MACTEC

Vogtle Units 3 & 4 COL Project

Attachment G
Resonant Column Torsional Shear (RCTS) Test Results

CONSISTS OF:
Fugro Consultants, Inc. Reports dated:

October 10, 2007
October 18, 2007
November 27, 2007
December 13, 2007
January 8, 2008
January 14, 2008

Volume 1 of 1

Job No. 6141-06-0286

MACTEC ENGINEERING
AND CONSULTING, INC.

February 8, 2008

MACTEC

February 8, 2008

Mr. Tom McCallum
Georgia Power Company
C/O Southern Nuclear Operating Company, Inc.
40 Inverness Center Parkway
Post Office Box 1295
Birmingham, Alabama 35201
Phone: (205) 992-6697
e-mail: tomccall@southernco.com

Subject: **Geotechnical Data Report Attachment G – RCTS Test Results**
Vogtle Units 3 & 4 COL Project
Vogtle Electric Generating Plant
Burke County, Georgia
MACTEC Project Number 6141-06-0286

Dear Mr. McCallum:

MACTEC Engineering & Consulting, Inc. is pleased to submit Attachment G of the Final Data Report for the geotechnical exploration and laboratory testing for the Vogtle Units 3 & 4 COL Project located adjacent to the existing Vogtle Electric Generating Plant near Waynesboro, Burke County, Georgia.

It has been a pleasure to perform the work described in the attached report. If you have any questions, or if we may be of further service, we hope that you will contact us at your convenience.

Sincerely,

MACTEC ENGINEERING & CONSULTING, INC.

Matthew F. Cooke

Matthew F. Cooke
Senior Geologist
Site Superintendent
Registered, Georgia 1887

Wm. Allen Lancaster
Project Manager
Civil Engineer
Registered, Georgia 7075

Pieter J. DePree.
Principal Geotechnical Engineer
Registered, Georgia 19637

DCN VGCOL 437
Revision 0, 2/8/08

ATTACHMENT G

This Attachment is one of a number of attachments that are part of the following report which was prepared by MACTEC Engineering & Consulting Inc.:

Geotechnical Data Report
Vogtle Units 3 & 4 COL Project
Vogtle Electric Generating Plant
Burke County, Georgia
Subsurface Investigation and Laboratory Testing
SNC Subcontract No. 7074425
MACTEC Job No. 6141-06-0286

For background and a description of scope of work contained in the report, please refer to the above referenced report. The report was addressed as follows:

Mr. Tom McCallum
Georgia Power Company
C/O Southern Nuclear Operating Company, Inc.
40 Inverness Center Parkway
Post Office Box 1295
Birmingham, Alabama 35201
Phone: (205) 992-6697
e-mail: tomccall@southernco.com

The following list shows other Attachments to the above report and their included information:

Survey Data and Test Locations..... See Attachment A

Geotechnical Boring Logs.....See Attachment B

Cone Penetrometer Test Results.....See Attachment C

Geophysical Test Data (Downhole and Field Electrical Resistivity) .....See Attachment D

ReMi Seismic Shear Wave Velocity Measurements .....See Attachment E

Laboratory Testing Data (Geotechnical).....See Attachment F

ATTACHMENT G

Resonant Column Torsional Shear (RCTS) Test Results

CONSISTS OF:

Fugro Consultants, Inc. Reports dated:

October 10, 2007
Attachments A (Specimen VGL B4001-UD1) &
B (Specimen VGL B3003-UD4)

October 18, 2007
Attachments C (Specimen VGL B3003-UD3)
D (Specimen VGL B4003-UD3)
E (Specimen VGL B3002-UD3)
F (Specimen VGL B3003-UD7)

November 27, 2007
Attachments G (Specimen TP-B-1117 at 95%)
H (Specimen TP-B-1117 at 97%)

December 13, 2007
Attachments I (Specimen VGL B3001-UD12)
J (Specimen TP-B-1121 at 95%)
K (Specimen TP-B-1121 at 97%)

January 8, 2008
Attachments L (Specimen TP-B-1108 at 95%),
M (Specimen TP-B-1108 at 100%)
N (Specimen VGL B3001-UD11)
O (Specimen VGL B3001-UD7)

January 14, 2008
Attachments P (Specimen TP-B-1197 at 95%)
Q (Specimen TP-B-1197 at 100%)
R (Specimen TP-B-1194 at 95%)
S (Specimen TP-B-1108 at 100%)

Volume 1 of 1

FUGRO CONSULTANTS, INC.

6100 Hillcroft (77081)
P.O. Box 740010
Houston, Texas 77274
Tel: 713-369-5400
Fax: 713-369-5518

October 10, 2007

Mr. Wm. Allen Lancaster
MACTEC Engineering and Consulting, Inc.
396 Plasters Avenue
Atlanta, Georgia 30324

RE: Two (2) Reports For The Vogtle (a.k.a. VGL) Project

Dear Mr. Lancaster:

Fugro has completed two (2) RCTS tests, which are B4001-UD1 and B3003-UD4, for the VGL project. Fugro has incorporated, as needed, Dr. Kenneth Stokoe's comments into the final reports. The final reports and the associated RCTS Test Approval by Dr. Kenneth Stokoe have been attached.

Please let us know if you have questions. Thanks.

Very truly yours,

Fugro Consultants, Inc.

Jiewu Meng, PhD, P.E.
Project Engineer

Bill DeGroff, P.E.
Laboratory Department Manager

Enclosures

A member of the Fugro group of companies with offices throughout the world.

VGCOL-36 8
55 pages

RCTS TEST APROVAL

PROJECT SITE/NAME	VOGTLE

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#A	B4001-UD1	100.5	KHS (1)	17 Sept. '07
RCTS#B	B3003-UD4	135.5	KHS (1)	17 Sept '07

The RCTS tests for the site referenced above were tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe II

Dr. Kenneth Stokoe

(1) Minor questions and suggested corrections.

APPENDIX A

Specimen VGL B4001-UD1
(LL=100, PI=69; Gs=2.72)

Borehole B4001
Sample UD1
Depth = 100.5 ft (30.6 m)
Total Unit Weight = 106.8 lb/ft^3
Water Content = 44.4 %
Estimated In-Situ Ko = 0.7
Estimated In-Situ Mean Effective
Stress = 49.9 psi

