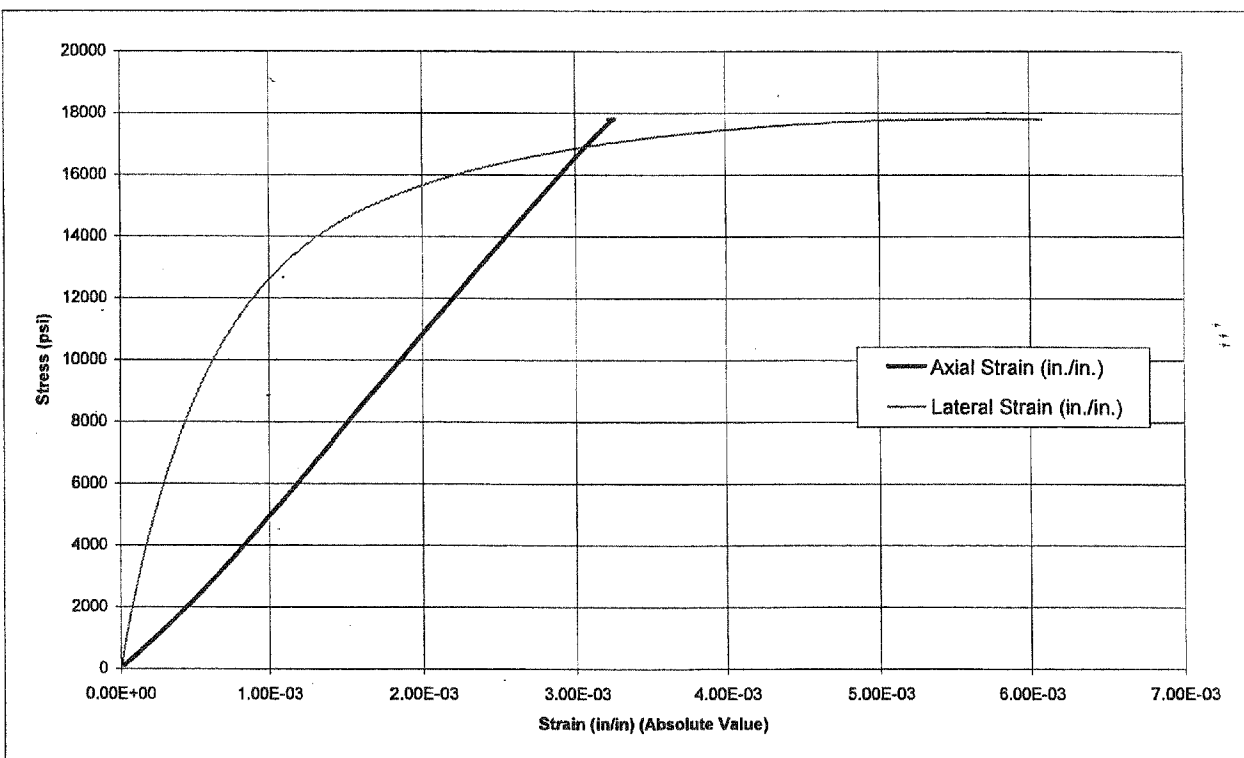


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
 Project Number: 6468061472
 Boring Number: 920
 Sample Depth (ft): 141.1
 Tested By: Jacob B. Mock
 Test Date: 12/5/2006

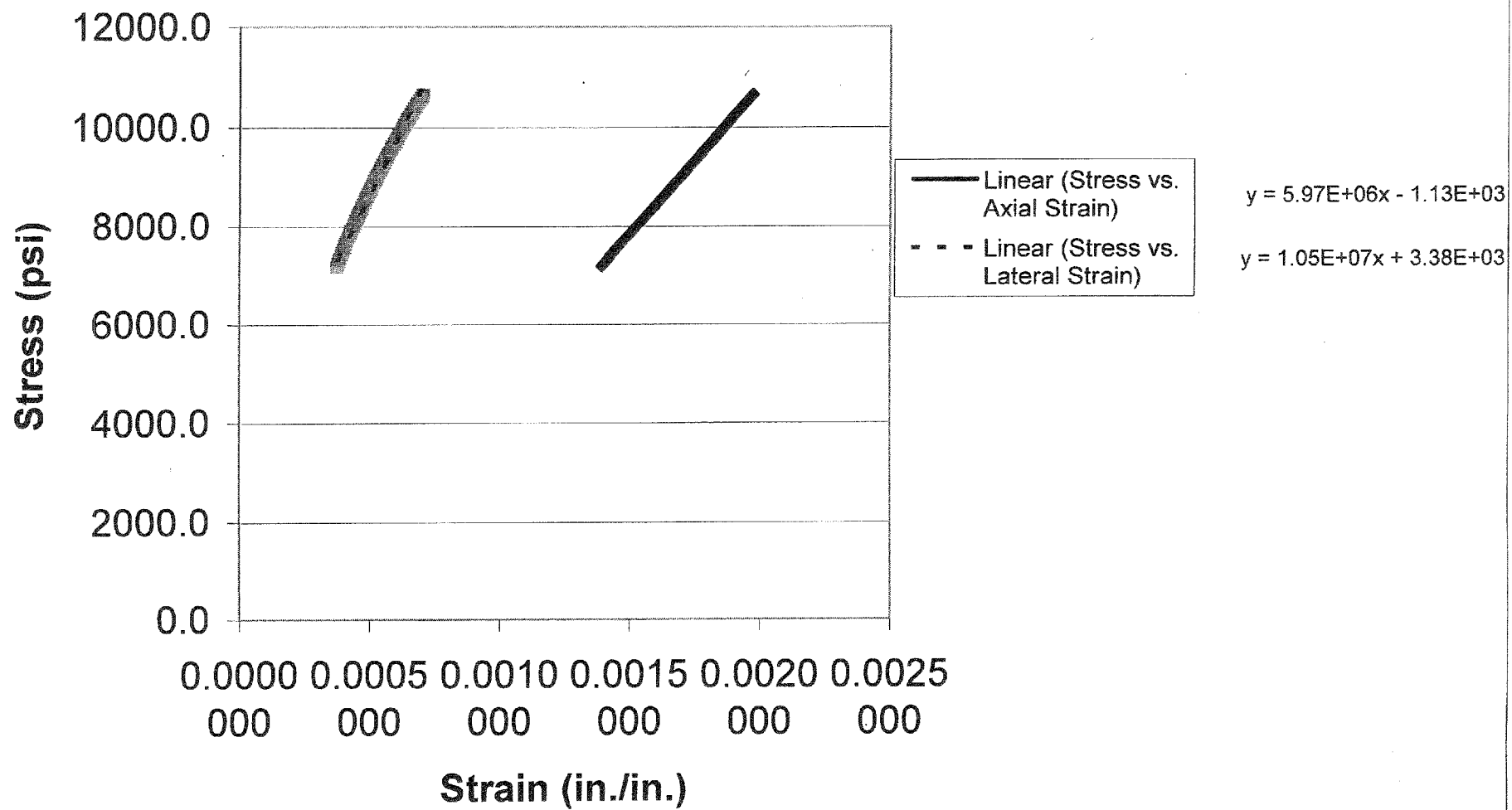
Reviewed By: DSC
 Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.398
Specimen Length, inch	5.345
Length/Diameter Ratio	2.23
Unit Weight (lbs/ft ³)	166
Test Duration (Time to Failure in Minutes)	8.7
Unconfined Compressive Strength, psi (from test)	17,817
Unconfined Compressive Strength, psi (with L/D correction)	18,040
Type of Break	Cone
Young's Modulus, psi	5,970,000
Poisson's Ratio	*



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
 Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.
 * = Value of Poisson's ratio is greater than 0.5 which indicates inelastic behavior probably due to presence of fractures or discontinuities affecting lateral strain.

