FINAL DATA REPORT Rev. 2
GEOTECHNICAL EXPLORATION AND TESTING

TURKEY POINT COL PROJECT
FLORIDA CITY, FLORIDA

October 6, 2008

VOLUME 4

Prepared By:

MACTEC Engineering and Consulting, Inc.
Raleigh, North Carolina

MACTEC Project No. 6468-07-1950

Prepared For:

Bechtel Power Corporation
Subcontract No. 25409-102-HC4-CY00-00001

Contents

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Appendix F – RCTS Data Reports

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APPENDIX F CONTENTS

FUGRO CONSULTANTS, INC.

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

June 24, 2008

Ms. Siesta Williams
MACTEC
3301 Atlantic Avenue
Raleigh, NC 27604

RE: Two (2) Reports For The Turkey Point Project

Dear Ms. Williams:

Fugro has completed two (2) RCTS tests, which are B630-UD8 and B630-UD2 for the Turkey Point project. Fugro has incorporated, as needed, Dr. Kenneth Stokoe's comments into the final reports. The final reports and the associated RCTS Test Approvals 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

RCTS TEST APROVAL

PROJECT SITE/NAME	Turkey Point

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#A	B630-UD8	163.1	KHS ⊕	18 June 08
RCTS#B	B630-UD2	131.9	KHS ⊕	18 June '08

Two RCTS tests for the site referenced above were tested, and two 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:

Dr. Kenneth Stokoe

⊕ Consider minor comments on a few figures.

APPENDIX A

Specimen B630-UD8

Borehole B630
Sample UD8
Depth = 163.1 ft (49.7 m)
Total Unit Weight = 118.7 lb/ft^3
Water Content = 33.0 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 47 psi

FUGRO JOB #: 0401-1701
Testing Station: RC9

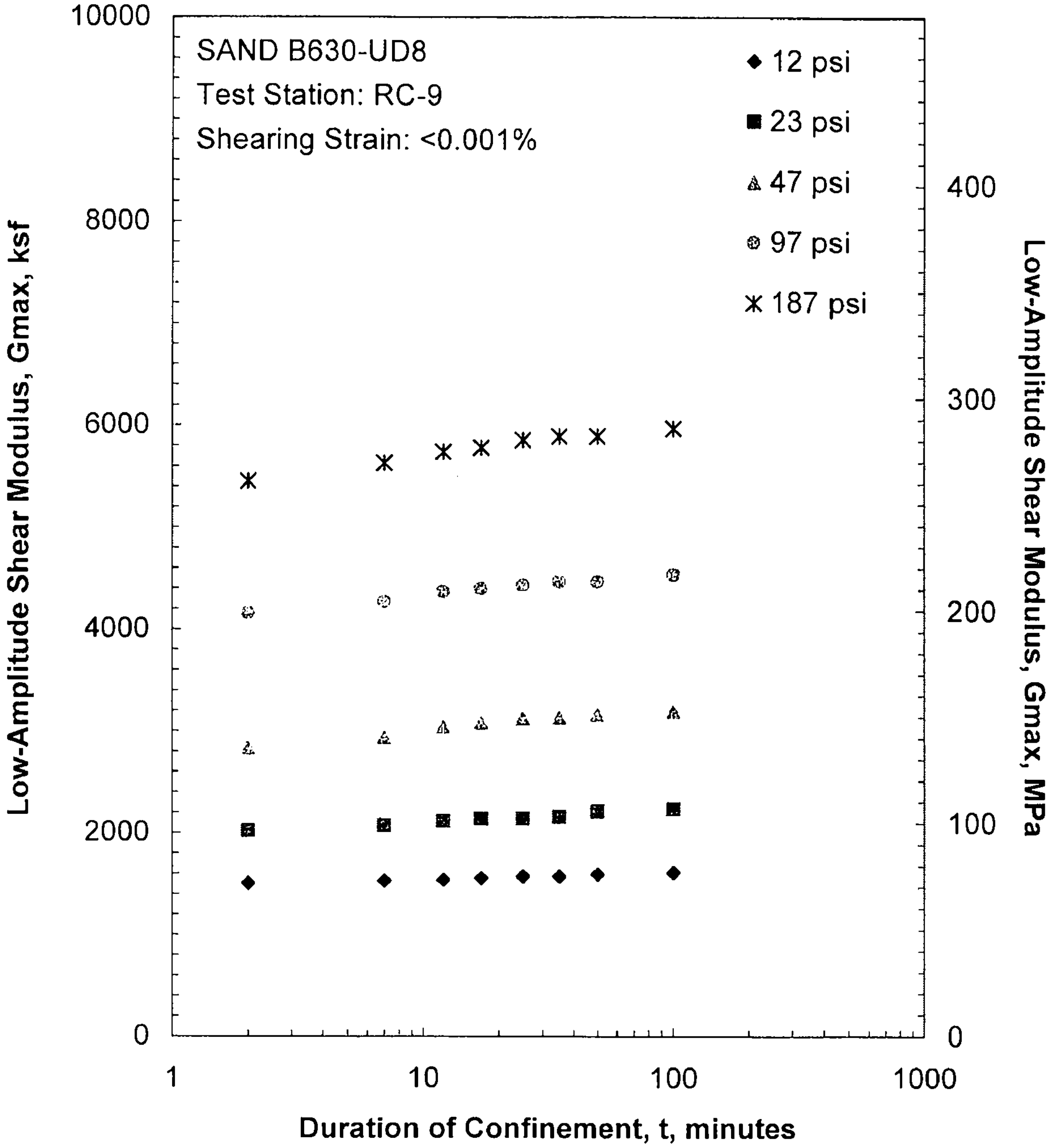

Figure A.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

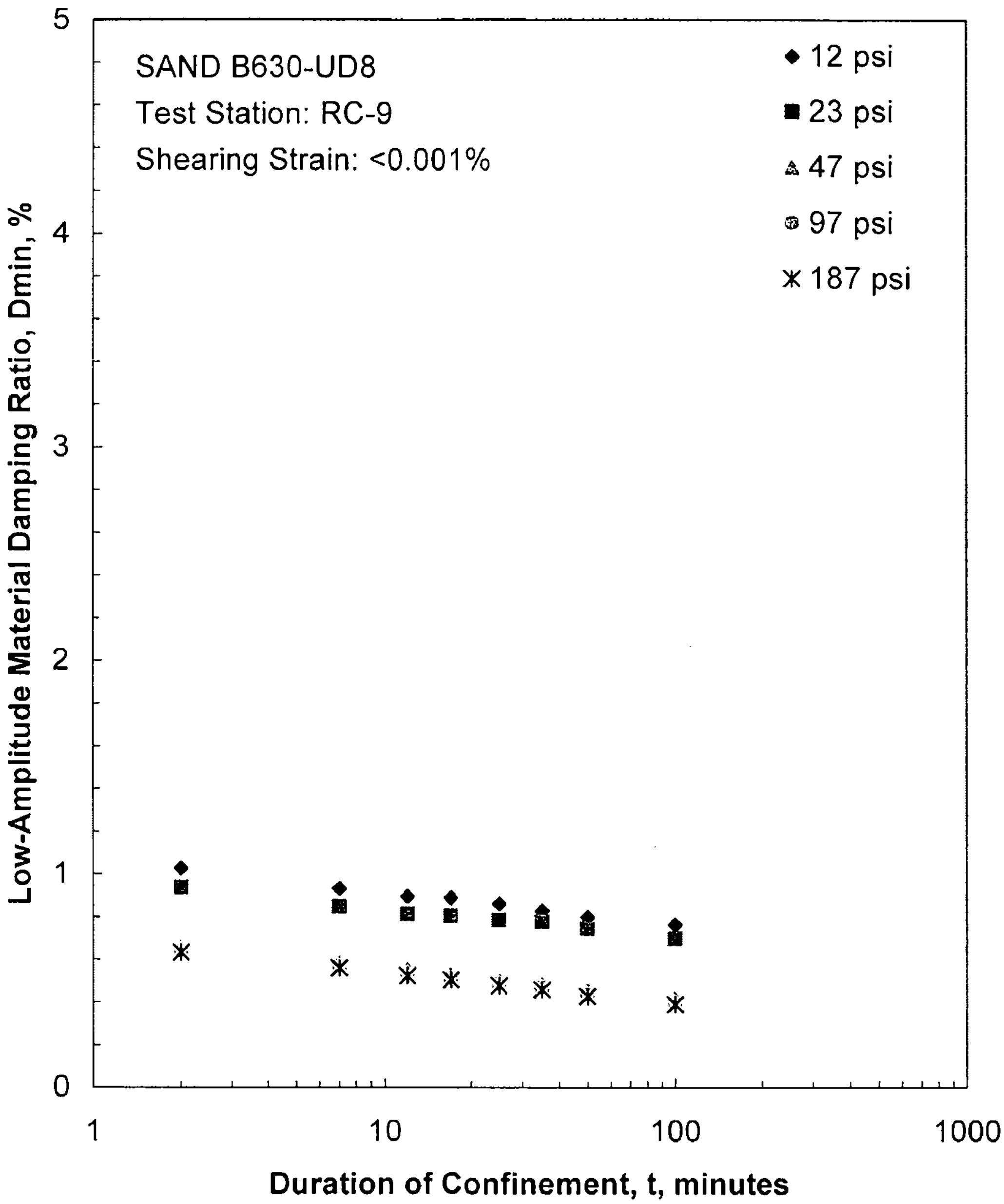

Figure A.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

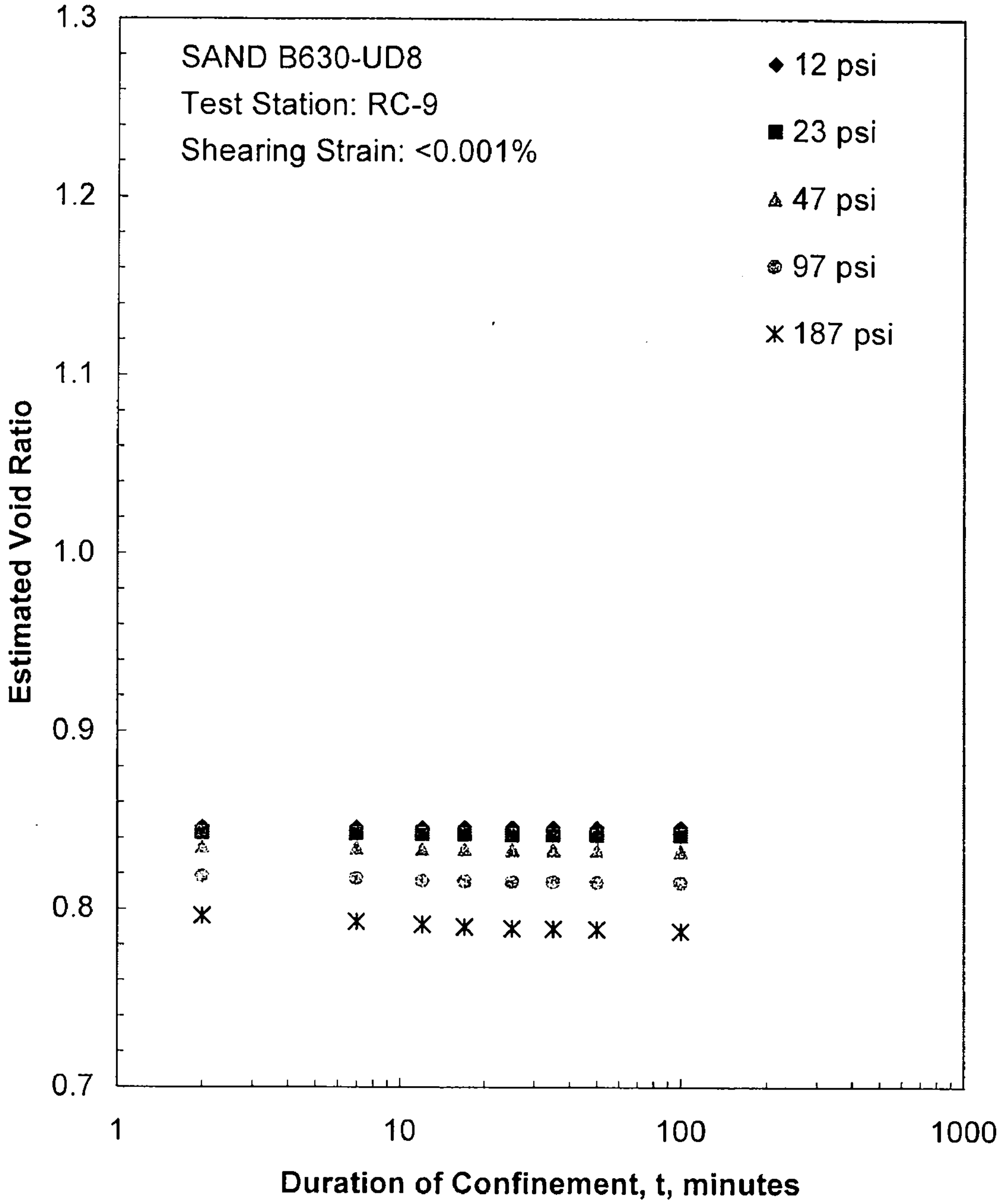

Figure A.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

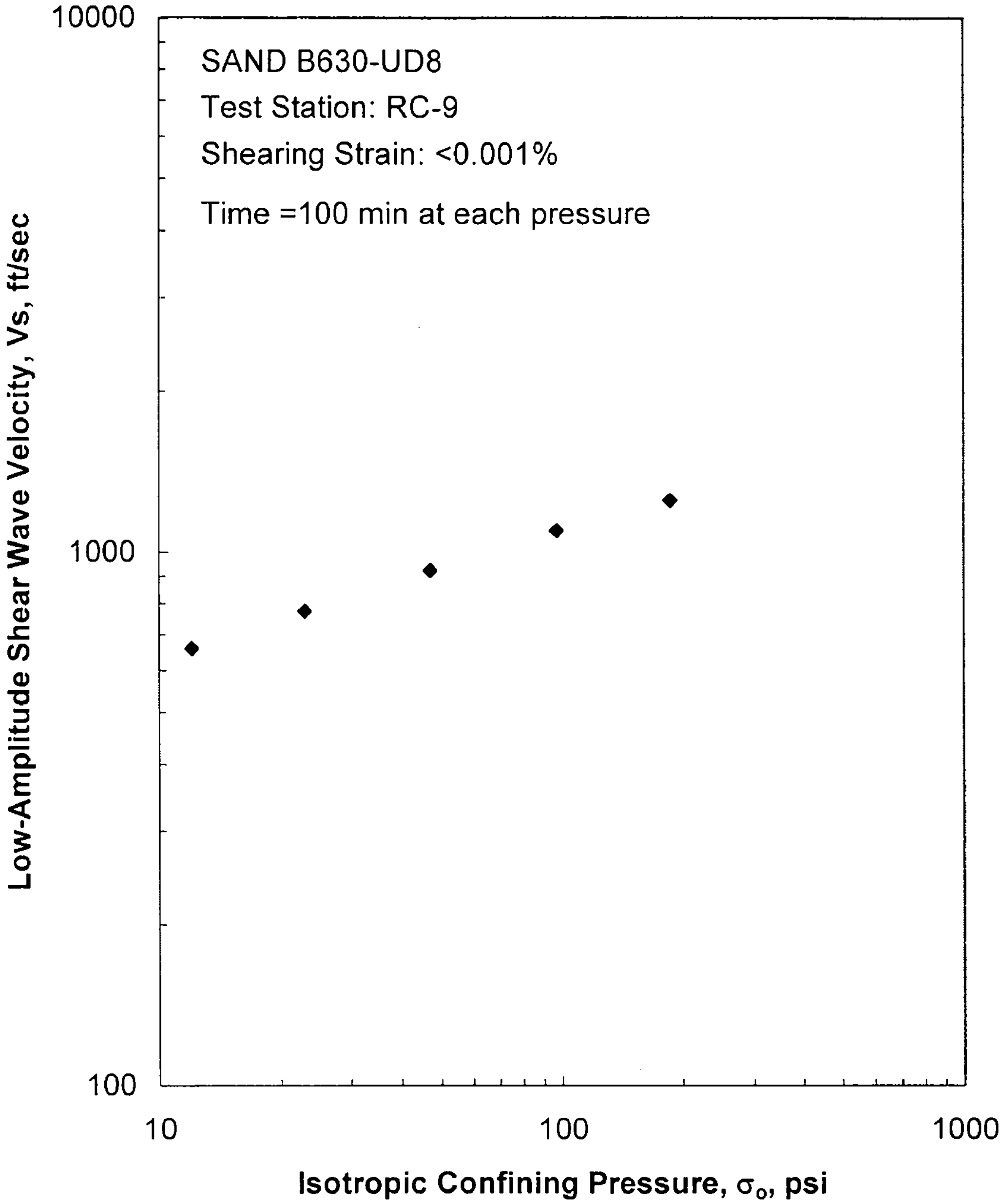

Figure A.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

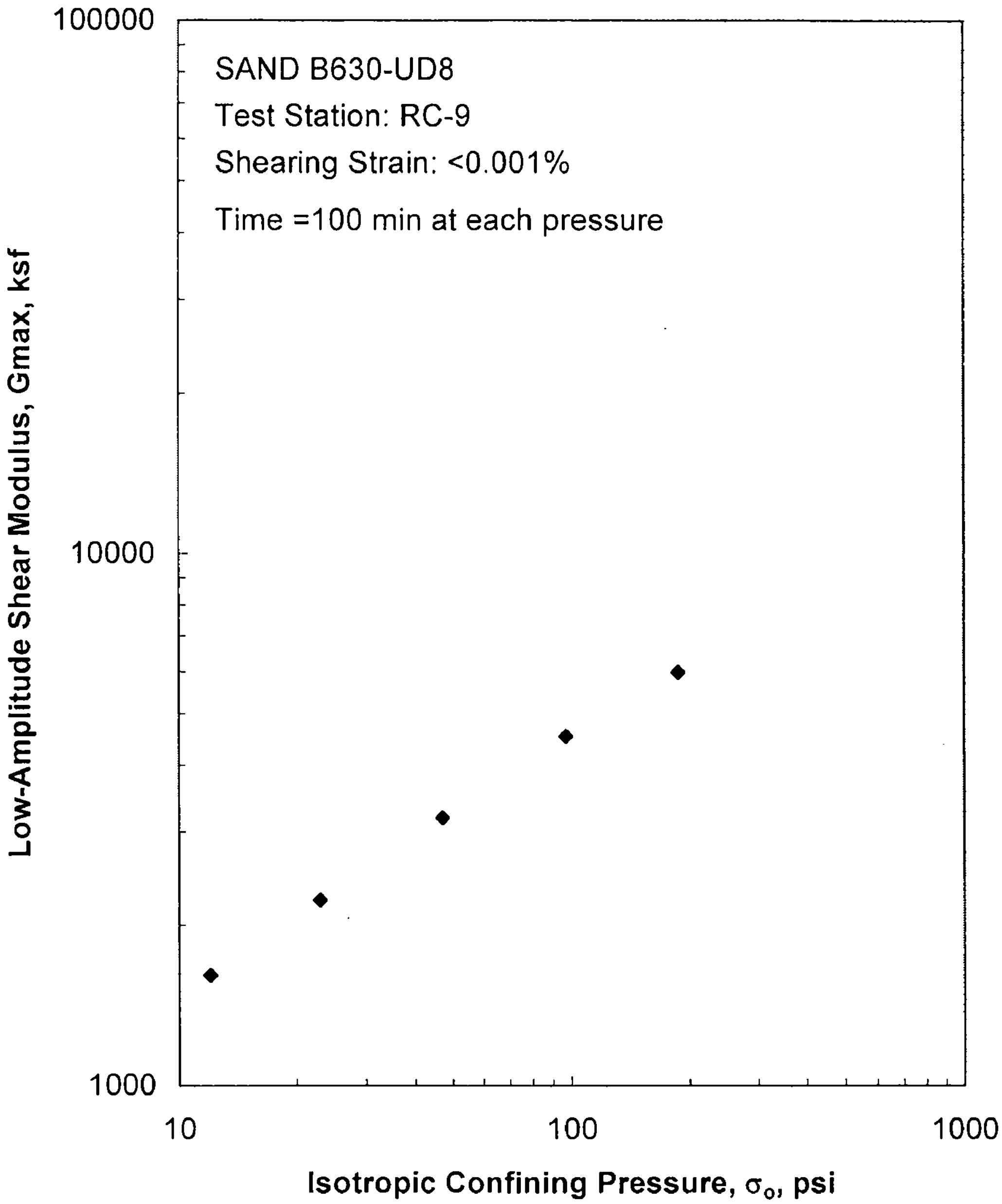

Figure A.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

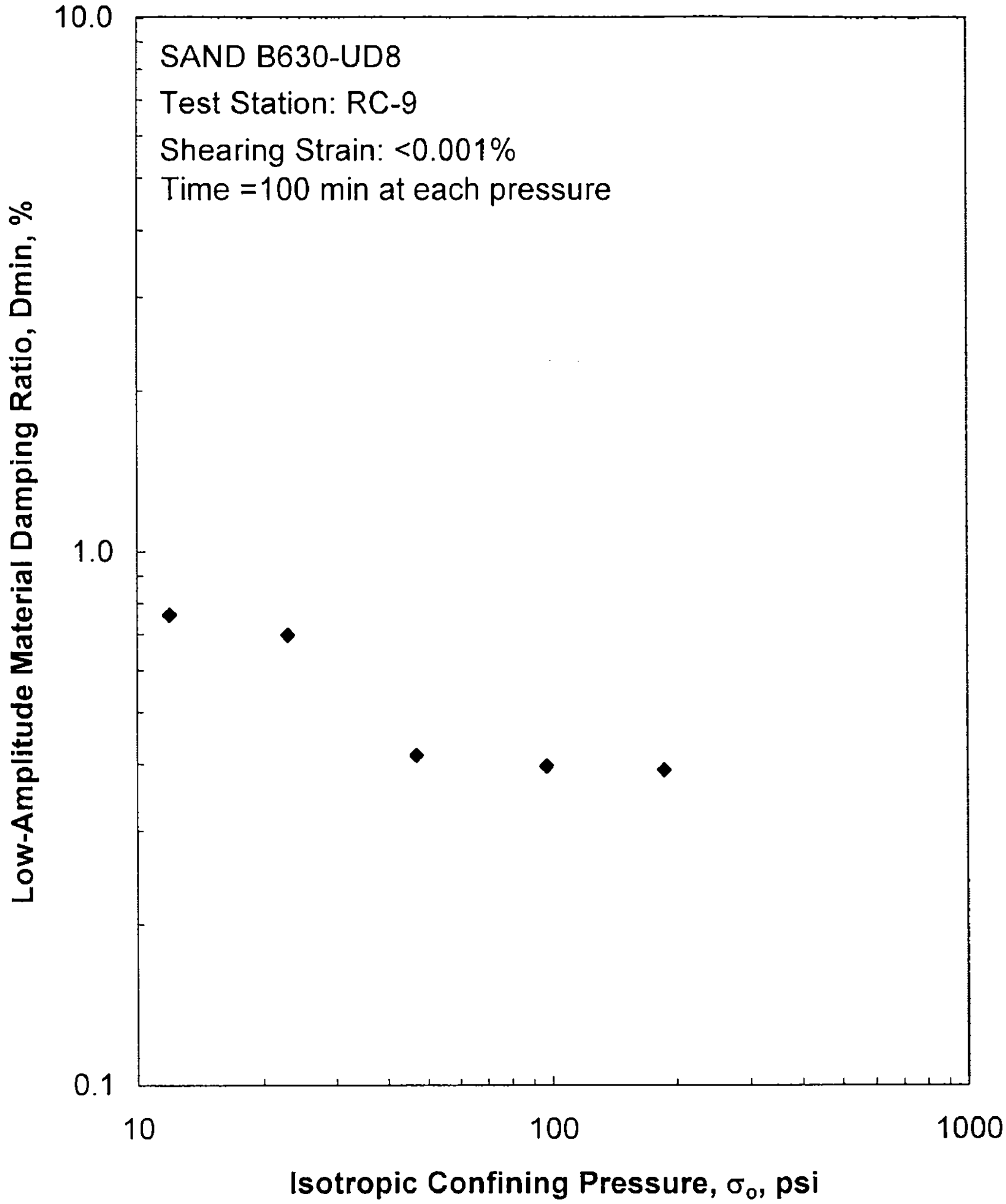

Figure A.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

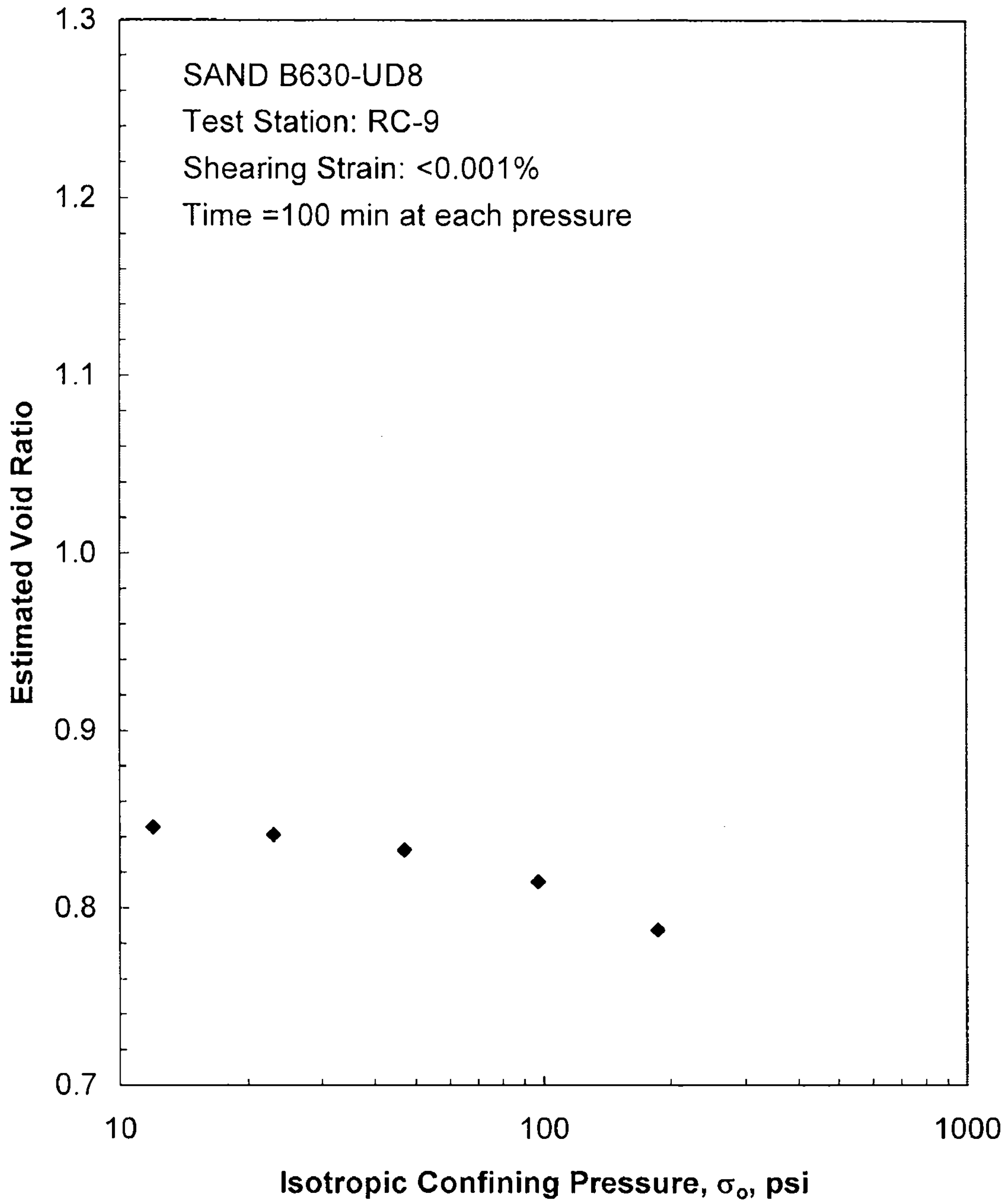

Figure A.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

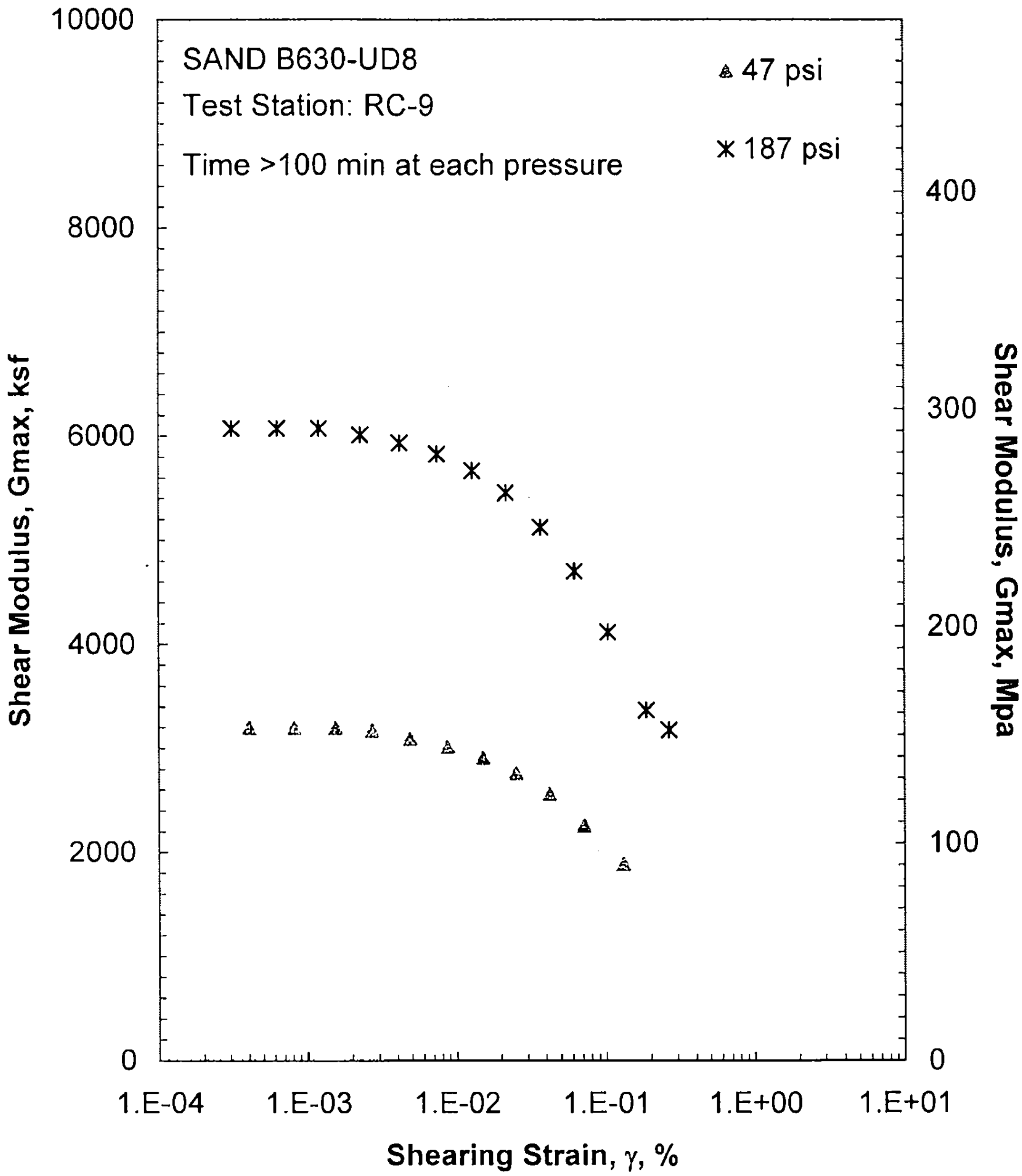

Figure A.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

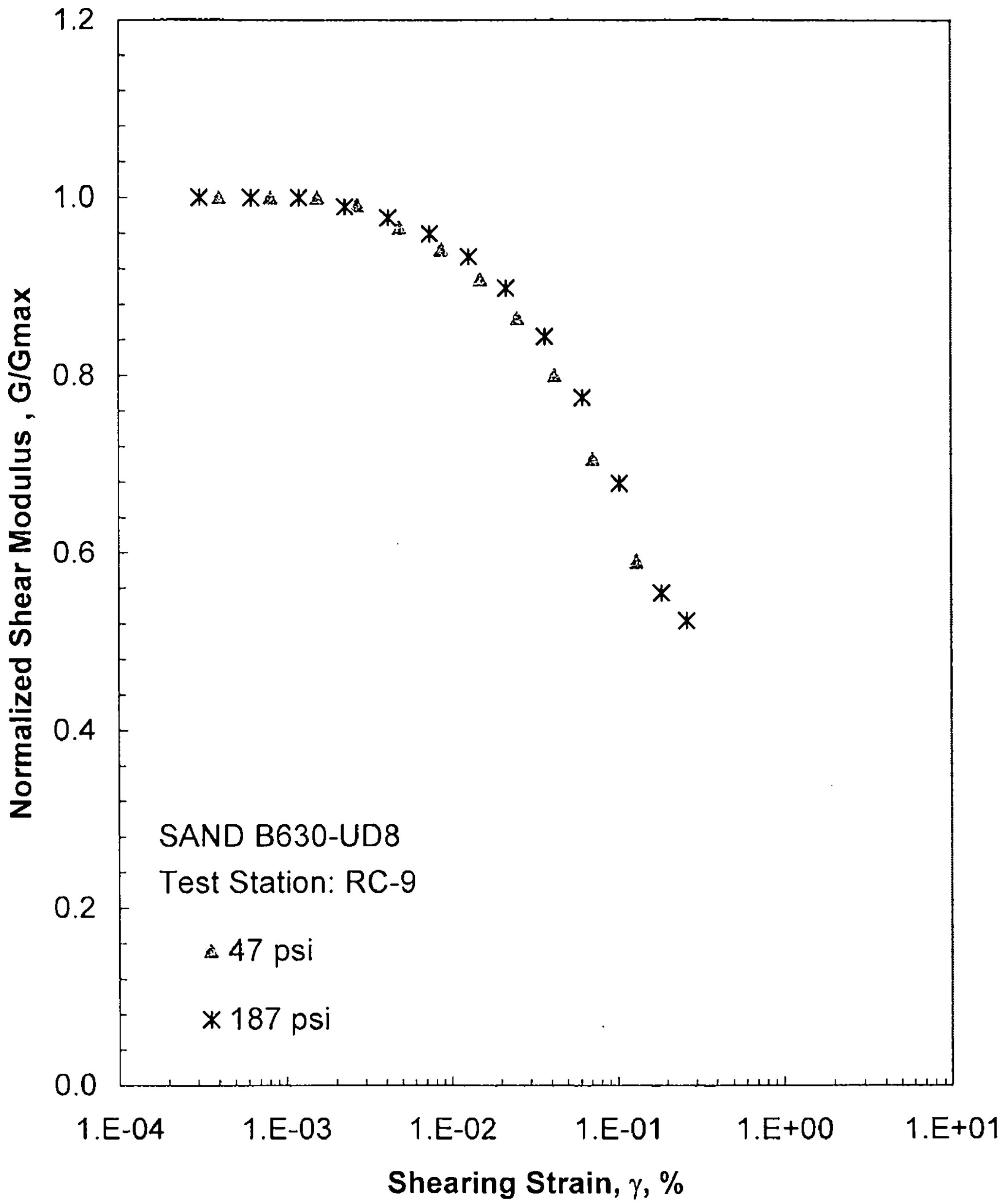

Figure A.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

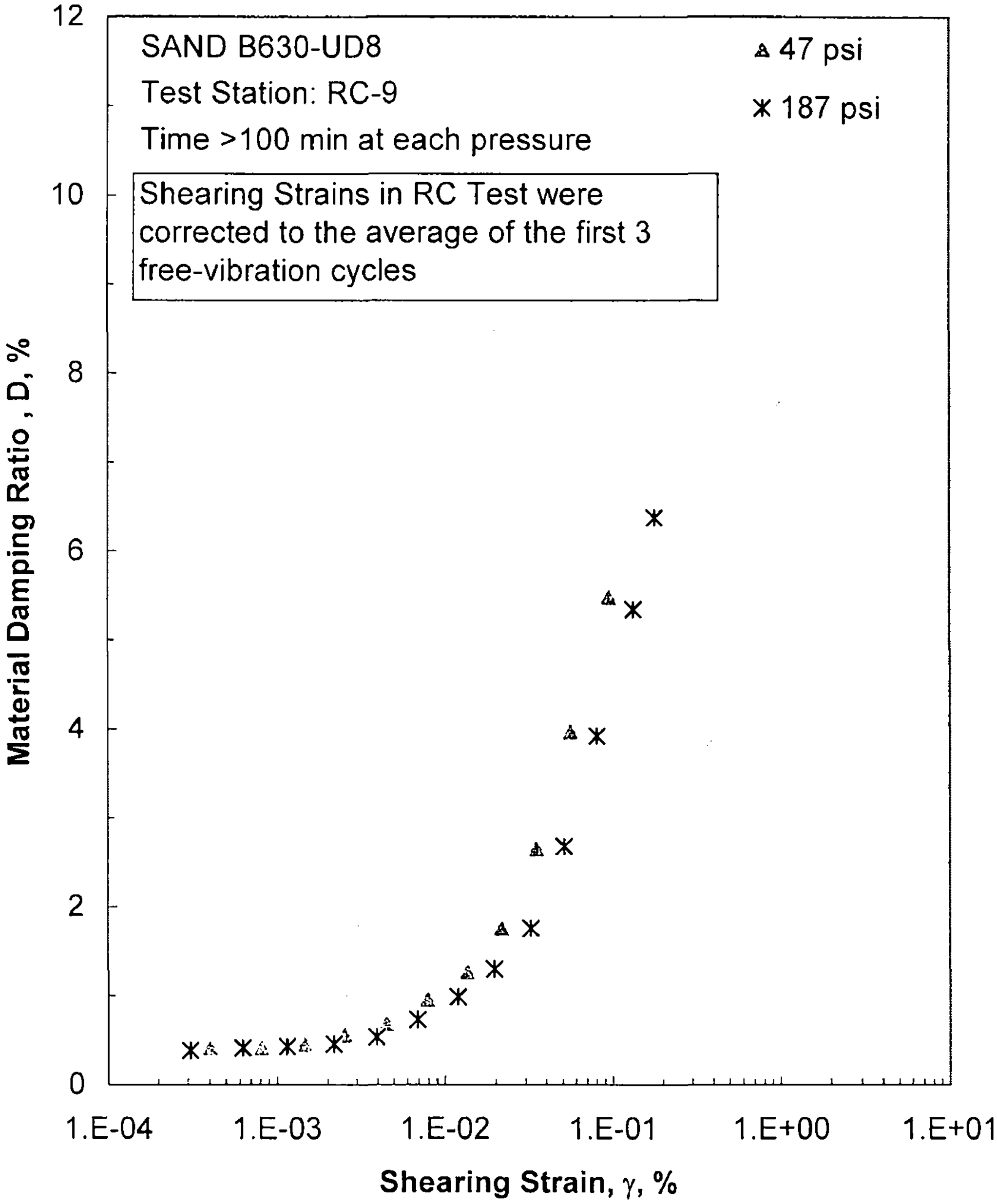

Figure A.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

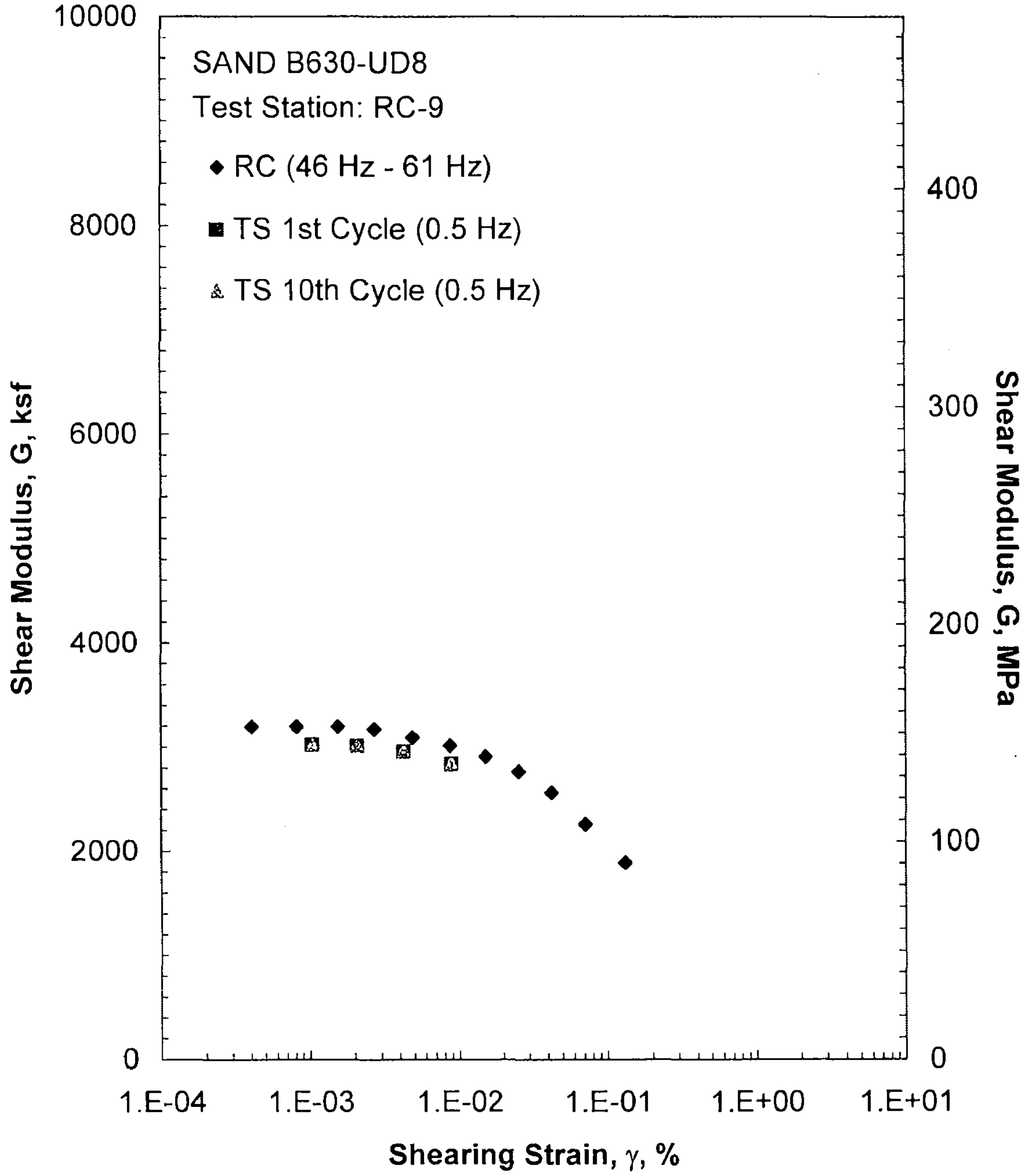

Figure A.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 47 psi from the Combined RCTS Tests

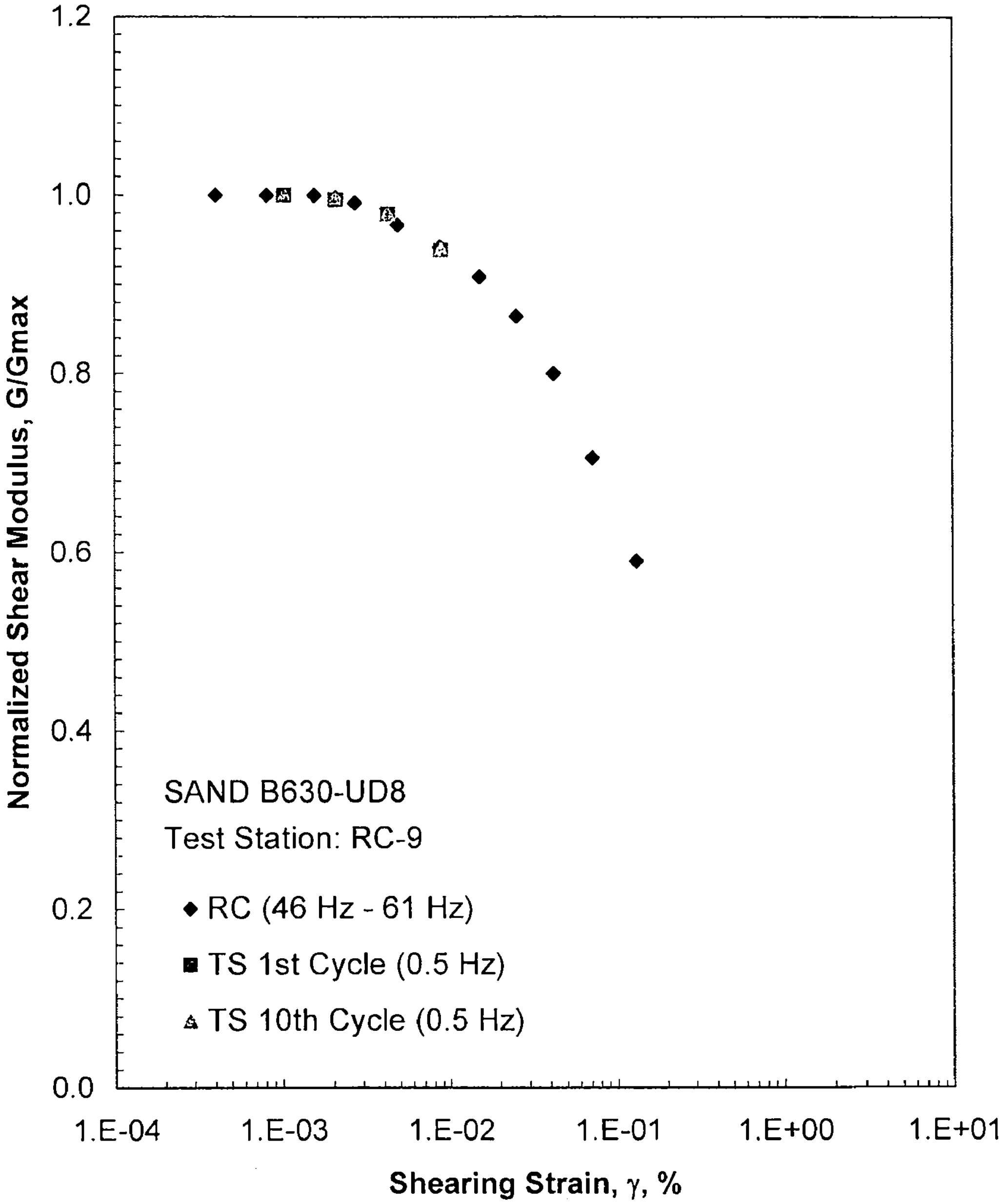

Figure A.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 47 psi from the Combined RCTS Tests

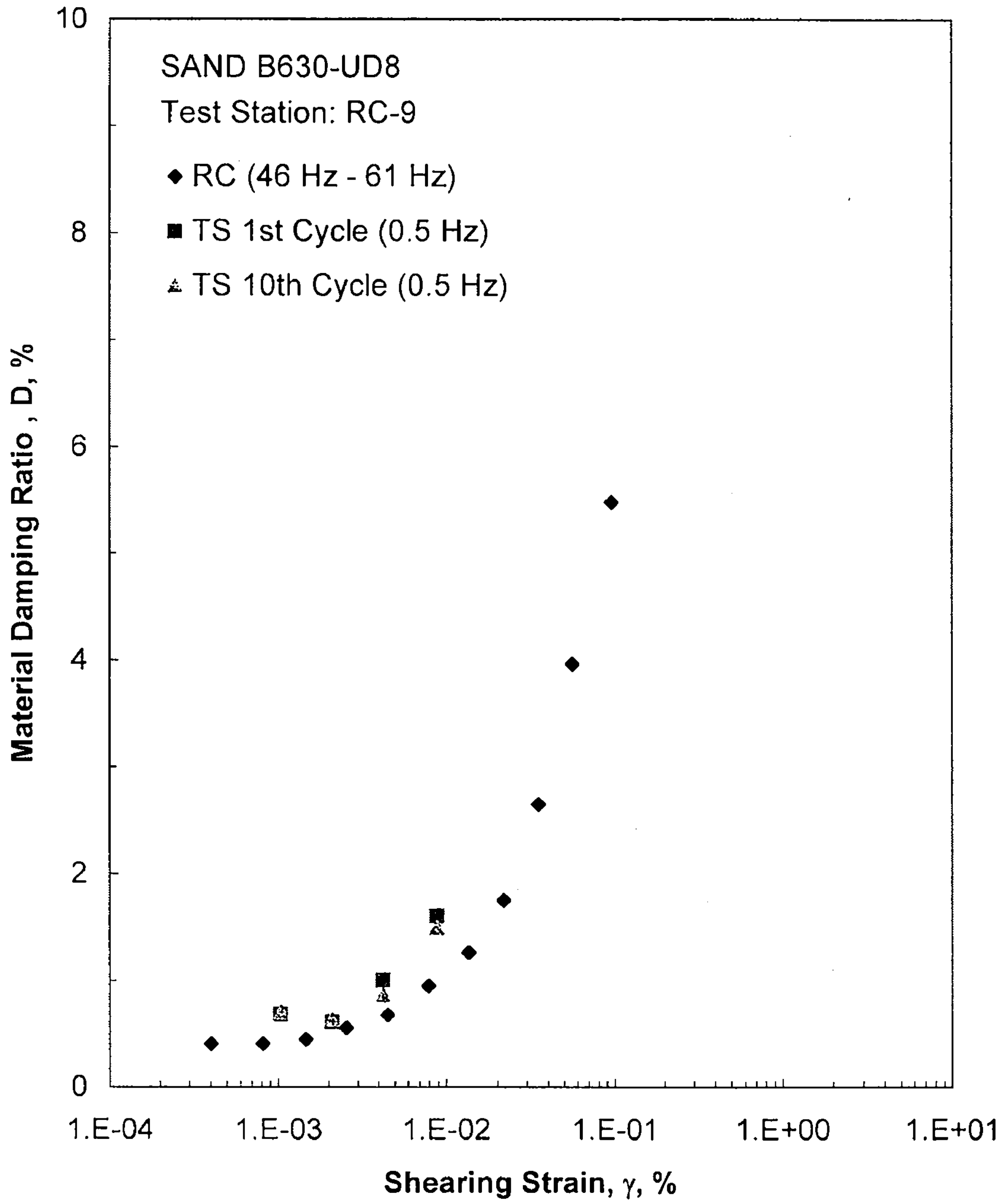

Figure A.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 47 psi from the Combined RCTS Tests

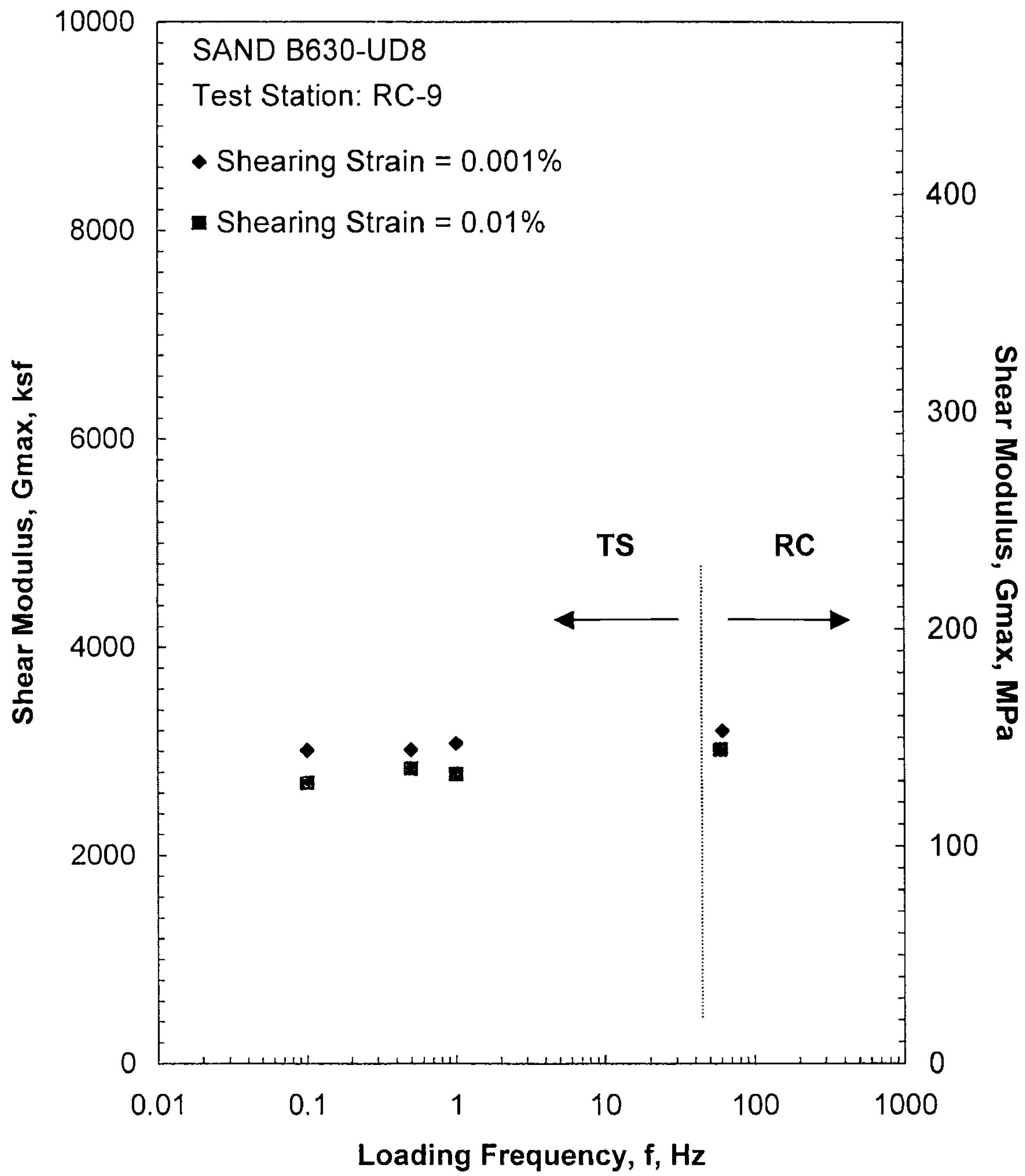

Figure A.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 47 psi from the Combined RCTS Tests

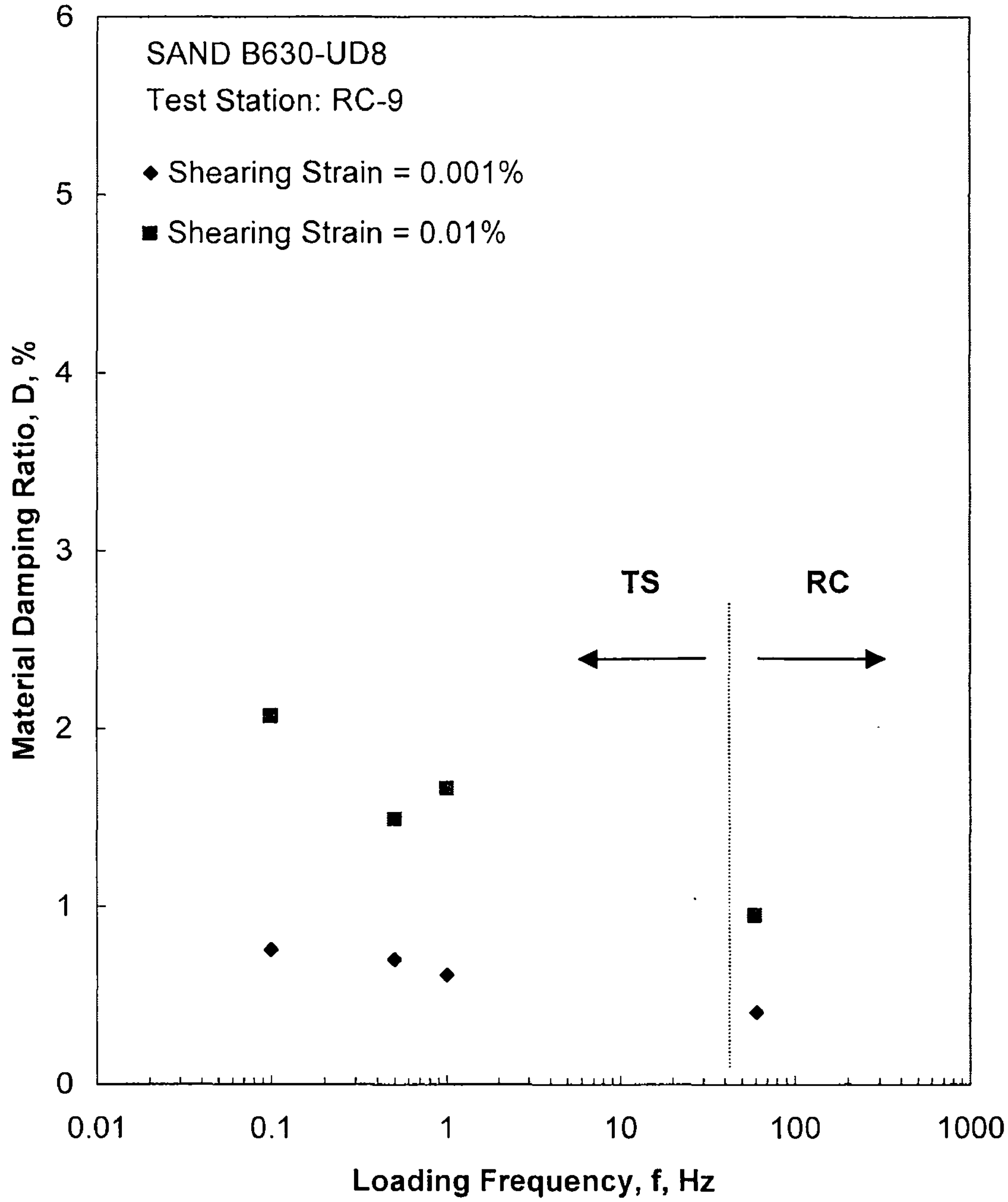

Figure A.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 47 psi from the Combined RCTS Tests

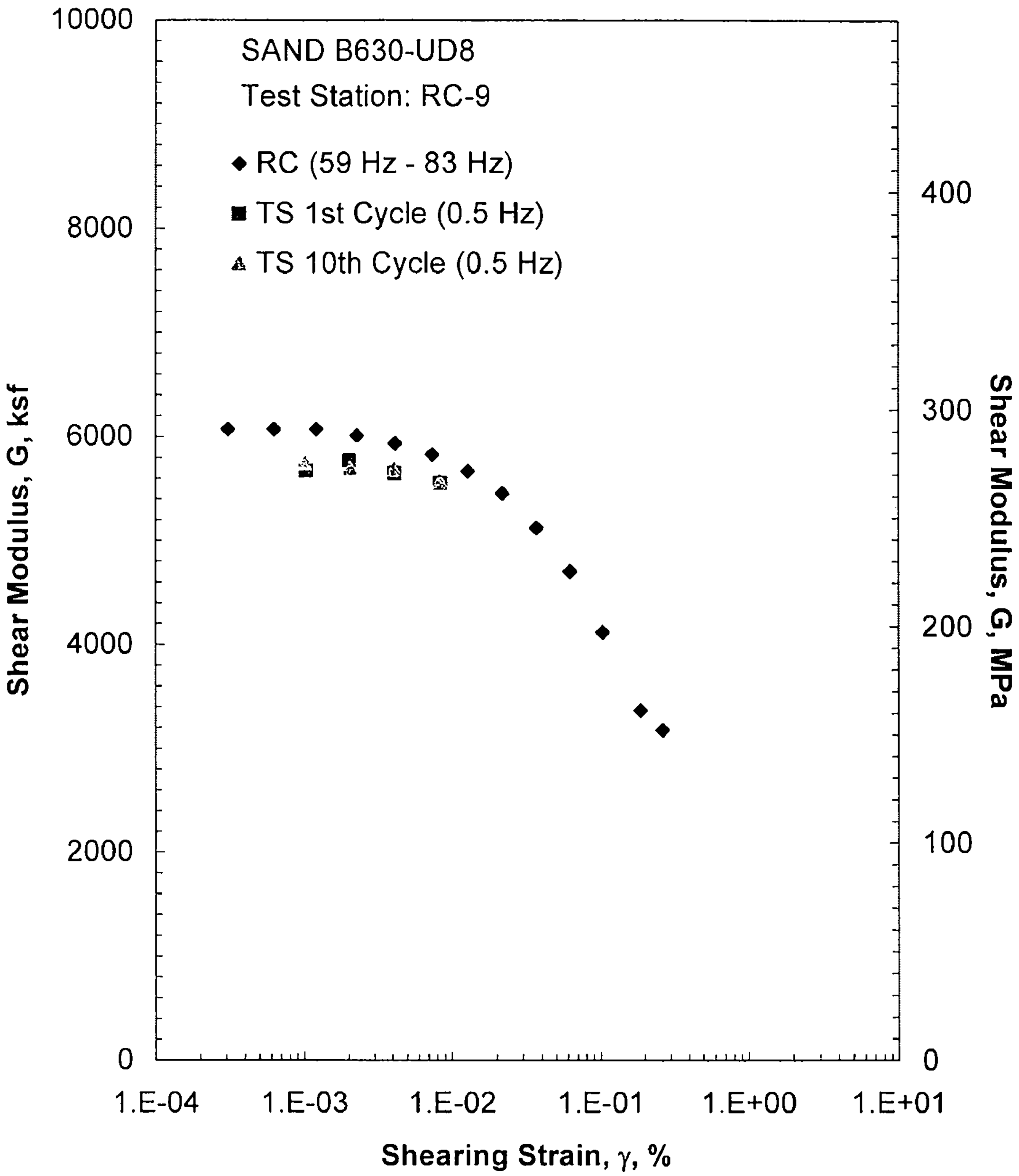

Figure A.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 187 psi from the Combined RCTS Tests

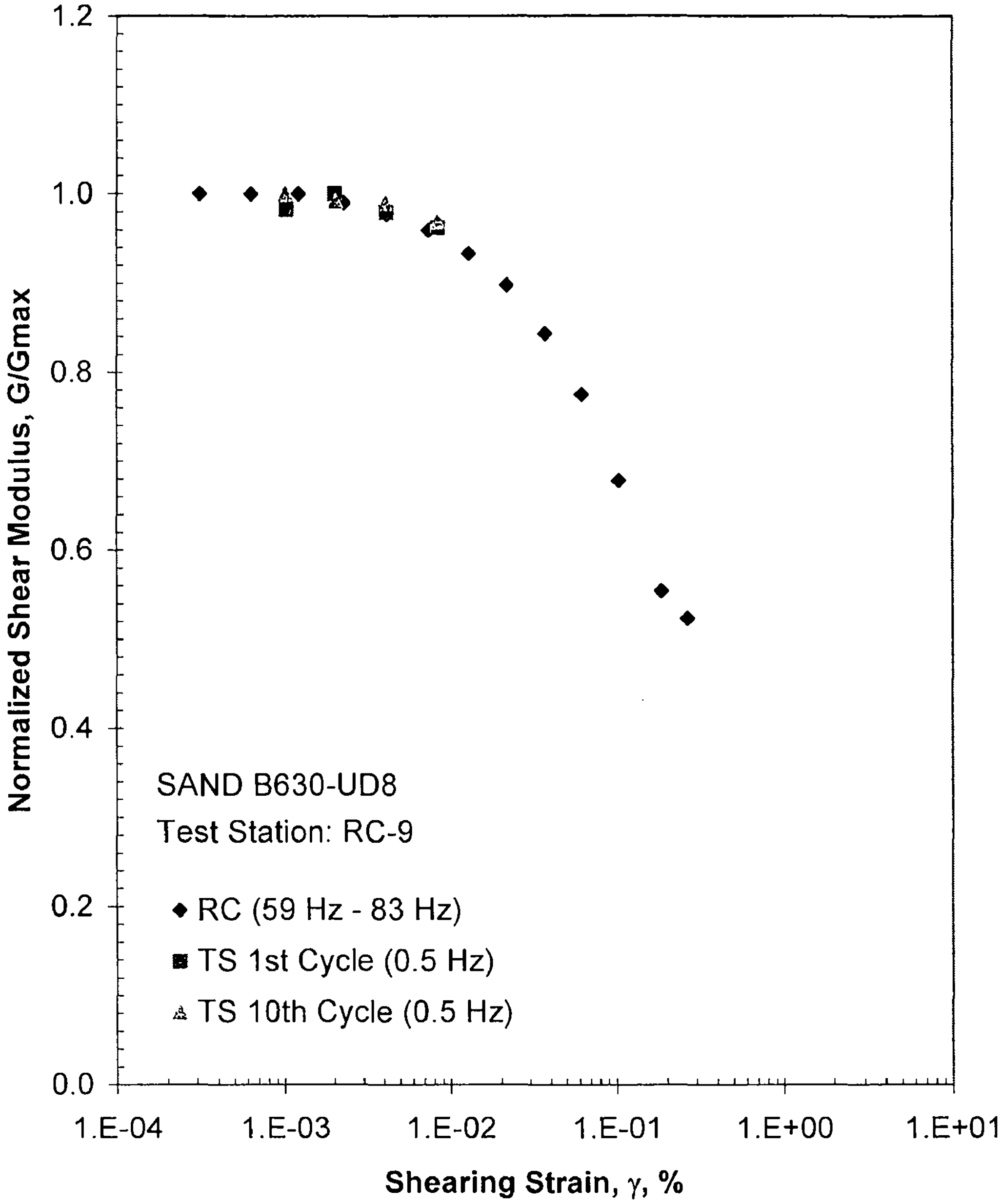

Figure A.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 187 psi from the Combined RCTS Tests