FUGRO JOB #: 0401-1667
Testing Station: RC6

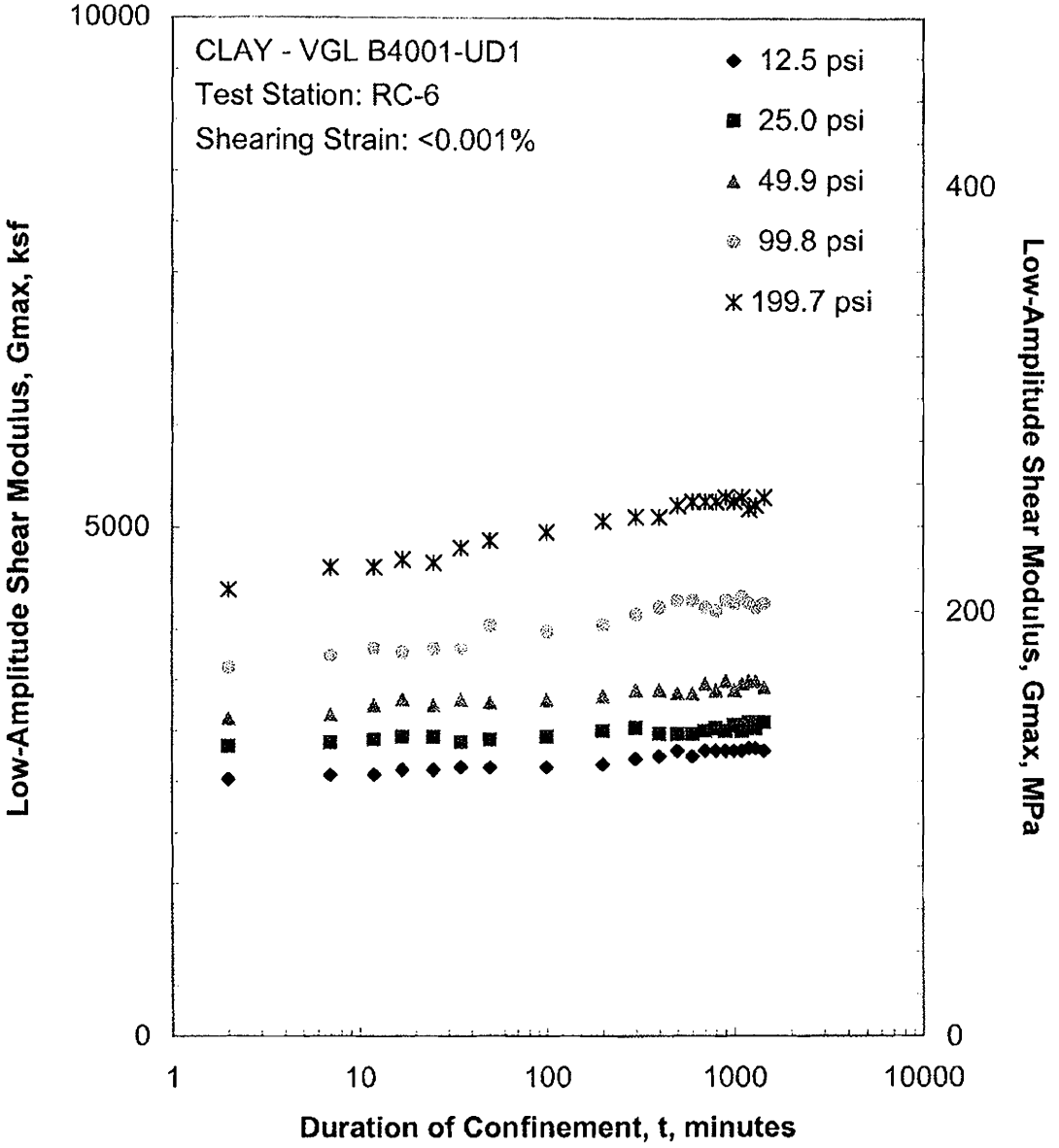


Figure A.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

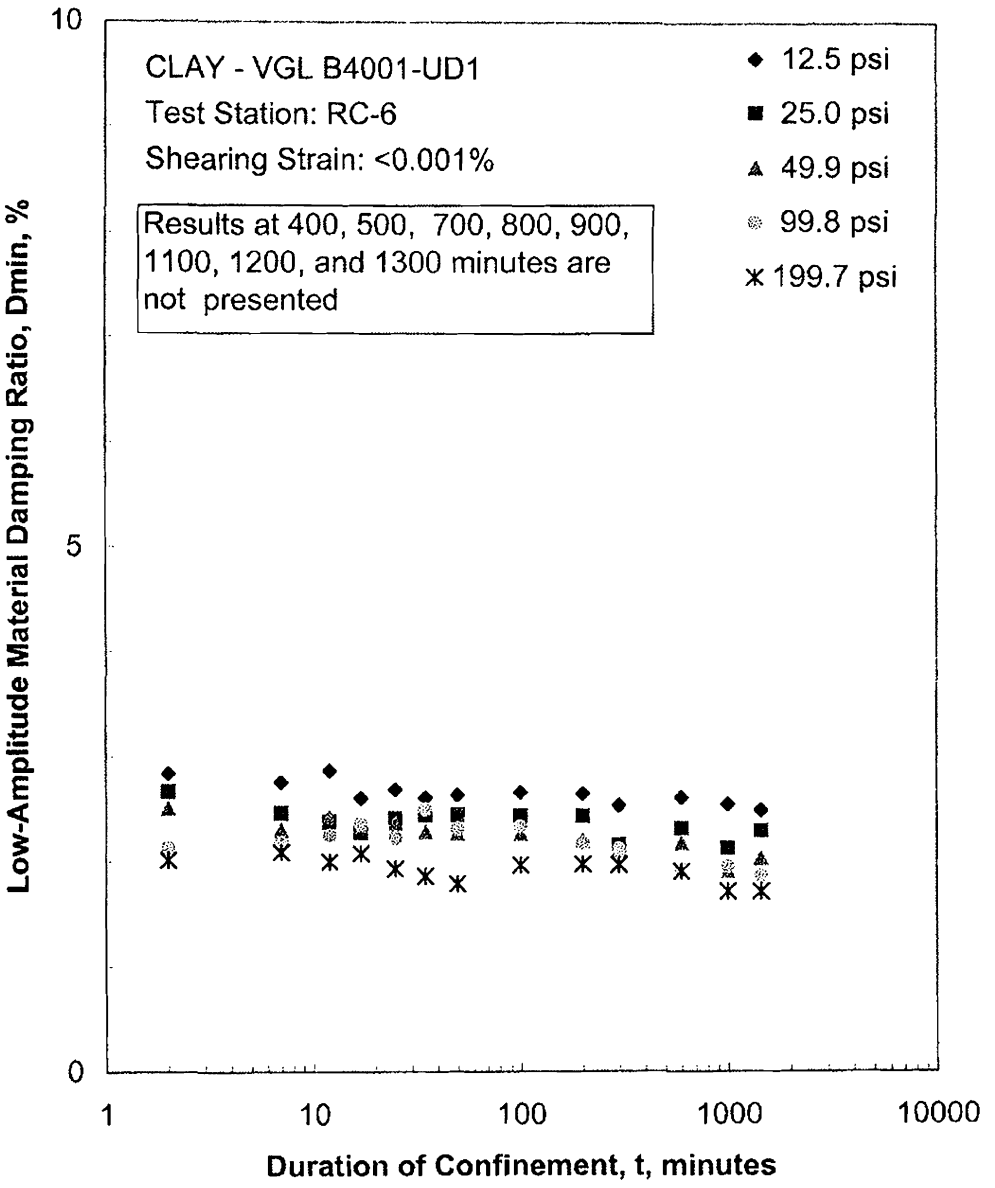


Figure A.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

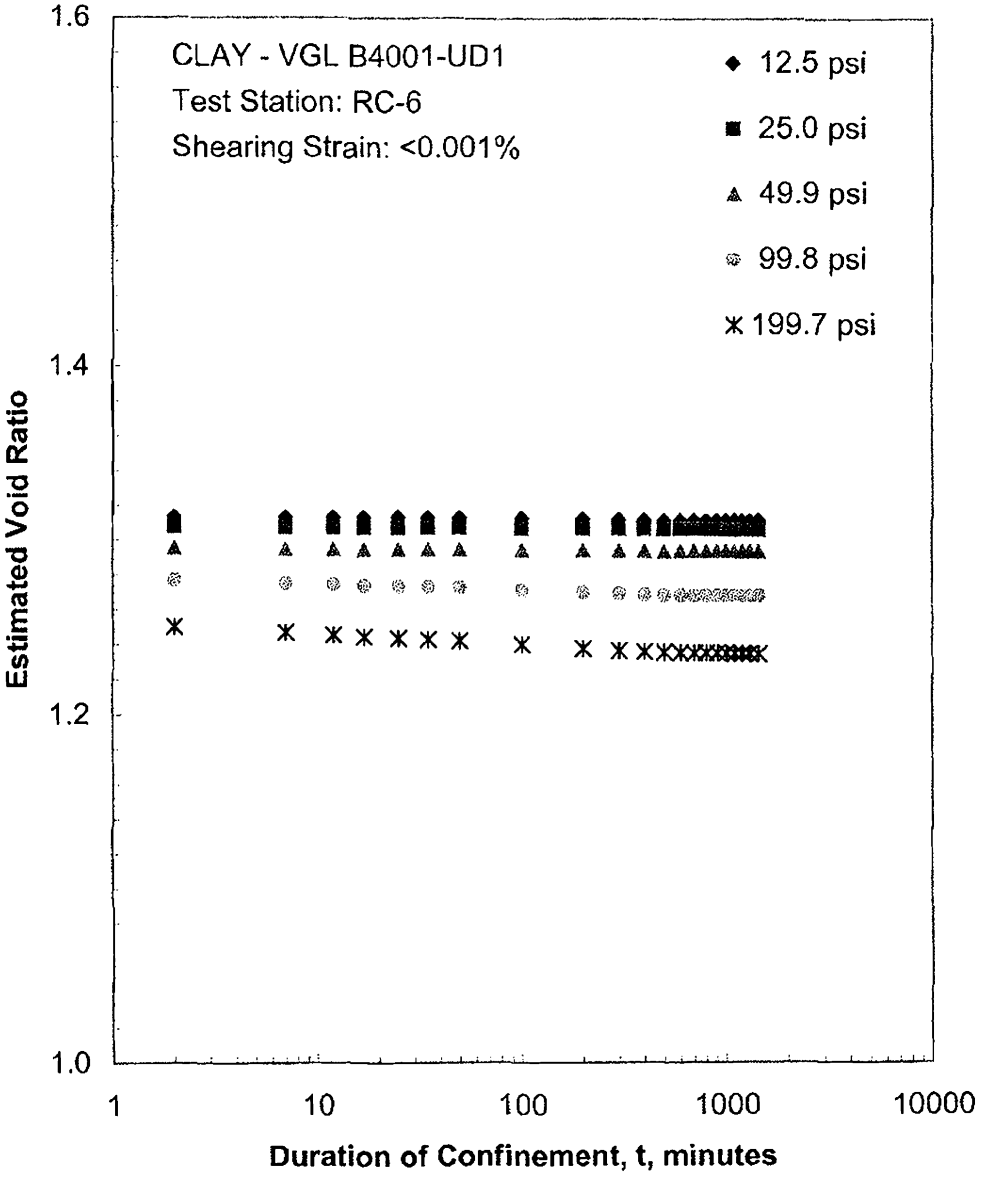


Figure A.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

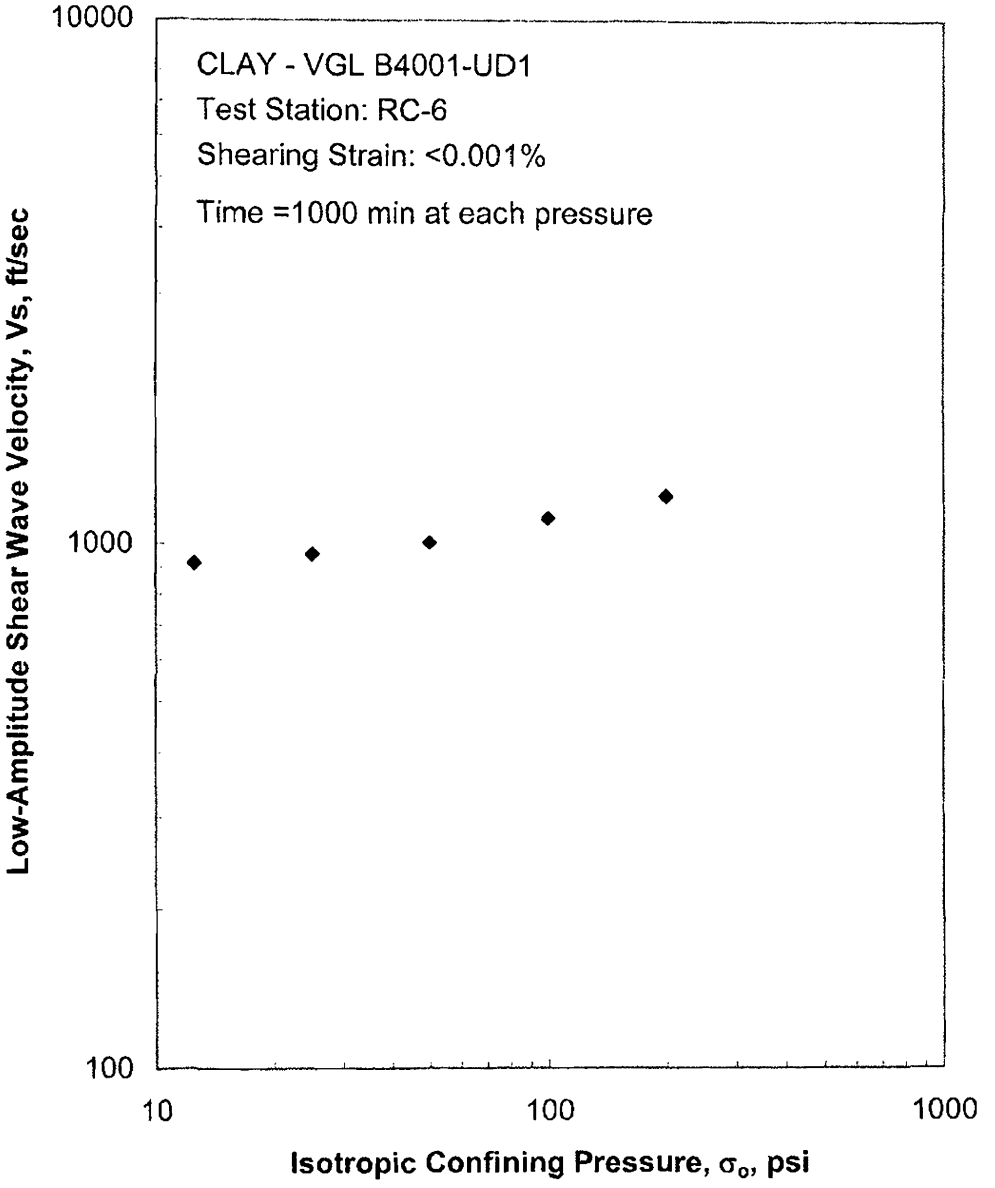


Figure A.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

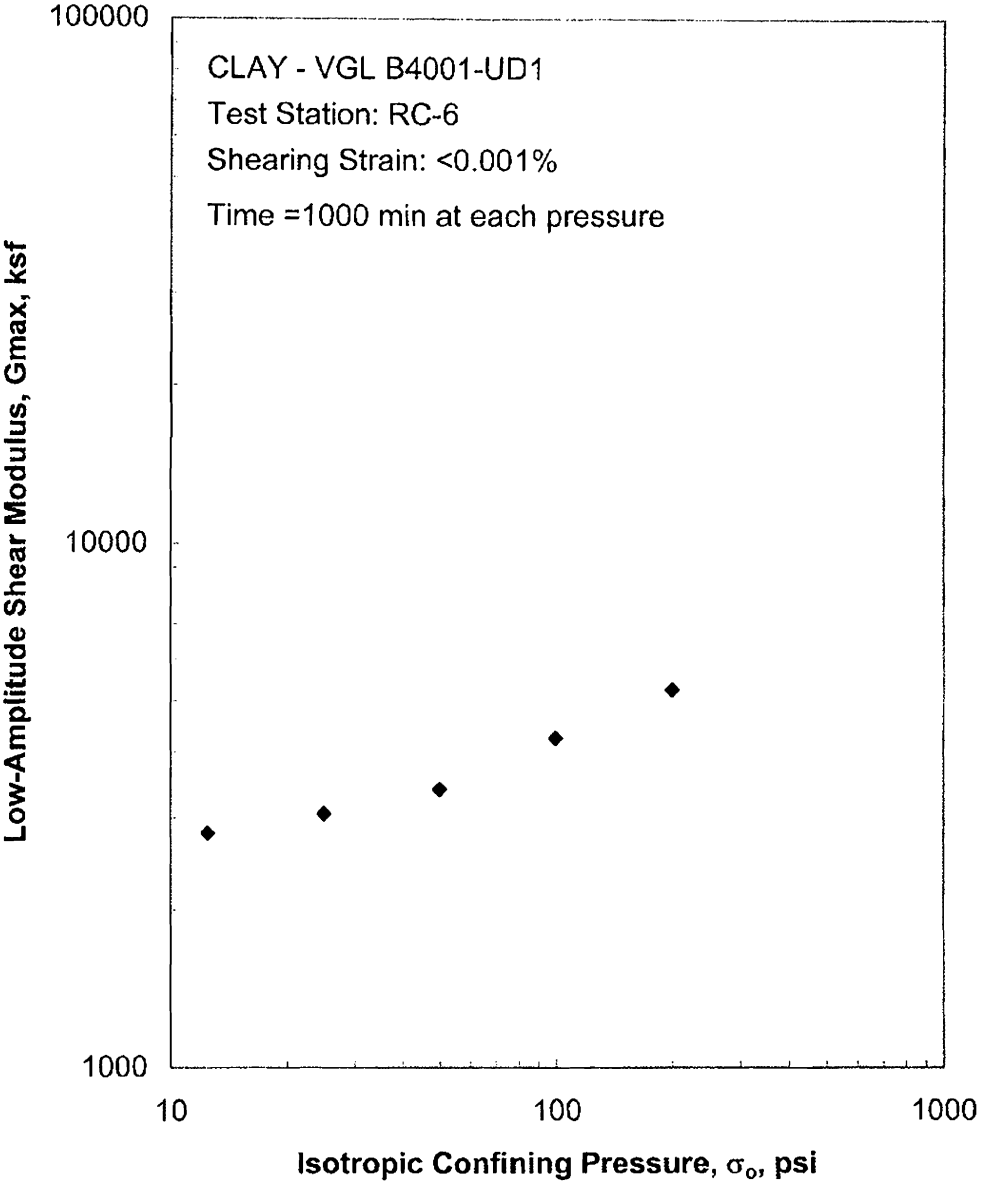


Figure A.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

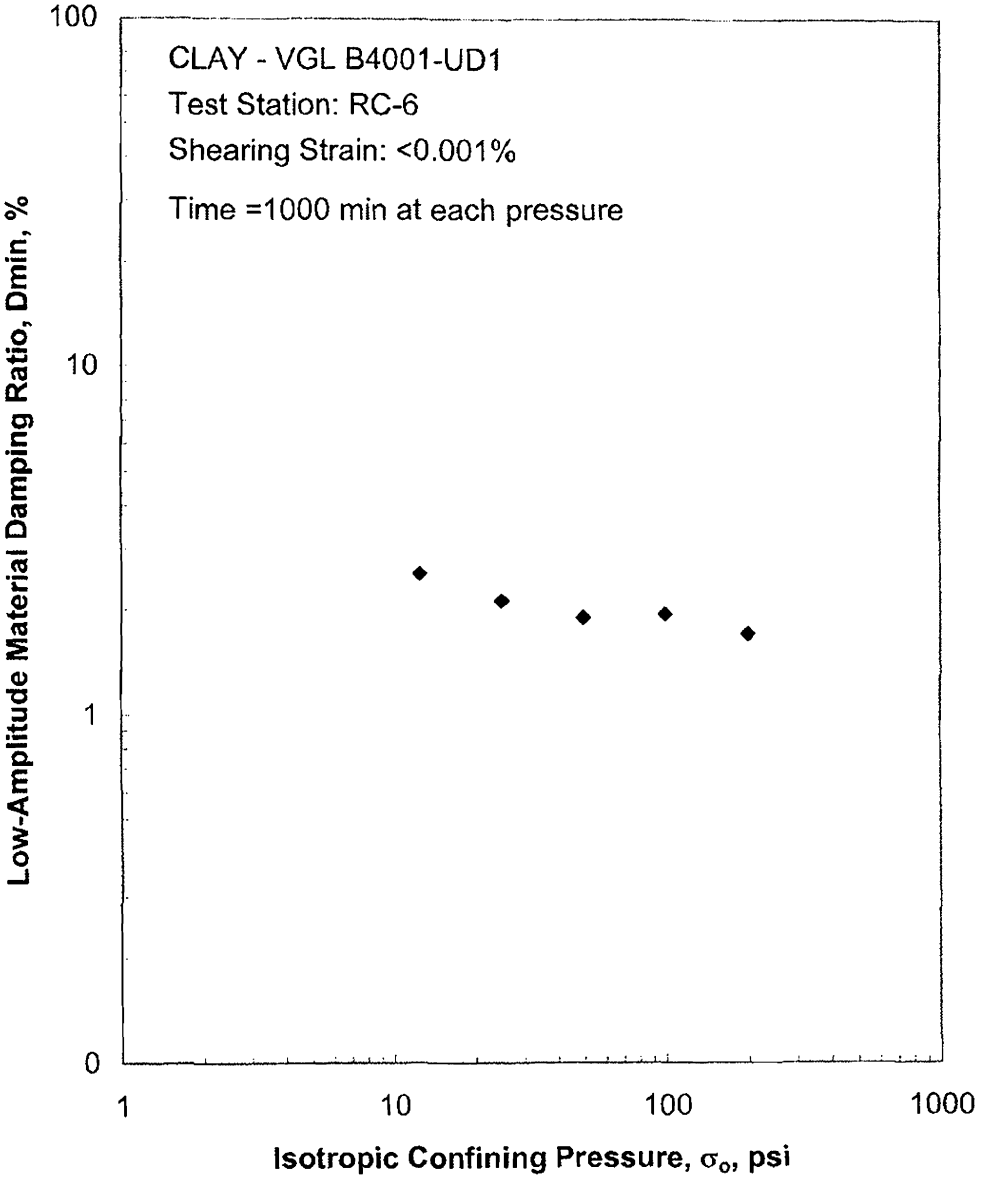


Figure A.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

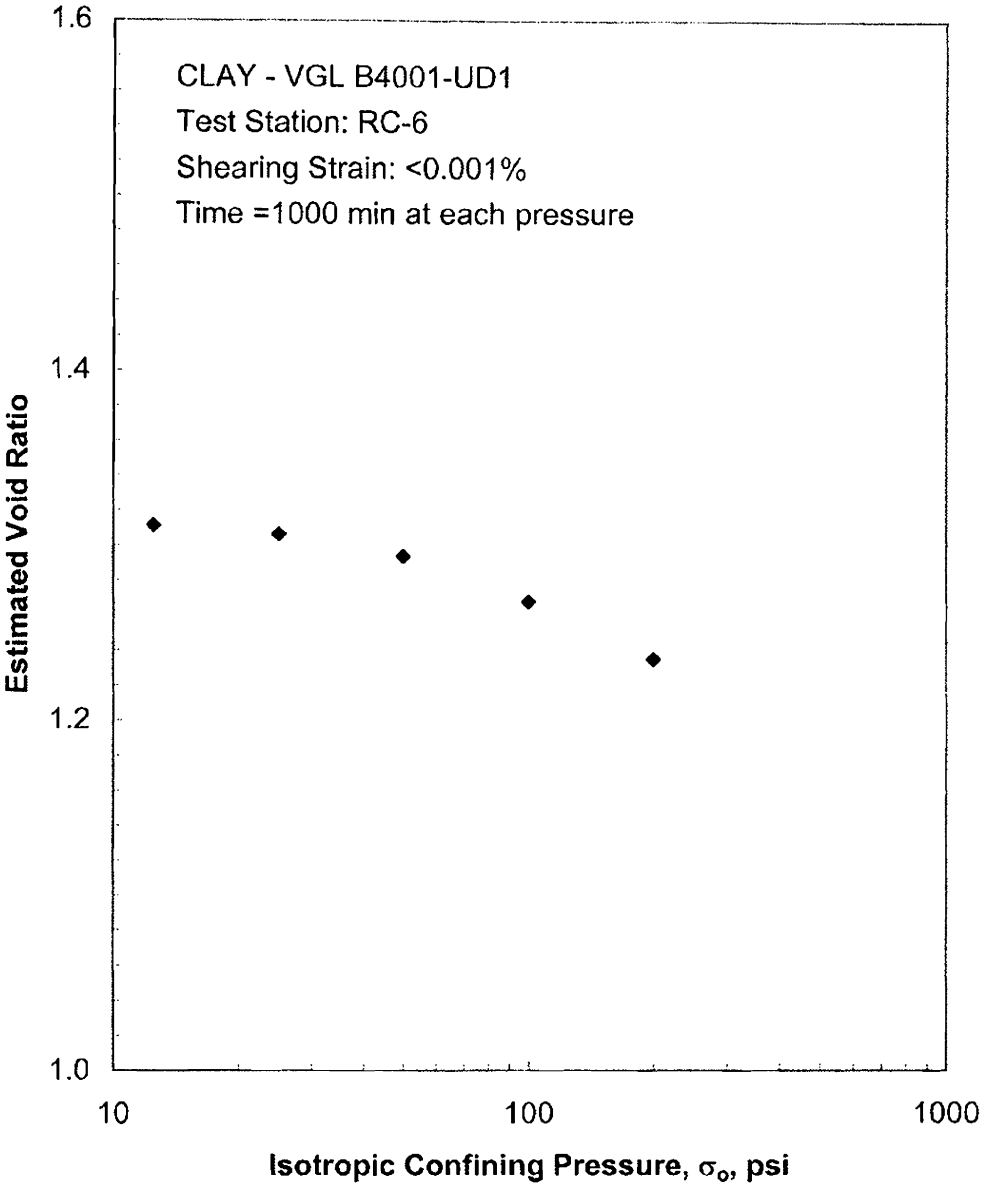


Figure A.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

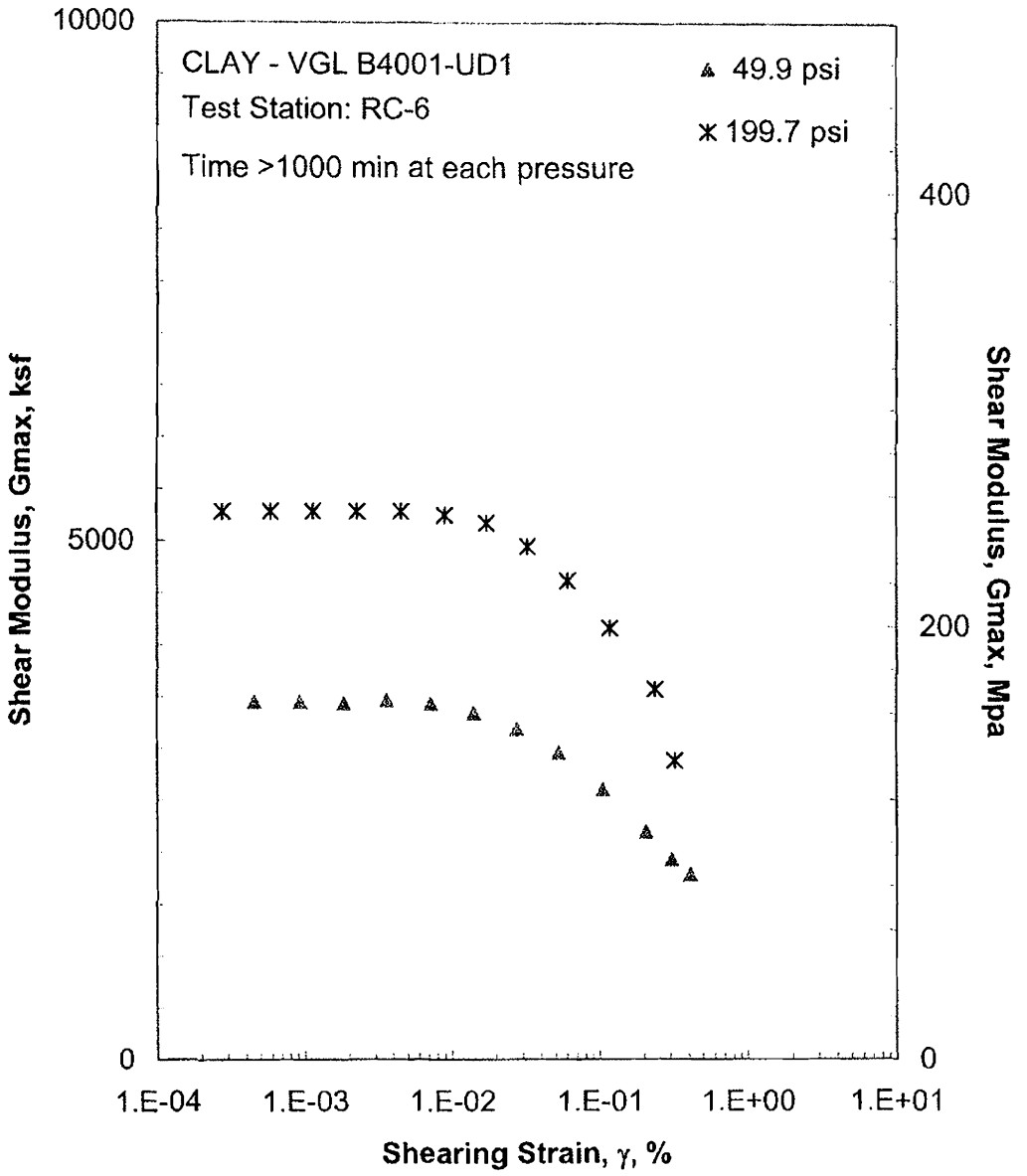


Figure A.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

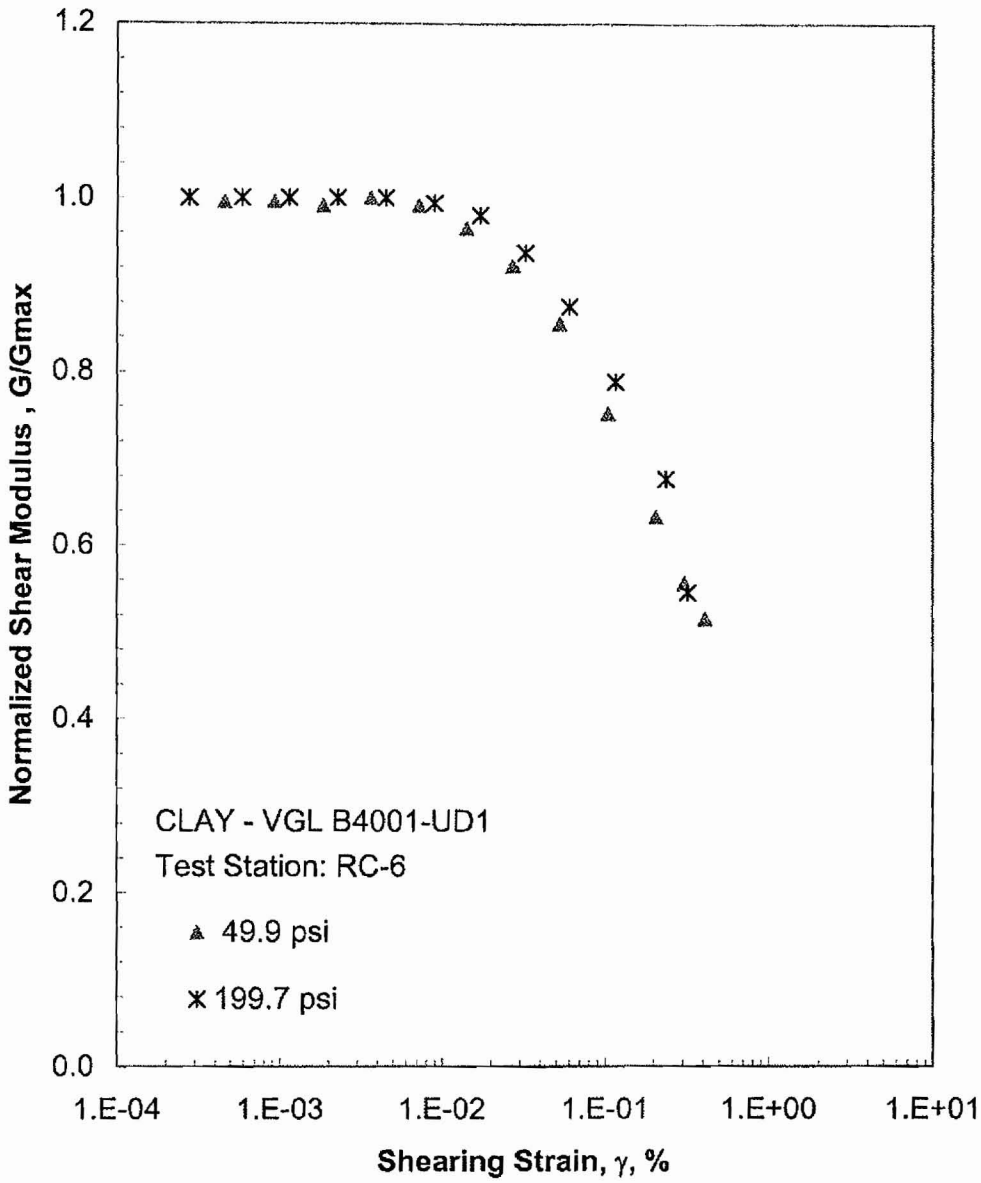


Figure A.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

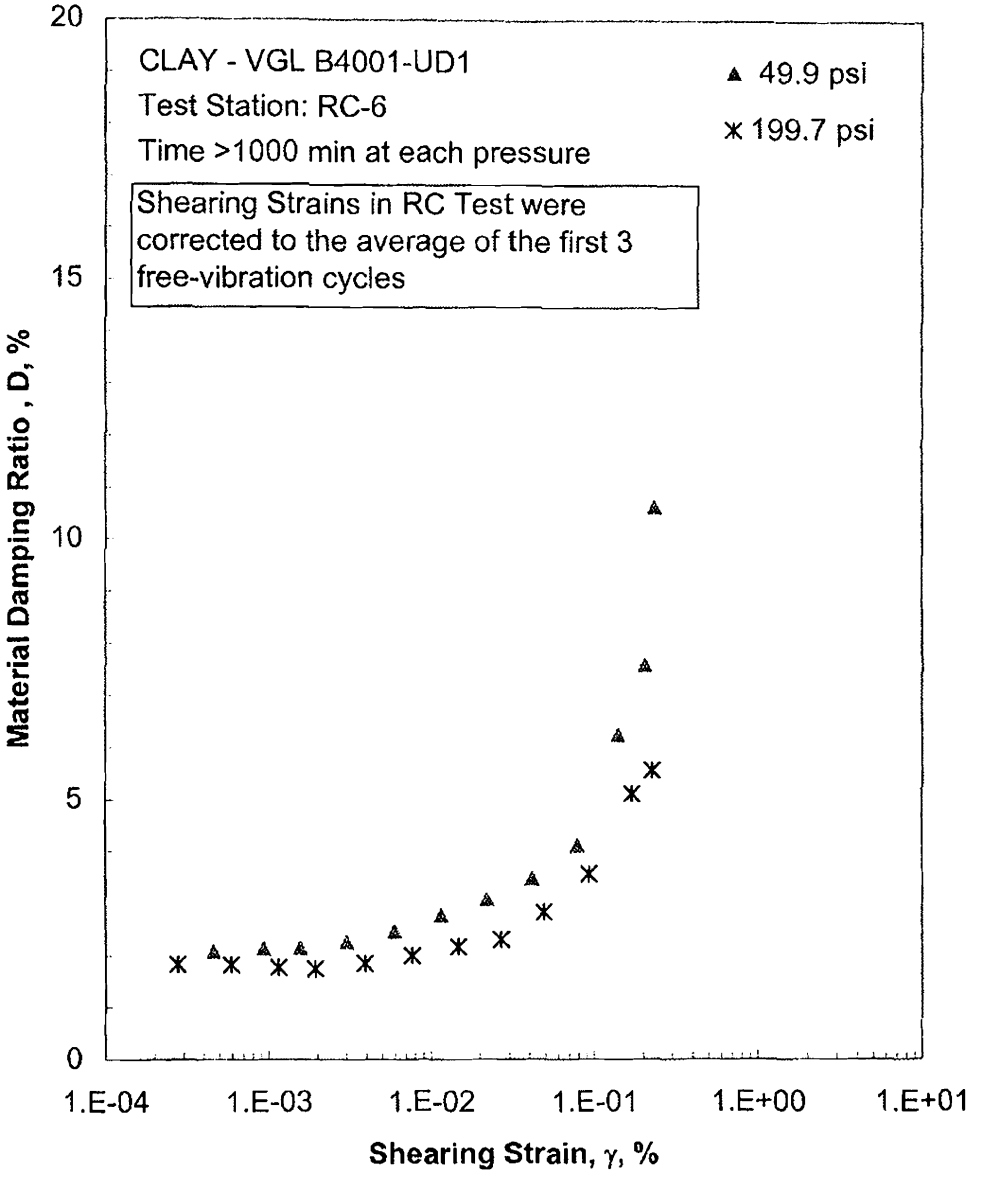


Figure A.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

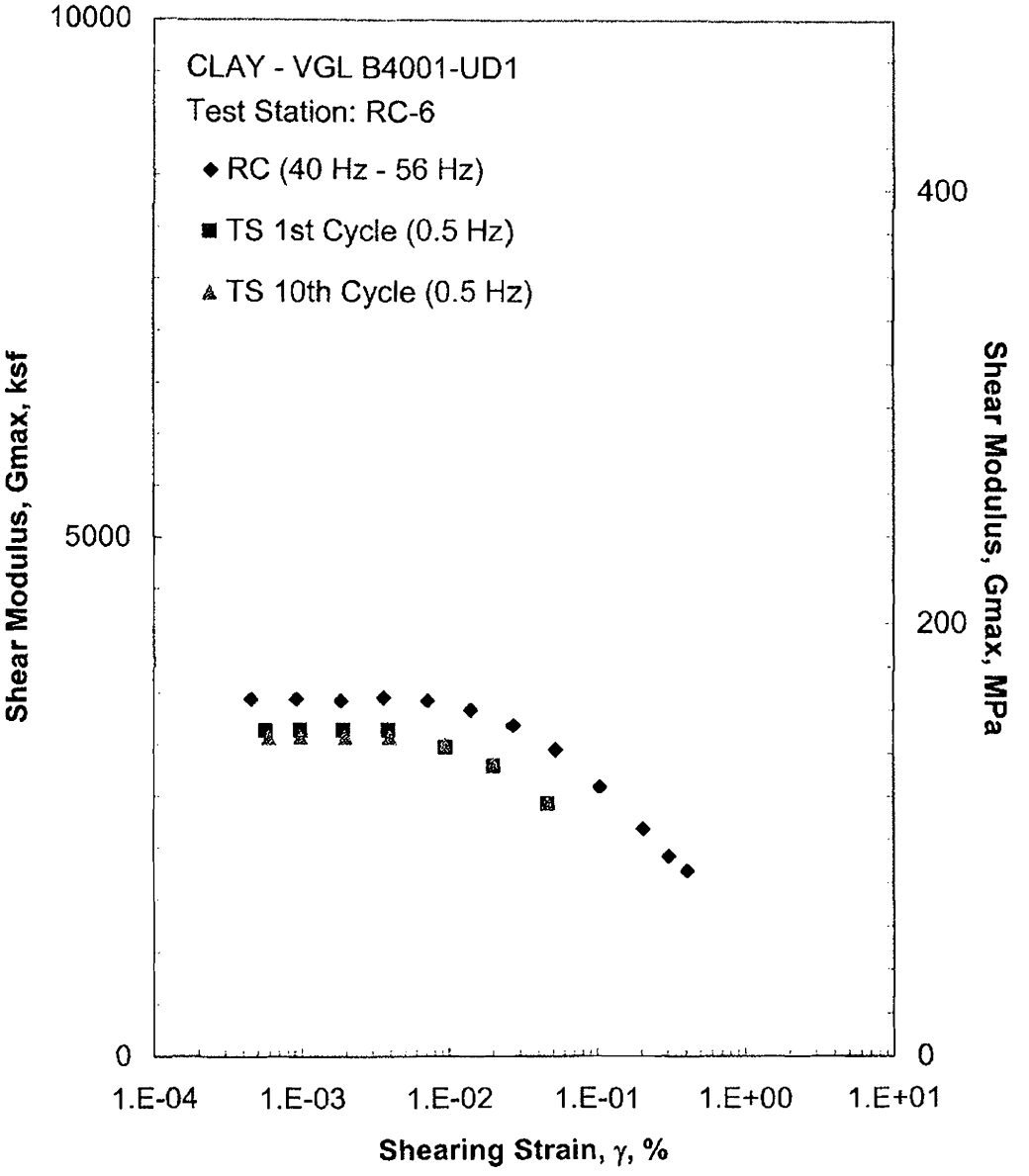


Figure A.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 49.9 psi from the Combined RCTS Tests

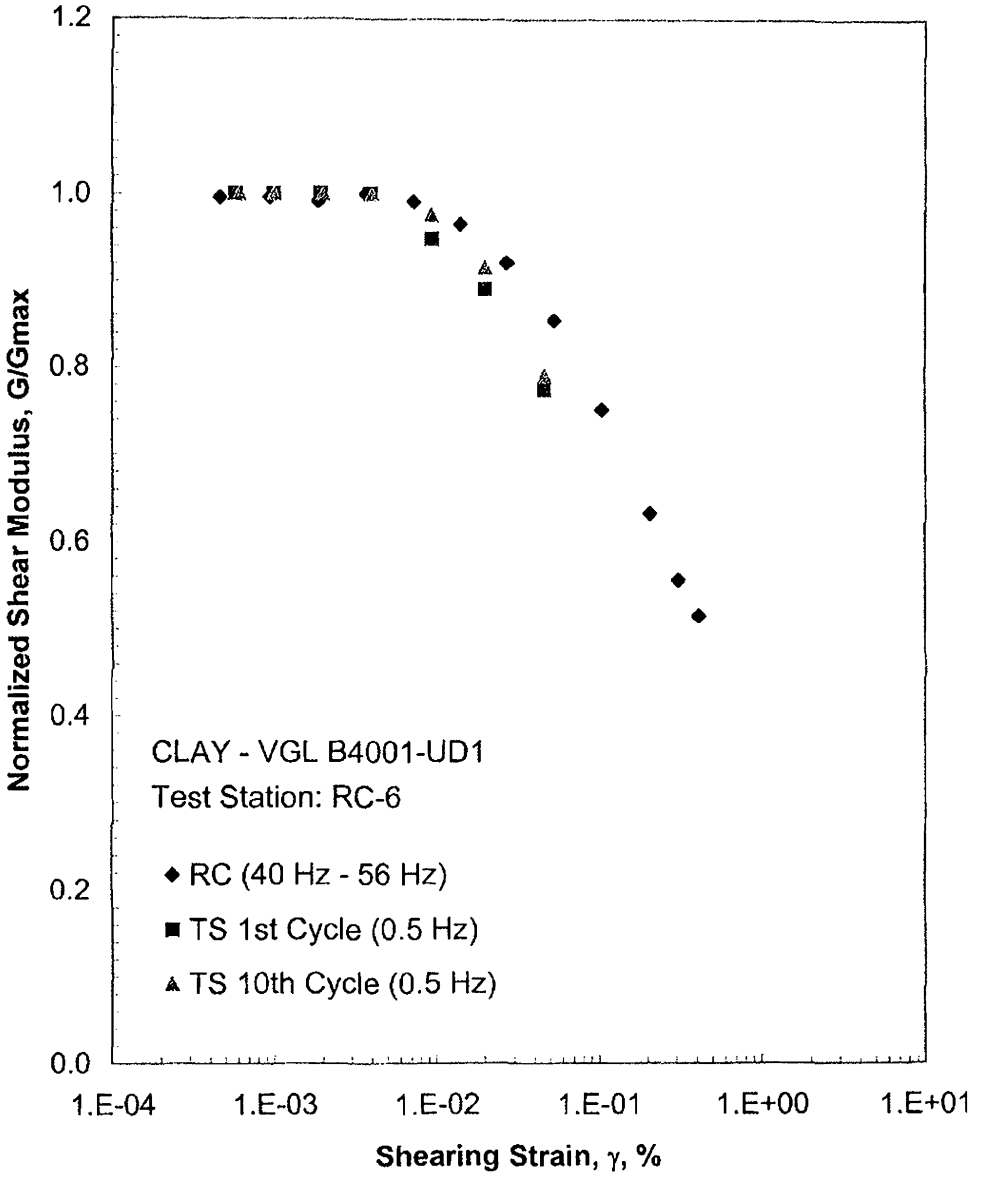


Figure A.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 49.9 psi from the Combined RCTS Tests

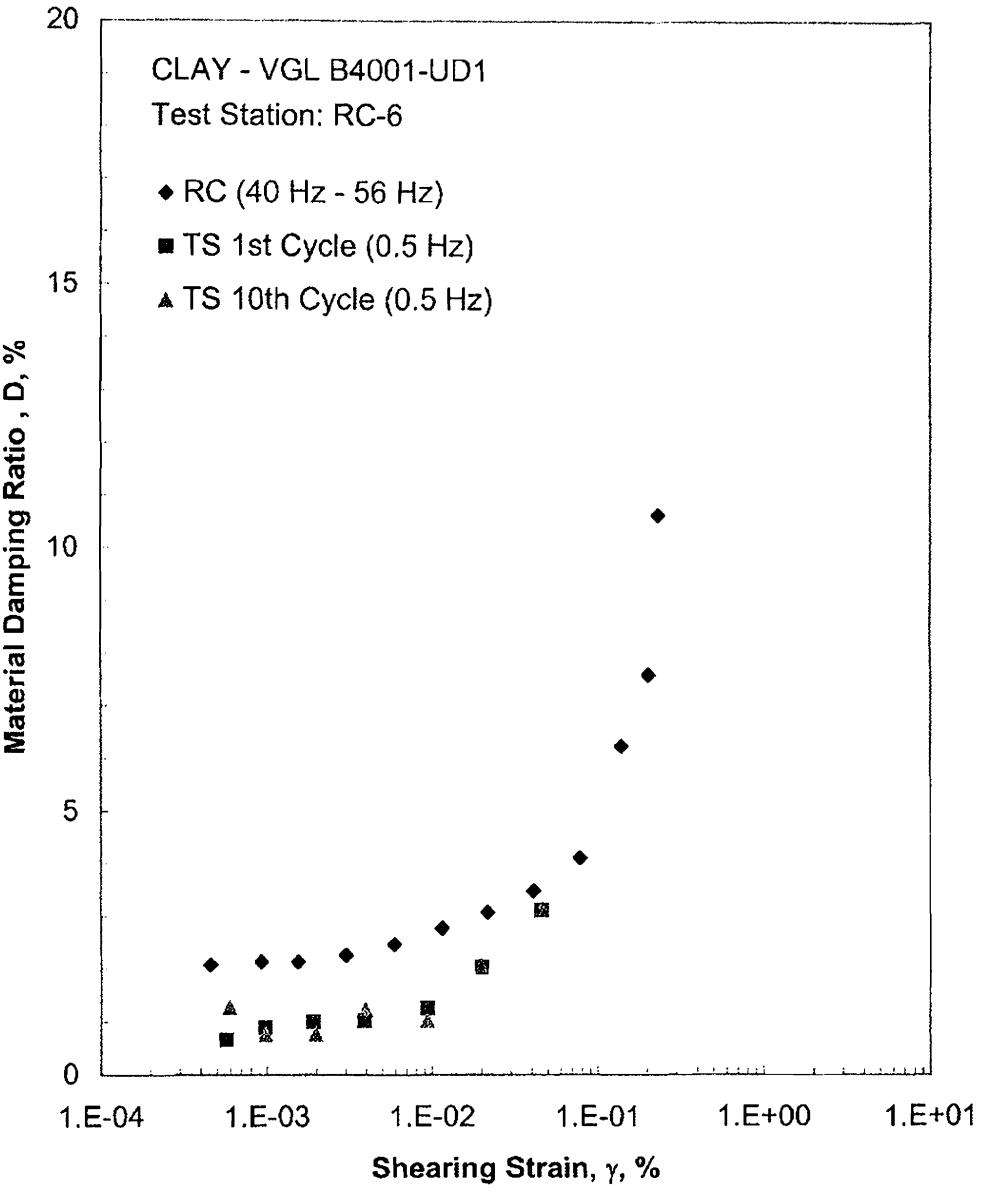


Figure A.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 49.9 psi from the Combined RCTS Tests

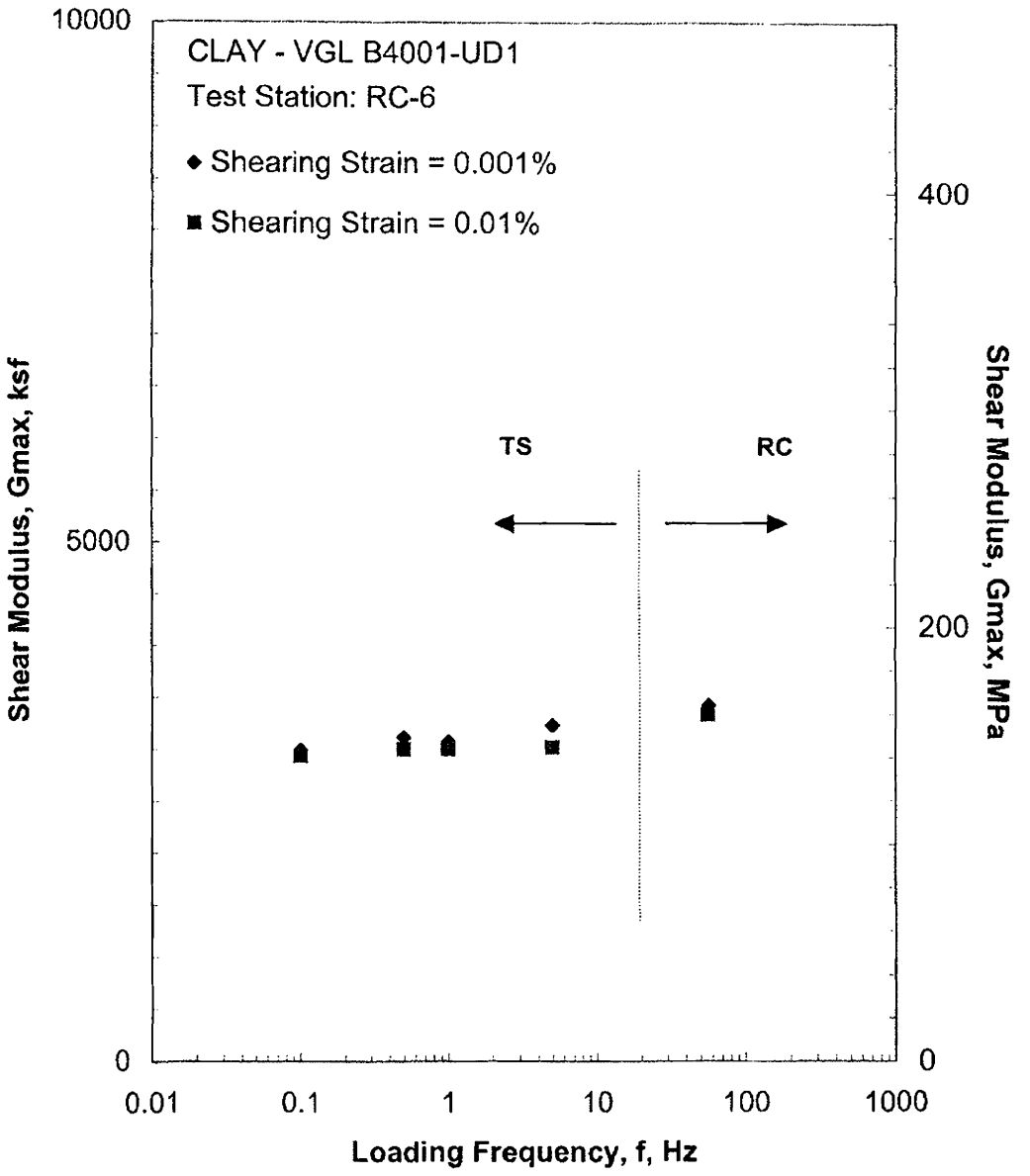


Figure A.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 49.9 psi from the Combined RCTS Tests

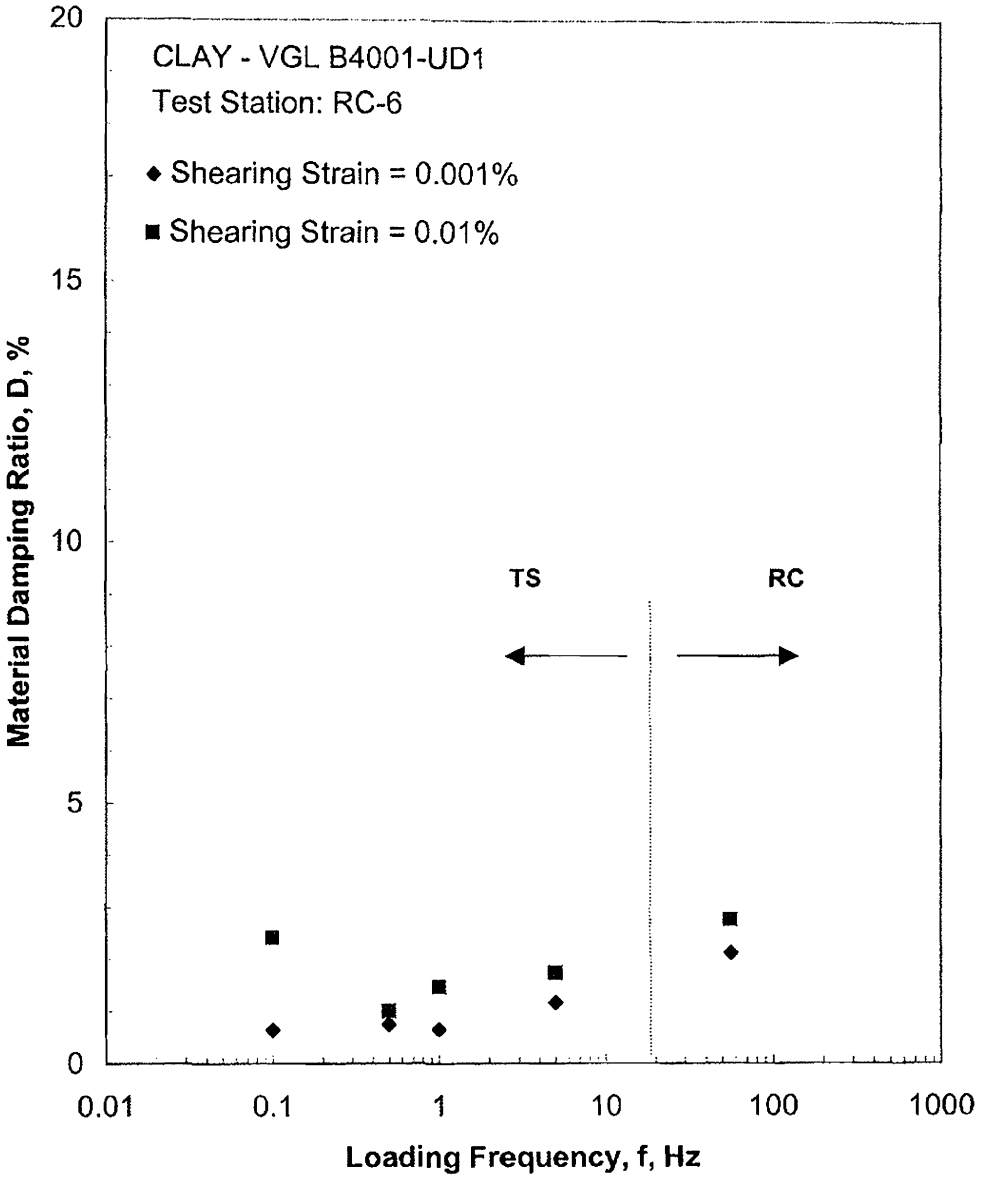


Figure A.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 49.9 psi from the Combined RCTS Tests

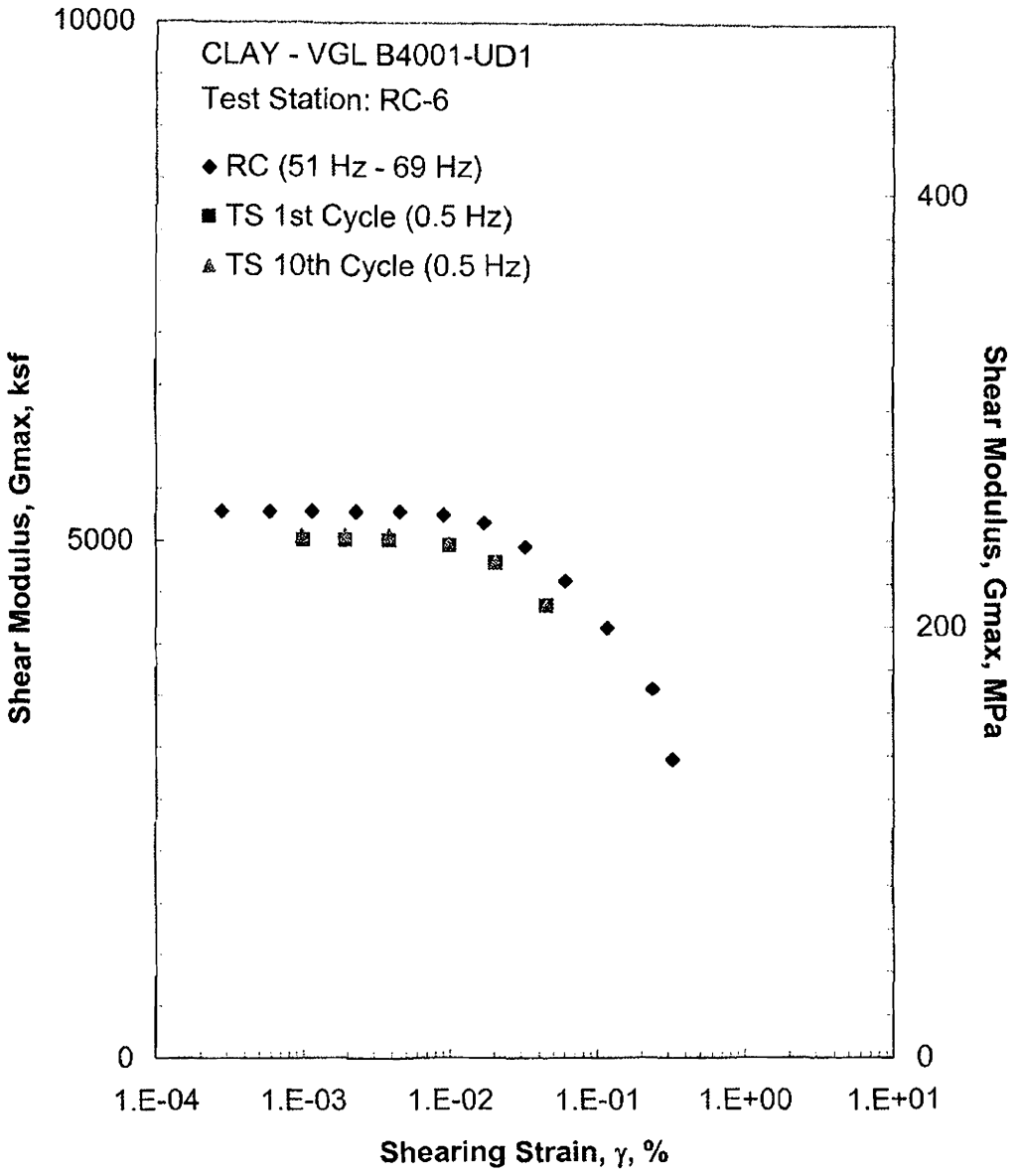


Figure A.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 199.7 psi from the Combined RCTS Tests

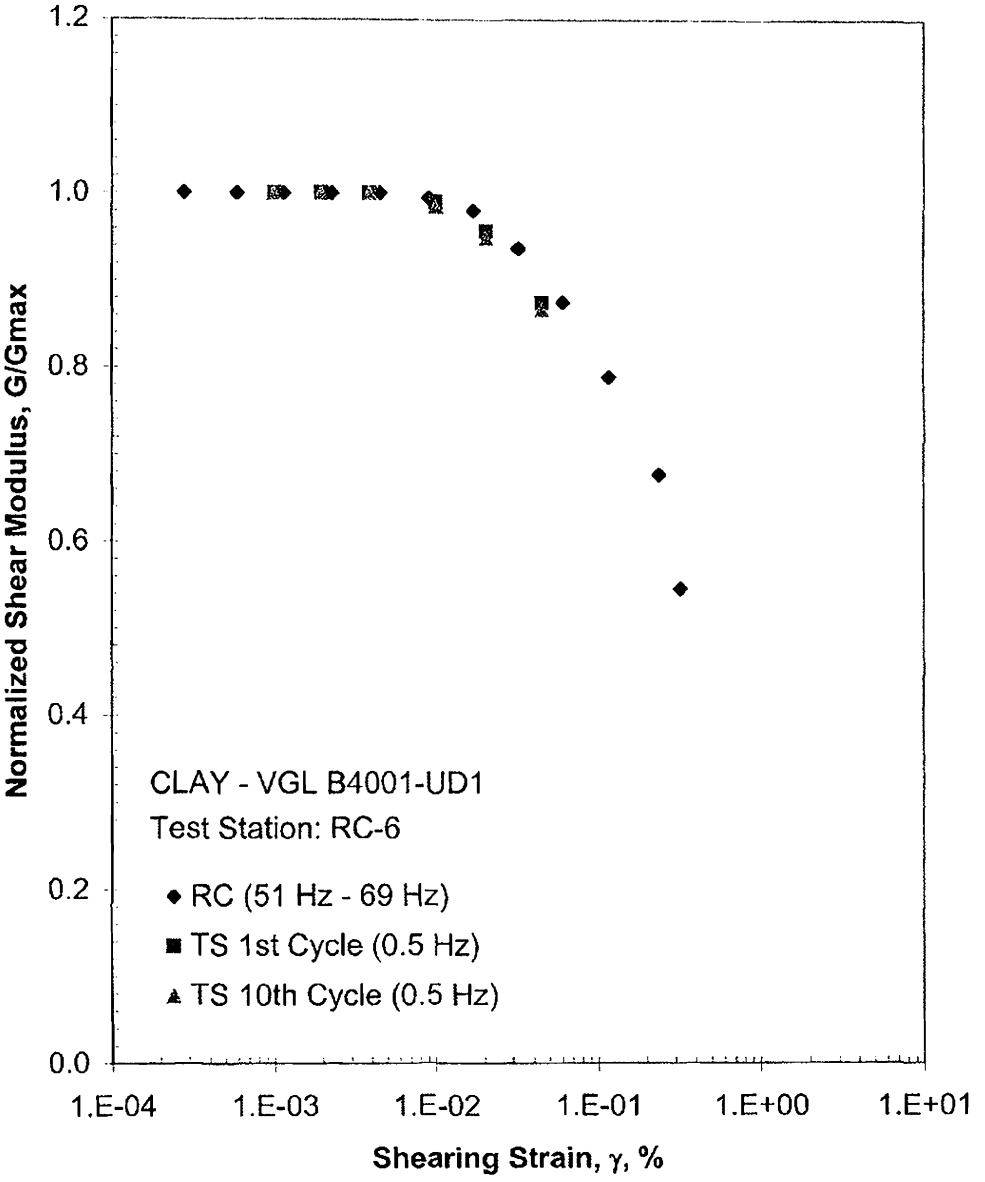


Figure A.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 199.7 psi from the Combined RCTS Tests

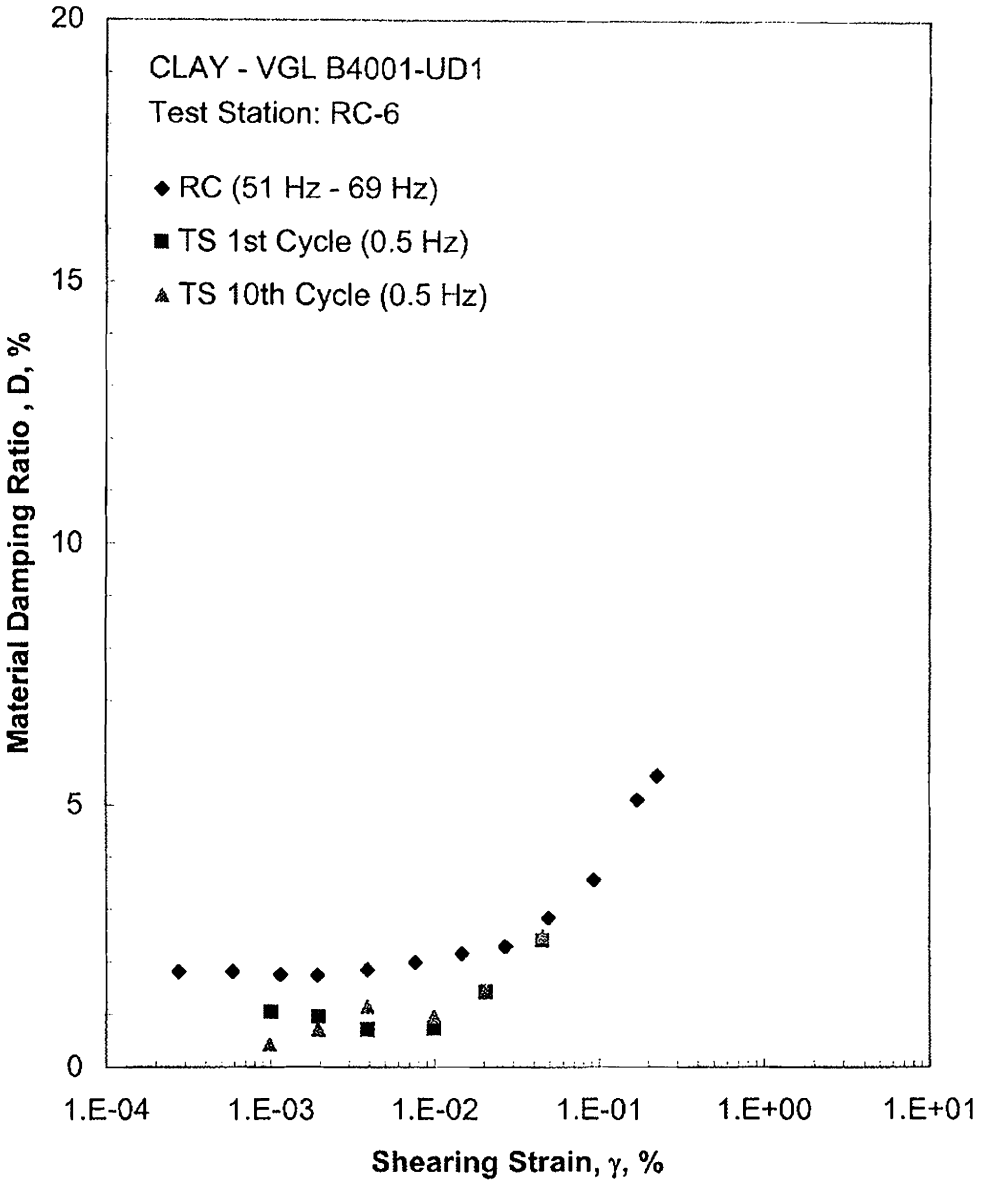


Figure A.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 199.7 psi from the Combined RCTS Tests