40%-60% Stress vs. Strain B-920 141.1'





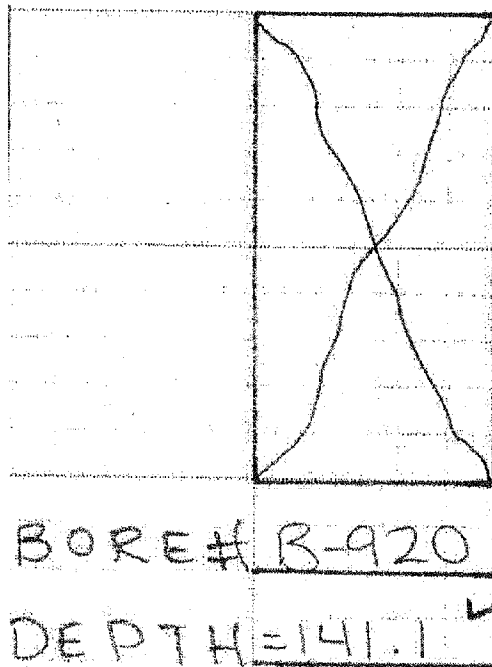
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
920
141.1
Jacob B. Mock
12/5/2006

Reviewed By: **DSC**
Review Date: **12/12/2006**





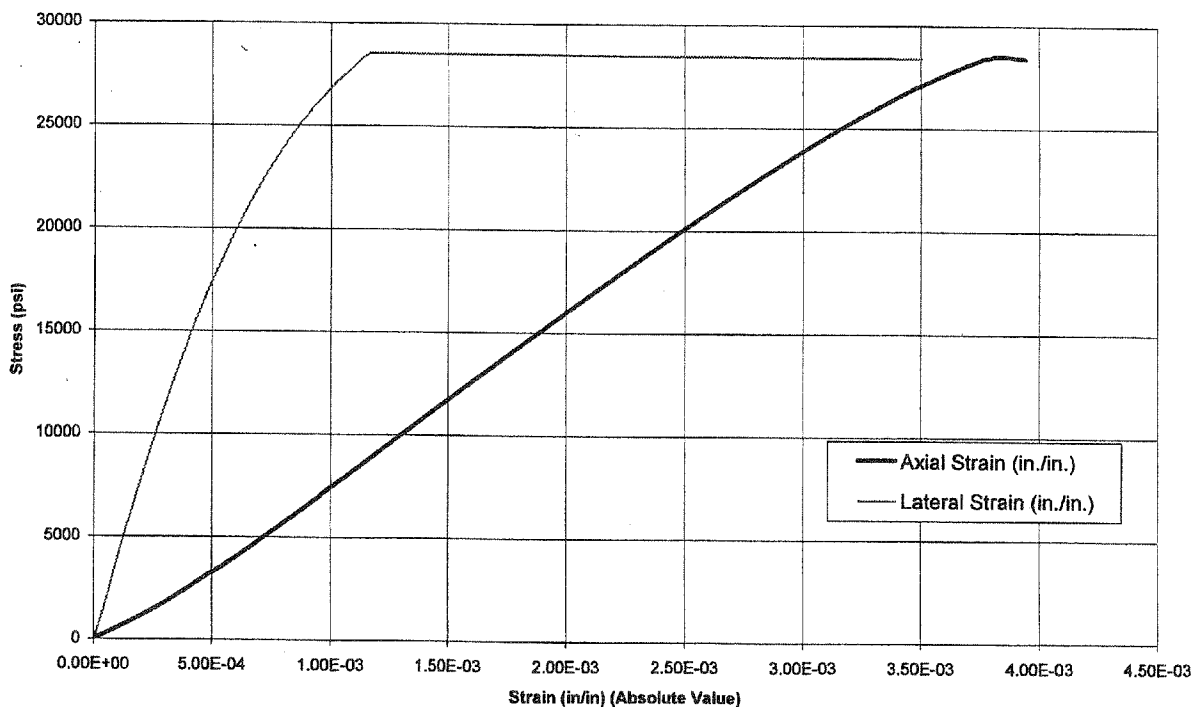
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 923
Sample Depth (ft): 20
Tested By: Jacob B. Mock
Test Date: 12/1/2006

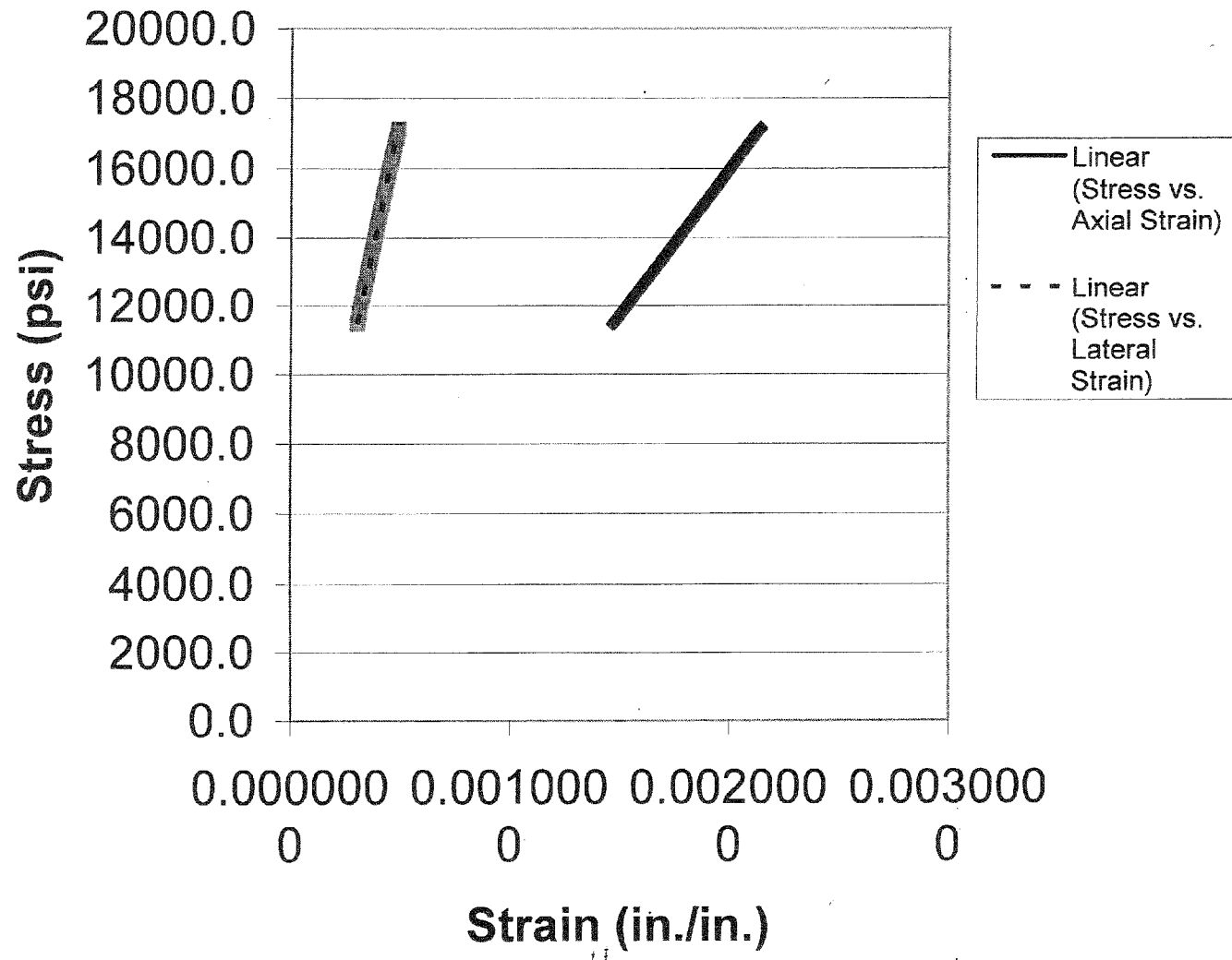
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.387
Specimen Length, inch	5.348
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	164
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	28,538
Unconfined Compressive Strength, psi (with L/D correction)	28,911
Type of Break	Cone & Shear
Young's Modulus, psi	8,510,000
Poisson's Ratio	0.28