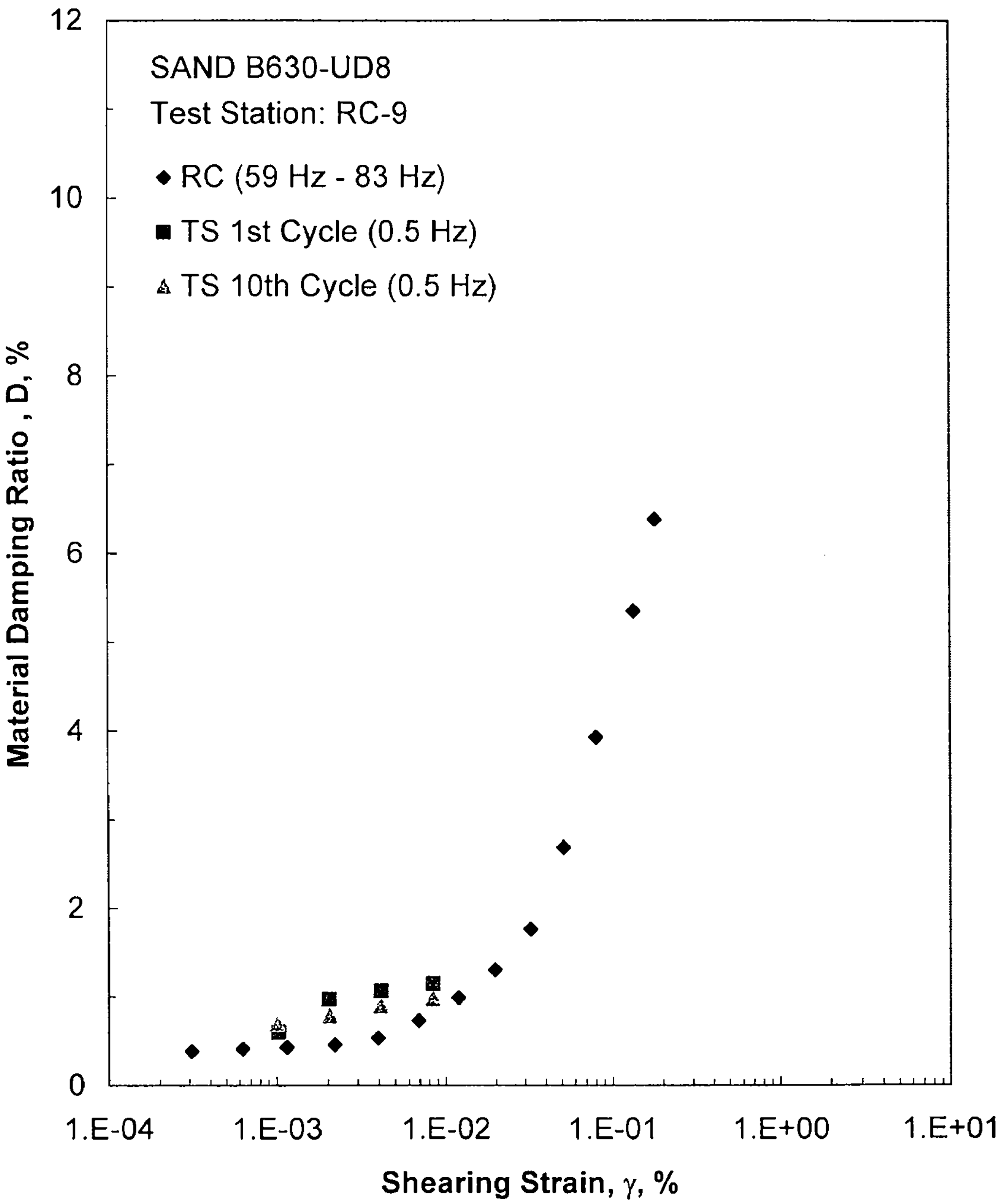

Figure A.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 187 psi from the Combined RCTS Tests

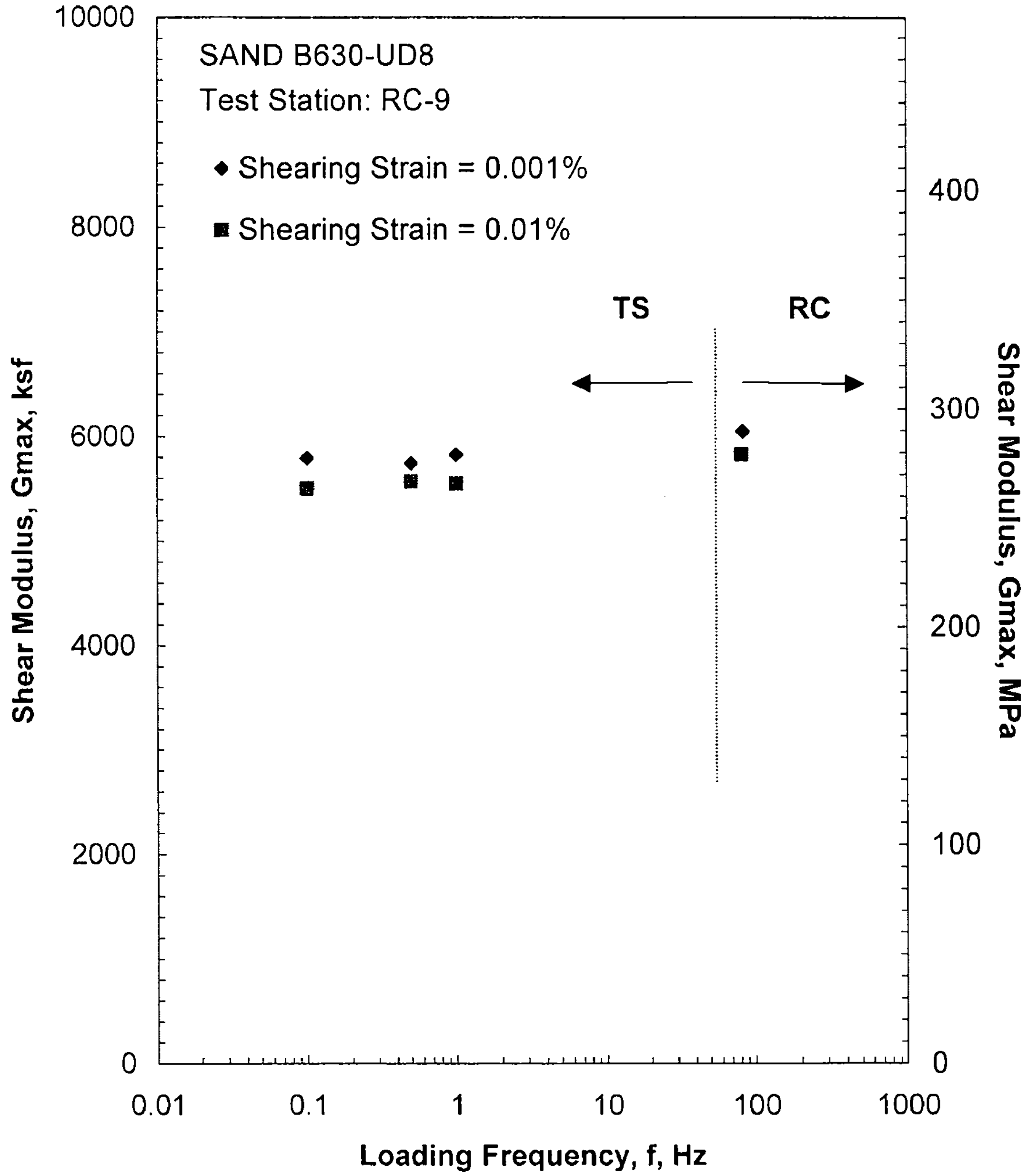

Figure A.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 187 psi from the Combined RCTS Tests

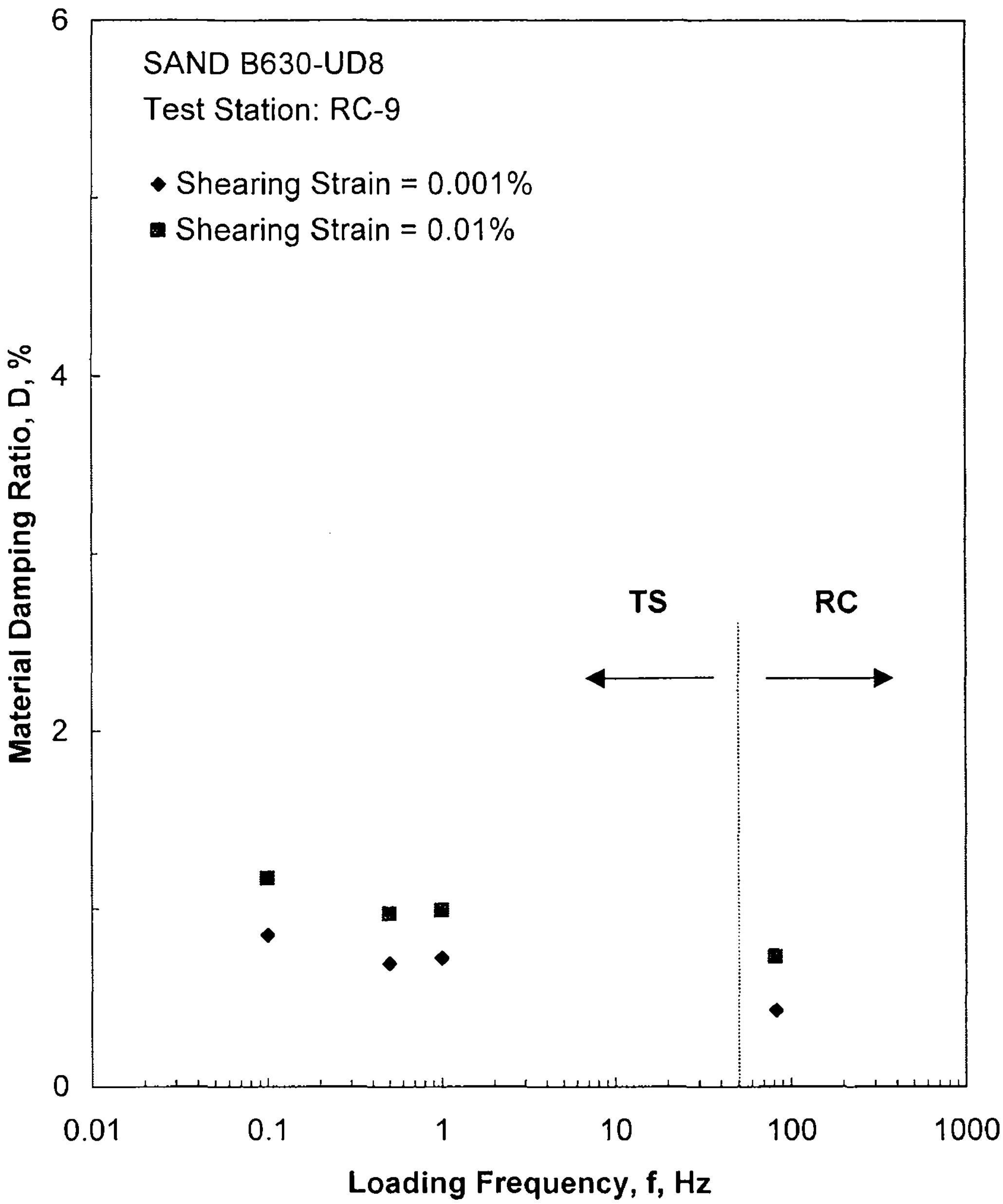

Figure A.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 187 psi from the Combined RCTS Tests

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 B630-UD8

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	1728	83	1609	77	659	0.76	0.85
23	3312	158	2230	107	775	0.70	0.84
47	6768	324	3183	153	924	0.42	0.83
97	13968	668	4530	217	1097	0.40	0.81
187	26928	1288	5967	286	1249	0.39	0.79

Table A.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD8; Isoptropic Confining Pressure, σ_o=47 psi (6.8 ksf = 324 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
4.04E-04	3196	1.00	4.04E-04	0.41
8.14E-04	3196	1.00	8.14E-04	0.41
1.55E-03	3196	1.00	1.46E-03	0.45
2.71E-03	3170	0.99	2.55E-03	0.55
4.86E-03	3090	0.97	4.52E-03	0.68
8.70E-03	3011	0.94	7.91E-03	0.95
1.51E-02	2903	0.91	1.36E-02	1.26
2.53E-02	2762	0.86	2.18E-02	1.75
4.22E-02	2556	0.80	3.50E-02	2.65
7.15E-02	2254	0.71	5.58E-02	3.96
1.31E-01	1886	0.59	9.54E-02	5.48

+ 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 B630-UD8; Isotropic Confining Pressure, σ_o= 47 psi (6.8 ksf = 324 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, %
1.03E-03	3020	1.00	0.68	1.04E-03	3016	1.00	0.70
2.09E-03	3005	0.99	0.61	2.09E-03	3010	1.00	0.63
4.25E-03	2956	0.98	1.00	4.25E-03	2954	0.98	0.86
8.86E-03	2834	0.94	1.60	8.87E-03	2832	0.94	1.49

Table A.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD8; Isoptropic Confining Pressure, σ_o= 187 psi (26.9 ksf = 1288 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
3.09E-04	6071	1.00	3.09E-04	0.38
6.26E-04	6071	1.00	6.26E-04	0.41
1.21E-03	6071	1.00	1.14E-03	0.43
2.28E-03	6009	0.99	2.19E-03	0.46
4.16E-03	5935	0.98	3.95E-03	0.54
7.40E-03	5825	0.96	6.88E-03	0.73
1.28E-02	5666	0.93	1.19E-02	0.99
2.17E-02	5453	0.90	1.97E-02	1.30
3.69E-02	5120	0.84	3.25E-02	1.76
6.19E-02	4703	0.77	5.14E-02	2.68
1.03E-01	4115	0.68	8.04E-02	3.92
1.86E-01	3365	0.55	1.34E-01	5.34
2.64E-01	3175	0.52	1.80E-01	6.37

+ 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 B630-UD8; Isotropic Confining Pressure, σ_o=187 psi (26.9 ksf = 1288 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, %
1.03E-03	5671	0.98	0.60	1.01E-03	5744	1.00	0.69
2.02E-03	5768	1.00	0.97	2.05E-03	5698	0.99	0.78
4.13E-03	5650	0.98	1.06	4.10E-03	5684	0.99	0.89
8.40E-03	5551	0.96	1.14	8.38E-03	5565	0.97	0.97

APPENDIX B

Specimen B630-UD2

Borehole B630
Sample UD2
Depth = 131.9 ft (40.2 m)
Total Unit Weight = 120.1 lb/ft^3
Water Content = 33.8 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 38 psi

FUGRO JOB #: 0411-08-1701
Testing Station: RC5

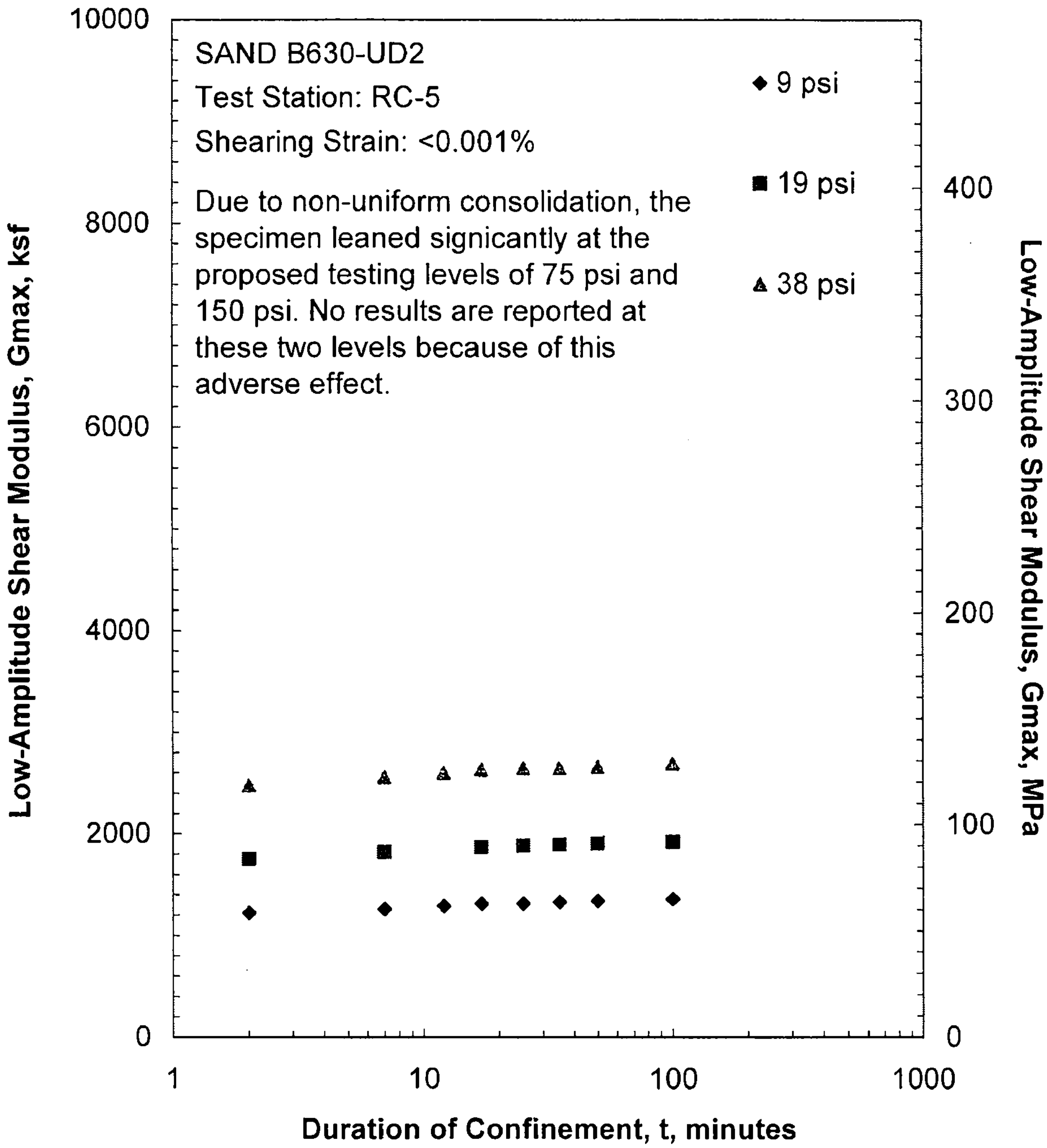

Figure B.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

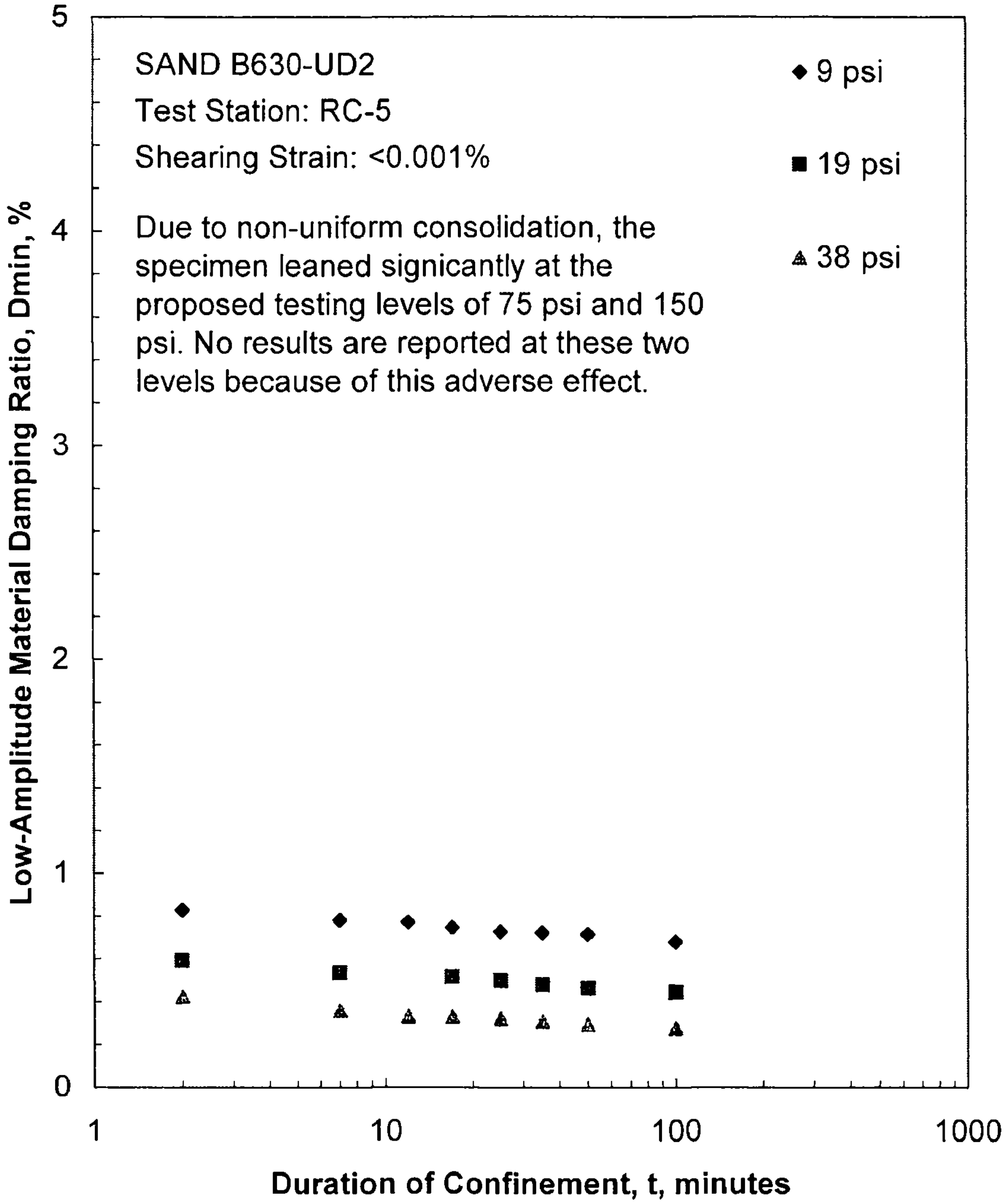

Figure B.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

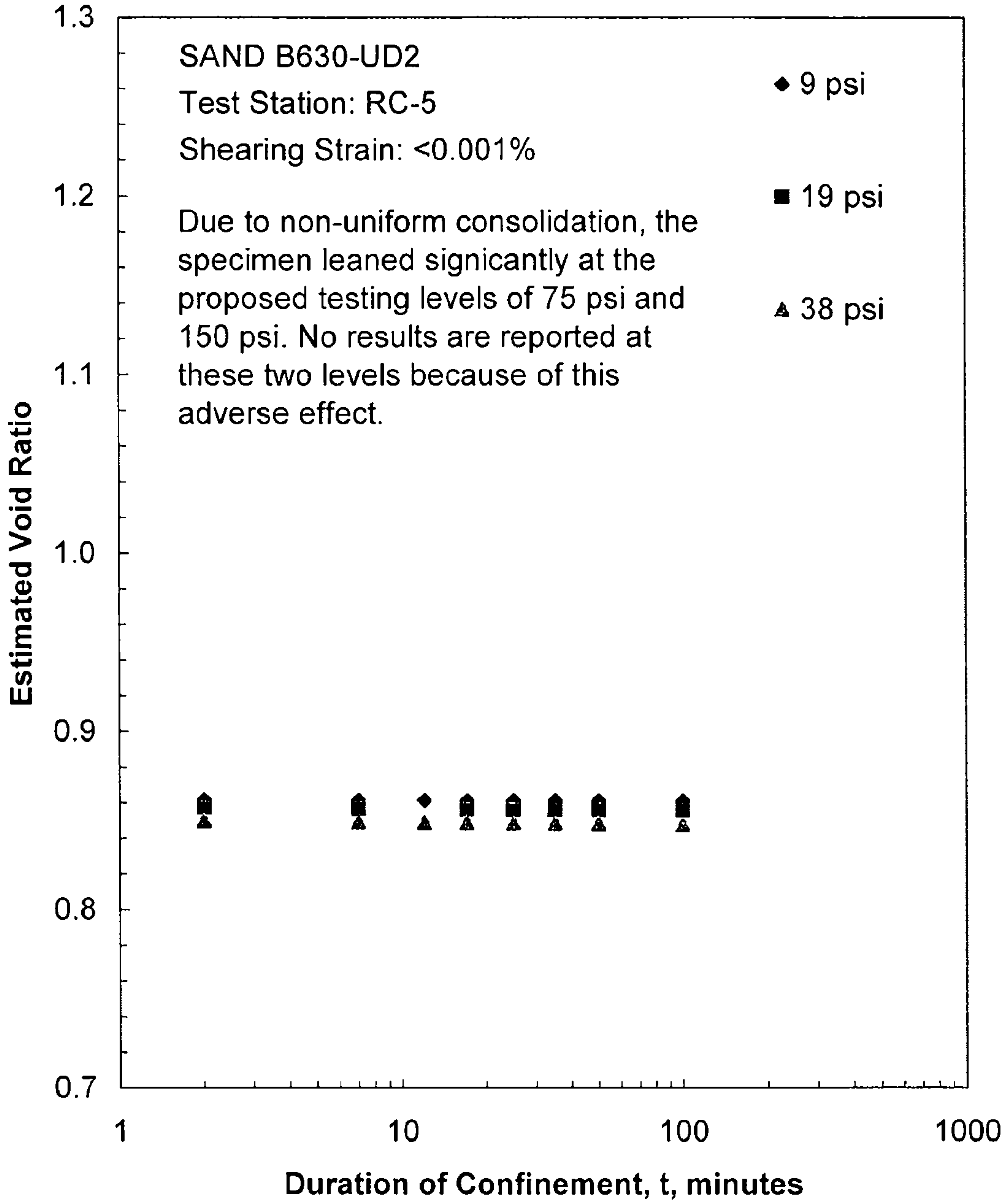

Figure B.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

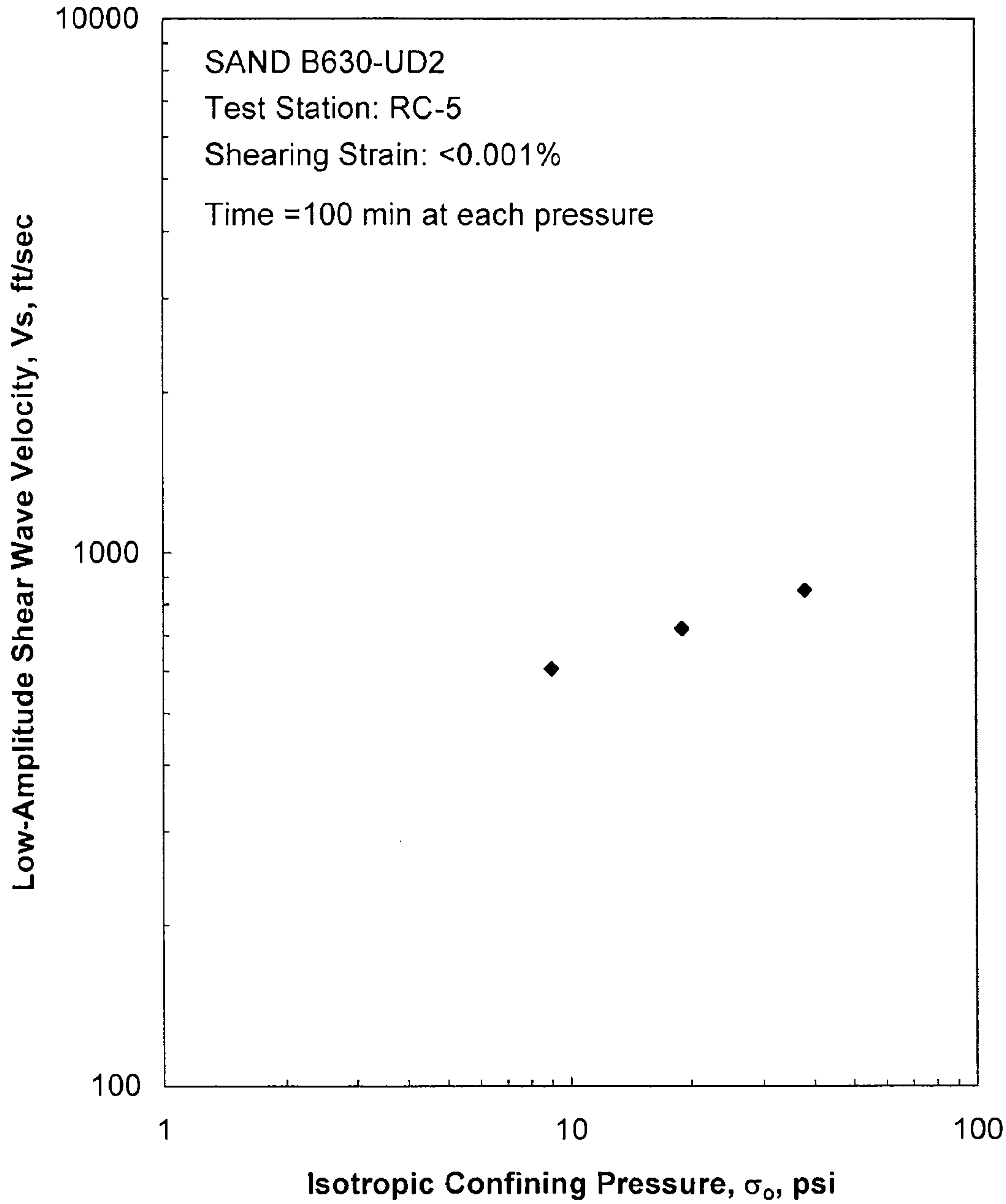

Figure B.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

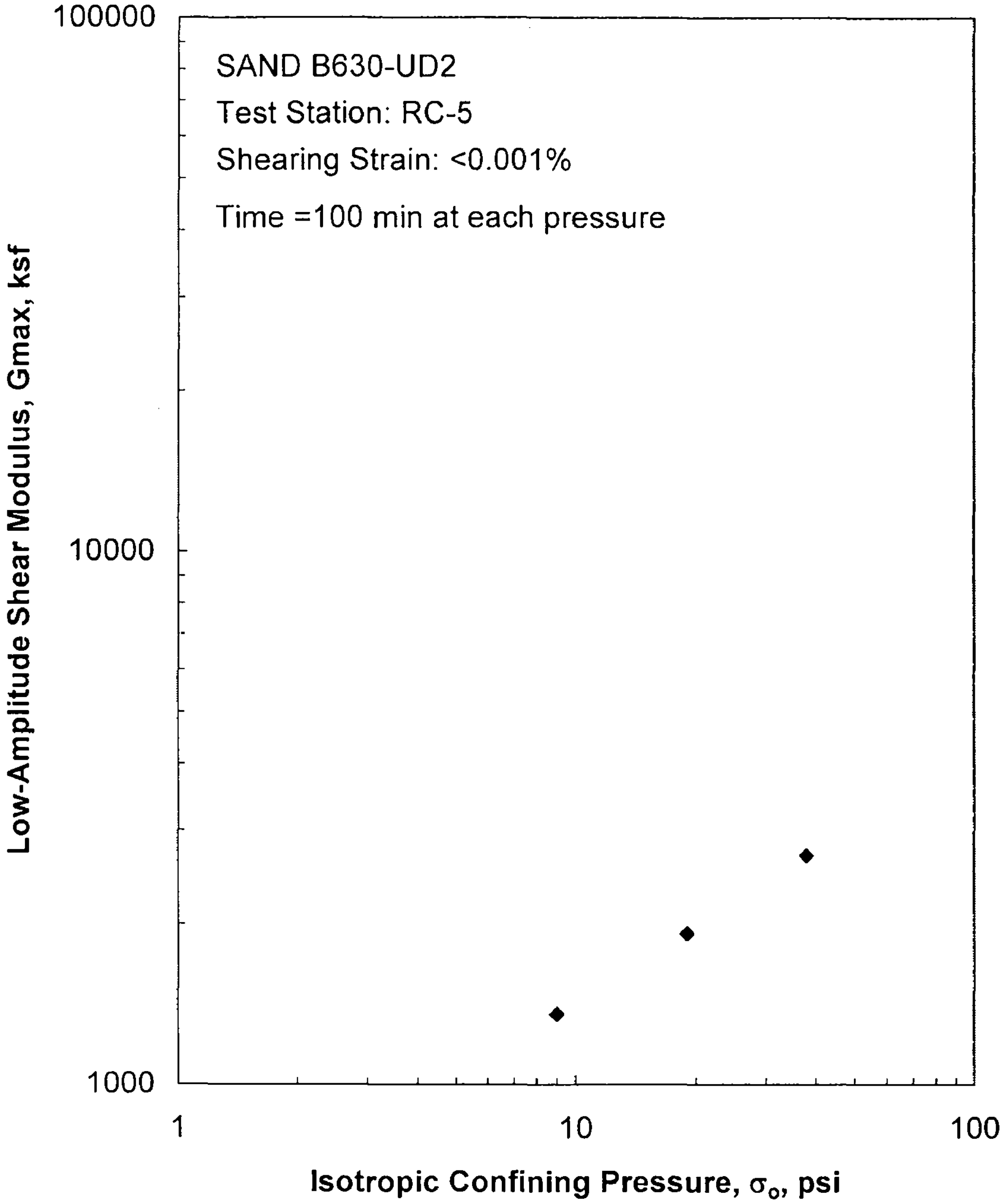

Figure B.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

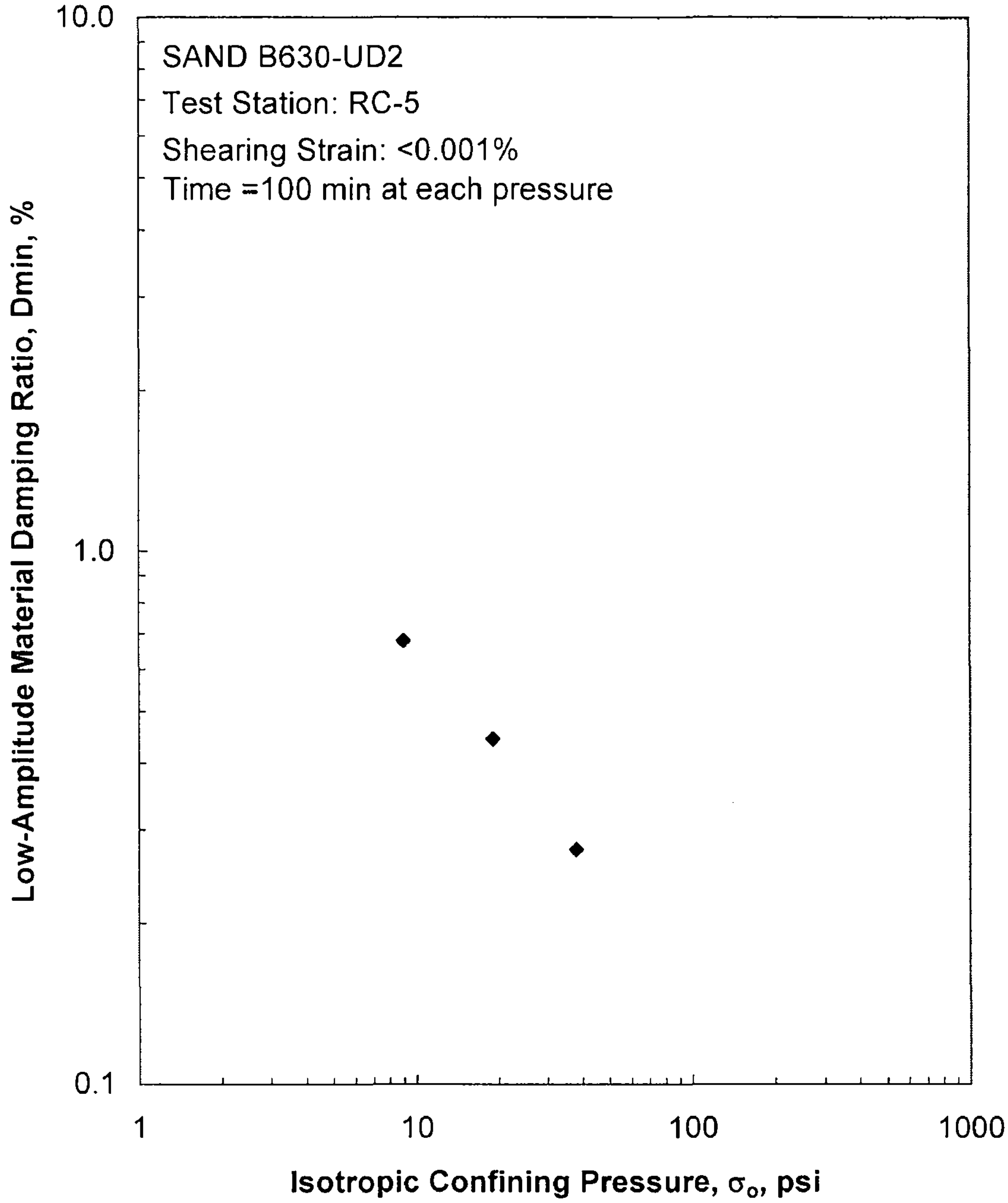

Figure B.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

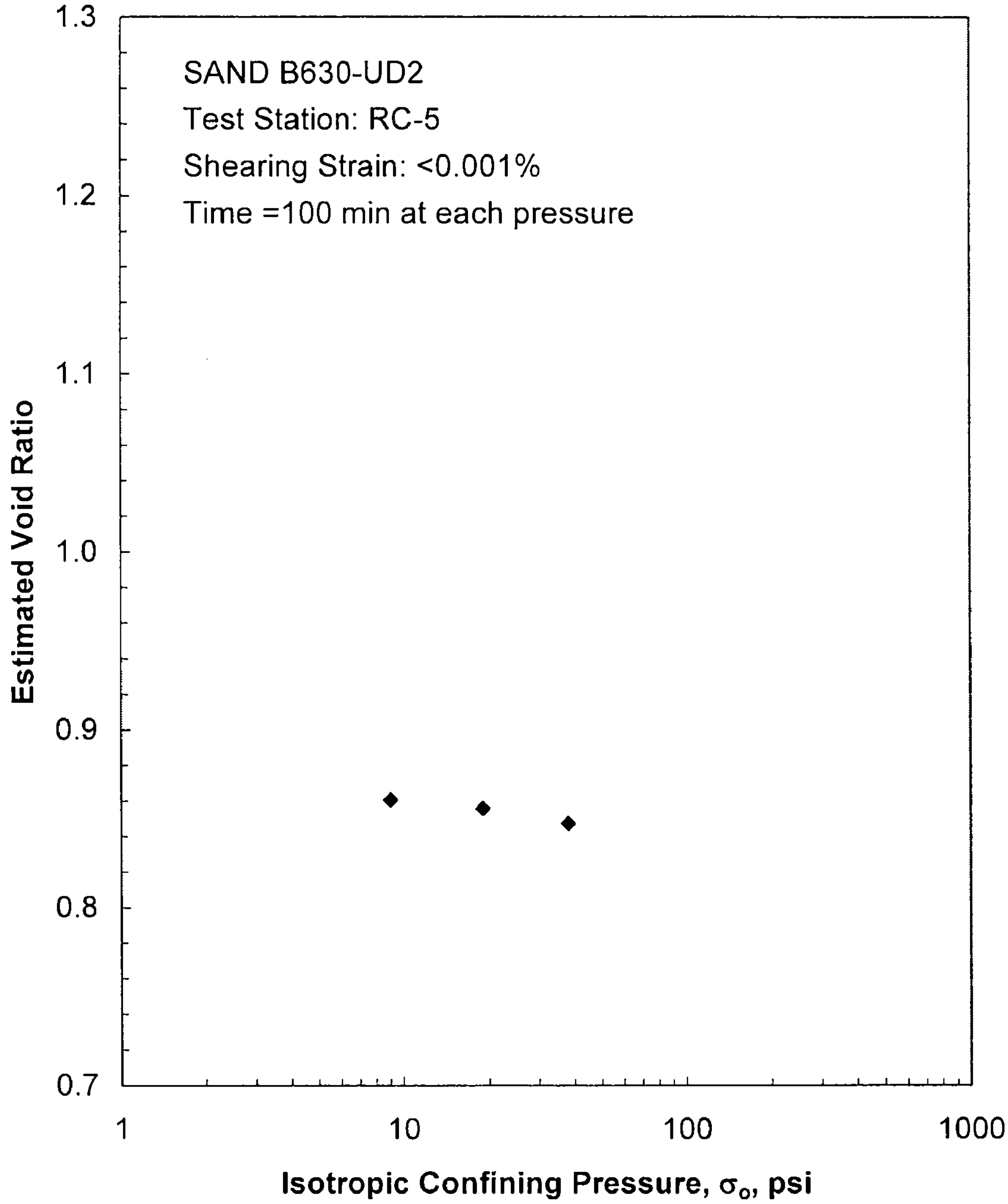

Figure B.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

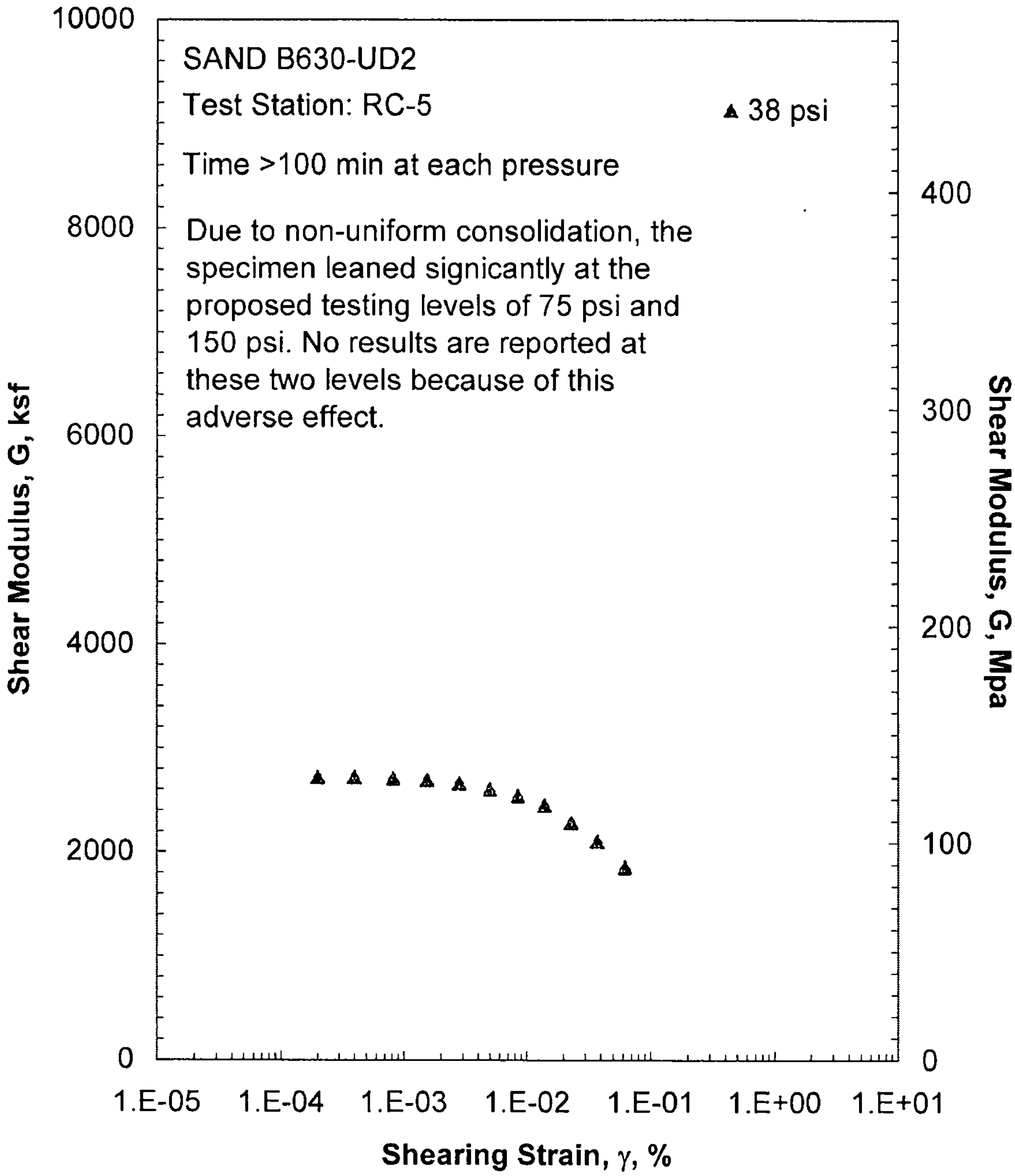

Figure B.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

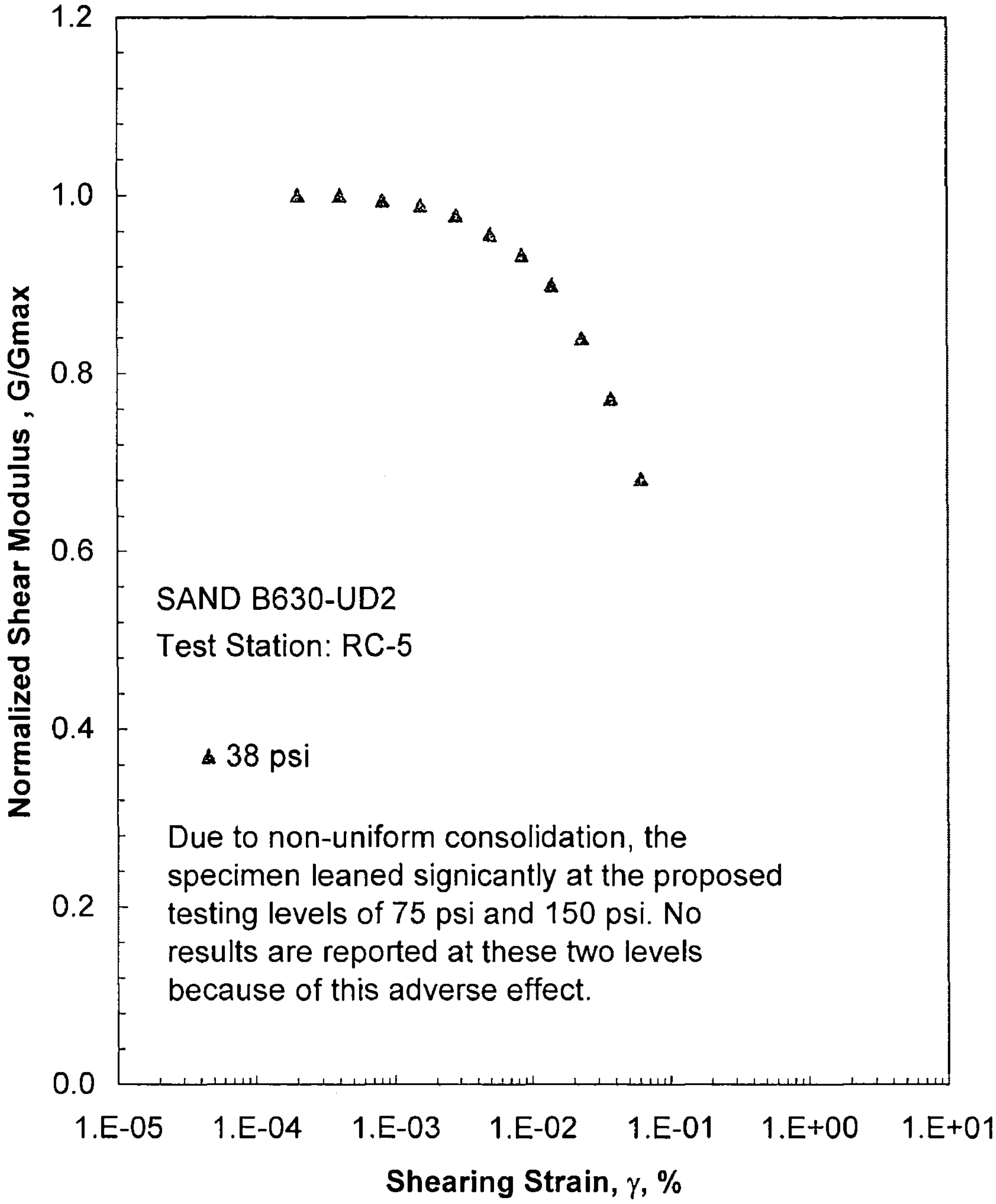

Figure B.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

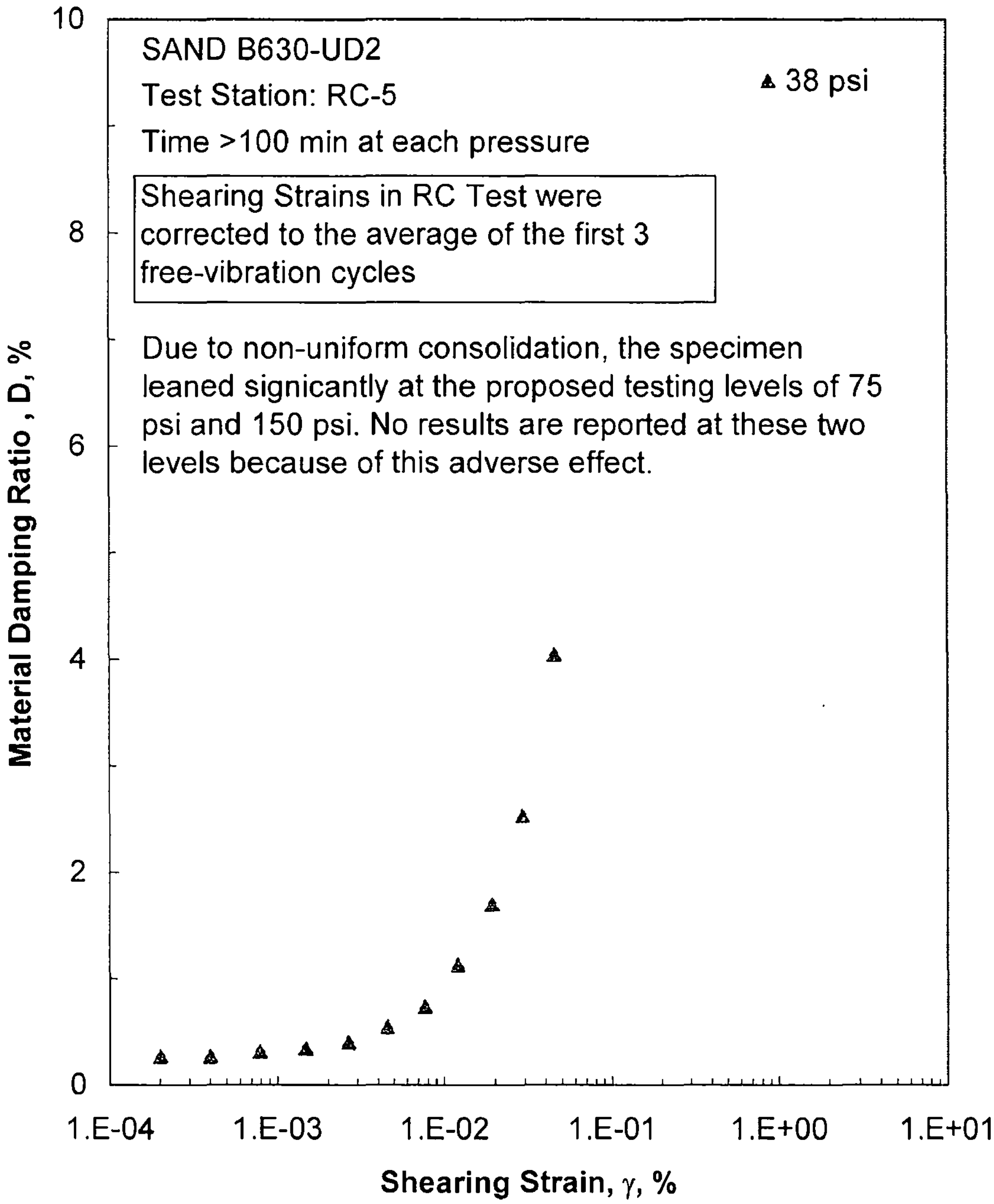

Figure B.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

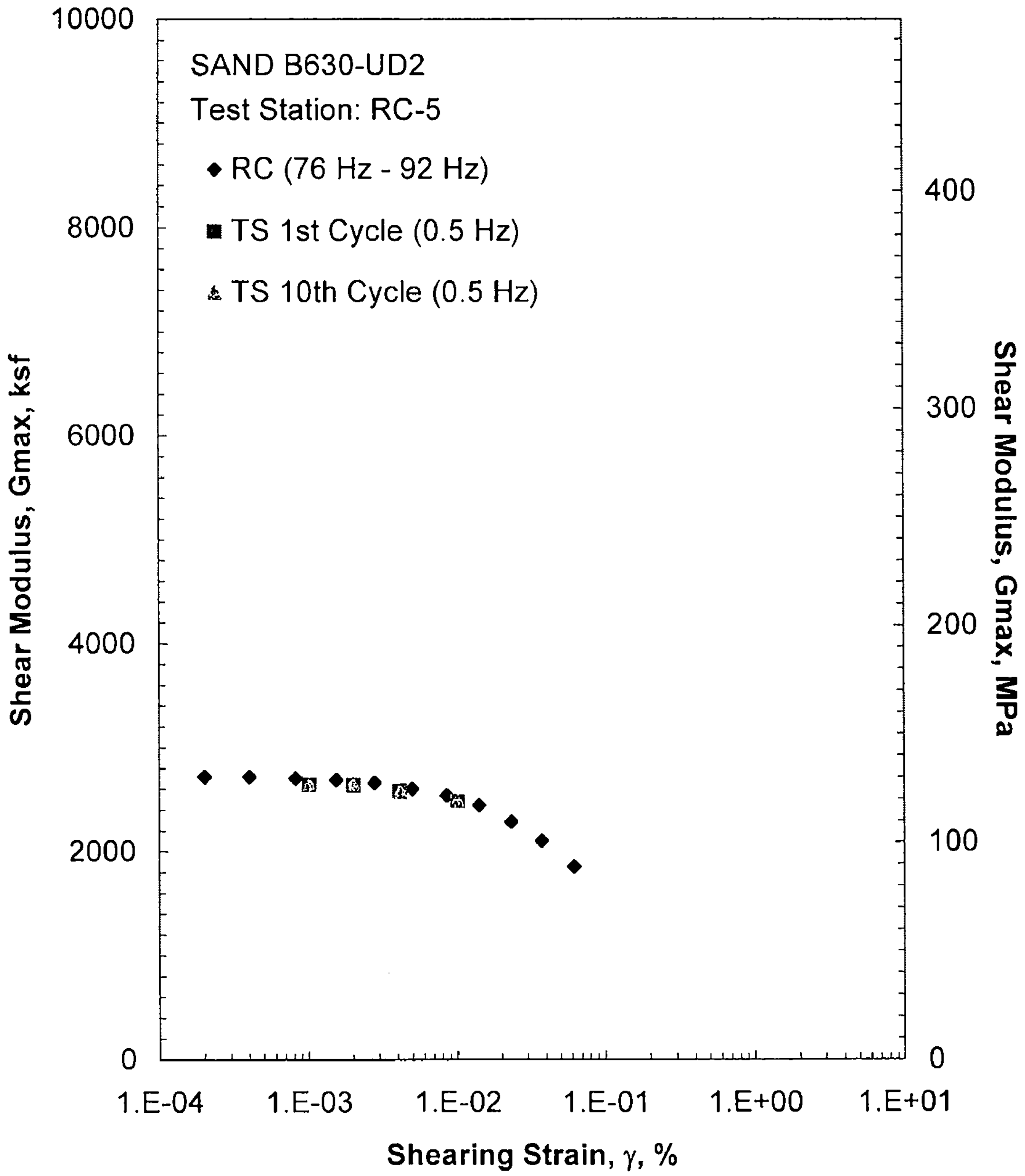

Figure B.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 38 psi from the Combined RCTS Tests

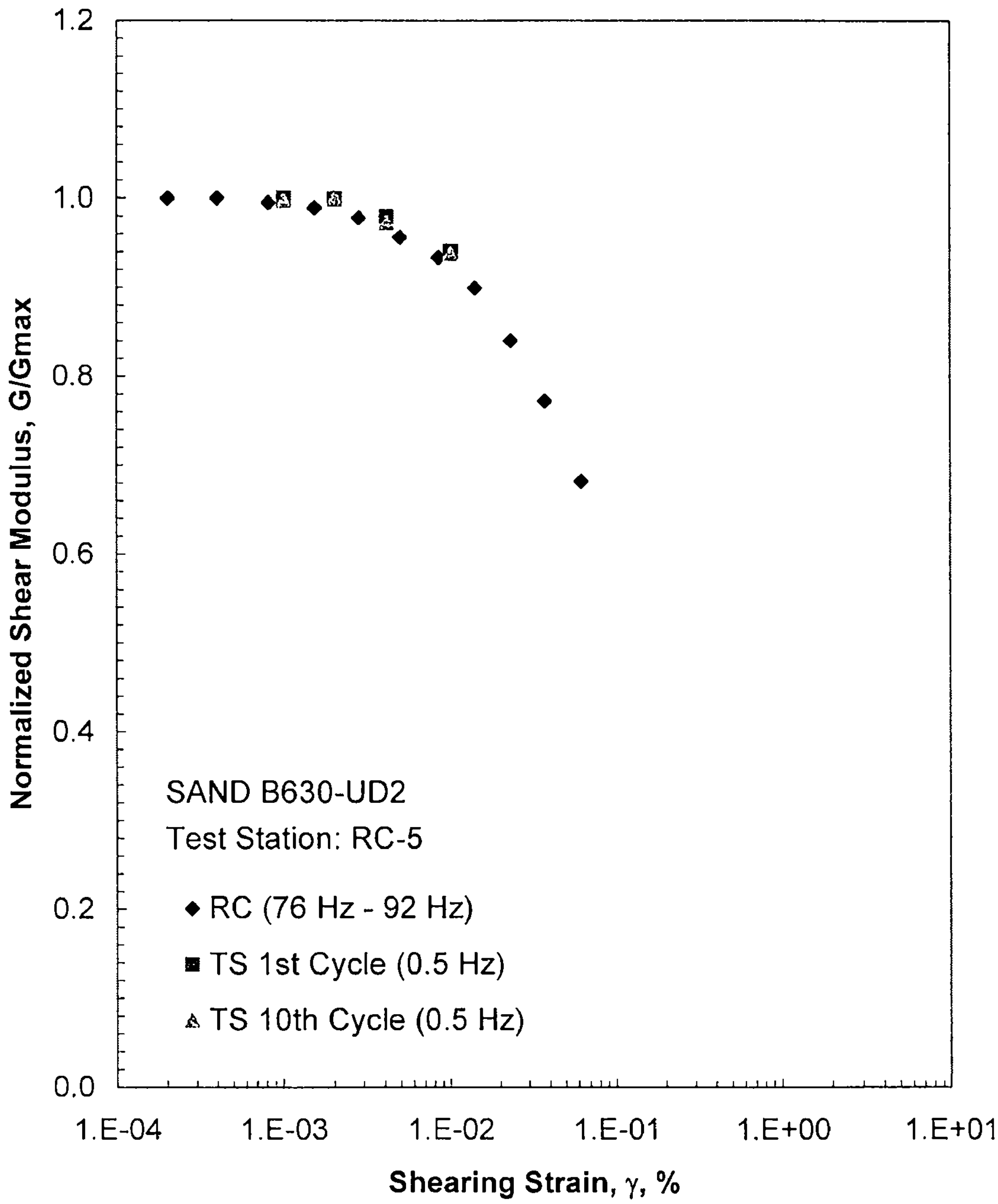

Figure B.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 38 psi from the Combined RCTS Tests

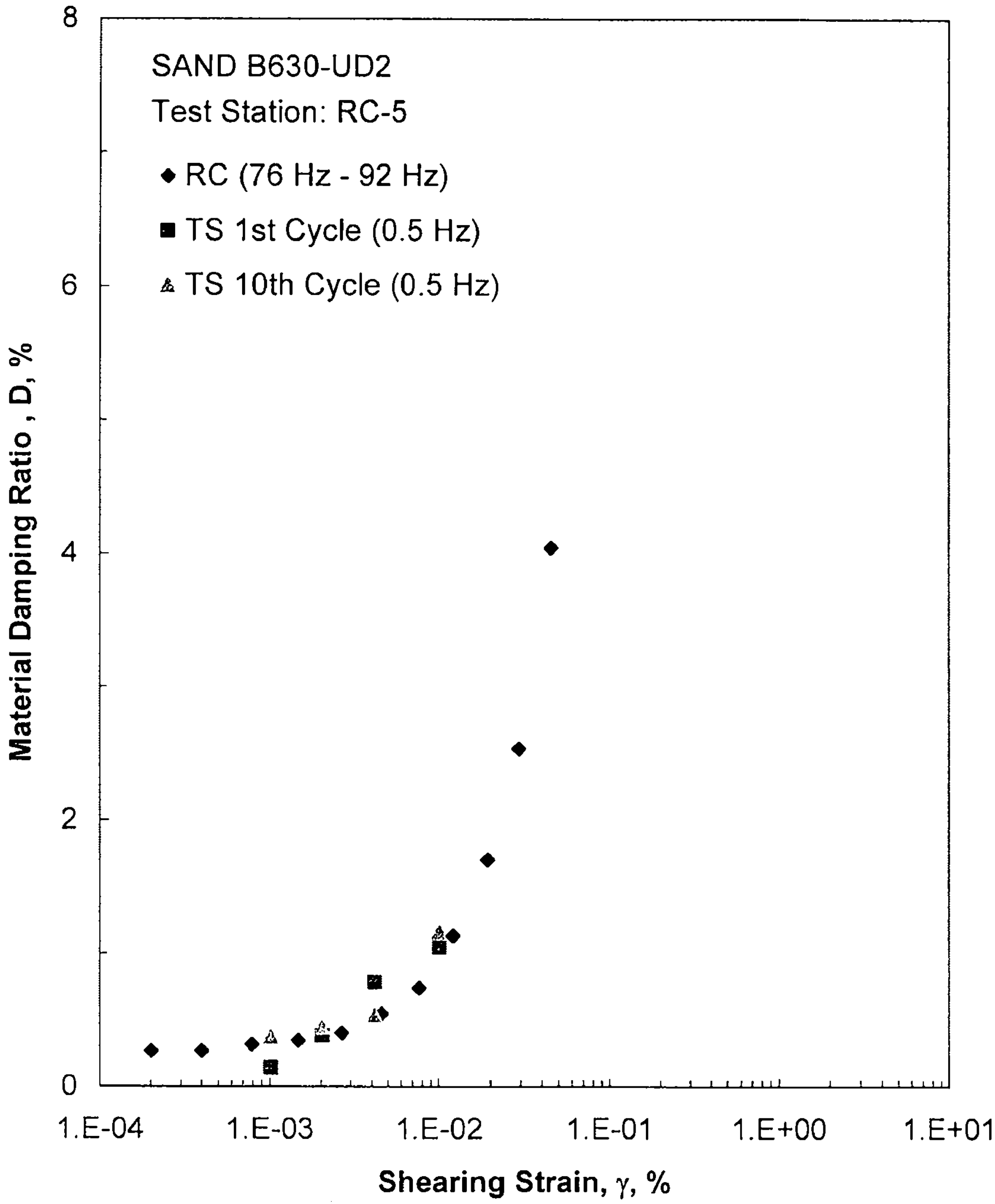

Figure B.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 38 psi from the Combined RCTS Tests

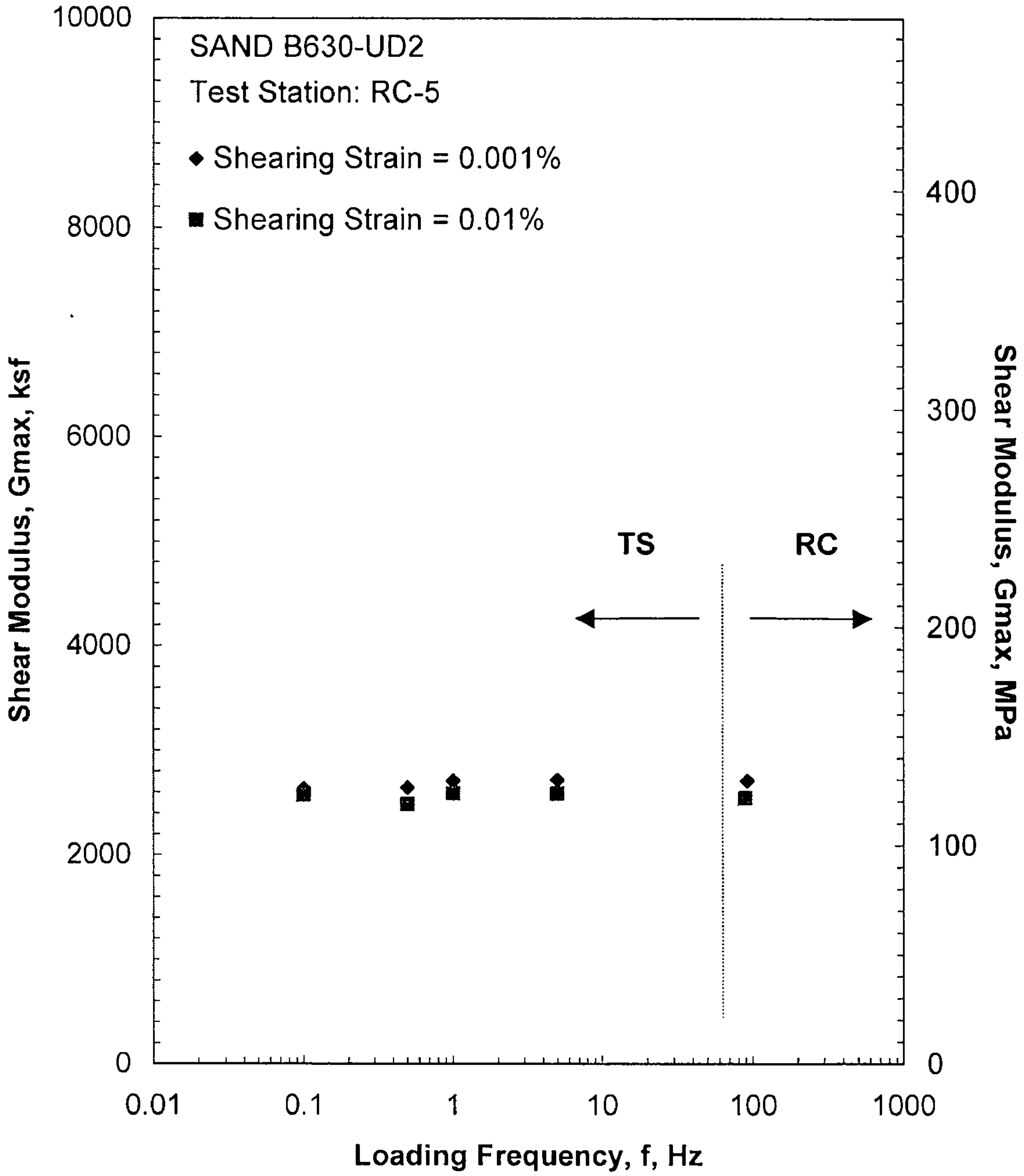

Figure B.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 38 psi from the Combined RCTS Tests

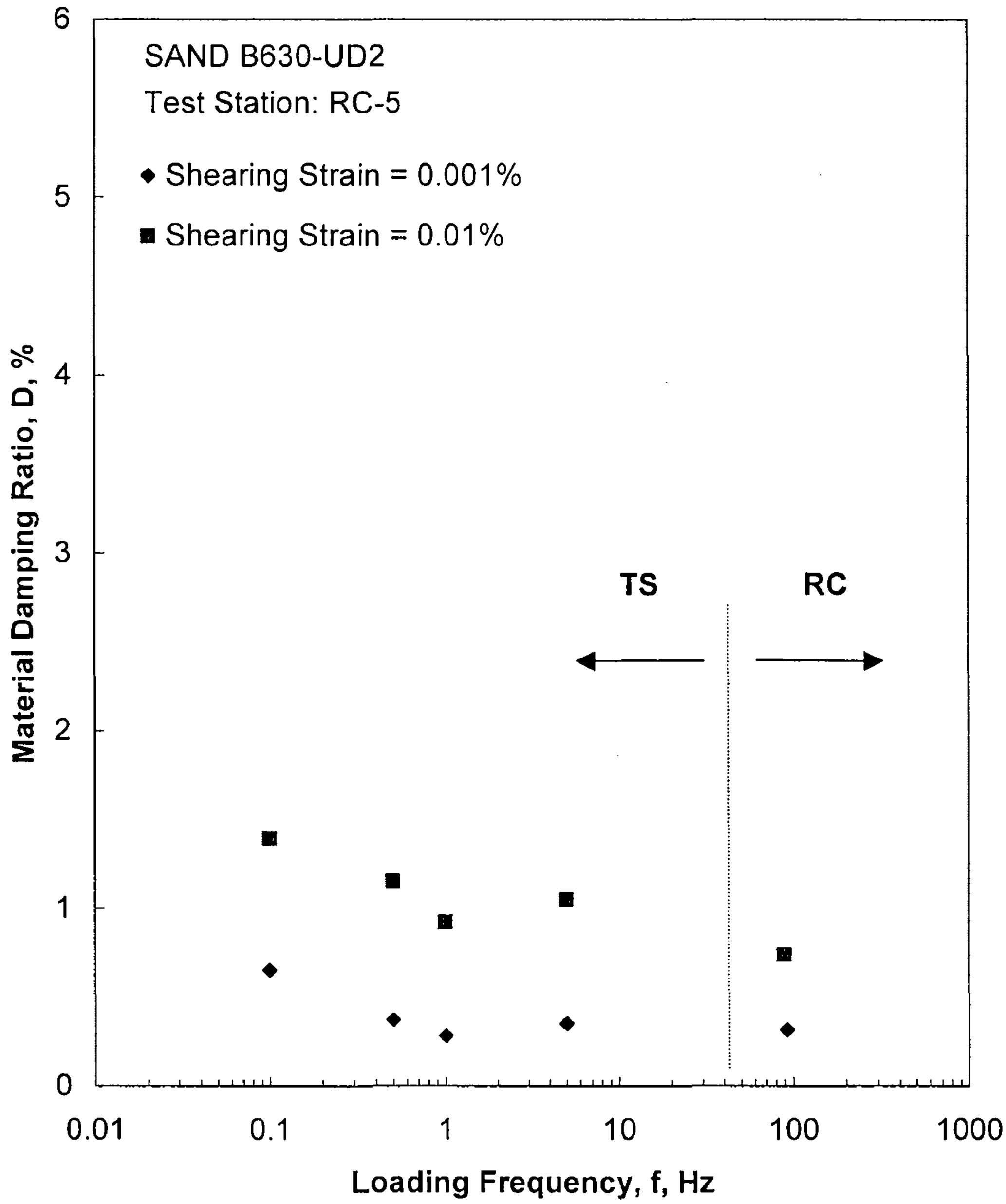

Figure B.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 38 psi from the Combined RCTS Tests

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 B630-UD2

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)	(%)	
9	1296	62	1354	65	605	0.68	0.86
19	2736	131	1918	92	719	0.44	0.86
38	5472	262	2688	129	850	0.28	0.85

Table B.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD2; Isoptropic Confining Pressure, σ_o= 38 psi (5.5 ksf = 262 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average⁺ Shearing Strain, %	Material Damping Ratio^x, D, %
2.01E-04	2719	1.00	2.01E-04	0.27
4.01E-04	2719	1.00	4.01E-04	0.27
8.20E-04	2704	0.99	7.87E-04	0.32
1.55E-03	2689	0.99	1.47E-03	0.34
2.82E-03	2659	0.98	2.65E-03	0.40
5.00E-03	2600	0.96	4.55E-03	0.54
8.52E-03	2538	0.93	7.67E-03	0.74
1.41E-02	2445	0.90	1.21E-02	1.13
2.32E-02	2283	0.84	1.93E-02	1.70
3.74E-02	2099	0.77	2.92E-02	2.53
6.20E-02	1853	0.68	4.53E-02	4.04

⁺ 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 B630-UD2; Isotropic Confining Pressure, σ_o= 38 psi (5.5 ksf =262 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, %
1.02E-03	2638	1.00	0.14	1.02E-03	2640	1.00	0.37
2.04E-03	2635	1.00	0.38	2.03E-03	2648	1.00	0.44
4.15E-03	2584	0.98	0.78	4.17E-03	2576	0.97	0.53
1.01E-02	2482	0.94	1.04	1.01E-02	2484	0.94	1.15

FUGRO CONSULTANTS, INC.