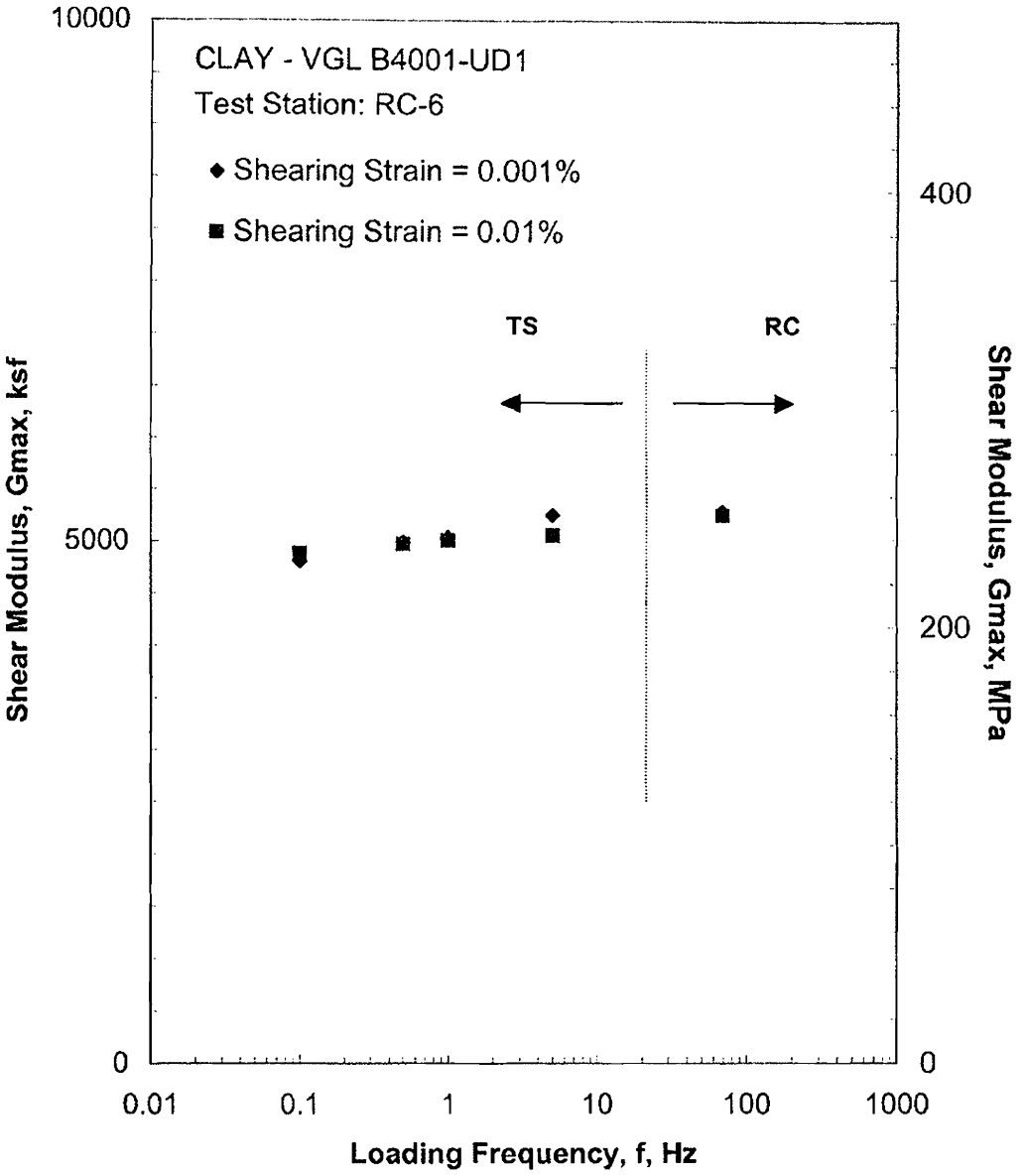


Figure A.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 199.7 psi from the Combined RCTS Tests

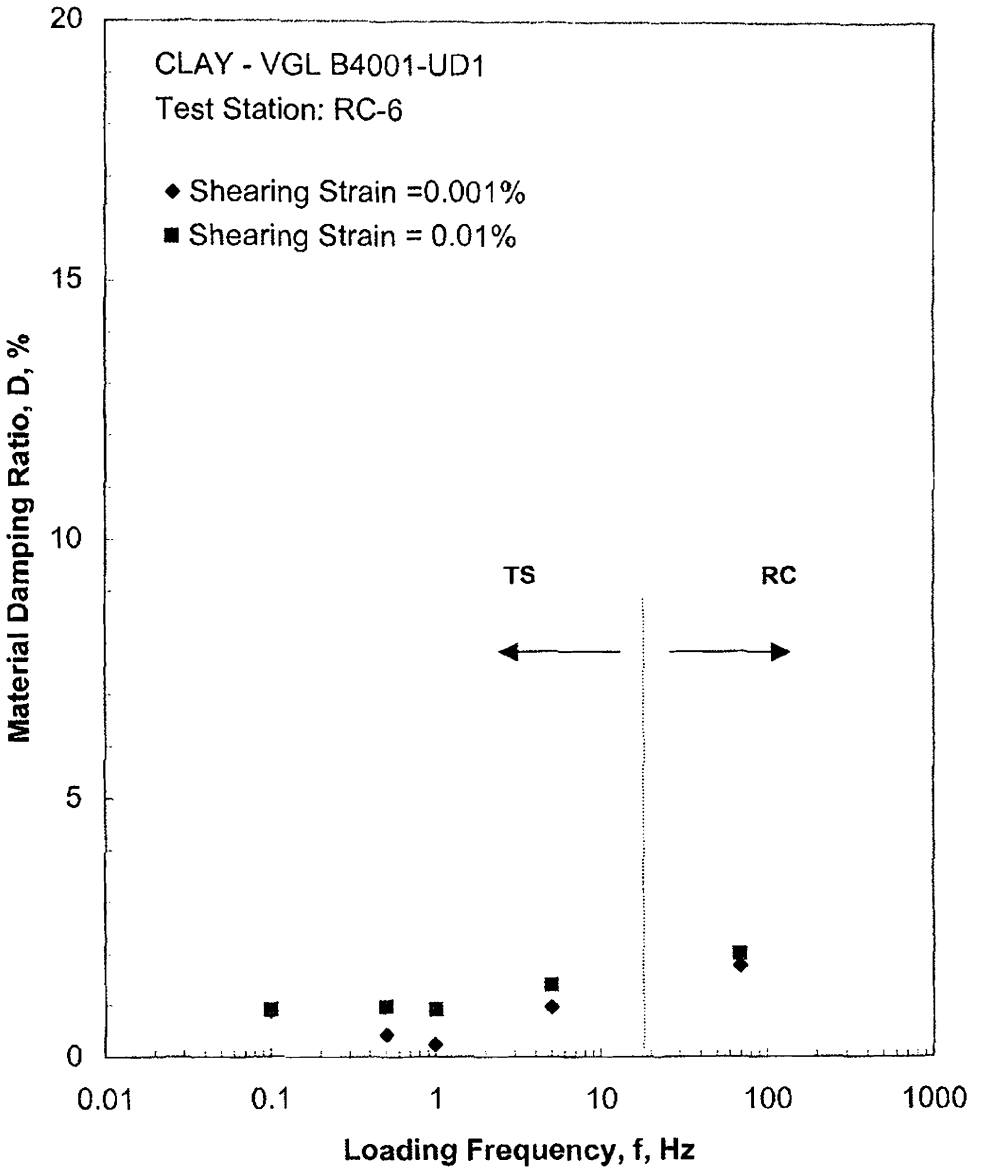


Figure A.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 199.7 psi from the Combined RCTS Tests

Table A.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen VGL B4001-UD1

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
12.5	1800	86	2804	135	917	2.55	1.311
25.0	3600	172	3055	147	956	2.13	1.306
49.9	7186	344	3399	163	1006	1.91	1.294
99.8	14371	688	4251	204	1119	1.95	1.268
199.7	28757	1376	5253	252	1235	1.72	1.235

Table A.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen VGL B4001-UD1; Isoptropic Confining Pressure, σ_o=49.9 psi (7.2 ksf = 344 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
4.58E-04	3445	1.00	4.58E-04	2.07
9.29E-04	3445	1.00	9.29E-04	2.13
1.85E-03	3429	0.99	1.56E-03	2.14
3.64E-03	3460	1.00	3.02E-03	2.26
7.24E-03	3429	0.99	5.94E-03	2.47
1.42E-02	3338	0.96	1.15E-02	2.77
2.74E-02	3189	0.92	2.19E-02	3.08
5.29E-02	2957	0.85	4.13E-02	3.48
1.05E-01	2599	0.75	7.87E-02	4.12
2.06E-01	2191	0.63	1.40E-01	6.24
3.09E-01	1925	0.56	2.04E-01	7.59
4.11E-01	1783	0.52	2.34E-01	10.62

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table A.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen VGL B4001-UD1; Isotropic Confining Pressure, σ_o = 49.9 psi (7.2 ksf =344 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
5.72E-04	3145	1.00	0.65	5.99E-04	3073	1.00	1.26
9.86E-04	3145	1.00	0.88	9.85E-04	3073	1.00	0.75
1.92E-03	3145	1.00	1.00	1.98E-03	3073	1.00	0.76
3.91E-03	3145	1.00	1.02	3.97E-03	3073	1.00	1.23
9.45E-03	2981	0.95	1.25	9.40E-03	3000	0.98	1.01
2.01E-02	2799	0.89	2.03	2.00E-02	2813	0.92	2.06
4.63E-02	2436	0.77	3.12	4.64E-02	2429	0.79	3.15

Table A.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen VGL B4001-UD1; Isoptropic Confining Pressure, σ_o= 199.7 psi (28.8 ksf = 1376 kPa)

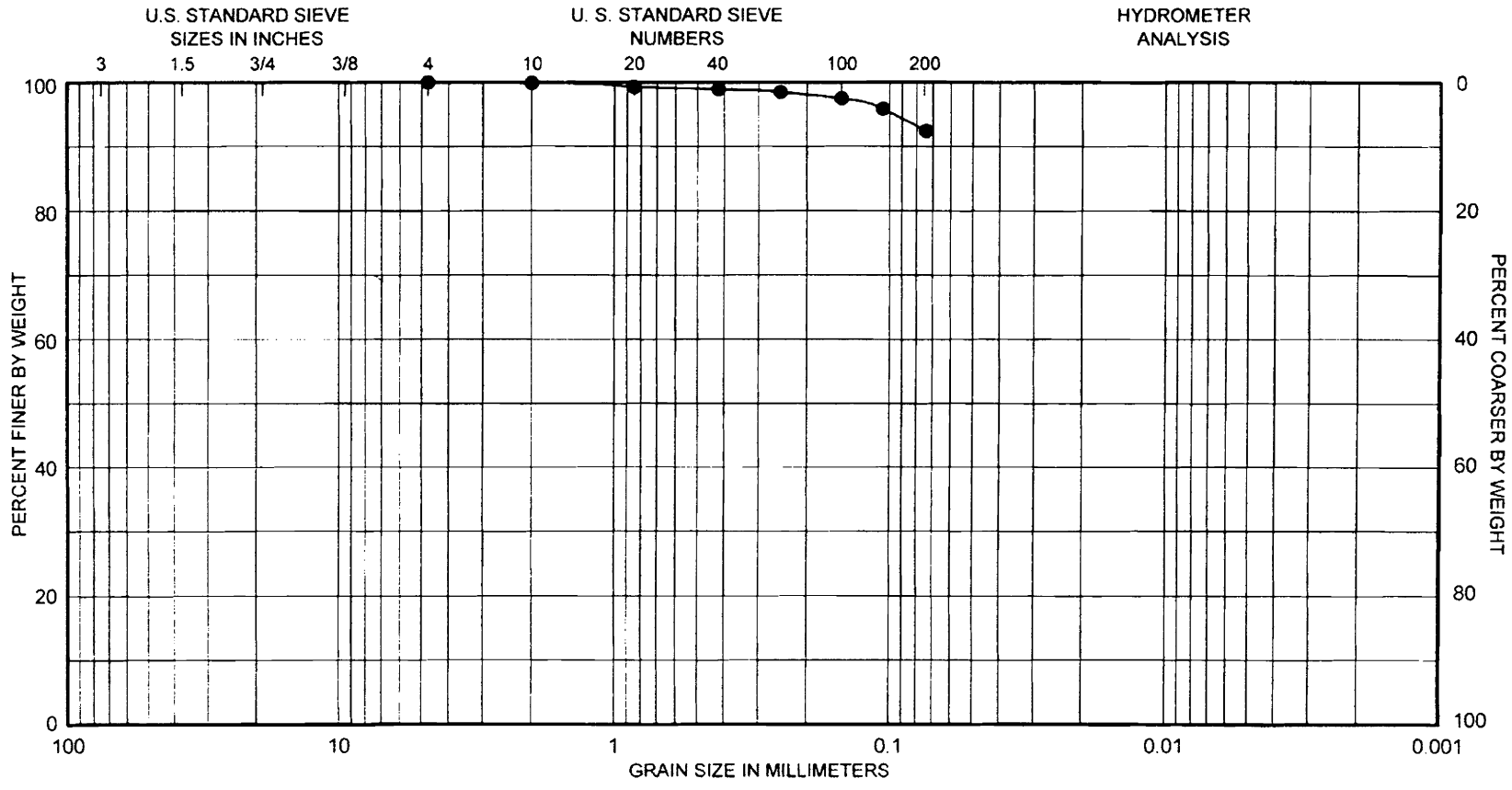
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
2.77E-04	5280	1.00	2.77E-04	1.82
5.89E-04	5280	1.00	5.89E-04	1.82
1.15E-03	5280	1.00	1.15E-03	1.77
2.28E-03	5280	1.00	1.94E-03	1.75
4.53E-03	5280	1.00	3.89E-03	1.85
9.00E-03	5249	0.99	7.65E-03	2.00
1.73E-02	5173	0.98	1.47E-02	2.16
3.25E-02	4947	0.94	2.70E-02	2.31
6.08E-02	4618	0.87	4.92E-02	2.85
1.17E-01	4163	0.79	9.25E-02	3.58
2.39E-01	3572	0.68	1.72E-01	5.11
3.24E-01	2883	0.55	2.27E-01	5.57

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table A.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen VGL B4001-UD1; Isotropic Confining Pressure, σ_o=199.7 psi (28.8 ksf = 1376 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
1.01E-03	5008	1.00	1.05	9.87E-04	5050	1.00	0.43
1.96E-03	5008	1.00	0.96	1.95E-03	5050	1.00	0.71
3.88E-03	5008	1.00	0.71	3.88E-03	5050	1.00	1.15
9.97E-03	4955	0.99	0.75	9.94E-03	4969	0.98	0.97
2.06E-02	4790	0.96	1.44	2.06E-02	4787	0.95	1.45
4.51E-02	4379	0.87	2.42	4.52E-02	4374	0.87	2.49



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B4001	100.5					Clay, olive gray, with sand pockets, and shell fragments

B4001- UD1

GRAIN SIZE CURVE

Report No. 0401-1667

PLATE

APPENDIX B

Specimen VGL B3003-UD4
(LL=47, PI=27; Gs=2.68)

Borehole B3003
Sample UD4
Depth = 135.5 ft (41.3 m)
Total Unit Weight = 120.1 lb/ft^3
Water Content = 27.4 %
Estimated In-Situ Ko = 0.7
Estimated In-Situ Mean Effective
Stress = 61.8 psi