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-923 20.0'



$$y = 8.51E+06x - 1.05E+03$$

$$y = 3.04E+07x + 2.32E+03$$



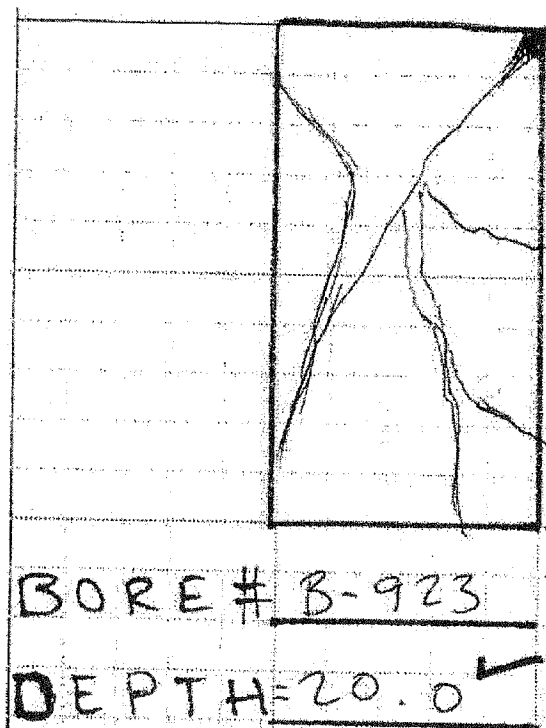
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
923
20
Jacob B. Mock
12/1/2006

Reviewed By: **DSC**
Review Date: **12/12/2006**





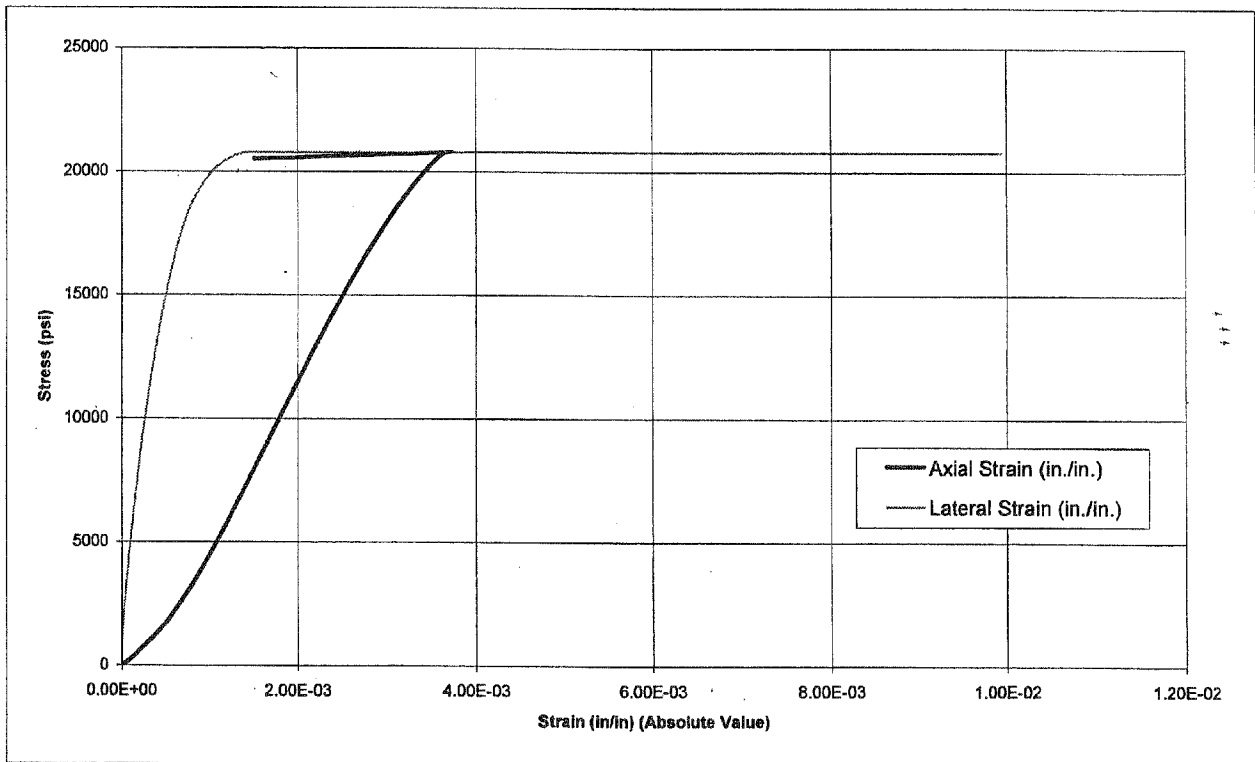
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

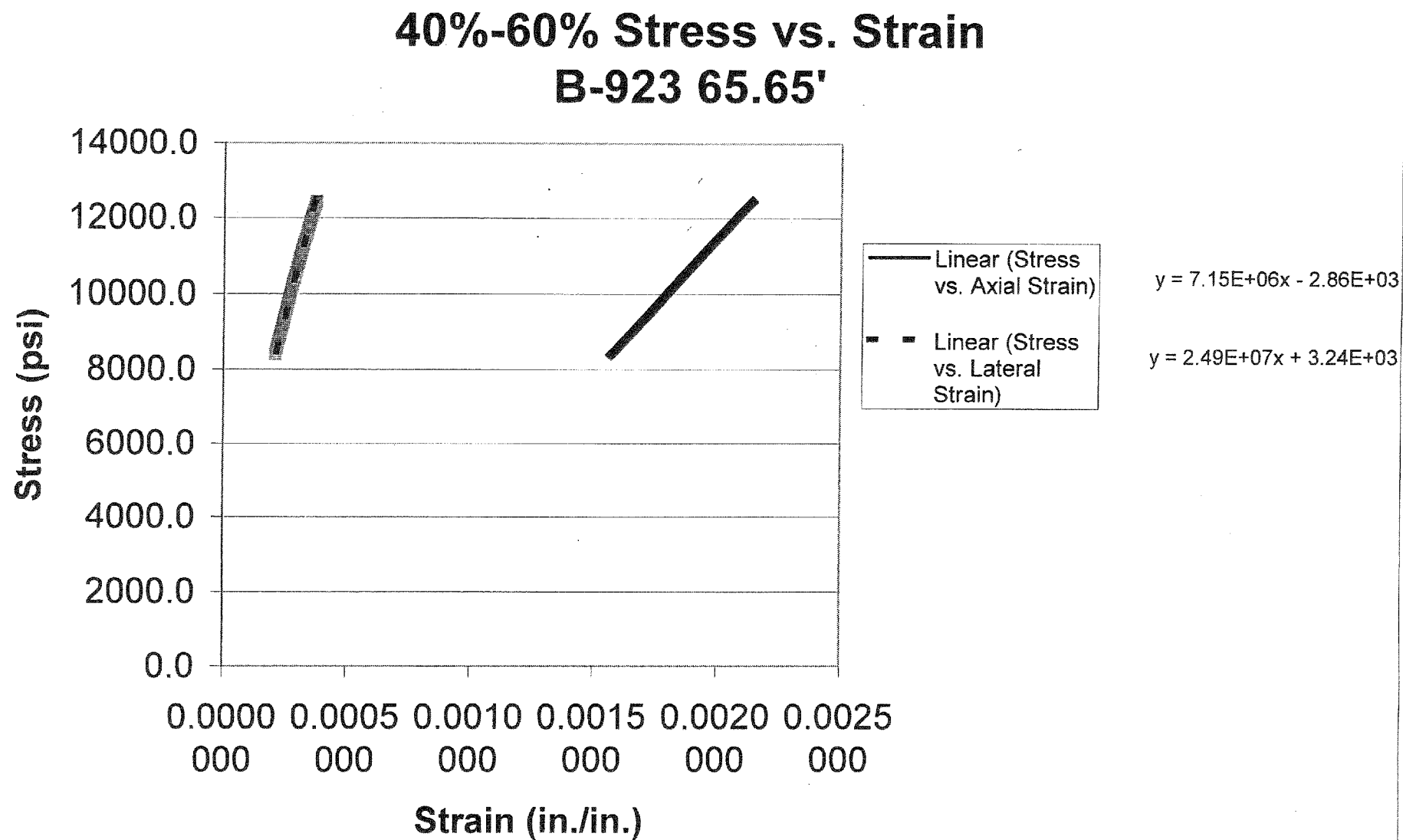
Project Name: North Anna
Project Number: 6468061472
Boring Number: 923
Sample Depth (ft): 65.65
Tested By: Jacob B. Mock
Test Date: 12/1/2006

Reviewed By: DSR
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.388
Specimen Length, inch	5.348
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	164
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	20,798
Unconfined Compressive Strength, psi (with L/D correction)	21,069
Type of Break	Cone
Young's Modulus, psi	7,150,000
Poisson's Ratio	0.29



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.