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

July 10, 2008

Ms. Siesta Williams
MACTEC
3301 Atlantic Avenue
Raleigh, NC 27604

RE: Two (2) Reports For The Turkey Point Project

Dear Ms. Williams:

Fugro has completed two (2) RCTS tests, which are B630-UD13 and B630-UD16 for the Turkey Point project. Fugro has incorporated, as needed, Dr. Kenneth Stokoe's comments into the final reports. The final reports and the associated RCTS Test Approvals 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

RCTS TEST APROVAL

PROJECT SITE/NAME	Turkey Point

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#C	B630-UD13	190	KHS (+)	3 July 08
RCTS#D	B630-UD16	211	KHS (▽)	3 July 08

Two RCTS tests for the site referenced above were tested, and two 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

(+) Carefully consider some of the suggested changes and/or deletions and some comments that could be added to a few figures.

(▽) See minor comments on a few figures

APPENDIX C

Specimen B630-UD13

Borehole 630
Sample UD13
Depth = 189.7 ft (57.8 m)
Total Unit Weight = 117.1 lb/ft^3
Water Content = 32.5 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective Stress = 55 psi

FUGRO JOB #: 0411-08-1701
Testing Station: RC5

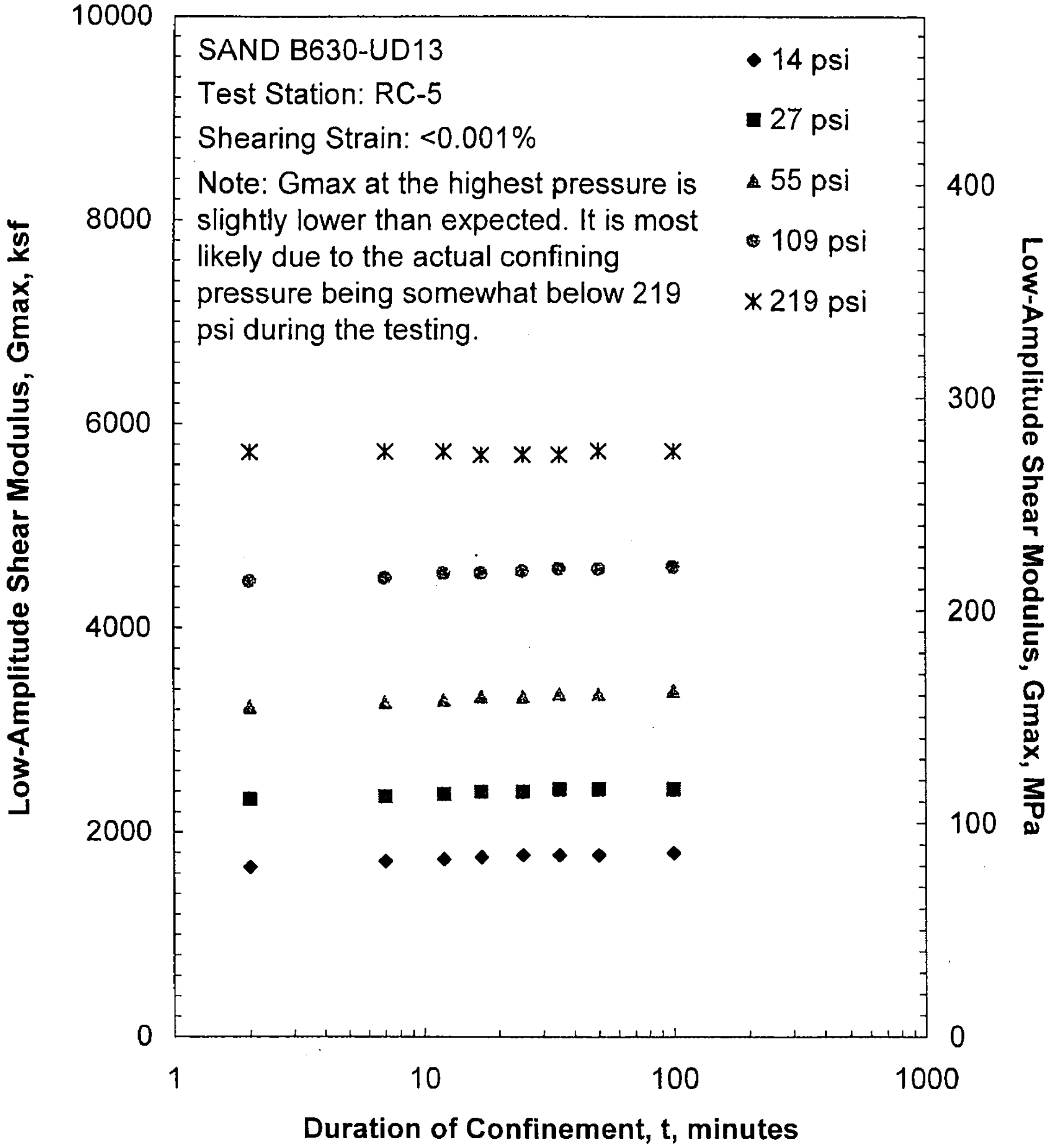

Figure C.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

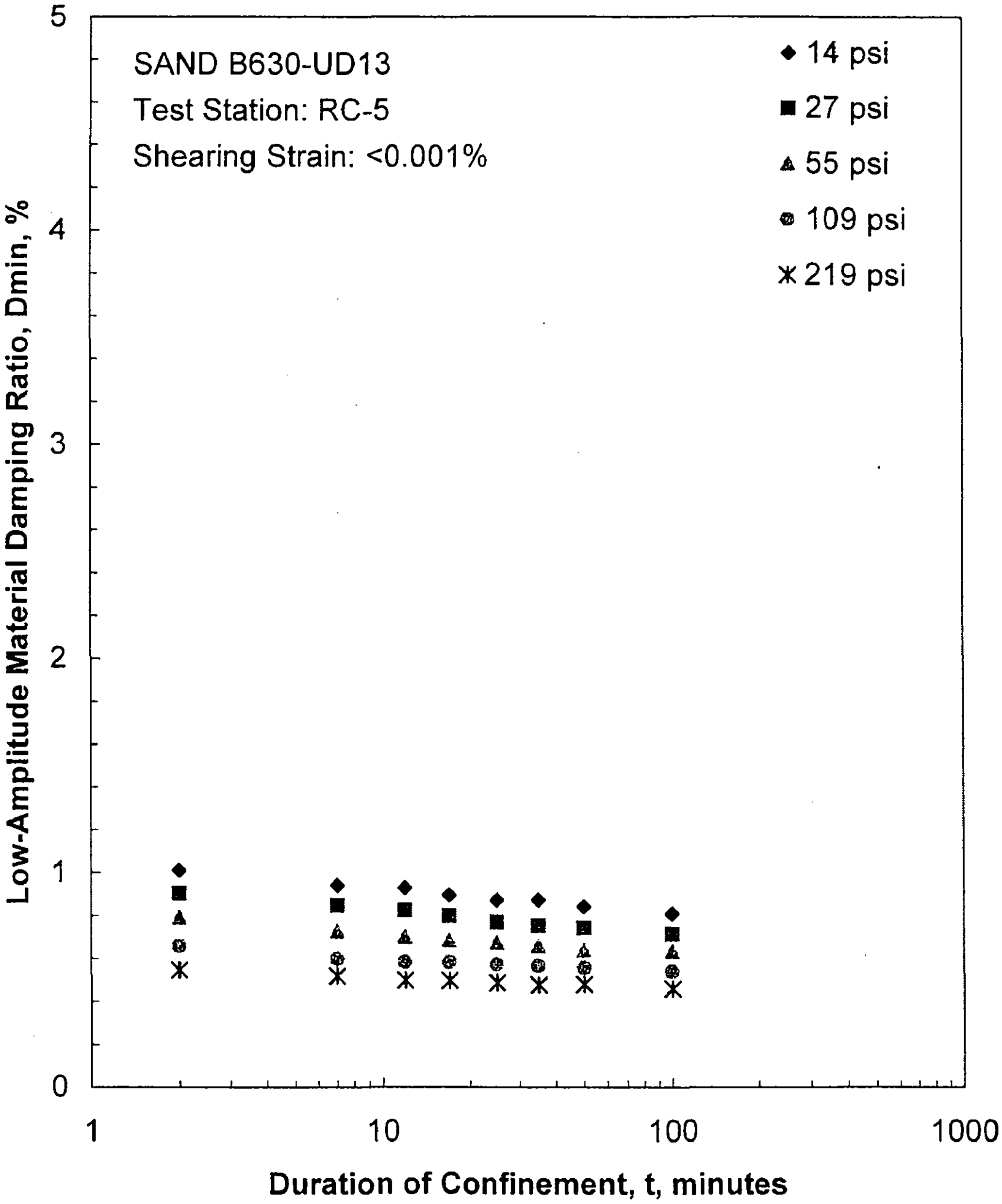

Figure C.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

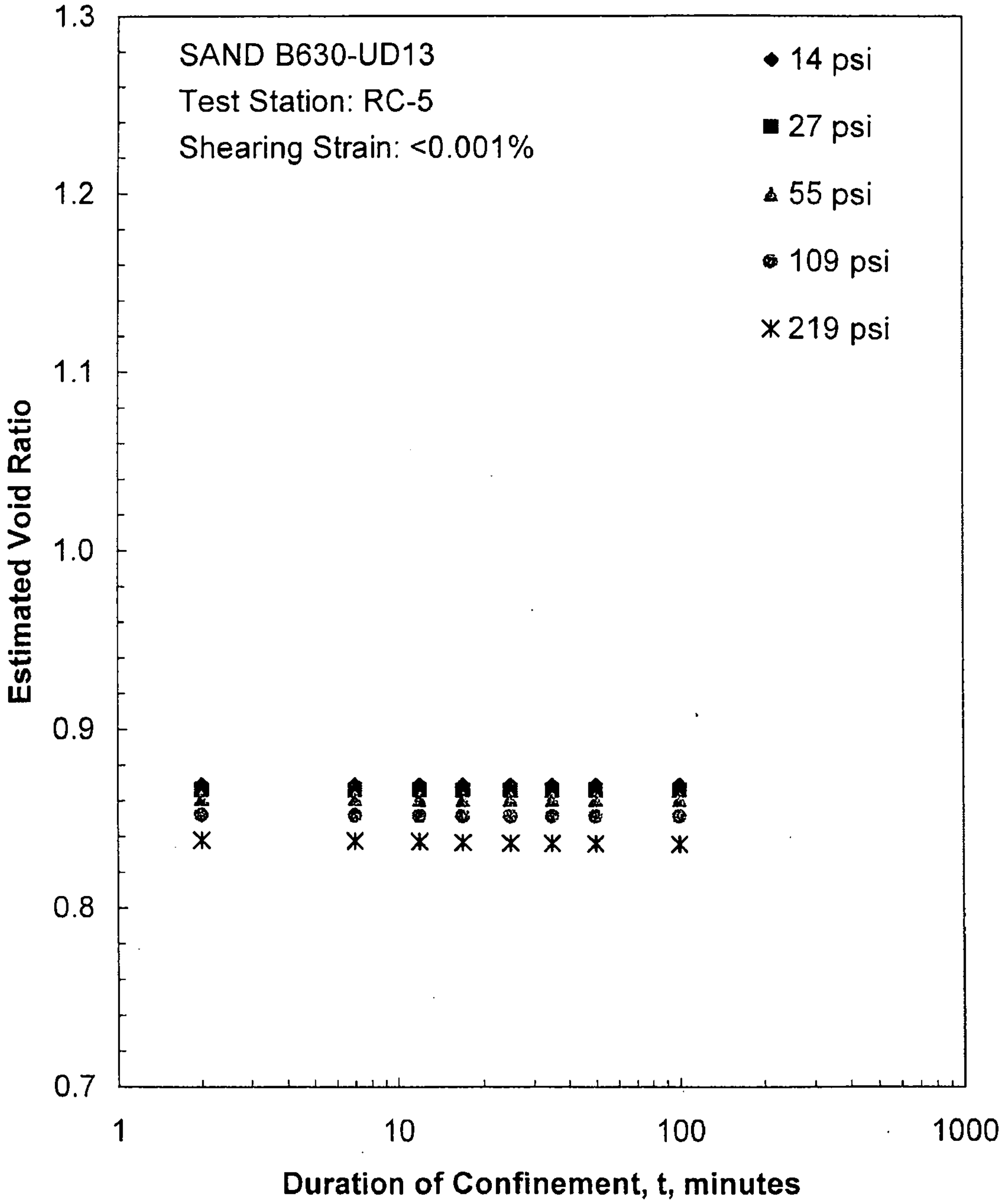

Figure C.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

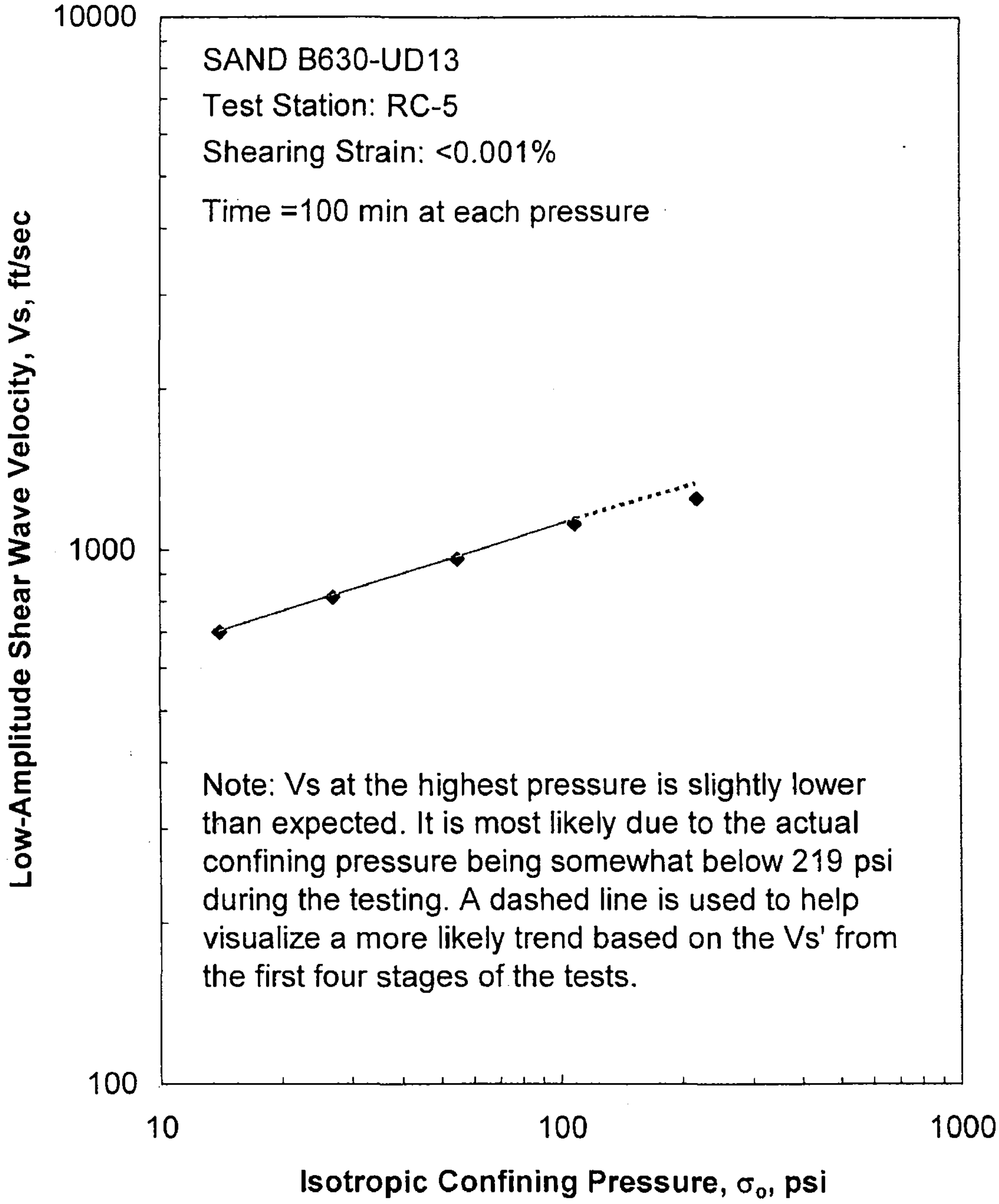

Figure C.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

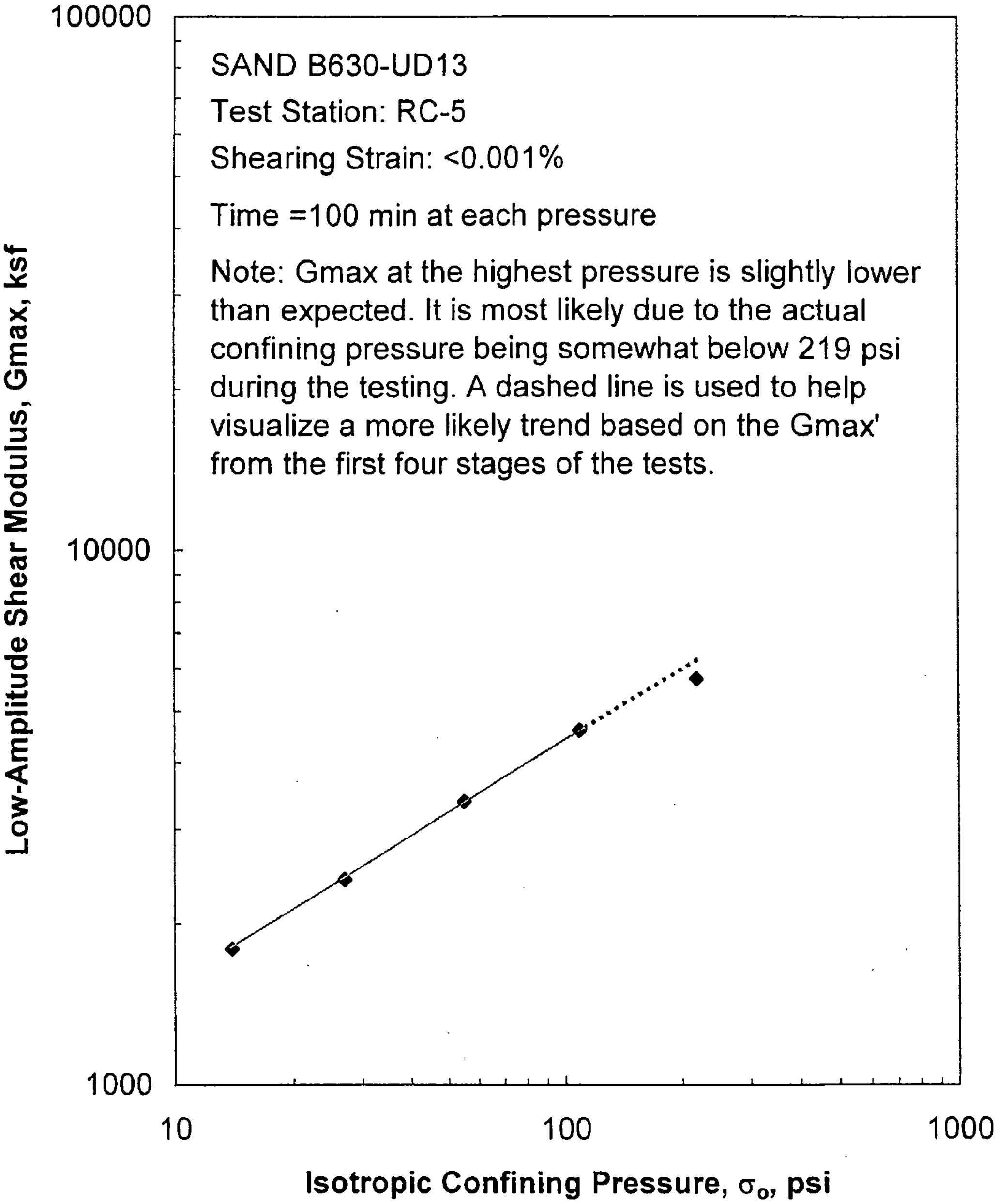

Figure C.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

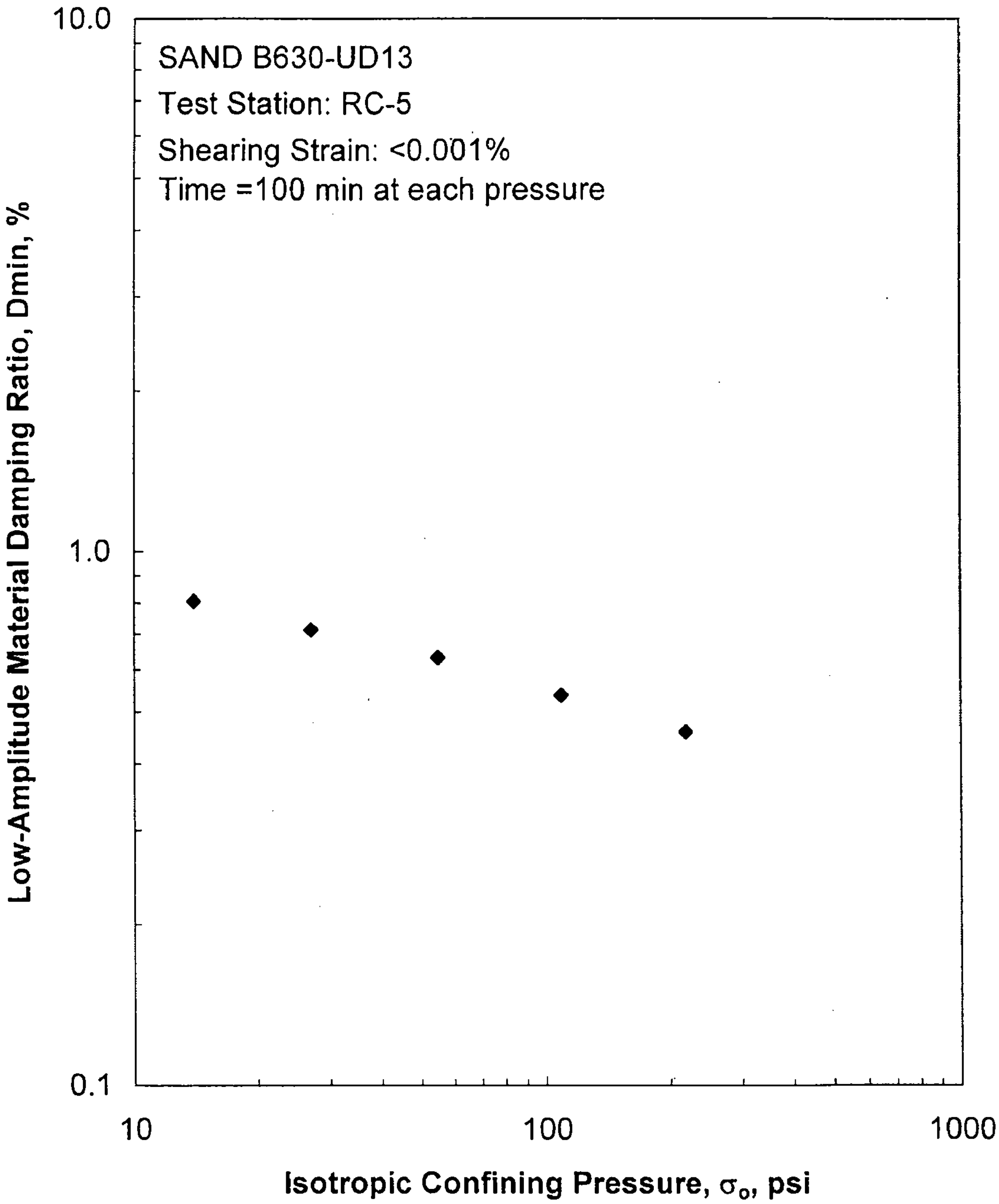

Figure C.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

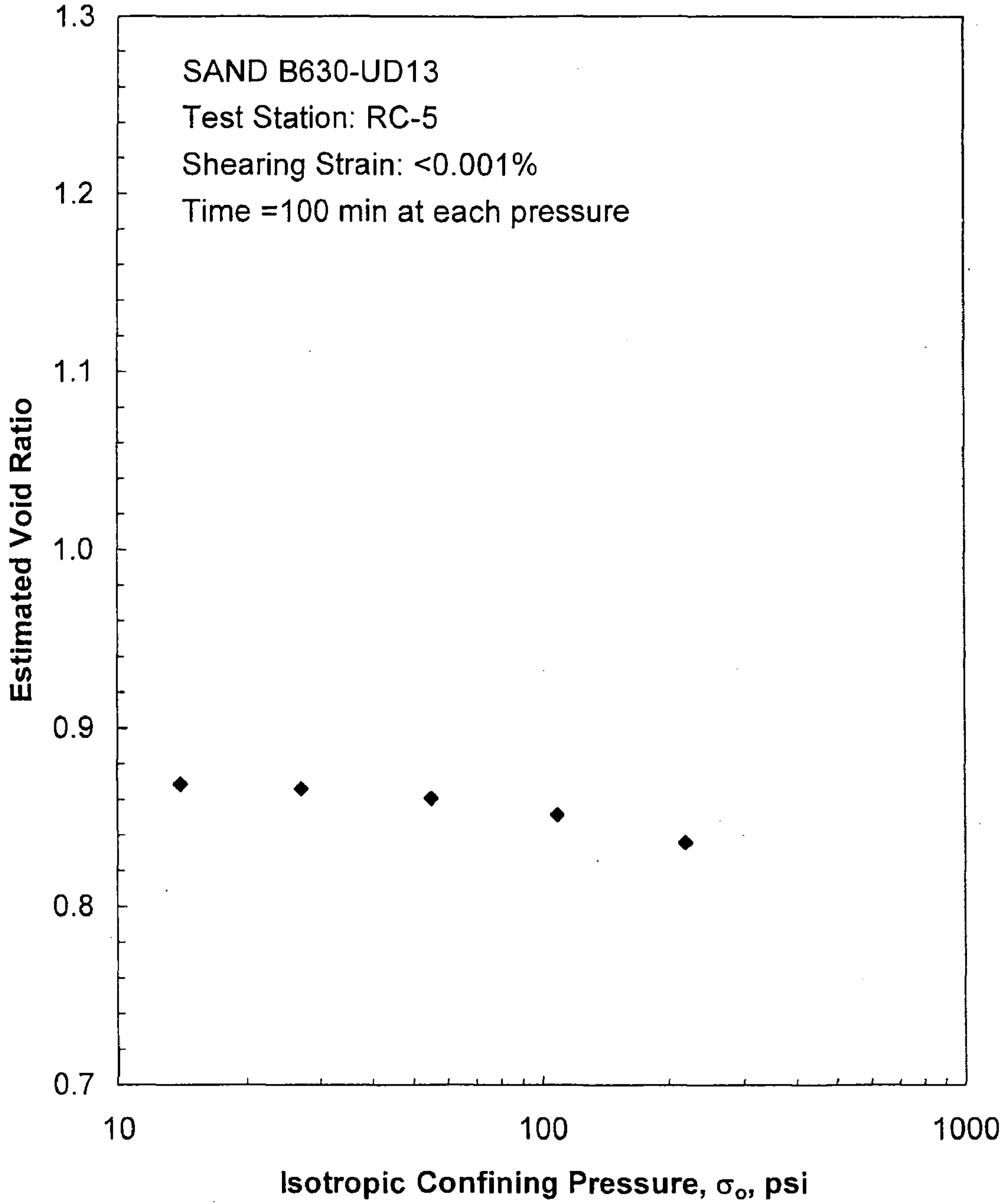

Figure C.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

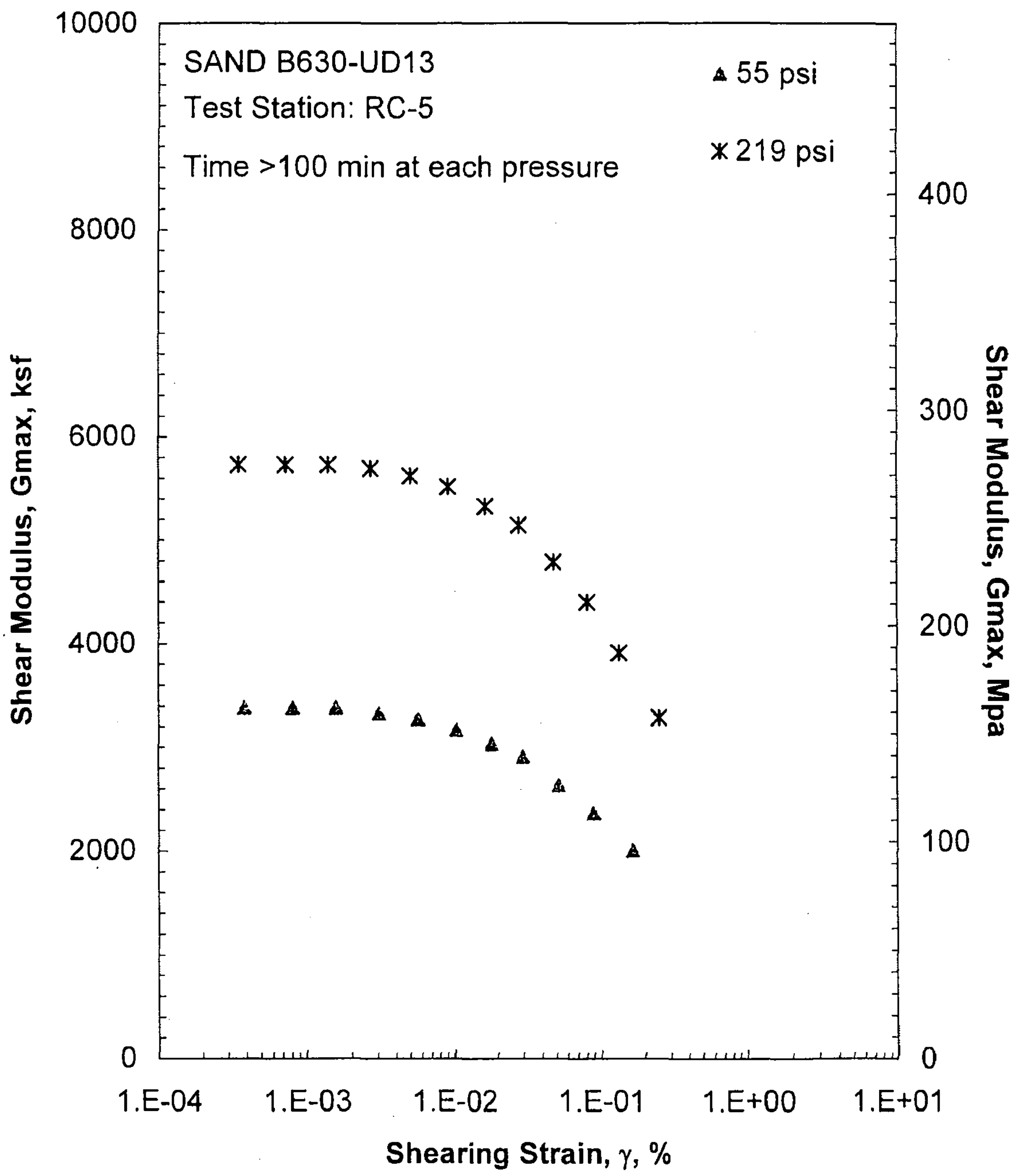

Figure C.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

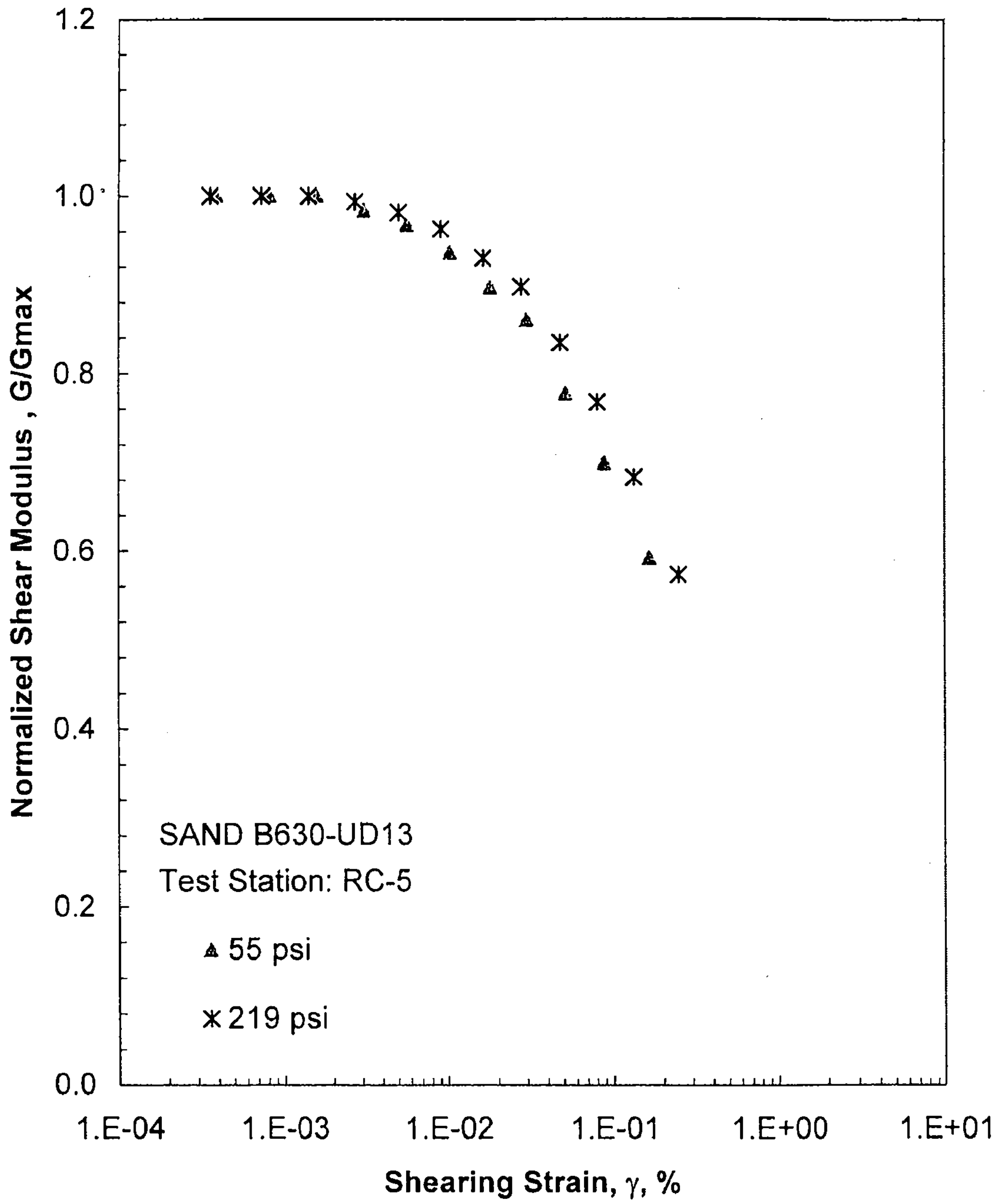

Figure C.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

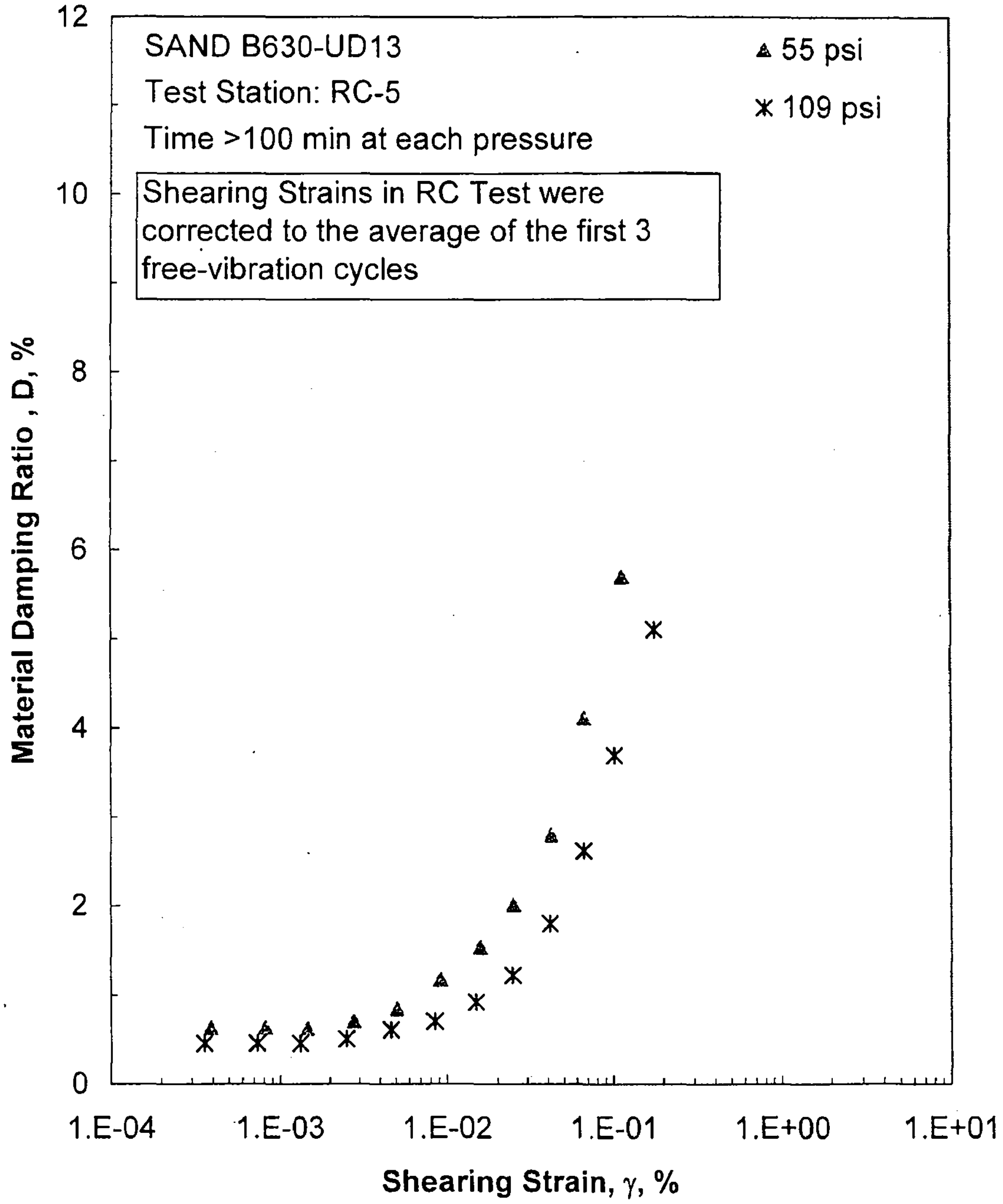

Figure C.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

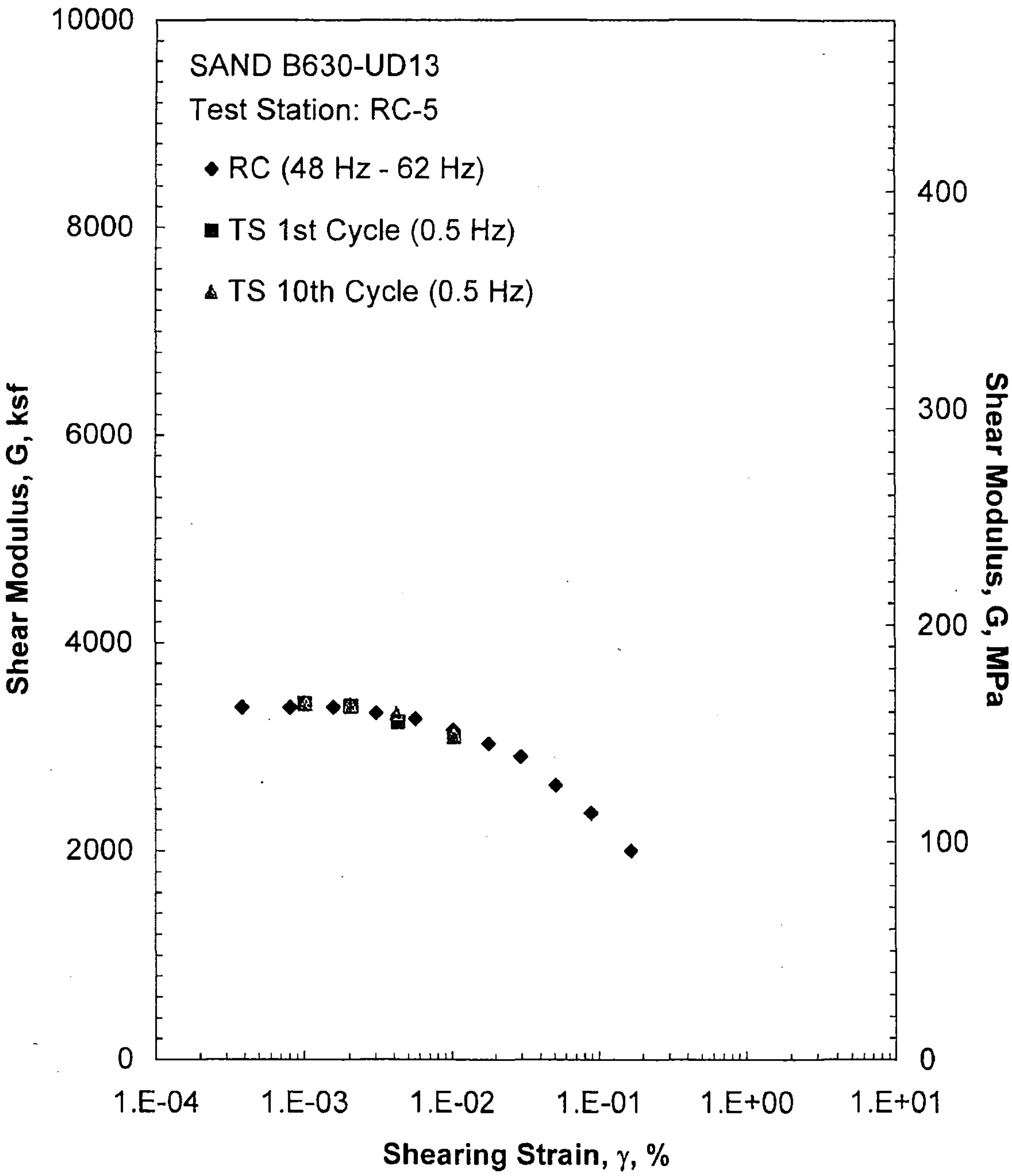

Figure C.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 55 psi from the Combined RCTS Tests

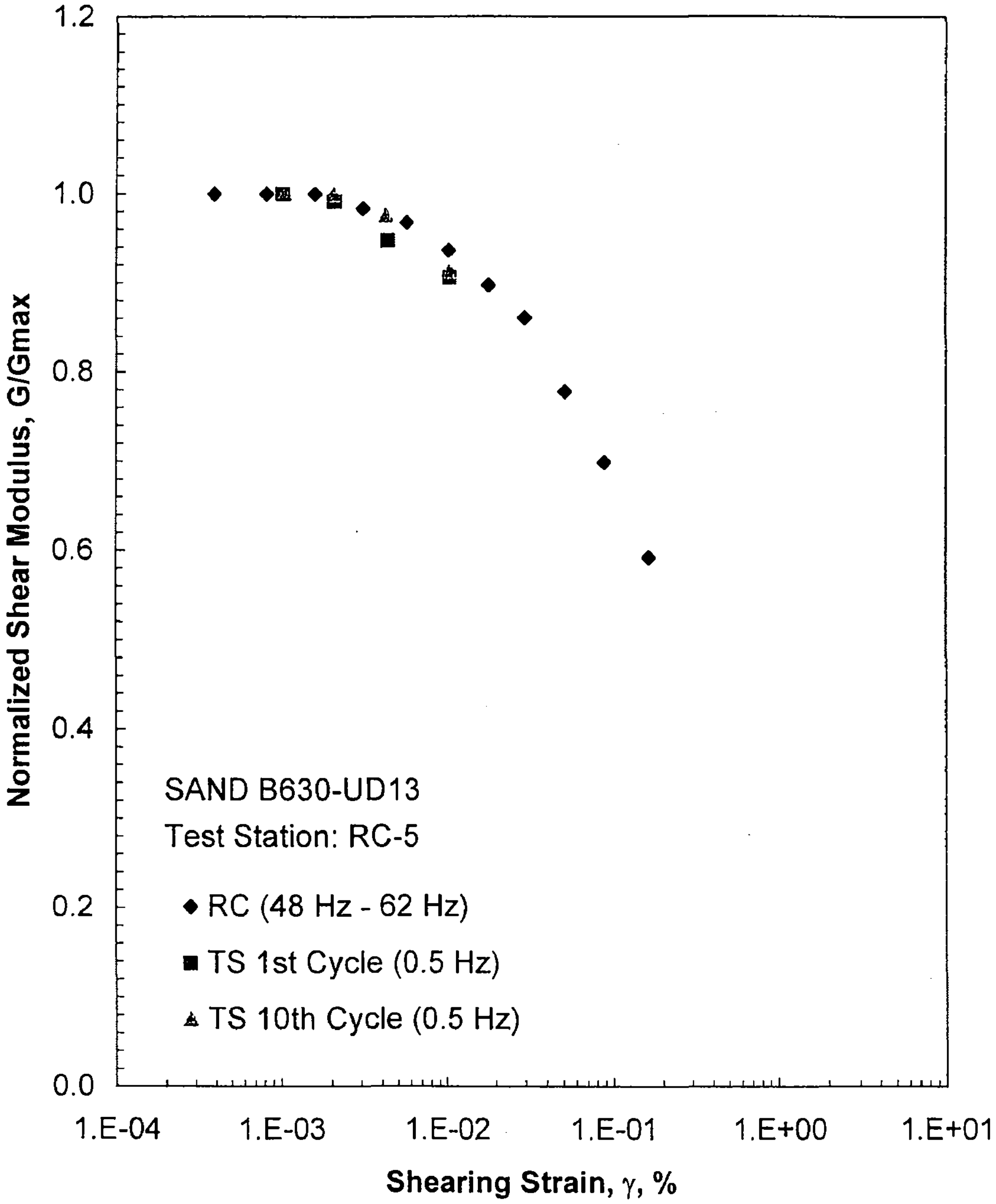

Figure C.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 55 psi from the Combined RCTS Tests

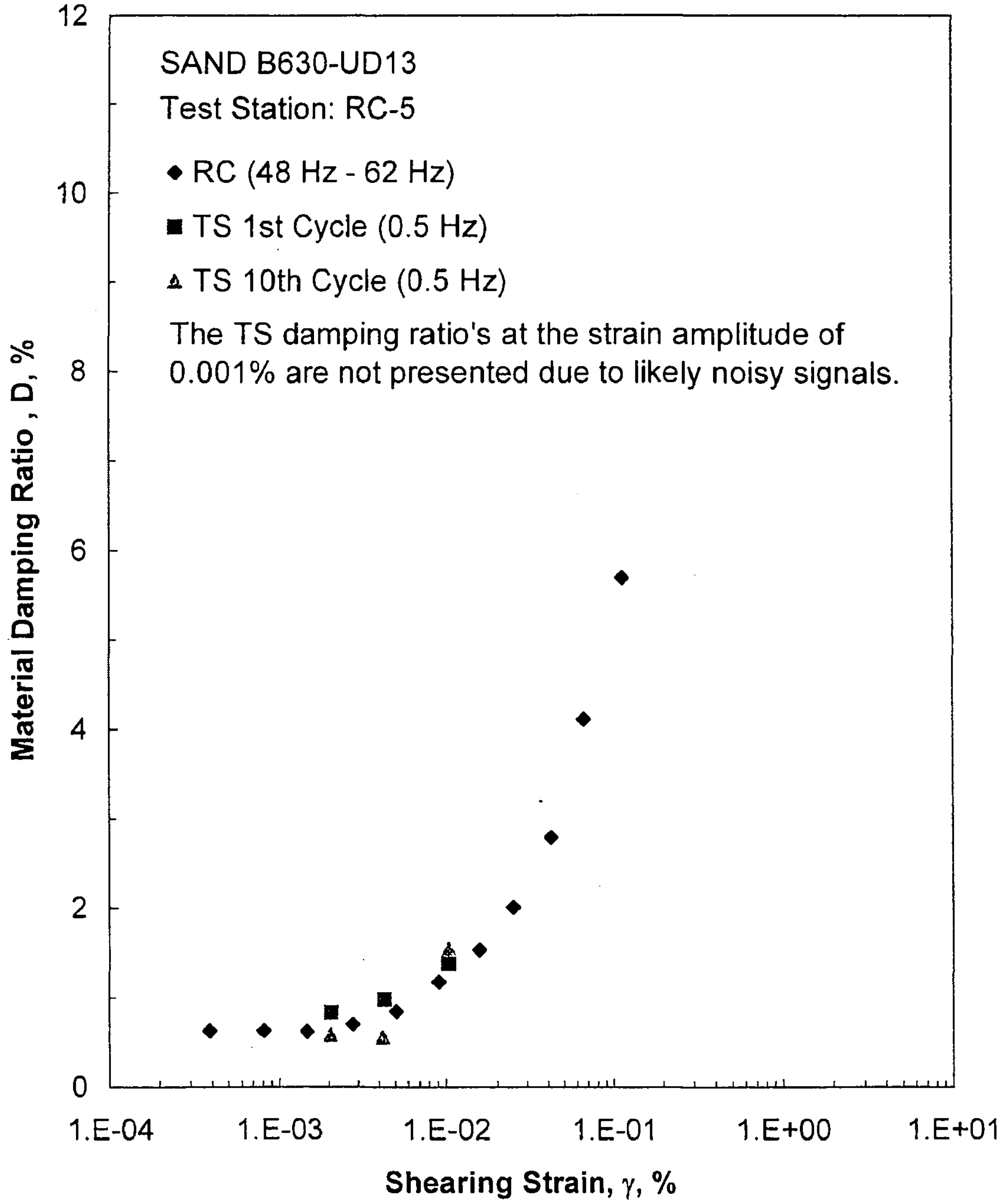

Figure C.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 55 psi from the Combined RCTS Tests

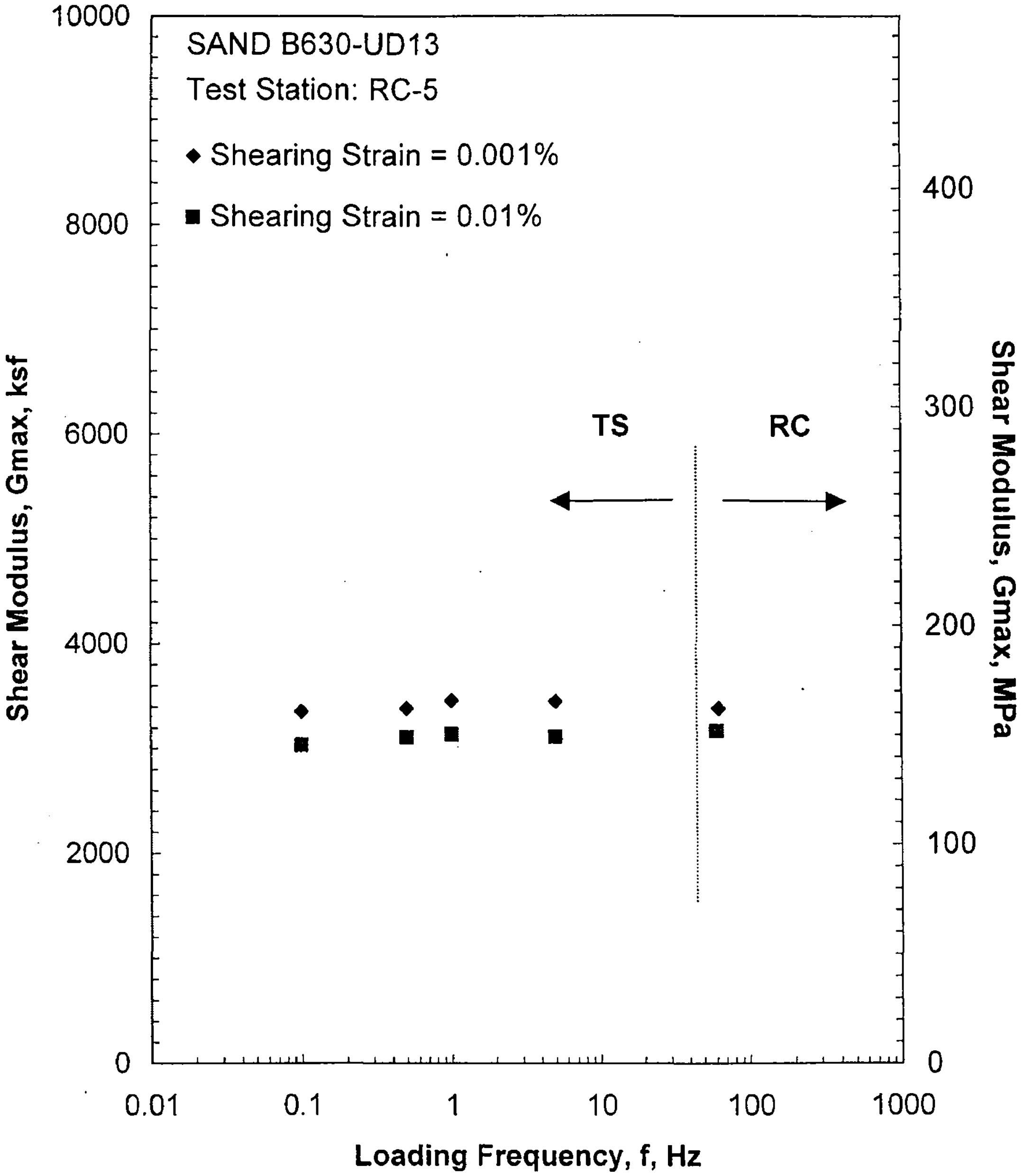

Figure C.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 55 psi from the Combined RCTS Tests

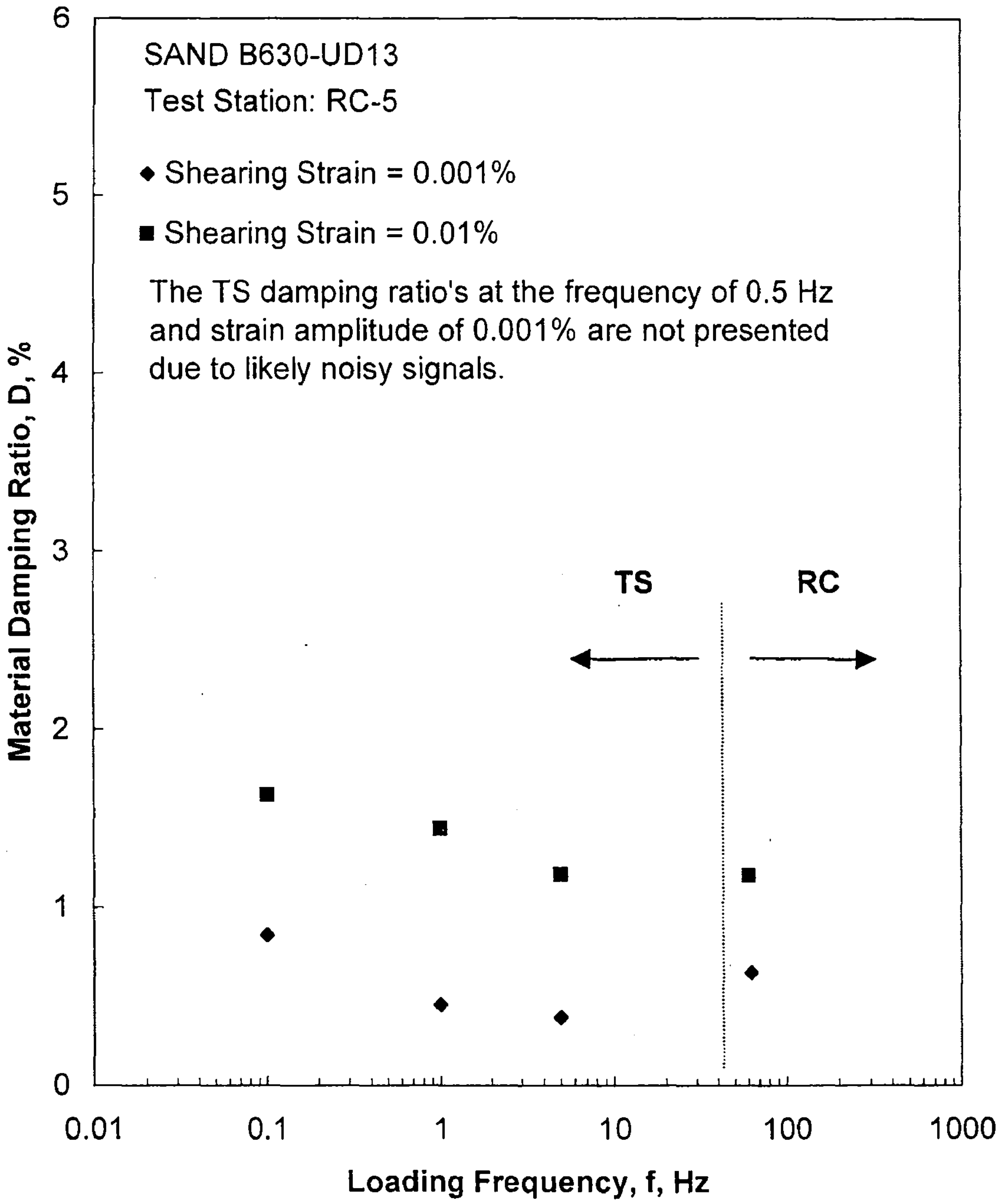

Figure C.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 55 psi from the Combined RCTS Tests

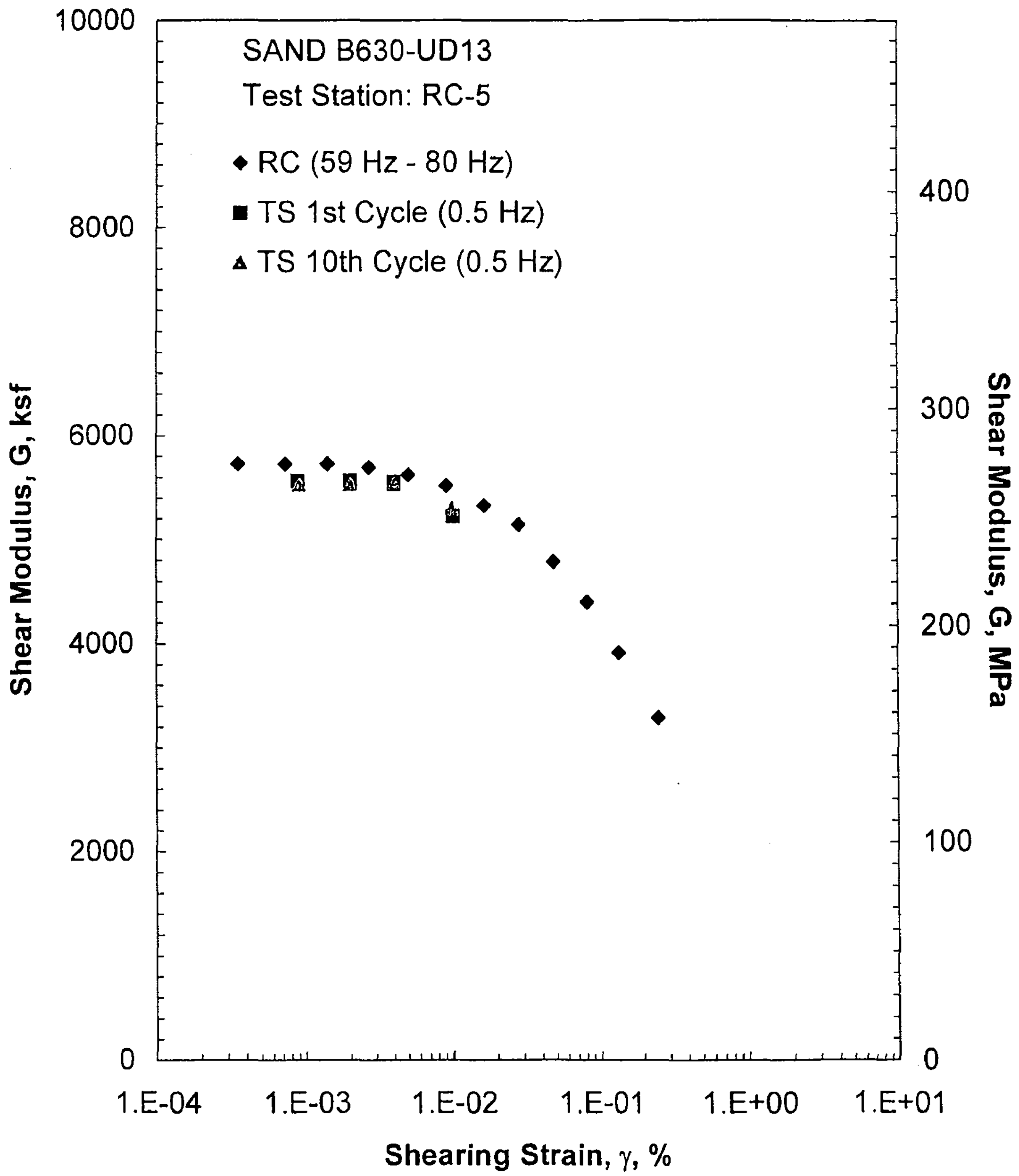

Figure C.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 219 psi from the Combined RCTS Tests