FUGRO JOB #: 0401-1667
Testing Station: RC6

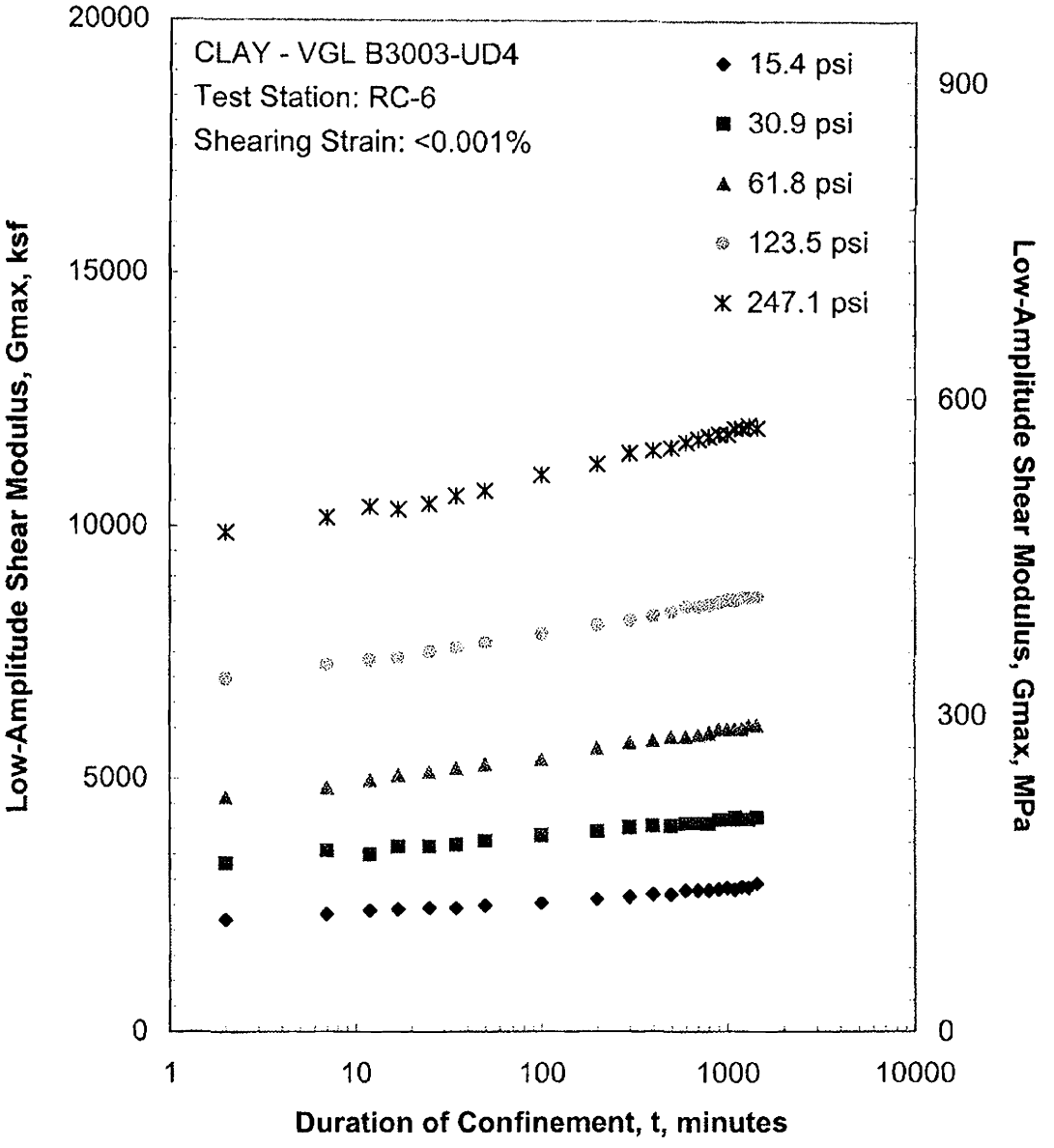


Figure B.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

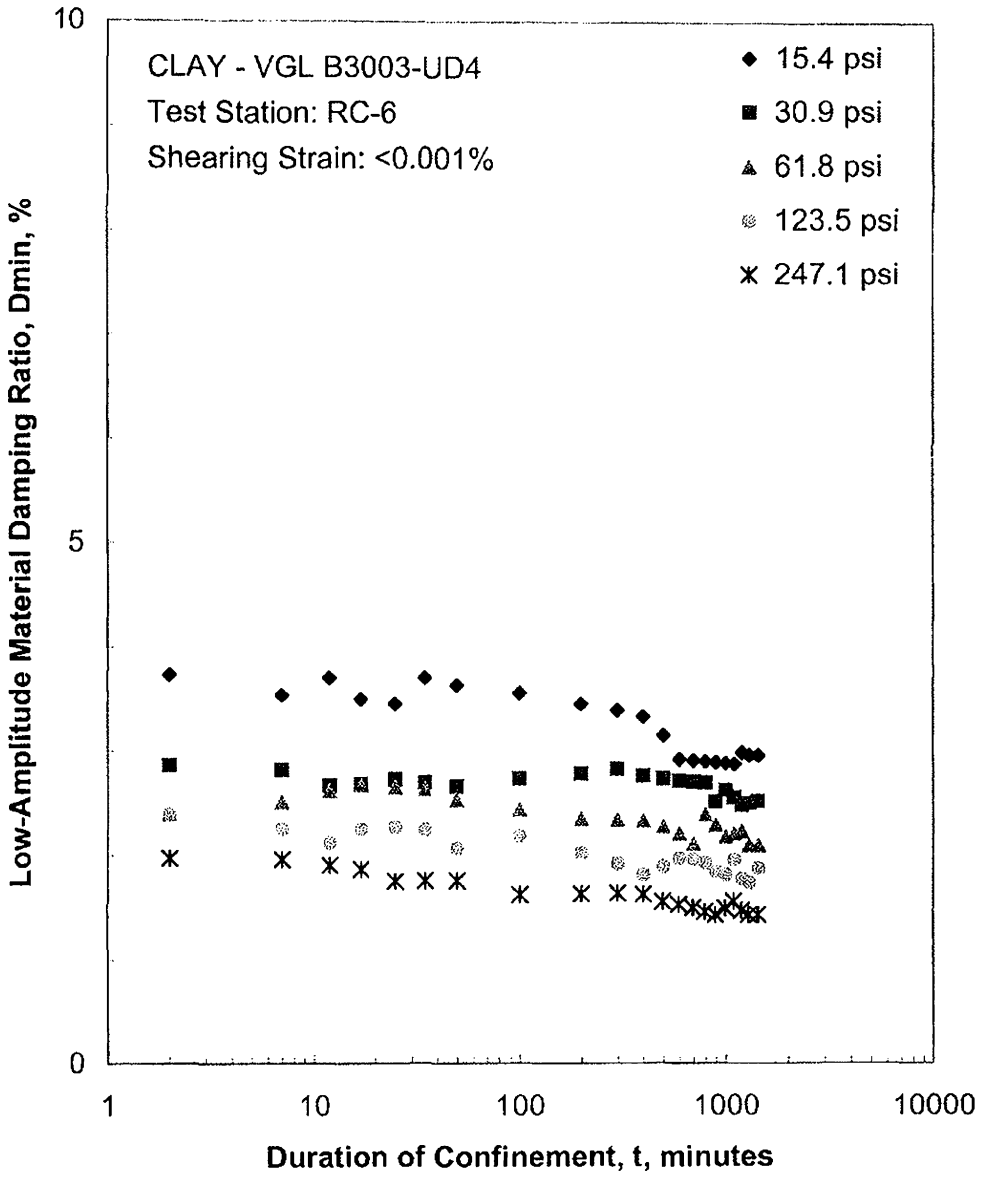


Figure B.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

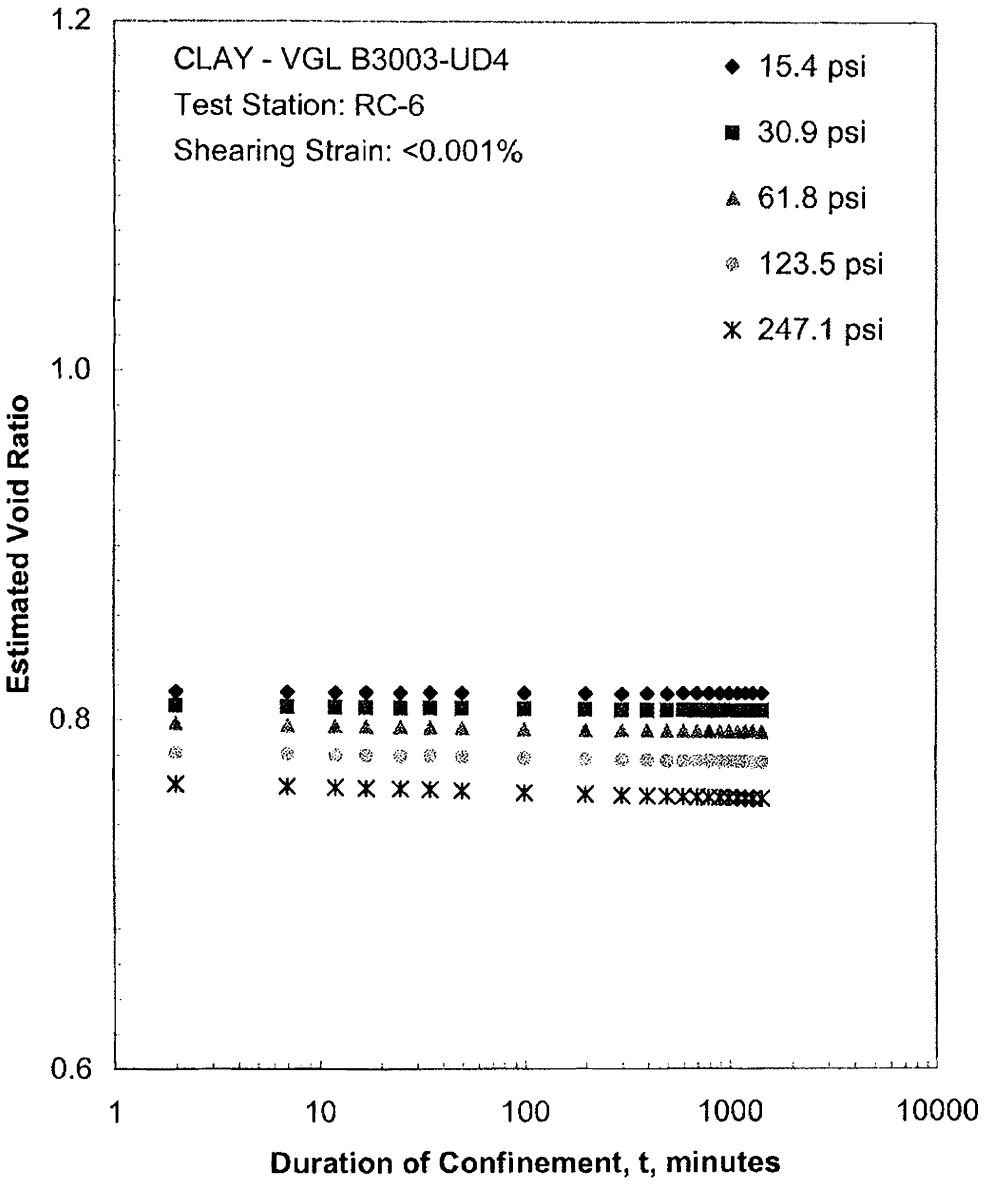


Figure B.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

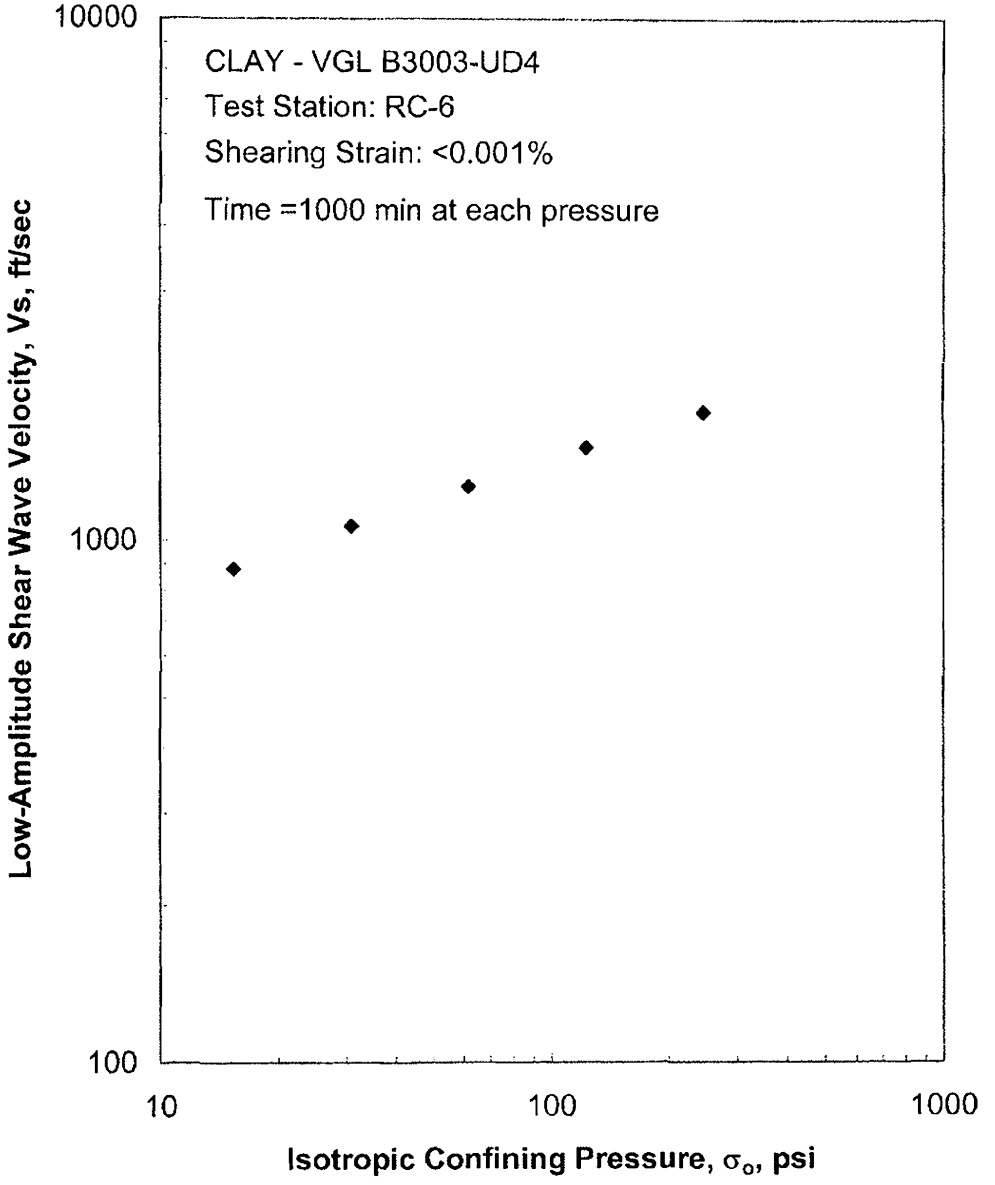


Figure B.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

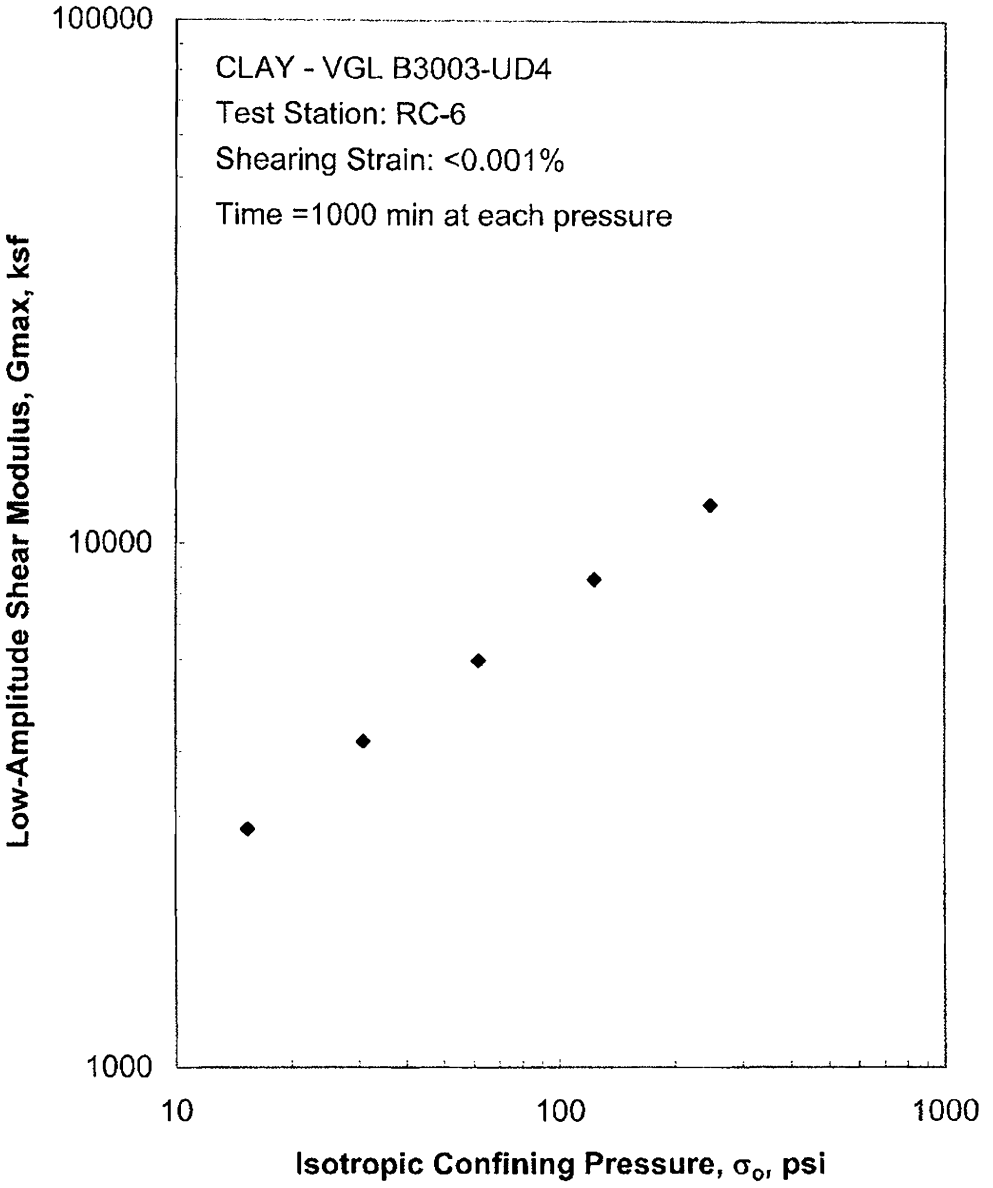


Figure B.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

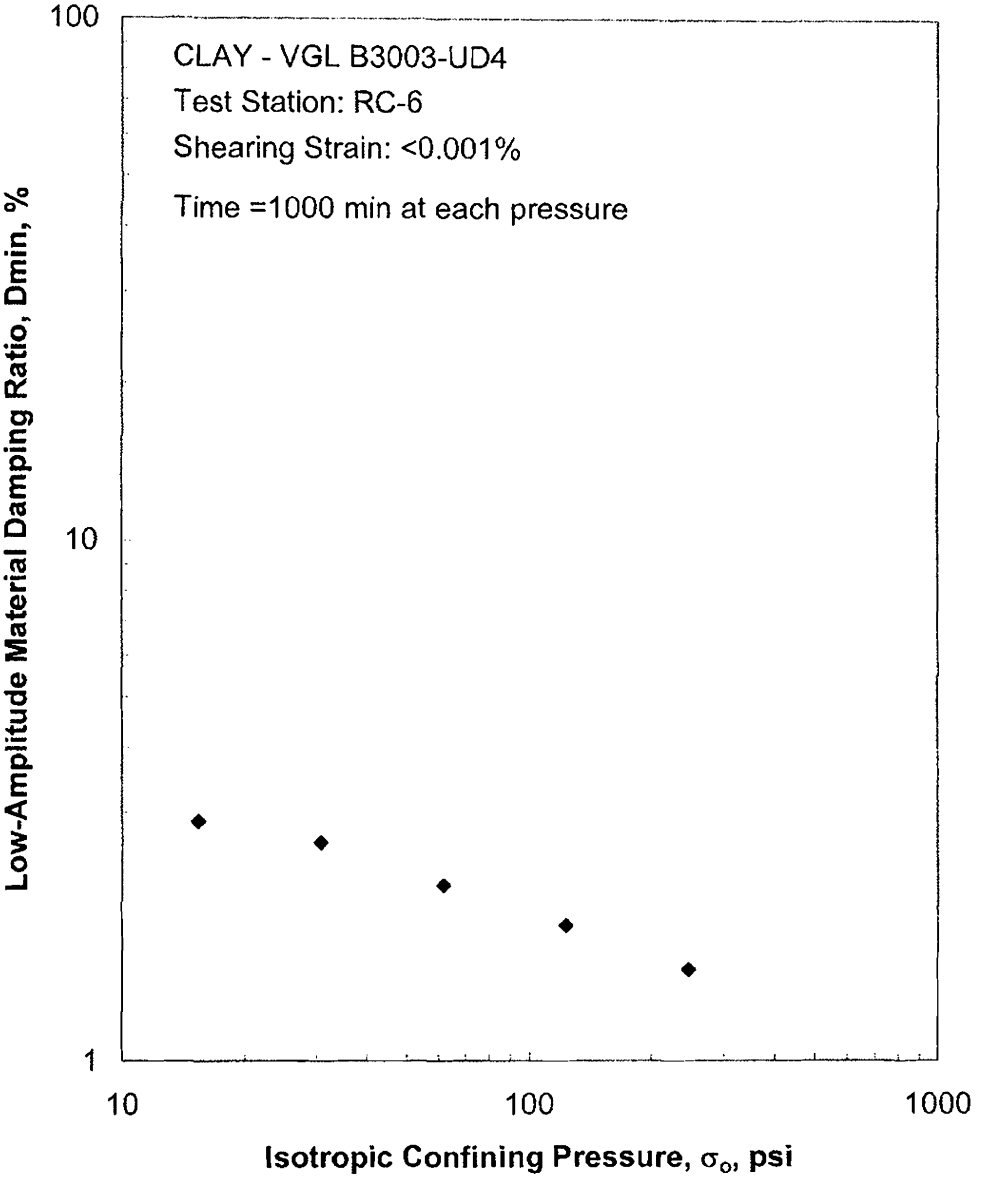


Figure B.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

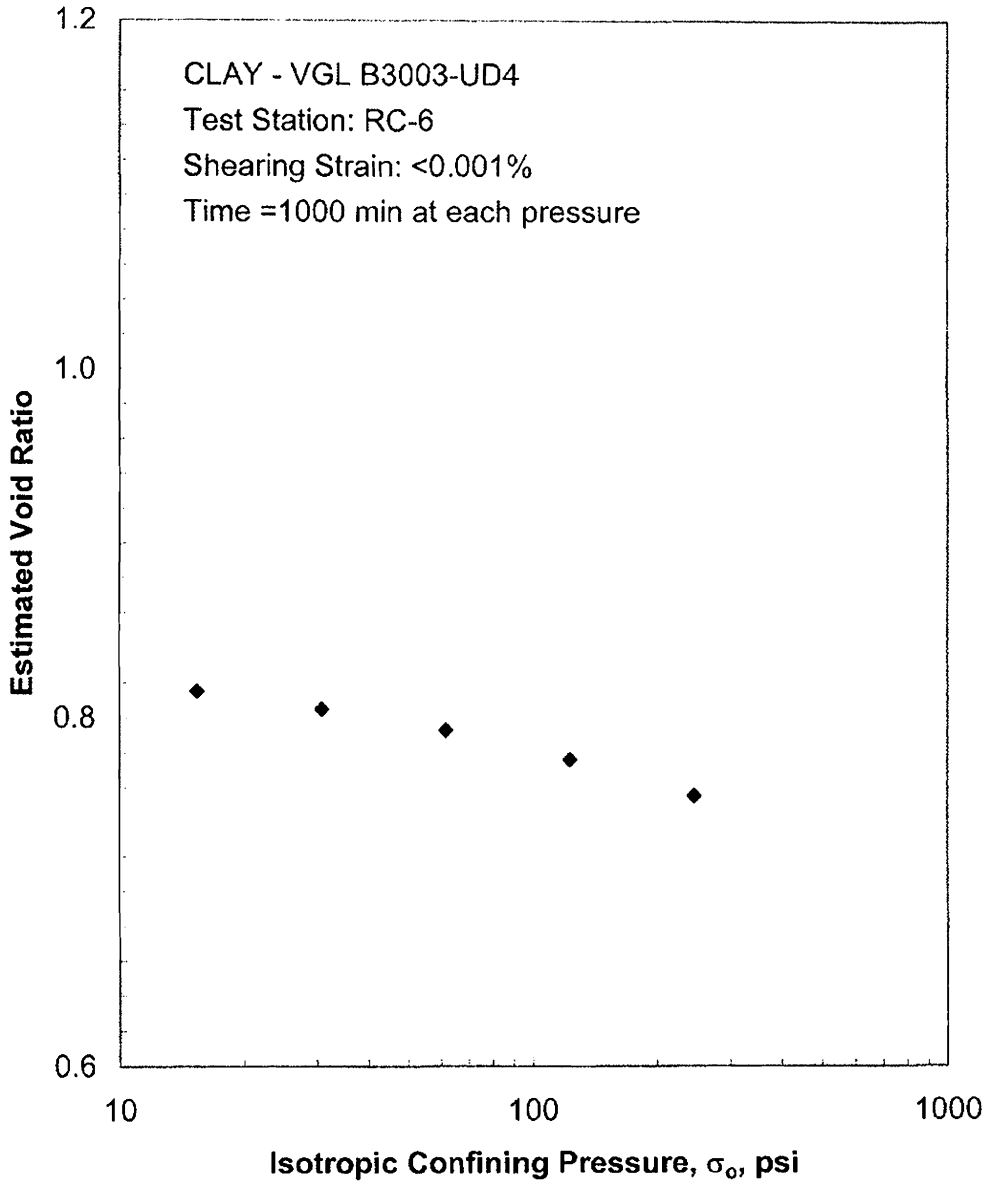


Figure B.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

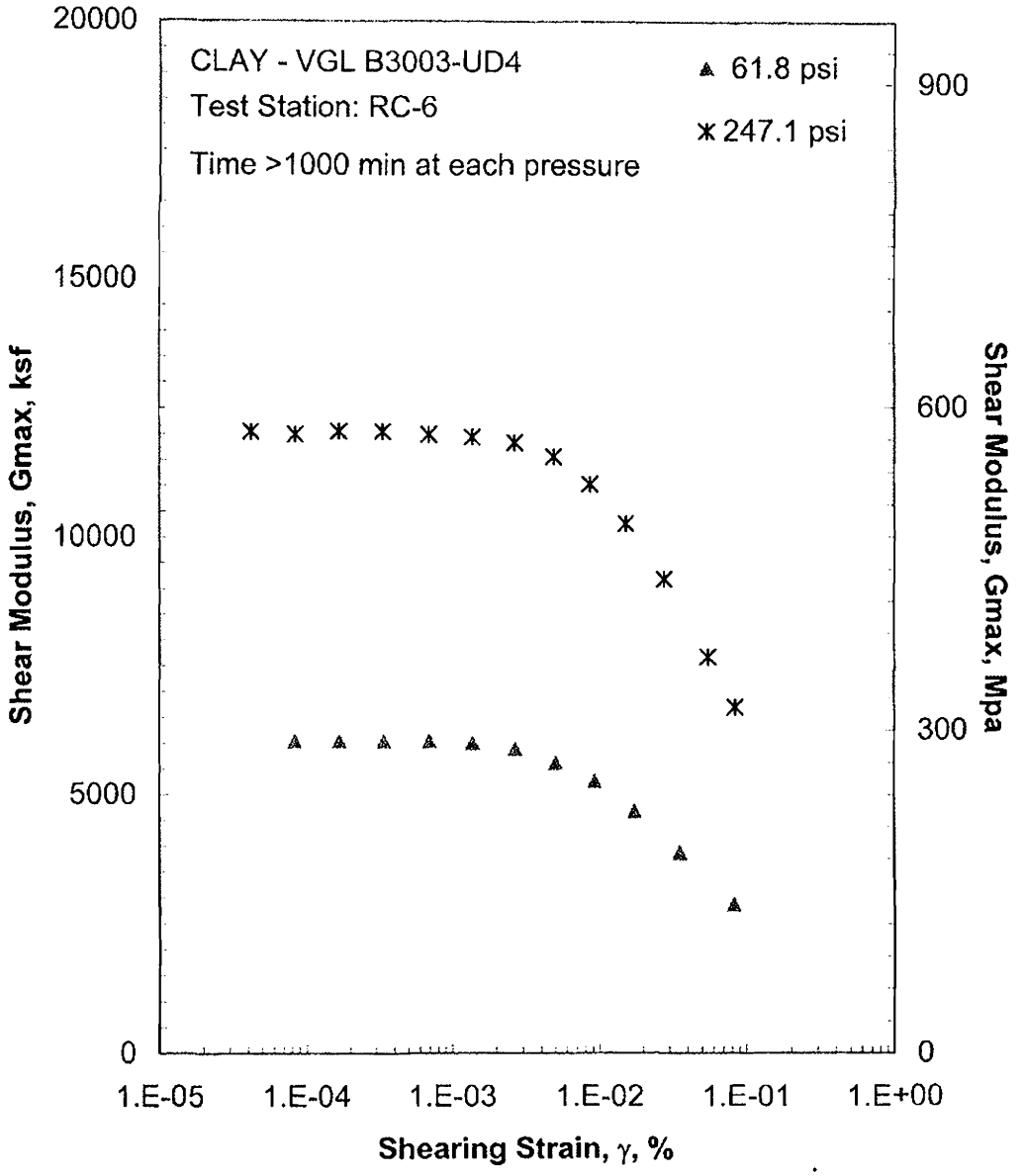


Figure B.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

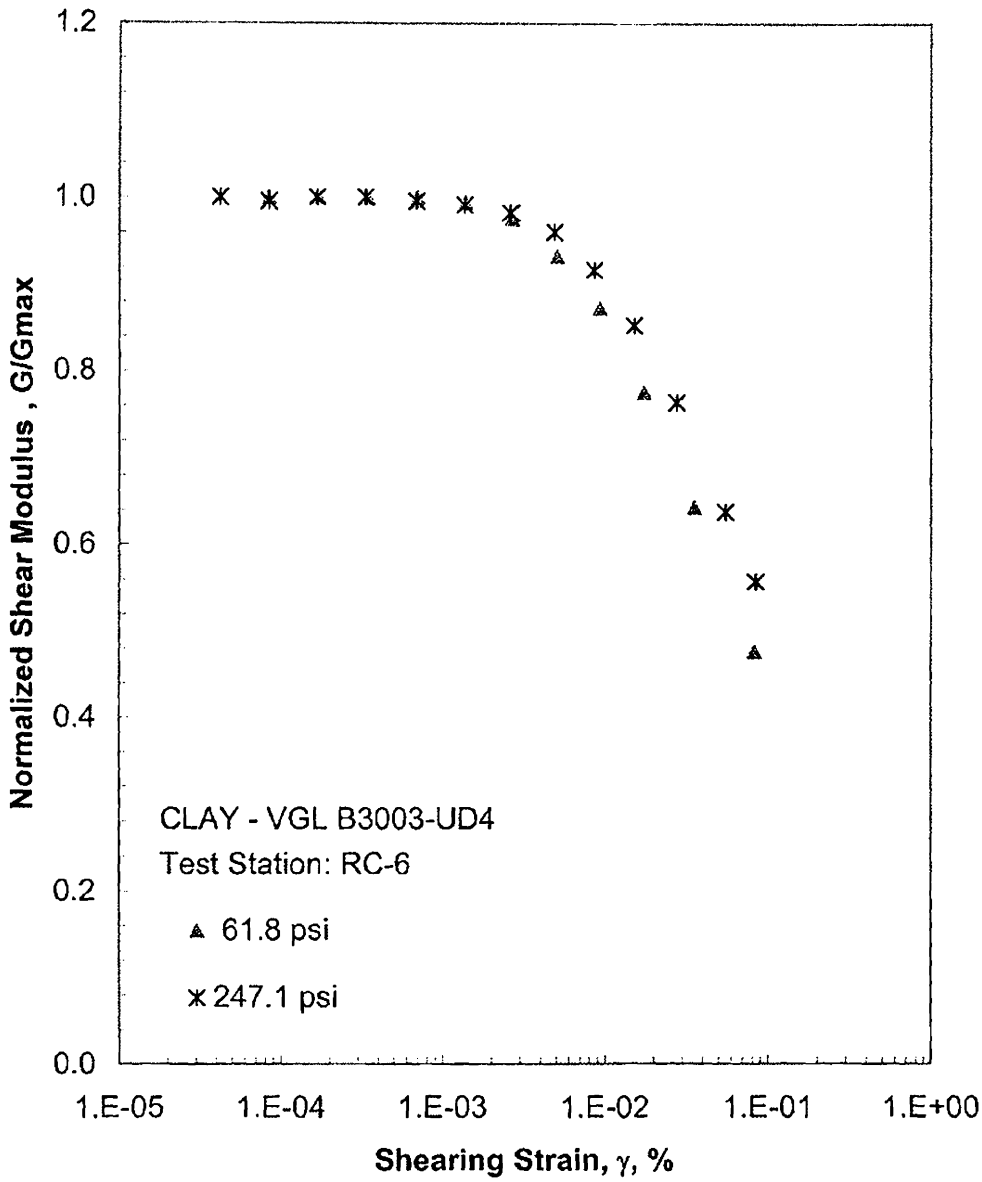


Figure A.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

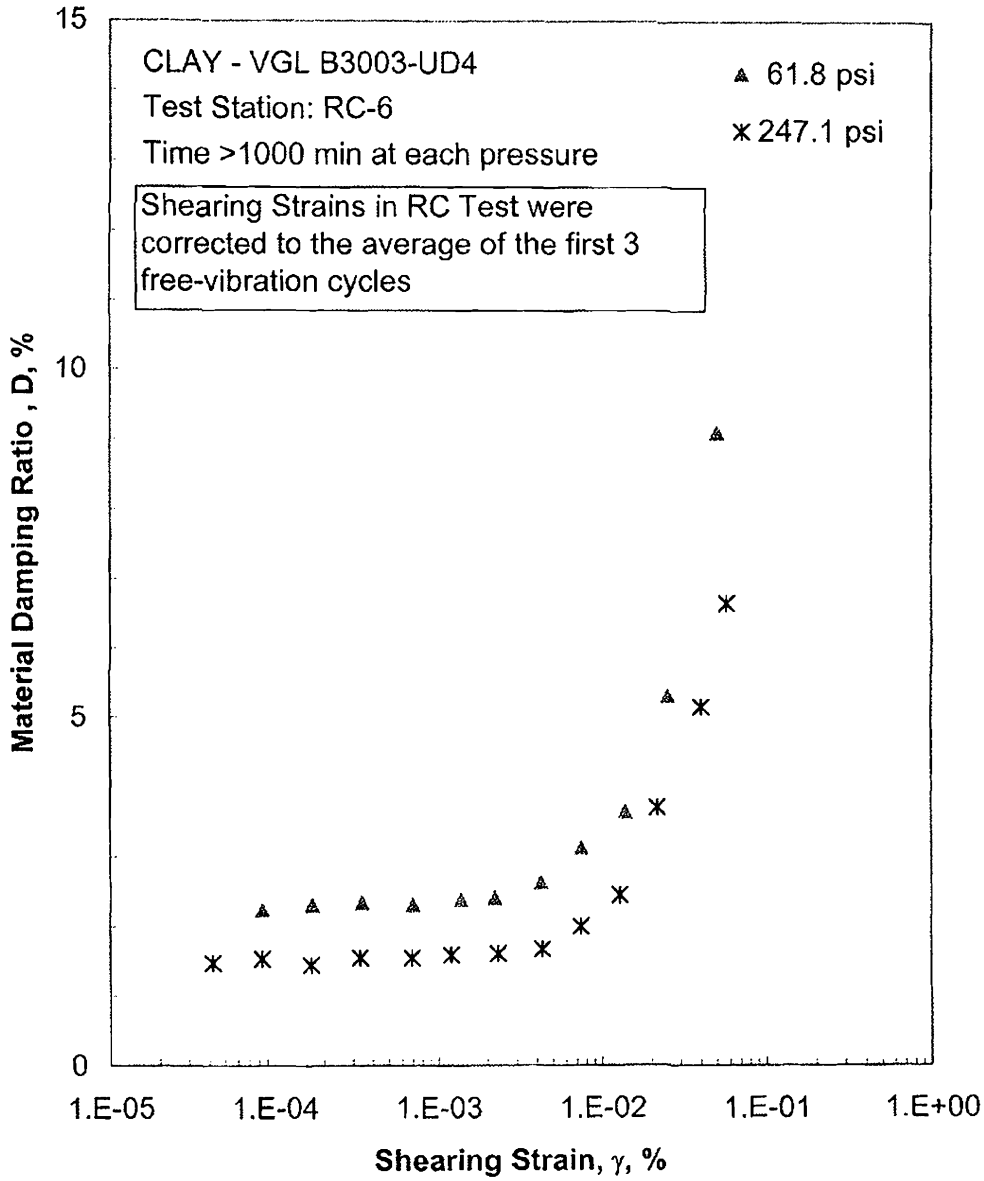


Figure B.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

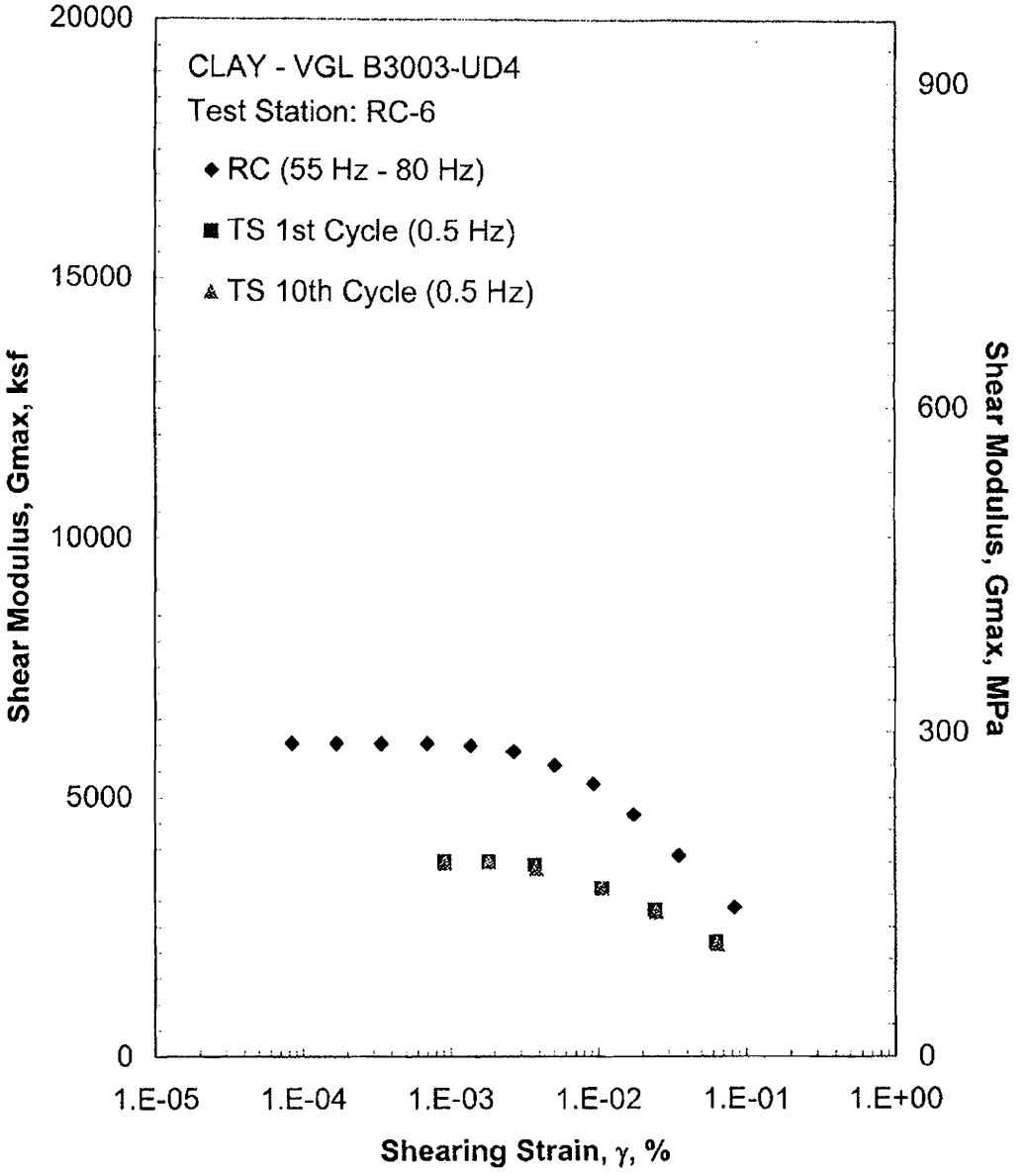


Figure B.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 61.8 psi from the Combined RCTS Tests

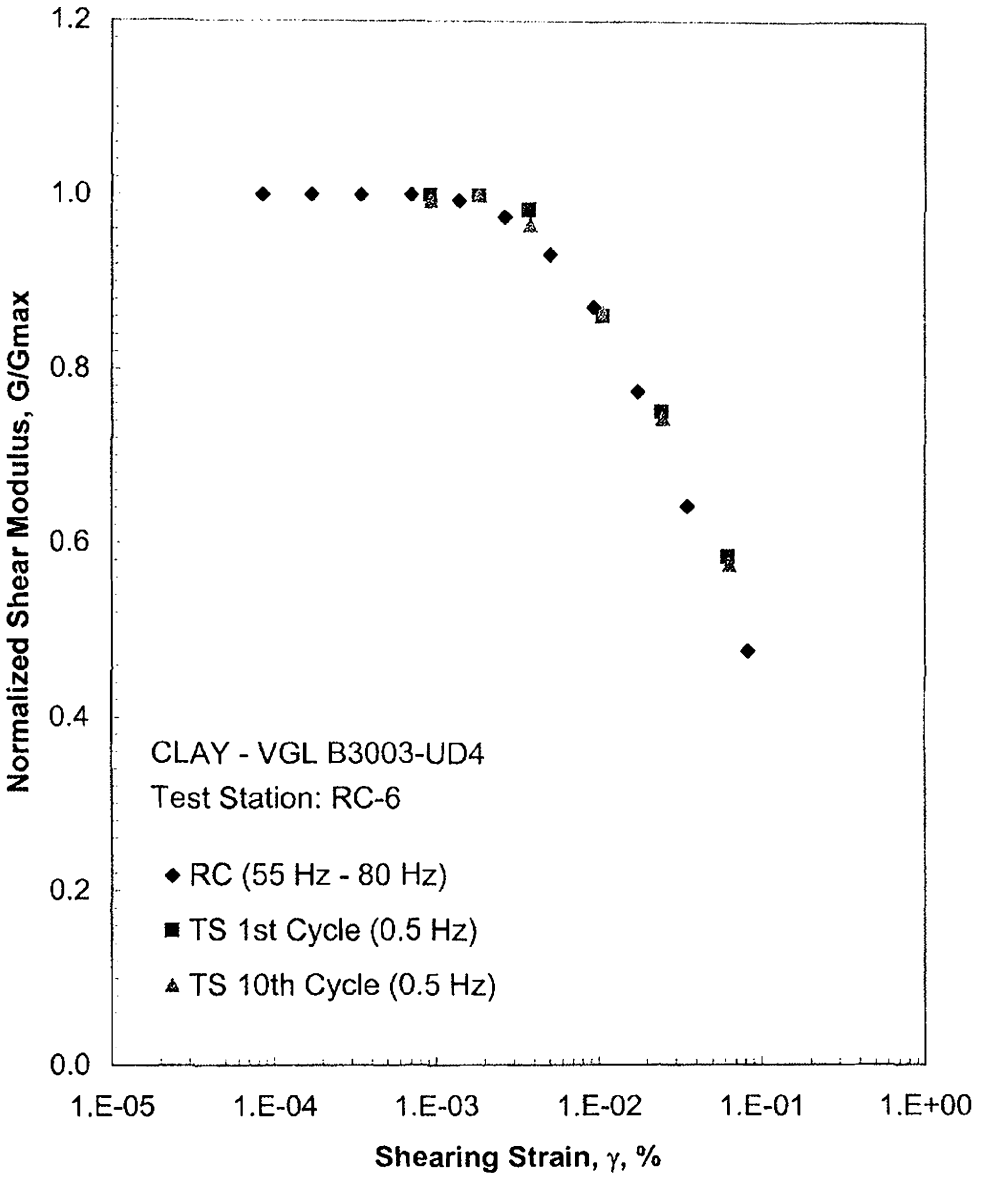


Figure B.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 61.8 psi from the Combined RCTS Tests

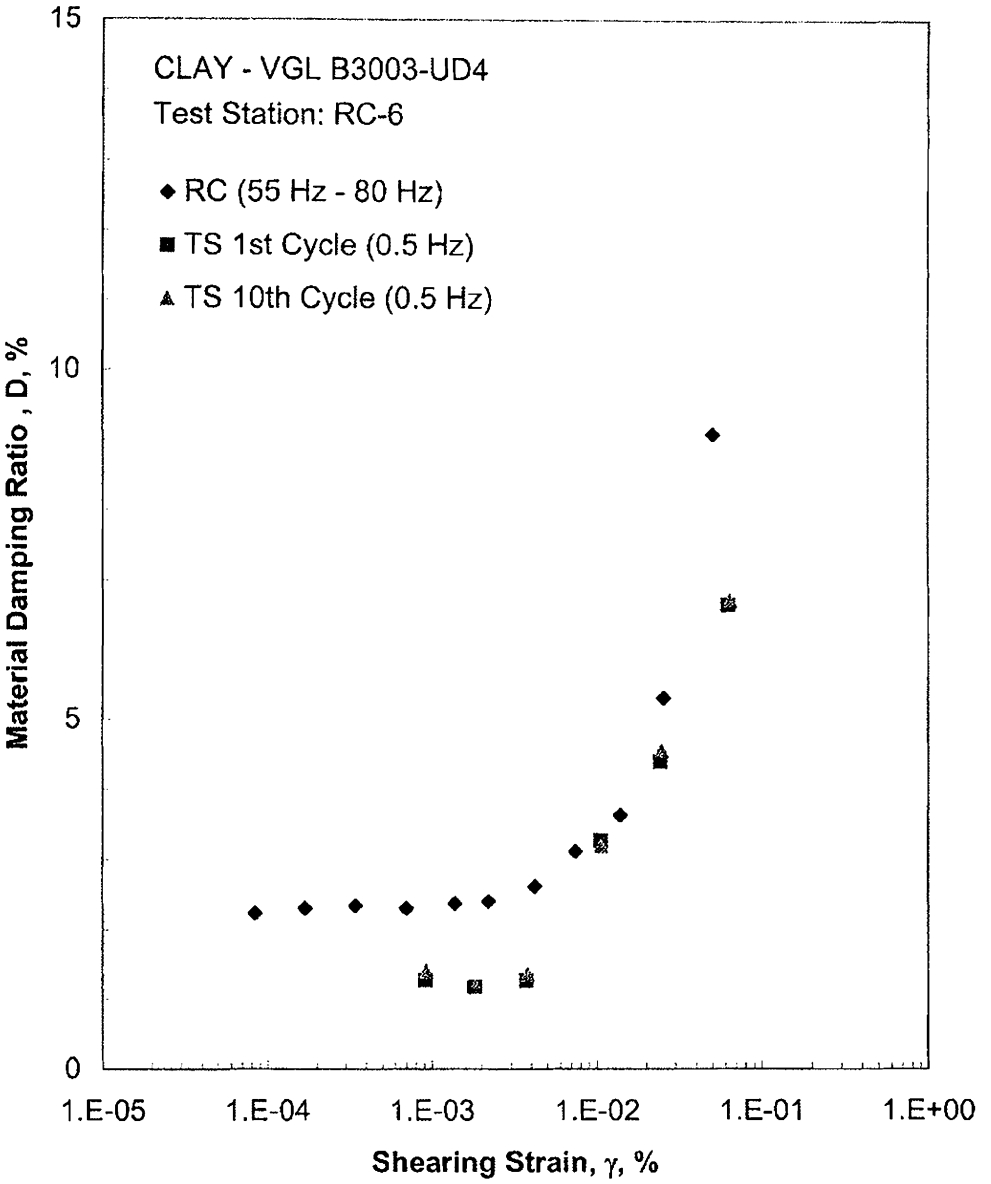


Figure B.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 61.8 psi from the Combined RCTS Tests

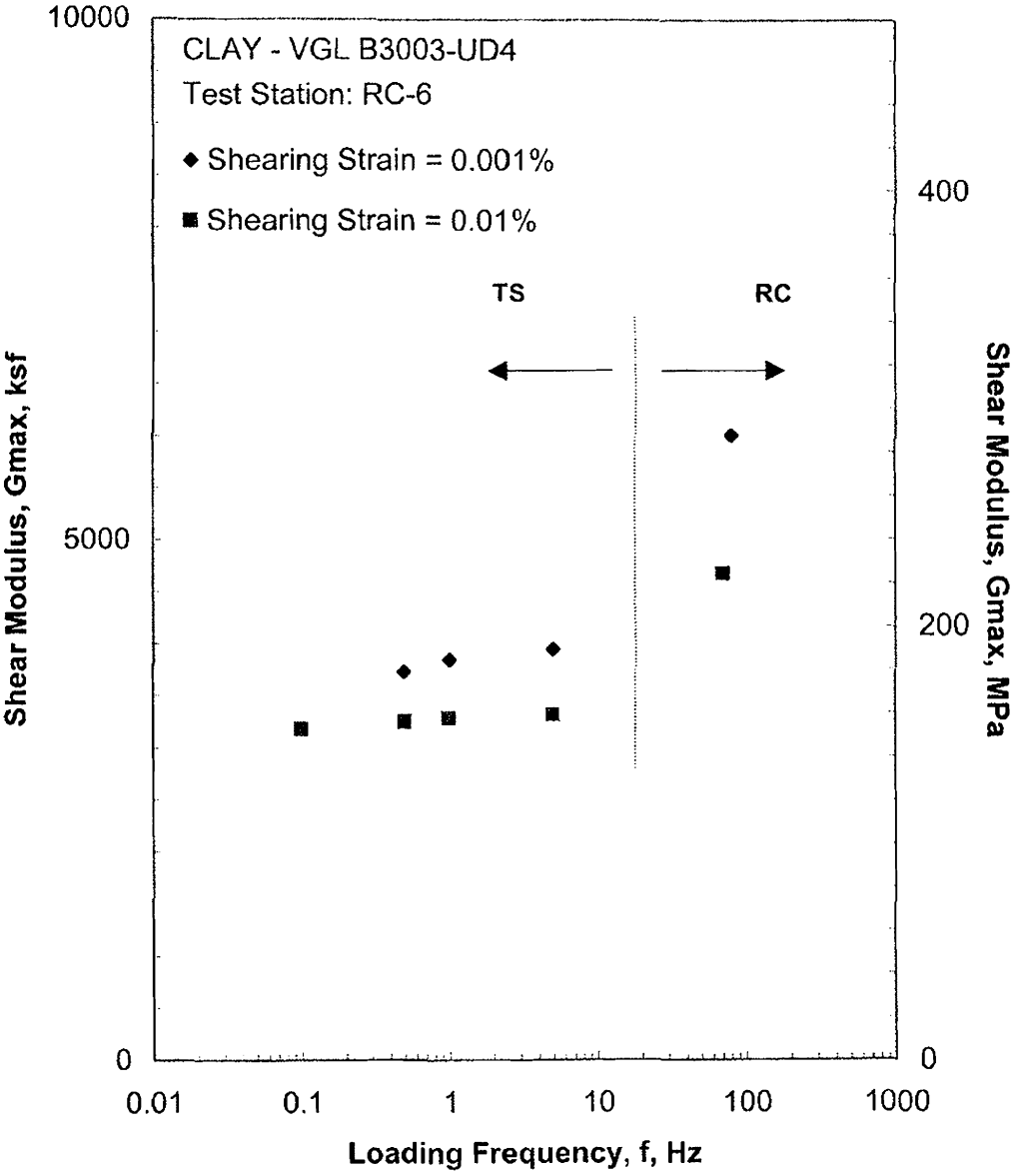


Figure B.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 61.8 psi from the Combined RCTS Tests

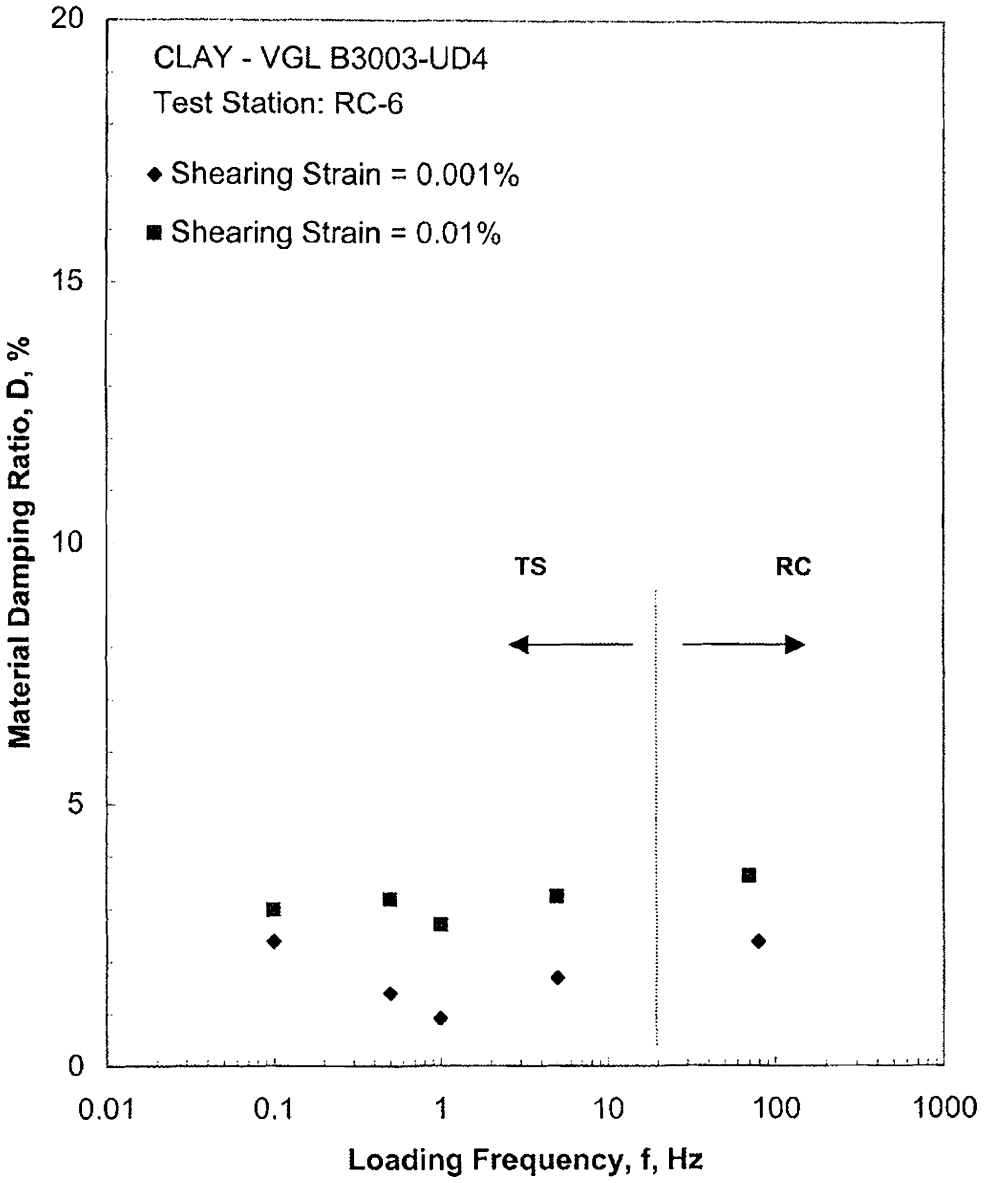


Figure B.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 61.8 psi from the Combined RCTS Tests