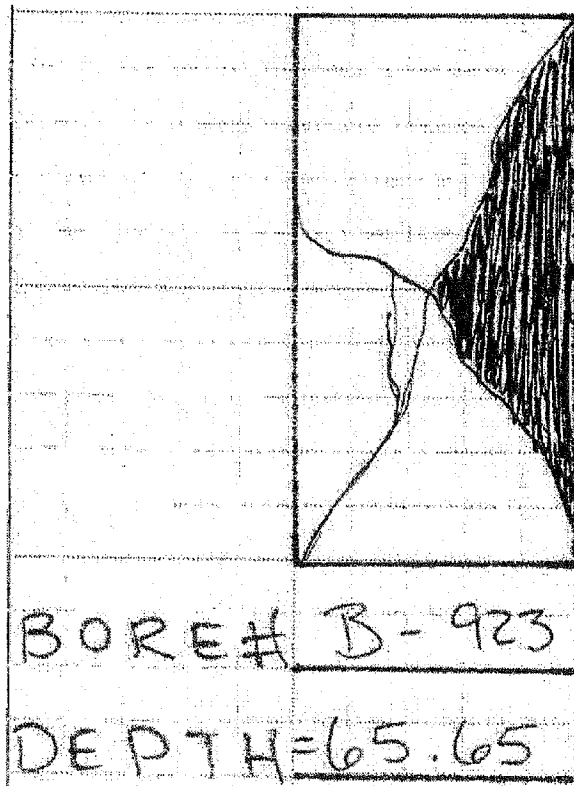
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
923
65.65
Jacob B. Mock
12/1/2006

Reviewed By: DSC
Review Date: 12/12/2006



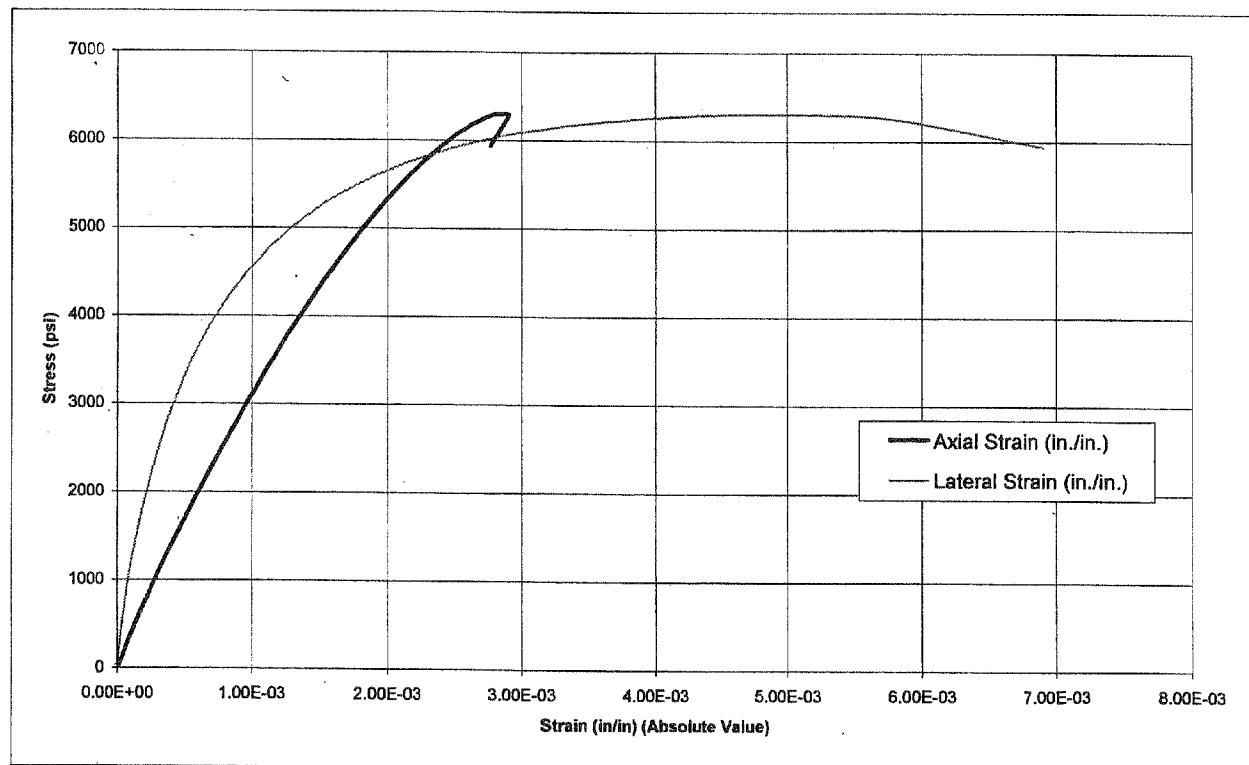


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 924
Sample Depth (ft): 44
Tested By: Jacob B. Mock
Test Date: 12/1/2006

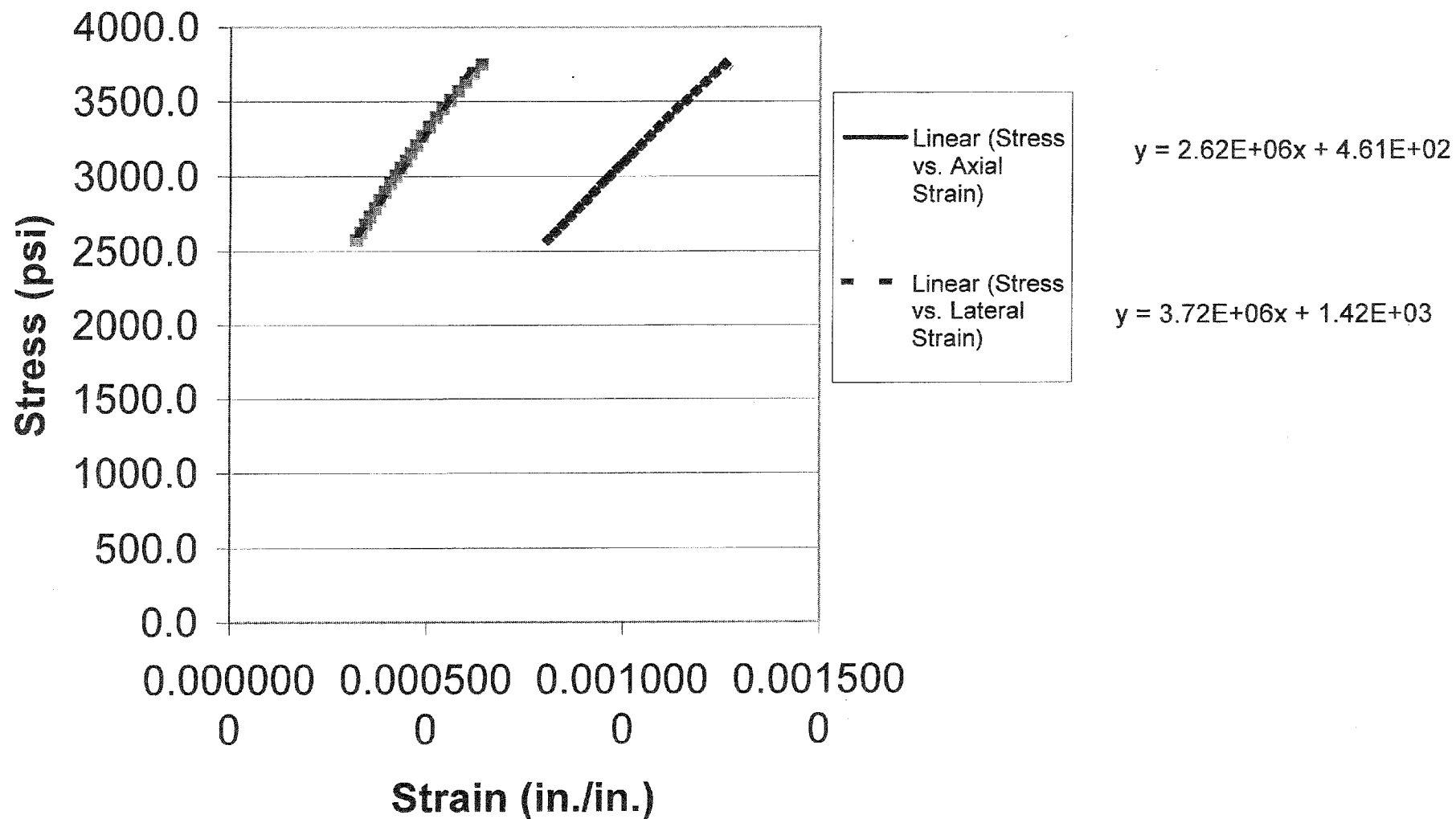
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.389
Specimen Length, inch	5.332
Length/Diameter Ratio	2.23
Unit Weight (lbs/ft ³)	174
Test Duration (Time to Failure in Minutes)	4.4
Unconfined Compressive Strength, psi (from test)	6,304
Unconfined Compressive Strength, psi (with L/D correction)	6,384
Type of Break	Shear
Young's Modulus, psi	2,620,000
Poisson's Ratio	*