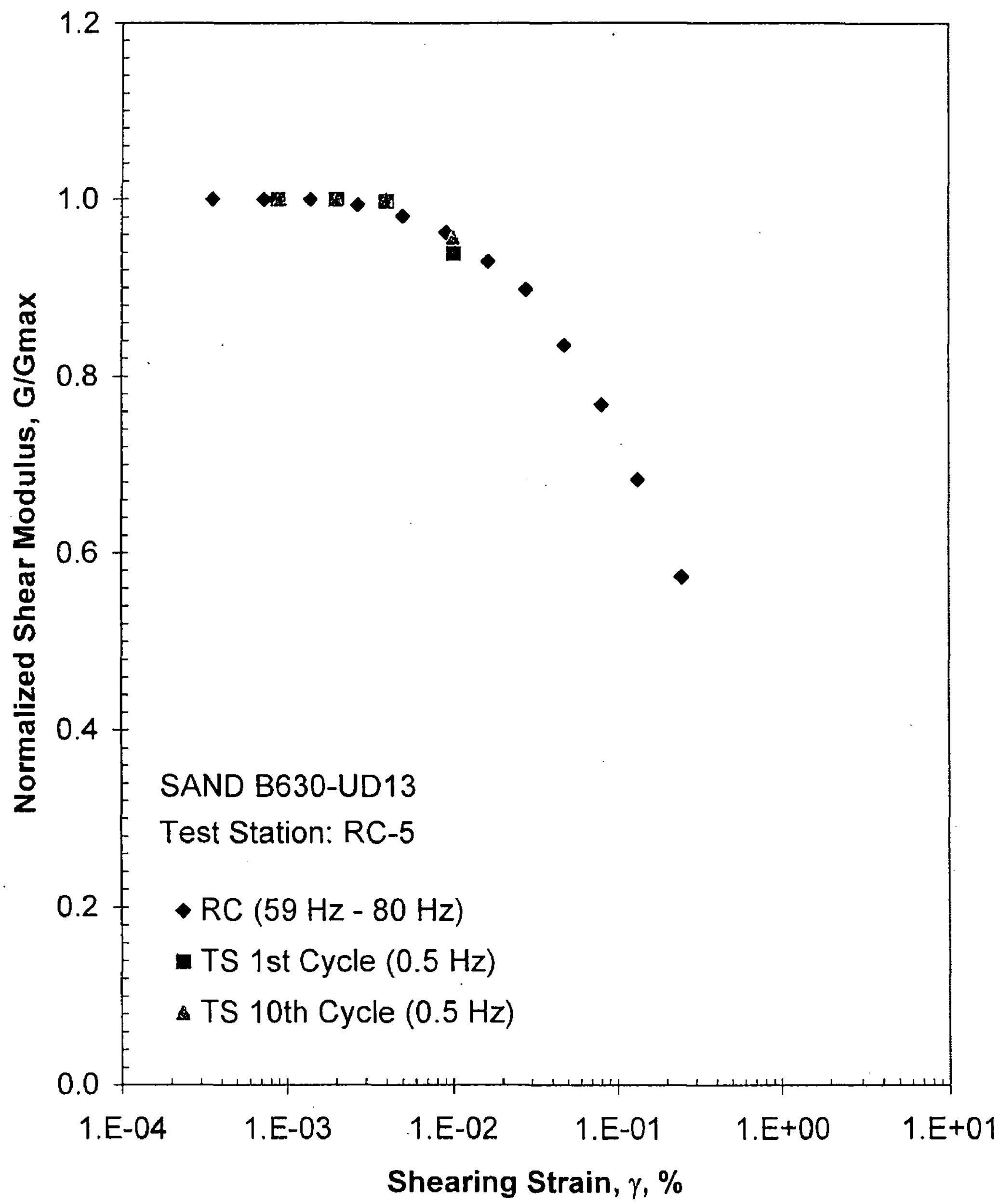

Figure C.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 219 psi from the Combined RCTS Tests

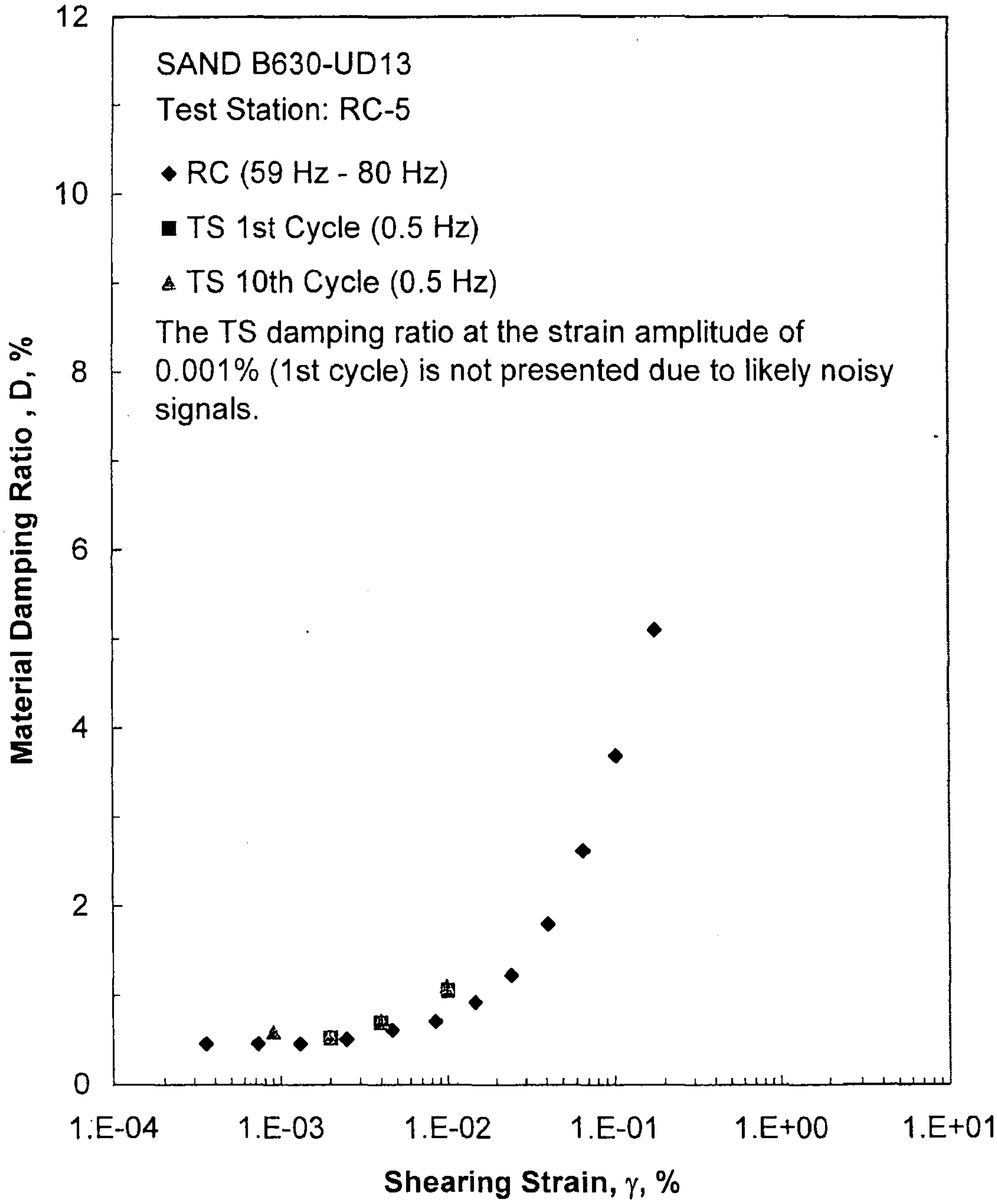

Figure C.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 219 psi from the Combined RCTS Tests

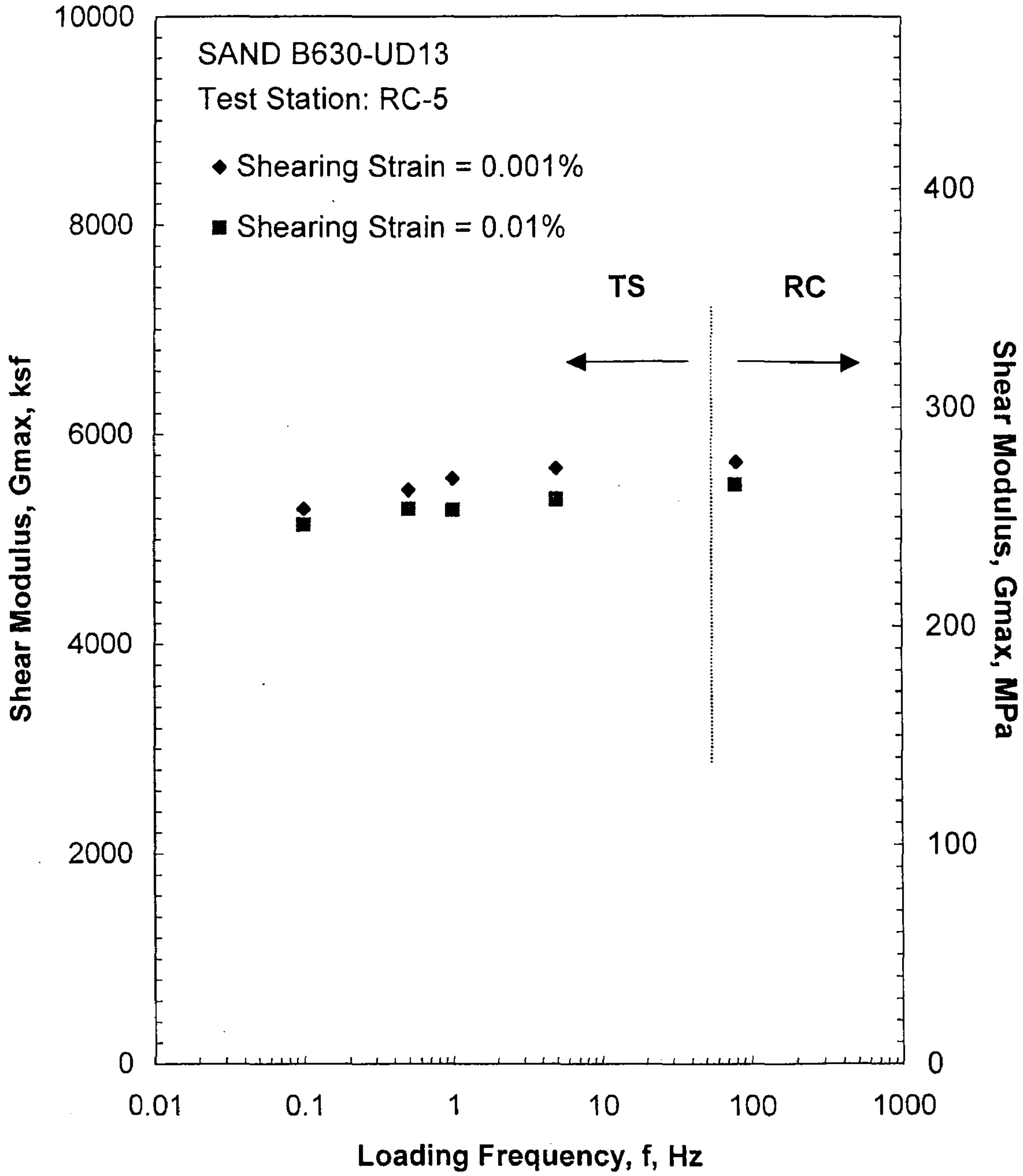

Figure C.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 219 psi from the Combined RCTS Tests

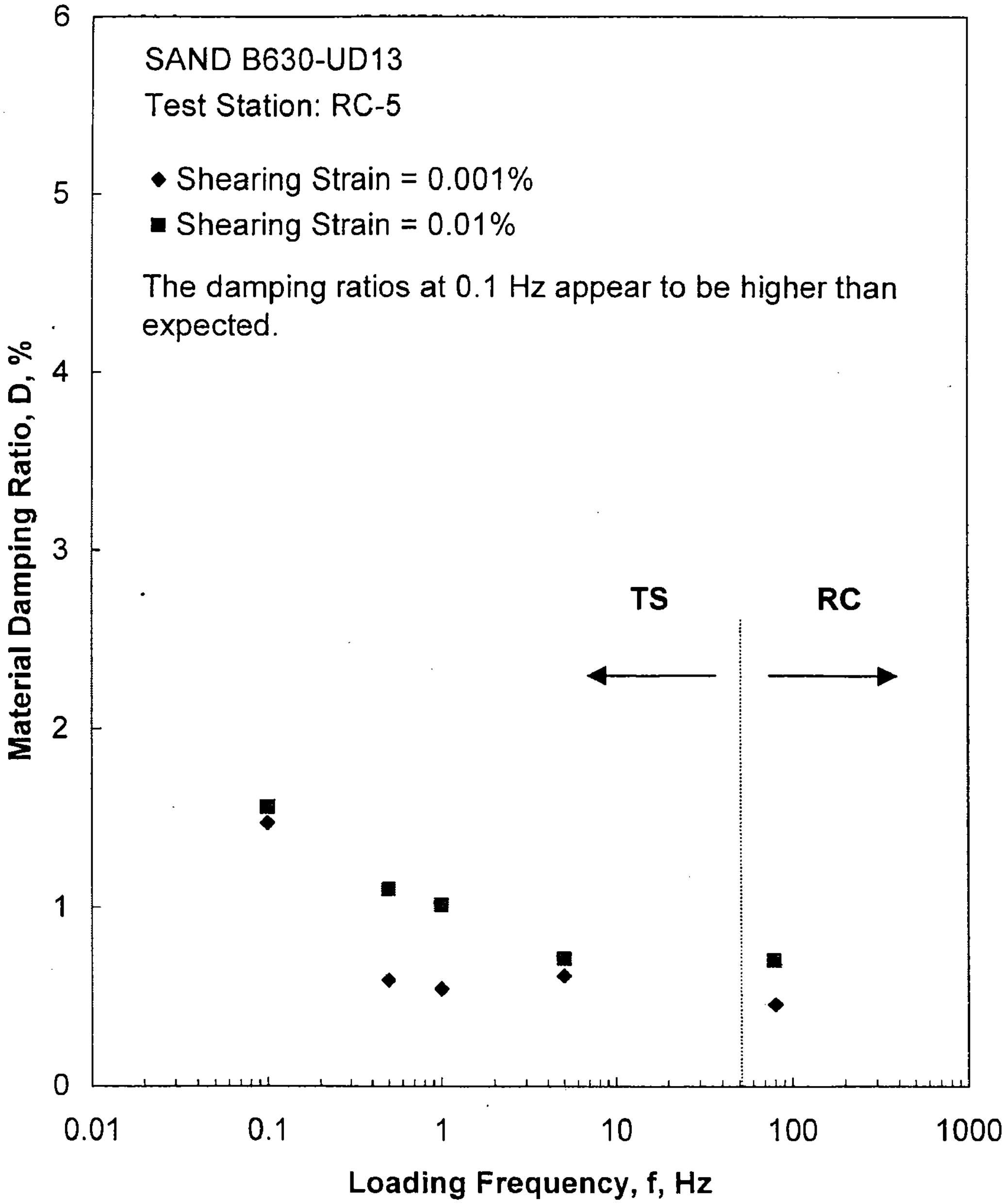

Figure C.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 219 psi from the Combined RCTS Tests

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 B630-UD13

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)	(%)	
14	2016	96	1794	86	701	0.81	0.87
27	3888	186	2417	116	814	0.71	0.87
55	7920	379	3381	162	961	0.63	0.86
109	15696	751	4596	221	1118	0.54	0.85
219	31536	1509	5732	275	1243	0.46	0.84

Table C.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD13; Isoptropic Confining Pressure, σ_o= 55 psi (7.9 ksf = 379 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratiox, D, %
3.88E-04	3381	1.00	3.88E-04	0.63
8.14E-04	3381	1.00	8.14E-04	0.63
1.58E-03	3381	1.00	1.47E-03	0.62
3.06E-03	3326	0.98	2.79E-03	0.70
5.66E-03	3272	0.97	5.09E-03	0.85
1.03E-02	3164	0.94	9.17E-03	1.17
1.81E-02	3033	0.90	1.57E-02	1.54
2.98E-02	2908	0.86	2.50E-02	2.01
5.17E-02	2629	0.78	4.19E-02	2.79
8.86E-02	2362	0.70	6.65E-02	4.11
1.65E-01	2002	0.59	1.14E-01	5.69

+ 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 B630-UD13; Isotropic Confining Pressure, σ_o= 55 psi (7.9 ksf = 379 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, %
1.02E-03	3420	1.00	---	1.04E-03	3407	1.00	---
2.07E-03	3390	0.99	0.83	2.05E-03	3407	1.00	0.58
4.33E-03	3239	0.95	0.98	4.22E-03	3325	0.98	0.56
1.04E-02	3097	0.91	1.38	1.04E-02	3108	0.91	1.54

Table C.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD13; Isoptropic Confining Pressure, σ_o= 219 psi (31.5 ksf = 1509 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average$^+$ Shearing Strain, %	Material Damping Ratio^x, D, %
3.55E-04	5727	1.00	3.55E-04	0.46
7.29E-04	5727	1.00	7.29E-04	0.46
1.41E-03	5727	1.00	1.32E-03	0.46
2.69E-03	5691	0.99	2.50E-03	0.51
5.02E-03	5619	0.98	4.67E-03	0.61
9.09E-03	5513	0.96	8.45E-03	0.70
1.63E-02	5325	0.93	1.49E-02	0.92
2.77E-02	5141	0.90	2.47E-02	1.22
4.79E-02	4782	0.83	4.12E-02	1.80
8.05E-02	4398	0.77	6.60E-02	2.62
1.33E-01	3910	0.68	1.03E-01	3.68
2.49E-01	3283	0.57	1.76E-01	5.10

$^+$ 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 B630-UD13; Isotropic Confining Pressure, σ_o= 219 psi (31.5 ksf = 1509 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, %
8.84E-04	5560	1.00	---	9.05E-04	5528	1.00	0.59
2.02E-03	5560	1.00	0.52	2.01E-03	5528	1.00	0.53
4.01E-03	5550	1.00	0.69	4.00E-03	5528	1.00	0.71
1.01E-02	5218	0.94	1.05	9.93E-03	5293	0.96	1.10

APPENDIX D

Specimen B630-UD16

Borehole 630
Sample UD16
Depth = 211.0 ft (64.3 m)
Total Unit Weight = 116.3 lb/ft^3
Water Content = 31.1 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 60 psi

FUGRO JOB #: 0411-08-1701
Testing Station: RC9

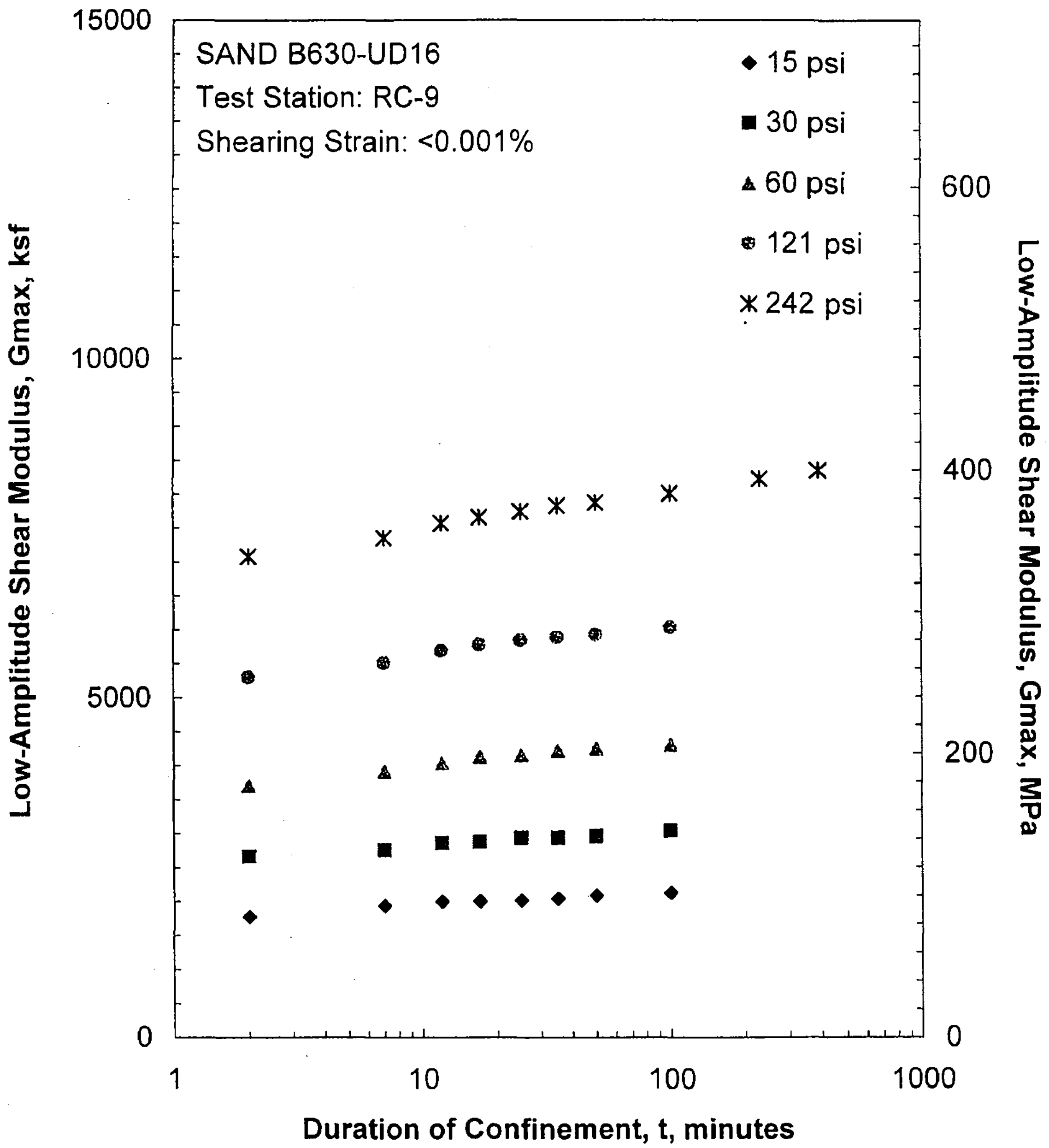

Figure D.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

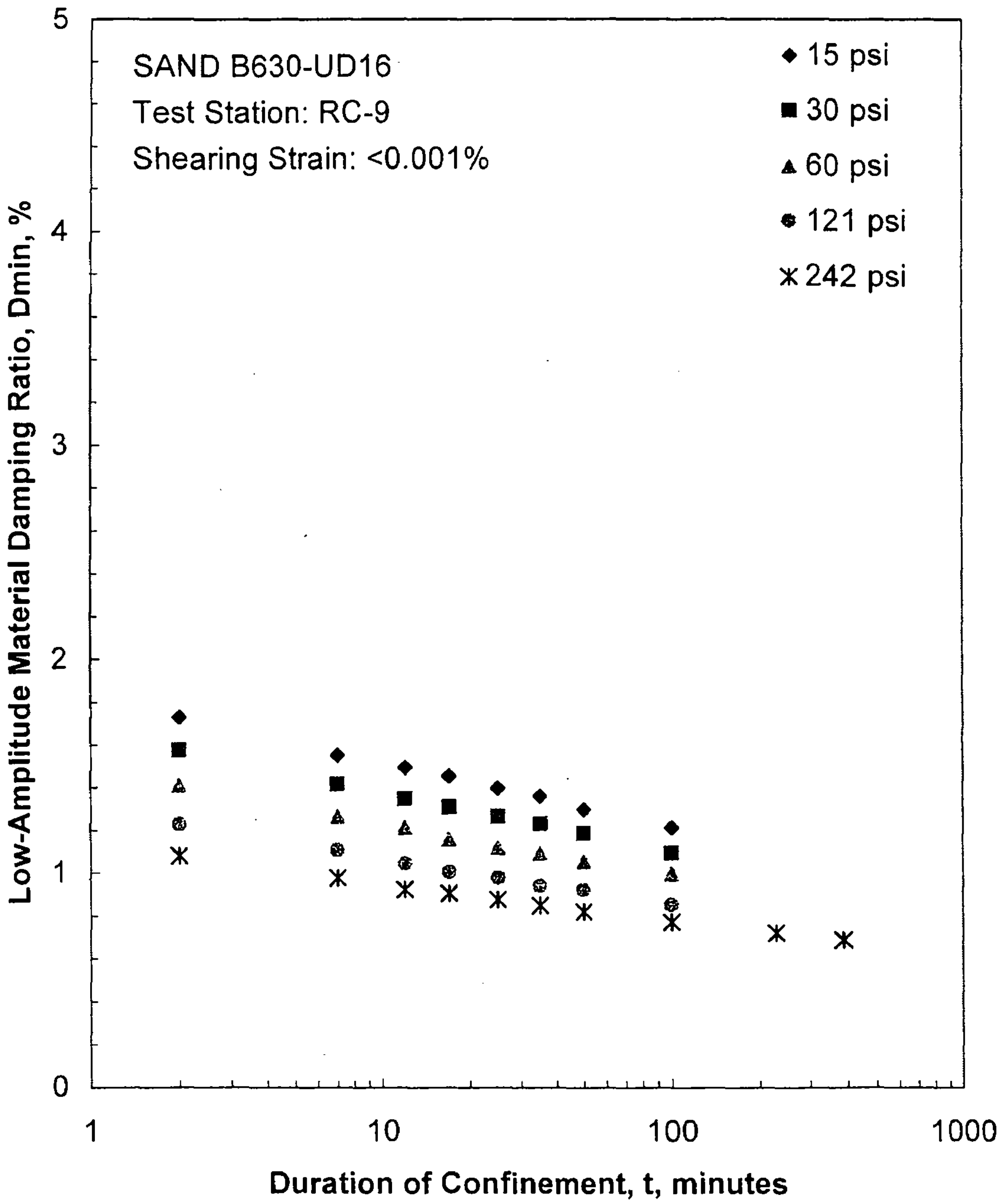

Figure D.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

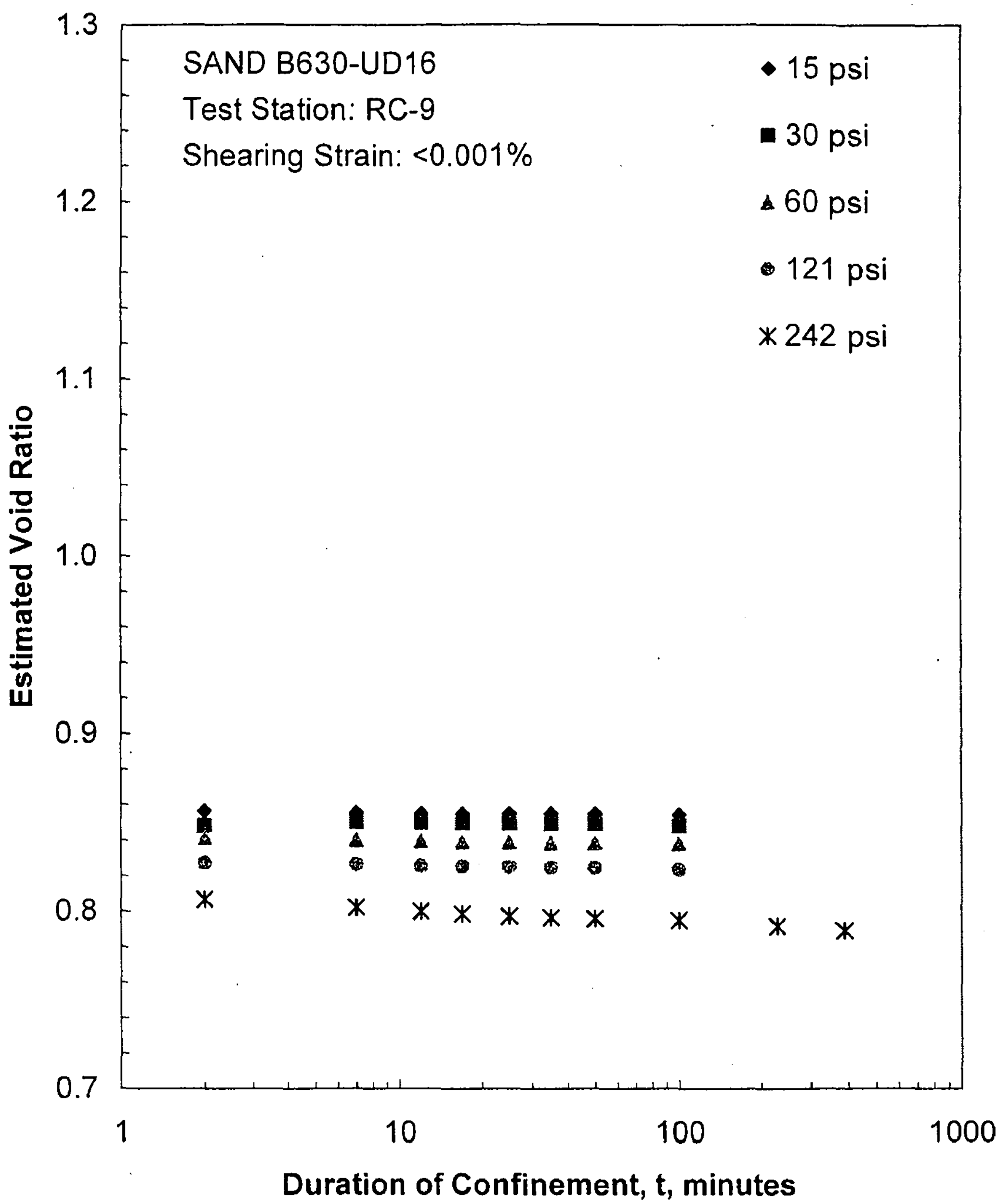

Figure D.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

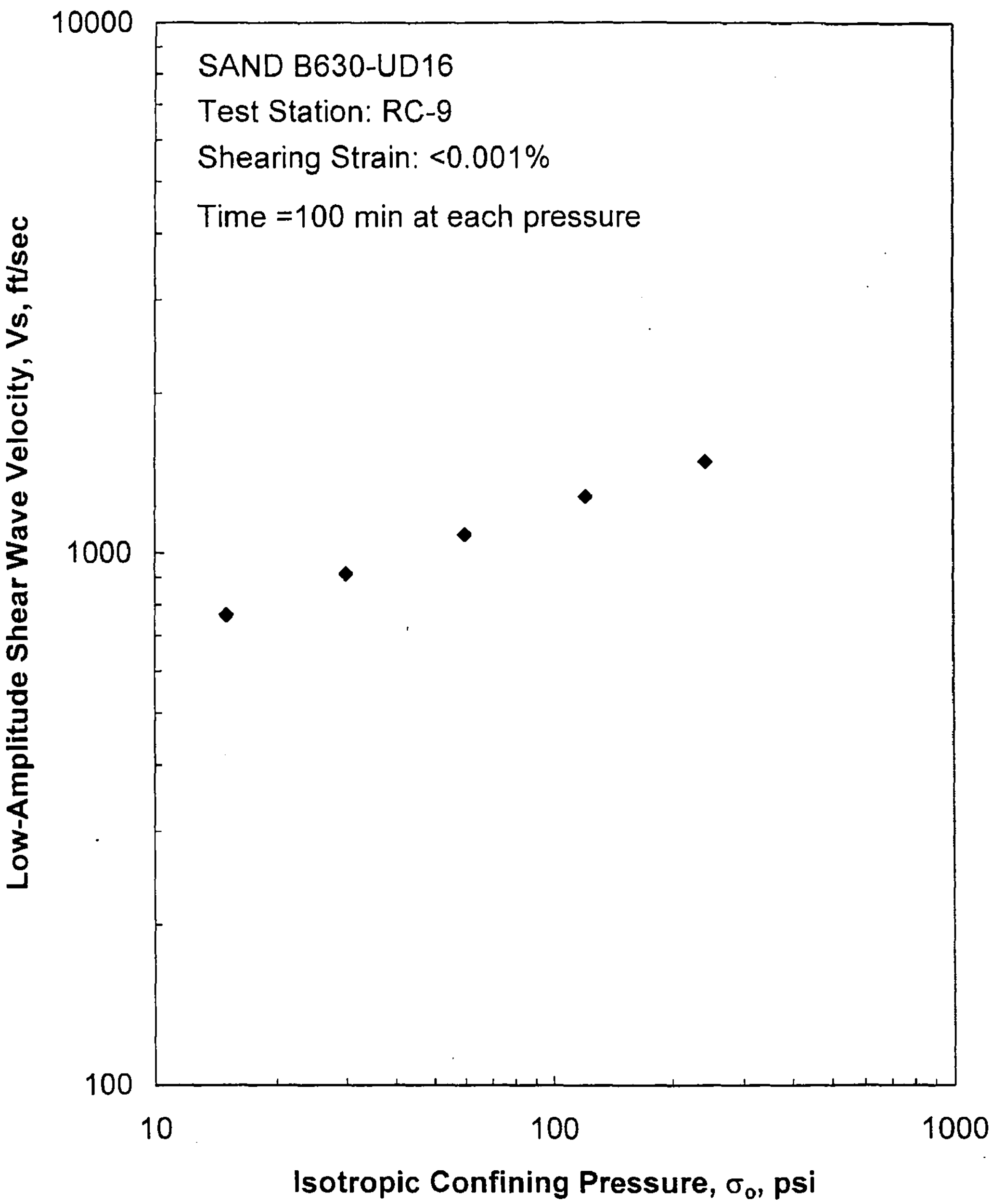

Figure D.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

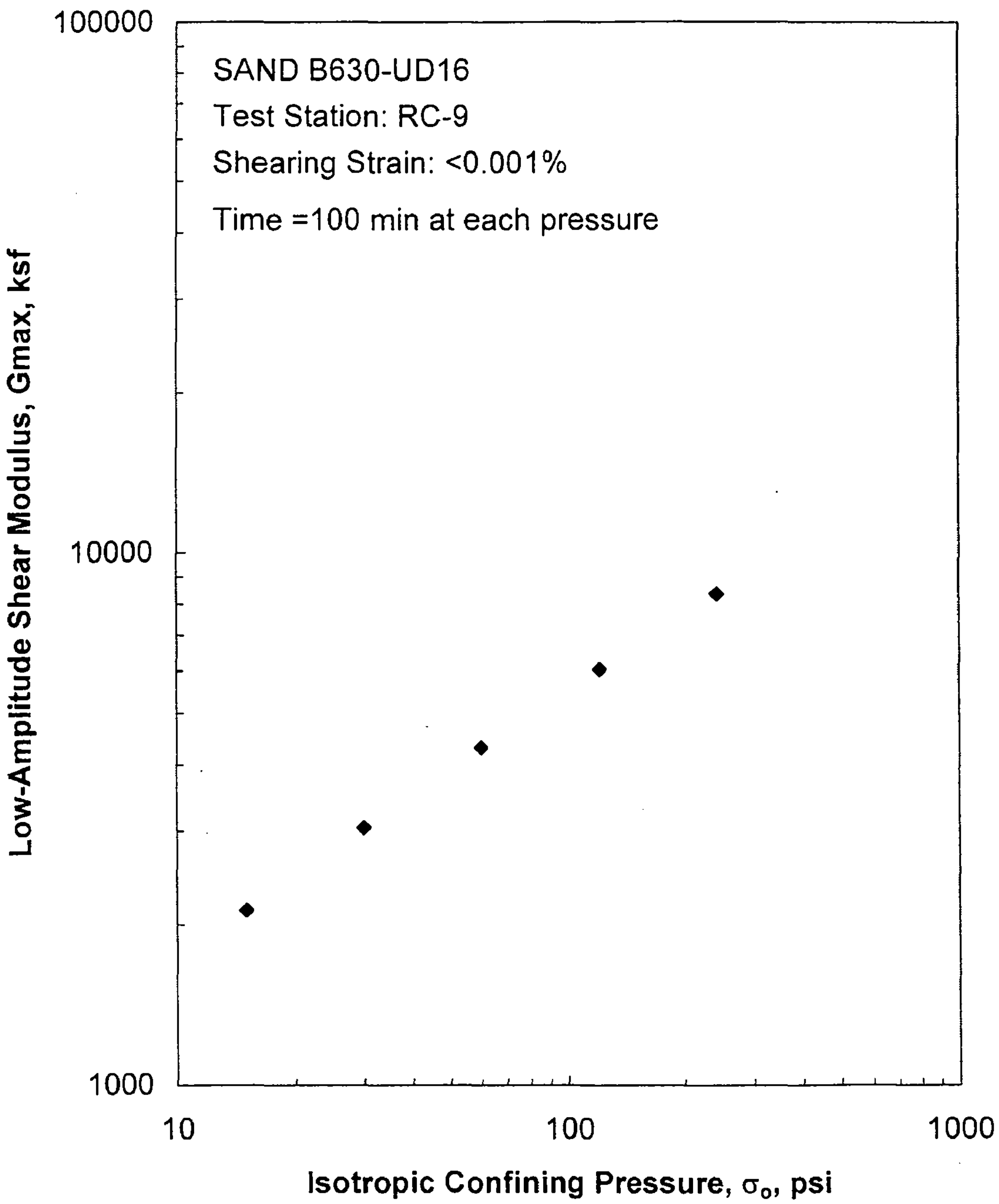

Figure D.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

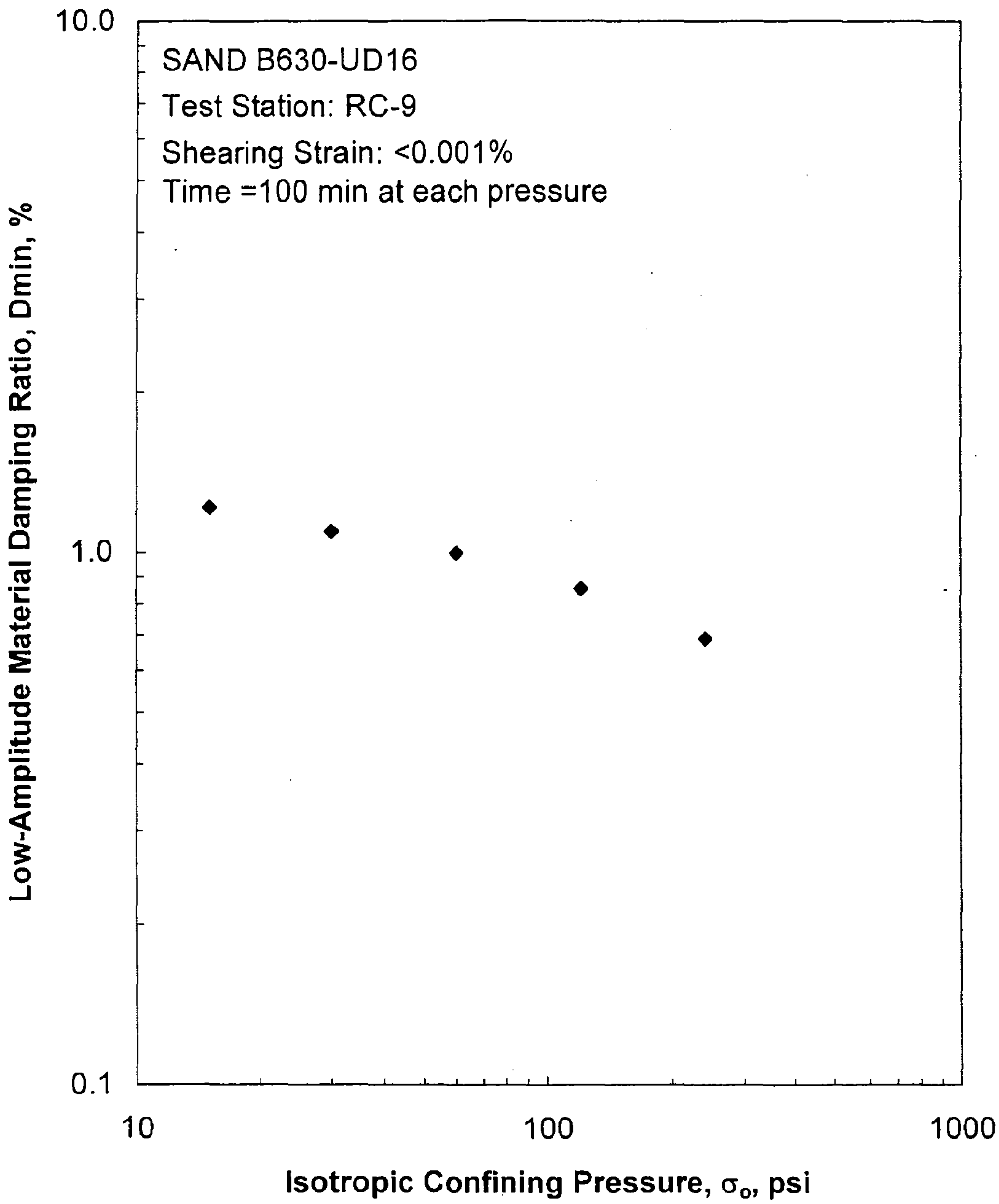

Figure D.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

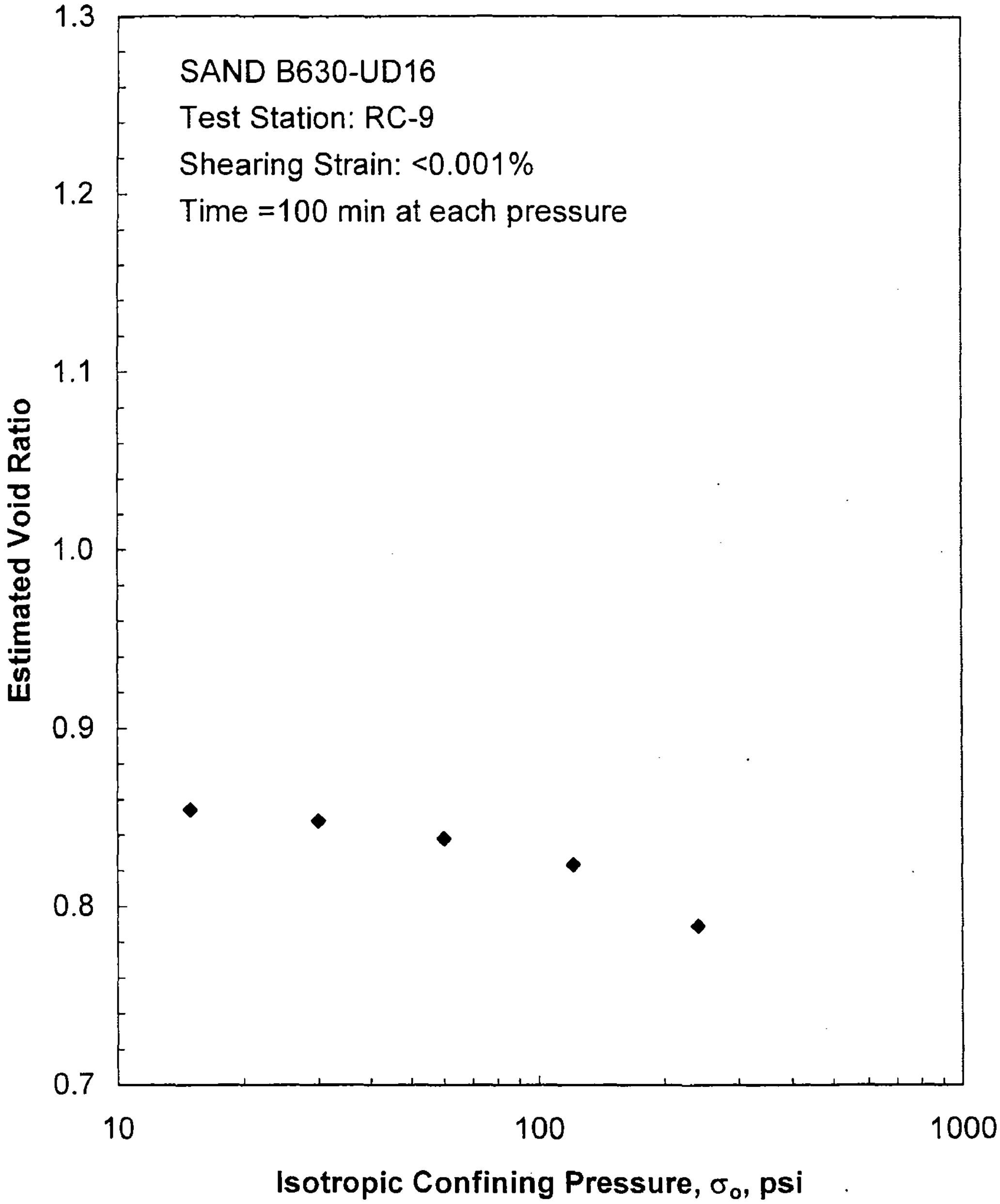

Figure D.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

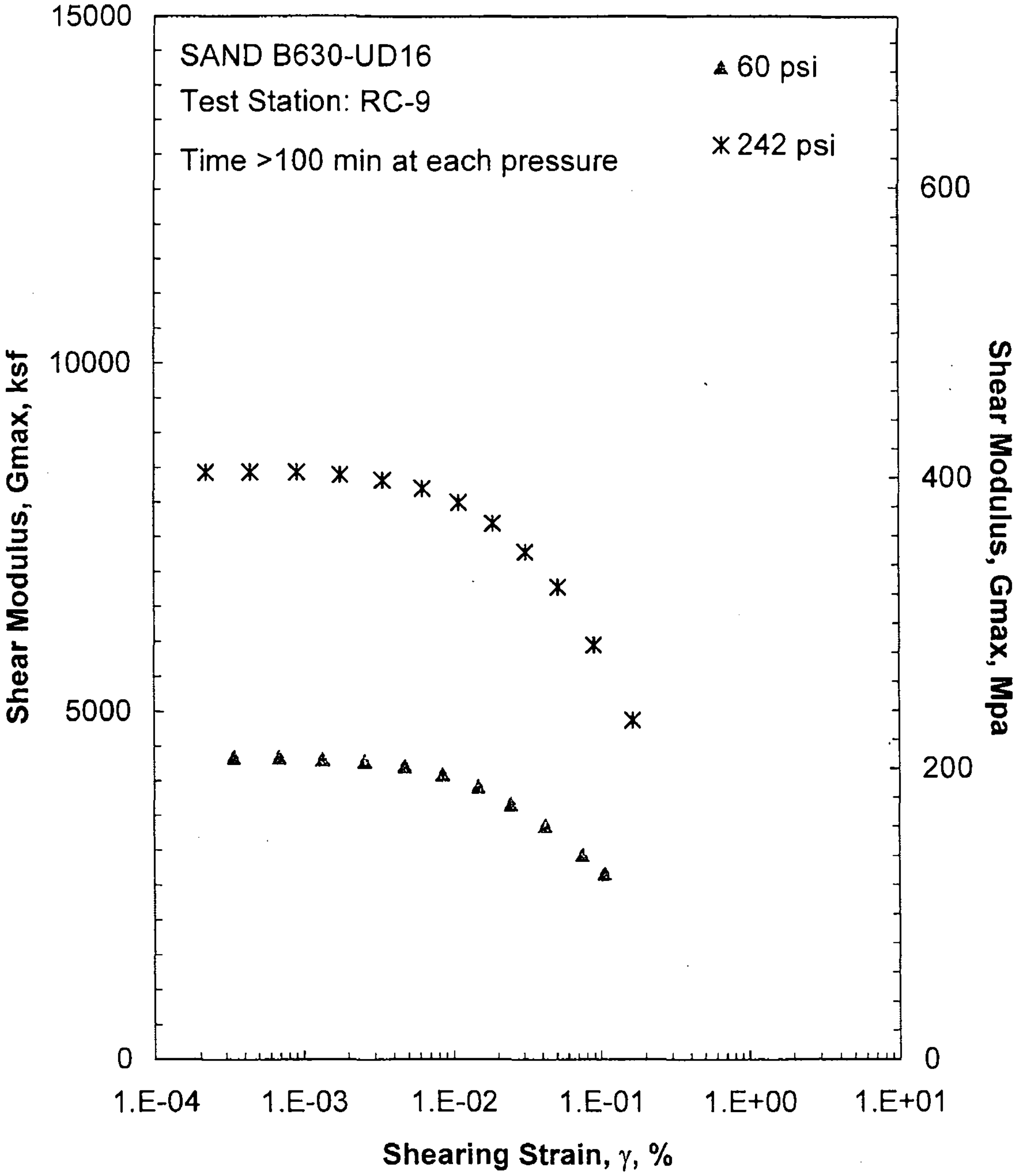

Figure D.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

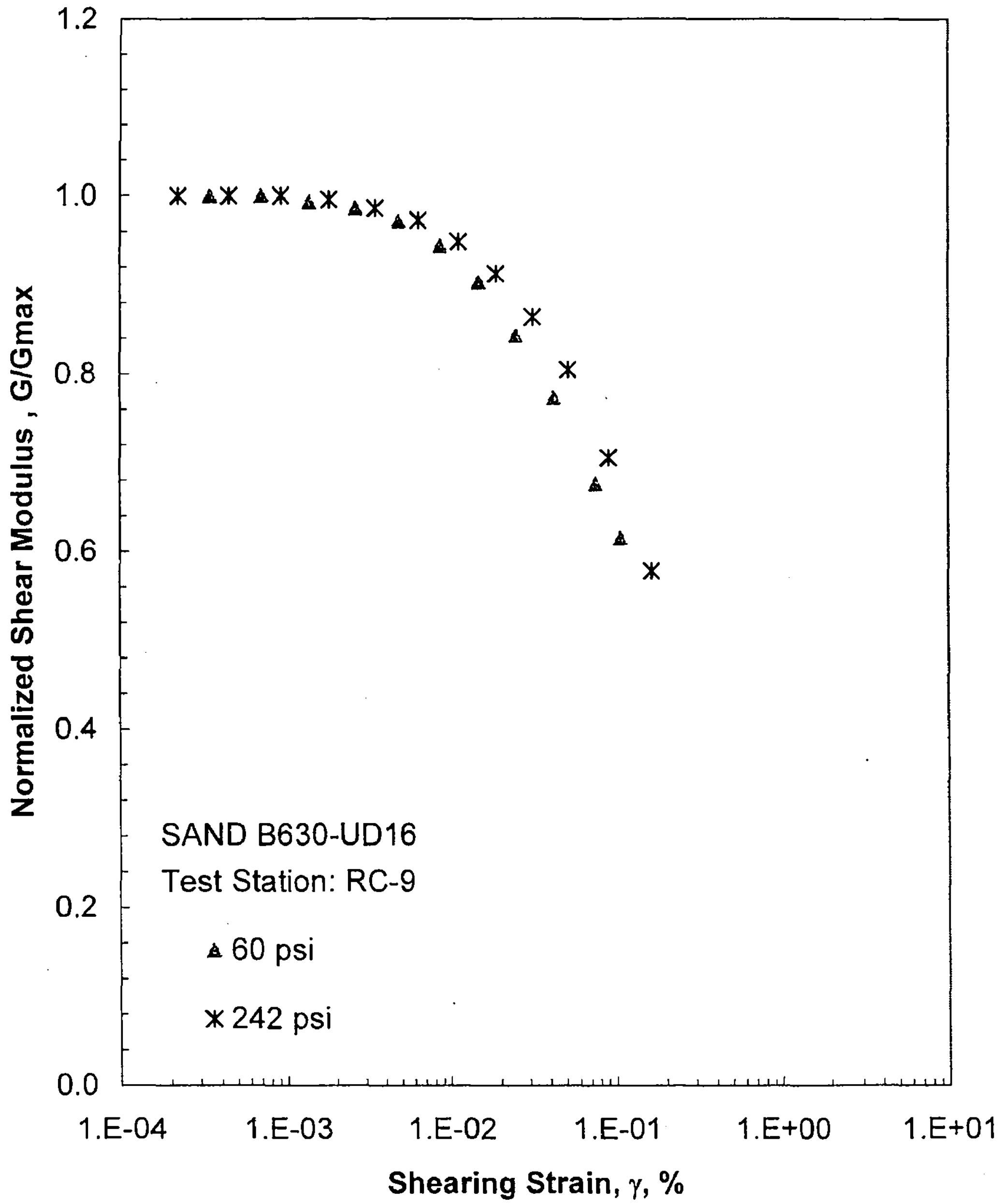

Figure D.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

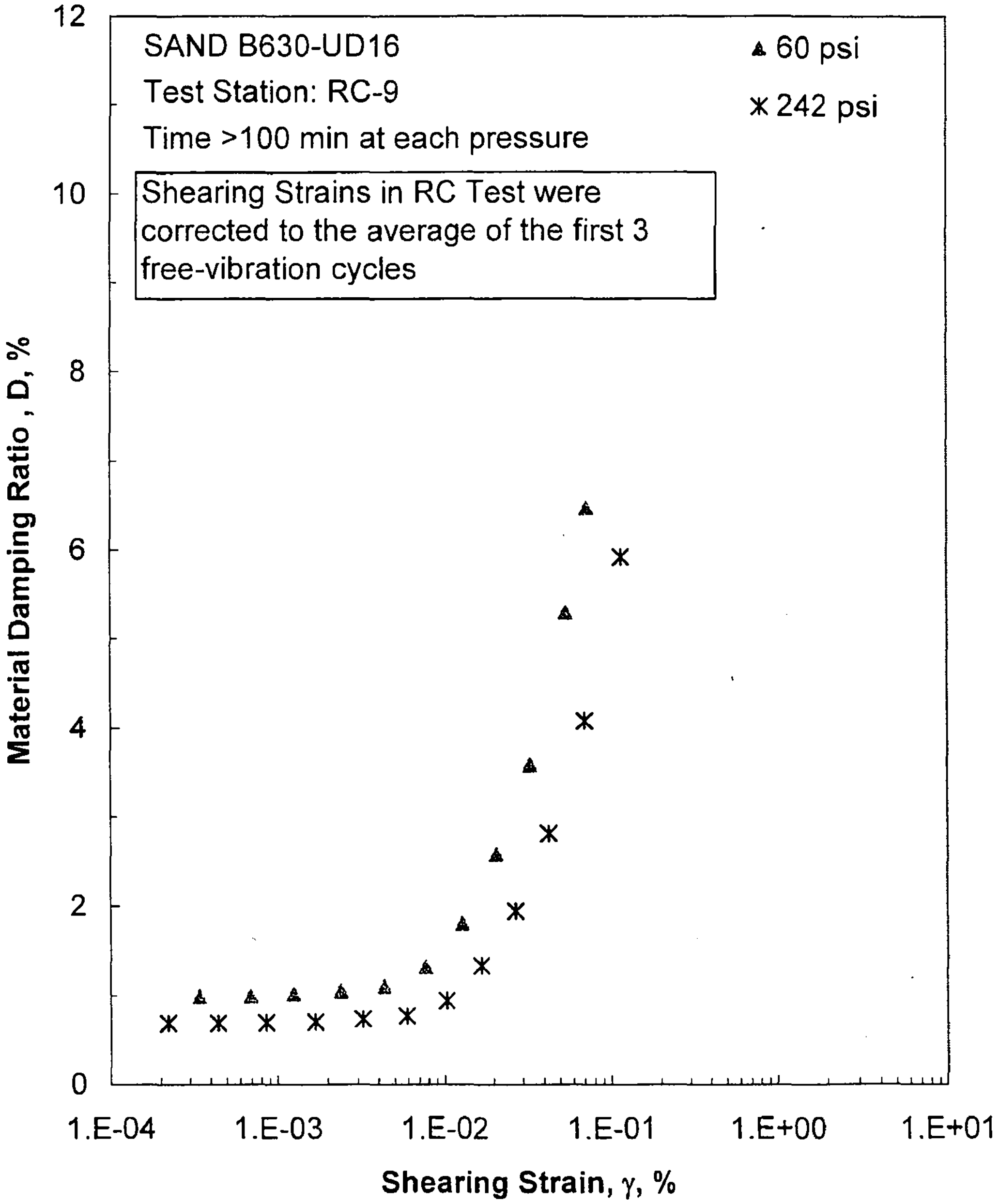

Figure D.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

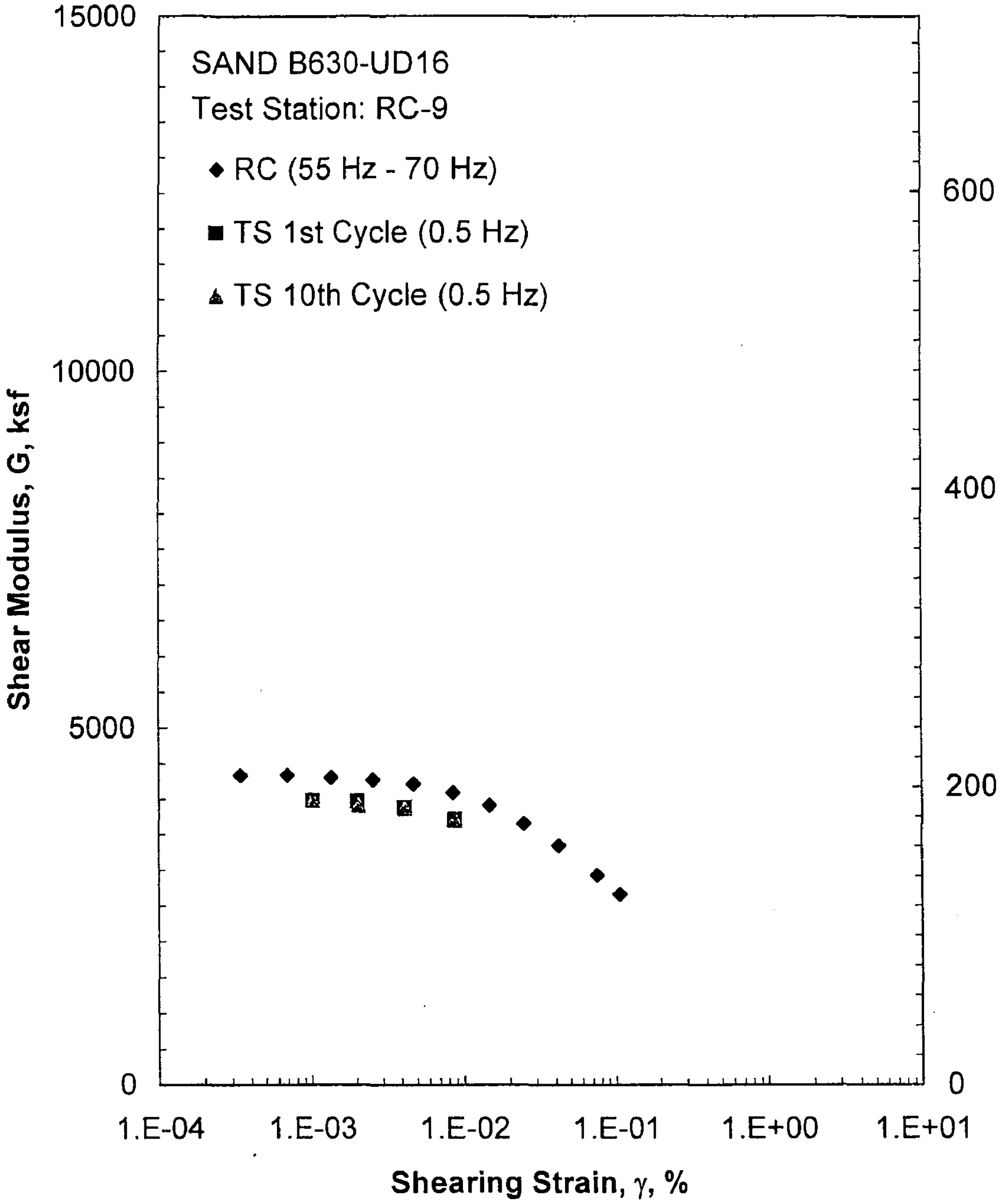

Figure D.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 60 psi from the Combined RCTS Tests

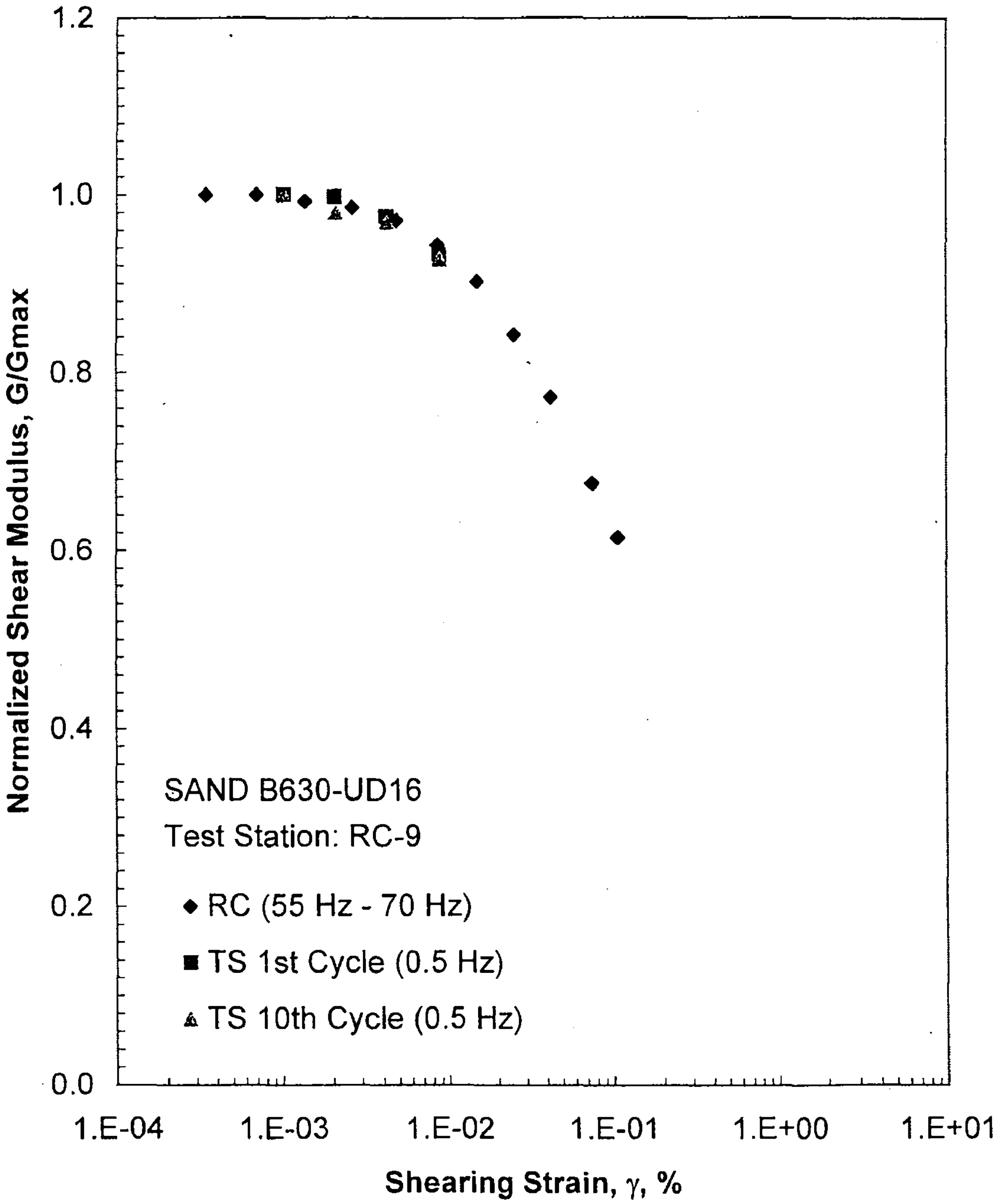

Figure D.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 60 psi from the Combined RCTS Tests

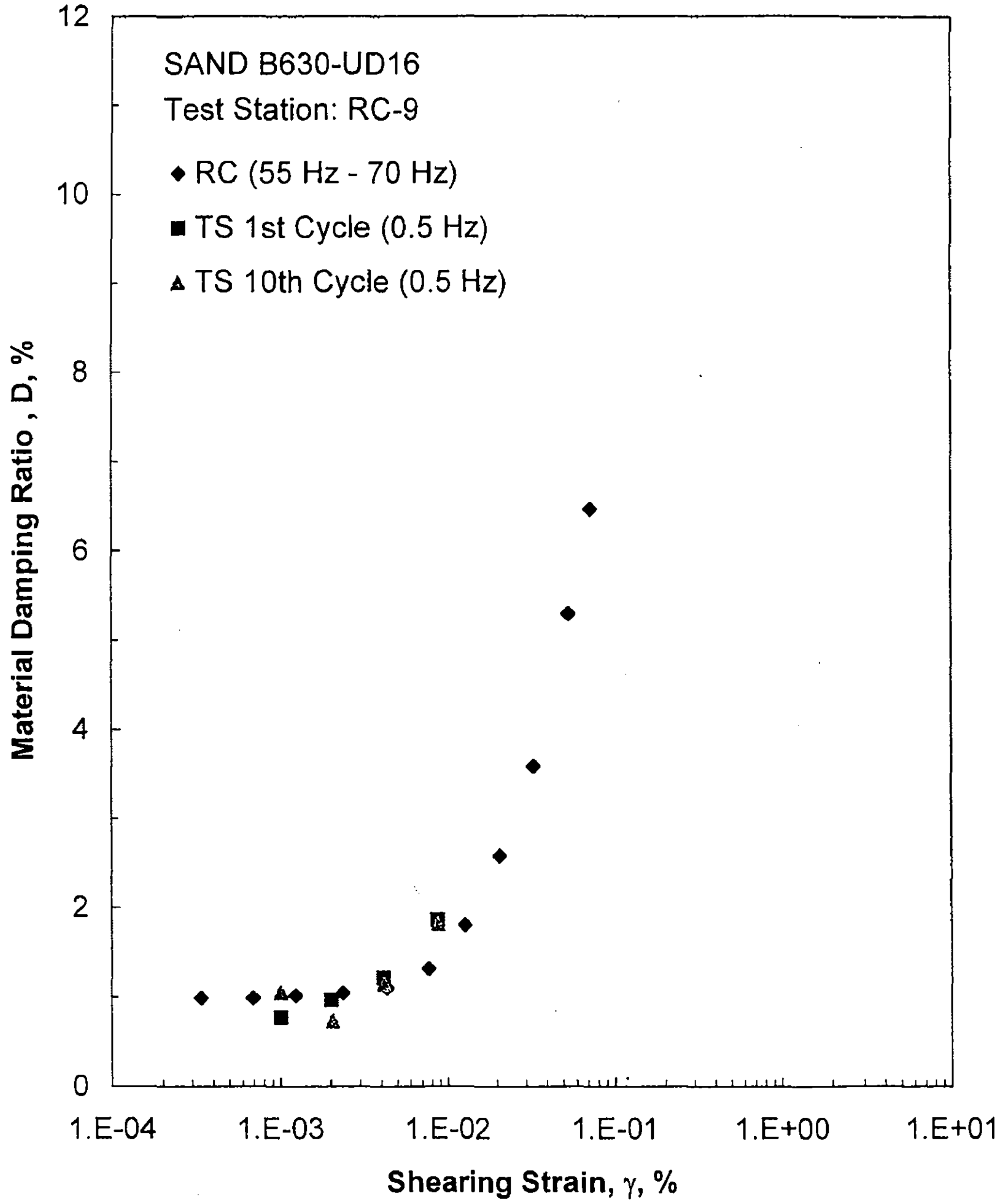

Figure D.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 60 psi from the Combined RCTS Tests