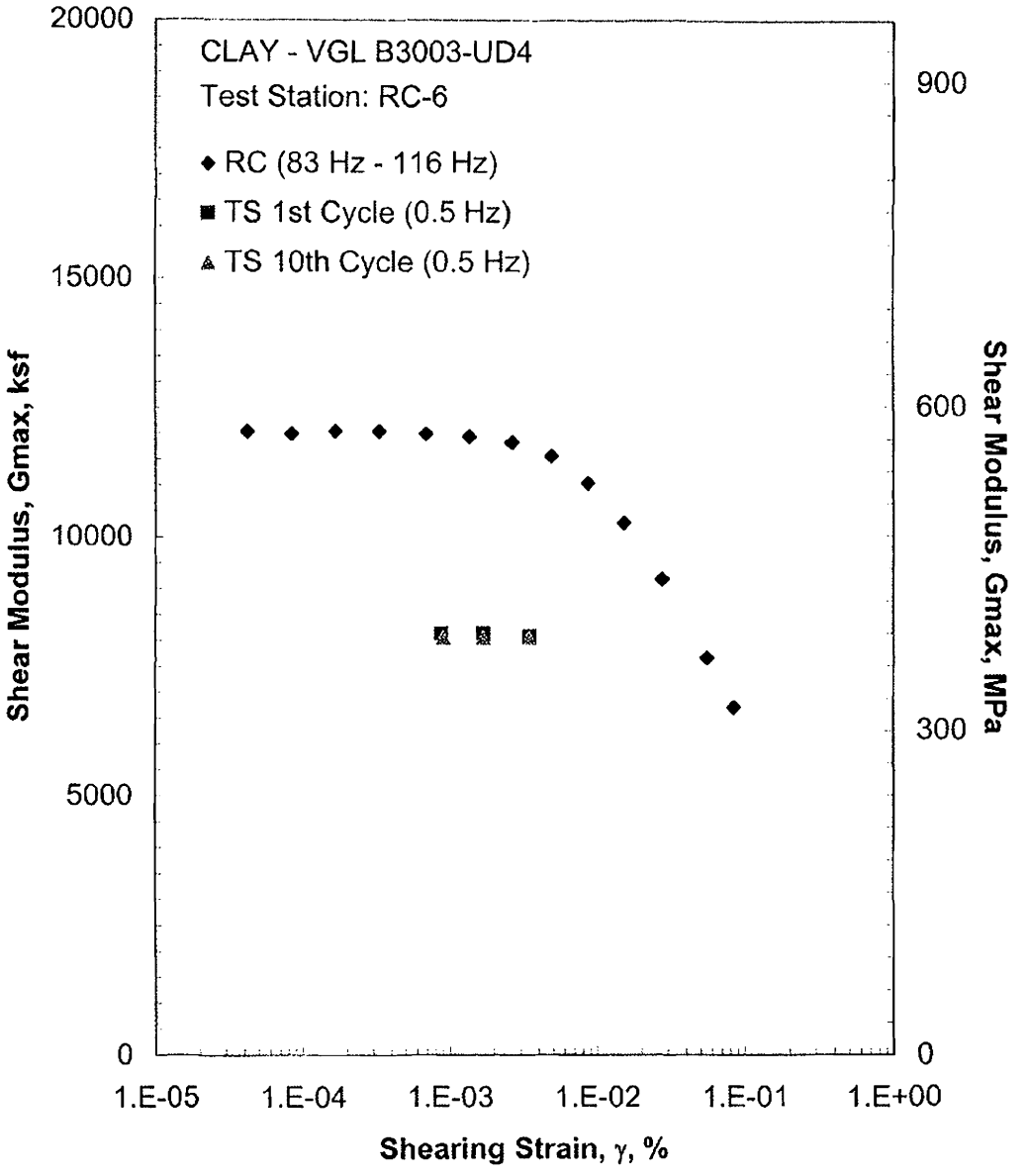


Figure B.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 247.1 psi from the Combined RCTS Tests

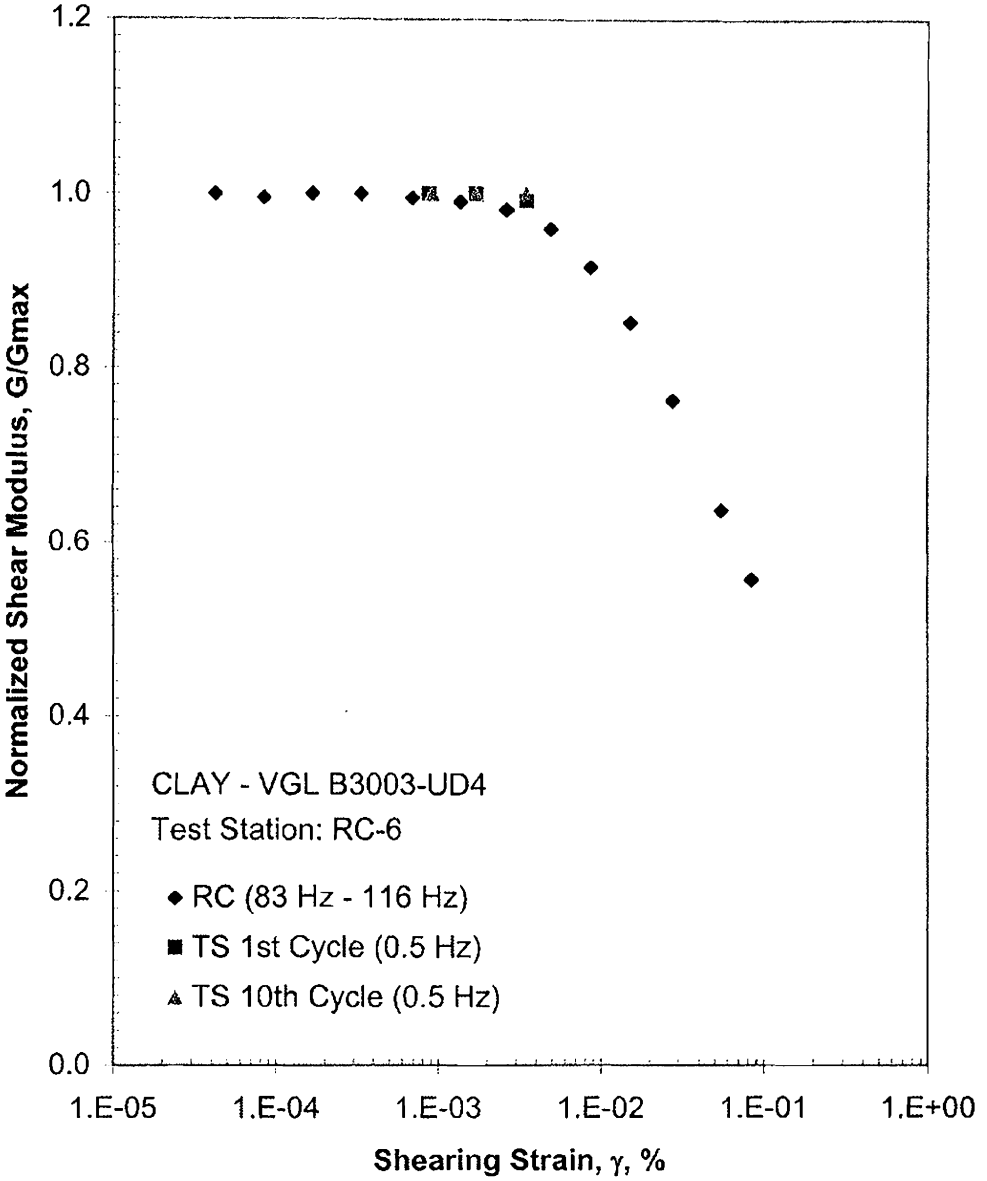


Figure B.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 247.1 psi from the Combined RCTS Tests

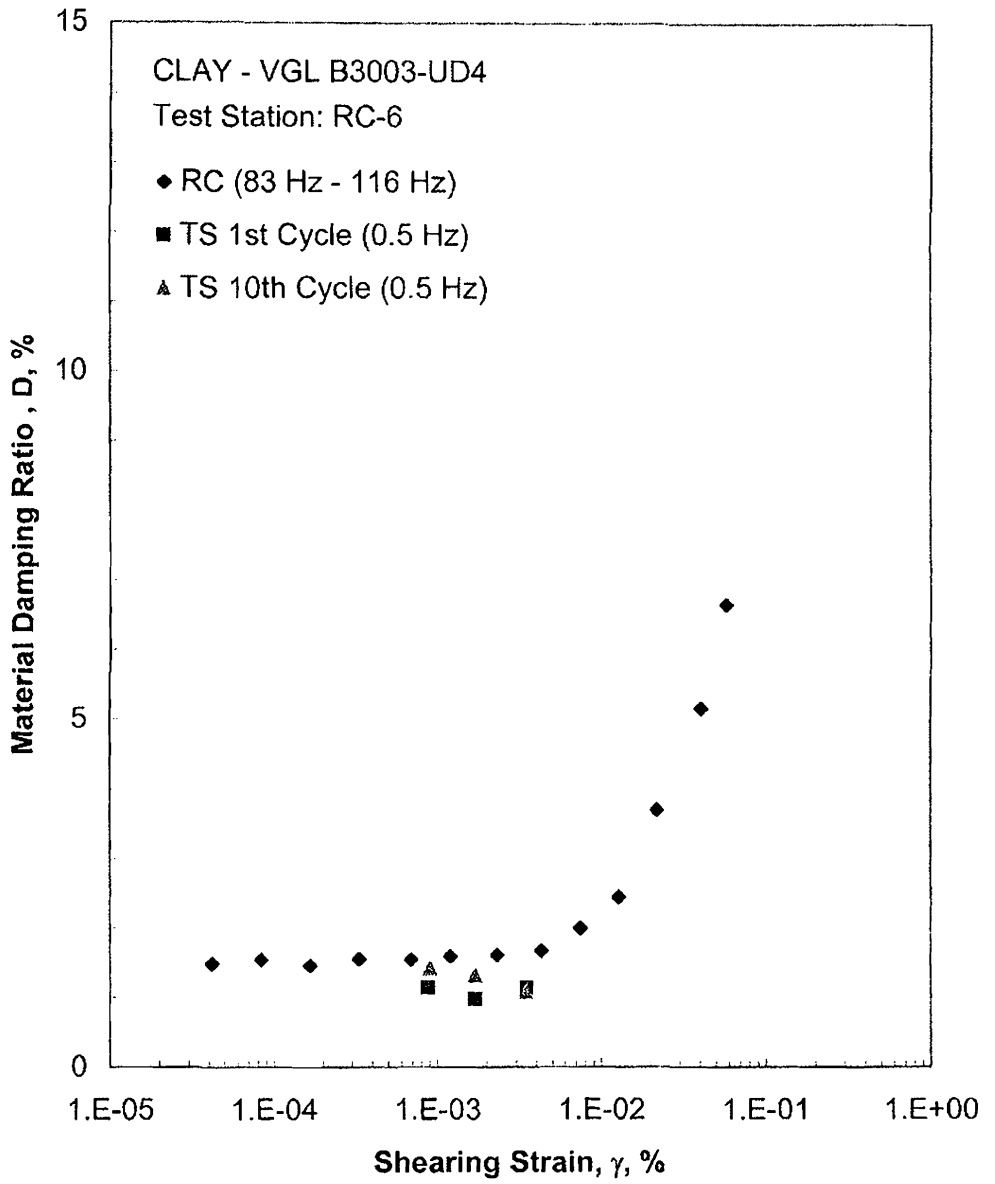


Figure B.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 247.1 psi from the Combined RCTS Tests

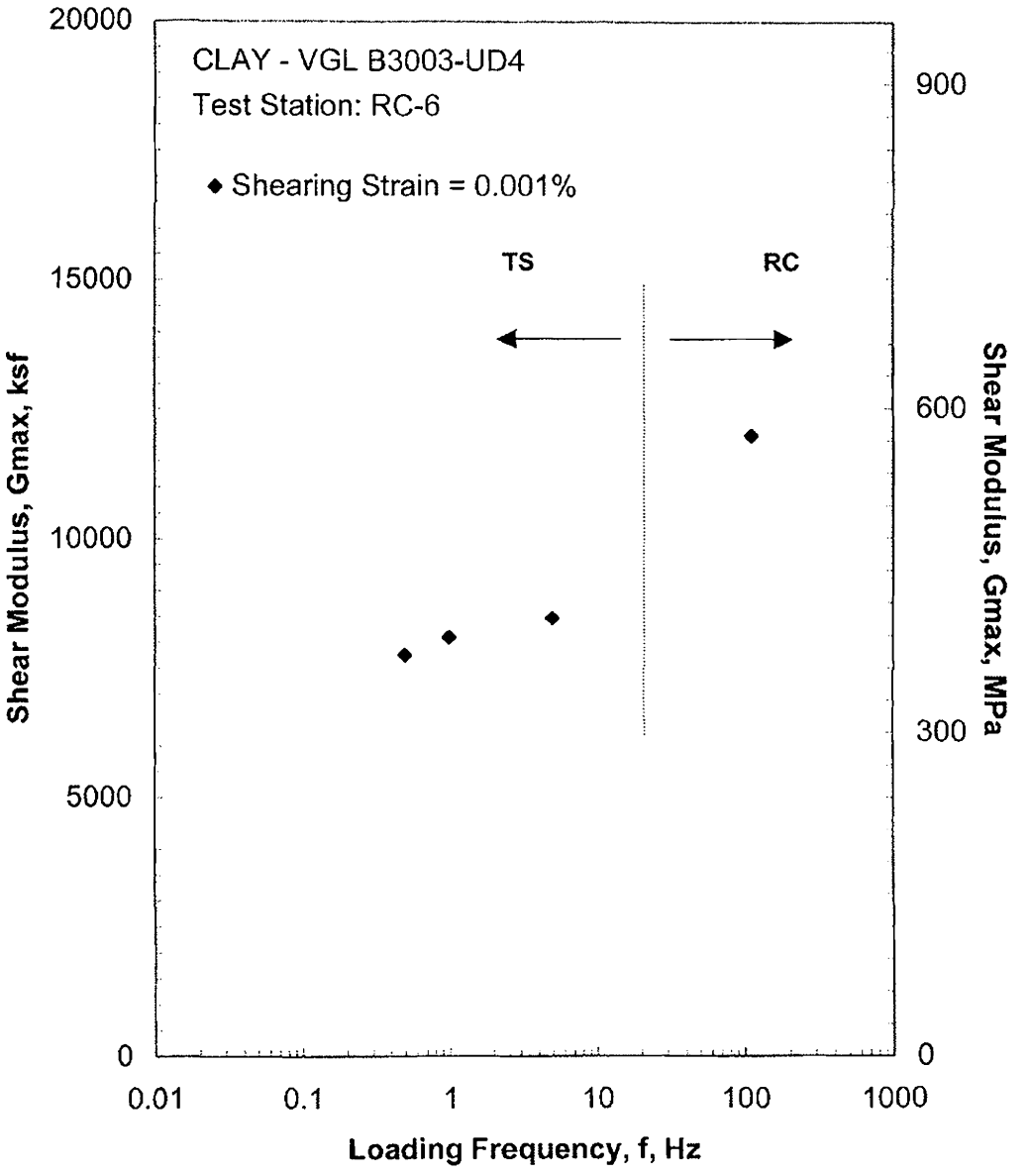


Figure B.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 247.1 psi from the Combined RCTS Tests

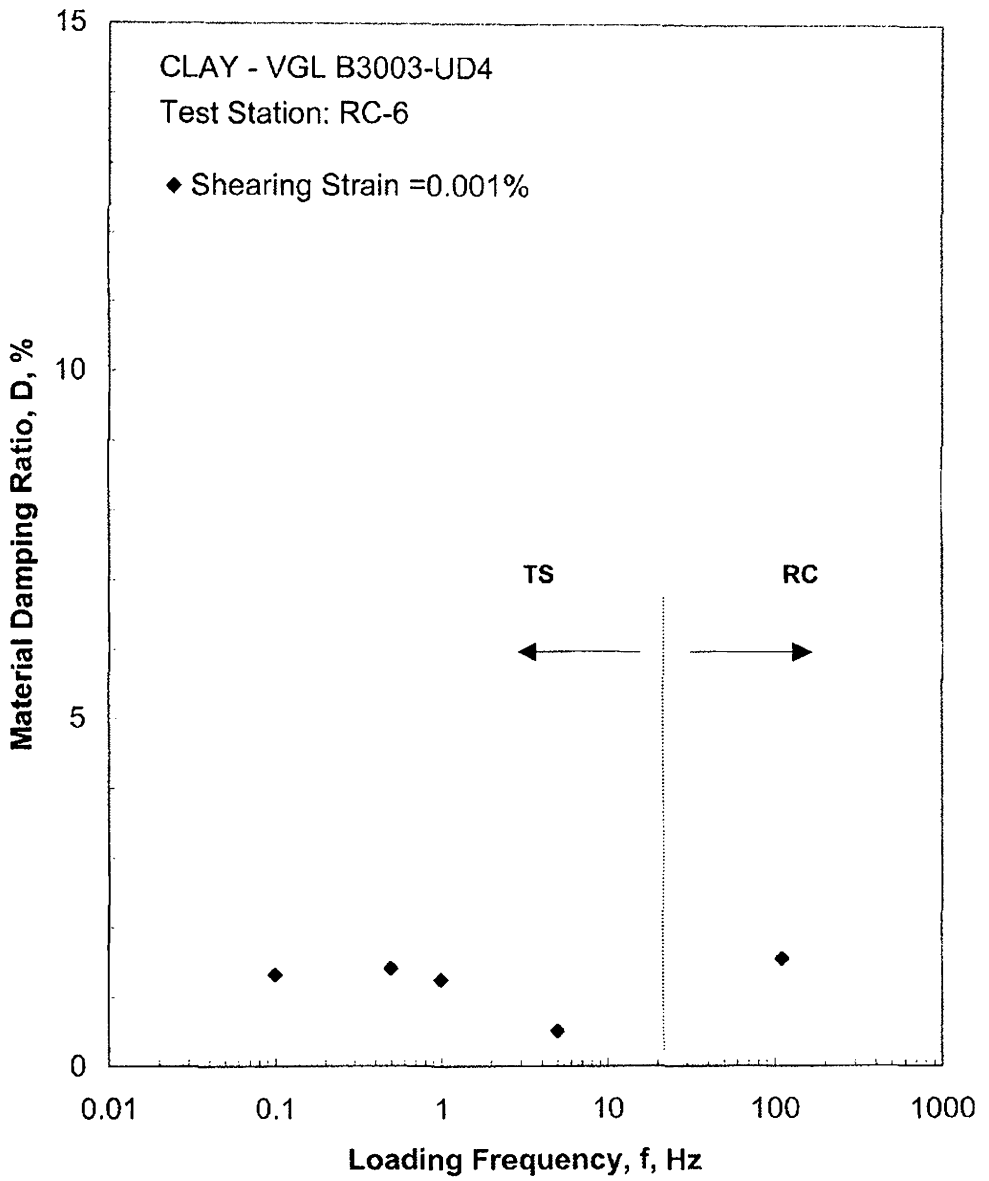


Figure B.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 247.1 psi from the Combined RCTS Tests

Table B.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen VGL B3003-UD4

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
15.4	2218	106	2848	137	880	3.24	0.815
30.9	4450	213	4193	201	1065	2.62	0.805
61.8	8899	426	5988	287	1268	2.18	0.793
123.5	17784	851	8548	410	1508	1.82	0.776
247.1	35582	1703	11830	568	1764	1.64	0.755

Table B.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen VGL B3003-UD4; Isoptropic Confining Pressure, σ_o=61.8 psi (8.9 ksf = 426 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
8.40E-05	6041	1.00	8.40E-05	2.24
1.69E-04	6041	1.00	1.69E-04	2.31
3.42E-04	6041	1.00	3.42E-04	2.34
7.00E-04	6041	1.00	7.00E-04	2.31
1.38E-03	6003	0.99	1.38E-03	2.38
2.68E-03	5889	0.97	2.22E-03	2.41
5.07E-03	5629	0.93	4.21E-03	2.62
9.34E-03	5267	0.87	7.47E-03	3.12
1.75E-02	4679	0.77	1.40E-02	3.64
3.54E-02	3879	0.64	2.55E-02	5.31
8.29E-02	2877	0.48	5.06E-02	9.08

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

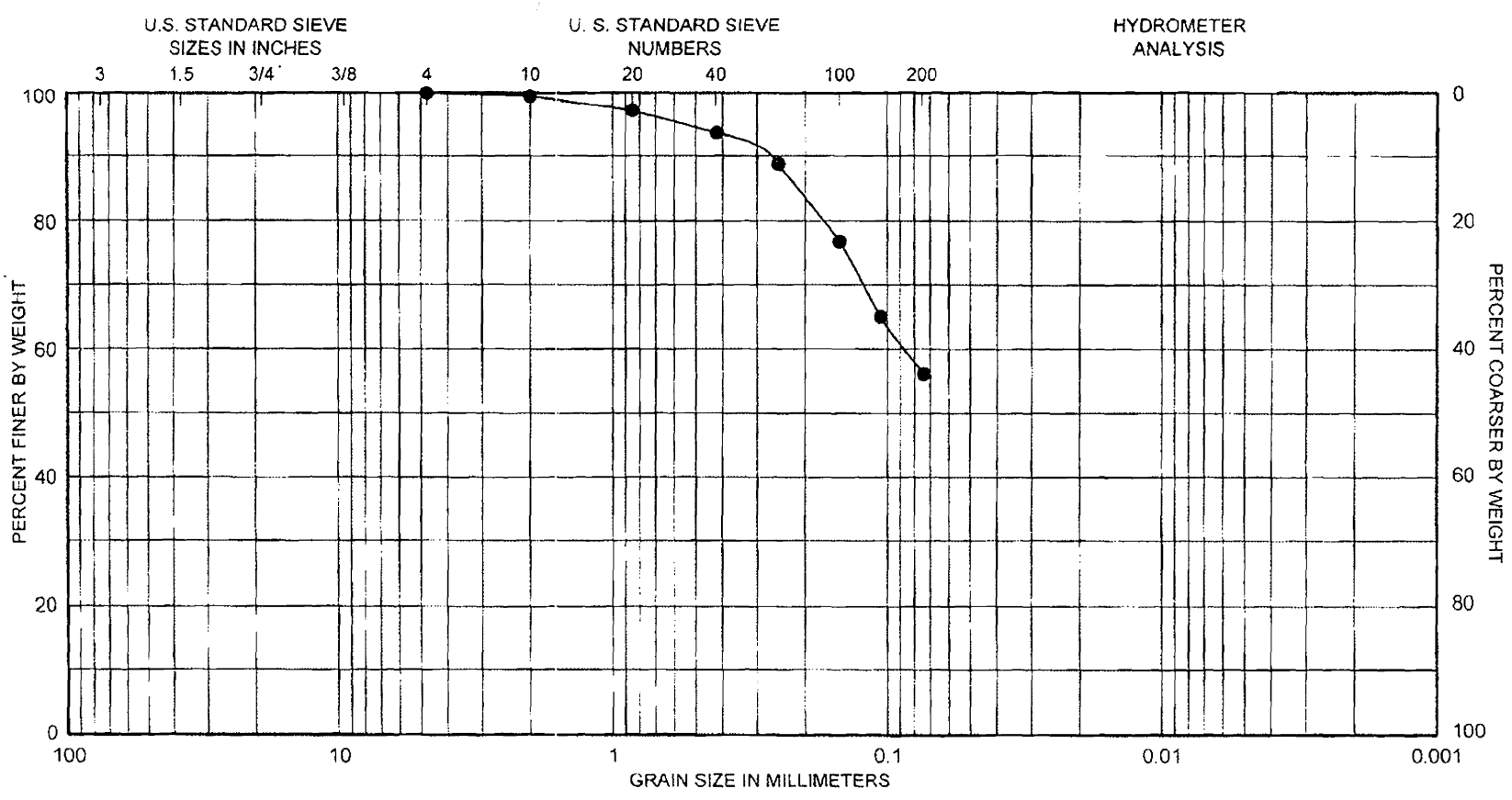
[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table B.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen VGL B3003-UD4; Isotropic Confining Pressure, σ_o = 61.8 psi (8.9 ksf =426 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
9.18E-04	3763	1.00	1.27	9.27E-04	3728	0.99	1.40
1.84E-03	3761	1.00	1.17	1.84E-03	3754	1.00	1.17
3.73E-03	3698	0.98	1.26	3.81E-03	3626	0.97	1.35
1.06E-02	3244	0.86	3.27	1.06E-02	3249	0.87	3.20
2.44E-02	2831	0.75	4.40	2.47E-02	2792	0.74	4.55
6.27E-02	2201	0.58	6.64	6.39E-02	2160	0.58	6.71

Table B.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen VGL B3003-UD4; Isotropic Confining Pressure, σ_o=247.1 psi (35.6 ksf = 1703 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
8.78E-04	8141	1.00	1.14	9.08E-04	8057	1.00	1.42
1.71E-03	8141	1.00	0.97	1.71E-03	8057	1.00	1.32
3.49E-03	8079	0.99	1.14	3.46E-03	8057	1.00	1.08



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-3003-UD4	135.5				0.29	Fine Sandy Clay, gray

GRAIN SIZE CURVE

FUGRO CONSULTANTS, INC.

6100 Hillcroft (77081)
P.O. Box 740010
Houston, Texas 77274
Tel: 713-369-5400
Fax: 713-369-5518

October 18, 2007

Mr. Wm. Allen Lancaster
MACTEC Engineering and Consulting, Inc.
396 Plasters Avenue
Atlanta, Georgia 30324

RE: Four (4) Reports For The Vogtle (a.k.a. VGL) Project

Dear Mr. Lancaster:

Fugro has completed four (4) RCTS tests, which are B3003-UD3, B4003-UD3, B3002-UD3, and B3003-UD7, for the VGL project. Fugro has incorporated, as needed, Dr. Kenneth Stokoe's comments into the final reports. The final reports and the associated RCTS Test Approval by Dr. Kenneth Stokoe have been attached.

Please let us know if you have questions. Thanks.

Very truly yours,

Fugro Consultants, Inc.

Jiewu Meng, PhD, P.E.
Project Engineer

Bill DeGroff, P.E.
Laboratory Department Manager

Enclosures

A member of the Fugro group of companies with offices throughout the world.

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RCTS TEST APROVAL

PROJECT SITE/NAME	VOGTLE

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#C	B3003-UD3	109.7	KHS +	5 Sept. 07

The RCTS test for the site referenced above was tested, and a report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe

Dr. Kenneth Stokoe

+ Minor suggestions and comments.

RCTS TEST APROVAL

PROJECT SITE/NAME	VOGTLE

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#D	B4003-UD3	159.0	KHS	29 Sept. '07
RCTS#E	---	---	---	---
RCTS#F	B3003-UD7	215.5	KHS	29 Sept '07

The RCTS tests for the site referenced above were tested, and reports were prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe II

Dr. Kenneth Stokoe

RCTS TEST APROVAL

PROJECT SITE/NAME	VGL

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#E	B3002-UD3	185.0	KHS	29 Sept '07

One RCTS test for the site referenced above was tested, and one report was prepared, by Fugro Consultants, Inc.

I have reviewed the data and associated results listed above and found them to be reasonable.

Approved By:

K. H. Stokoe

Dr. Kenneth Stokoe

APPENDIX C

Specimen VGL B3003-UD3
(LL=74, PI=46;Gs=2.65)

Borehole B3003
Sample UD3
Depth = 109.7 ft (33.4 m)
Total Unit Weight = 113.8 lb/ft^3
Water Content = 33.6%
Estimated In-Situ Ko = 0.7
Estimated In-Situ Mean Effective
Stress = 53.1 psi