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.
* = Value of Poisson's ratio is greater than 0.5 which indicates inelastic behavior probably due to presence of fractures or discontinuities affecting lateral strain.

40%-60% Stress vs. Strain B-924 44.0'





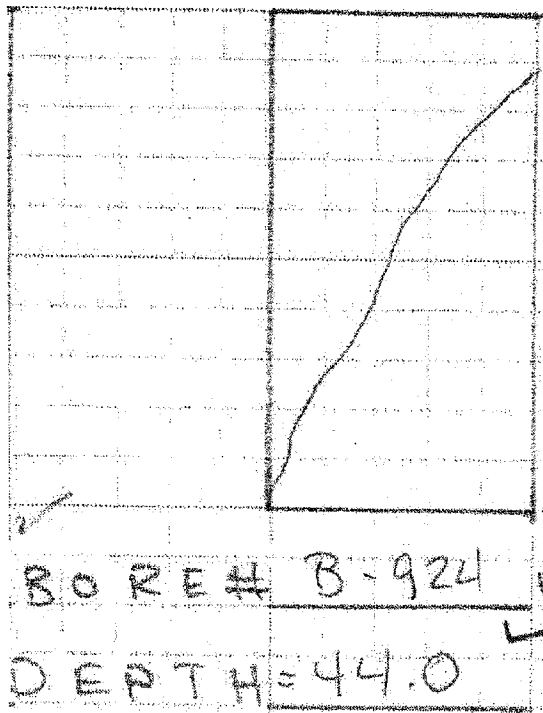
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
924
44
Jacob B. Mock
12/1/2006

Reviewed By: DSC
Review Date: 12/12/2006



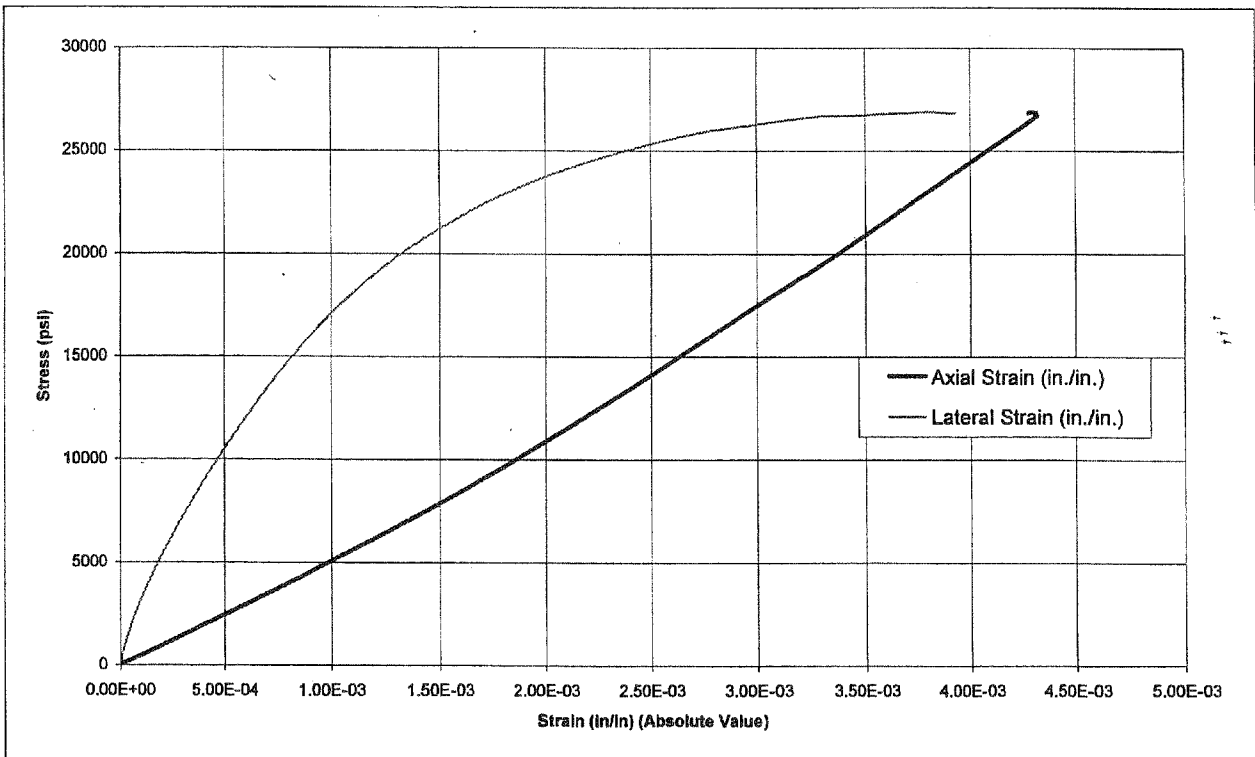


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
 Project Number: 6468061472
 Boring Number: 927
 Sample Depth (ft): 51.55
 Tested By: Jacob B. Mock
 Test Date: 12/5/2006