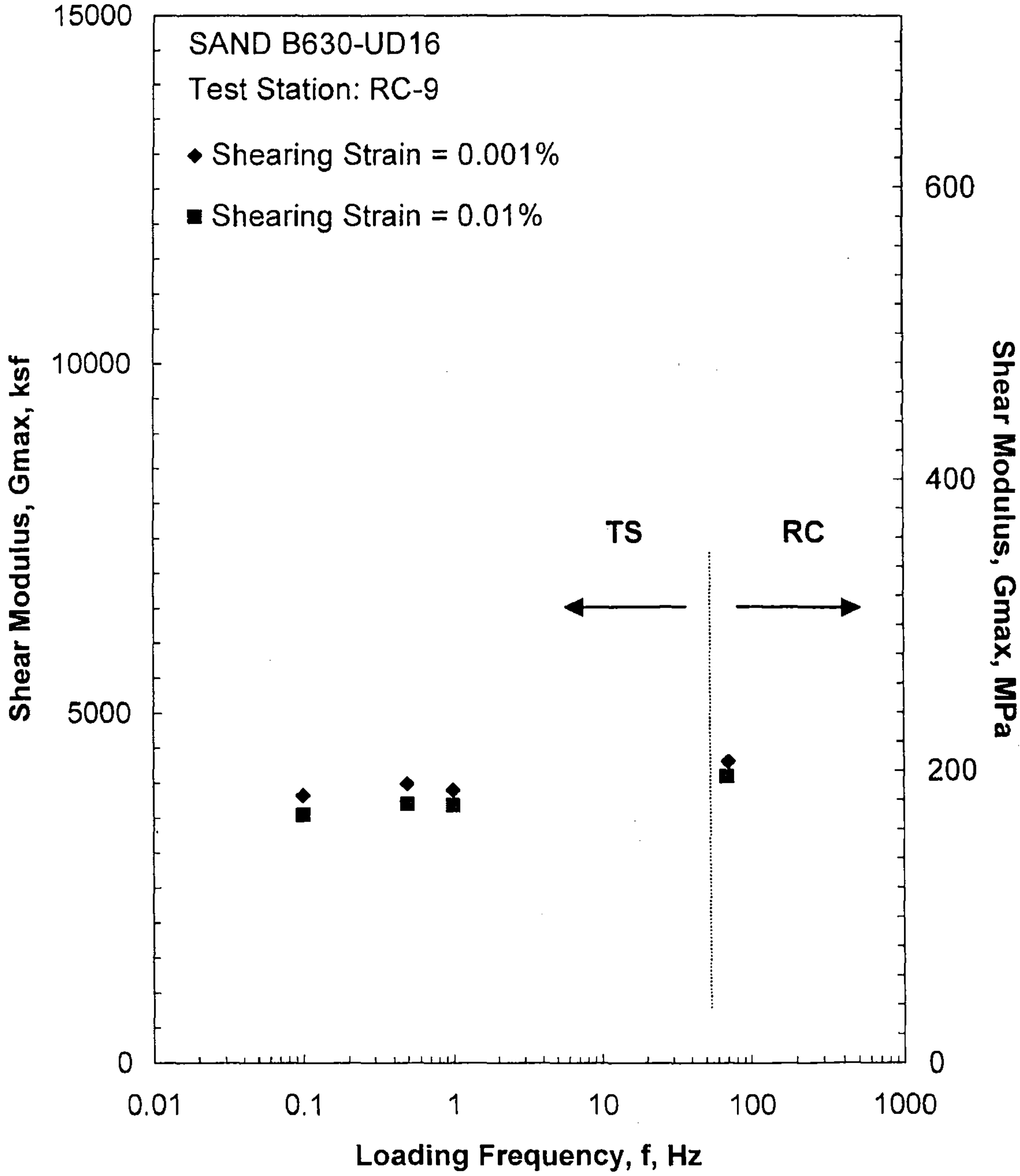

Figure D.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 60 psi from the Combined RCTS Tests

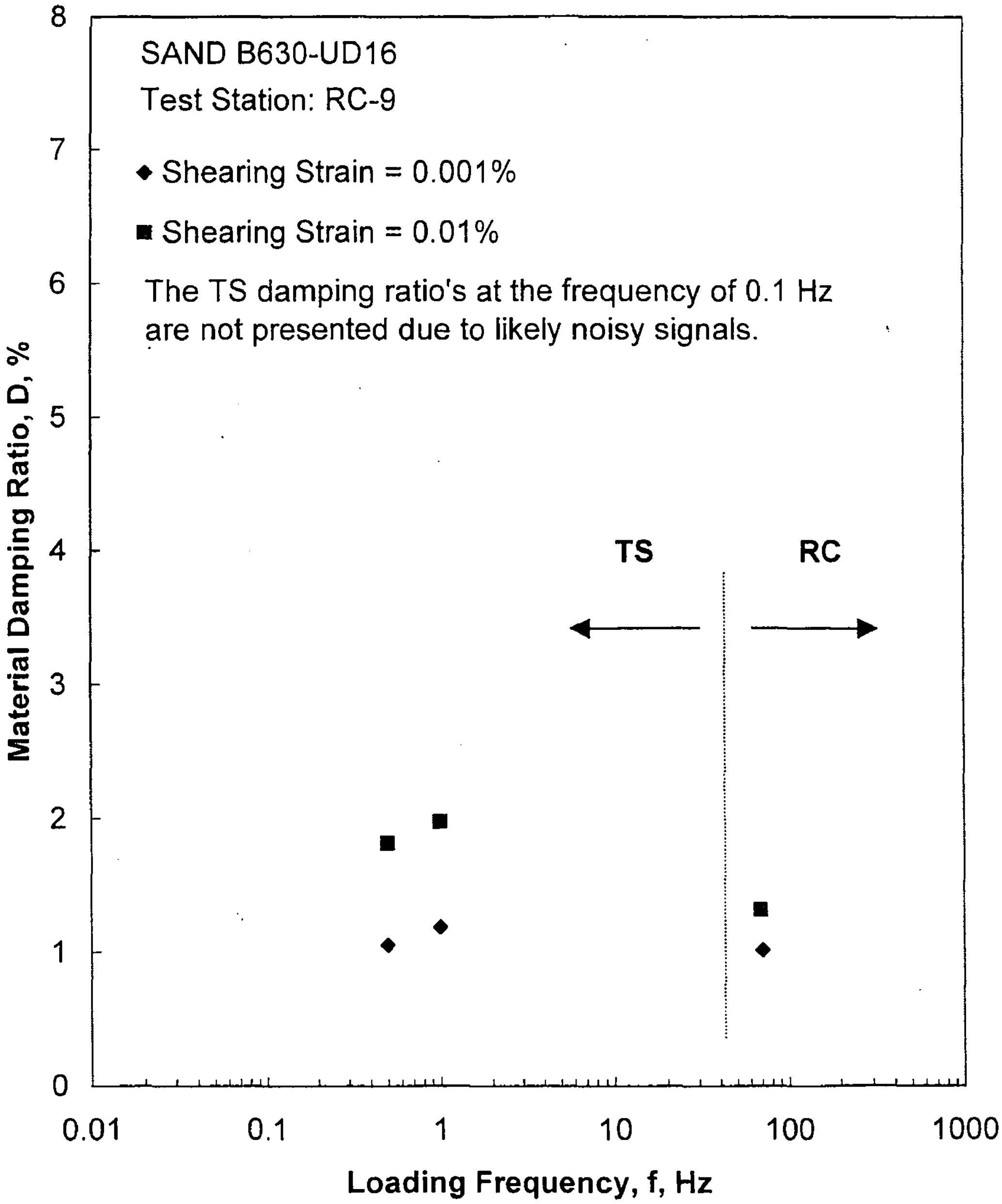

Figure D.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 60 psi from the Combined RCTS Tests

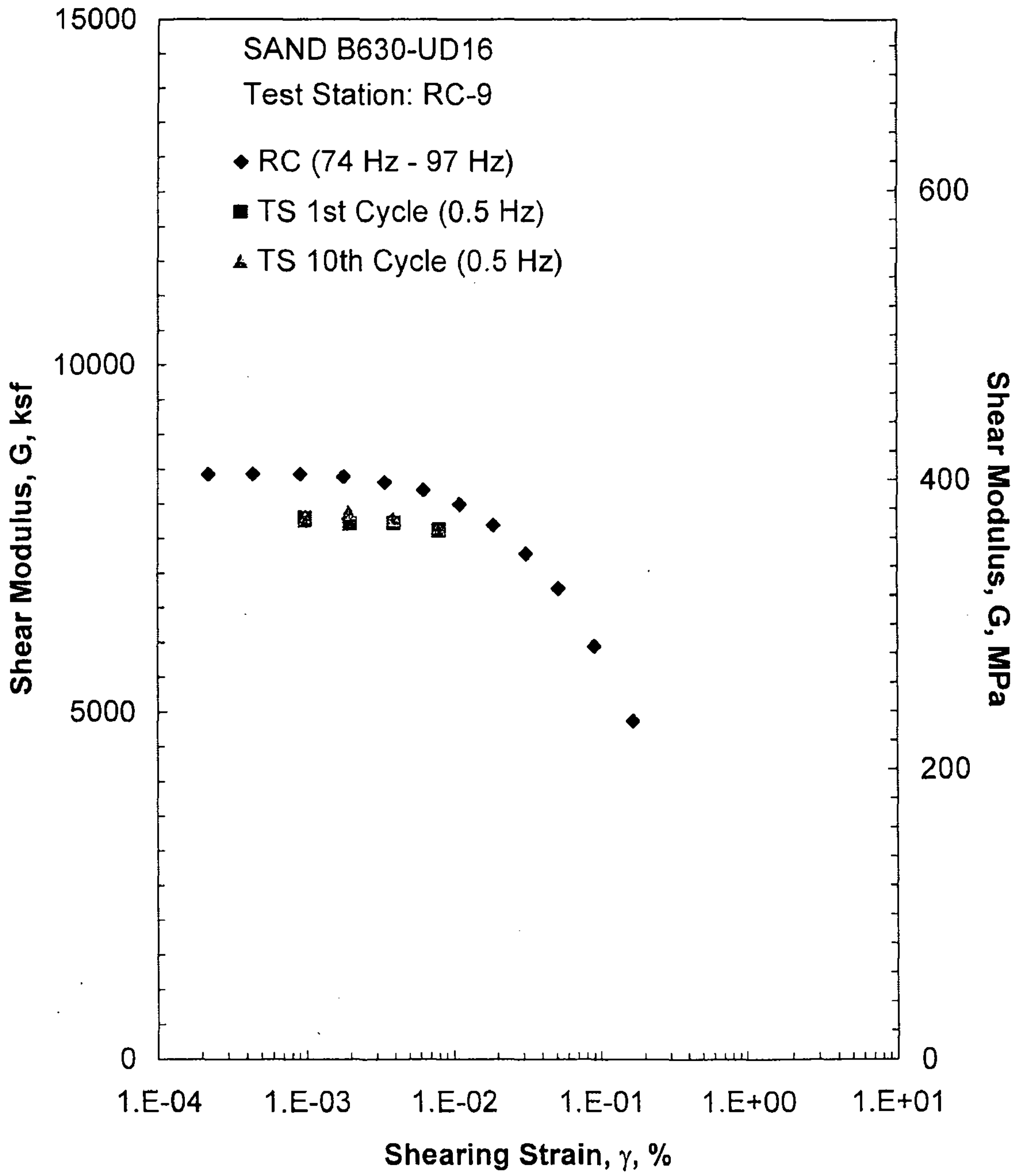

Figure D.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 242 psi from the Combined RCTS Tests

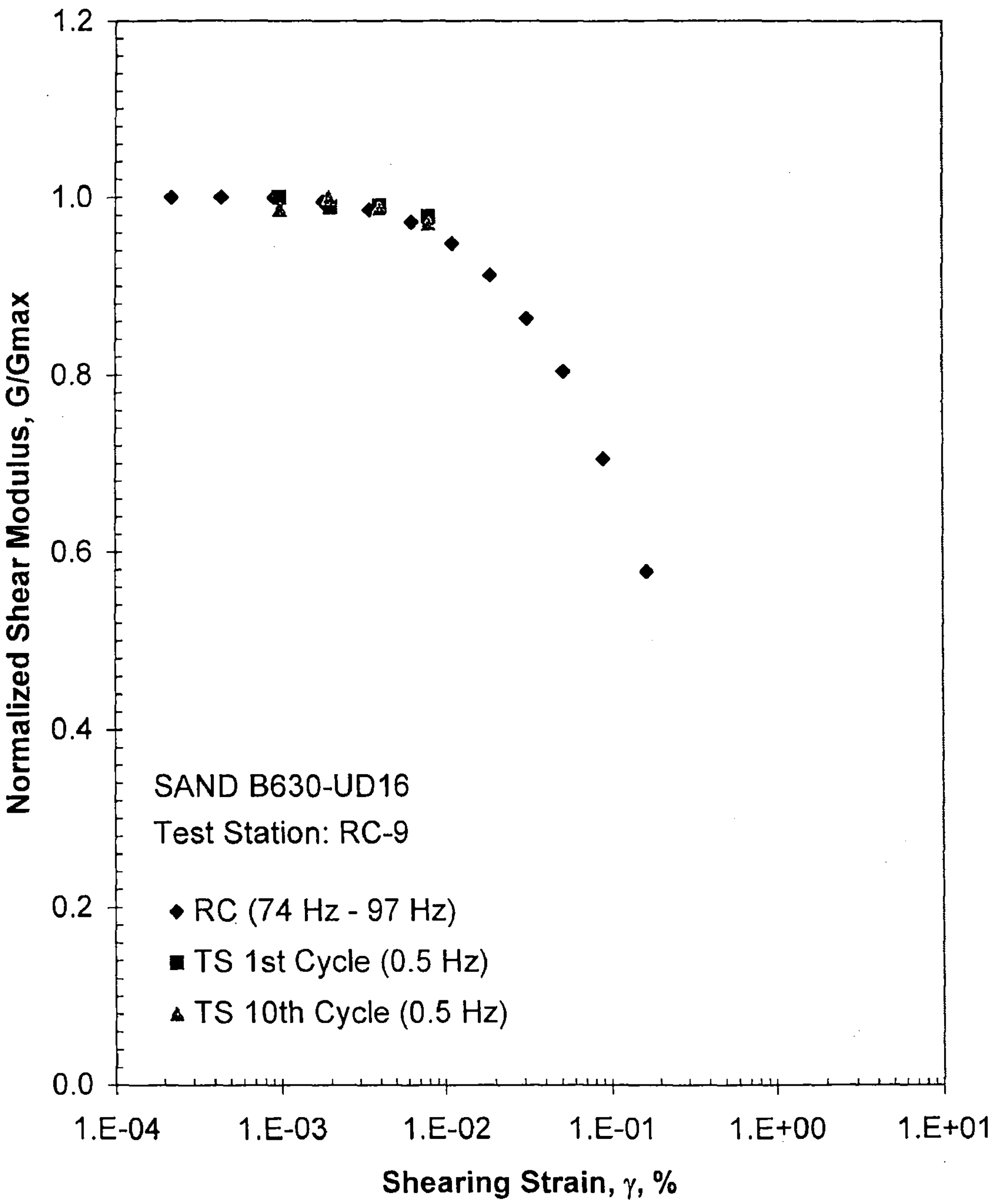

Figure D.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 242 psi from the Combined RCTS Tests

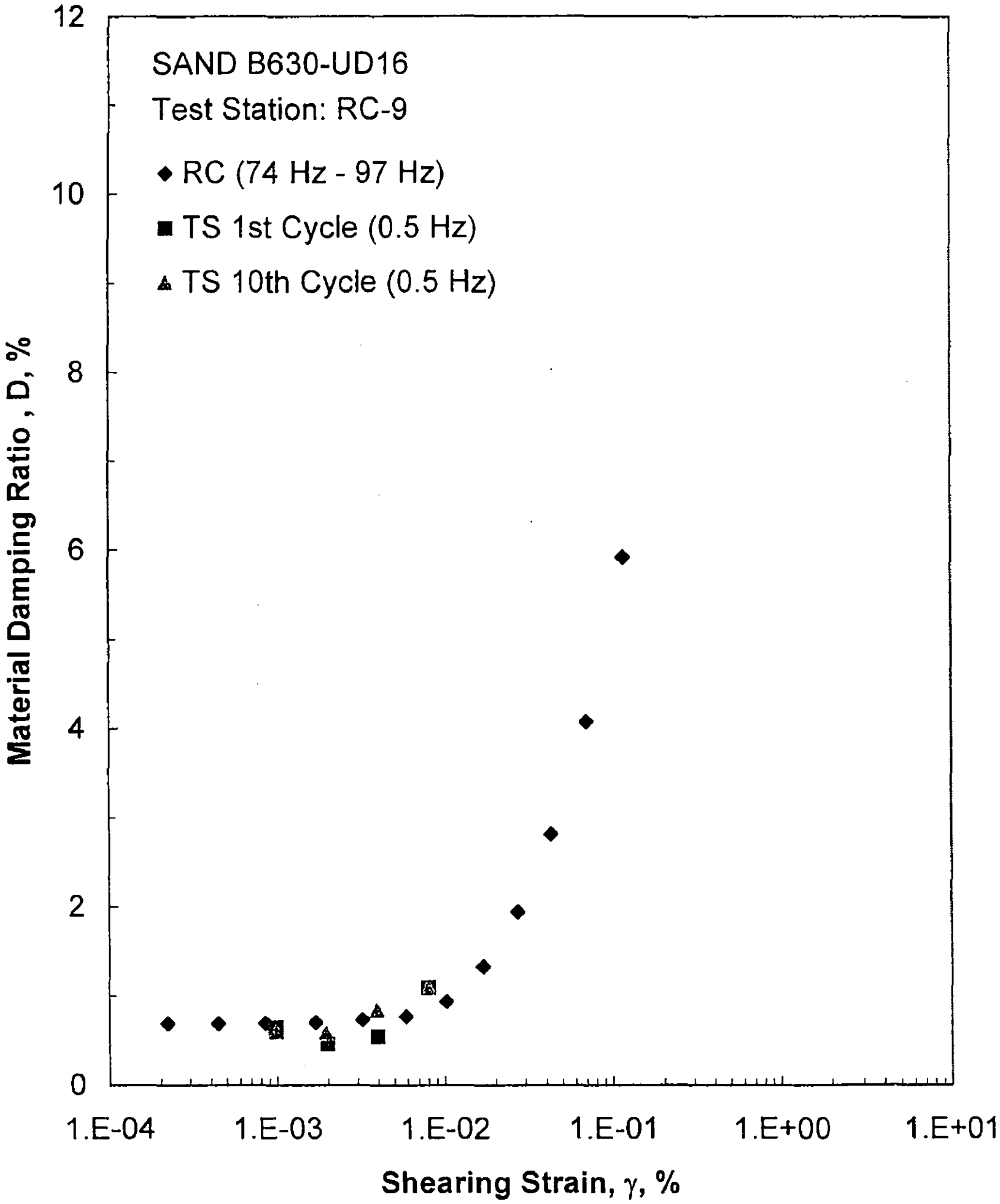

Figure D.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 242 psi from the Combined RCTS Tests

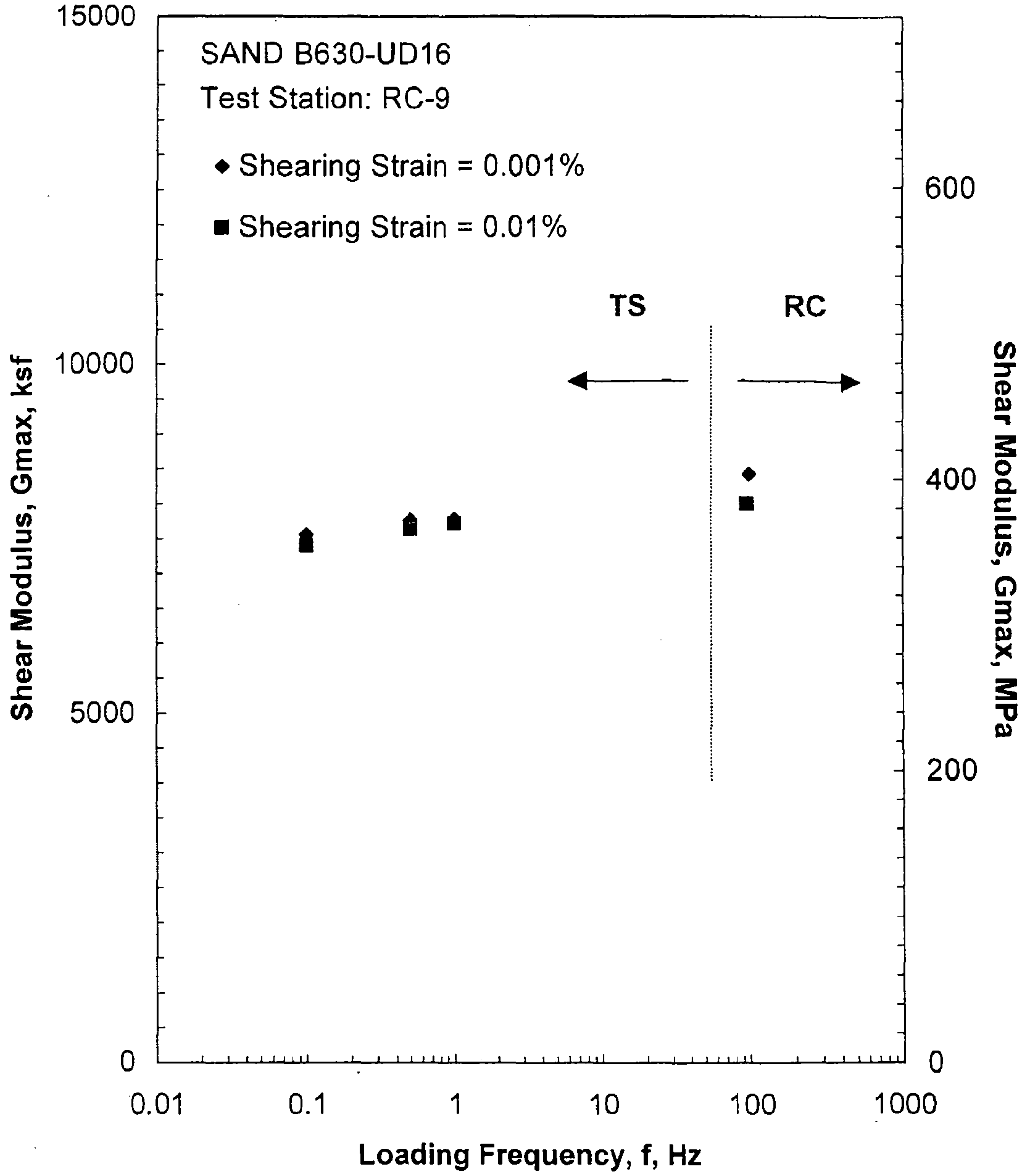

Figure D.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 242 psi from the Combined RCTS Tests

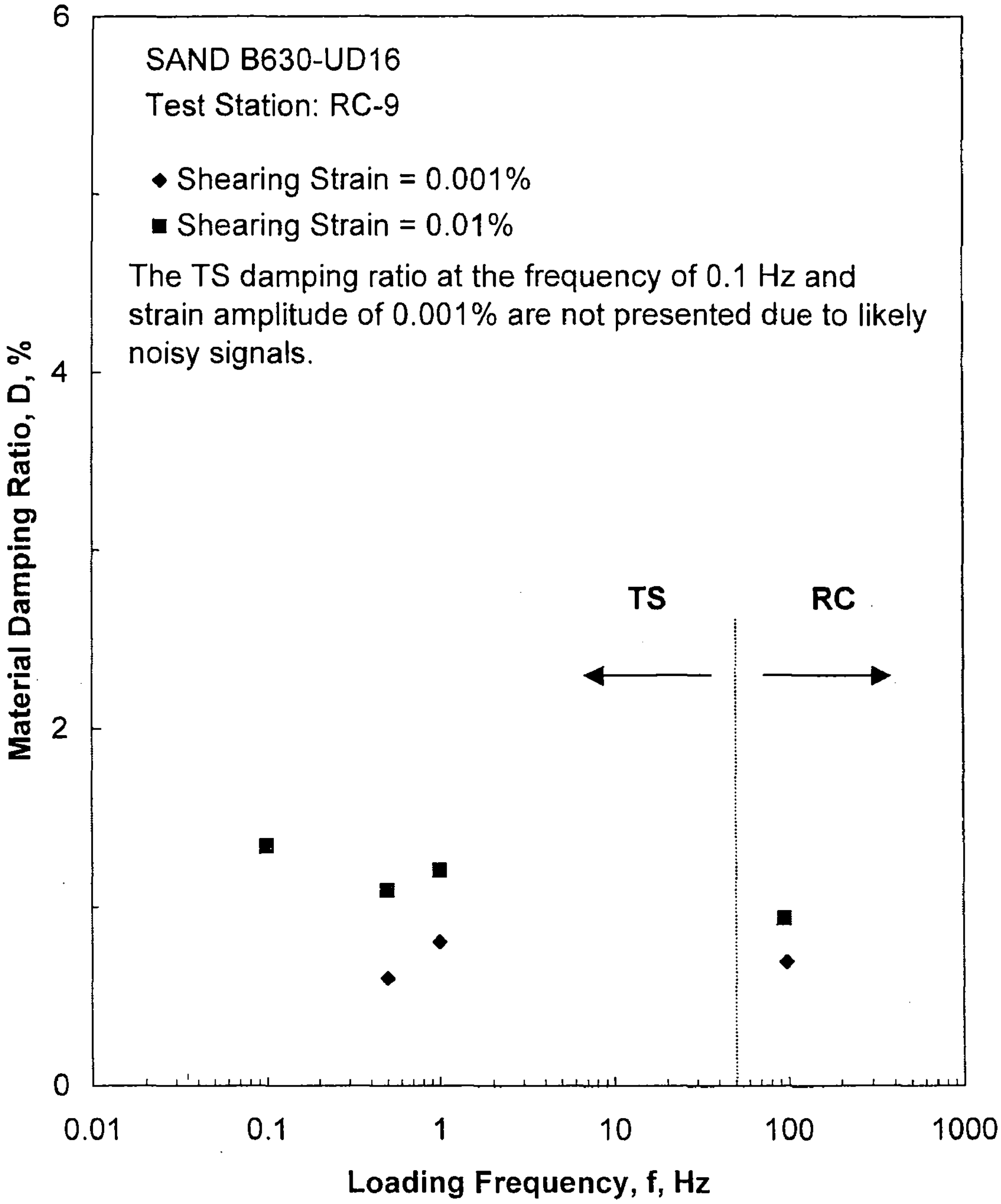

Figure D.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 242 psi from the Combined RCTS Tests

Table D.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 B630-UD16

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	2160	103	2127	102	765	1.21	0.85
30	4320	207	3042	146	913	1.09	0.85
60	8640	413	4303	207	1083	1.00	0.84
121	17424	834	6033	290	1277	0.85	0.82
242	34848	1667	8347	401	1488	0.69	0.79

Table D.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD16; Isoptropic Confining Pressure, σ_o= 60 psi (8.6 ksf = 413 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average$^+$ Shearing Strain, %	Material Damping Ratio^x, D, %
3.41E-04	4335	1.00	3.41E-04	0.99
6.93E-04	4335	1.00	6.93E-04	0.99
1.36E-03	4304	0.99	1.25E-03	1.01
2.60E-03	4273	0.99	2.39E-03	1.04
4.78E-03	4212	0.97	4.35E-03	1.10
8.53E-03	4091	0.94	7.68E-03	1.31
1.47E-02	3912	0.90	1.28E-02	1.80
2.48E-02	3652	0.84	2.08E-02	2.58
4.23E-02	3347	0.77	3.34E-02	3.58
7.52E-02	2929	0.68	5.42E-02	5.29
1.06E-01	2662	0.61	7.23E-02	6.47

$^+$ 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 D.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD16; Isotropic Confining Pressure, σ_o= 60 psi (8.6 ksf = 413 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	3981	1.00	0.77	1.01E-03	3988	1.00	1.05
2.04E-03	3972	1.00	0.96	2.07E-03	3910	0.98	0.73
4.17E-03	3885	0.98	1.21	4.19E-03	3868	0.97	1.14
8.72E-03	3713	0.93	1.86	8.75E-03	3701	0.93	1.81

Table D.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD16; Isoptropic Confining Pressure, σ_o= 242 psi (34.8 ksf = 1667 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
2.21E-04	8430	1.00	2.21E-04	0.69
4.43E-04	8430	1.00	4.43E-04	0.69
9.09E-04	8430	1.00	8.54E-04	0.69
1.79E-03	8390	1.00	1.68E-03	0.70
3.42E-03	8312	0.99	3.21E-03	0.73
6.28E-03	8195	0.97	5.90E-03	0.77
1.11E-02	7993	0.95	1.03E-02	0.94
1.88E-02	7689	0.91	1.69E-02	1.33
3.12E-02	7279	0.86	2.72E-02	1.94
5.17E-02	6777	0.80	4.29E-02	2.81
9.00E-02	5945	0.71	7.02E-02	4.07
1.65E-01	4867	0.58	1.16E-01	5.91

+ 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 D.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD16; Isotropic Confining Pressure, σ_o= 242 psi (34.8 ksf = 1667 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, %
9.81E-04	7797	1.00	0.64	9.85E-04	7764	0.99	0.60
1.98E-03	7713	0.99	0.46	1.94E-03	7872	1.00	0.58
3.96E-03	7720	0.99	0.54	3.94E-03	7779	0.99	0.83
8.03E-03	7625	0.98	1.09	8.02E-03	7638	0.97	1.09

FUGRO CONSULTANTS, INC.

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

July 12, 2008

Ms. Siesta Williams
MACTEC
3301 Atlantic Avenue
Raleigh, NC 27604

RE: Three (3) Reports For The Turkey Point Project

Dear Ms. Williams:

Fugro has completed three (3) RCTS tests, which are B630-UD19, B630-UD23, and B630-UD27 for the Turkey Point project. Fugro has incorporated, as needed, Dr. Kenneth Stokoe's comments into the final reports. The final reports and the associated RCTS Test Approvals 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

RCTS TEST APROVAL

PROJECT SITE/NAME	Turkey Point

Test ID	Sample ID	Depth B.S. (Ft)	Approved By (Initials)	Date
RCTS#E	B630-UD19	231.0	KHS (+)	5 July '08
RCTS#F	B630-UD23	260.5	KHS (+) (A)	5 July '08
RCTS#G	B630-UD27	294.0	KHS (+)	5 July '08

Three RCTS tests for the site referenced above were tested, and three 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

Dr. Kenneth Stokoe

(+) See minor comments and suggestions on a few figures

(A) In Appendix F, the reported γ_t of 150.1 lb/ft³ on the cover page can not be correct. Please correct to ~ 121 lb/ft³.

APPENDIX E

Specimen B630-UD19

Borehole 630
Sample UD19
Depth = 231.0 ft (70.6 m)
Total Unit Weight = 121.9 lb/ft^3
Water Content = 26.6 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 66 psi

FUGRO JOB #: 0411-08-1701
Testing Station: RC9

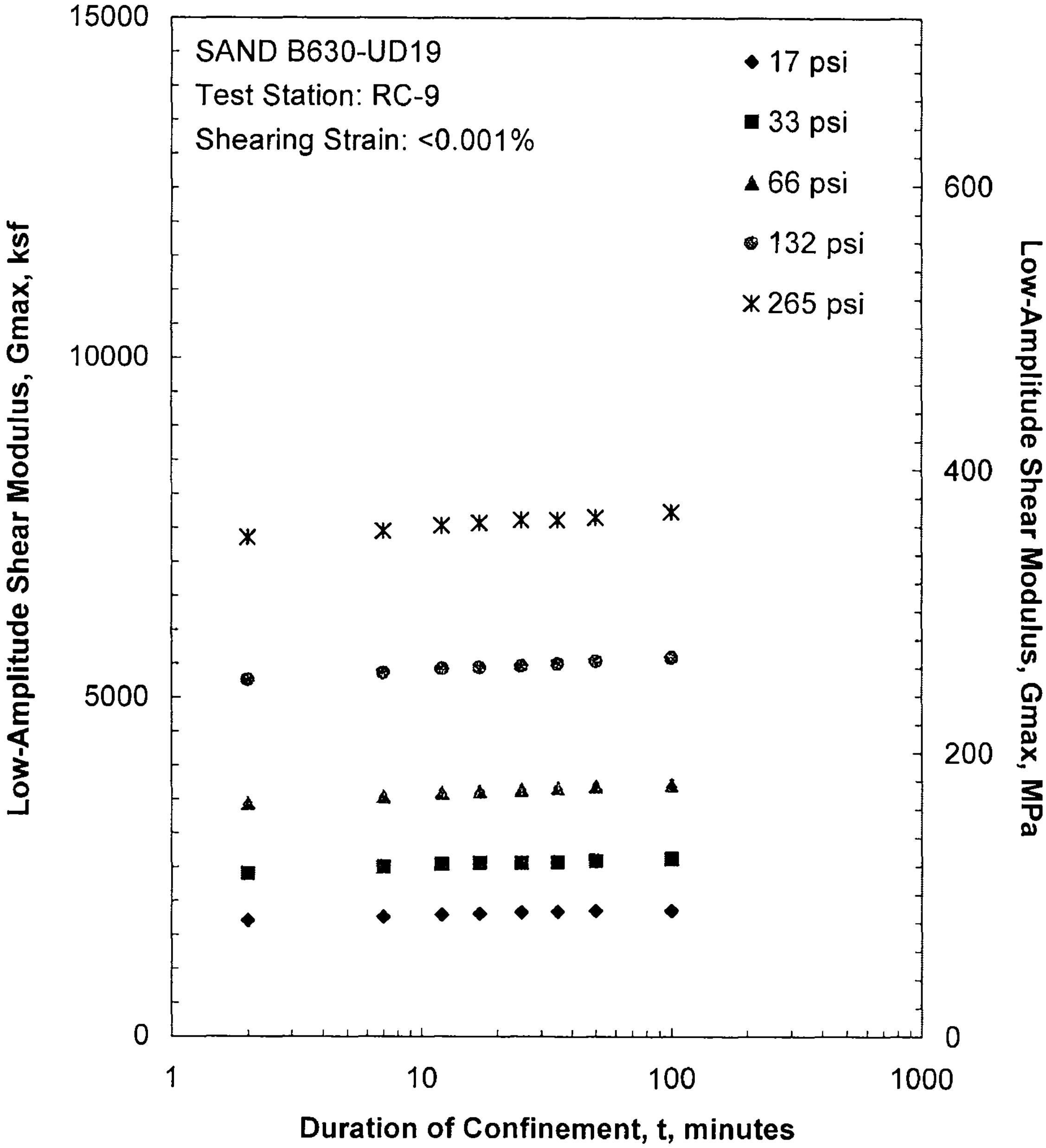

Figure E.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

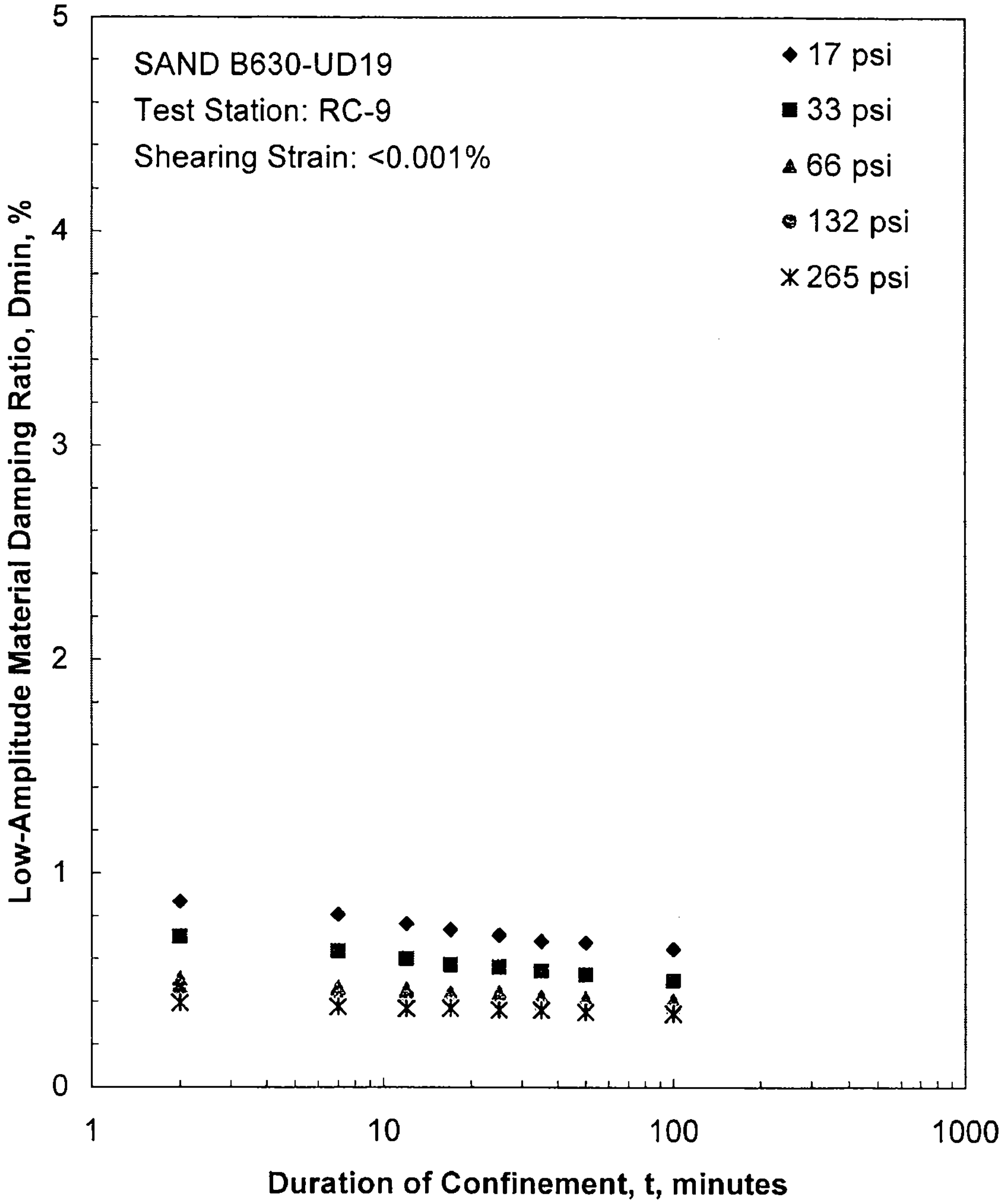

Figure E.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

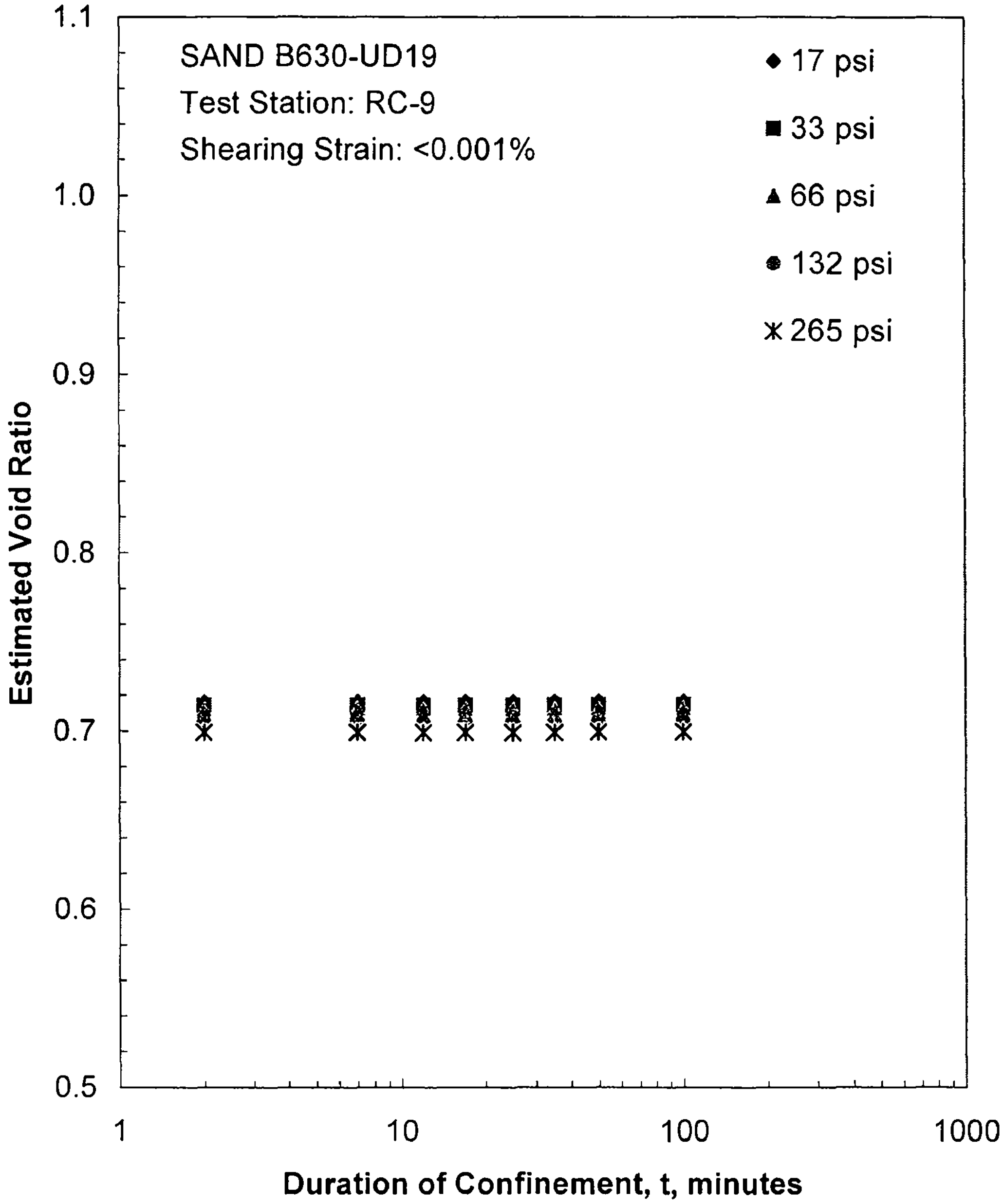

Figure E.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

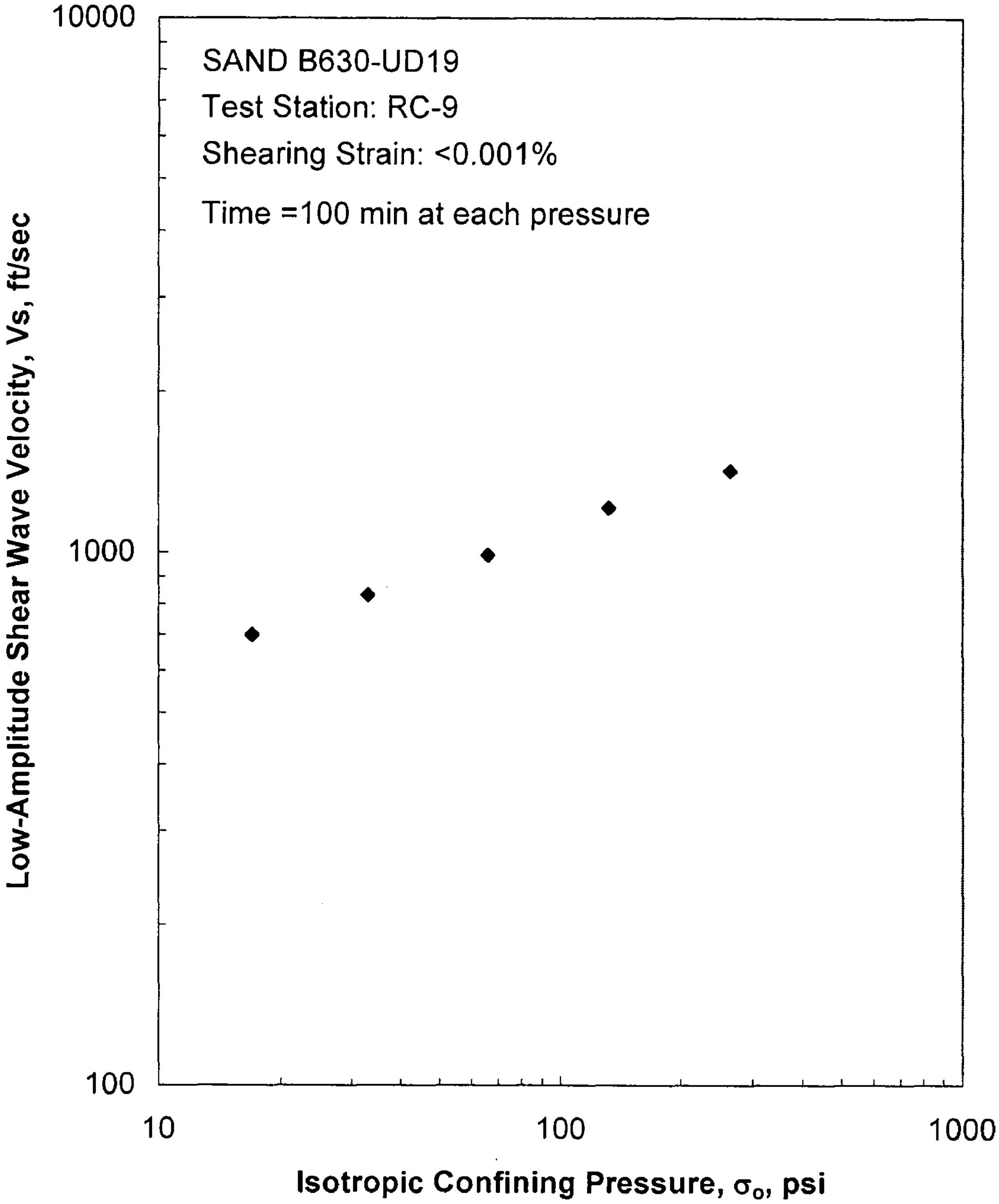

Figure E.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

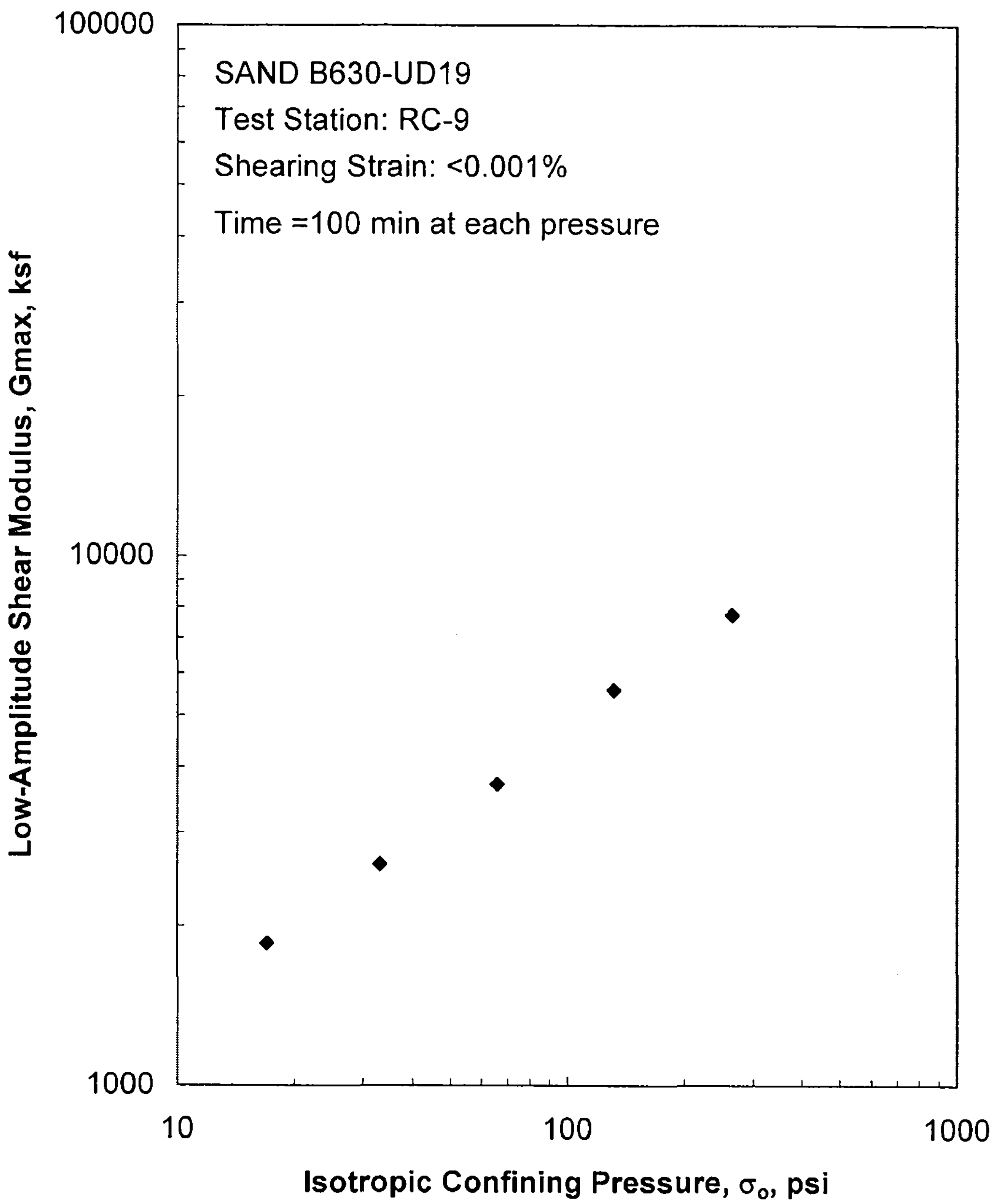

Figure E.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

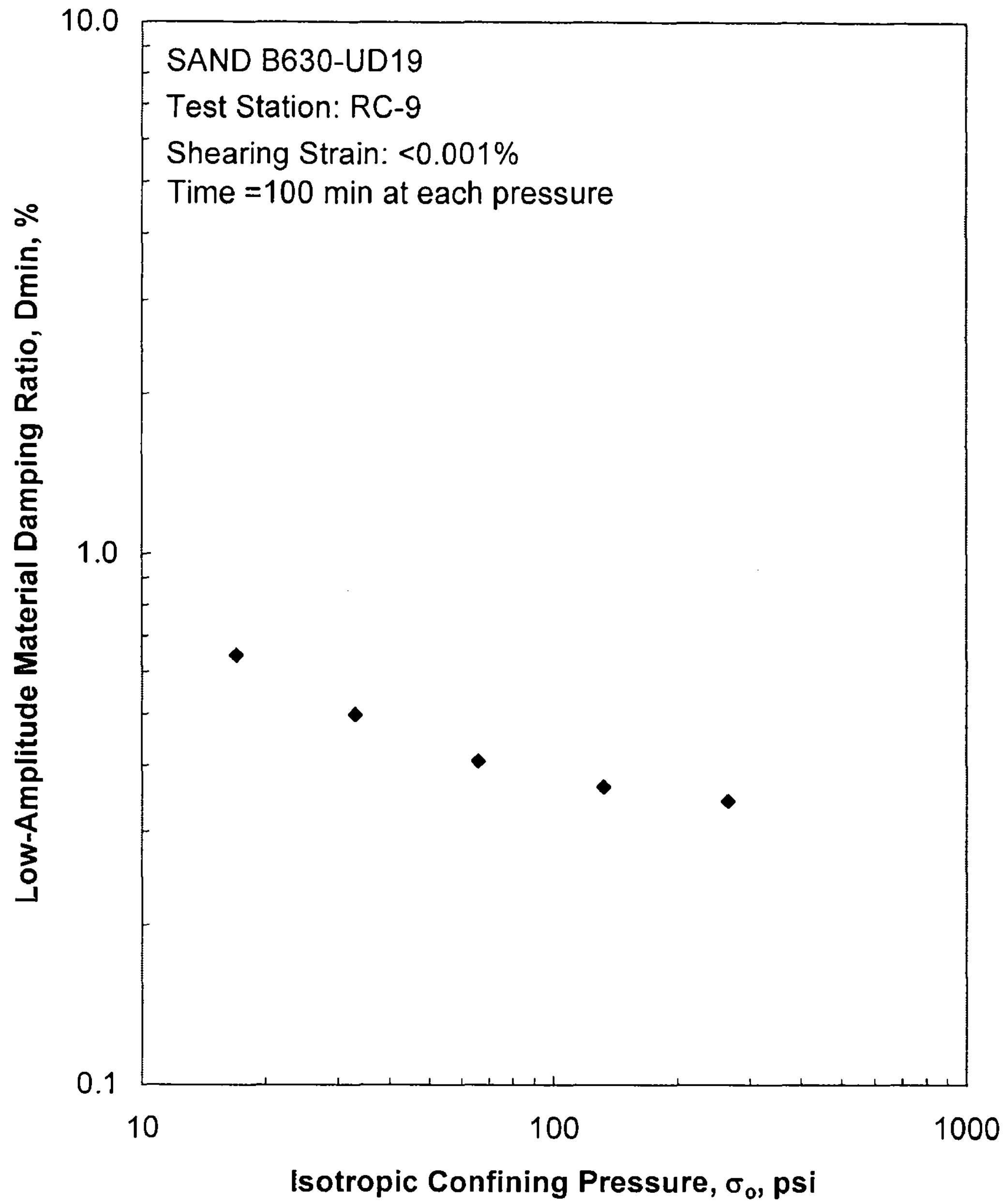

Figure E.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

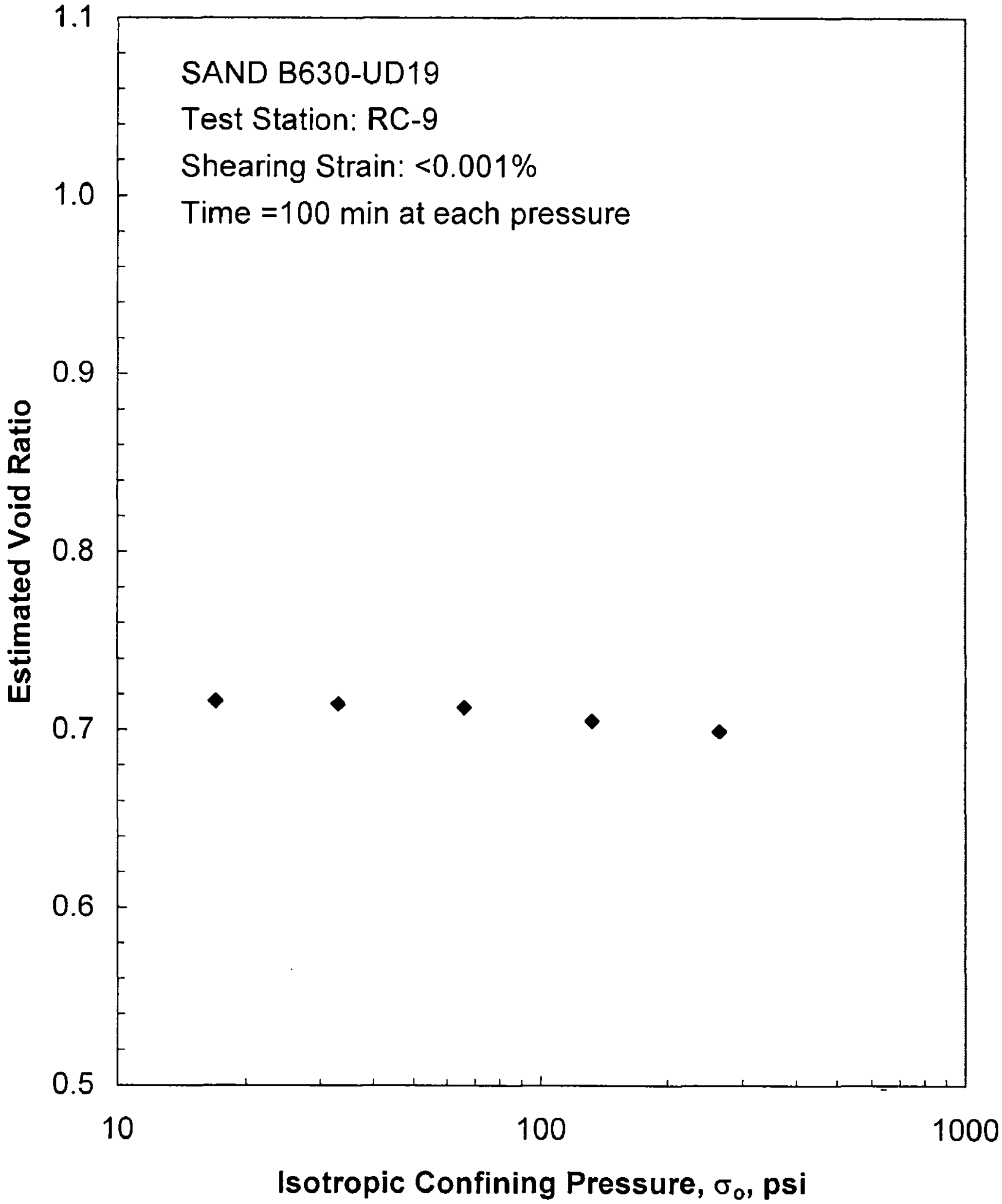

Figure E.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

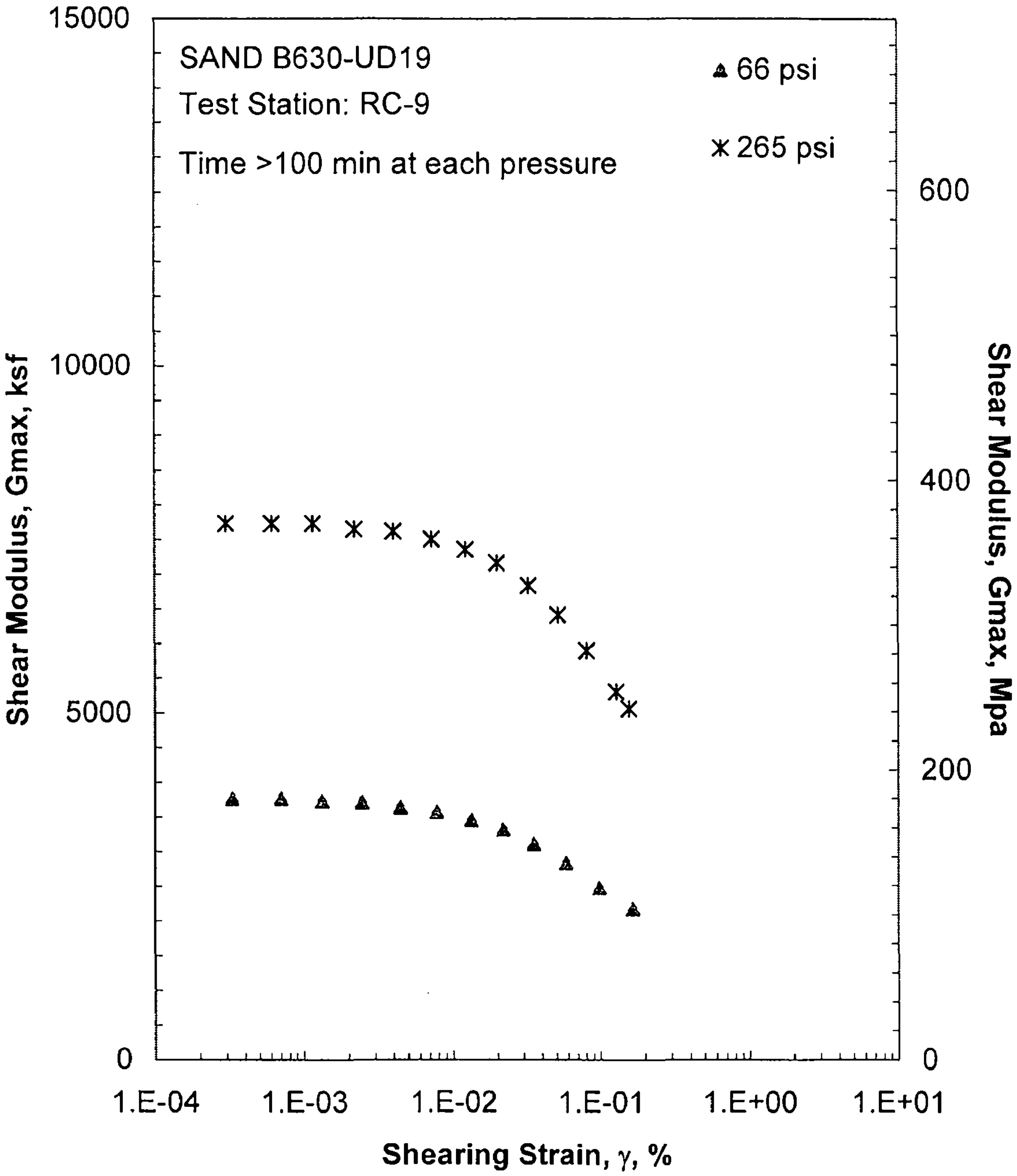

Figure E.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

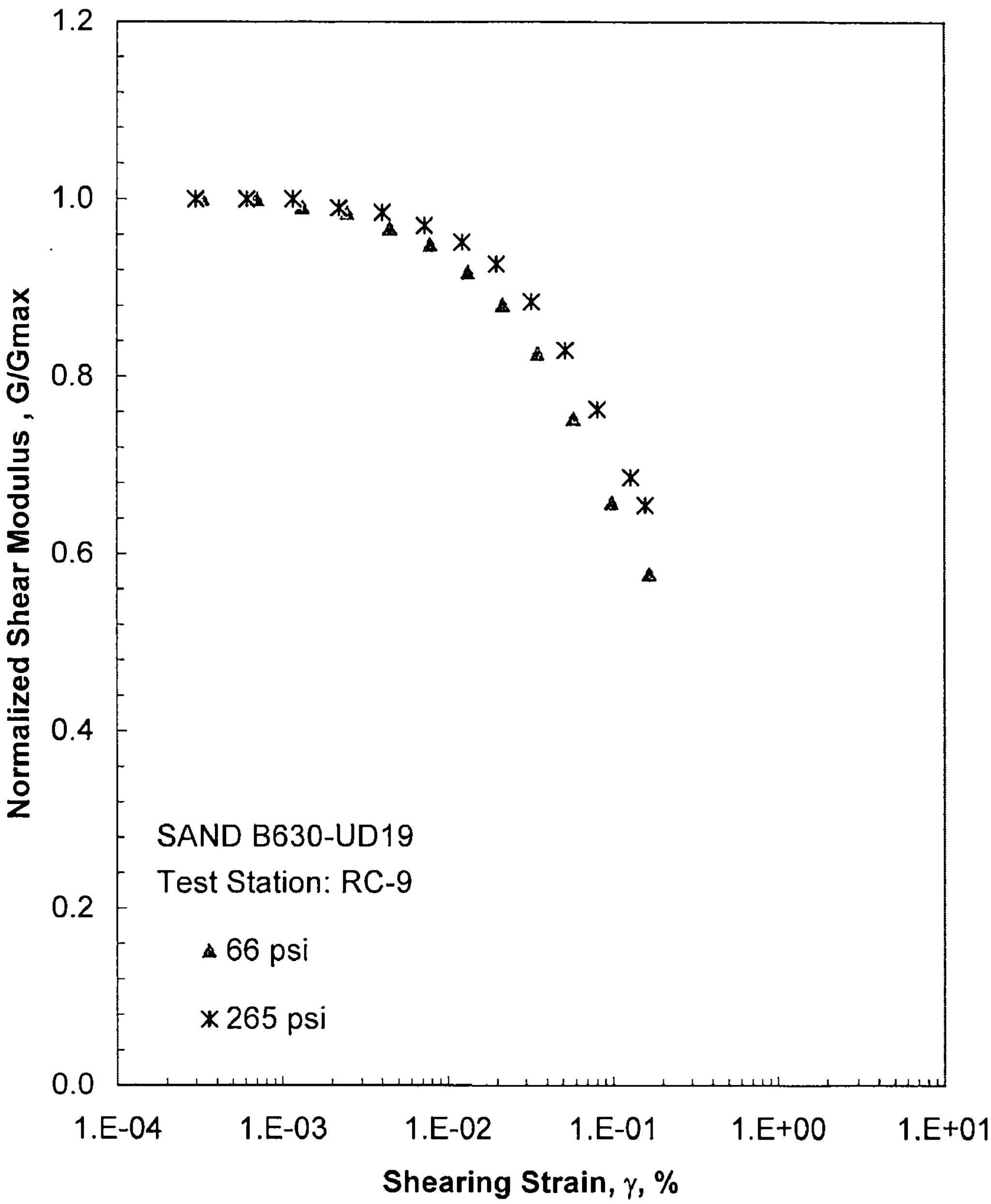

Figure E.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

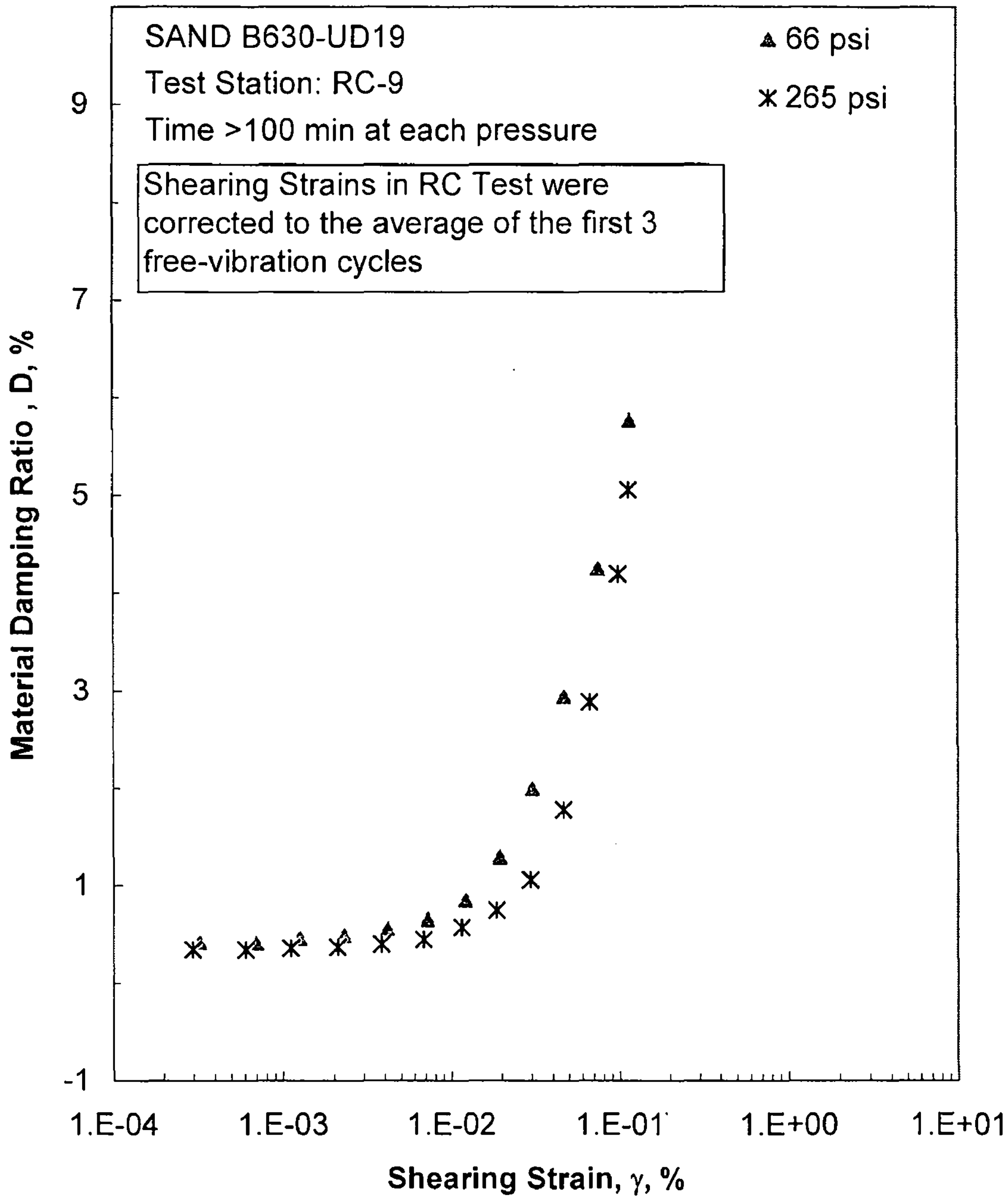

Figure E.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

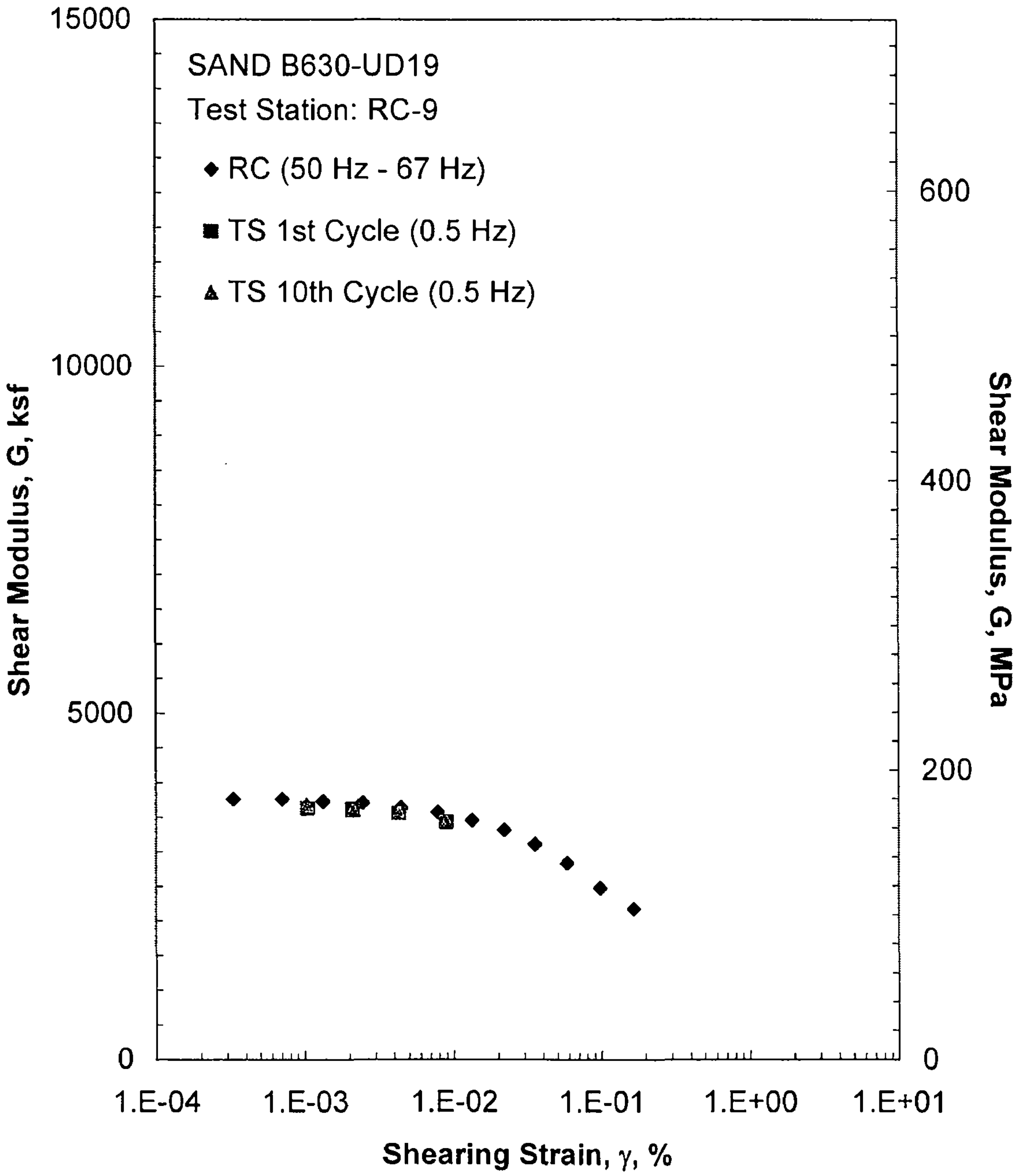

Figure E.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 66 psi from the Combined RCTS Tests