FUGRO JOB #: 0401-1667
Testing Station: RC6

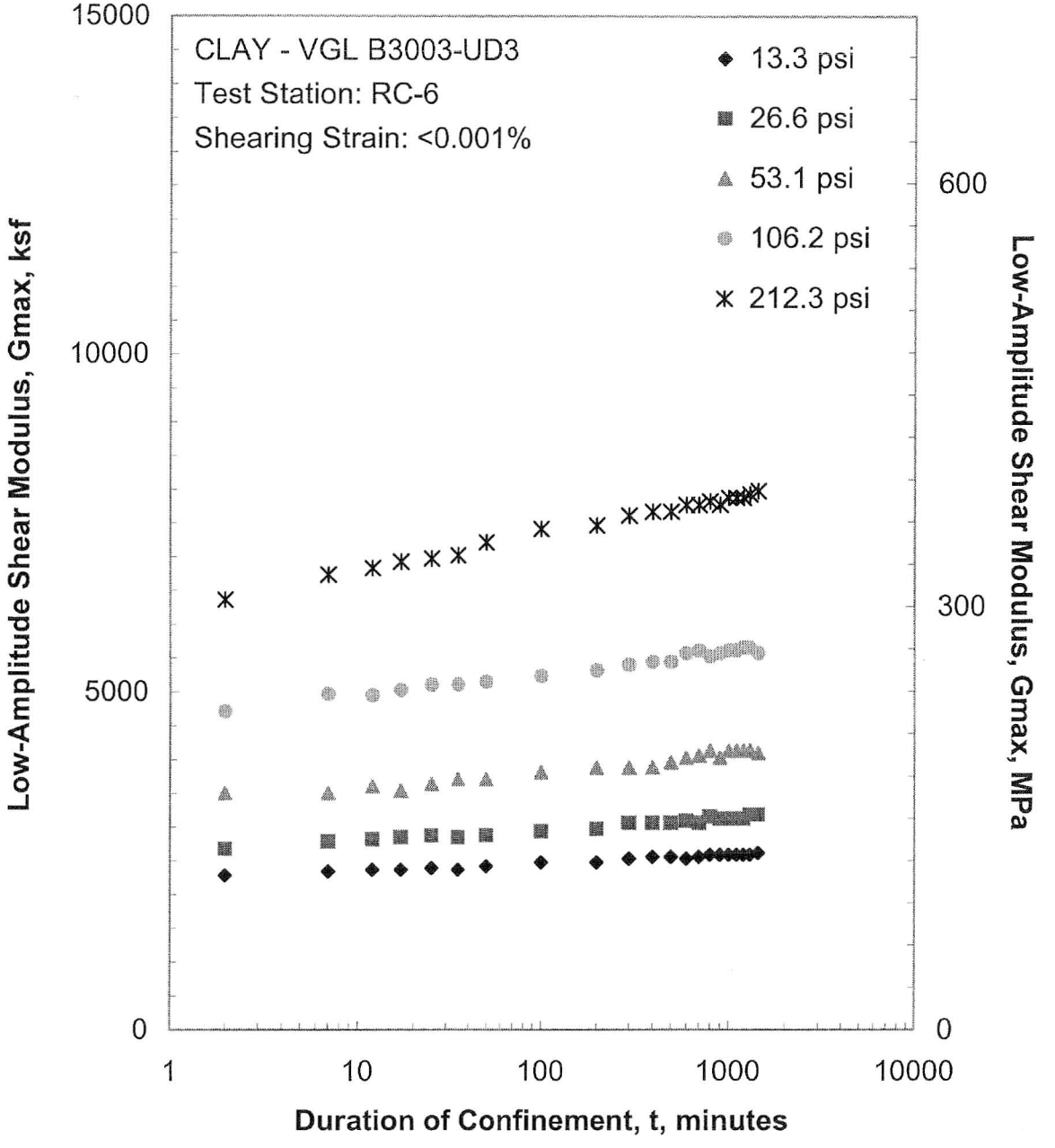


Figure C.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

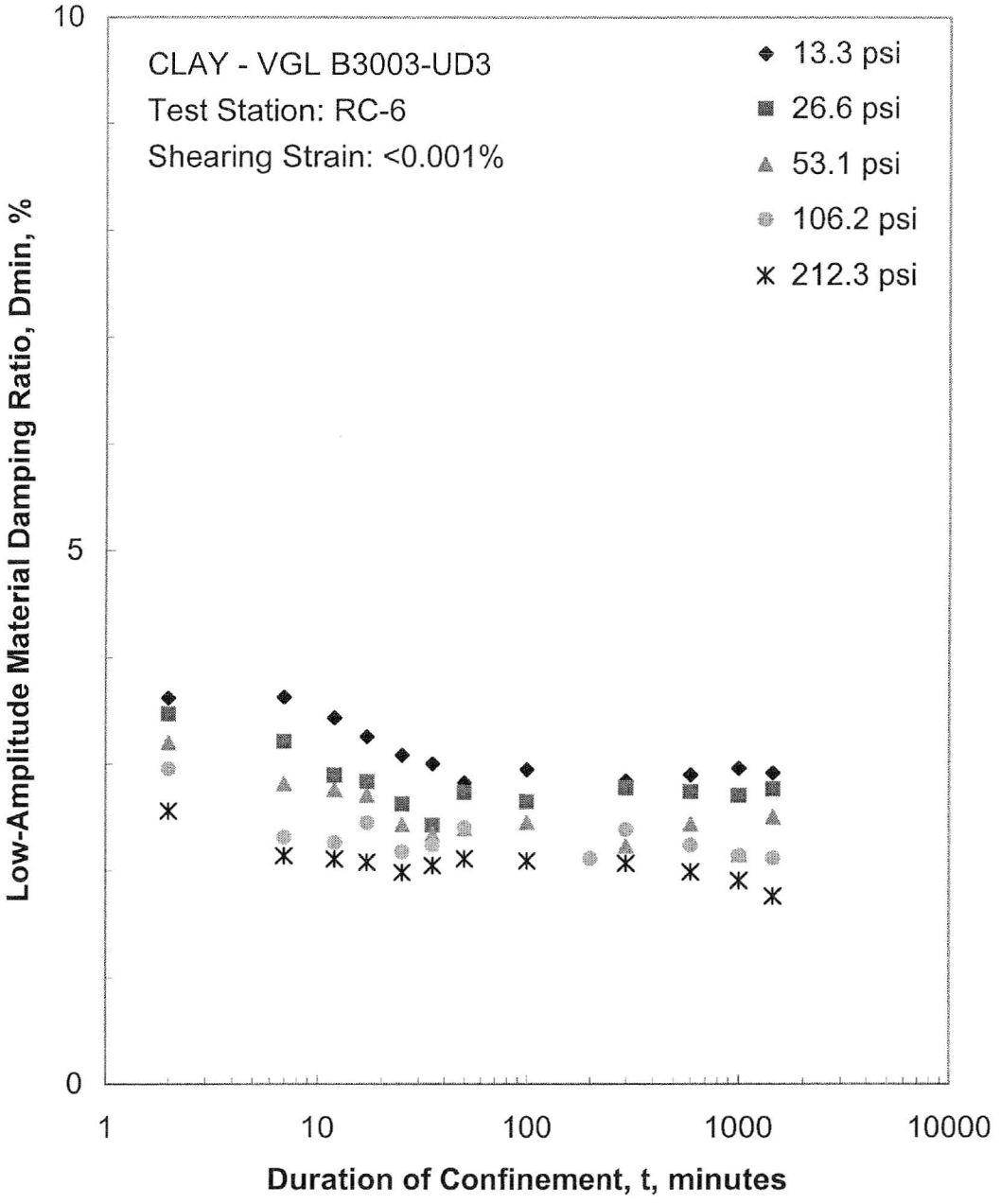


Figure C.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

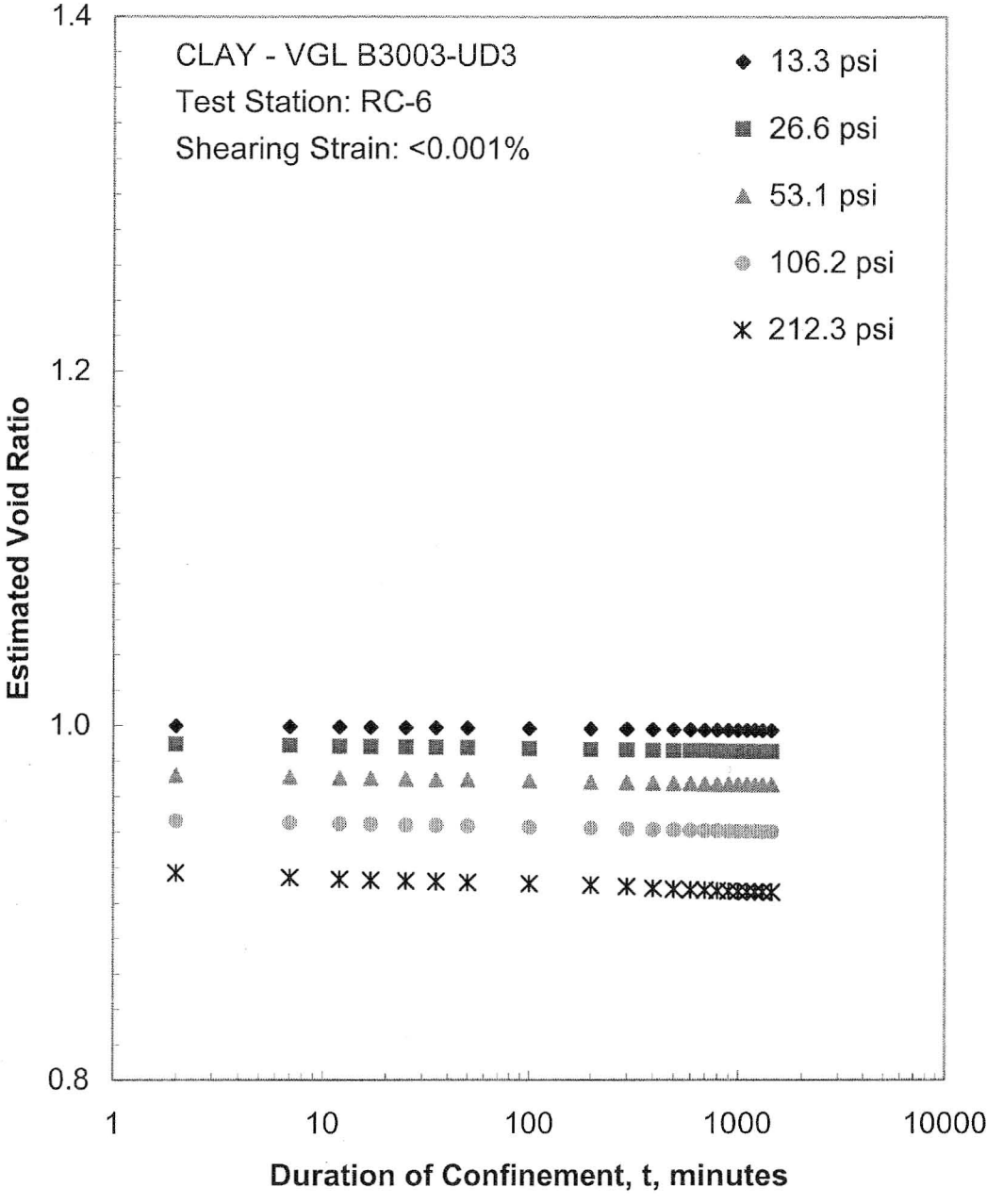


Figure C.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

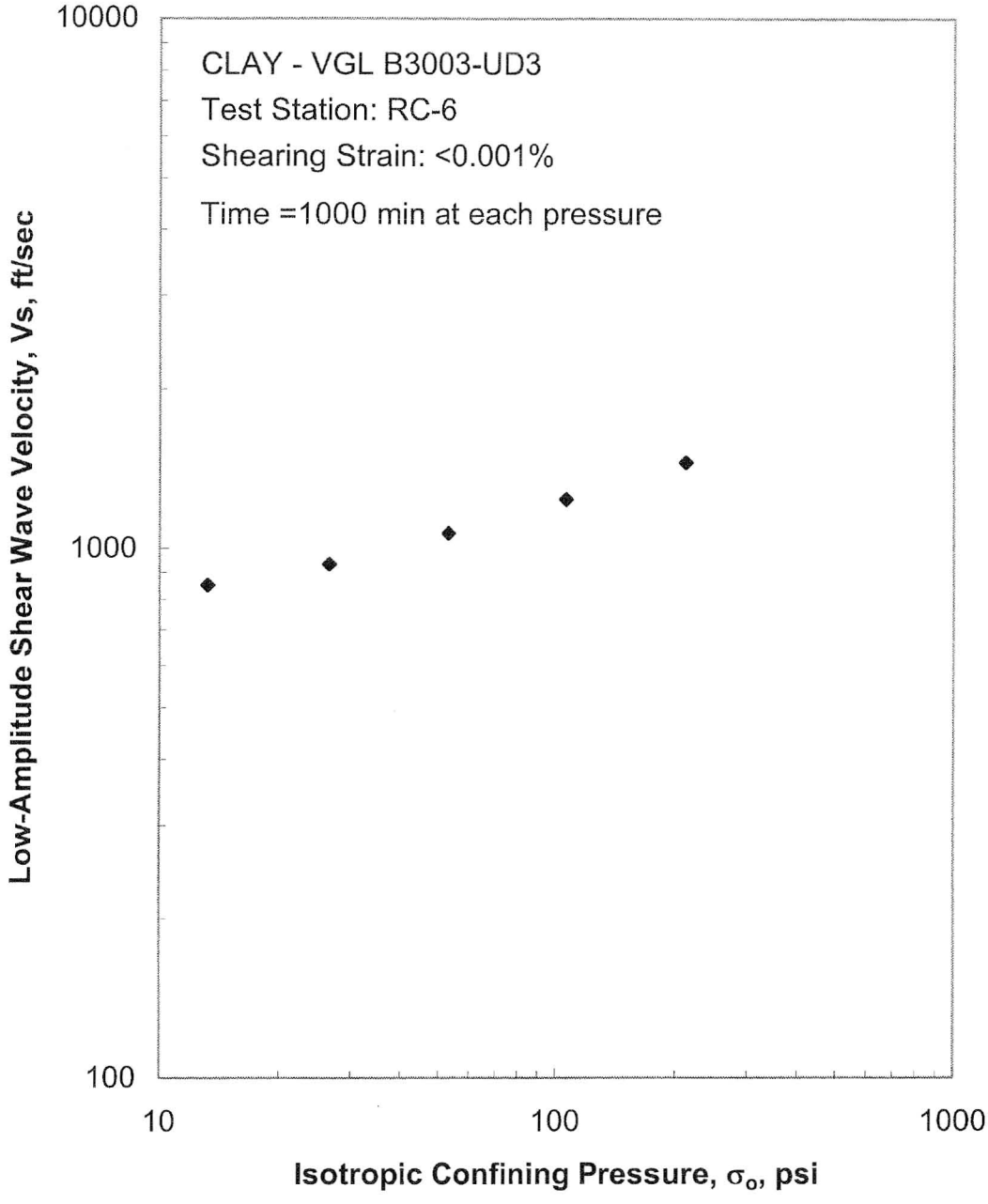


Figure C.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

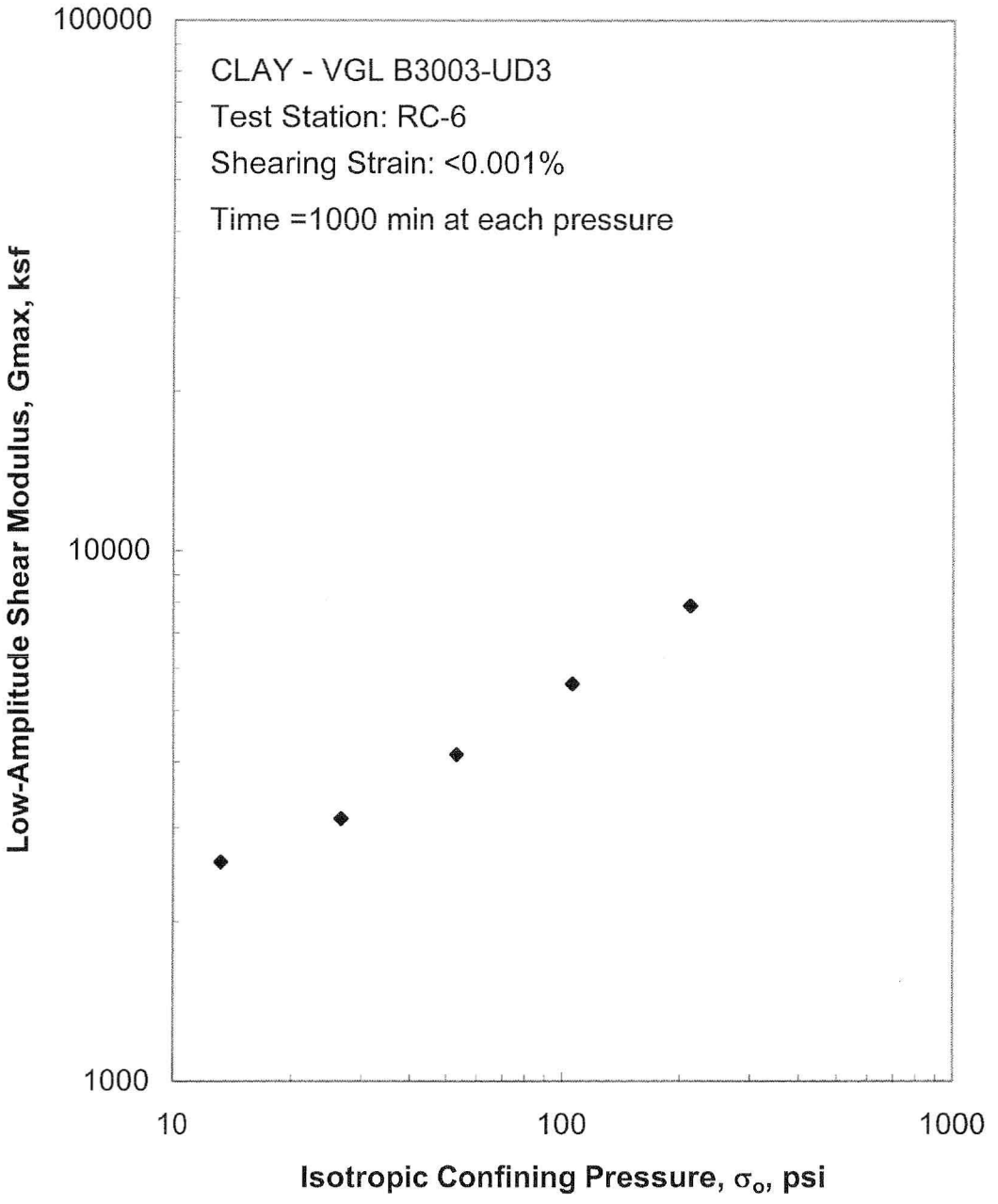


Figure C.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

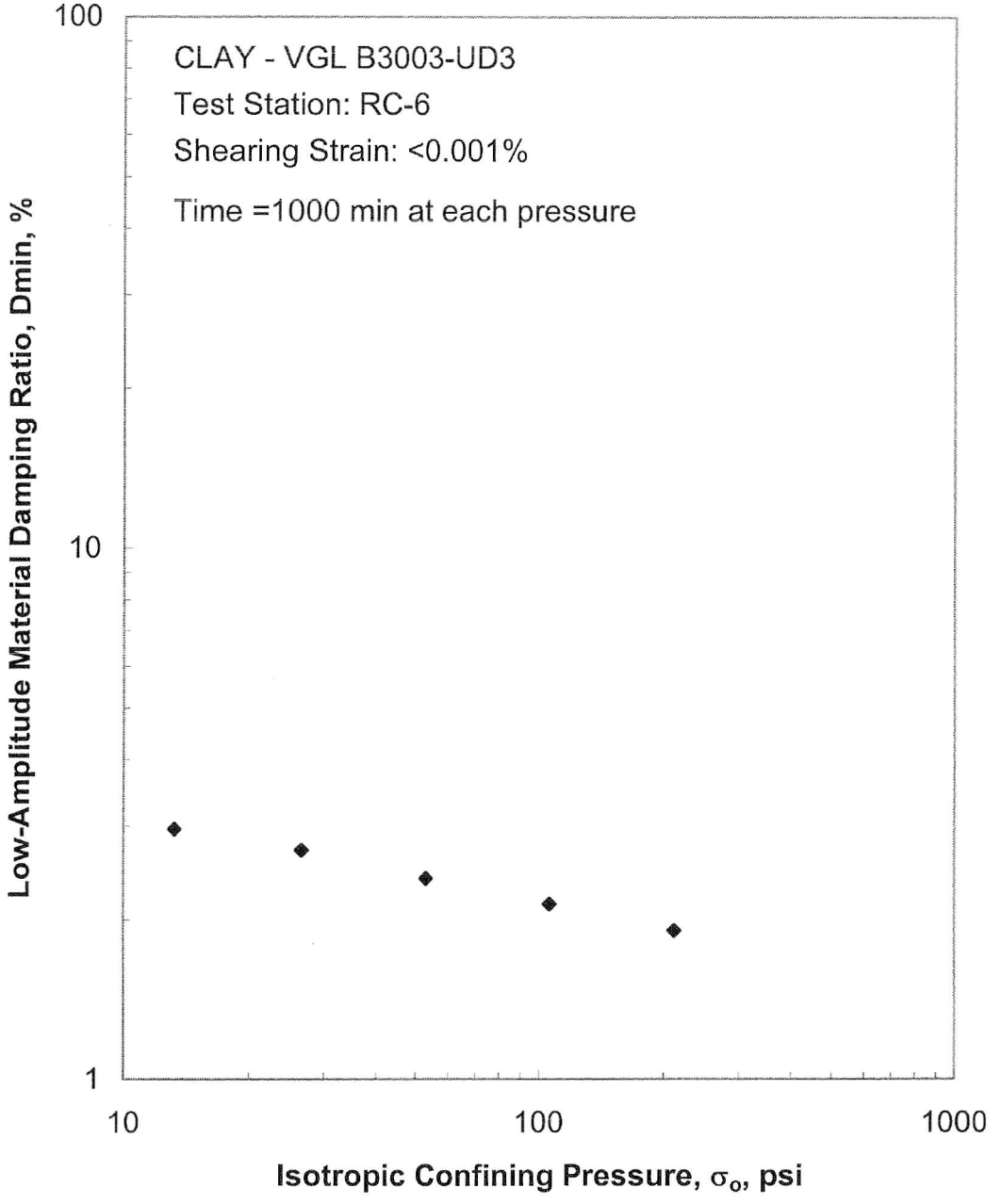


Figure C.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

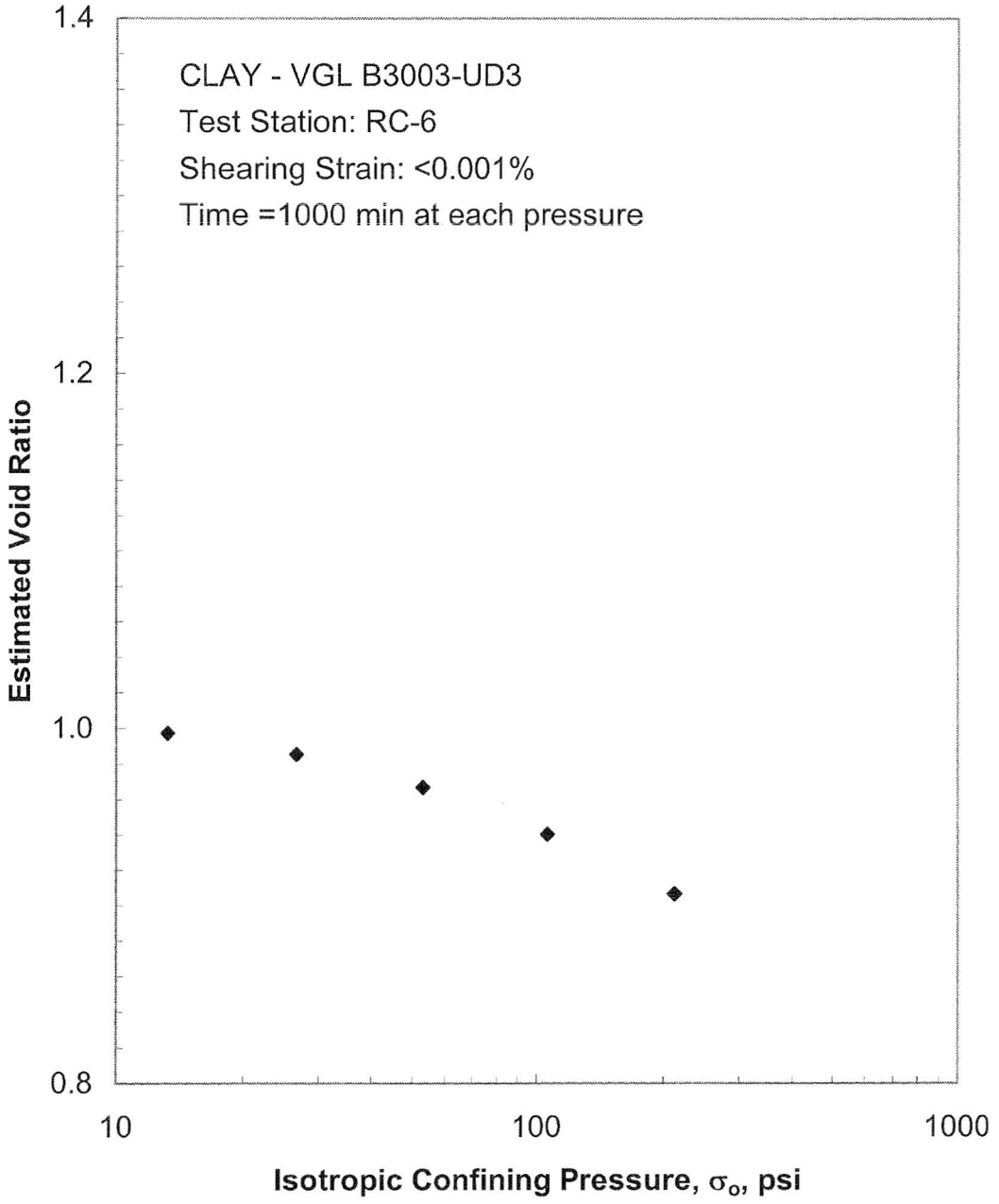


Figure C.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

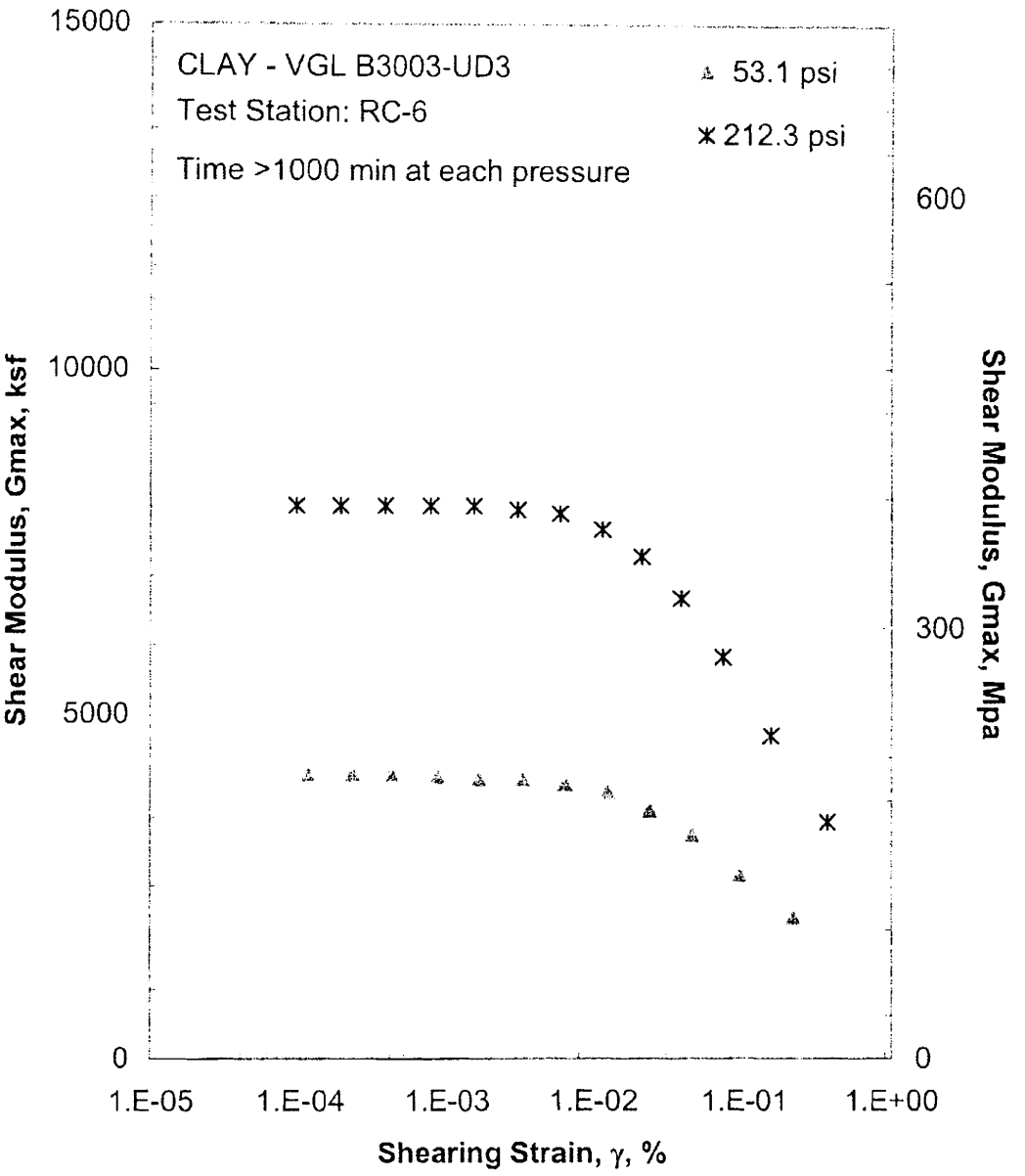


Figure C.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

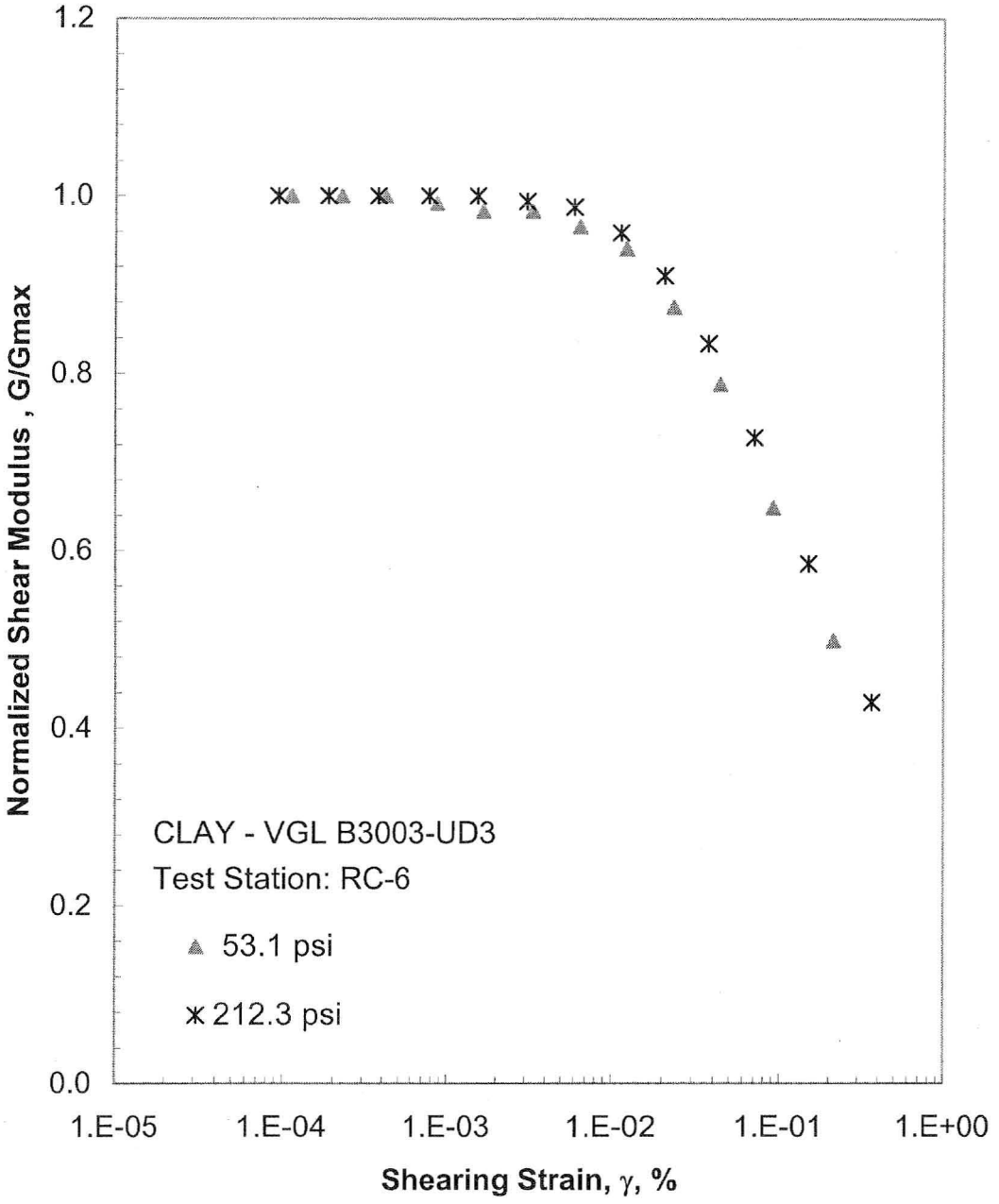


Figure C.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

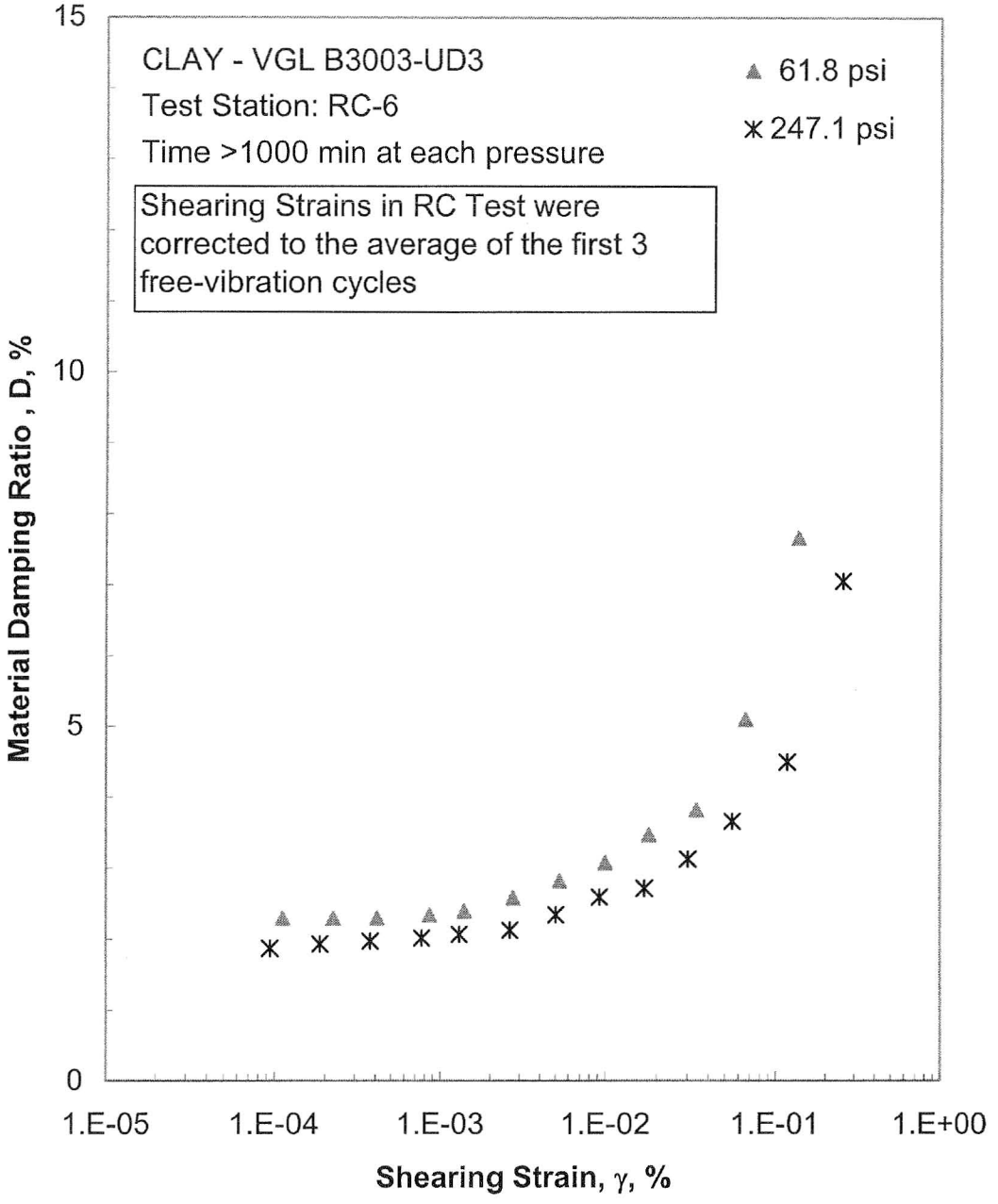


Figure C.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

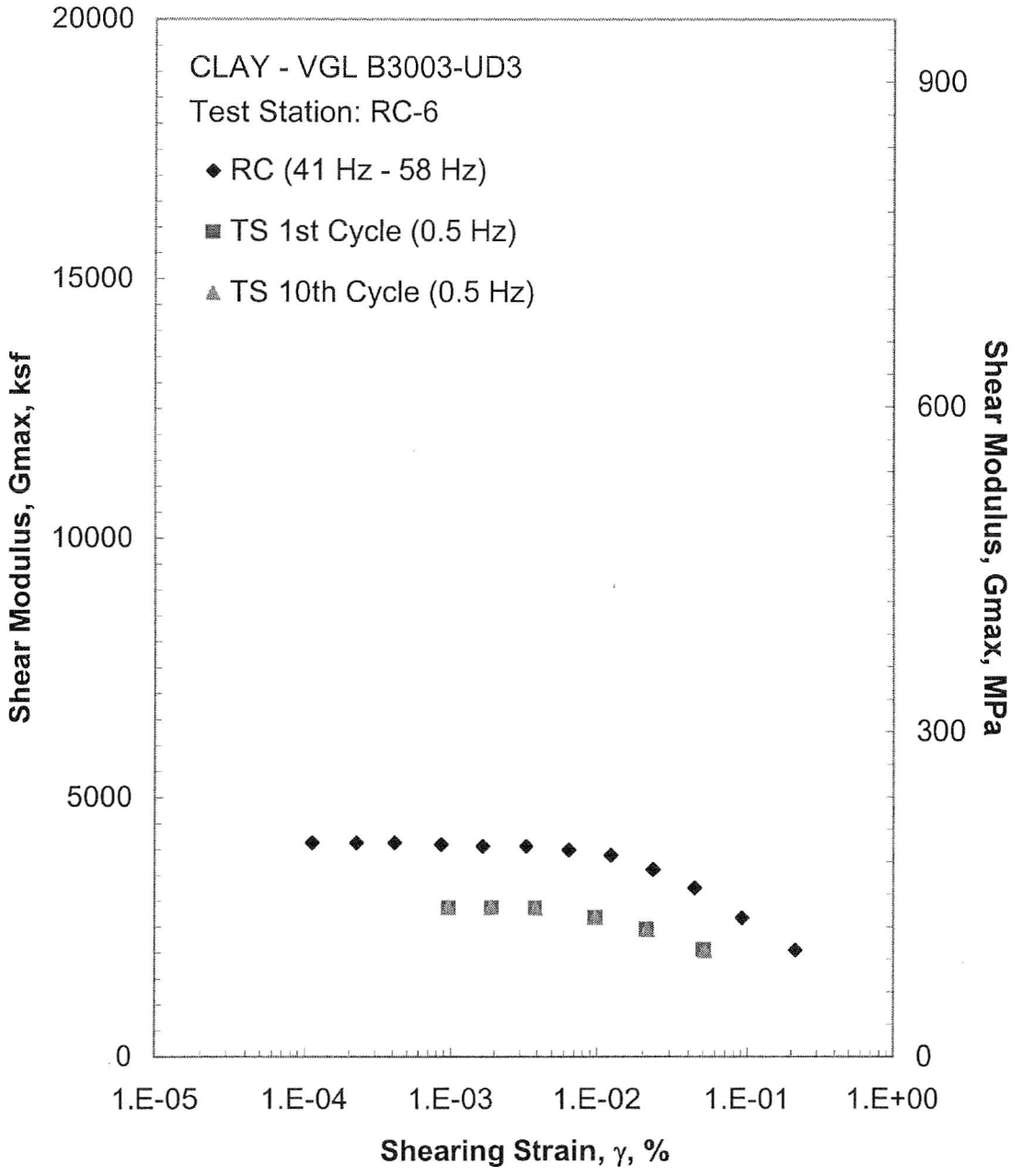


Figure C.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 53.1 psi from the Combined RCTS Tests

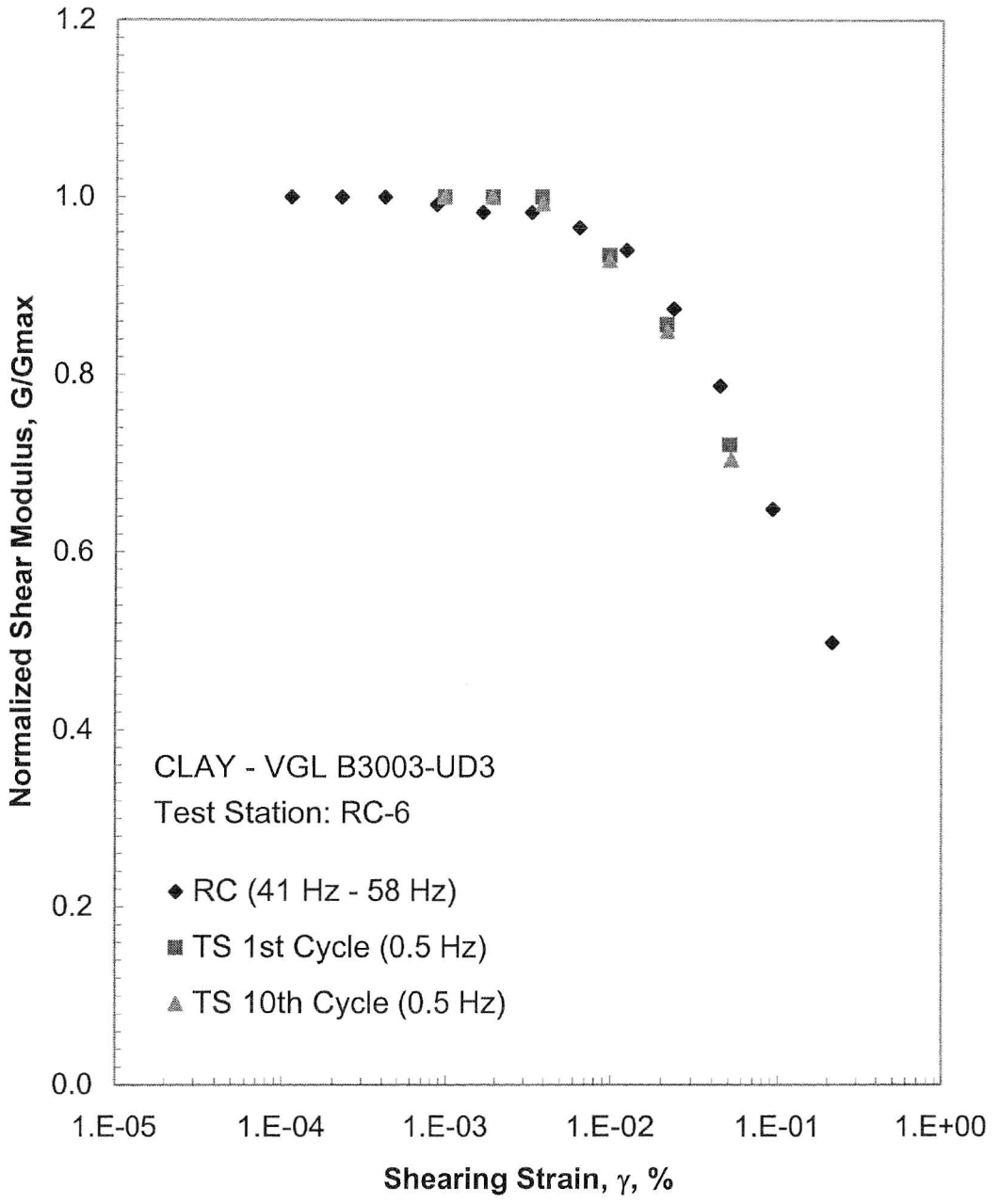


Figure C.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 53.1 psi from the Combined RCTS Tests