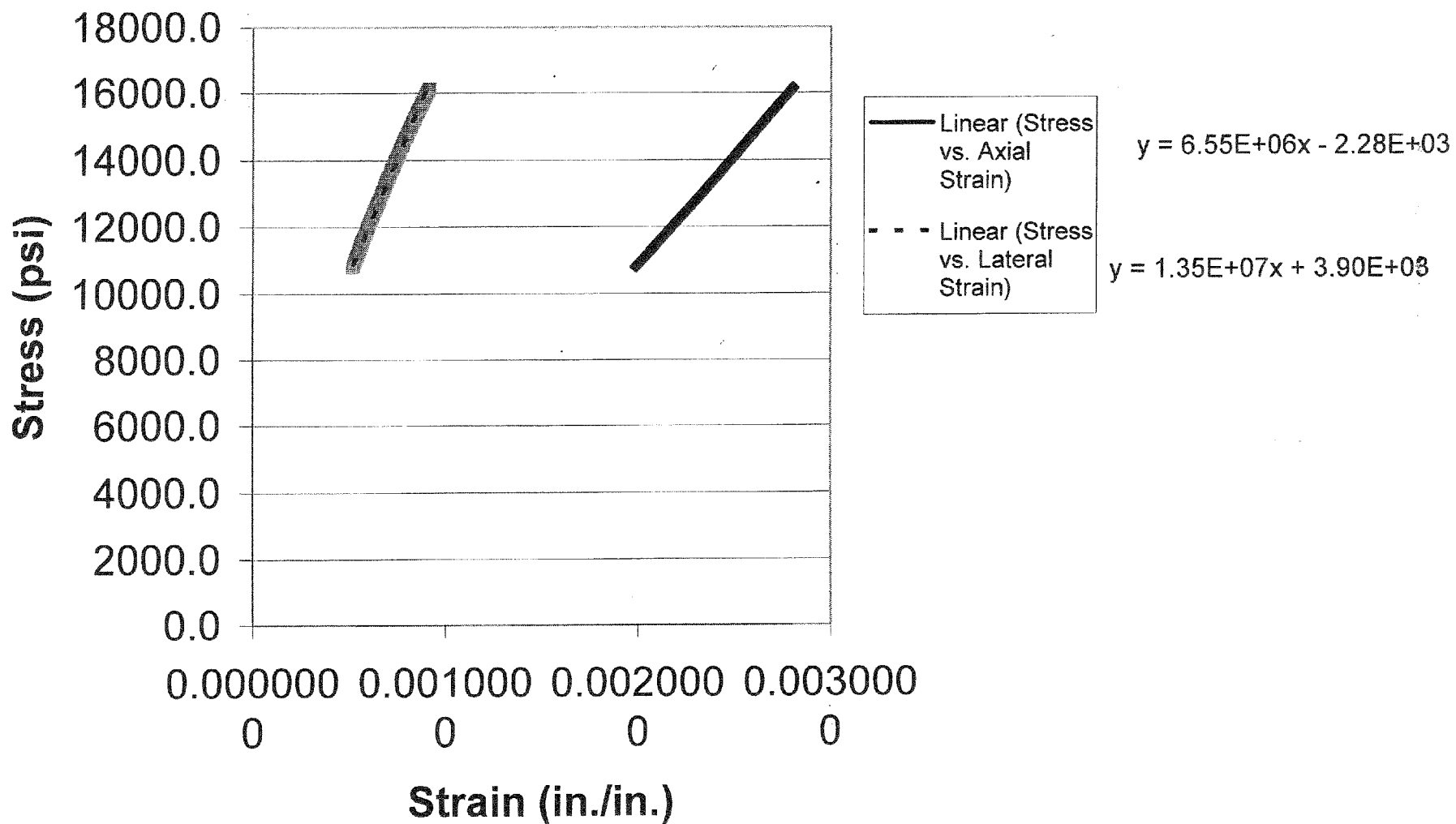
Reviewed By: DSS
 Review Date: 1-19-07

Rock Type	Quartz-Biotite Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.392
Specimen Length, inch	5.350
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	163
Test Duration (Time to Failure in Minutes)	11.3
Unconfined Compressive Strength, psi (from test)	26,893
Unconfined Compressive Strength, psi (with L/D correction)	27,239
Type of Break	Cone & Shear
Young's Modulus, psi	6,550,000
Poisson's Ratio	0.49



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from
approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-927 51.55'





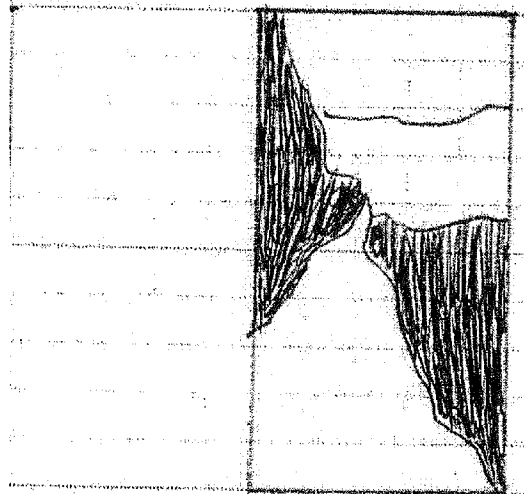
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
927
51.55
Jacob B. Mock
12/5/2006

Reviewed By: **DSC**
Review Date: **12/12/2006**



BORE# B-927
DEPTH=51.55

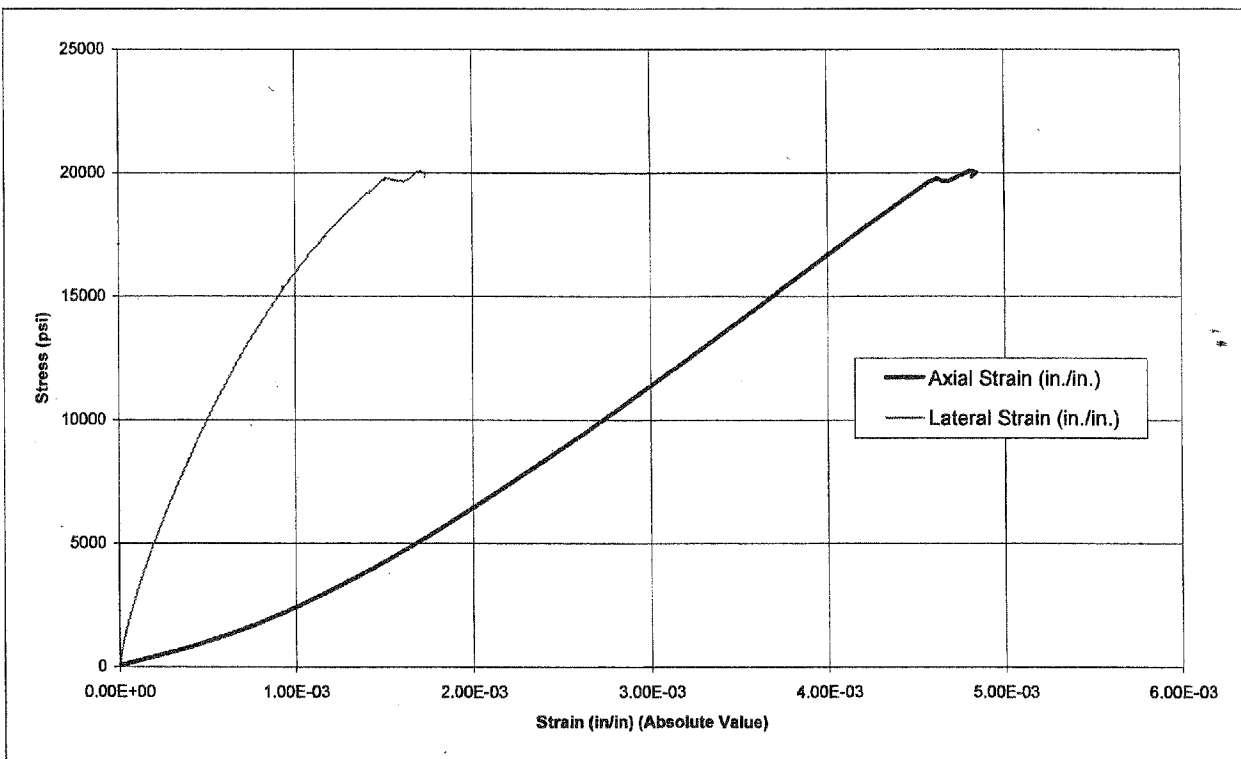


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
 Project Number: 6468061472
 Boring Number: 928
 Sample Depth (ft): 74.7
 Tested By: Jacob B. Mock
 Test Date: 12/5/2006