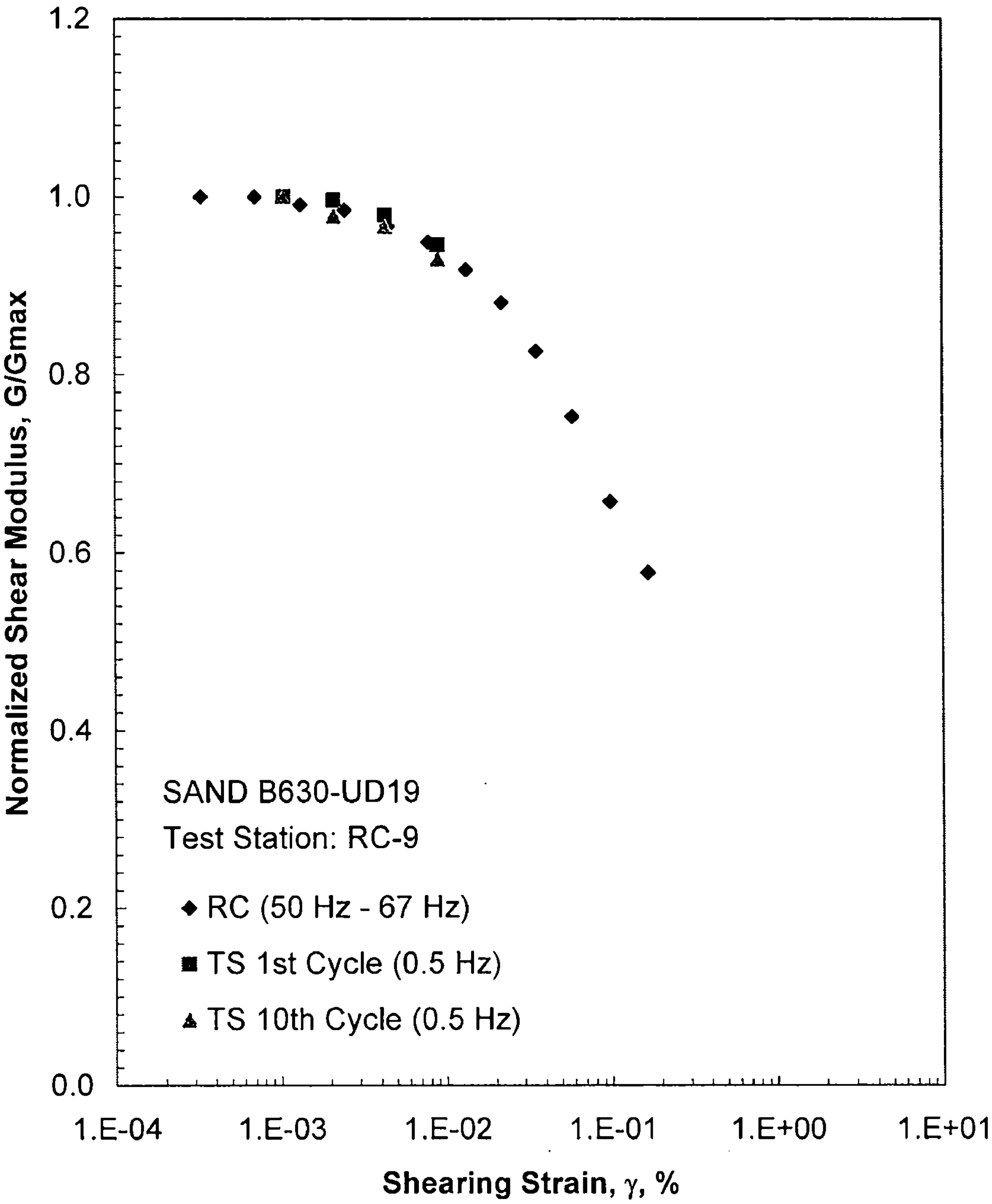

Figure E.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 66 psi from the Combined RCTS Tests

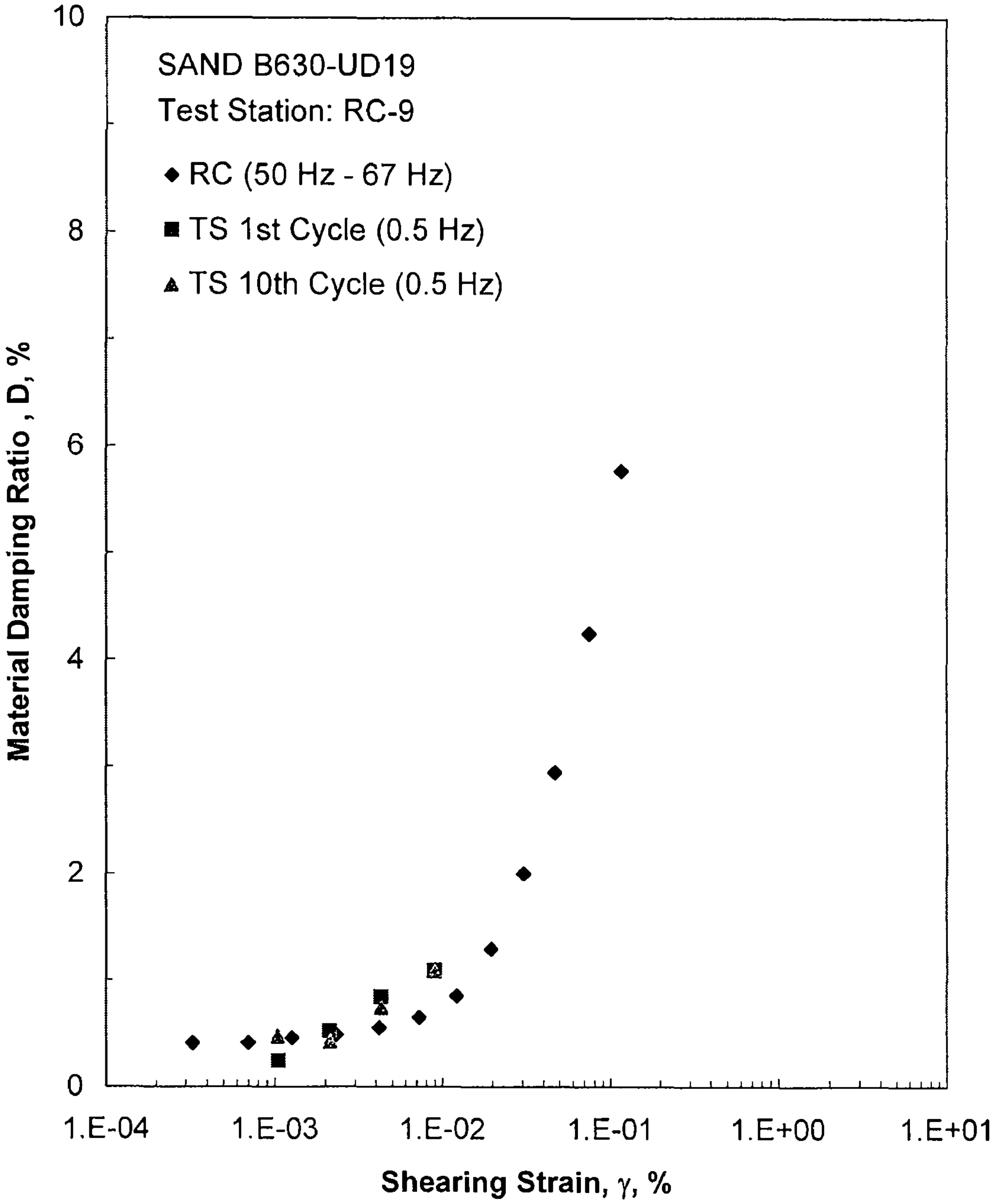

Figure E.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 66 psi from the Combined RCTS Tests

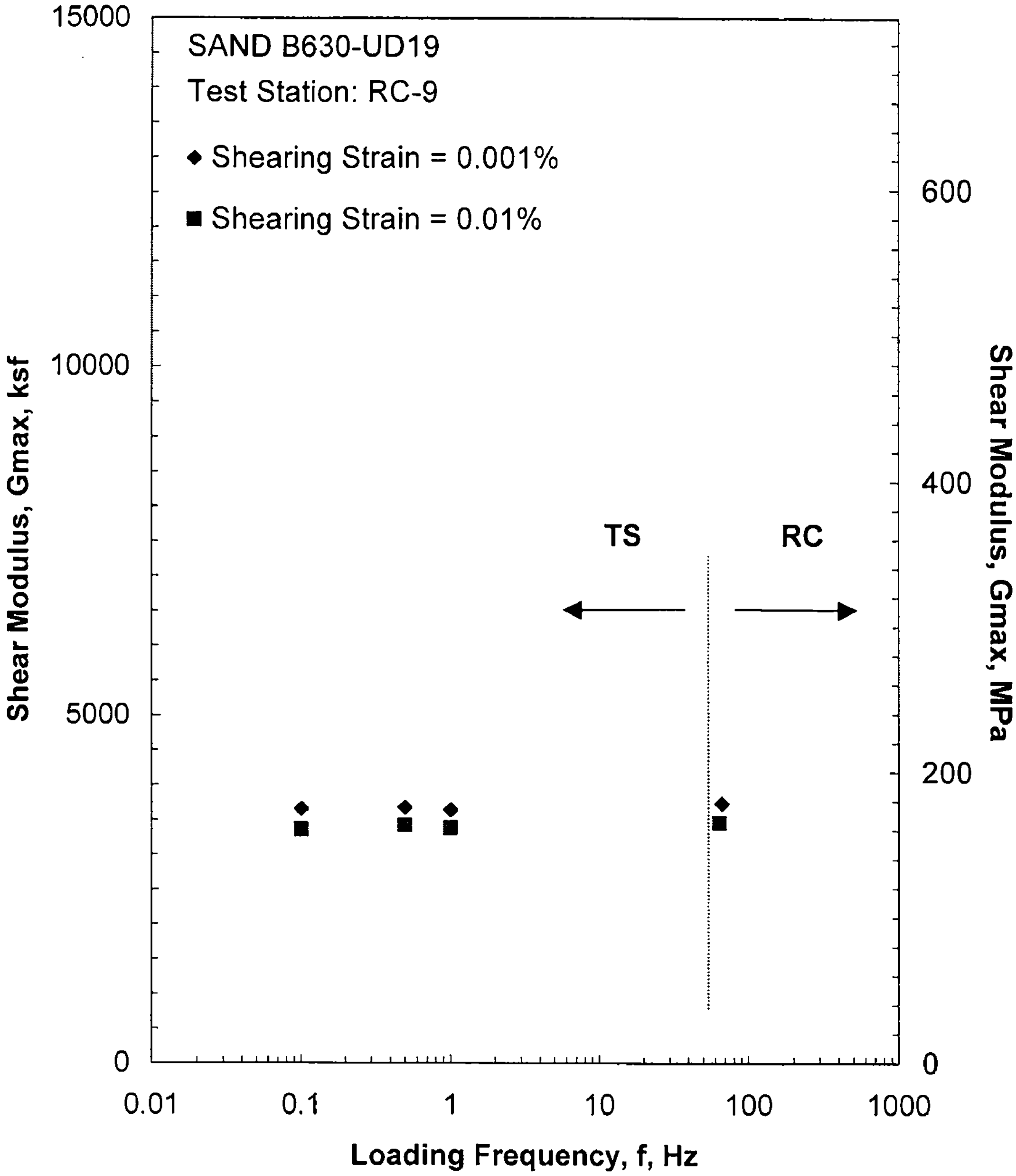

Figure E.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 66 psi from the Combined RCTS Tests

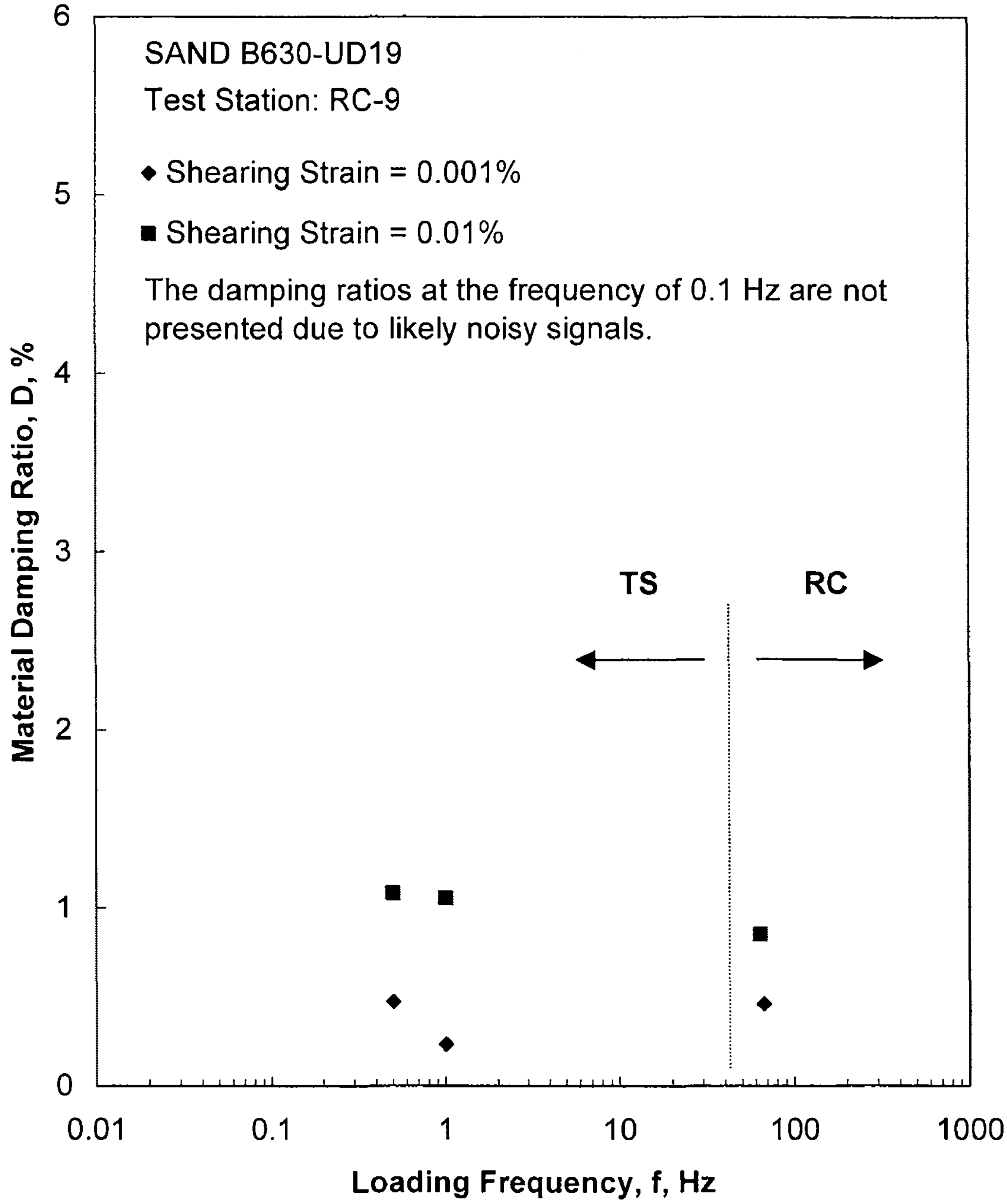

Figure E.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 66 psi from the Combined RCTS Tests

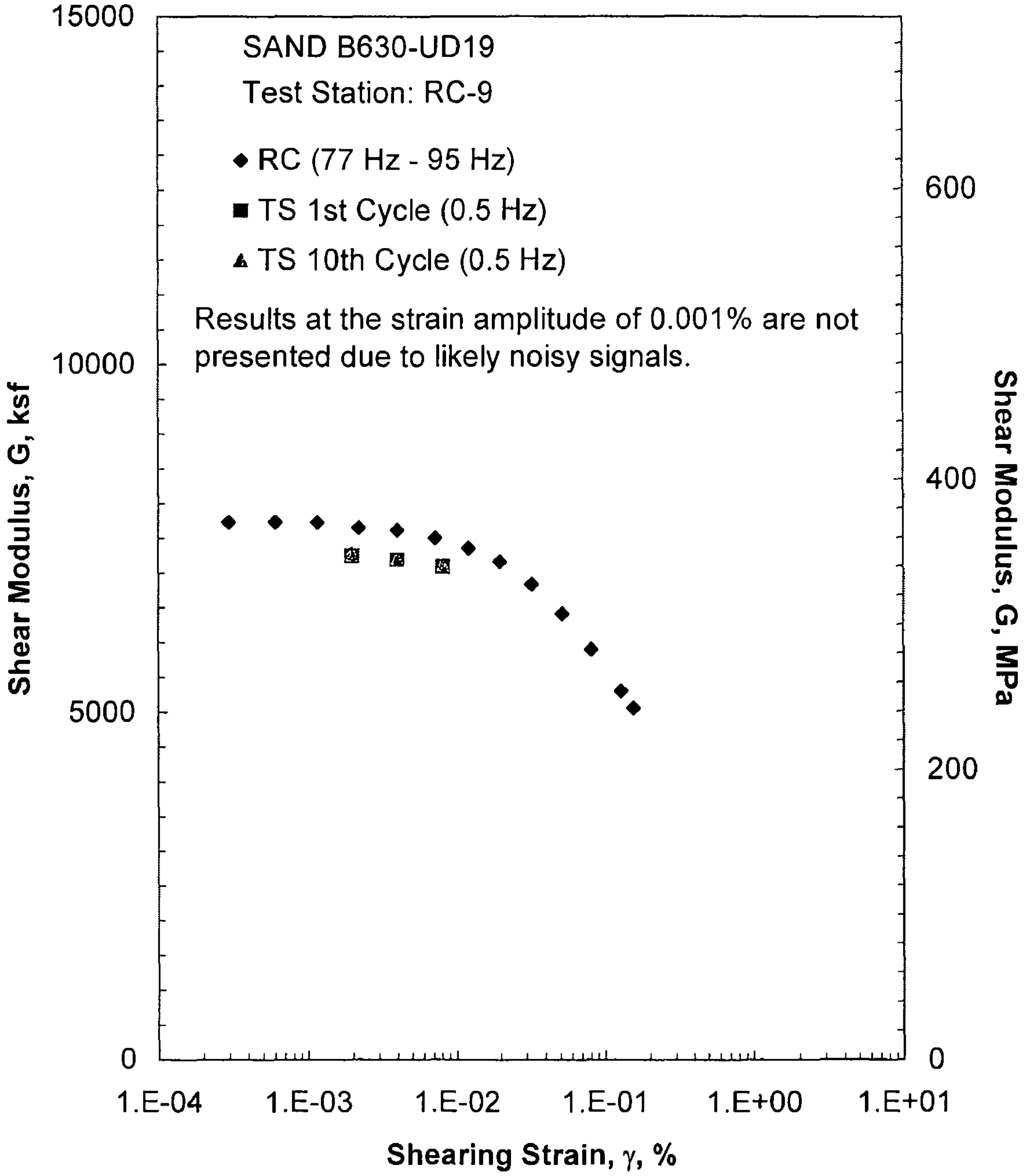

Figure E.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 265 psi from the Combined RCTS Tests

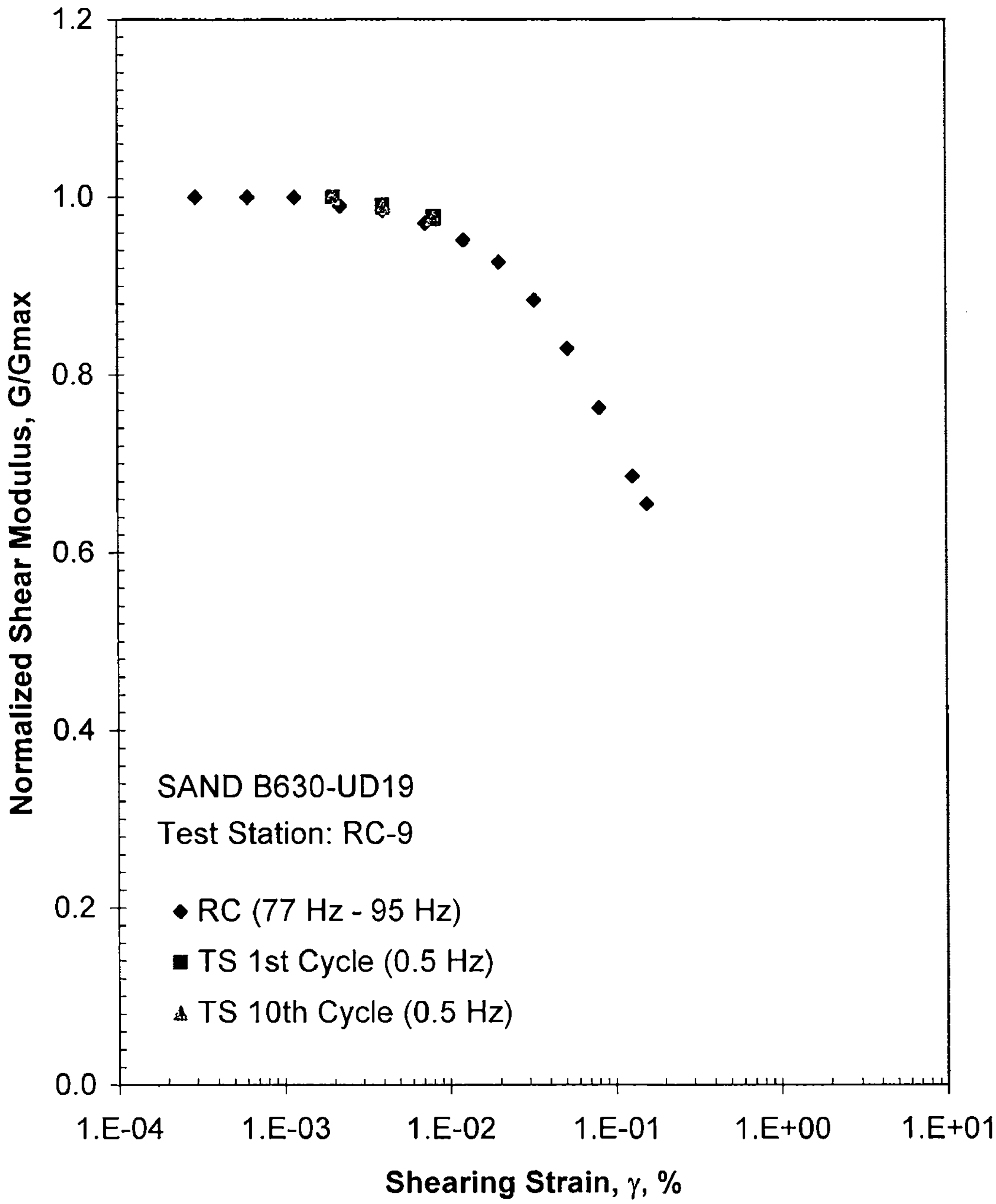

Figure E.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 265 psi from the Combined RCTS Tests

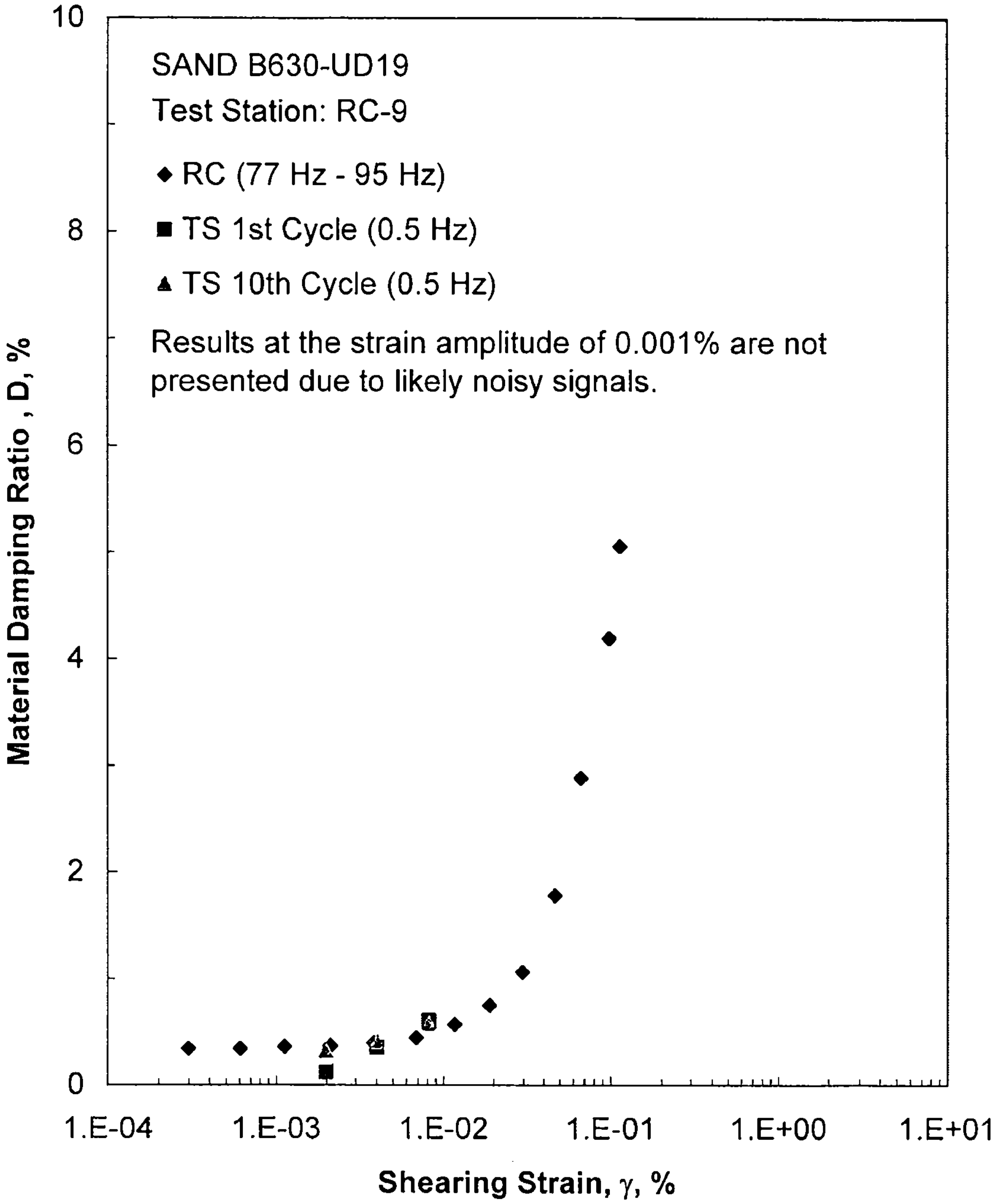

Figure E.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 265 psi from the Combined RCTS Tests

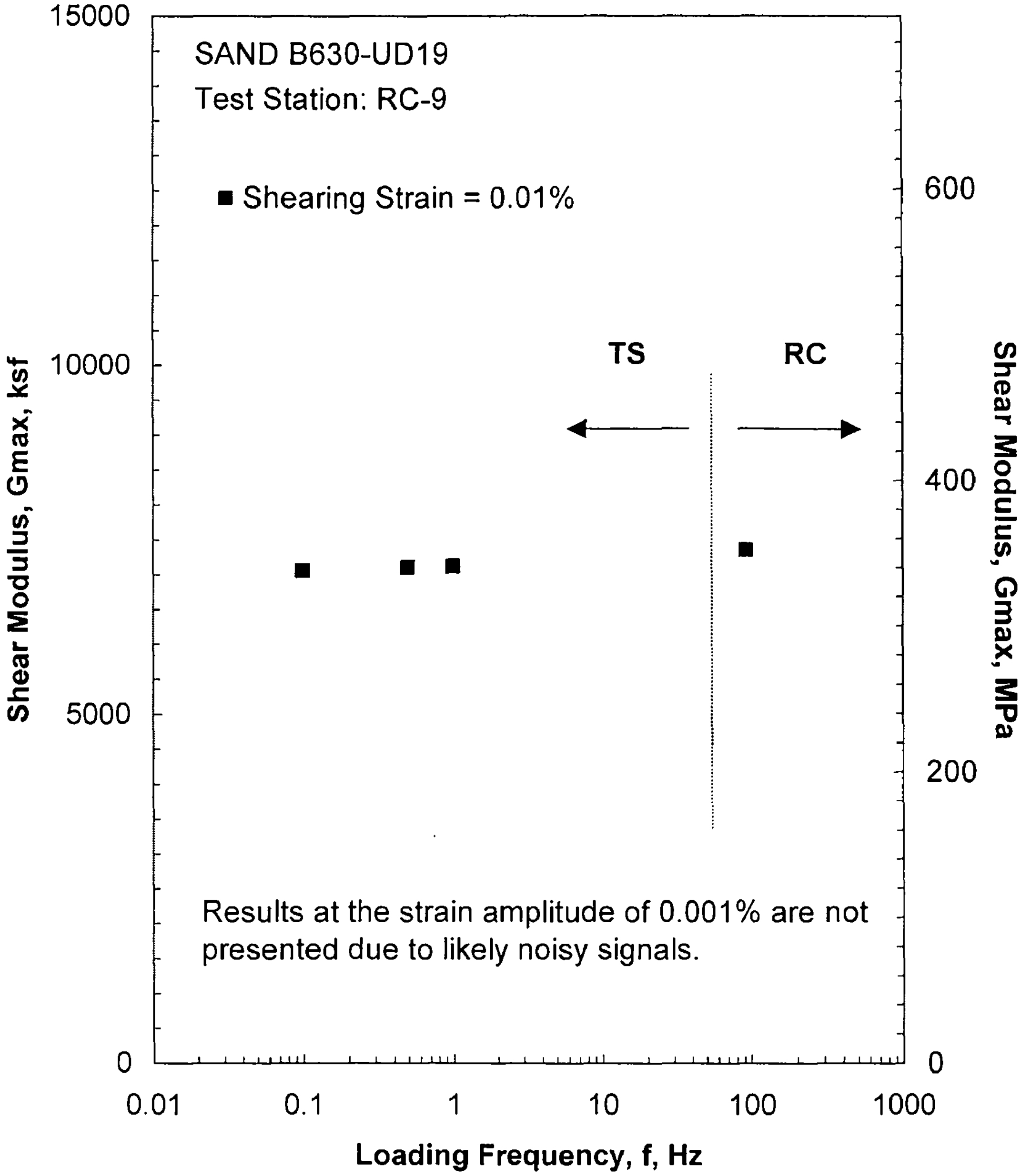

Figure E.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 242 psi from the Combined RCTS Tests

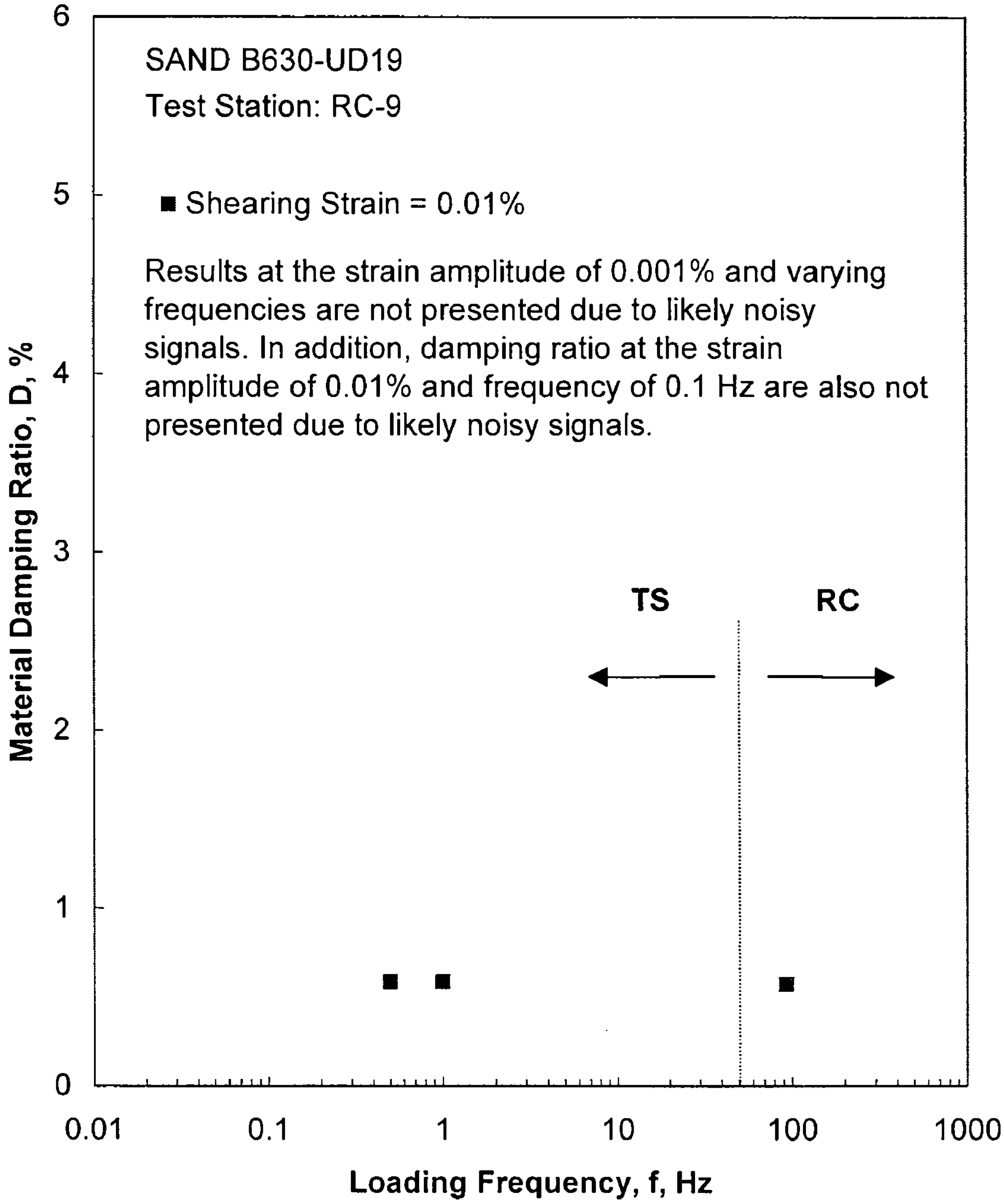

Figure E.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 242 psi from the Combined RCTS Tests

Table E.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 B630-UD19

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)	(%)	
17	2448	117	1854	89	699	0.64	0.72
33	4752	227	2617	126	830	0.50	0.71
66	9504	455	3705	178	987	0.41	0.71
132	19008	909	5579	268	1209	0.36	0.71
265	38160	1826	7729	371	1420	0.34	0.70

Table E.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD19; Isoptropic Confining Pressure, σ_o= 66 psi (9.5ksf = 455 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average$^+$ Shearing Strain, %	Material Damping Ratio^x, D, %
3.29E-04	3762	1.00	3.29E-04	0.41
7.01E-04	3762	1.00	7.01E-04	0.41
1.33E-03	3728	0.99	1.27E-03	0.46
2.47E-03	3705	0.98	2.32E-03	0.49
4.45E-03	3637	0.97	4.18E-03	0.55
7.81E-03	3570	0.95	7.27E-03	0.65
1.33E-02	3452	0.92	1.22E-02	0.85
2.18E-02	3312	0.88	1.96E-02	1.29
3.54E-02	3107	0.83	3.04E-02	1.99
5.82E-02	2831	0.75	4.71E-02	2.94
9.82E-02	2473	0.66	7.46E-02	4.24
1.66E-01	2172	0.58	1.16E-01	5.77

$^+$ 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 E.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD19; Isotropic Confining Pressure, σ_o= 66 psi (9.5 ksf = 455 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, %
1.05E-03	3628	1.00	0.24	1.04E-03	3679	1.00	0.47
2.12E-03	3615	1.00	0.52	2.13E-03	3597	0.98	0.42
4.31E-03	3554	0.98	0.84	4.31E-03	3555	0.97	0.74
8.93E-03	3431	0.95	1.09	8.96E-03	3420	0.93	1.08

Table E.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD19; Isoptropic Confining Pressure, σ_o= 265 psi (38.2 ksf = 1826 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
2.99E-04	7729	1.00	2.99E-04	0.34
6.09E-04	7729	1.00	6.09E-04	0.34
1.16E-03	7729	1.00	1.12E-03	0.36
2.20E-03	7652	0.99	2.11E-03	0.37
4.02E-03	7614	0.99	3.86E-03	0.39
7.23E-03	7500	0.97	6.87E-03	0.44
1.22E-02	7354	0.95	1.16E-02	0.57
1.99E-02	7163	0.93	1.88E-02	0.74
3.26E-02	6834	0.88	2.96E-02	1.06
5.19E-02	6412	0.83	4.67E-02	1.78
8.07E-02	5896	0.76	6.70E-02	2.88
1.28E-01	5301	0.69	9.85E-02	4.19
1.57E-01	5057	0.65	1.14E-01	5.05

+ 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 E.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD19; Isotropic Confining Pressure, σ_o= 265 psi (38.2 ksf = 1826 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, %
2.00E-03	7251	1.00	0.12	1.99E-03	7279	1.00	0.32
4.03E-03	7186	0.99	0.35	4.03E-03	7192	0.99	0.40
8.17E-03	7091	0.98	0.60	8.16E-03	7103	0.98	0.58

APPENDIX F

Specimen B630-UD23

Borehole 630
Sample UD23
Depth = 260.5 ft (79.4 m)
Total Unit Weight = 121.3 lb/ft^3
Water Content = 27.1 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective Stress = 75 psi

FUGRO JOB #: 0411-08-1701
Testing Station: RC8

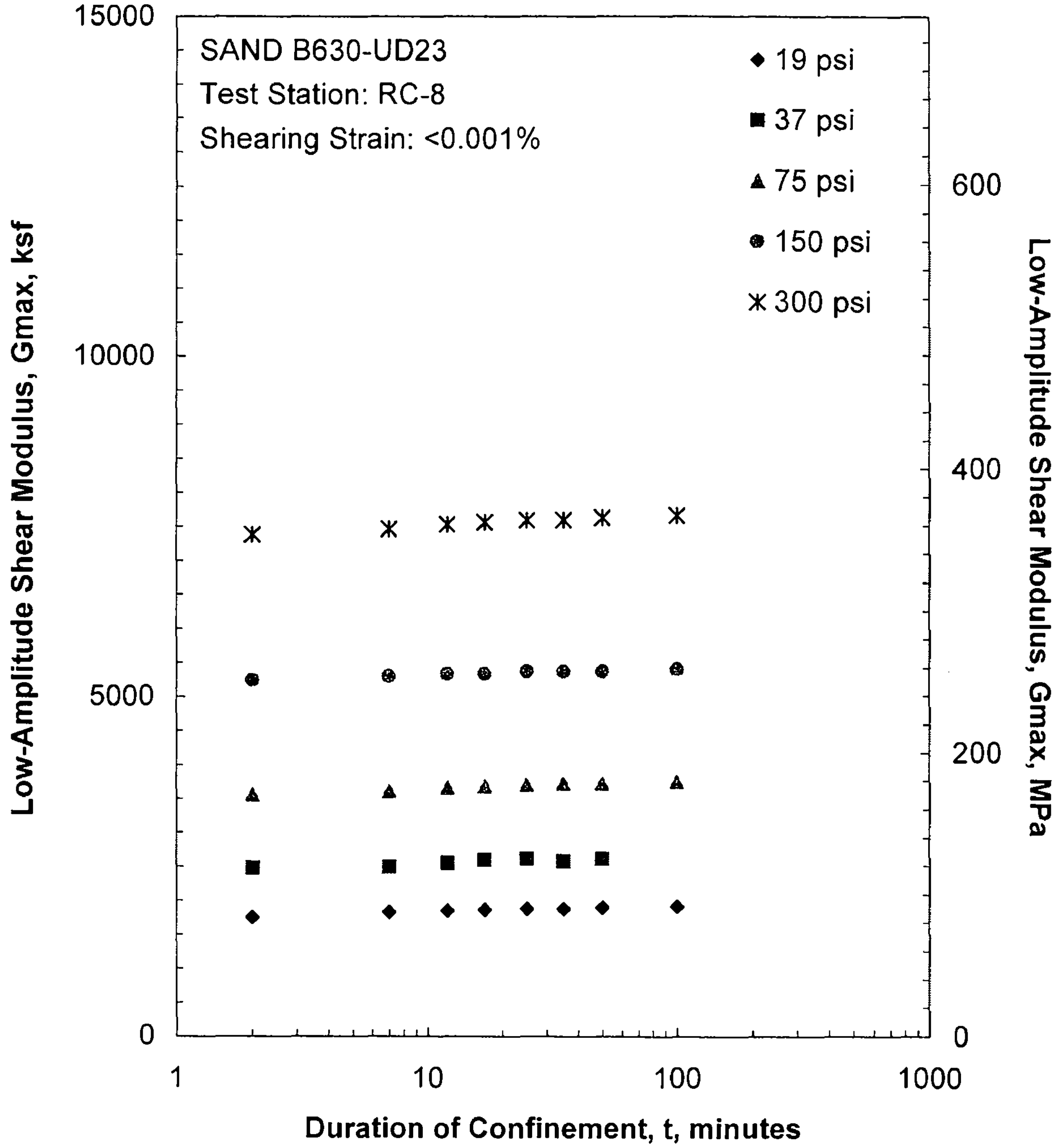

Figure F.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

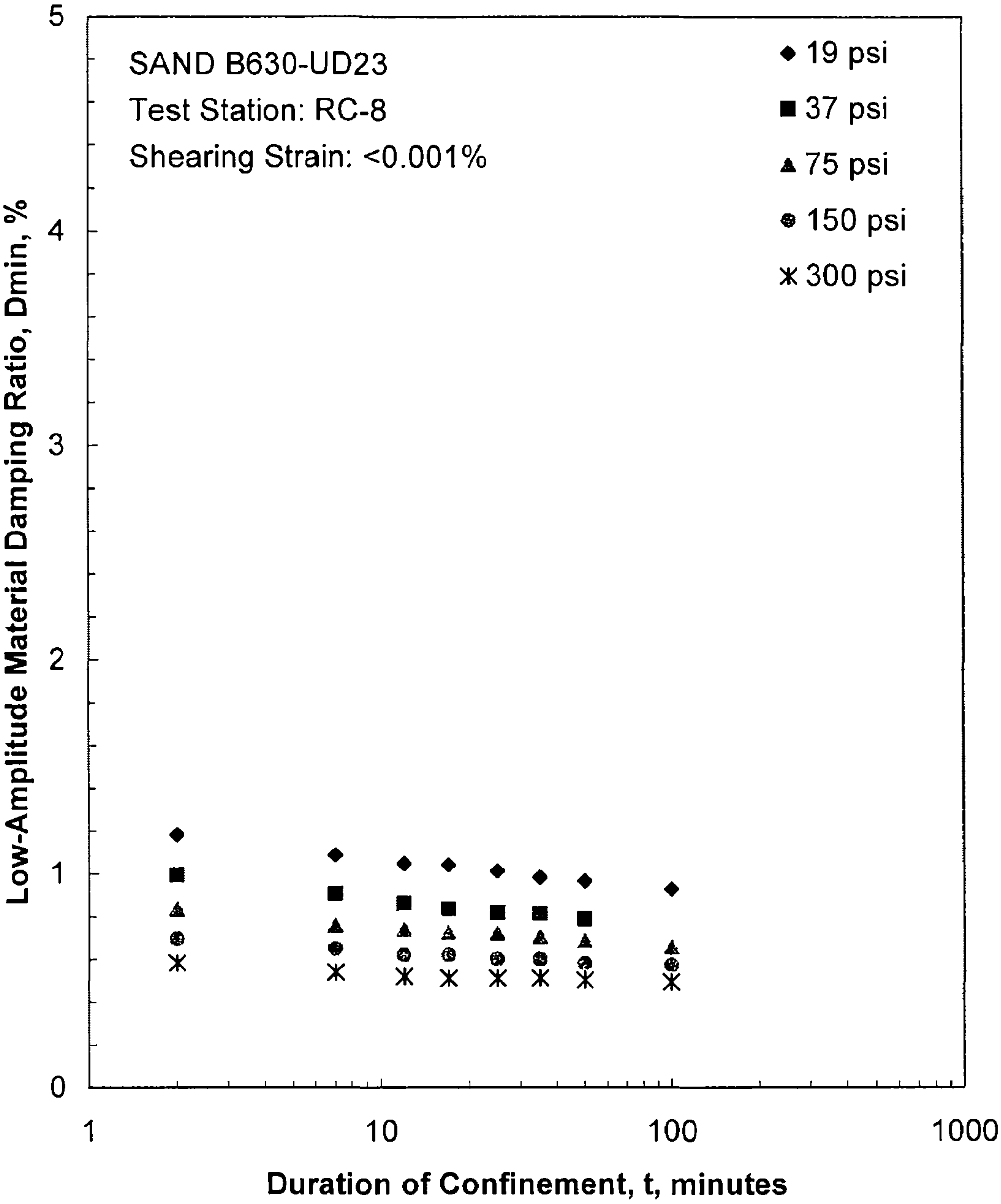

Figure F.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

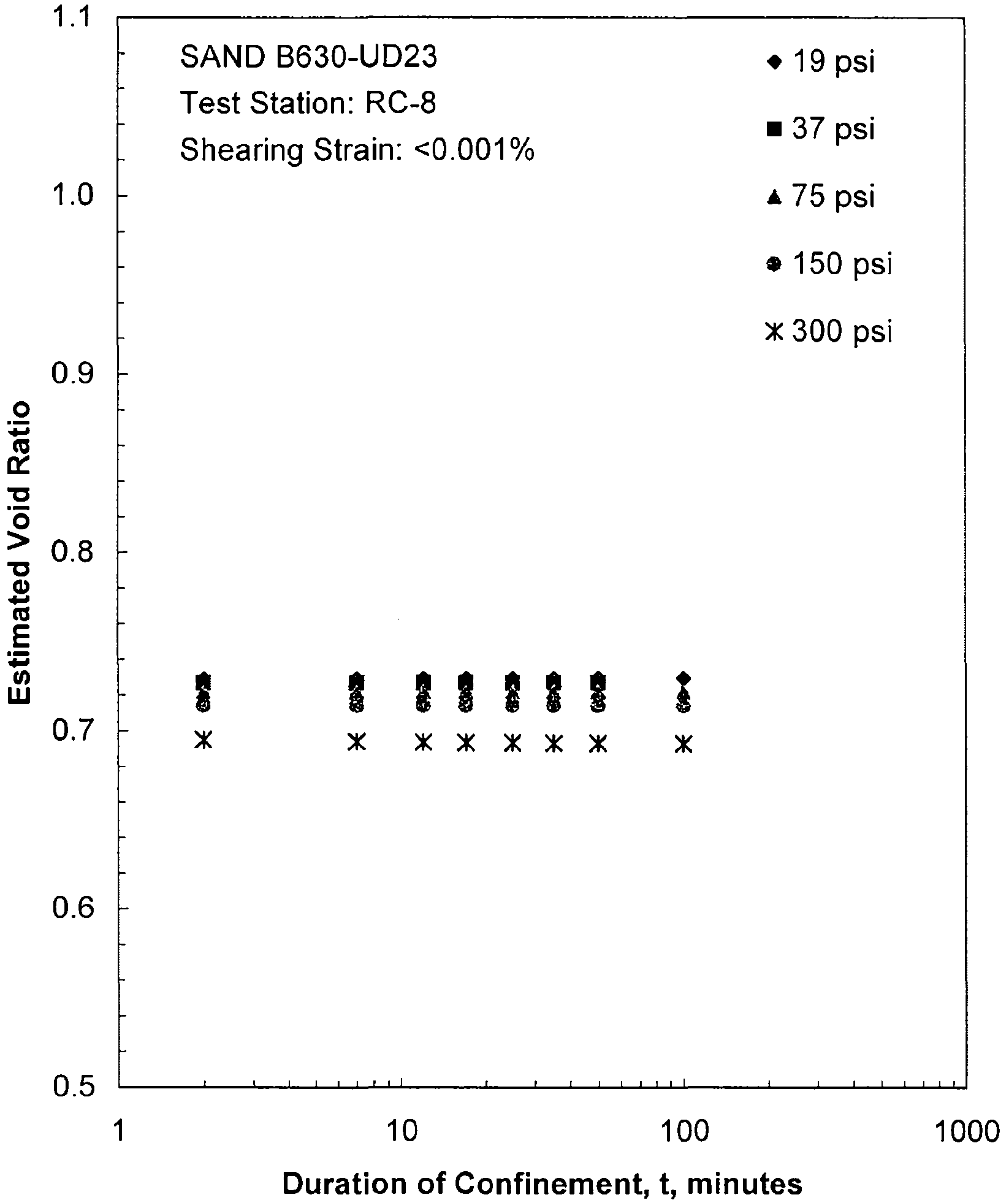

Figure F.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

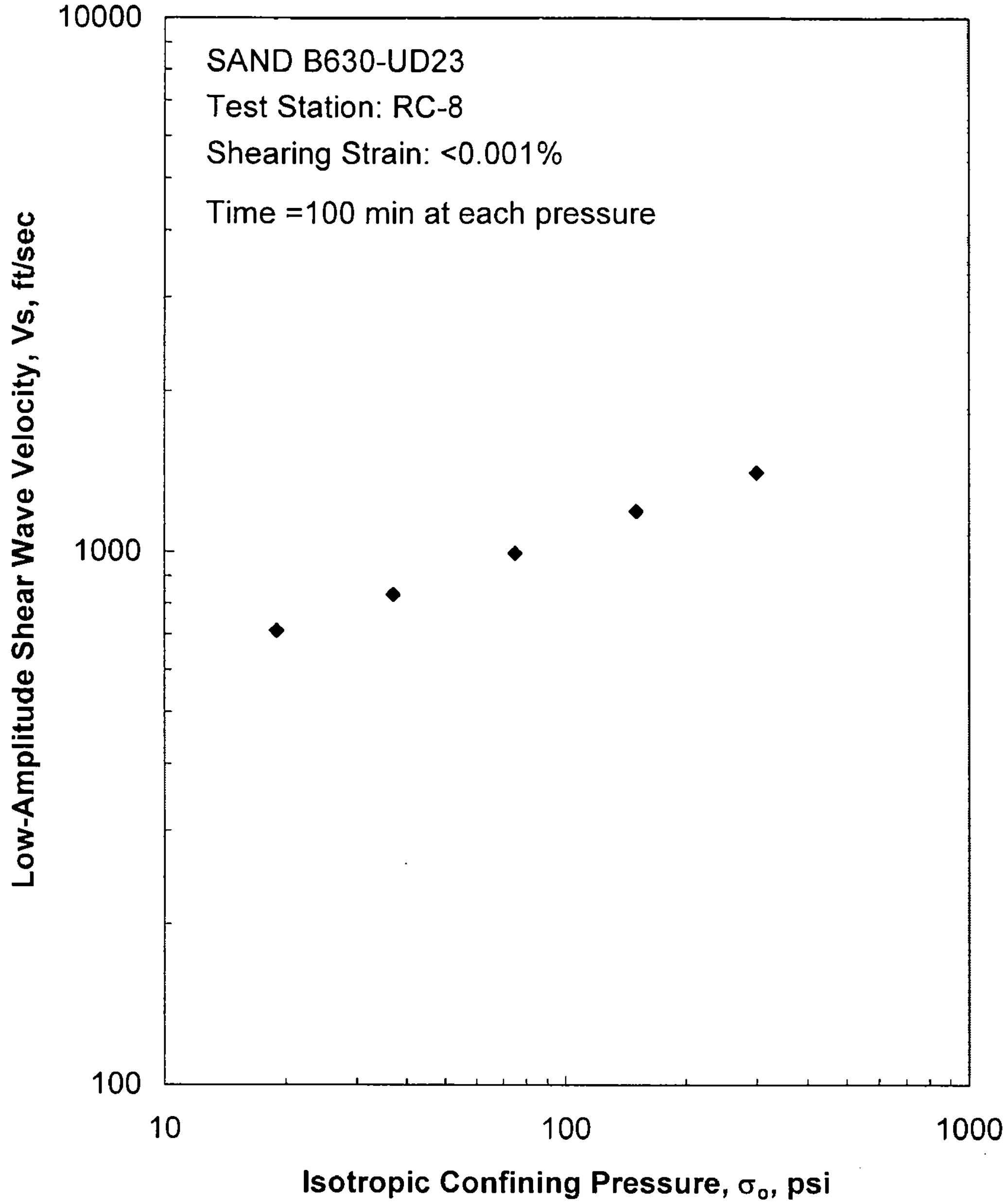

Figure F.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

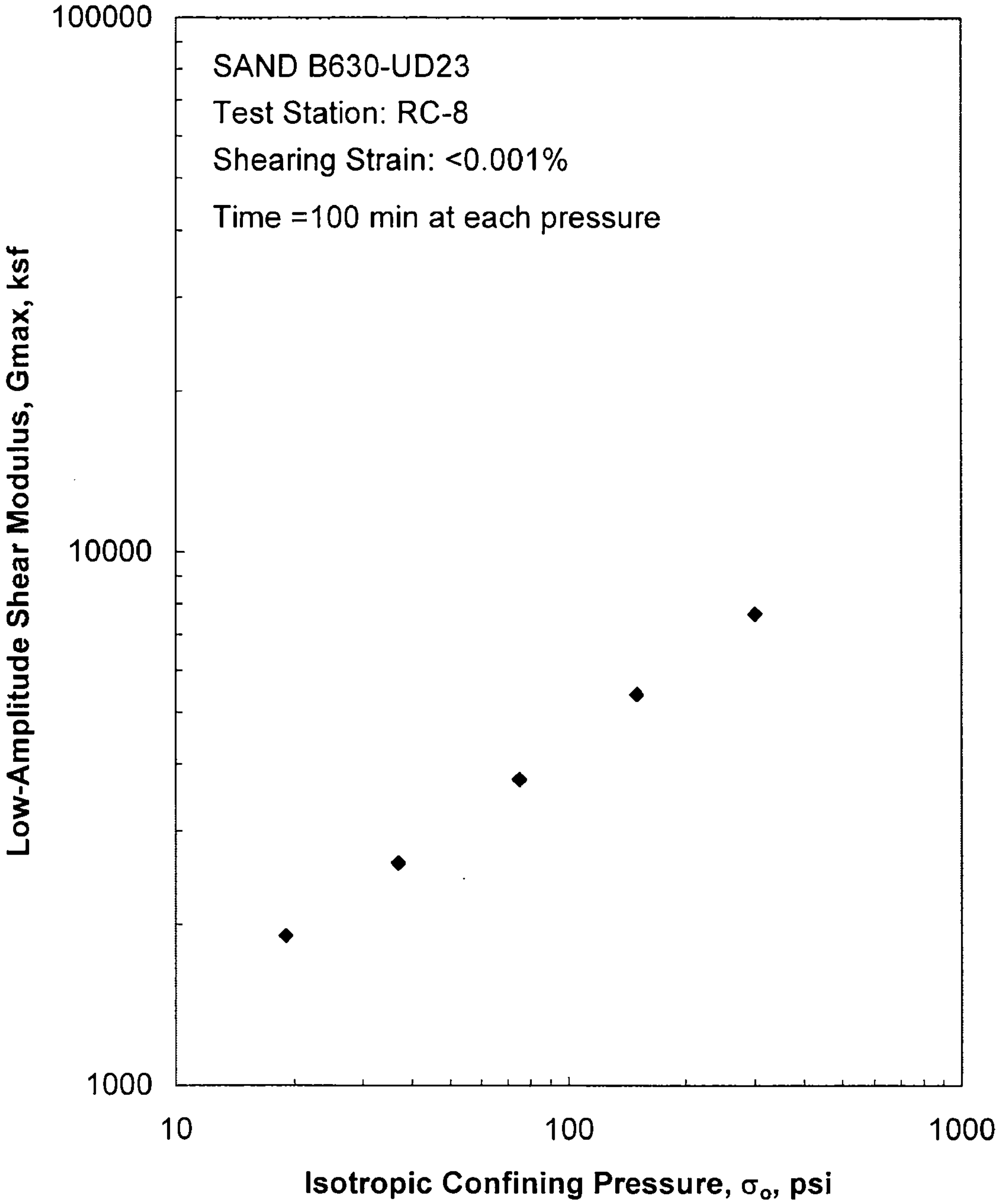

Figure F.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

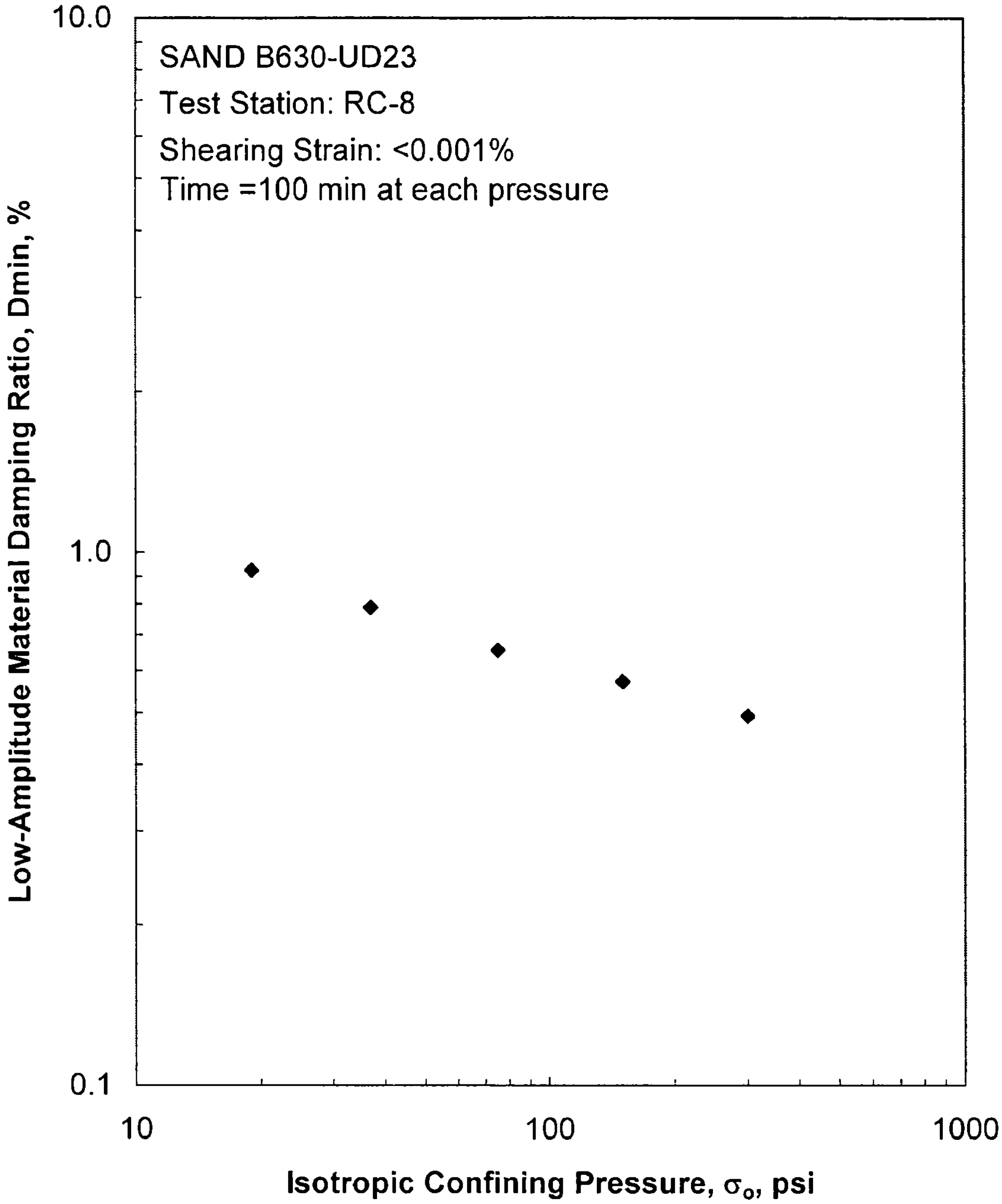

Figure F.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

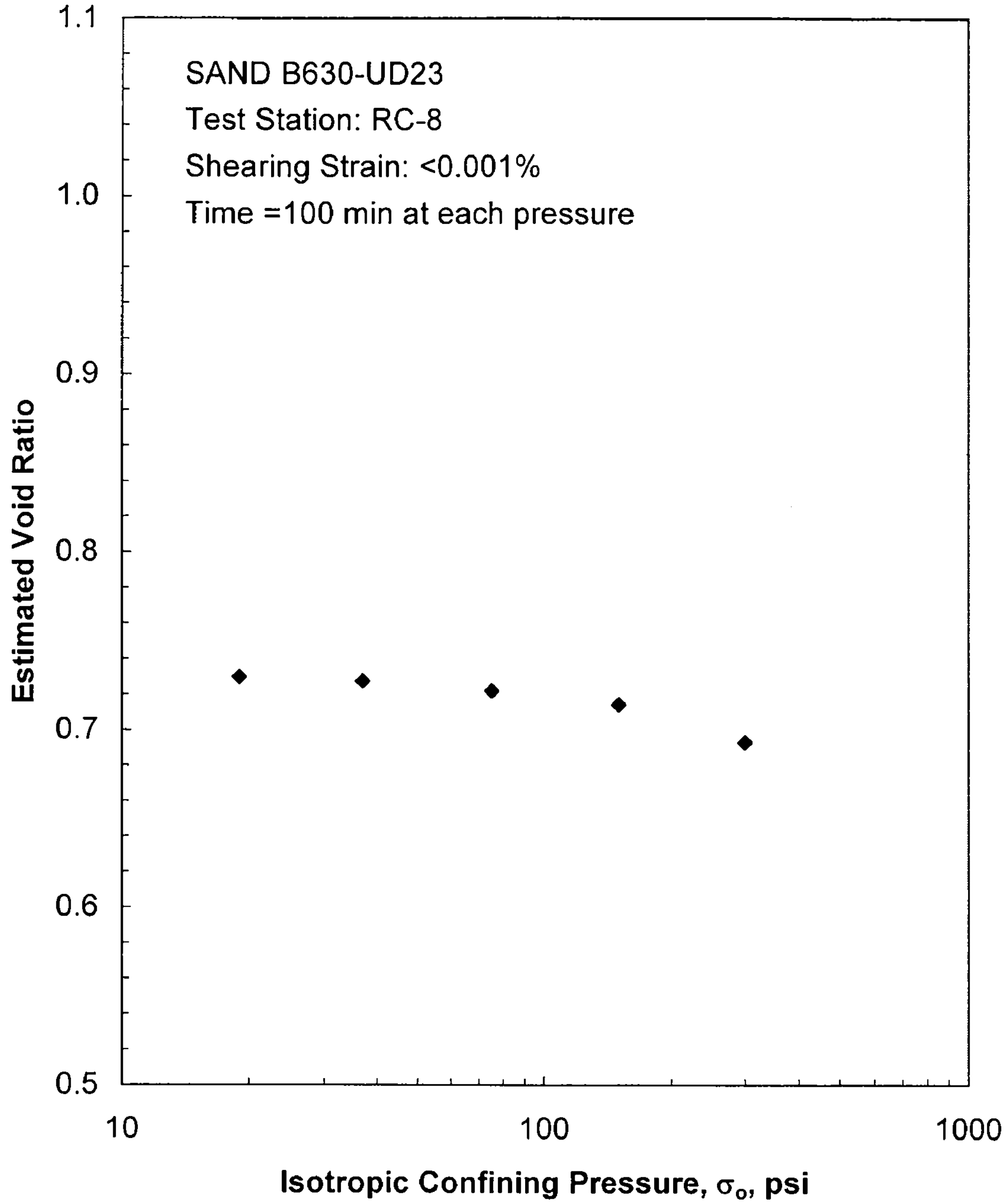

Figure F.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

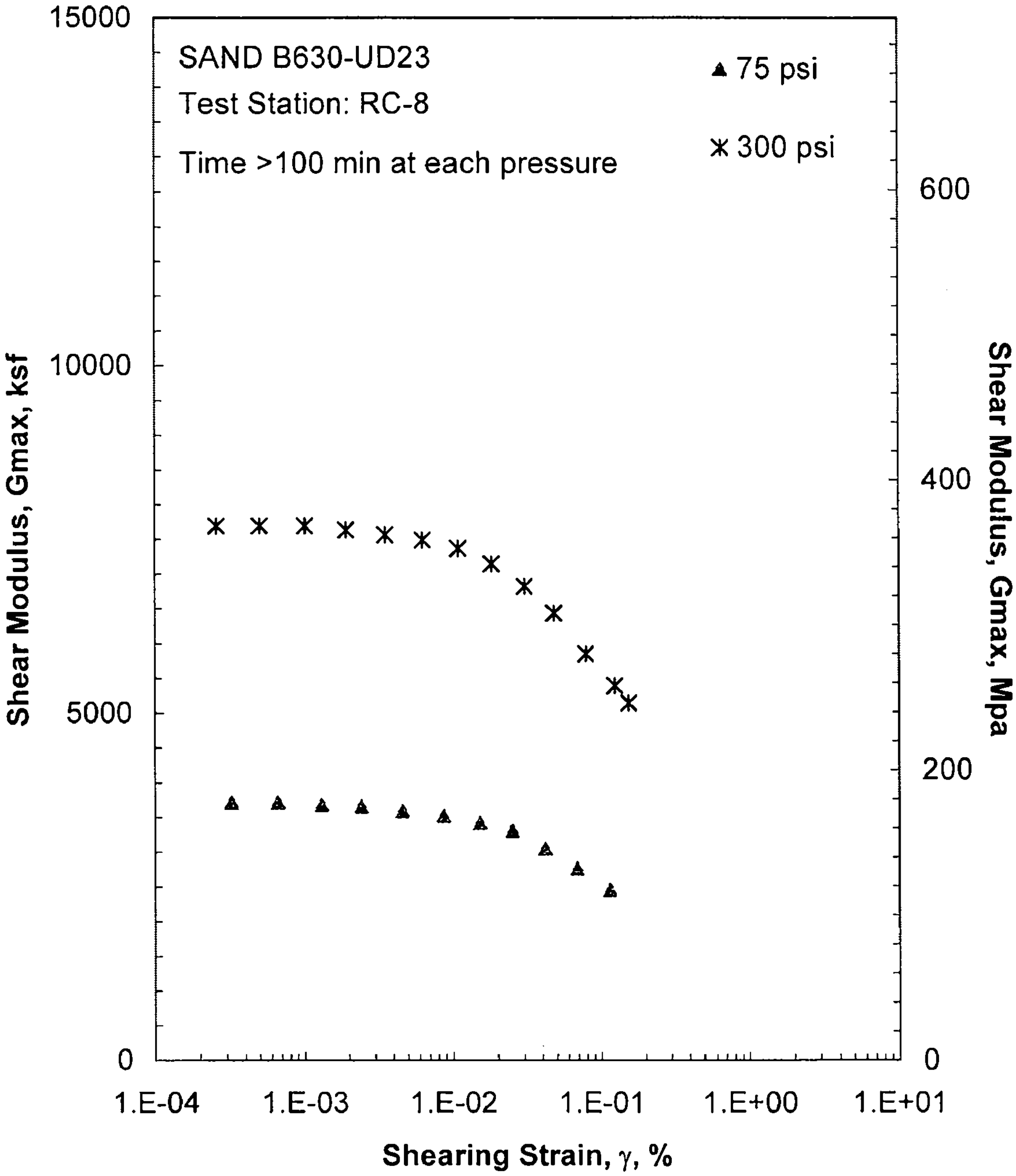

Figure F.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

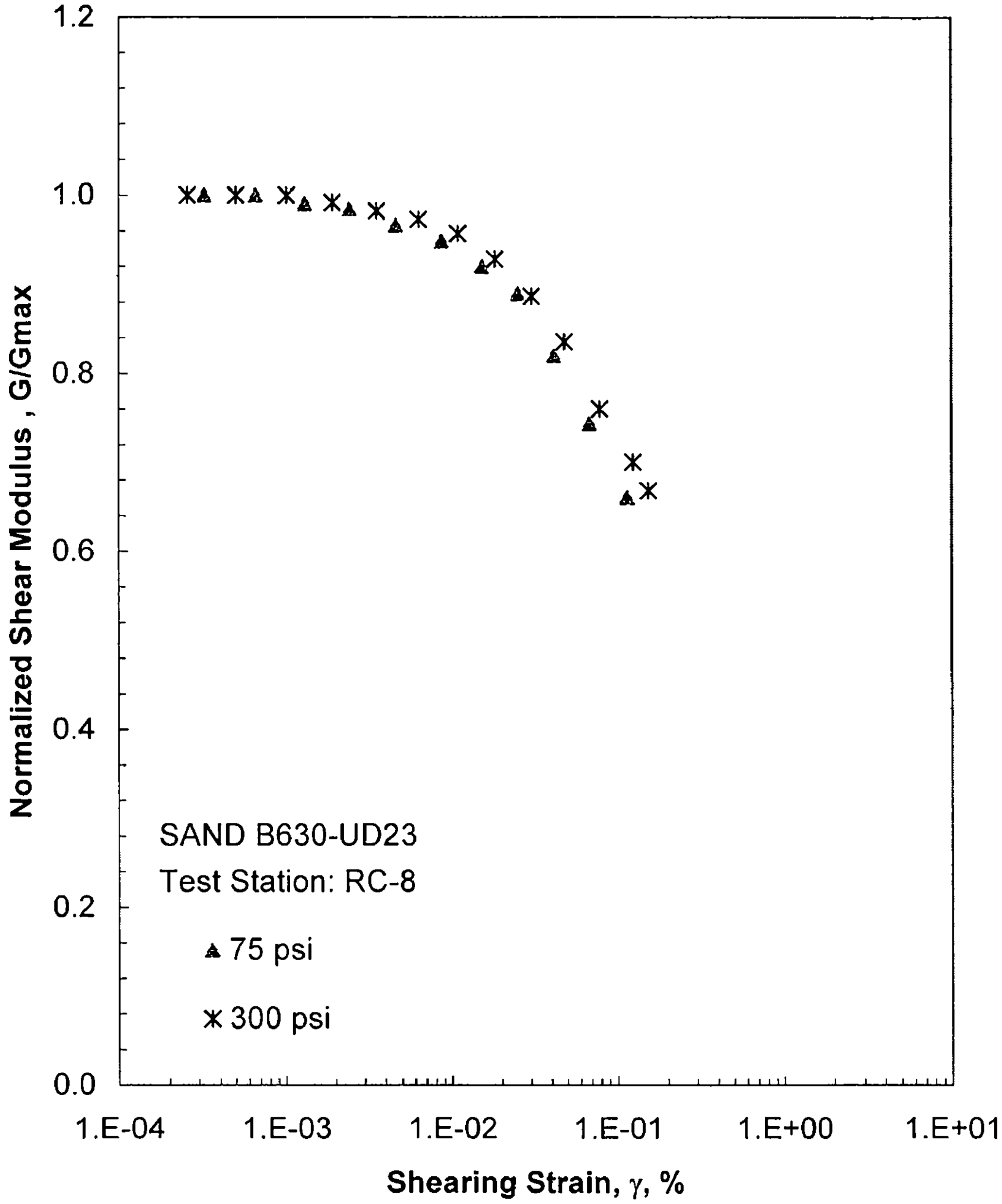

Figure F.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

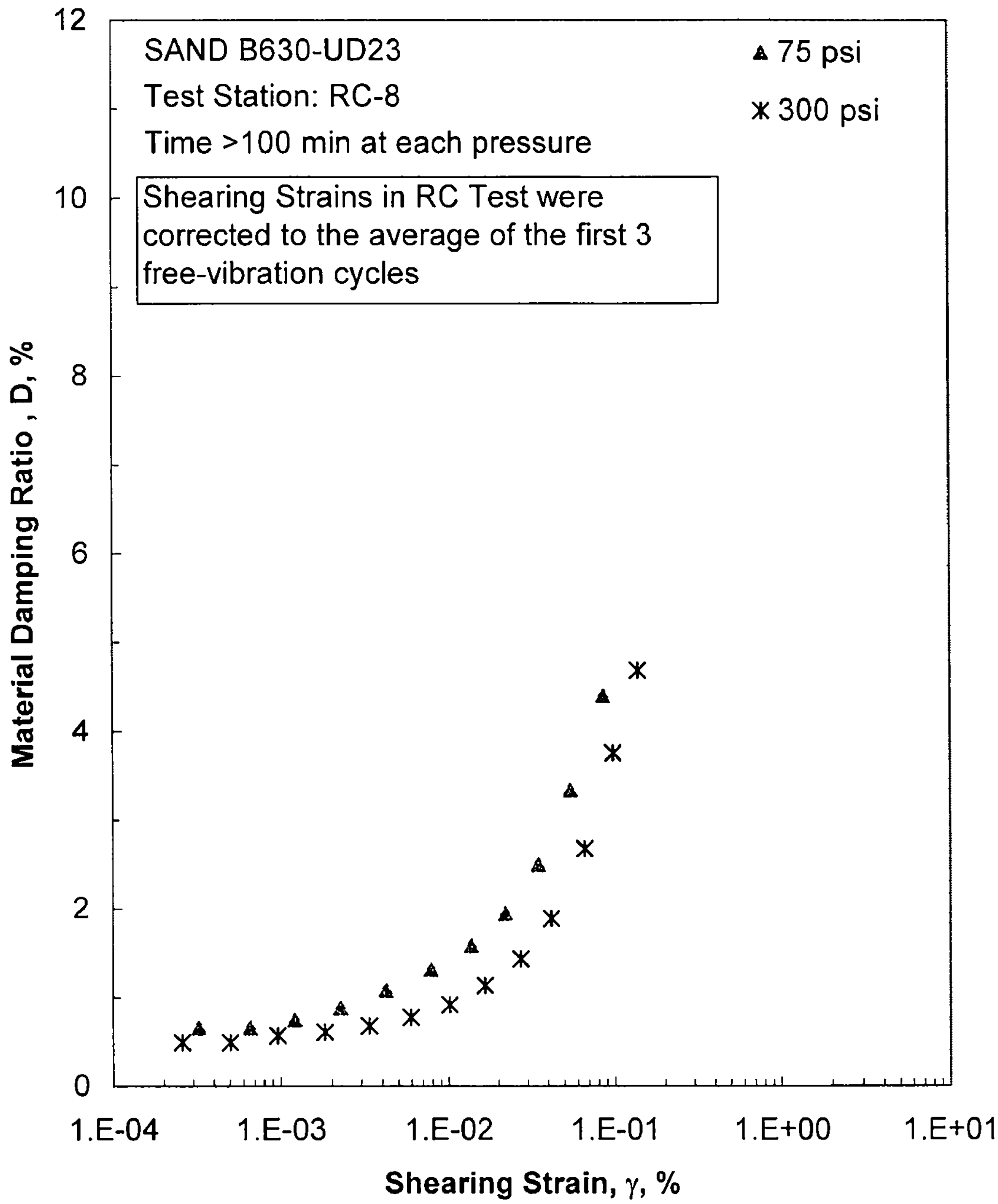

Figure F.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

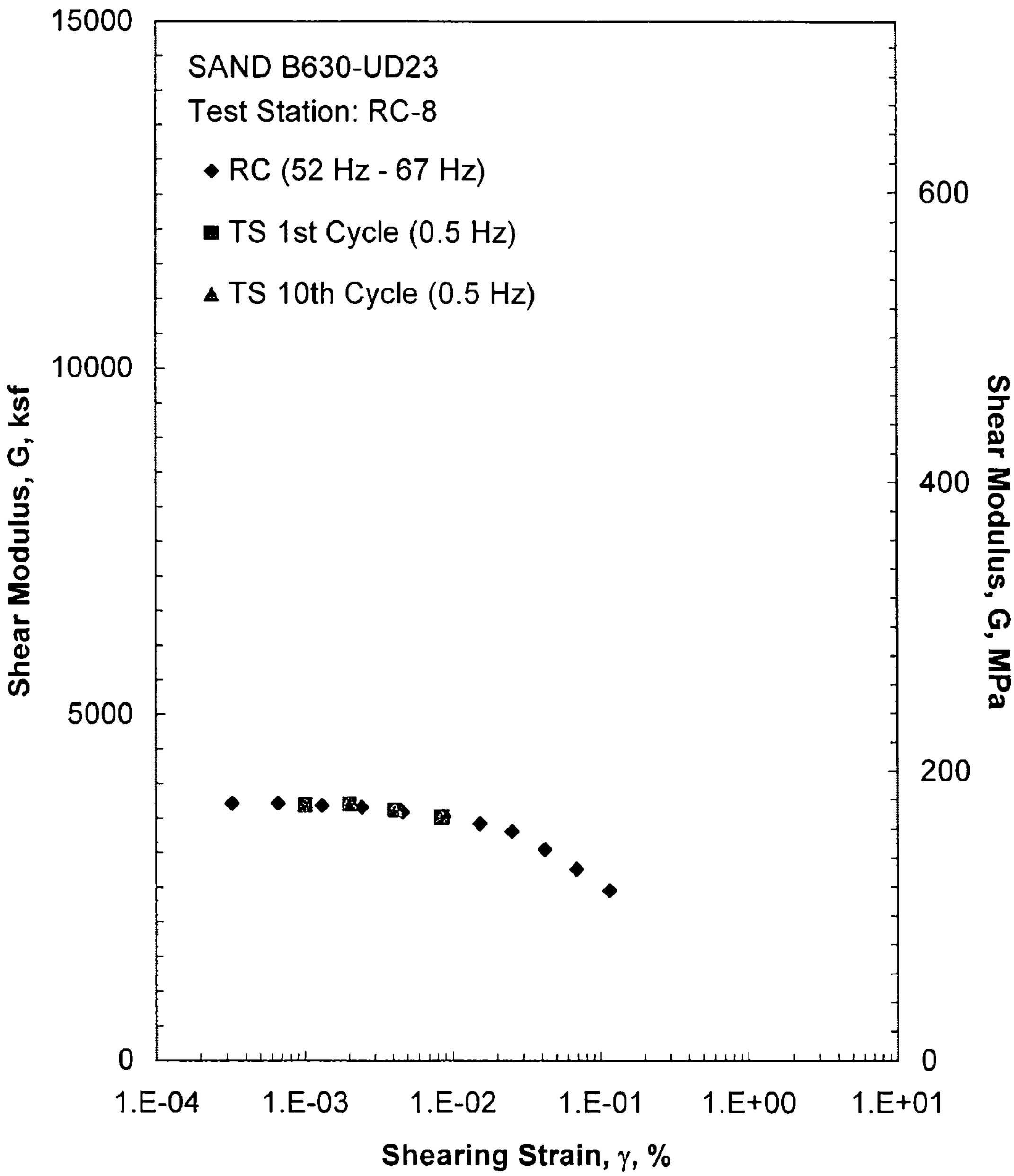

Figure F.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 75 psi from the Combined RCTS Tests

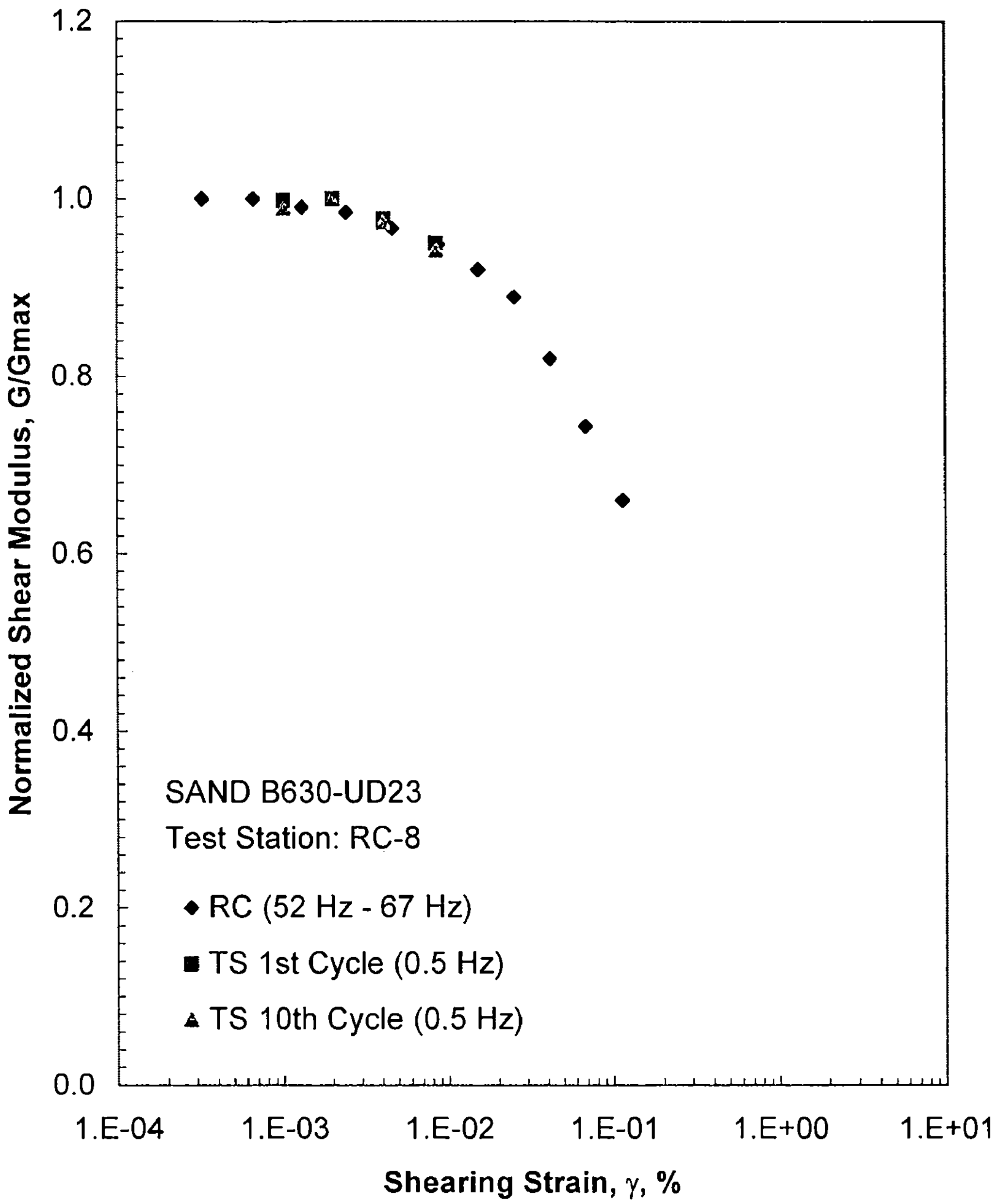

Figure F.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 75 psi from the Combined RCTS Tests

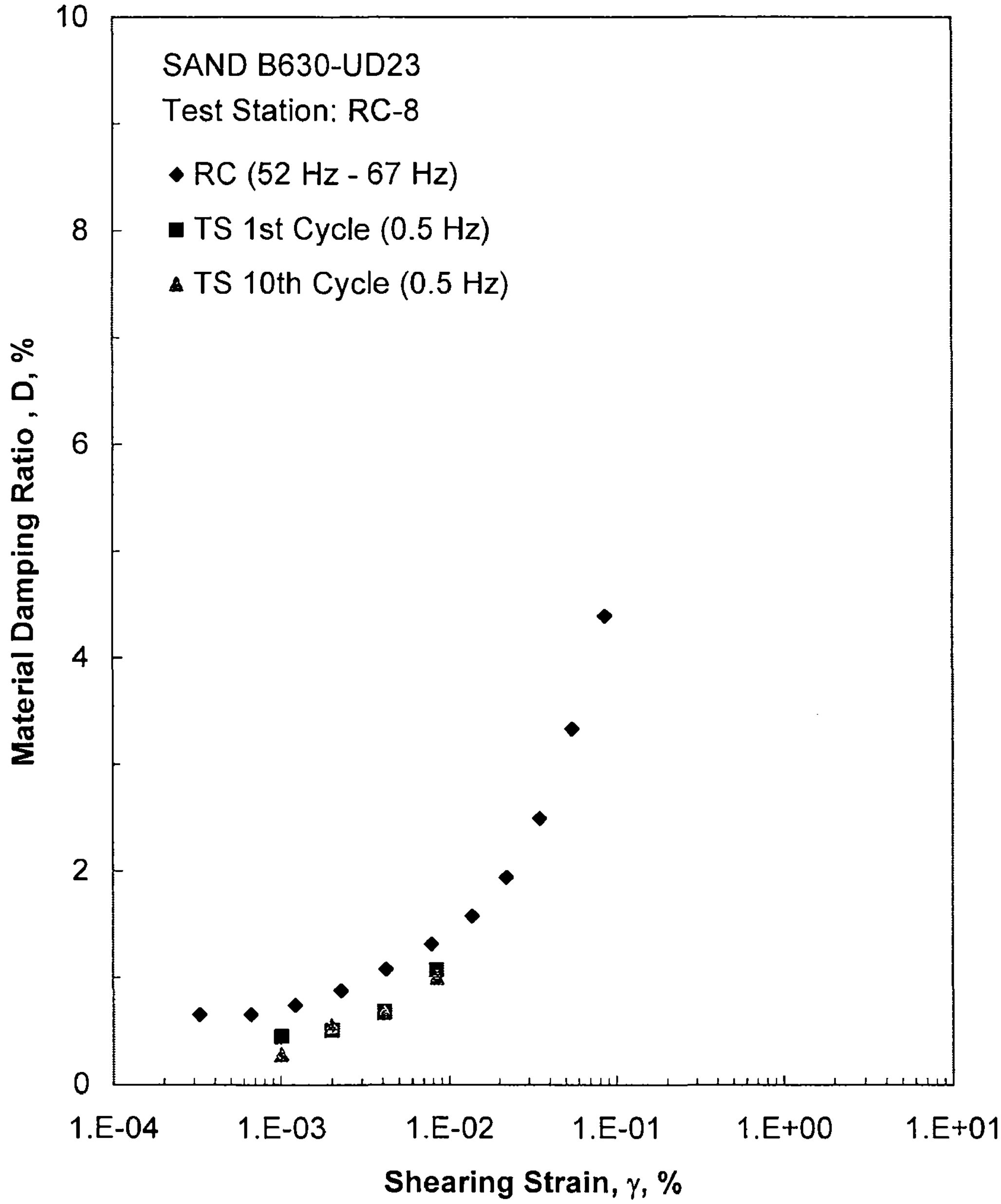

Figure F.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 75 psi from the Combined RCTS Tests

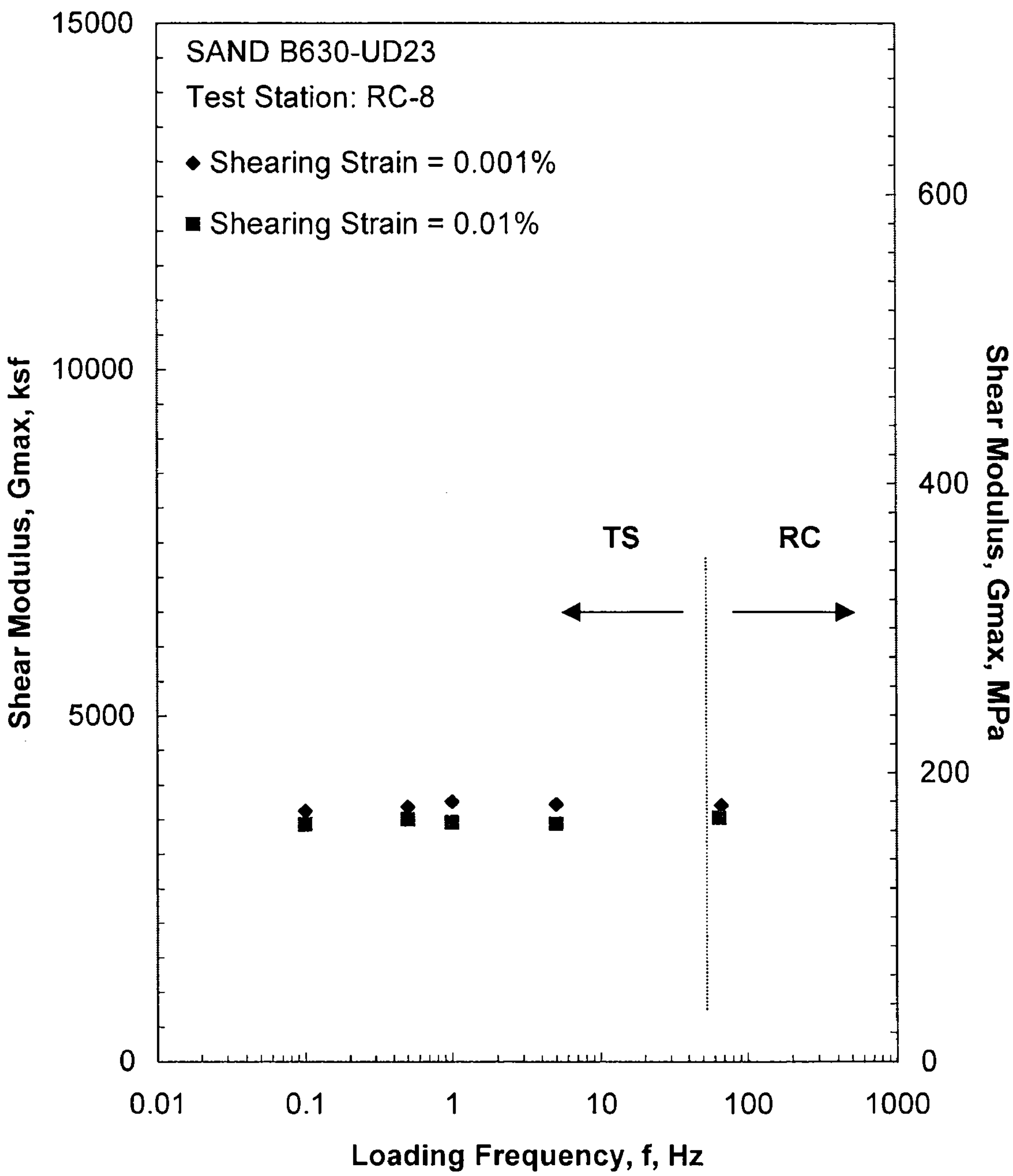

Figure F.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 75 psi from the Combined RCTS Tests

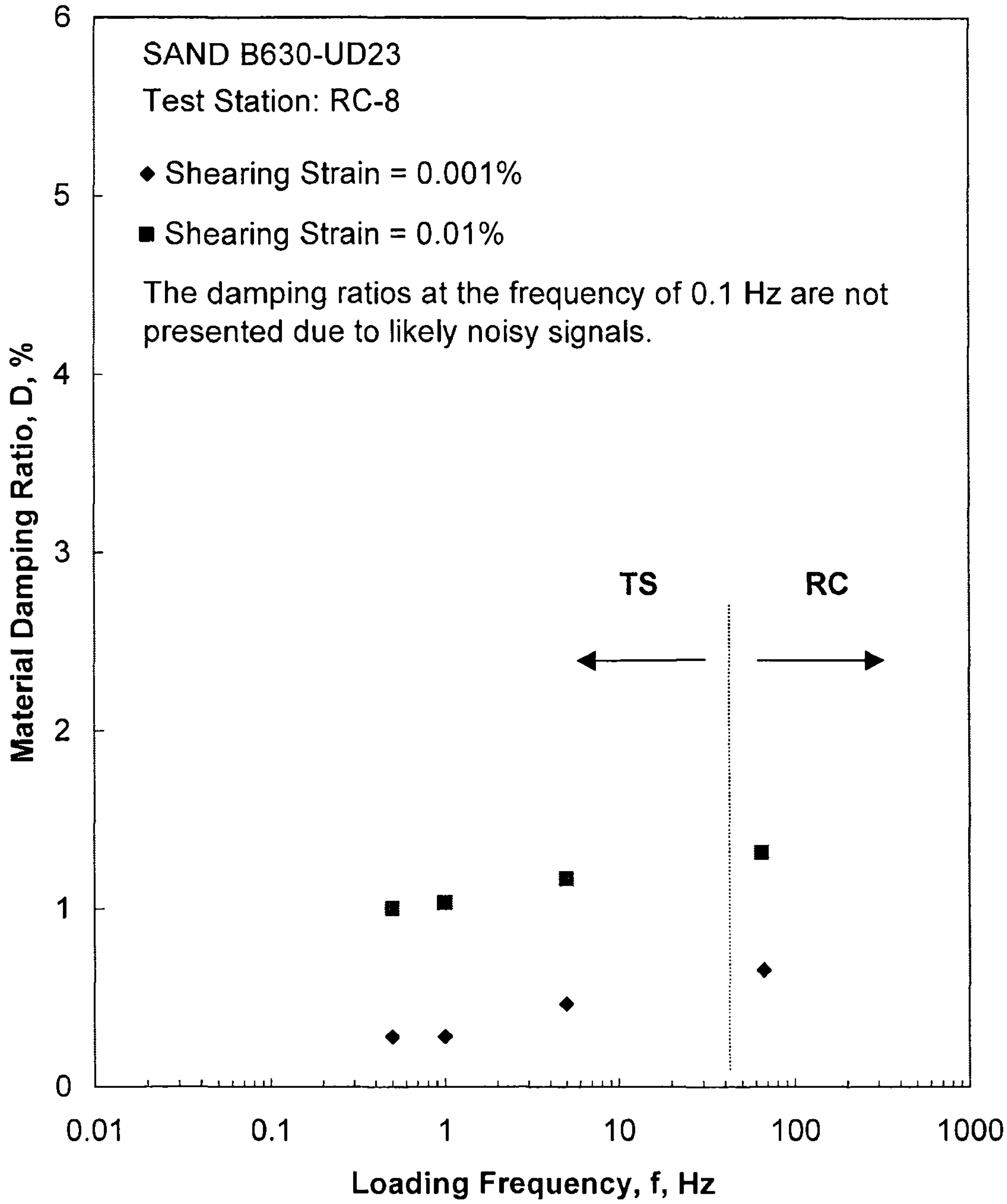

Figure F.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 75 psi from the Combined RCTS Tests

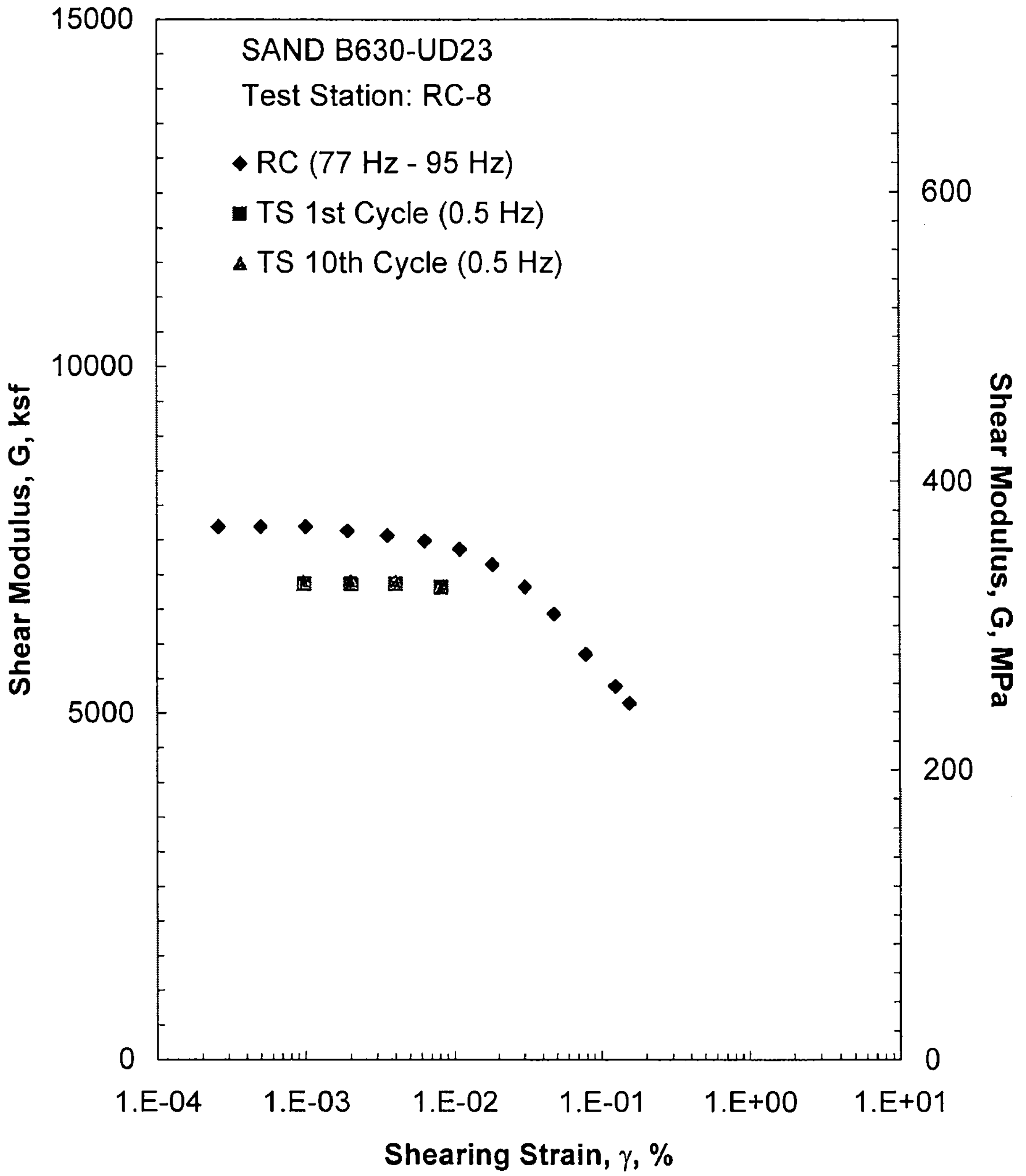

Figure F.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 300 psi from the Combined RCTS Tests

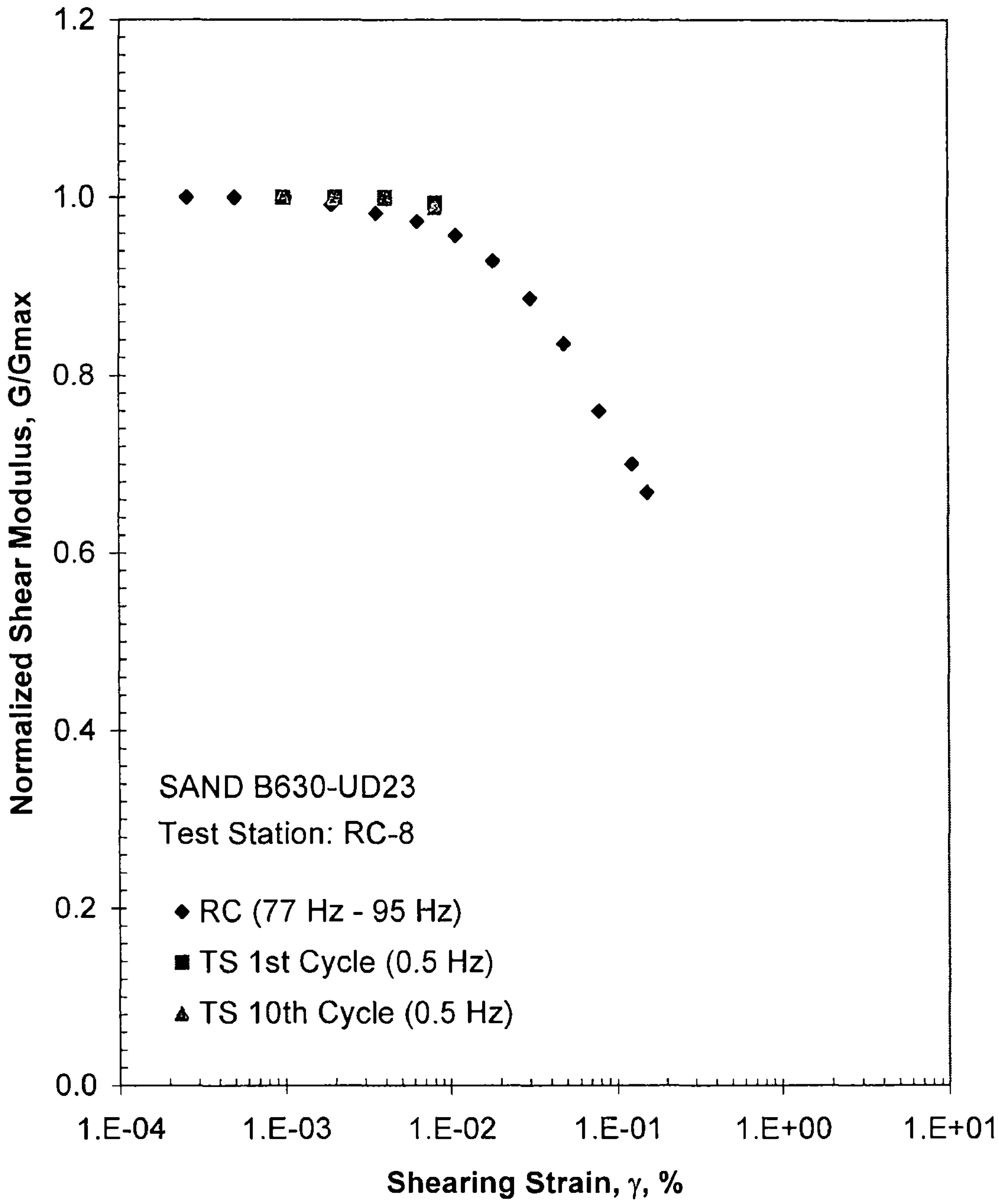

Figure F.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 300 psi from the Combined RCTS Tests

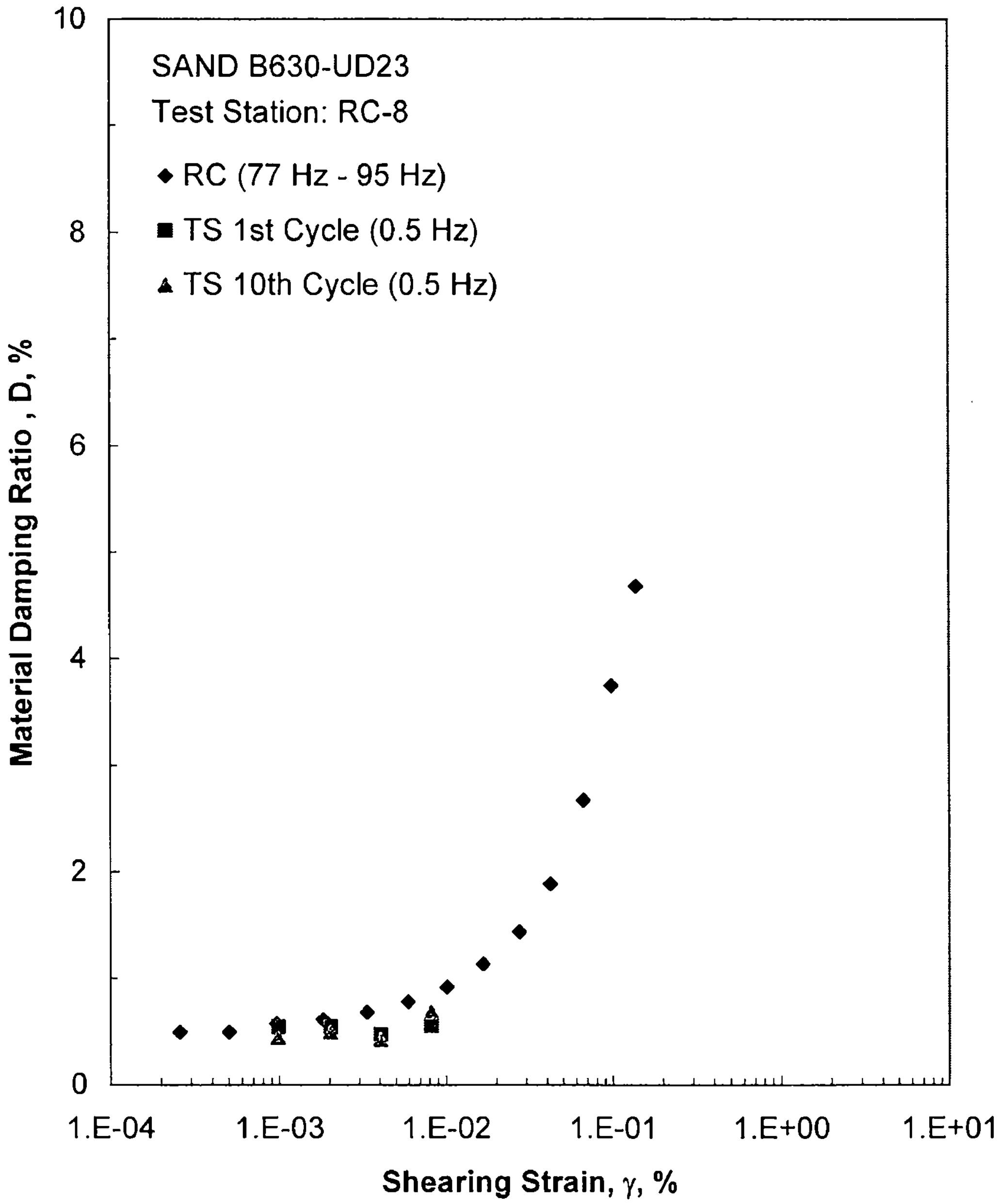

Figure F.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 300 psi from the Combined RCTS Tests

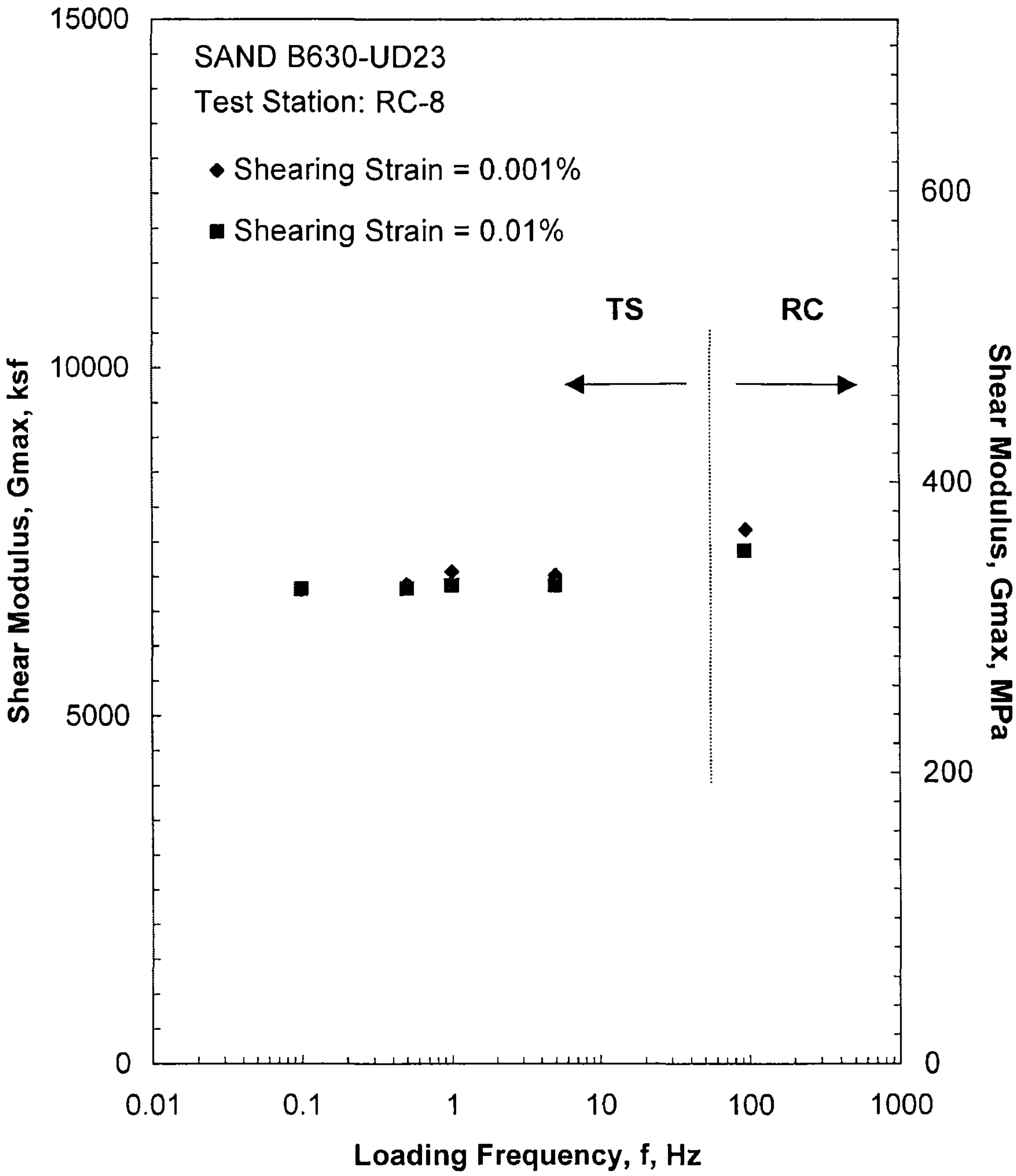

Figure F.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 300 psi from the Combined RCTS Tests

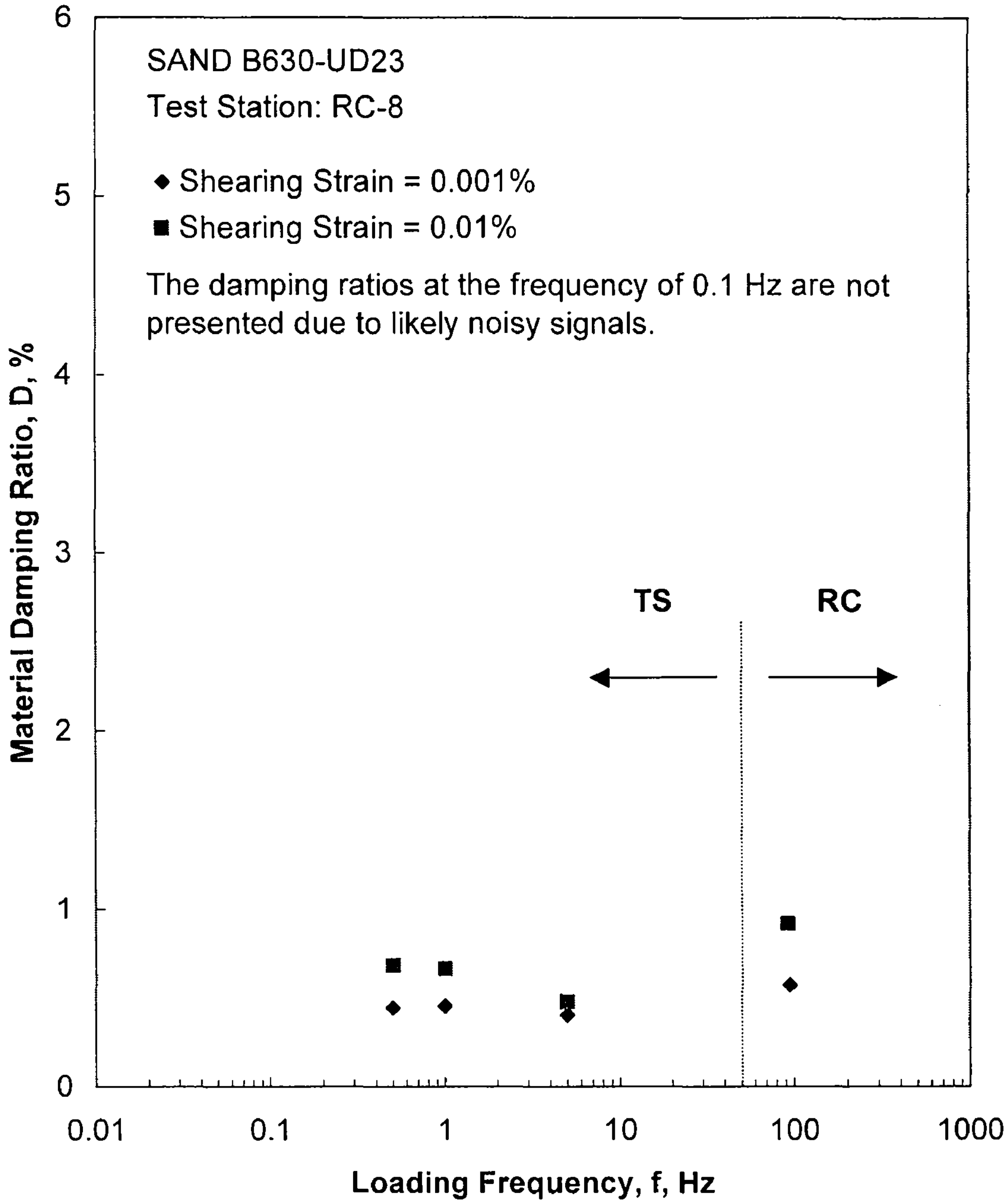

Figure F.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 300 psi from the Combined RCTS Tests

Table F.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 B630-UD23

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)	(%)	
19	2736	131	1908	92	711	0.92	0.73
37	5328	255	2612	125	831	0.79	0.73
75	10800	517	3742	180	993	0.66	0.72
150	21600	1034	5405	259	1191	0.57	0.71
300	43200	2067	7663	368	1409	0.49	0.69

Table F.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD23; Isoptropic Confining Pressure, σ_o= 75 psi (10.8 ksf = 517 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
3.24E-04	3713	1.00	3.24E-04	0.66
6.60E-04	3713	1.00	6.60E-04	0.66
1.30E-03	3679	0.99	1.21E-03	0.74
2.43E-03	3656	0.98	2.26E-03	0.88
4.62E-03	3589	0.97	4.21E-03	1.08
8.71E-03	3523	0.95	7.83E-03	1.31
1.52E-02	3417	0.92	1.37E-02	1.58
2.50E-02	3302	0.89	2.20E-02	1.94
4.17E-02	3043	0.82	3.50E-02	2.49
6.85E-02	2760	0.74	5.48E-02	3.33
1.14E-01	2451	0.66	8.59E-02	4.39

+ 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 F.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD23; Isotropic Confining Pressure, σ_o= 75 psi (10.8 ksf = 517 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, %
1.00E-03	3694	1.00	0.45	1.01E-03	3677	0.99	0.28
2.00E-03	3700	1.00	0.51	2.00E-03	3715	1.00	0.55
4.09E-03	3616	0.98	0.68	4.10E-03	3617	0.97	0.67
8.43E-03	3515	0.95	1.07	8.47E-03	3500	0.94	1.00

Table F.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD23; Isoptropic Confining Pressure, σ_o= 300 psi (43.2 ksf = 2067 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average+ Shearing Strain, %	Material Damping Ratio^x, D, %
2.58E-04	7696	1.00	2.58E-04	0.49
5.02E-04	7696	1.00	5.02E-04	0.49
1.01E-03	7696	1.00	9.61E-04	0.57
1.92E-03	7635	0.99	1.82E-03	0.61
3.55E-03	7562	0.98	3.34E-03	0.68
6.32E-03	7489	0.97	5.94E-03	0.78
1.09E-02	7365	0.96	1.01E-02	0.91
1.82E-02	7146	0.93	1.66E-02	1.13
3.04E-02	6822	0.89	2.73E-02	1.43
4.81E-02	6430	0.84	4.19E-02	1.88
7.89E-02	5847	0.76	6.63E-02	2.67
1.24E-01	5386	0.70	9.81E-02	3.75
1.54E-01	5138	0.67	1.38E-01	4.68

+ 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 F.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD23; Isotropic Confining Pressure, σ_o= 168 psi (43.2 ksf = 2067 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, %
9.87E-04	6865	1.00	0.54	9.81E-04	6898	1.00	0.44
2.02E-03	6865	1.00	0.54	2.01E-03	6898	1.00	0.49
4.05E-03	6865	1.00	0.47	4.04E-03	6893	1.00	0.42
8.17E-03	6817	0.99	0.55	8.17E-03	6820	0.99	0.68

APPENDIX G

Specimen B630-UD27

Borehole 630
Sample UD27
Depth = 294.0 ft (89.6m)
Total Unit Weight = 121.3 lb/ft^3
Water Content = 25.5 %
Estimated In-Situ Ko = 0.5
Estimated In-Situ Mean Effective
Stress = 84 psi

FUGRO JOB #: 0411-08-1701
Testing Station: RC8

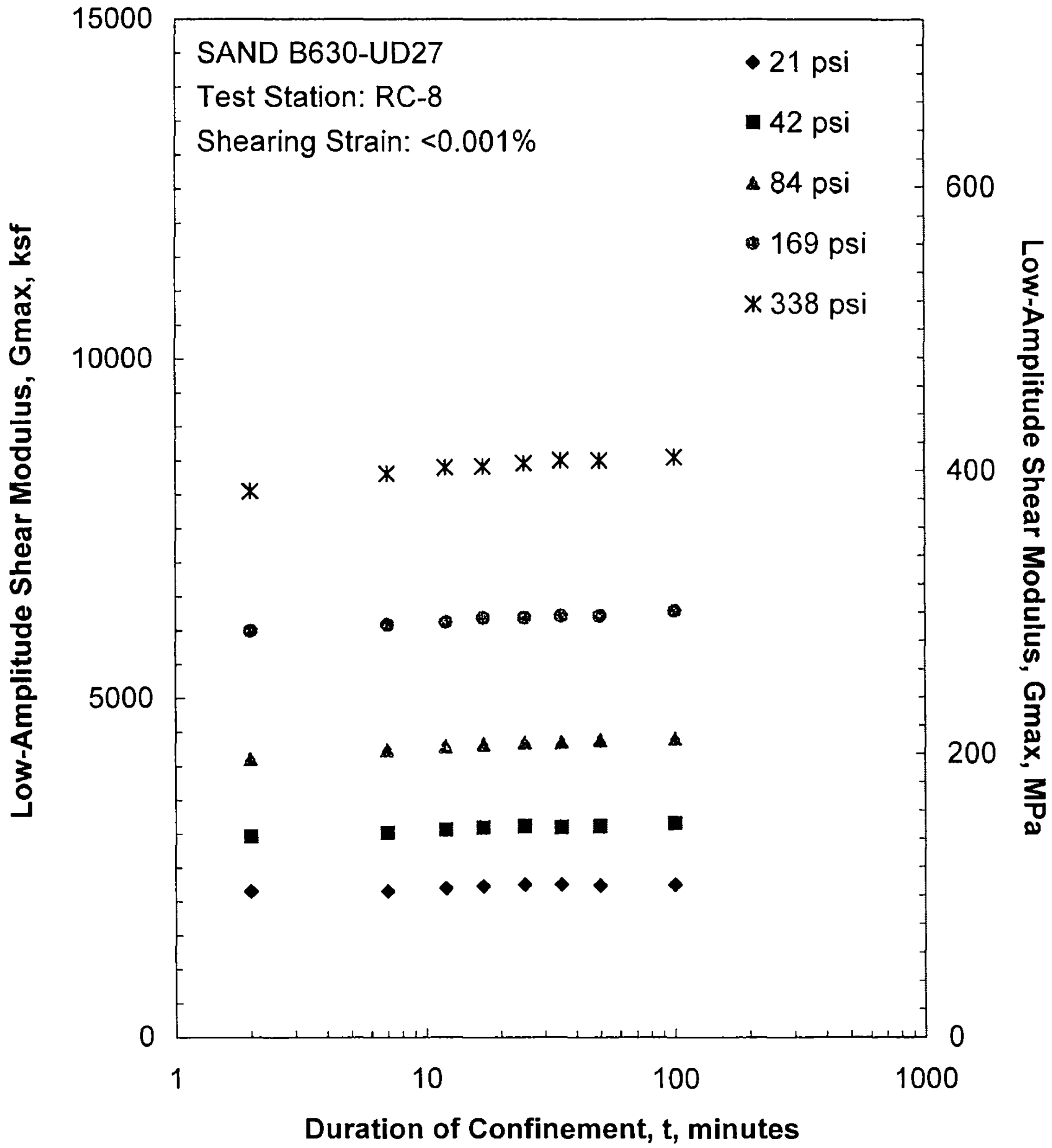

Figure G.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

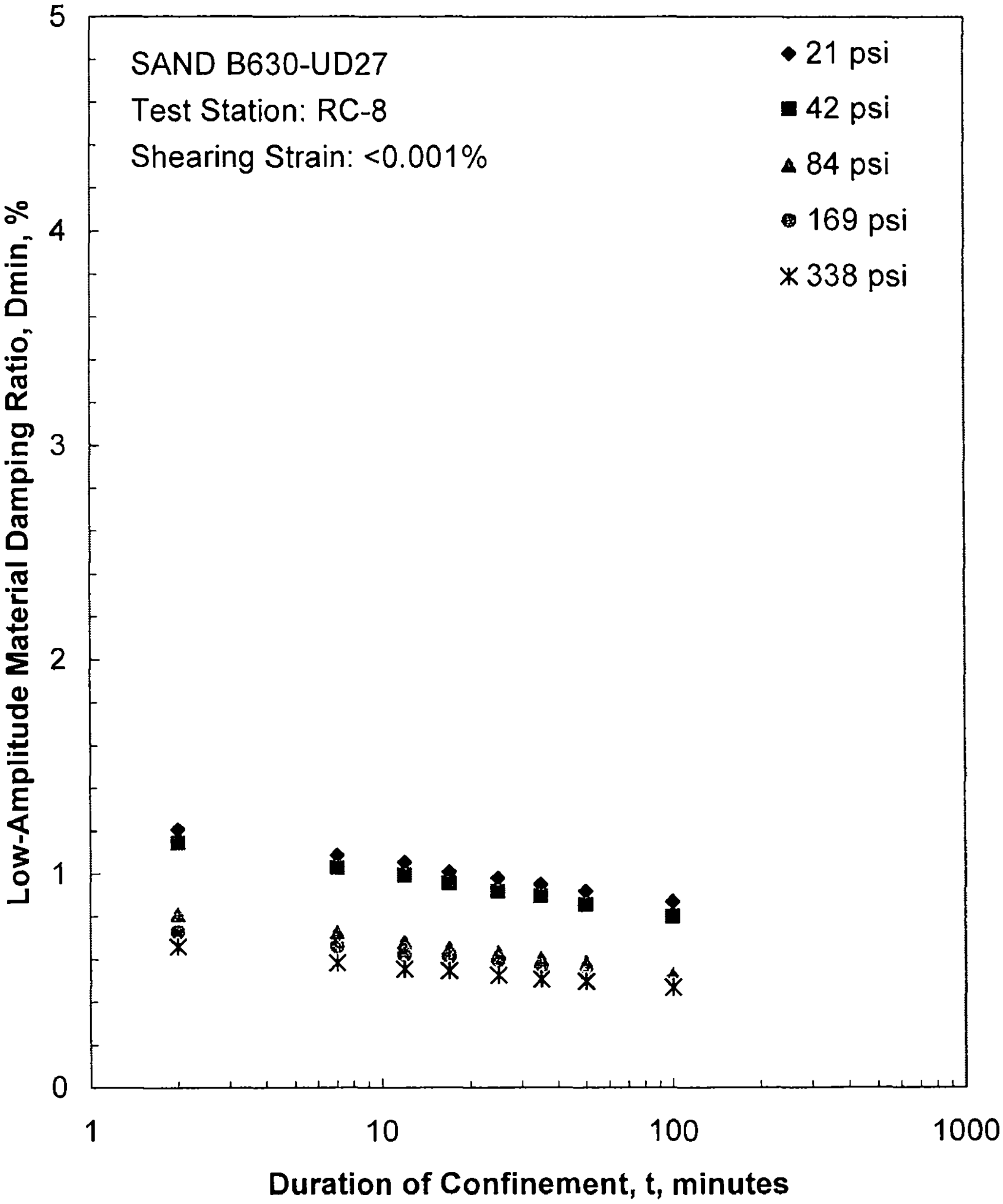

Figure G.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

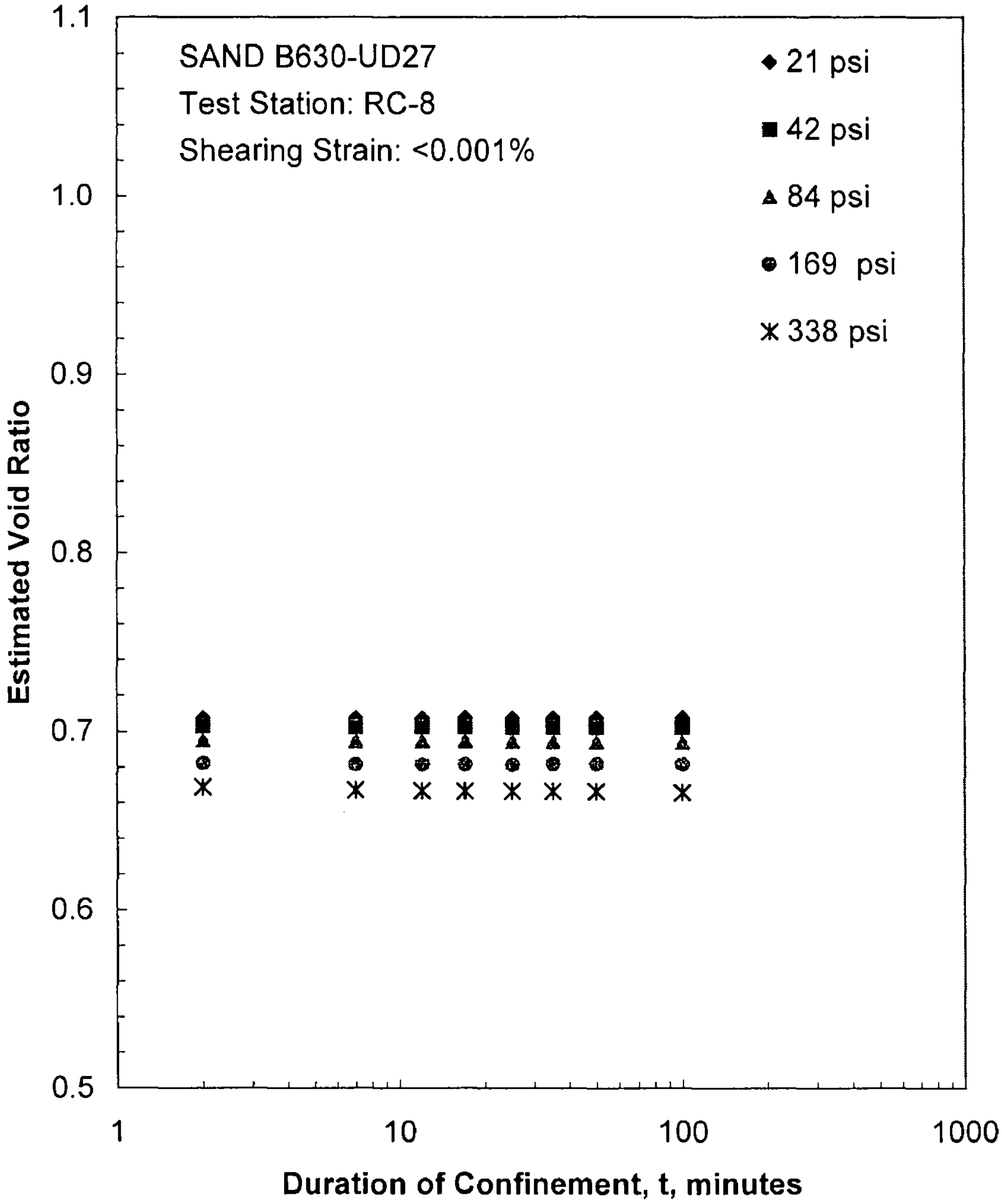

Figure G.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests

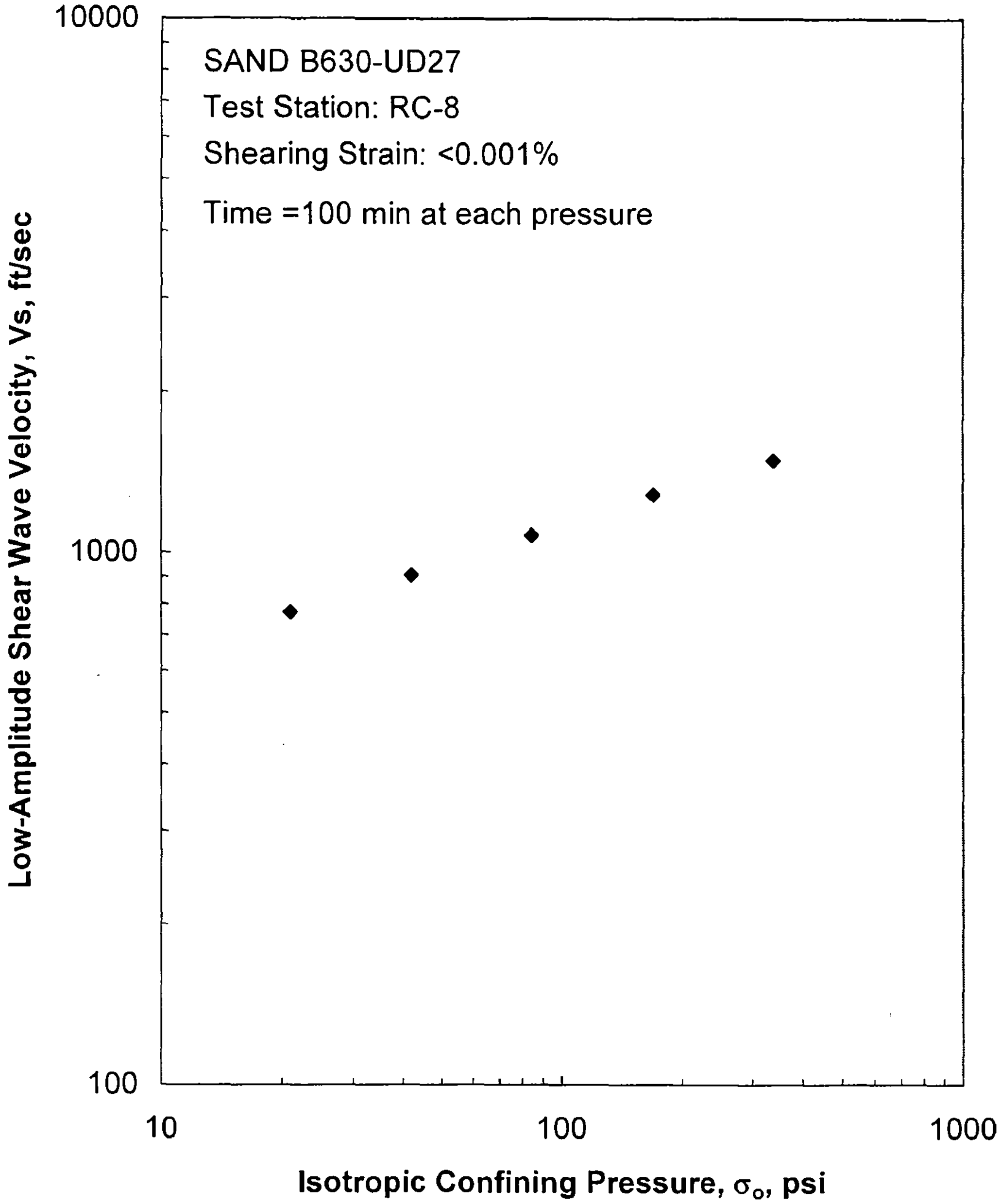

Figure G.4 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests

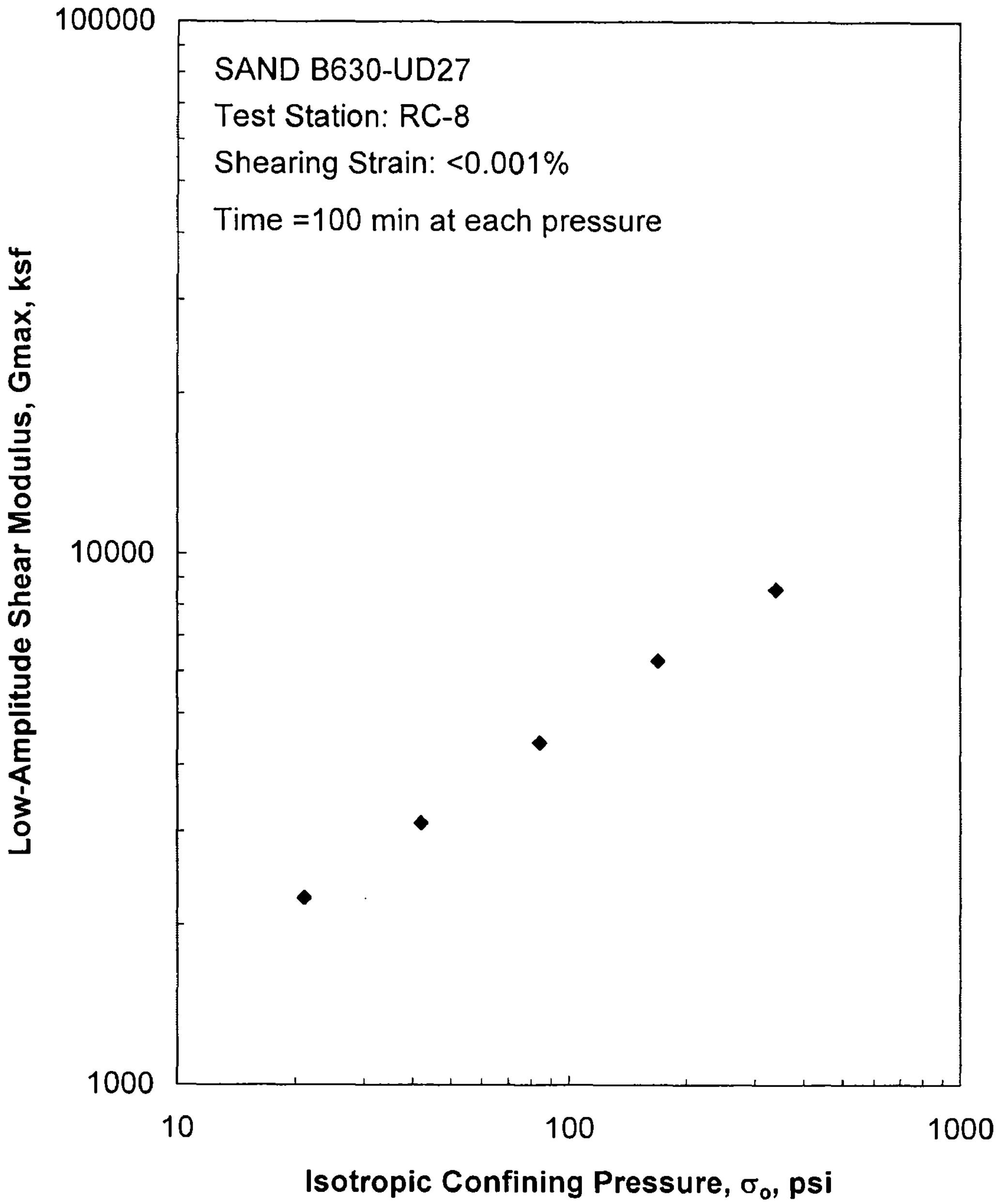

Figure G.5 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Tests

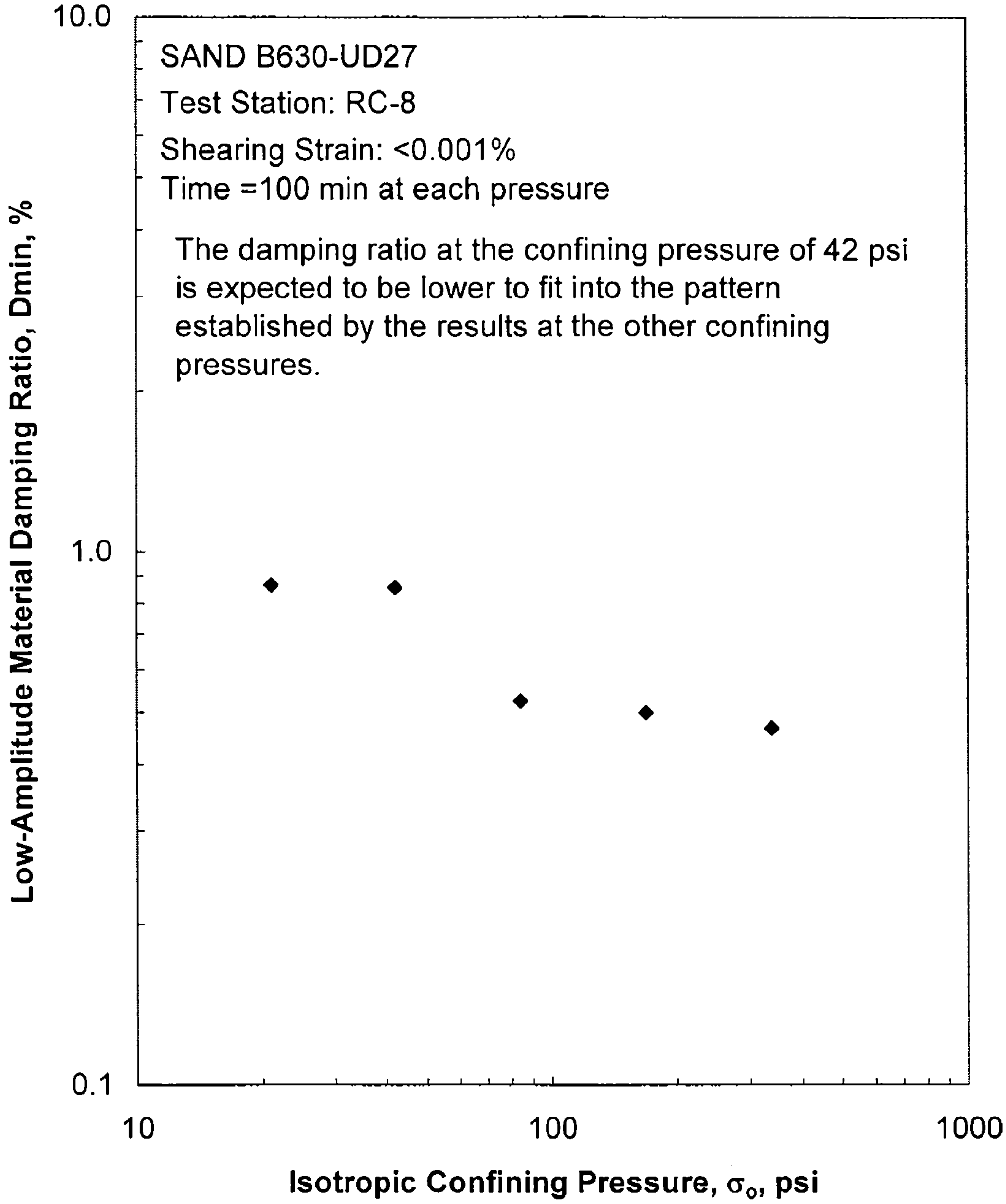

Figure G.6 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests

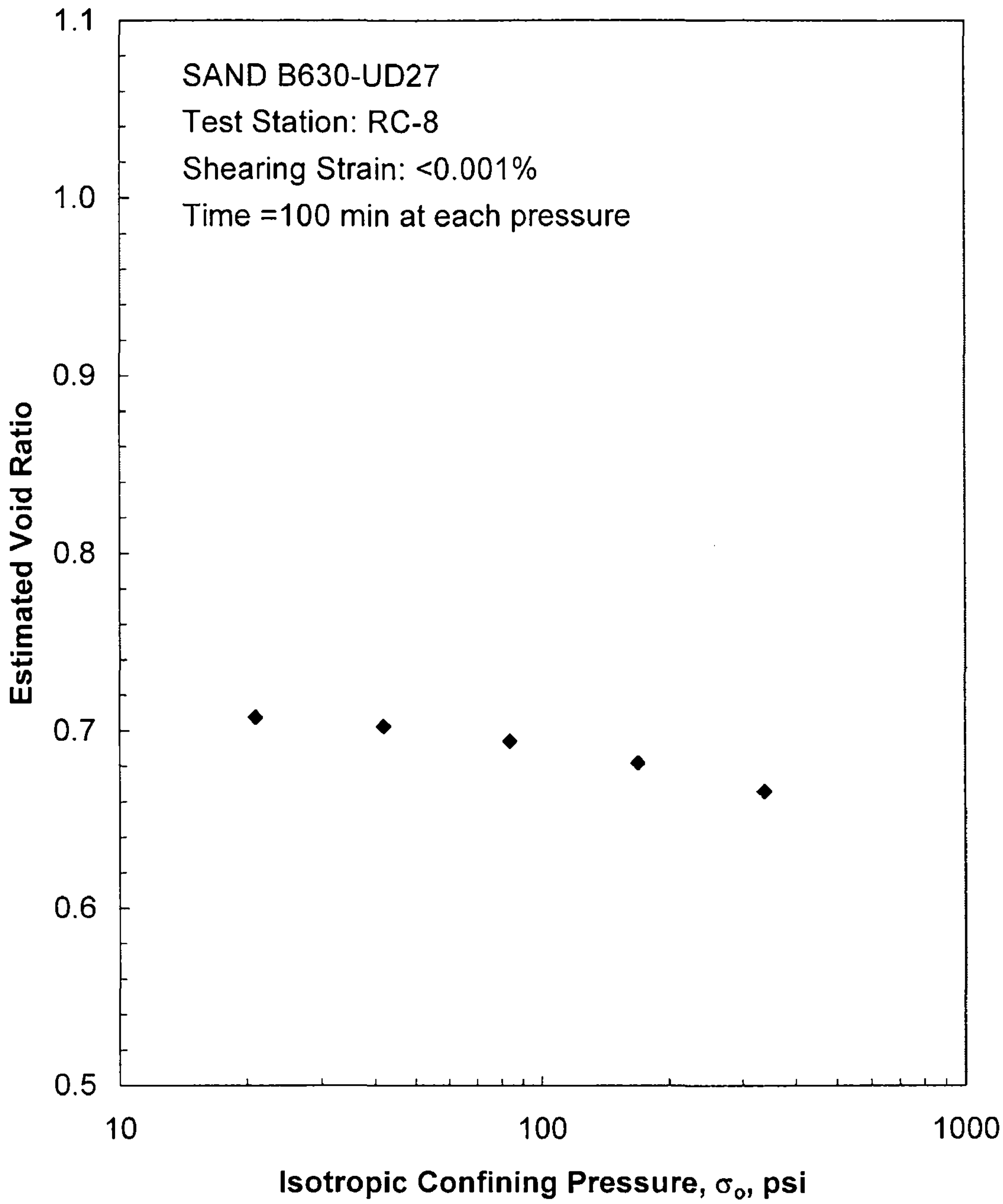

Figure G.7 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests

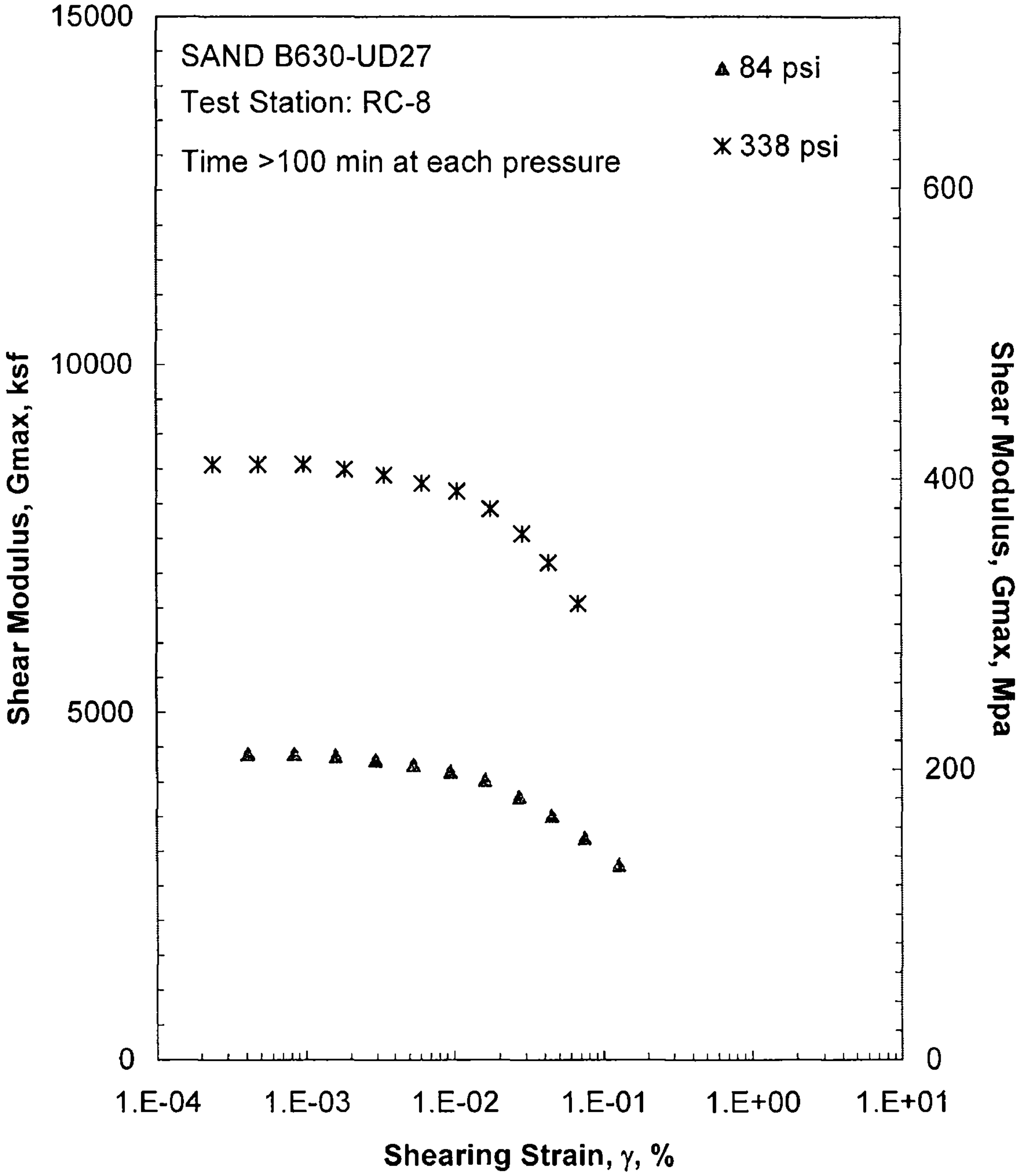

Figure G.8 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

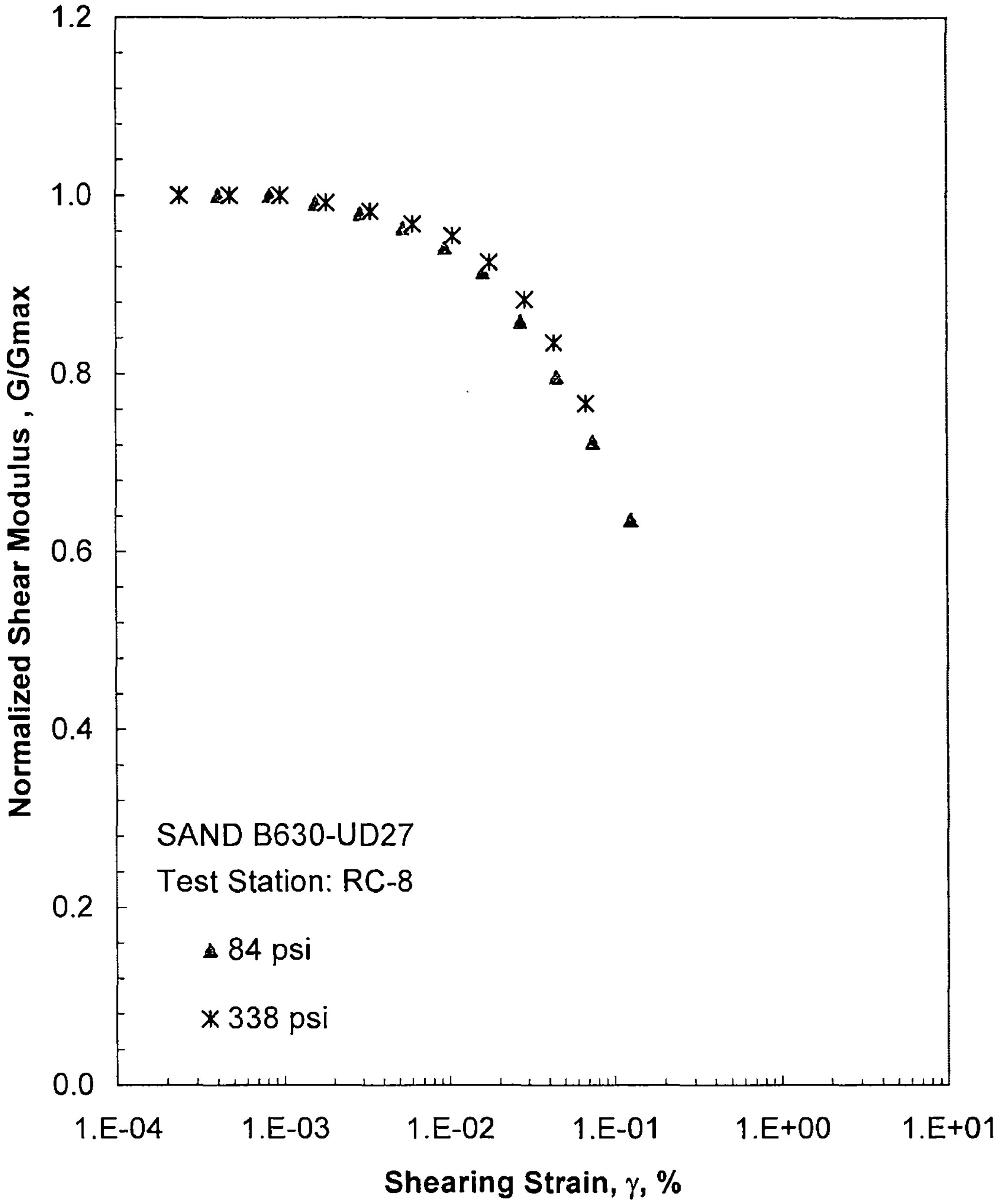

Figure G.9 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

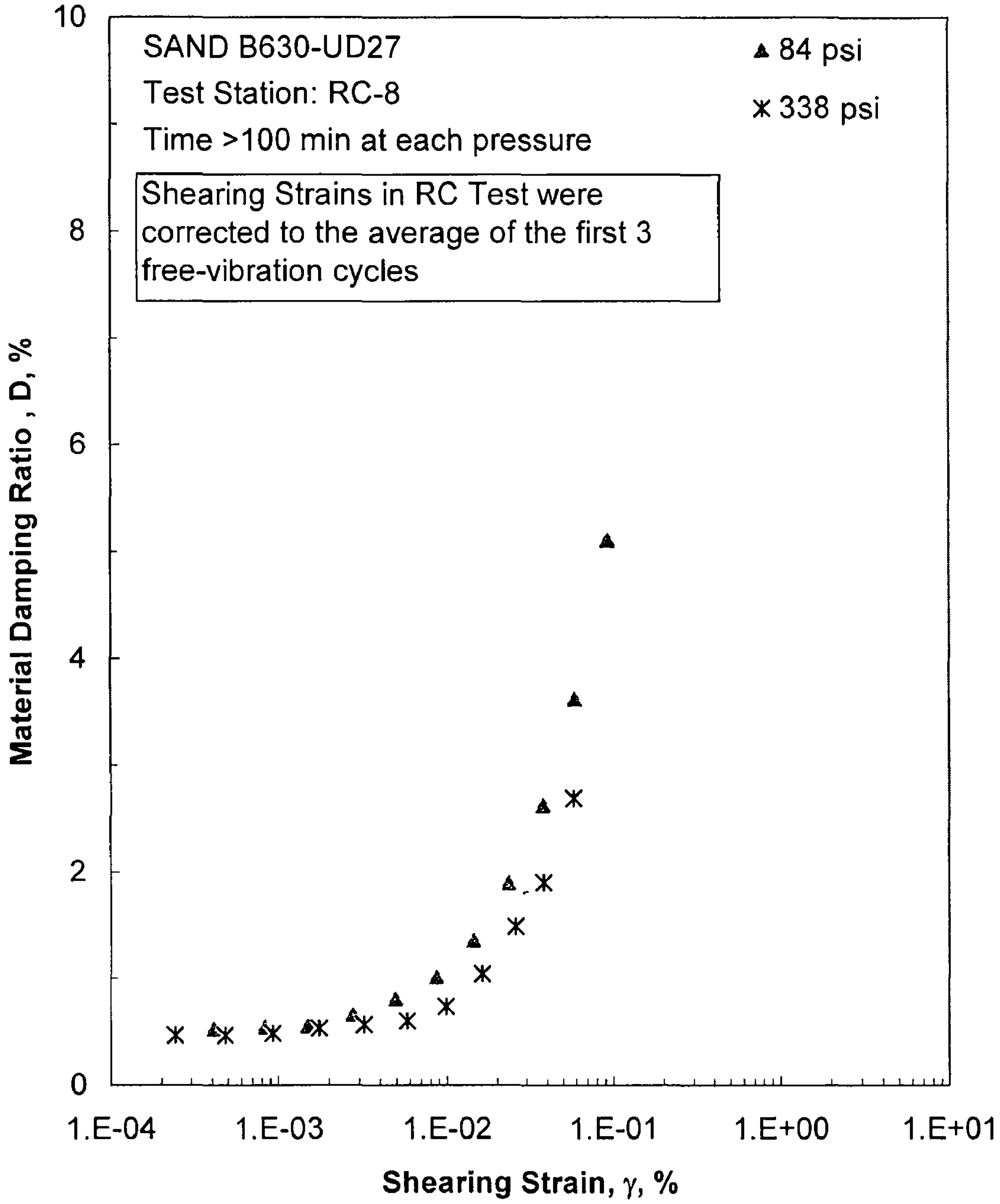

Figure G.10 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests

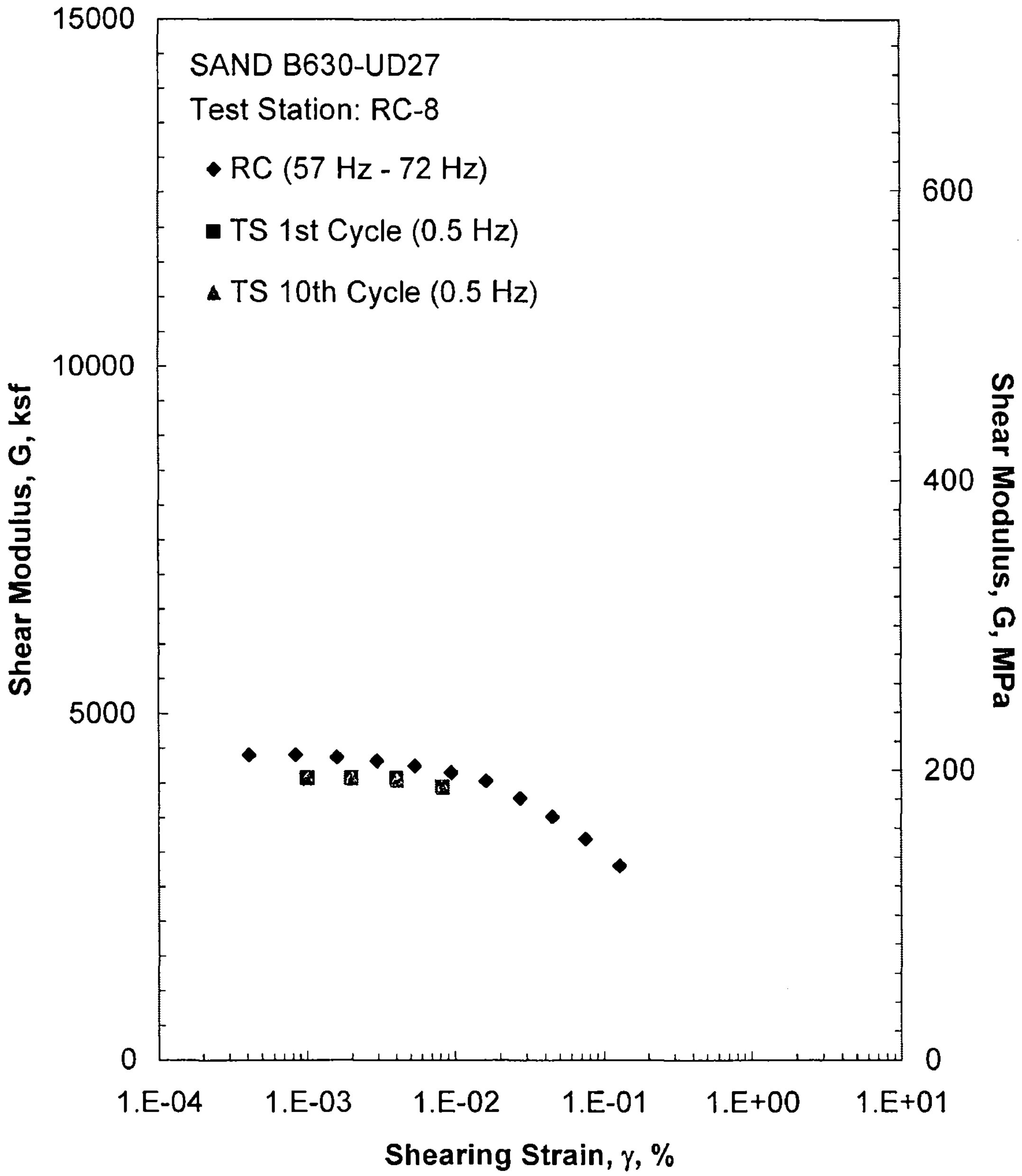

Figure G.11 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 84 psi from the Combined RCTS Tests

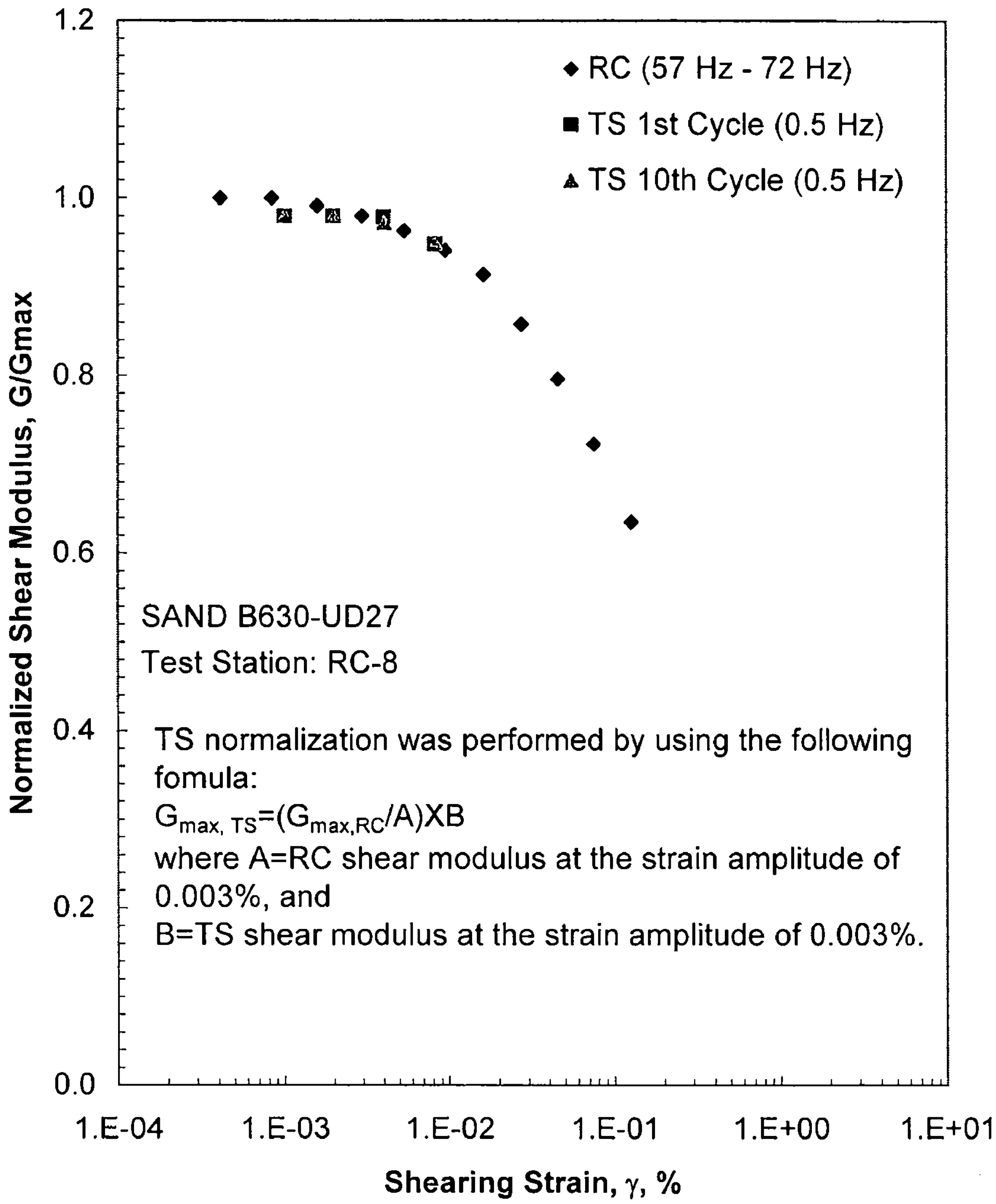

Figure G.12 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 84 psi from the Combined RCTS Tests

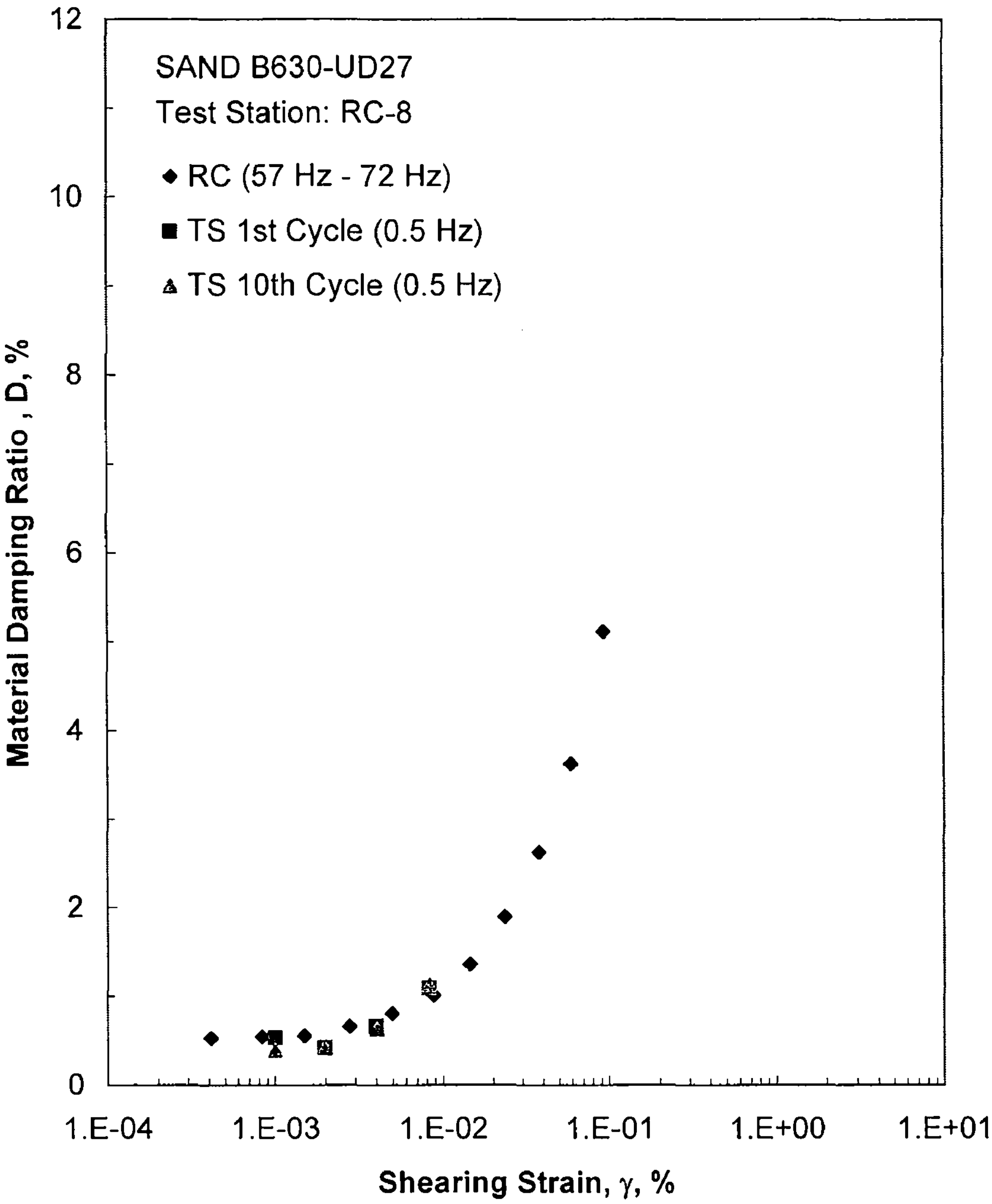

Figure G.13 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 84 psi from the Combined RCTS Tests

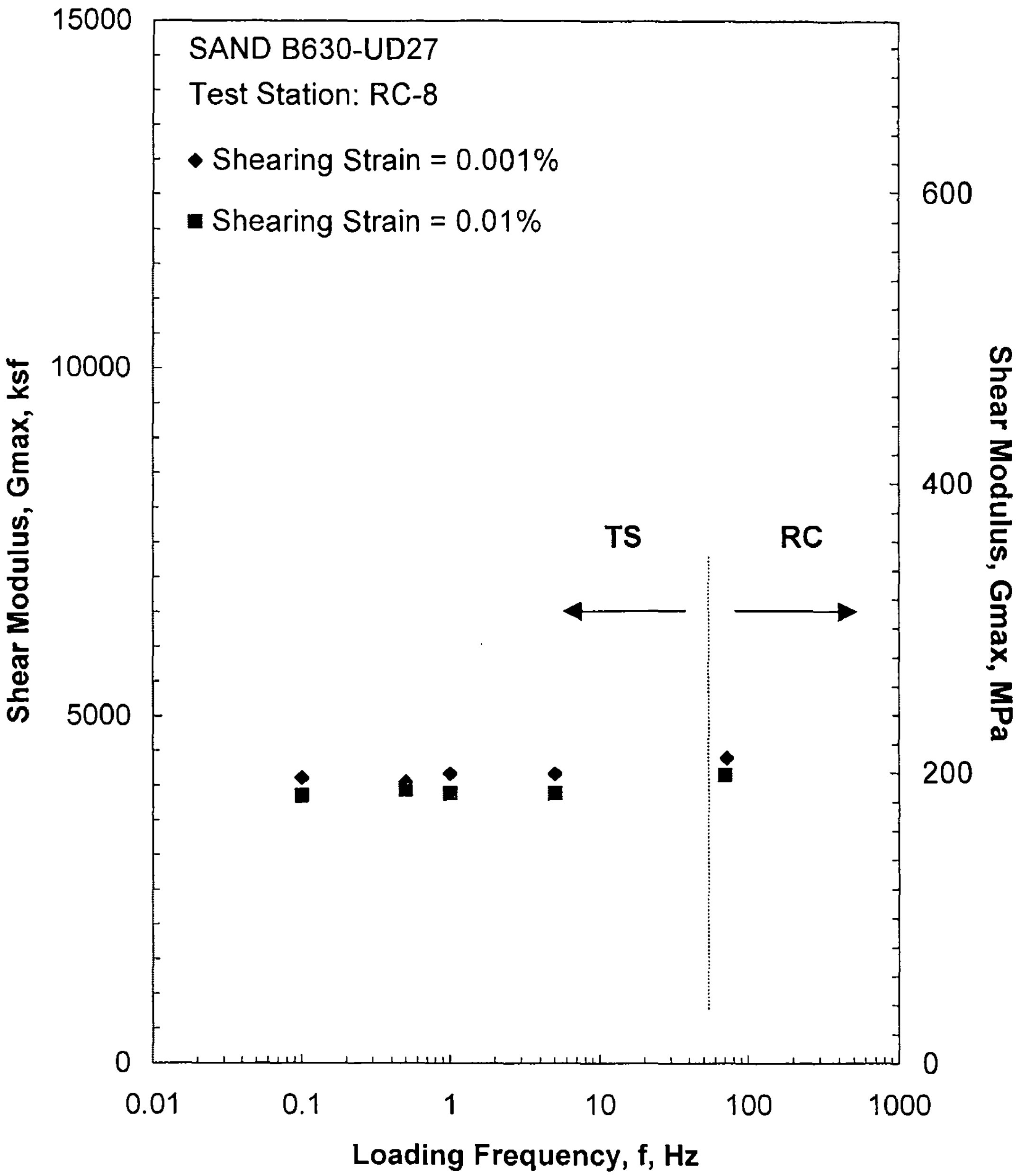

Figure G.14 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 84 psi from the Combined RCTS Tests

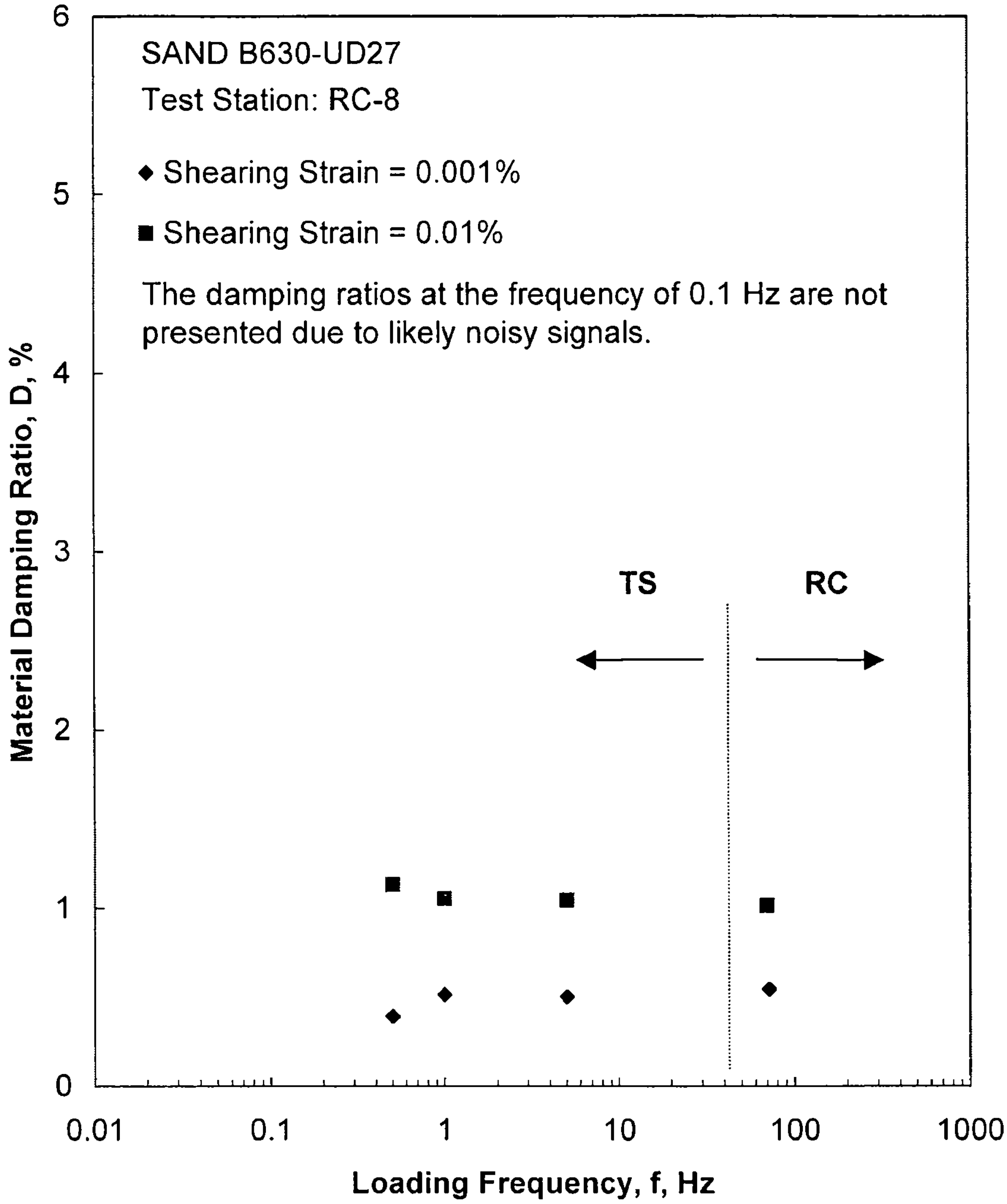

Figure G.15 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 84 psi from the Combined RCTS Tests

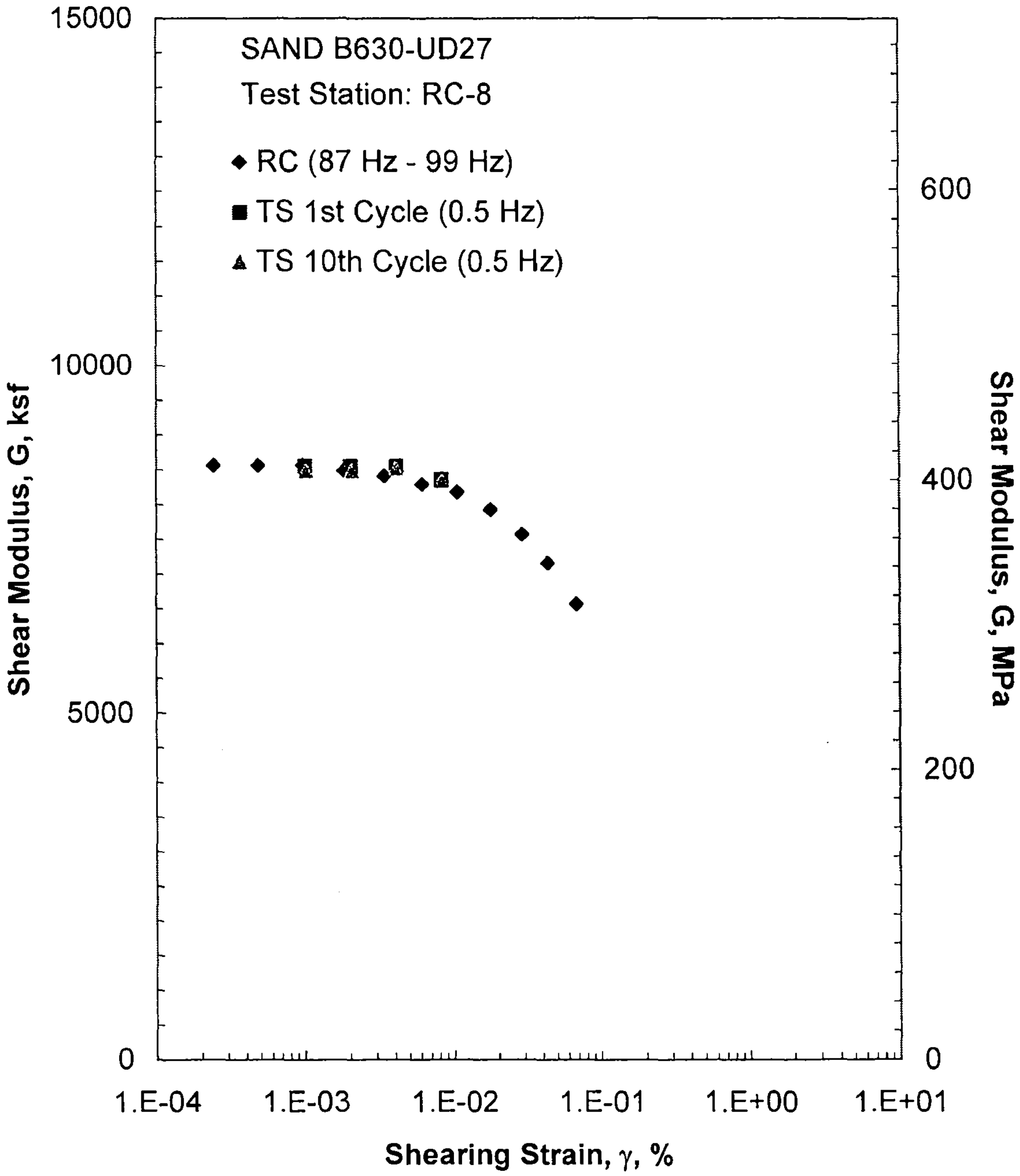

Figure G.16 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 338 psi from the Combined RCTS Tests

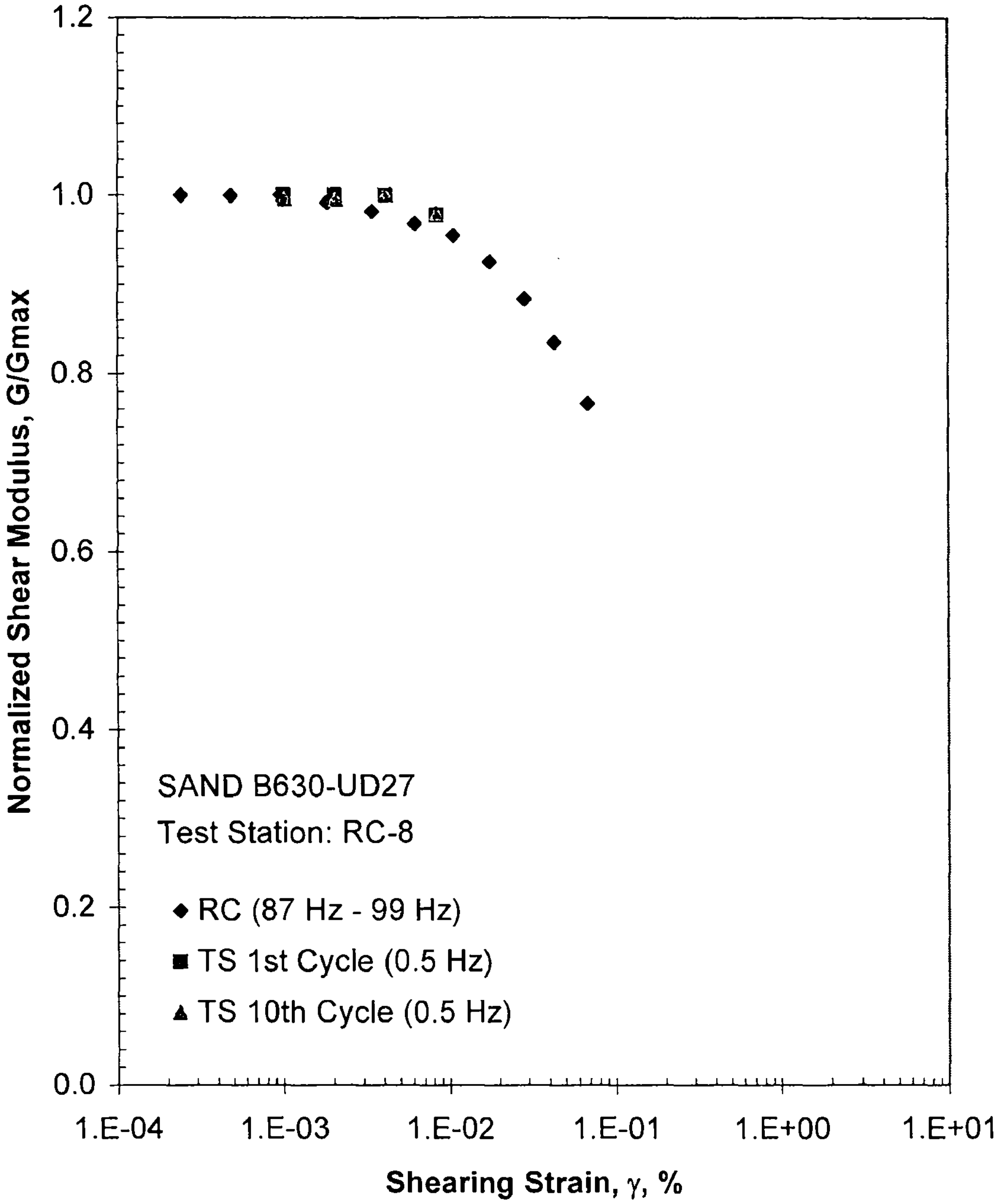

Figure G.17 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 338 psi from the Combined RCTS Tests

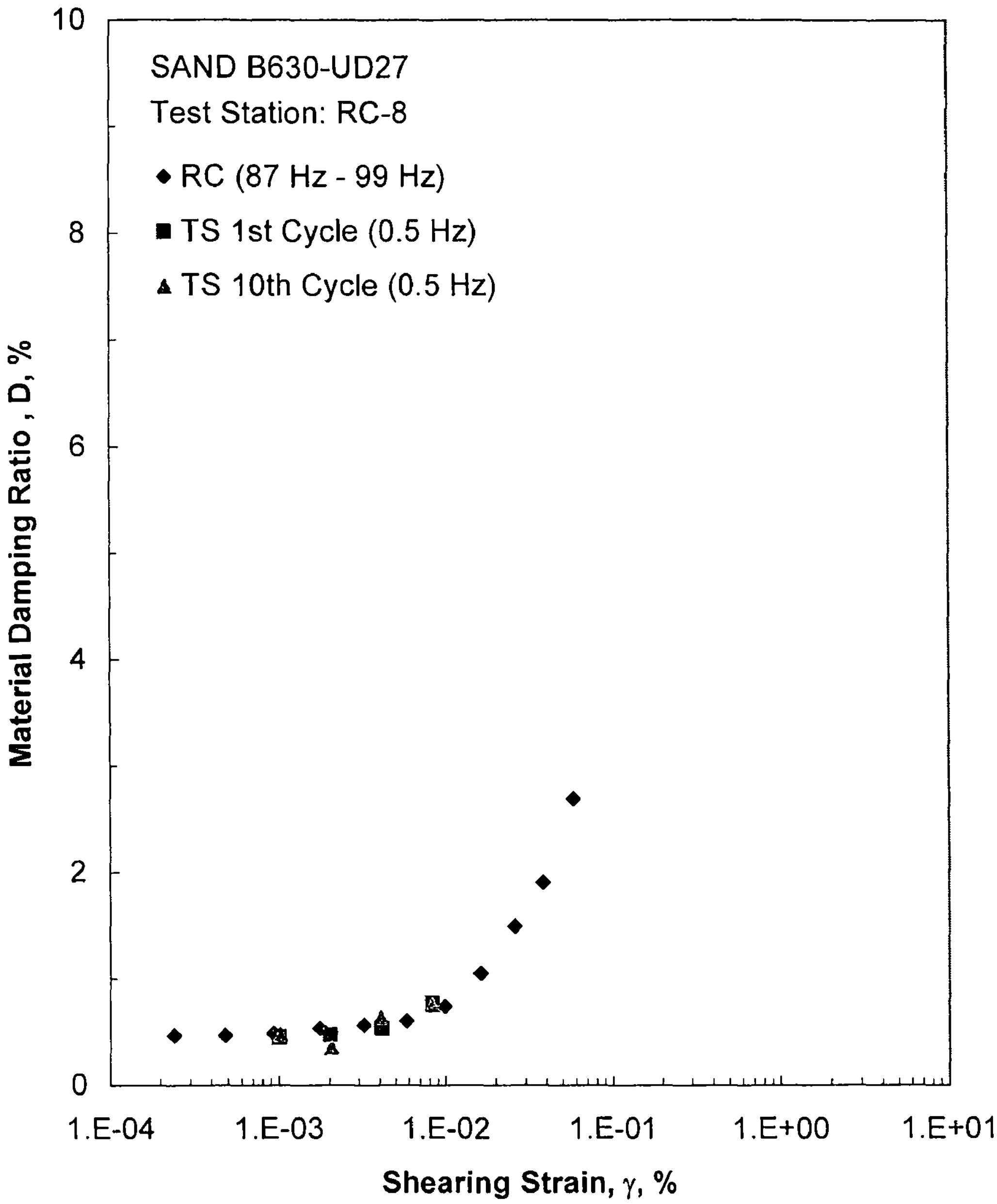

Figure G.18 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 338 psi from the Combined RCTS Tests

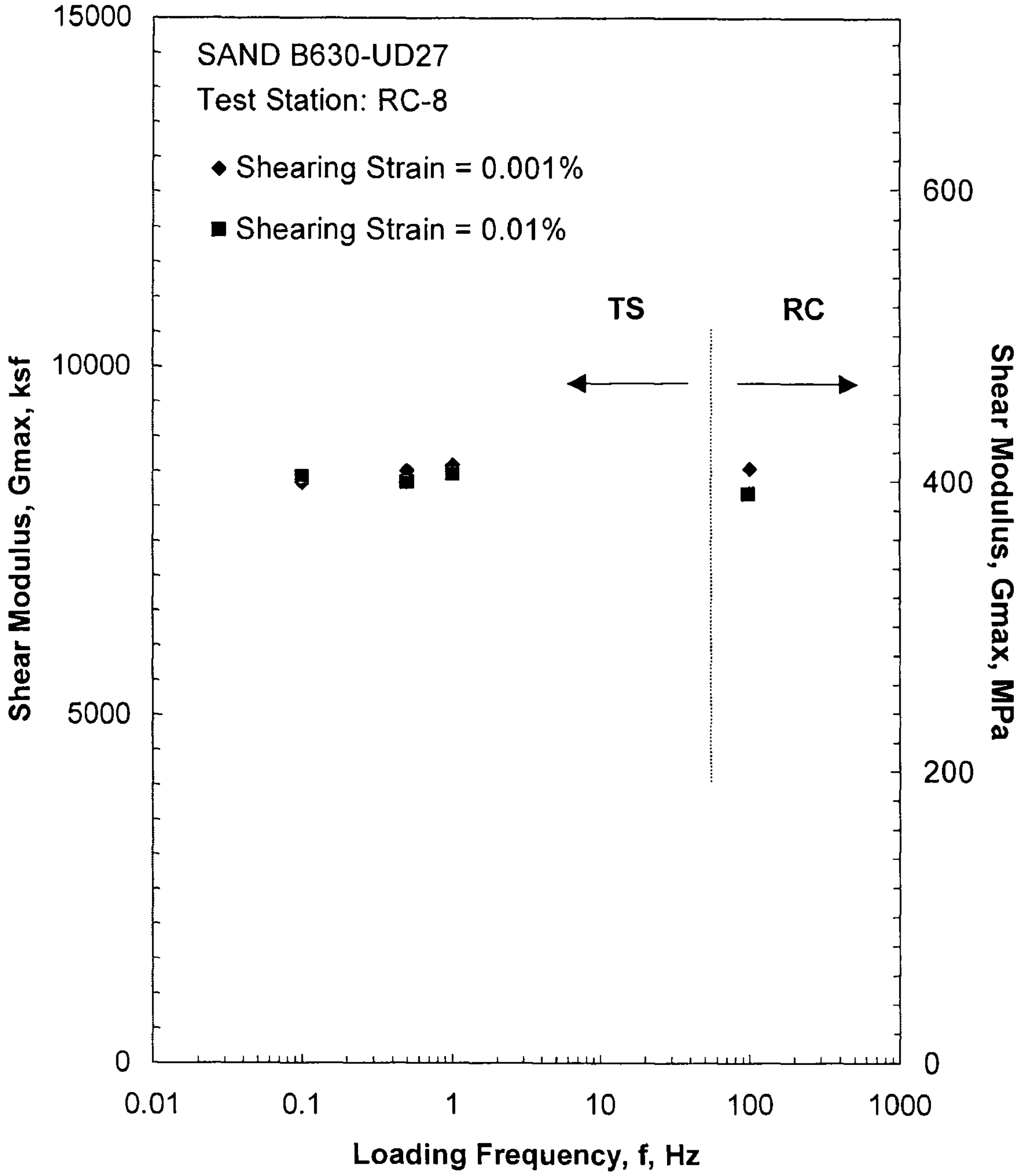

Figure G.19 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 338 psi from the Combined RCTS Tests

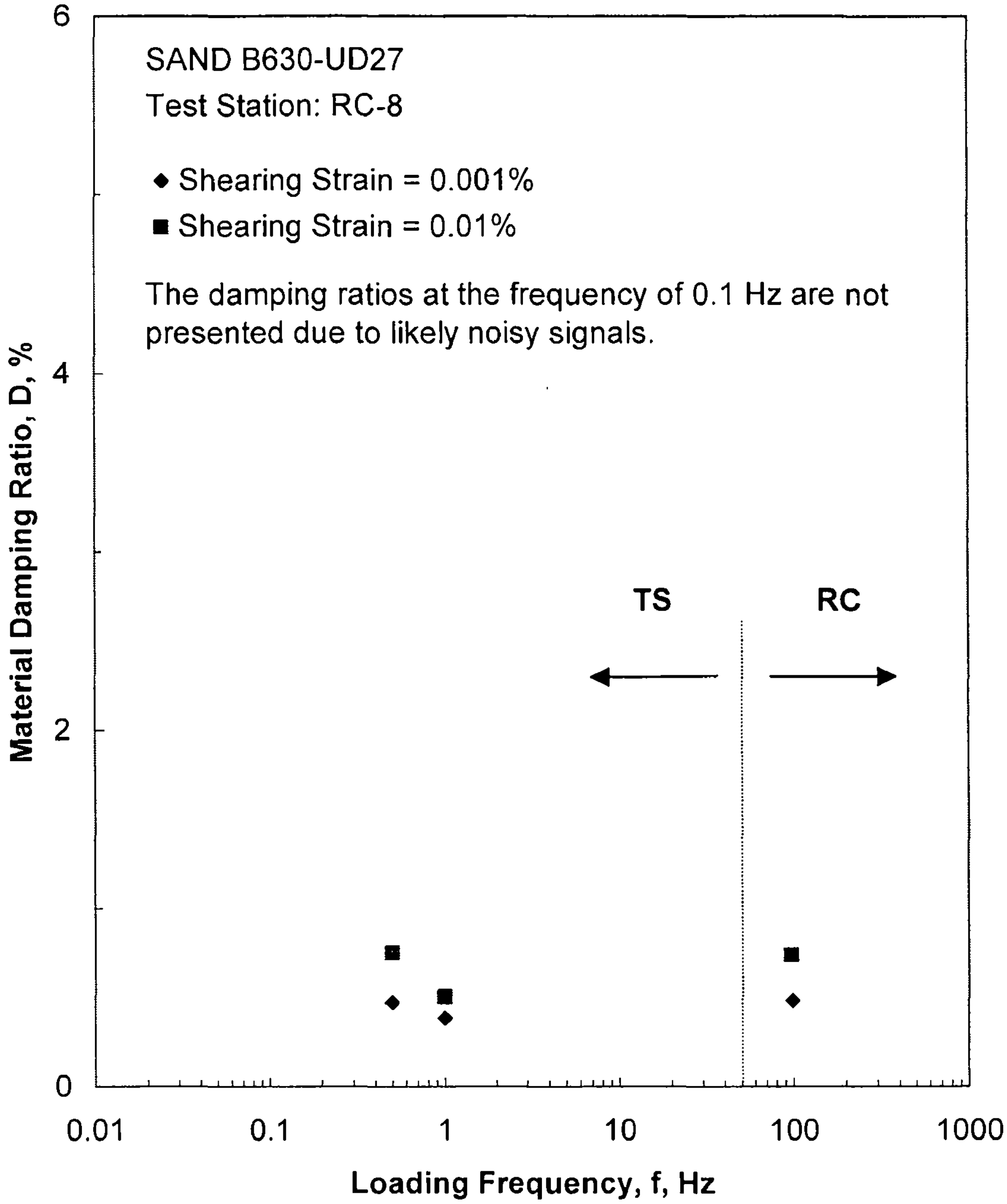

Figure G.20 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 338 psi from the Combined RCTS Tests

Table G.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 B630-UD27

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)	(%)	
21	3024	145	2246	108	771	0.87	0.71
42	6048	289	3108	149	905	0.86	0.70
84	12096	579	4401	211	1075	0.52	0.69
169	24336	1164	6283	302	1279	0.50	0.68
338	48672	2329	8549	410	1485	0.47	0.67

Table G.2 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD27; Isoptropic Confining Pressure, σ_o= 84 psi (12.1 ksf = 579 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average⁺ Shearing Strain, %	Material Damping Ratio^x, D, %
4.10E-04	4404	1.00	4.10E-04	0.52
8.37E-04	4404	1.00	8.37E-04	0.54
1.58E-03	4367	0.99	1.50E-03	0.55
2.94E-03	4318	0.98	2.77E-03	0.66
5.34E-03	4244	0.96	4.96E-03	0.81
9.49E-03	4147	0.94	8.73E-03	1.01
1.61E-02	4026	0.91	1.45E-02	1.36
2.71E-02	3780	0.86	2.35E-02	1.89
4.50E-02	3508	0.80	3.78E-02	2.62
7.47E-02	3183	0.72	5.90E-02	3.62
1.27E-01	2797	0.63	9.28E-02	5.11

$^+$ 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 G.3 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD27; Isotropic Confining Pressure, σ_o= 84 psi (12.1 ksf = 579 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, %
1.00E-03	4074	0.98	0.53	1.00E-03	4061	0.98	0.39
1.98E-03	4074	0.98	0.42	1.99E-03	4061	0.98	0.42
3.99E-03	4068	0.98	0.66	4.03E-03	4027	0.97	0.63
8.23E-03	3942	0.95	1.09	8.25E-03	3933	0.95	1.13

Table G.4 Variation in Shear Modulus and Material Damping Ratio with Shearing Strain from RC Tests of Specimen B630-UD27; Isoptropic Confining Pressure, σ_o= 338 psi (48.7 ksf = 2329 kPa)

Peak Shearing Strain, %	Shear Modulus, G, ksf	Normalized Shear Modulus, G/G_{max}	Average$^+$ Shearing Strain, %	Material Damping Ratio^x, D, %
2.41E-04	8564	1.00	2.41E-04	0.47
4.81E-04	8564	1.00	4.81E-04	0.47
9.67E-04	8564	1.00	9.28E-04	0.48
1.83E-03	8495	0.99	1.75E-03	0.53
3.39E-03	8413	0.98	3.22E-03	0.56
6.12E-03	8291	0.97	5.82E-03	0.60
1.06E-02	8180	0.96	9.92E-03	0.74
1.76E-02	7925	0.93	1.62E-02	1.04
2.88E-02	7566	0.88	2.59E-02	1.49
4.30E-02	7151	0.84	3.83E-02	1.90
6.79E-02	6562	0.77	5.77E-02	2.69

$^+$ 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 G.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen B630-UD27; Isotropic Confining Pressure, σ_o= 338 psi (48.7 ksf = 2329 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	8551	1.00	0.45	1.02E-03	8486	1.00	0.47
2.03E-03	8551	1.00	0.47	2.05E-03	8486	1.00	0.35
4.10E-03	8551	1.00	0.53	4.07E-03	8523	1.00	0.63
8.31E-03	8362	0.98	0.77	8.32E-03	8352	0.98	0.75