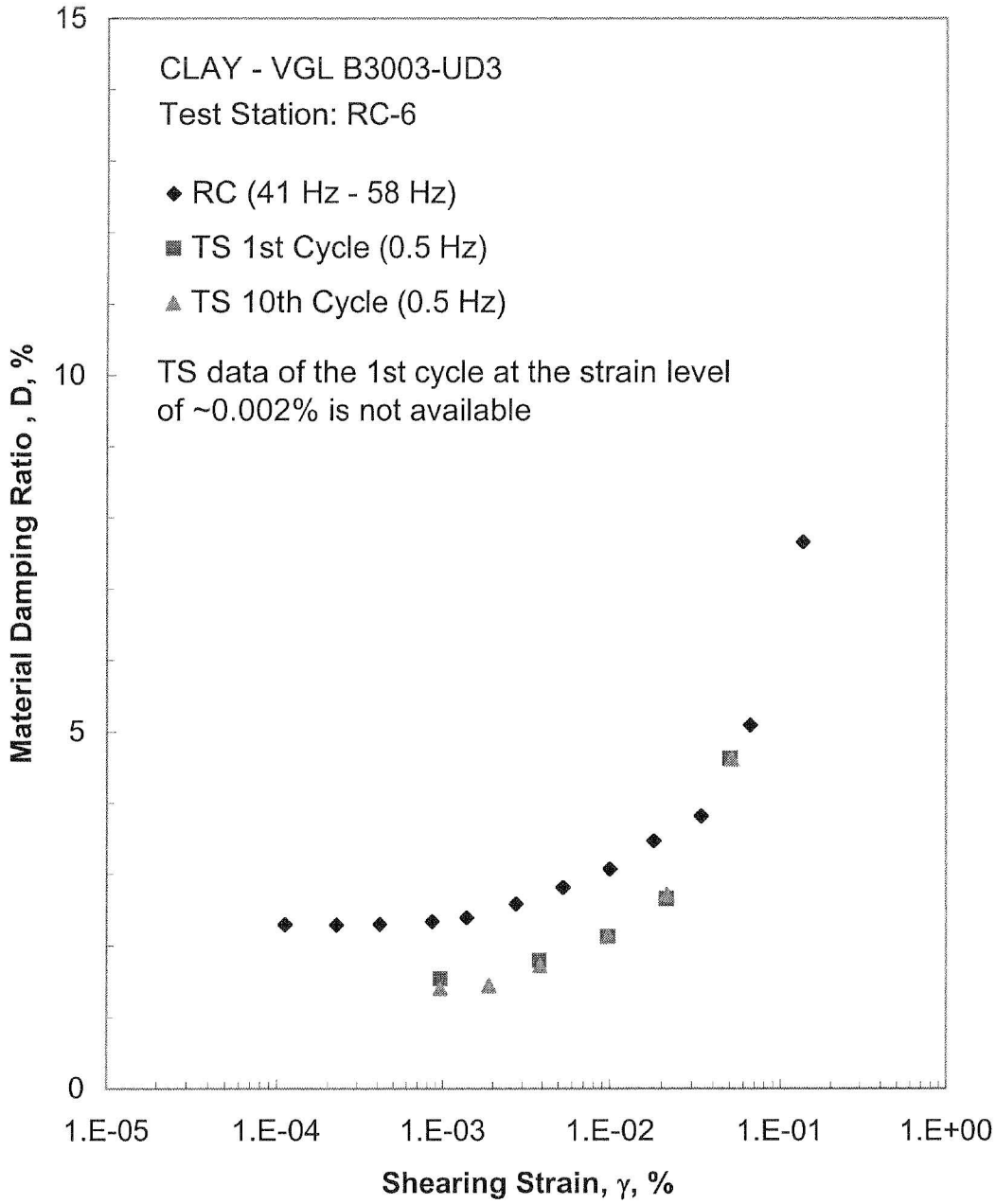


Figure C.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 53.1 psi from the Combined RCTS Tests

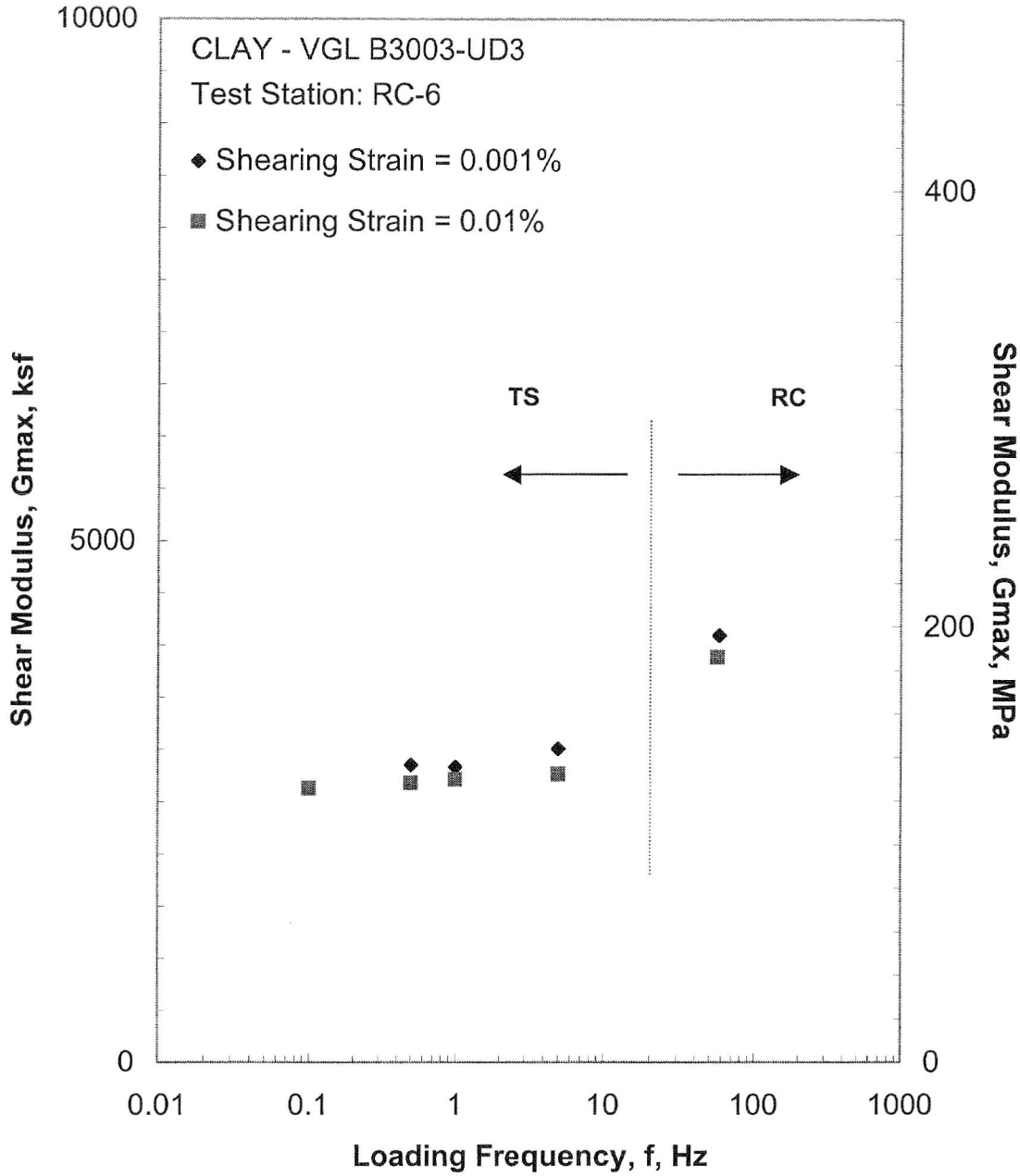


Figure C.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 53.1 psi from the Combined RCTS Tests

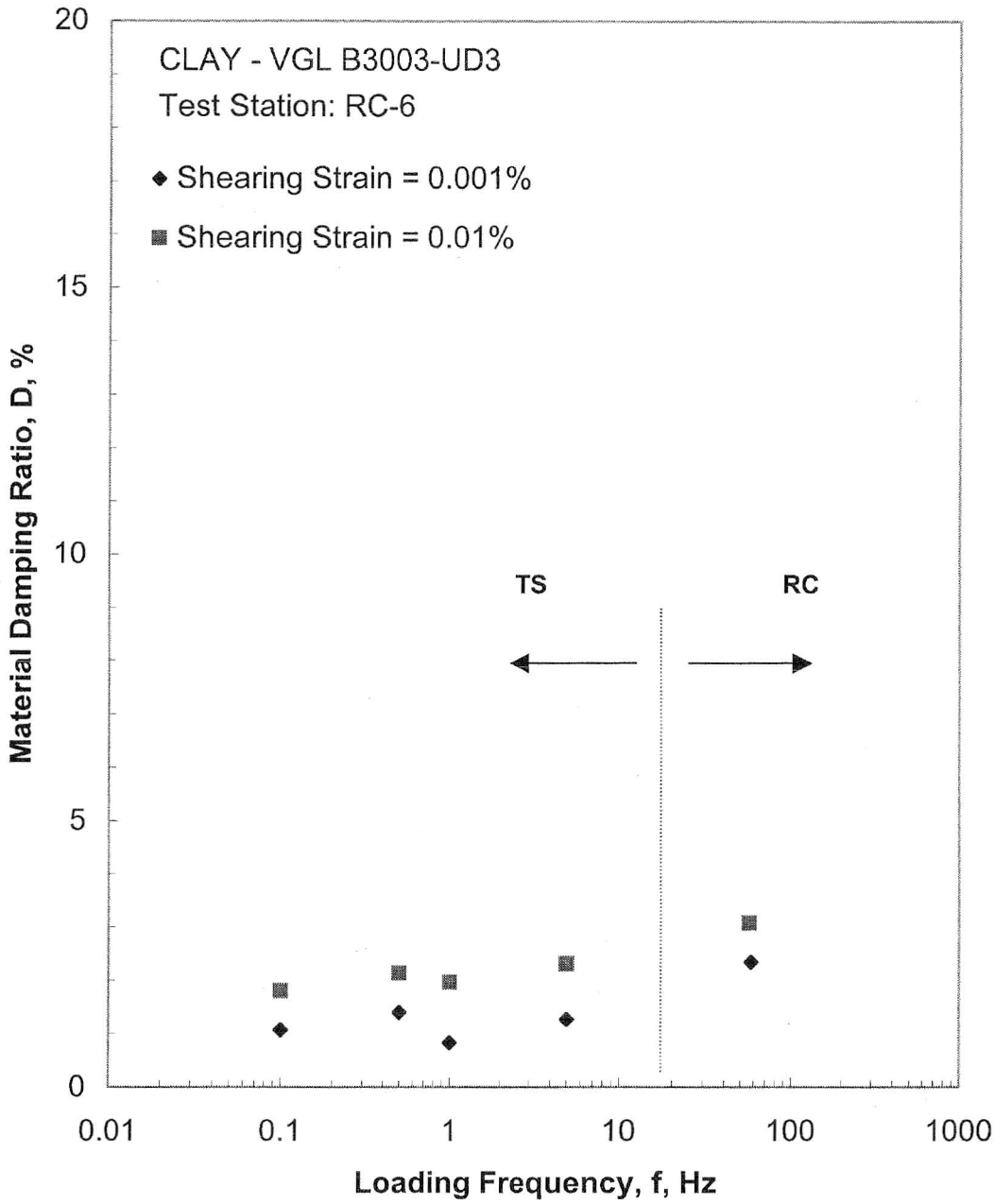


Figure C.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 53.1 psi from the Combined RCTS Tests

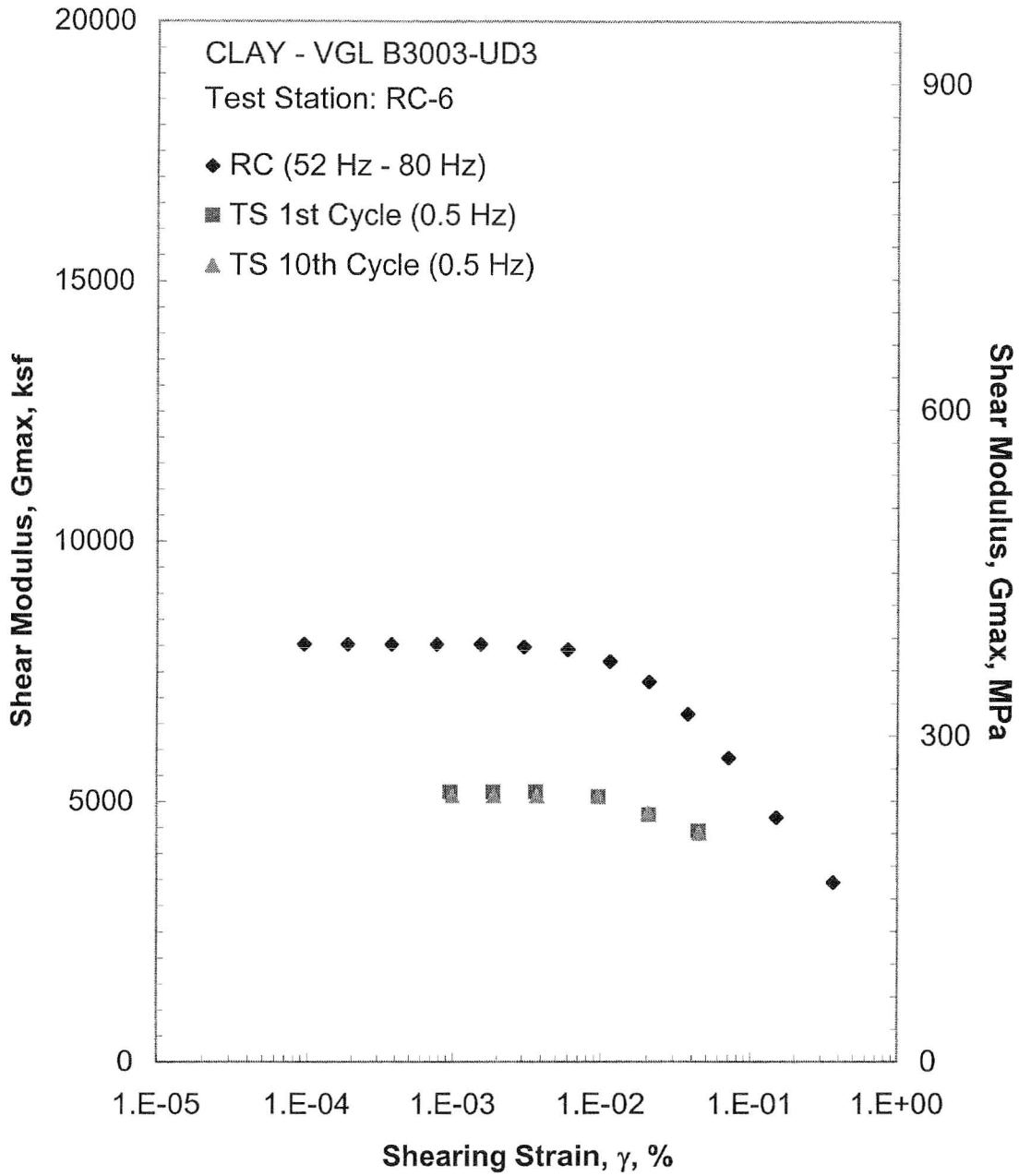


Figure C.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 212.3 psi from the Combined RCTS Tests

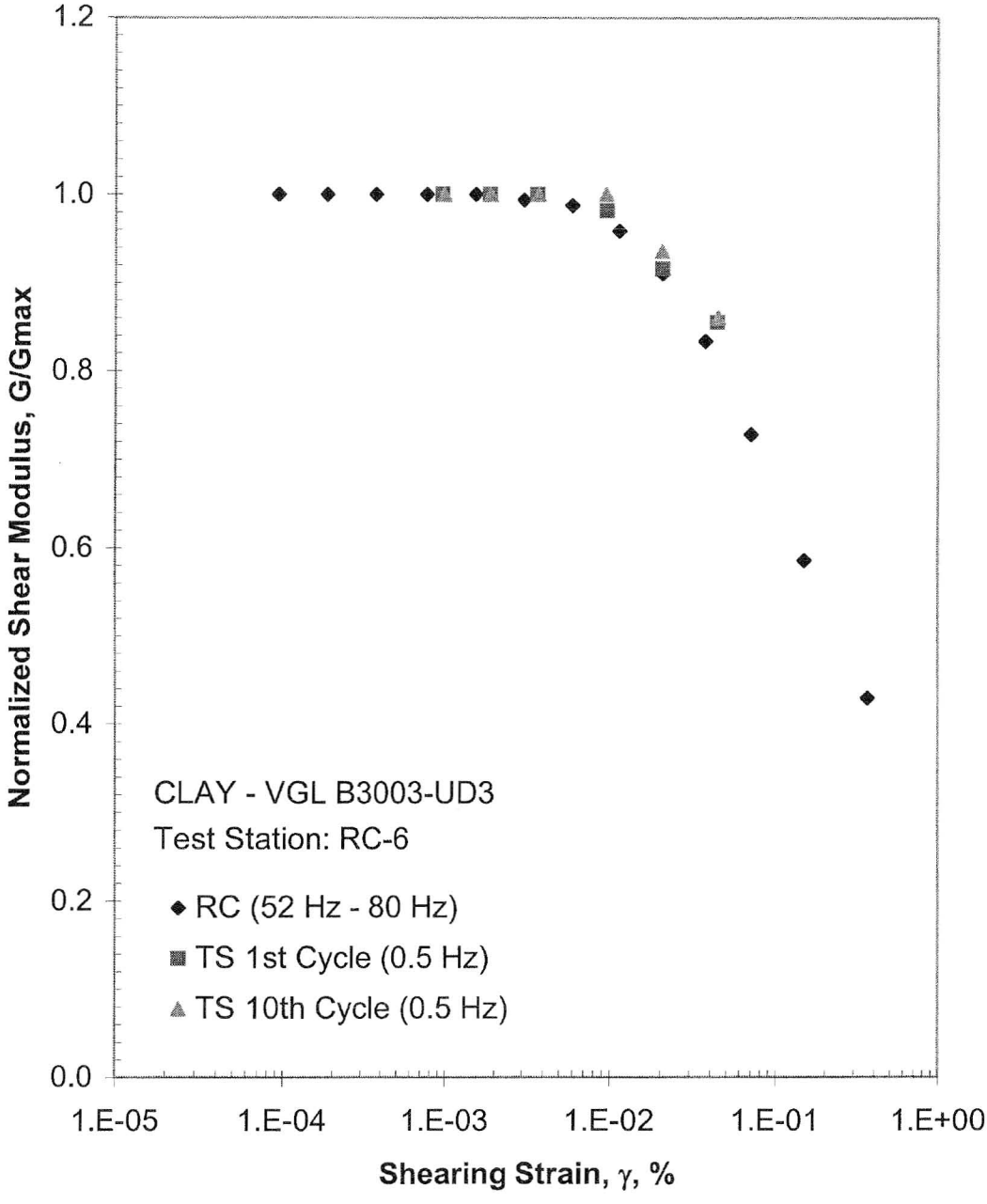


Figure C.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 212.3 psi from the Combined RCTS Tests

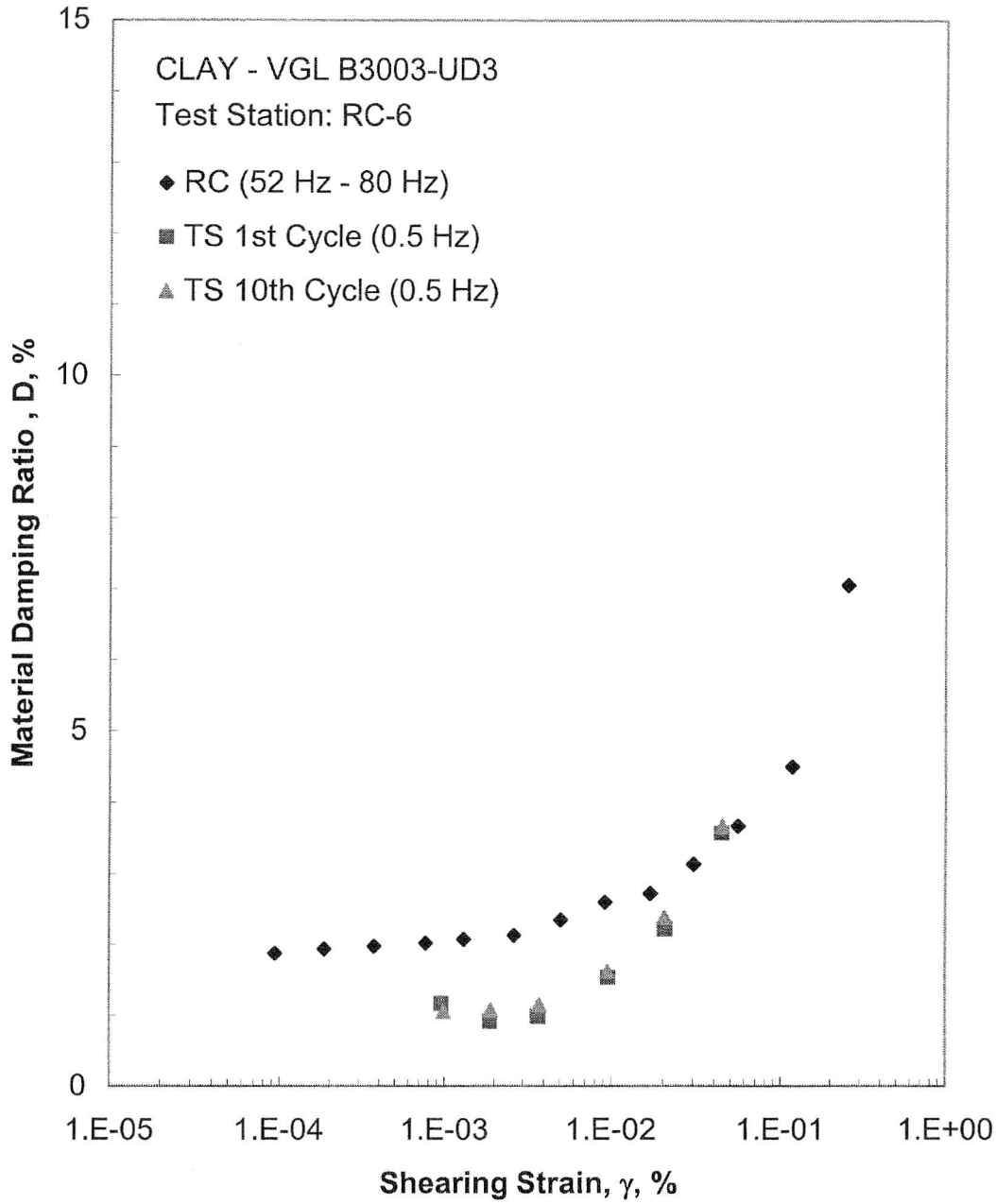


Figure C.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 212.3 psi from the Combined RCTS Tests

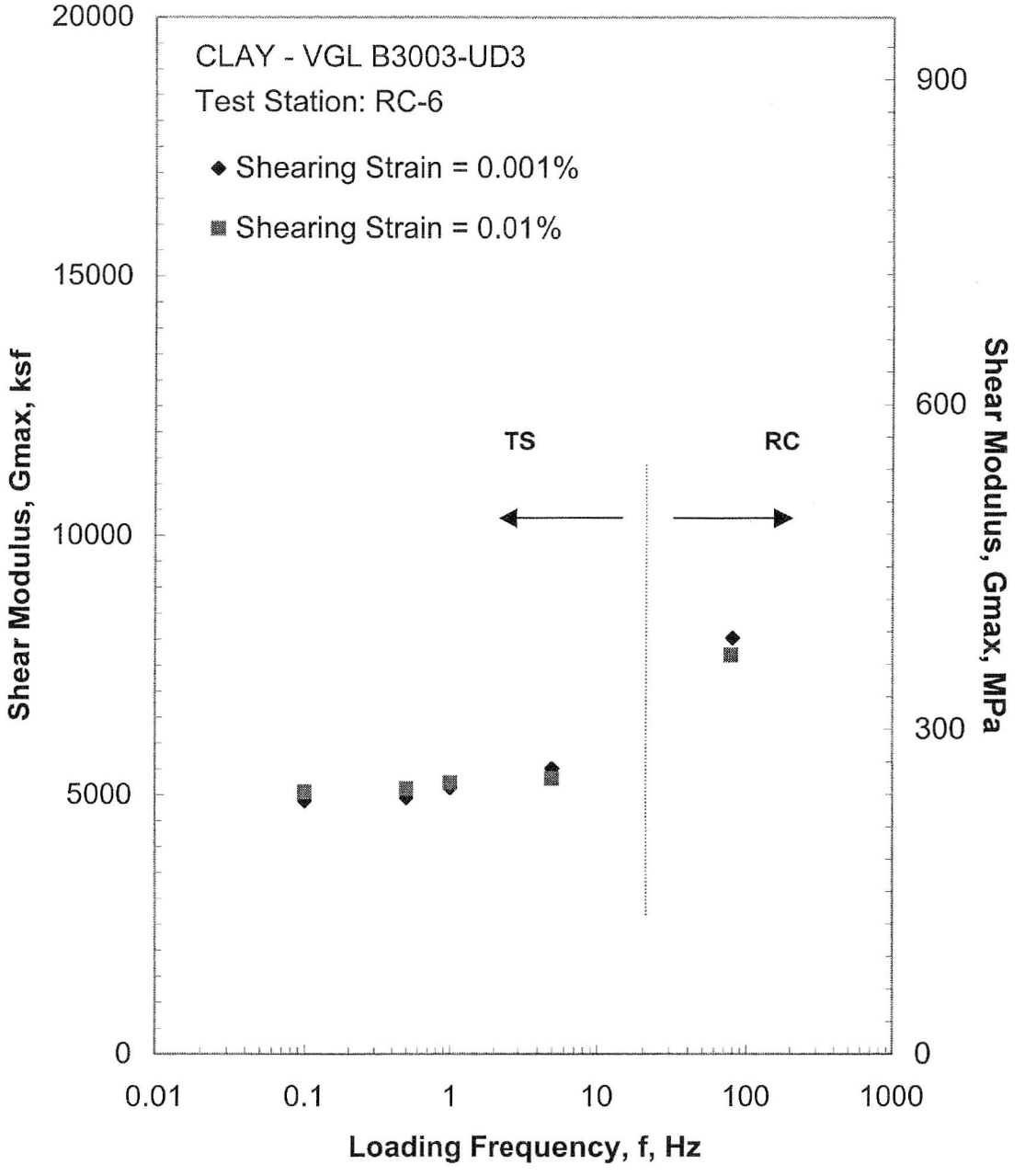


Figure C.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 212.3 psi from the Combined RCTS Tests

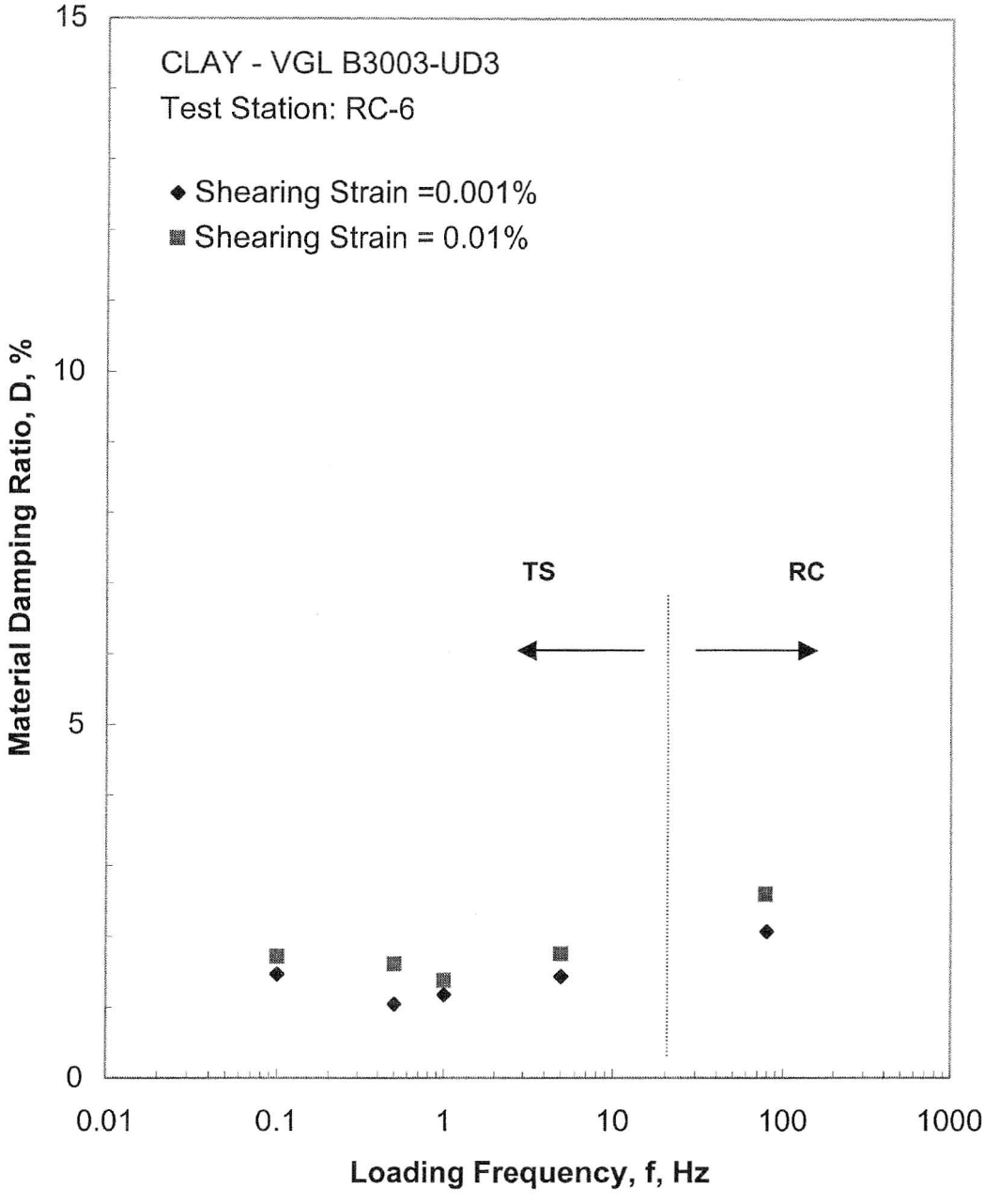


Figure C.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 212.3 psi from the Combined RCTS Tests

Table C.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio and Estimated Void Ratio with Isotropic Confining Pressure from RC Tests of Specimen VGL B3003-UD3

Isotropic Confining Pressure, σ_o			Low-Amplitude Shear Modulus, G_{max}		Low-Amplitude Shear Wave Velocity, Vs	Low-Amplitude Material Damping Ratio, Dmin	Estimated Void Ratio, e
(psi)	(psf)	(kPa)	(ksf)	(MPa)	(fps)	(%)	
13.3	1915	92	2590	124	852	2.96	0.997
26.6	3830	183	3124	150	933	2.70	0.985
53.1	7646	366	4131	198	1068	2.39	0.967
106.2	15293	732	5613	269	1236	2.14	0.940
212.3	30571	1463	7873	378	1451	1.91	0.907

Table C.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen VGL B3003-UD3; Isoptropic Confining Pressure, σ_o=53.1 psi (7.6 ksf = 366 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
1.12E-04	4132	1.00	1.12E-04	2.30
2.24E-04	4132	1.00	2.24E-04	2.29
4.11E-04	4132	1.00	4.11E-04	2.30
8.61E-04	4096	0.99	8.61E-04	2.34
1.66E-03	4060	0.98	1.40E-03	2.39
3.31E-03	4060	0.98	2.75E-03	2.58
6.47E-03	3990	0.97	5.30E-03	2.82
1.23E-02	3885	0.94	9.95E-03	3.07
2.34E-02	3612	0.87	1.80E-02	3.47
4.40E-02	3254	0.79	3.39E-02	3.82
9.18E-02	2679	0.65	6.61E-02	5.10
2.13E-01	2058	0.50	1.37E-01	7.66

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table C.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen VGL B3003-UD3; Isotropic Confining Pressure, σ_o=53.1 psi (7.6 ksf = 366 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Material Damping Ratio, D, %
9.66E-04	2872	1.00	1.54	9.66E-04	2885	1.00	1.40
1.91E-03	2872	1.00	---	1.89E-03	2885	1.00	1.44
3.84E-03	2872	1.00	1.79	3.86E-03	2864	0.99	1.72
9.70E-03	2685	0.93	2.12	9.72E-03	2680	0.93	2.13
2.12E-02	2461	0.86	2.65	2.13E-02	2449	0.85	2.71
5.03E-02	2071	0.72	4.63	5.13E-02	2032	0.70	4.62

Table C.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen VGL B3003-UD3; Isoptropic Confining Pressure, σ_o= 212.3 psi (30.6 ksf = 1463 kPa)

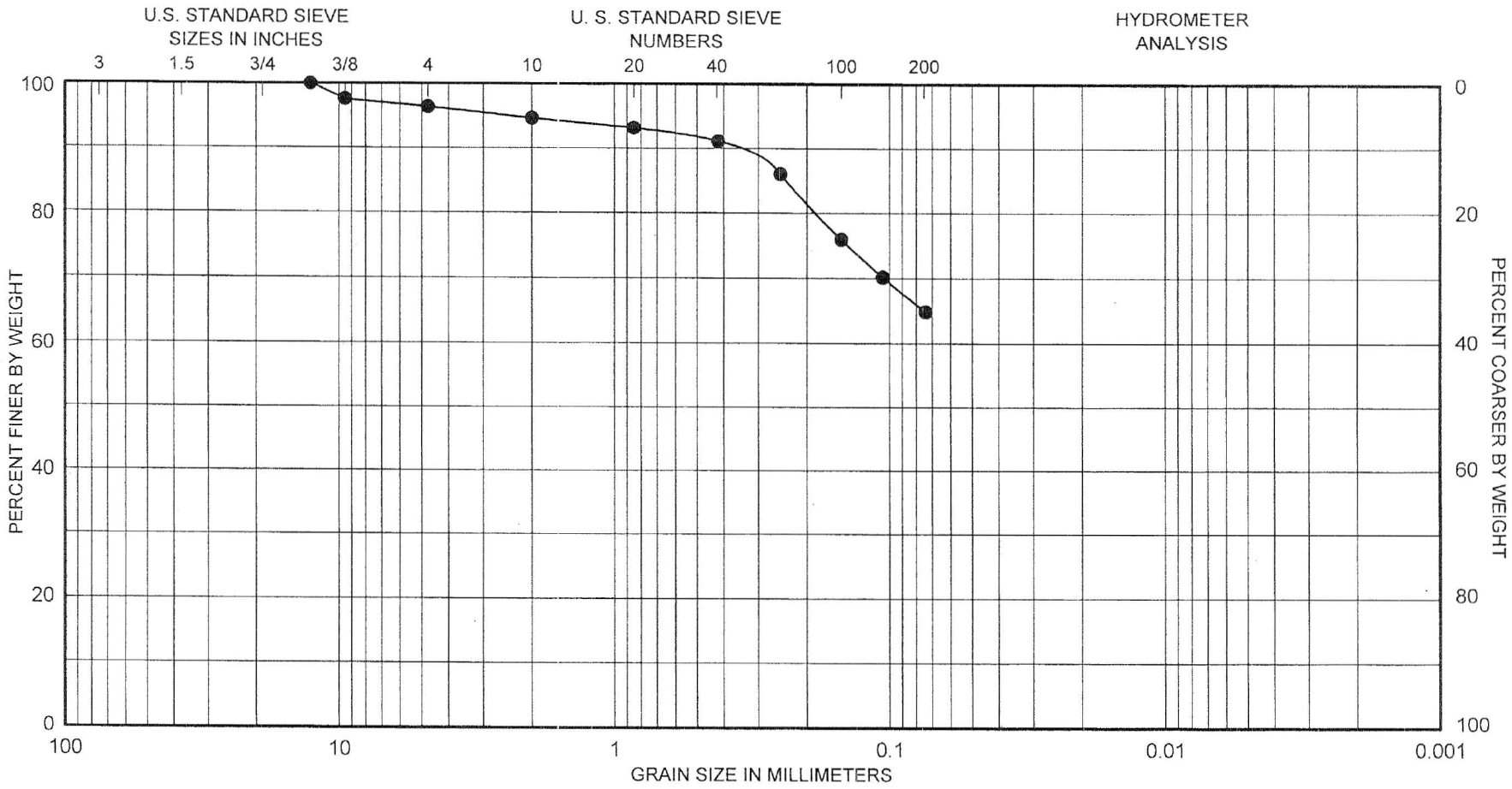
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average[+] Shearing Strain, %	Material Damping Ratio[x], D, %
9.40E-05	8027	1.00	9.40E-05	1.87
1.86E-04	8027	1.00	1.86E-04	1.93
3.73E-04	8027	1.00	3.73E-04	1.98
7.70E-04	8027	1.00	7.70E-04	2.02
1.54E-03	8027	1.00	1.31E-03	2.07
3.07E-03	7976	0.99	2.64E-03	2.13
6.00E-03	7926	0.99	5.04E-03	2.35
1.14E-02	7693	0.96	9.21E-03	2.60
2.06E-02	7303	0.91	1.69E-02	2.72
3.74E-02	6690	0.83	3.03E-02	3.13
7.07E-02	5842	0.73	5.52E-02	3.66
1.50E-01	4698	0.59	1.17E-01	4.49
3.65E-01	3445	0.43	2.56E-01	7.05