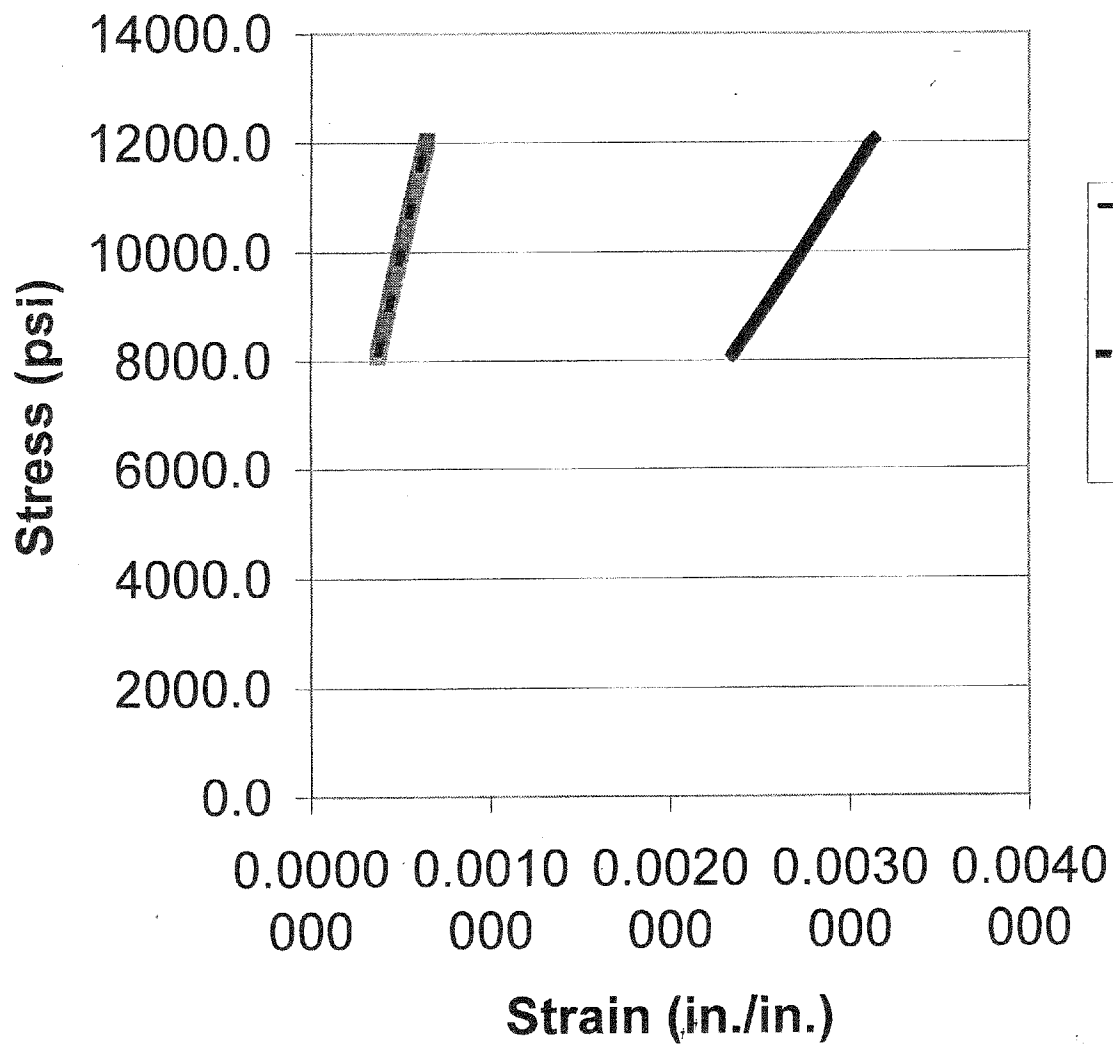
Reviewed By: DSC
 Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.389
Specimen Length, inch	5.349
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	162
Test Duration (Time to Failure in Minutes)	6.7
Unconfined Compressive Strength, psi (from test)	20,072
Unconfined Compressive Strength, psi (with L/D correction)	20,333
Type of Break	Cone
Young's Modulus, psi	5,070,000
Poisson's Ratio	0.35



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from
approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.

40%-60% Stress vs. Strain B-928 74.7'



— Linear
(Stress vs.
Axial Strain)

- - Linear
(Stress vs.
Lateral
Strain)

$$y = 5.07E+06x - 3.86E+03$$

$$y = 1.44E+07x + 2.74E+03$$



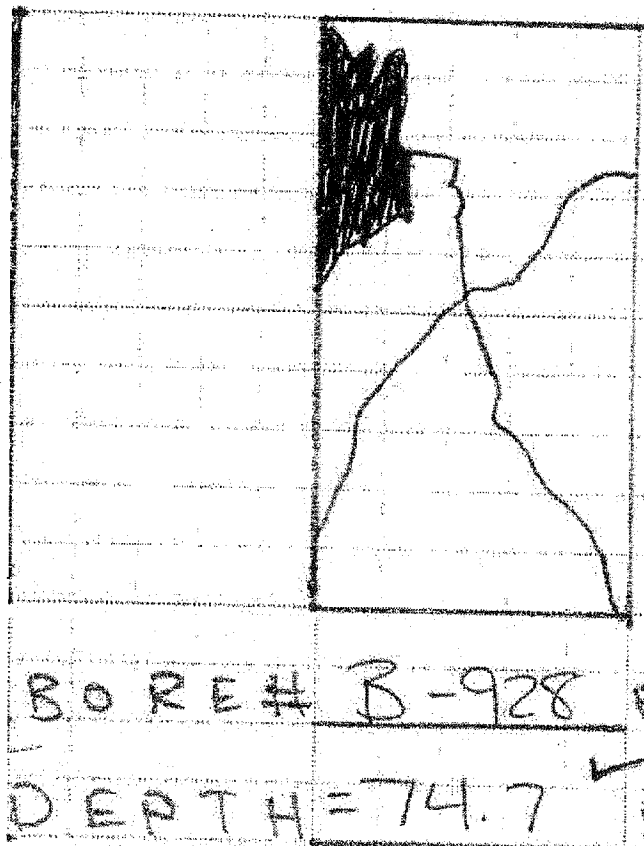
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
928
74.7
Jacob B. Mock
12/5/2006

Reviewed By: DSC
Review Date: 12/12/2006



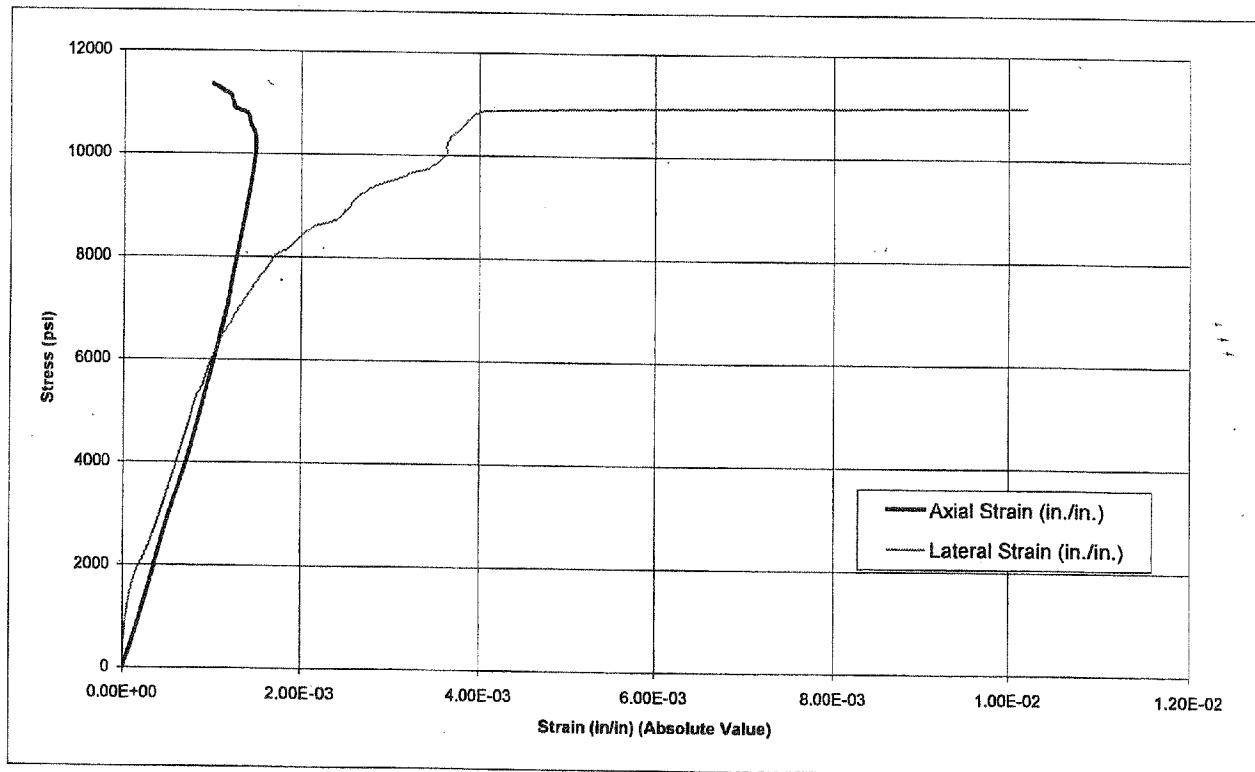


Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression
ASTM D 7012-04

Project Name: North Anna
Project Number: 6468061472
Boring Number: 933
Sample Depth (ft): 66.6
Tested By: Jacob B. Mock
Test Date: 12/1/2006

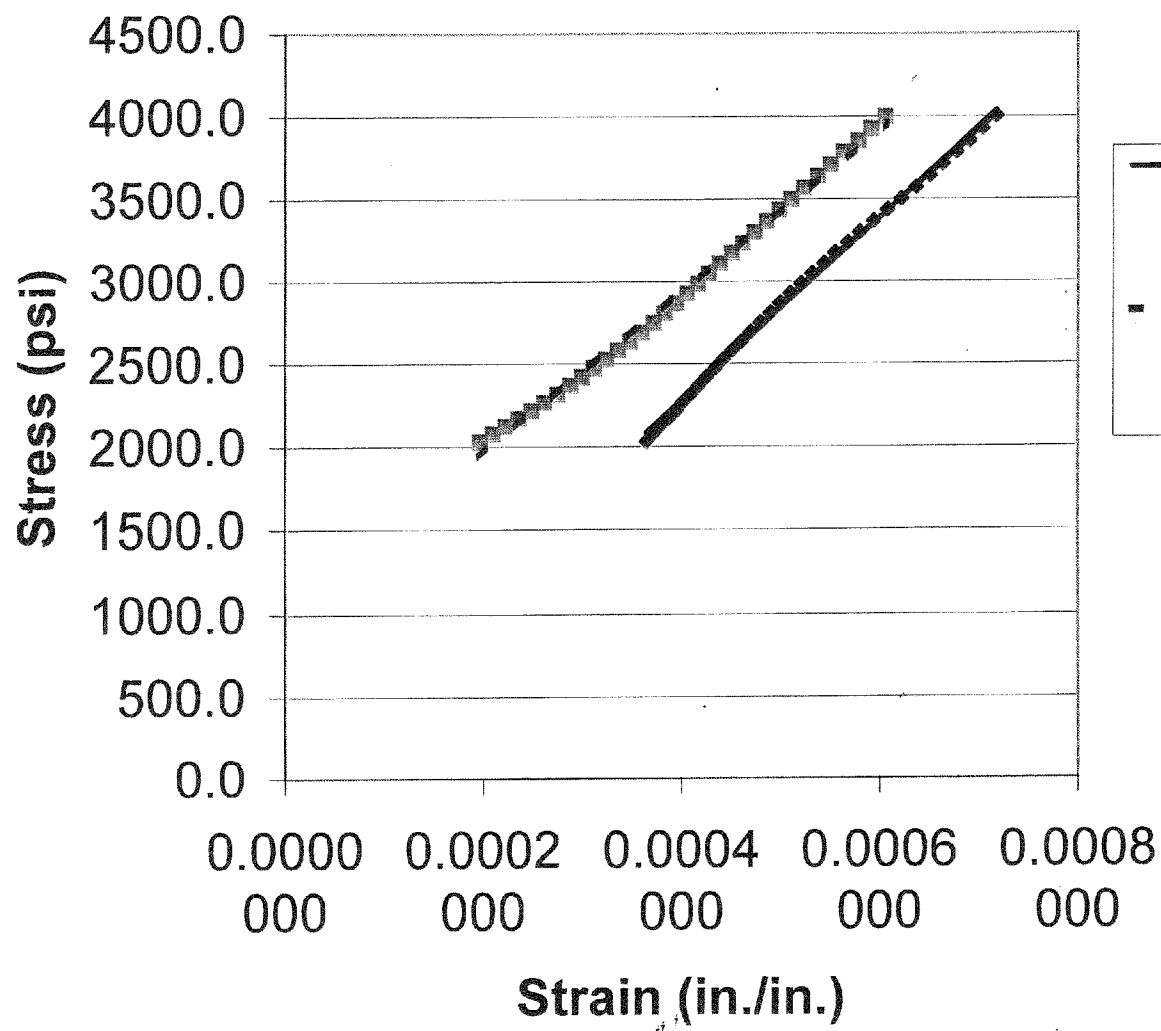
Reviewed By: DSC
Review Date: 1-19-07

Rock Type	Biotite-Quartz Gneiss
Moisture Condition	As Received
Specimen Diameter, inch	2.382
Specimen Length, inch	5.338
Length/Diameter Ratio	2.24
Unit Weight (lbs/ft ³)	162
Test Duration (Time to Failure in Minutes)	6.8
Unconfined Compressive Strength, psi (from test)	15,561
Unconfined Compressive Strength, psi (with L/D correction)	15,764
Type of Break	Shear
Young's Modulus, psi	5,500,000
Poisson's Ratio	*



Comments: Young's Modulus and Poisson's Ratio determined using linear fit of curve from approximately 40% to 60% of unconfined compressive strength.
Strain values shown are in terms of absolute value: Axial Strain is negative, Lateral Strain is positive.
* = Value of Poisson's ratio is greater than 0.5 which indicates inelastic behavior probably due to presence of fractures or discontinuities affecting lateral strain.

40%-60% Stress vs. Strain B-933 66.6'



— Linear
(Stress vs.
Axial Strain)

- - Linear
(Stress vs.
Lateral
Strain)

$$y = 5.53E+06x + 6.19E+01$$

$$y = 4.94E+06x + 9.61E+02$$



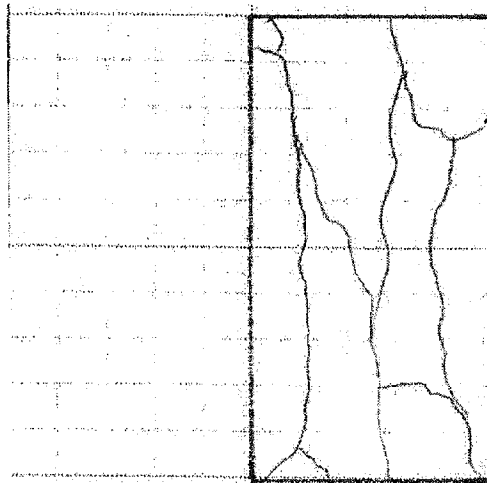
Elastic Moduli of Intact Rock Core Specimens in Uniaxial Compression

ASTM D 7012-04

Project Name:
Project Number:
Boring Number:
Sample Depth (ft):
Tested By:
Test Date:

North Anna
6468061472
933
66.6
Jacob B. Mock
12/1/2006

Reviewed By: DSC
Review Date: 12/12/2006



BORE# B-933
DEPTH= 66.6

APPENDIX G

LABORATORY TEST DATA FOR RESONANT COLUMN TORSIONAL SHEAR

**THESE TESTS ARE IN PROGRESS AS OF 1-23-07.
RESULTS WILL BE SUBMITTED AS AN ADDENDUM TO
THE GEOTECHNICAL DATA REPORT.**

NORTH ANNA COL

**DATA REPORT REV. 0
JANUARY 23, 2007**

MACTEC PROJECT NO. 6468-06-1472