[+] Average Shearing Strain from the First Three Cycles of the Free Vibration Decay Curve

[x] Average Damping Ratio from the First Three Cycles of the Free Vibration Decay Curve

Table C.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen VGL B3003-UD3; Isotropic Confining Pressure, σ_o=212.3 psi (30.6 ksf = 1463 kPa)

First Cycle				Tenth Cycle			
Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D,	Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus,	Material Damping Ratio, D, %
9.59E-04	5184	1.00	1.16	9.87E-04	5110	1.00	1.05
1.88E-03	5184	1.00	0.91	1.89E-03	5110	1.00	1.07
3.71E-03	5184	1.00	0.98	3.75E-03	5110	1.00	1.14
9.61E-03	5090	0.98	1.53	9.55E-03	5110	1.00	1.61
2.06E-02	4747	0.92	2.21	2.05E-02	4780	0.94	2.37
4.41E-02	4431	0.85	3.56	4.45E-02	4393	0.86	3.66



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	B-3003-UD3	109.7				0.37	Silty Clay, olive gray, with sand pockets and siltstone

GRAIN SIZE CURVE

APPENDIX D

Specimen VGL B4003-UD3
(LL=43, PI=26; Gs=2.69)

Borehole B4003
Sample UD3
Depth = 159.0 ft (48.5 m)
Total Unit Weight = 120.4 lb/ft^3
Water Content = 25.9 %
Estimated In-Situ Ko = 0.7
Estimated In-Situ Mean Effective
Stress = 70.3 psi

FUGRO JOB #: 0401-1667
Testing Station: RC6

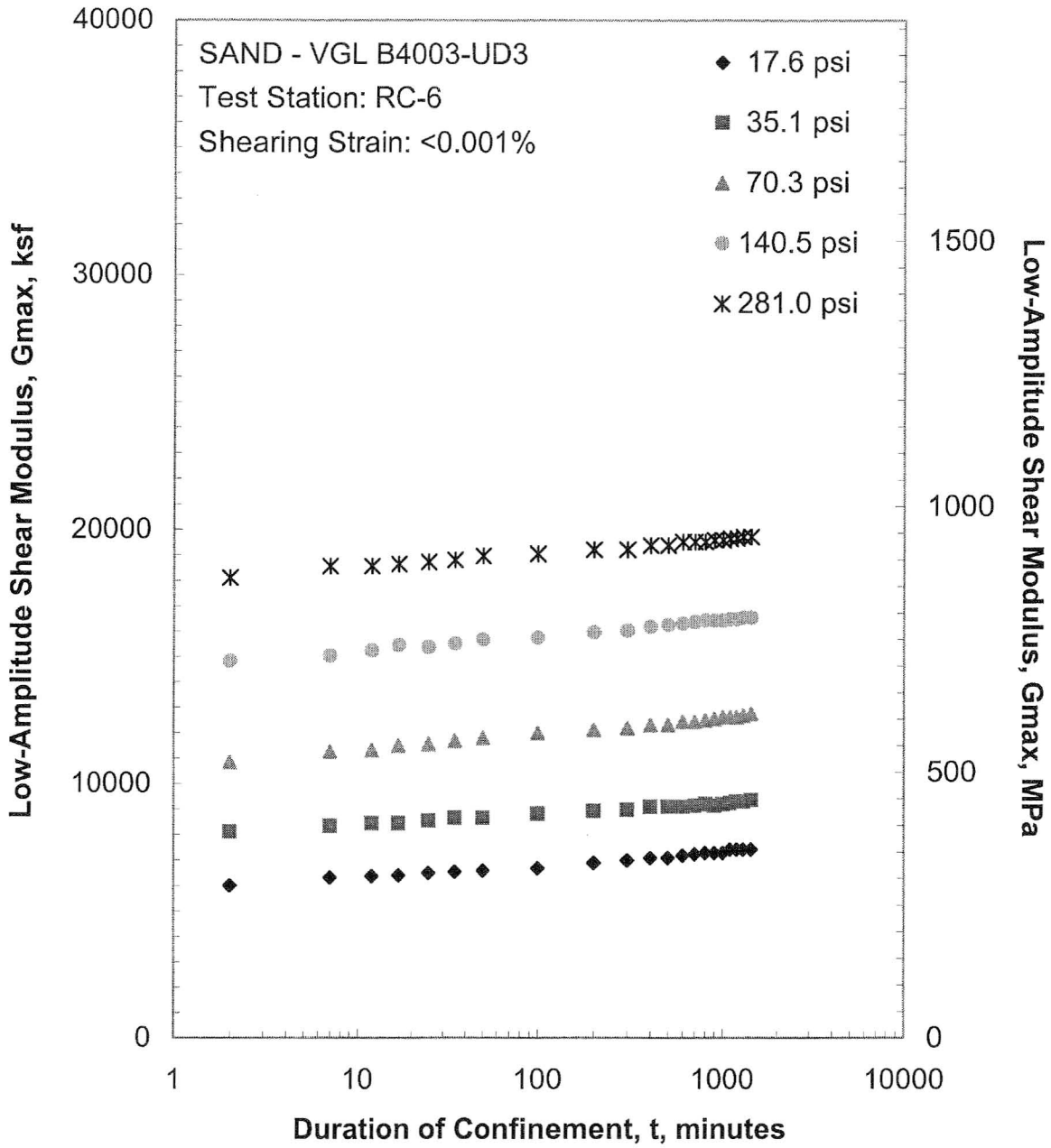


Figure D.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

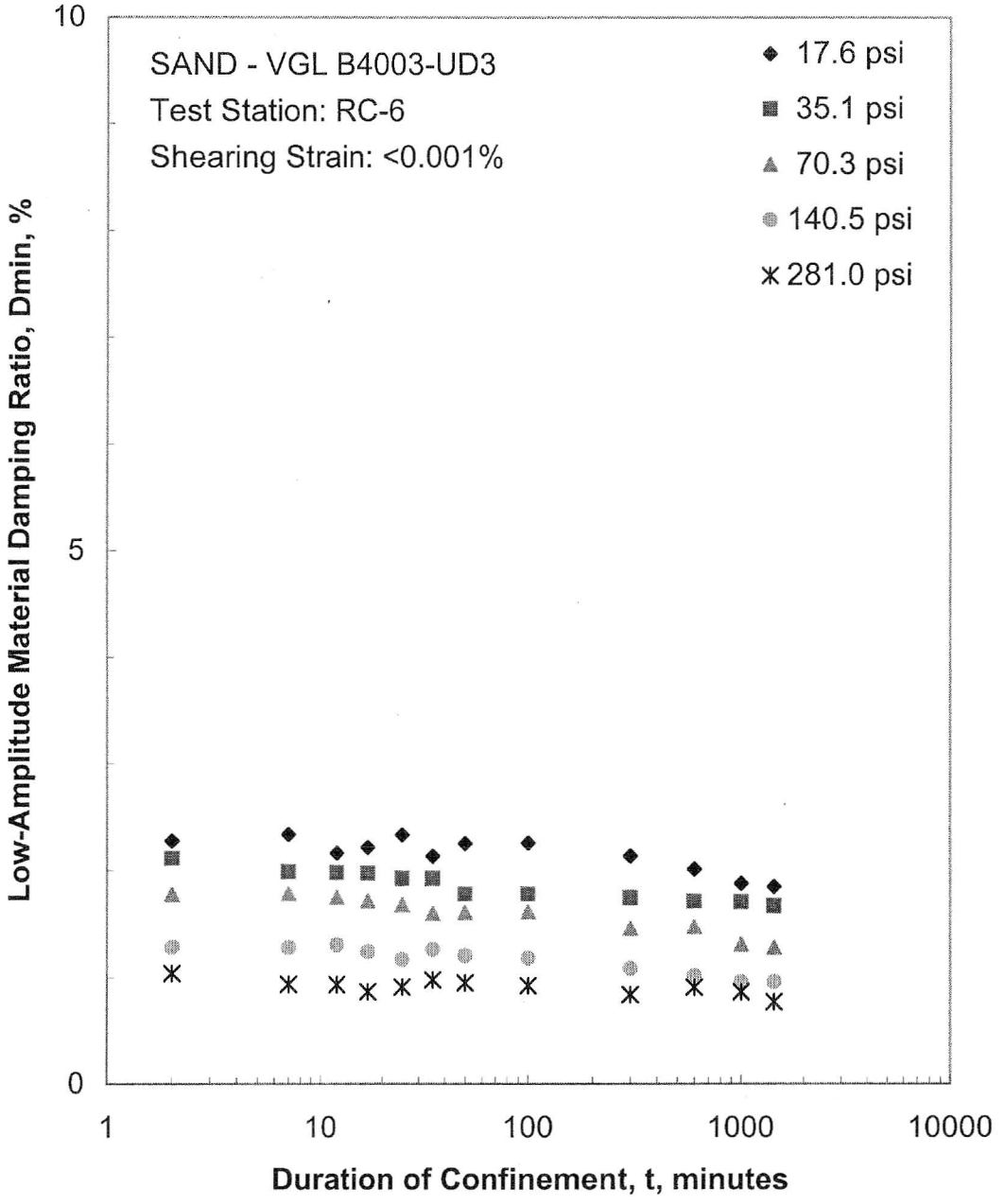


Figure D.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

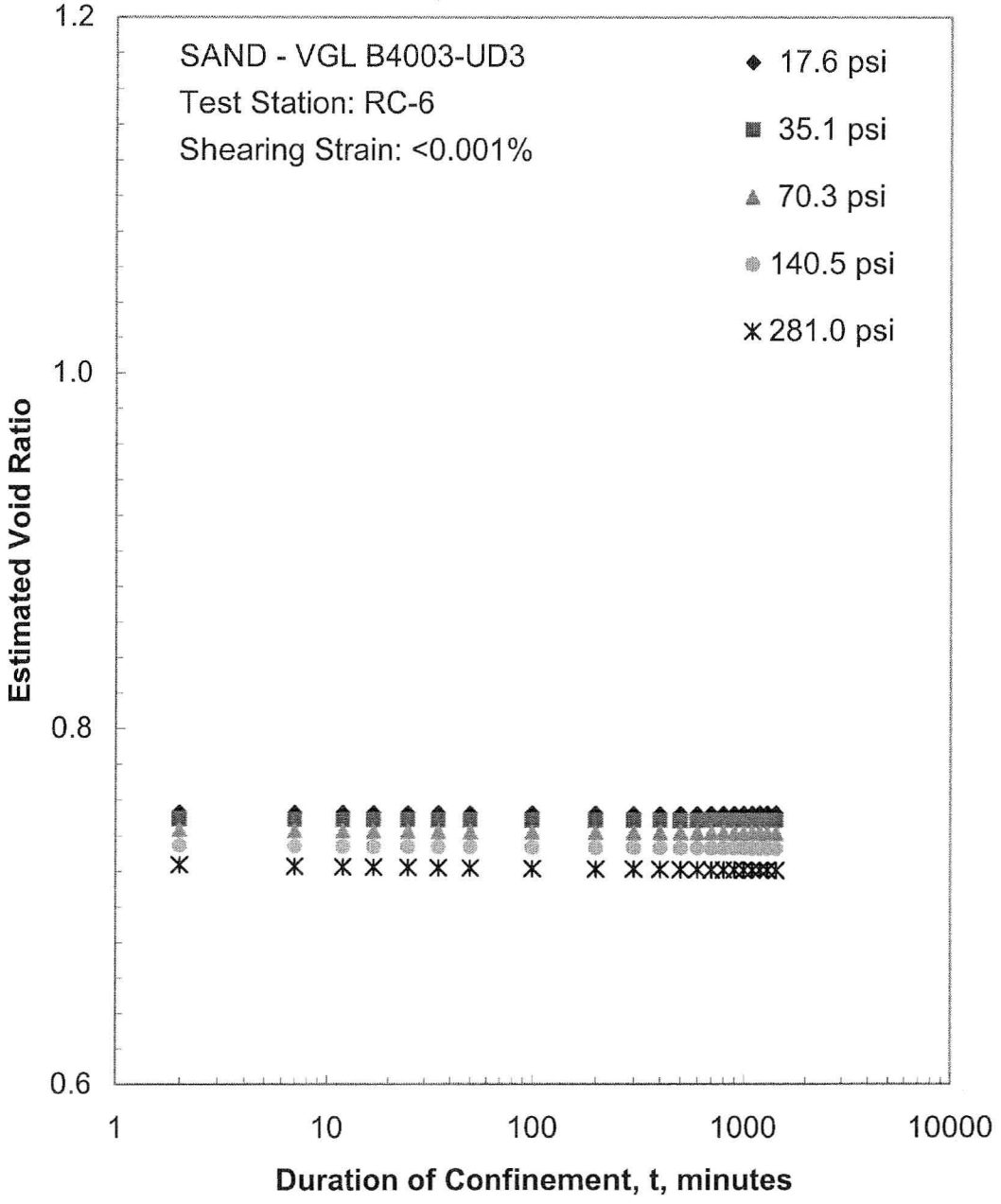


Figure D.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

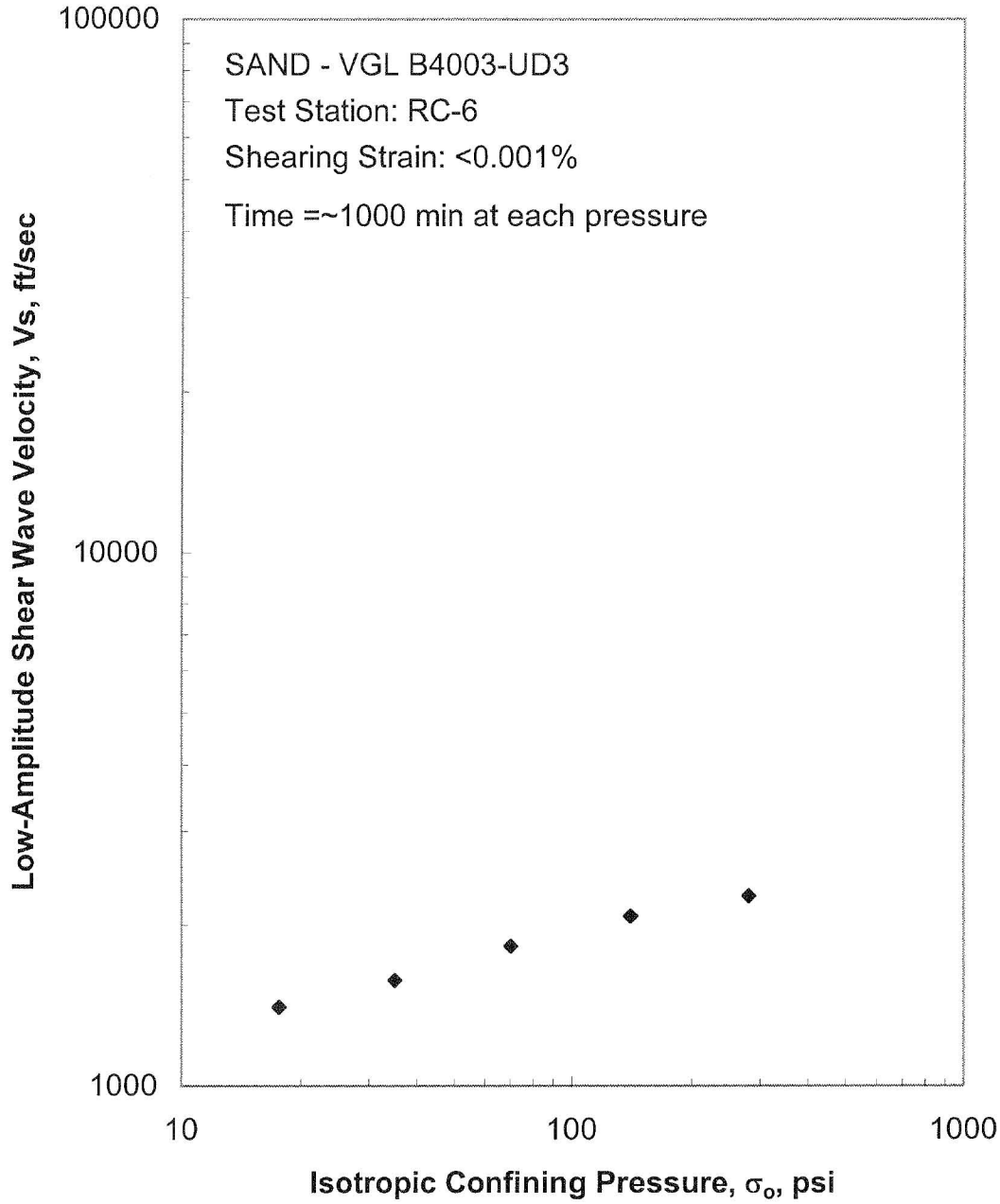


Figure D.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

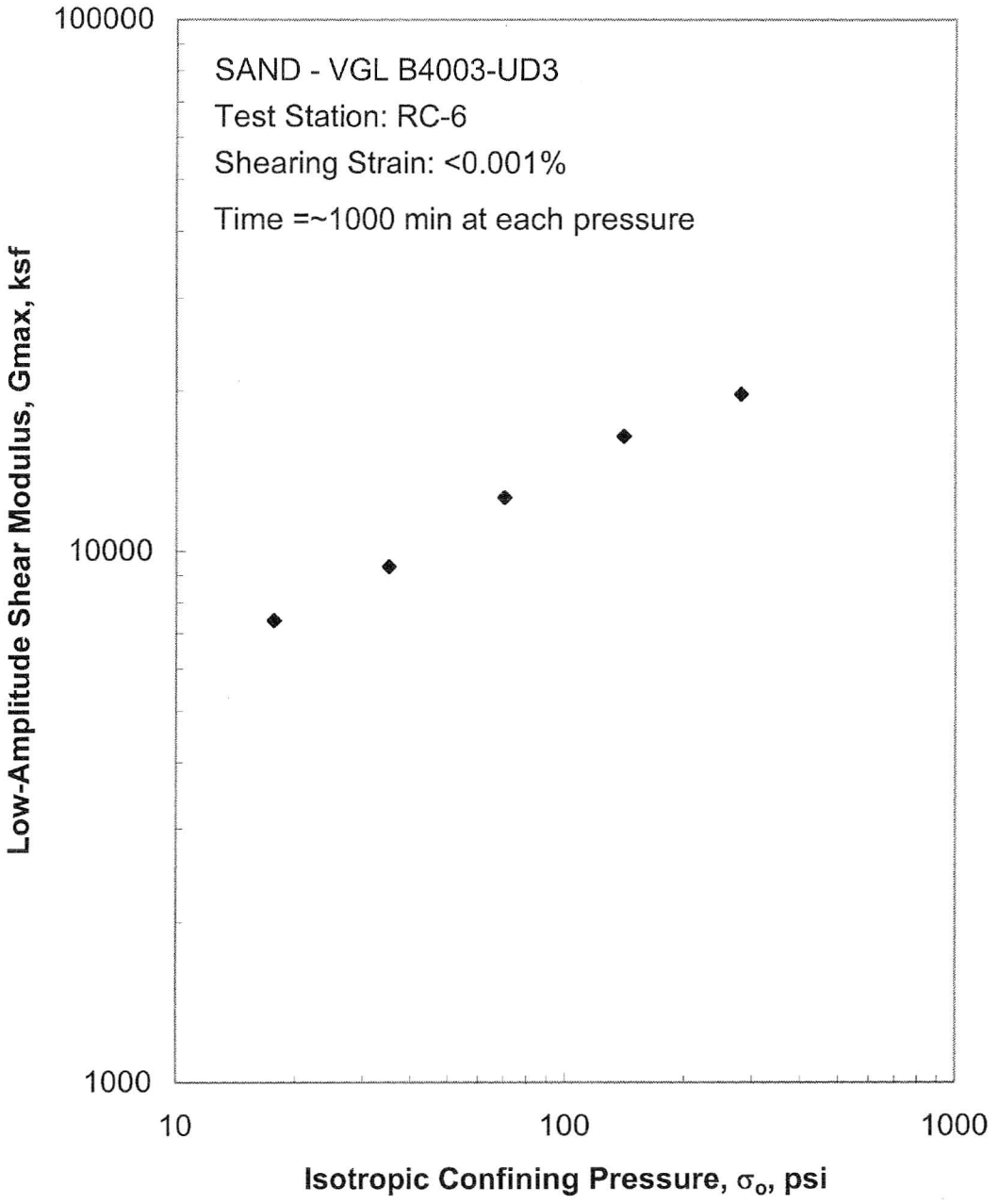


Figure D.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

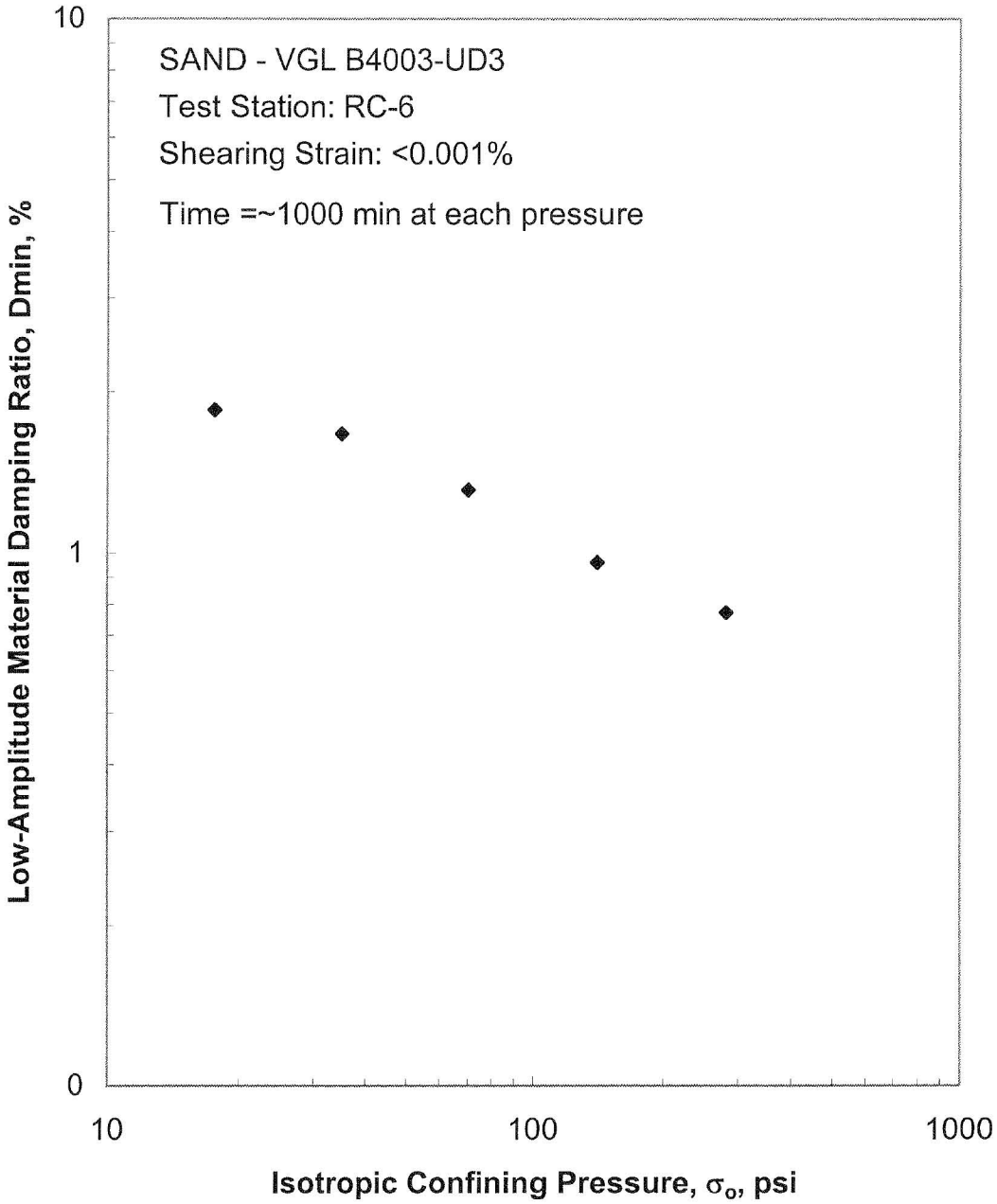


Figure D.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

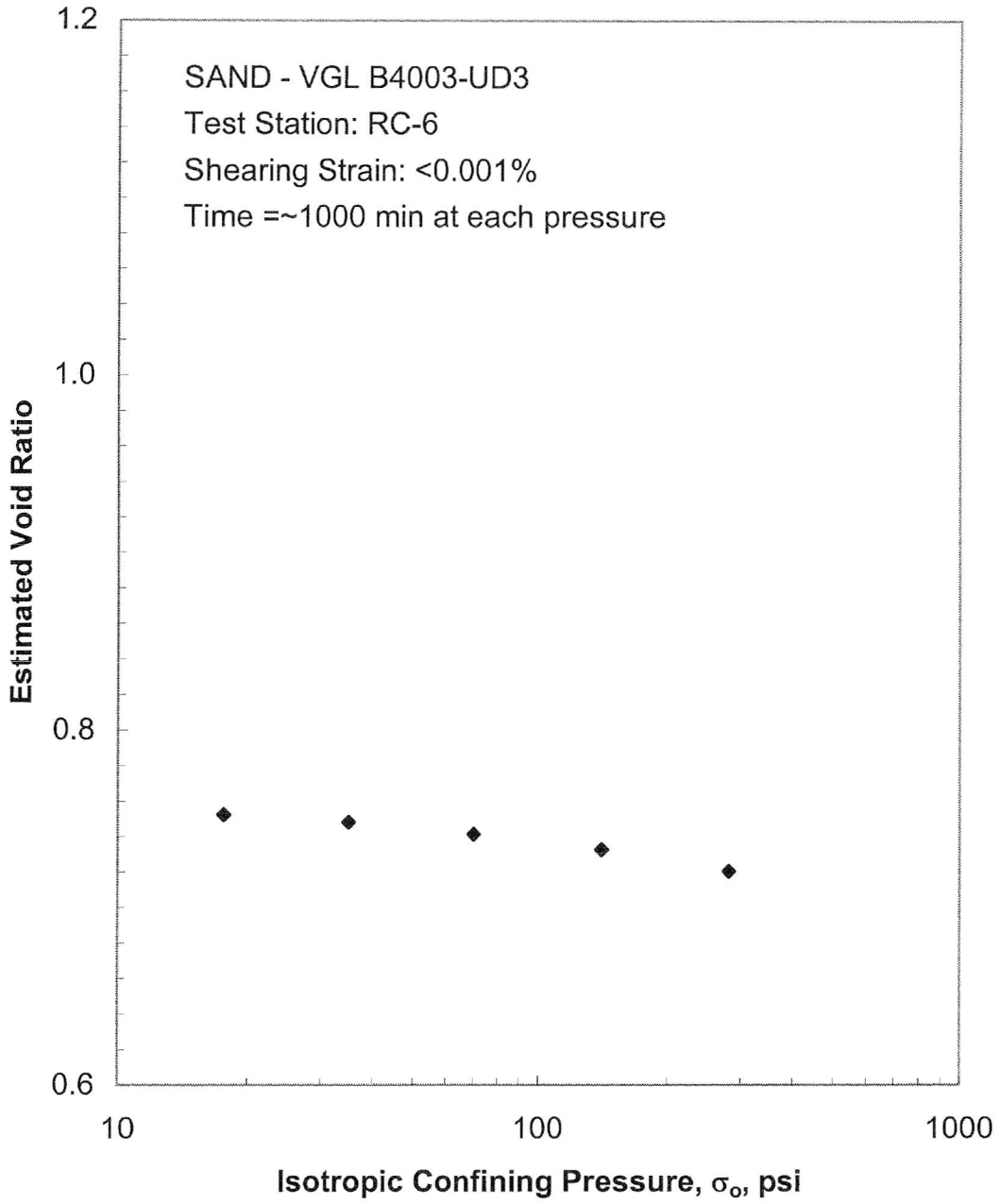


Figure D.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

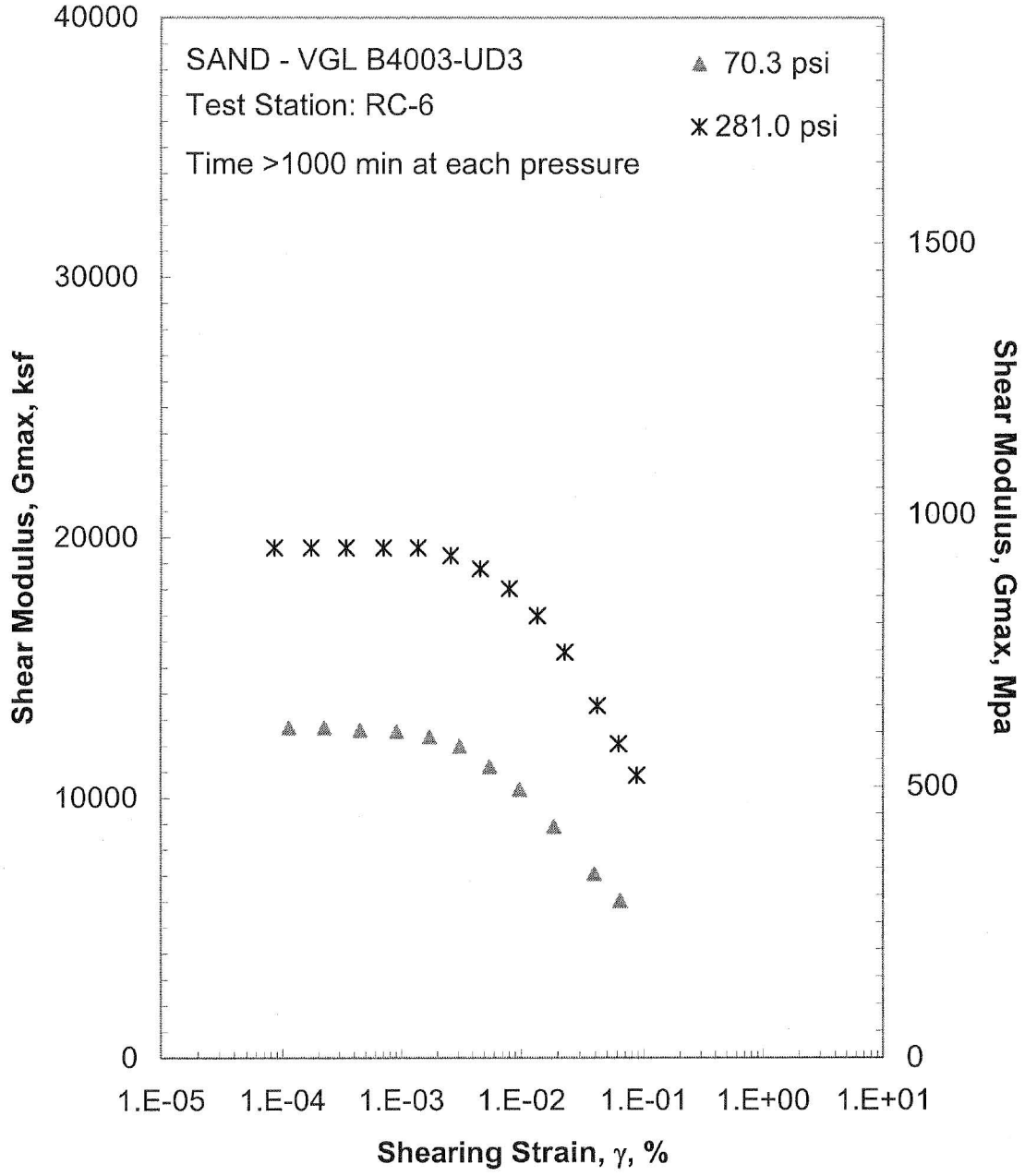


Figure D.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

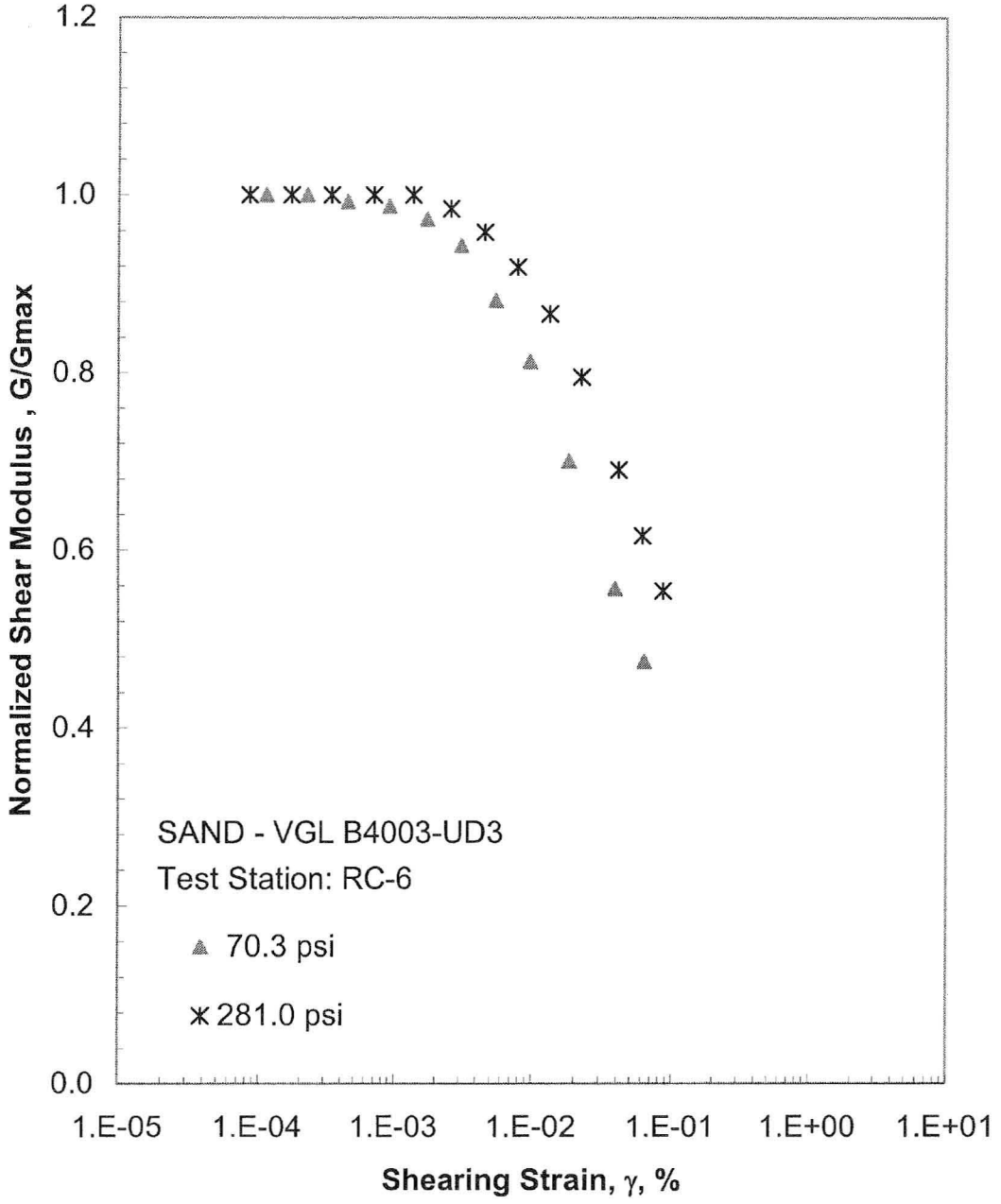


Figure D.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests