**Kleinfelder Specimen ID:**

# K2-13-005

**Boring No: R-6-1b**
**Sample No: SC-3**

**Limestone (Fort Thompson Formation)**
**Depth = 47.6 ft – 48.1 ft (below existing ground surface)**
**Total Unit Weight = 151.8 lb/ft$^3$**
**Natural Moisture Content = 3.6%**
**Estimated In-Situ Mean Effective Stress = 16 psi**

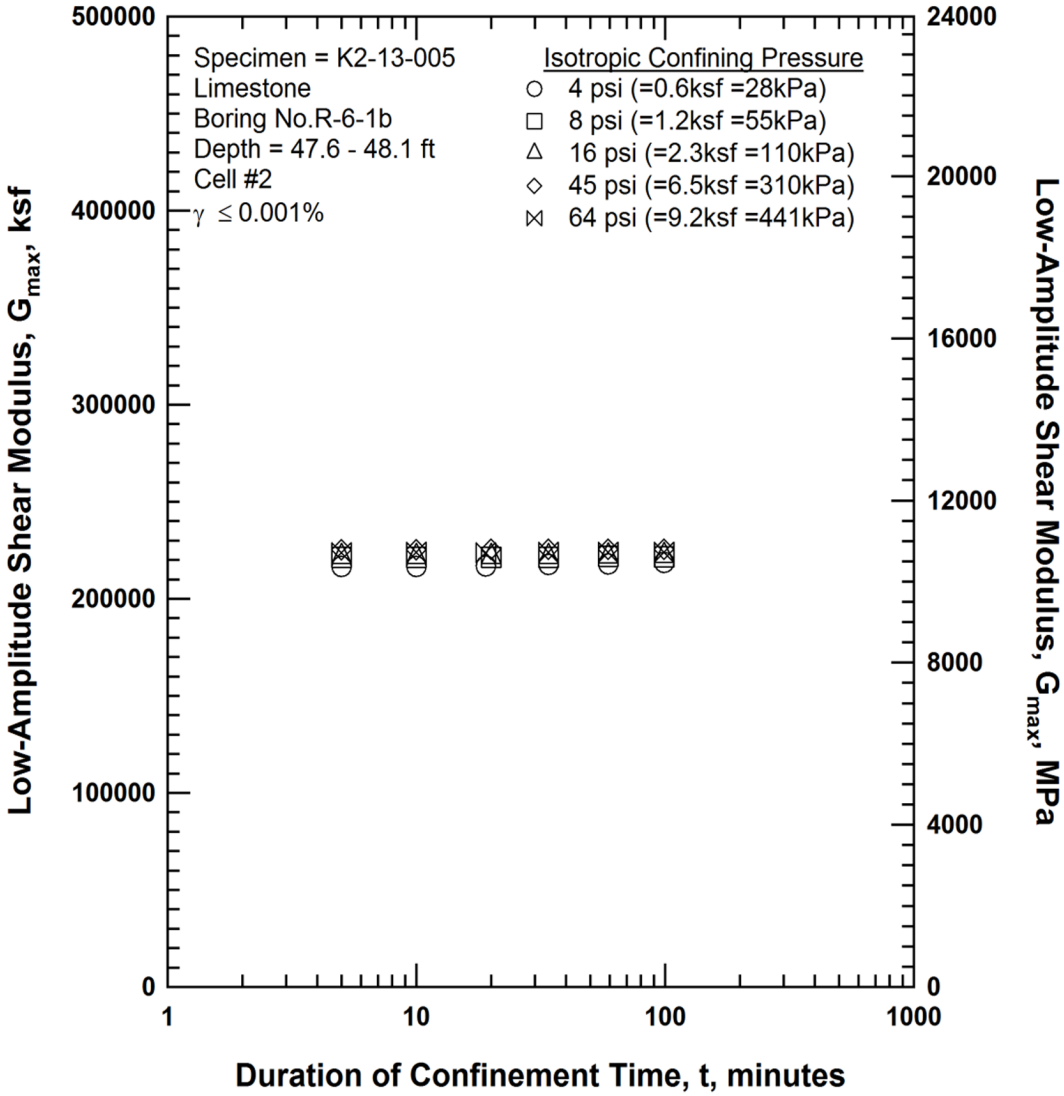


Figure F.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-005

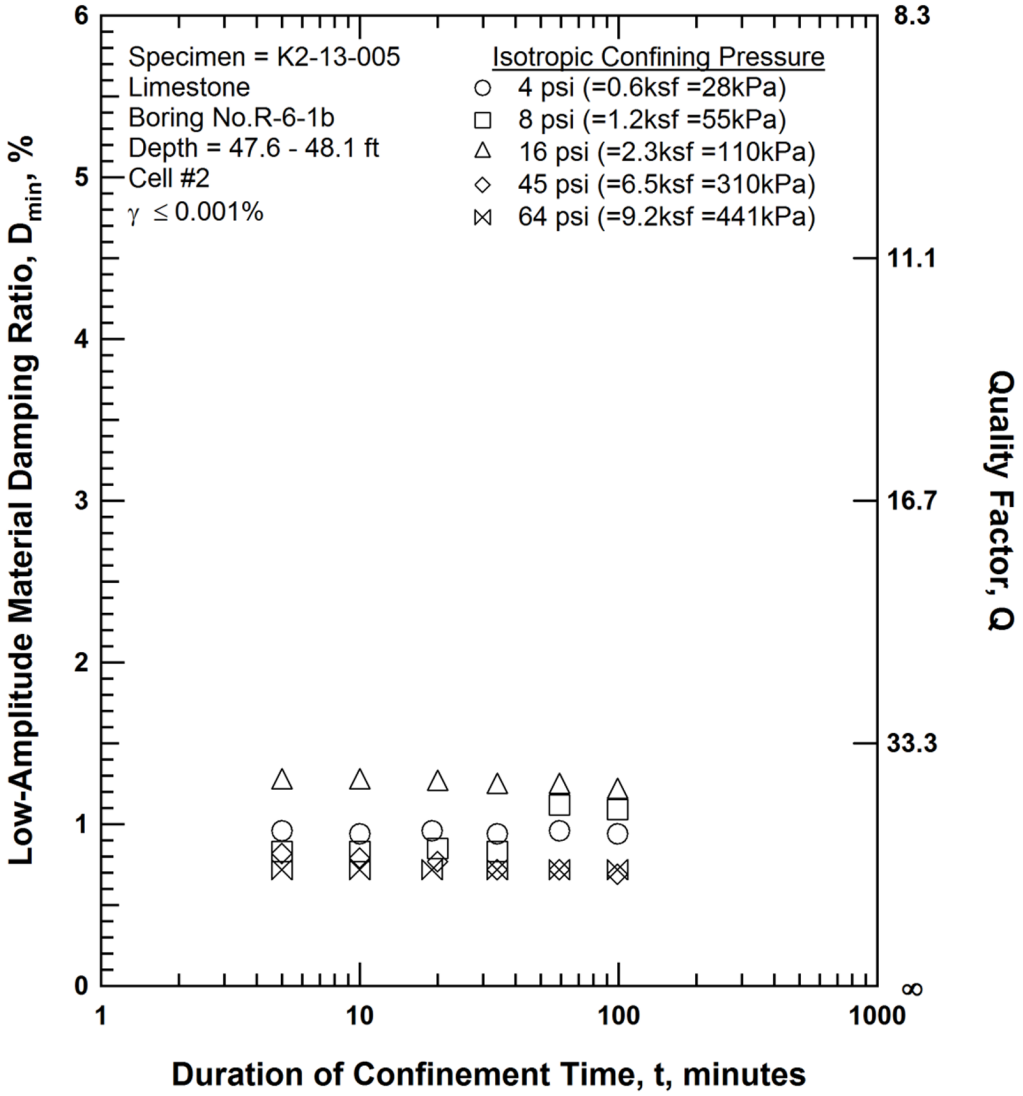


Figure F.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-005

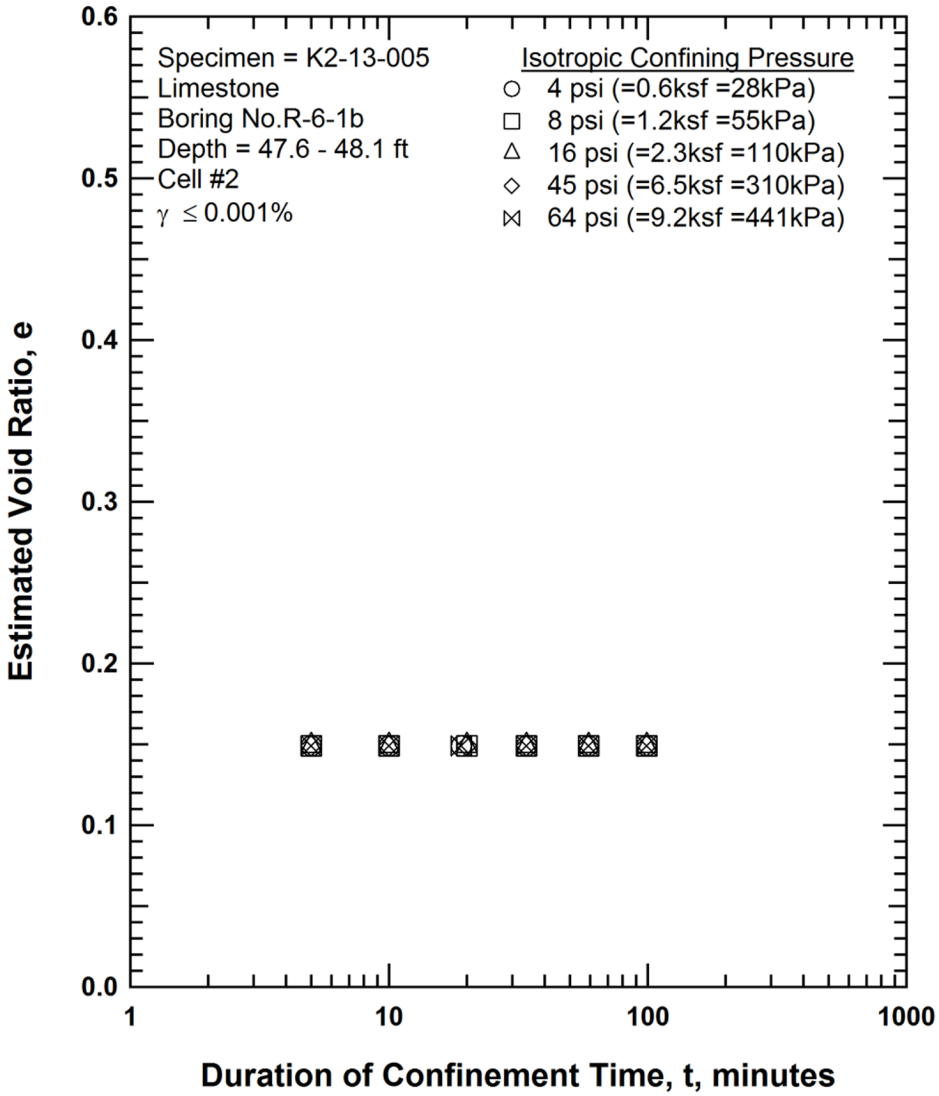


Figure F.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Test of Specimen K2-13-005

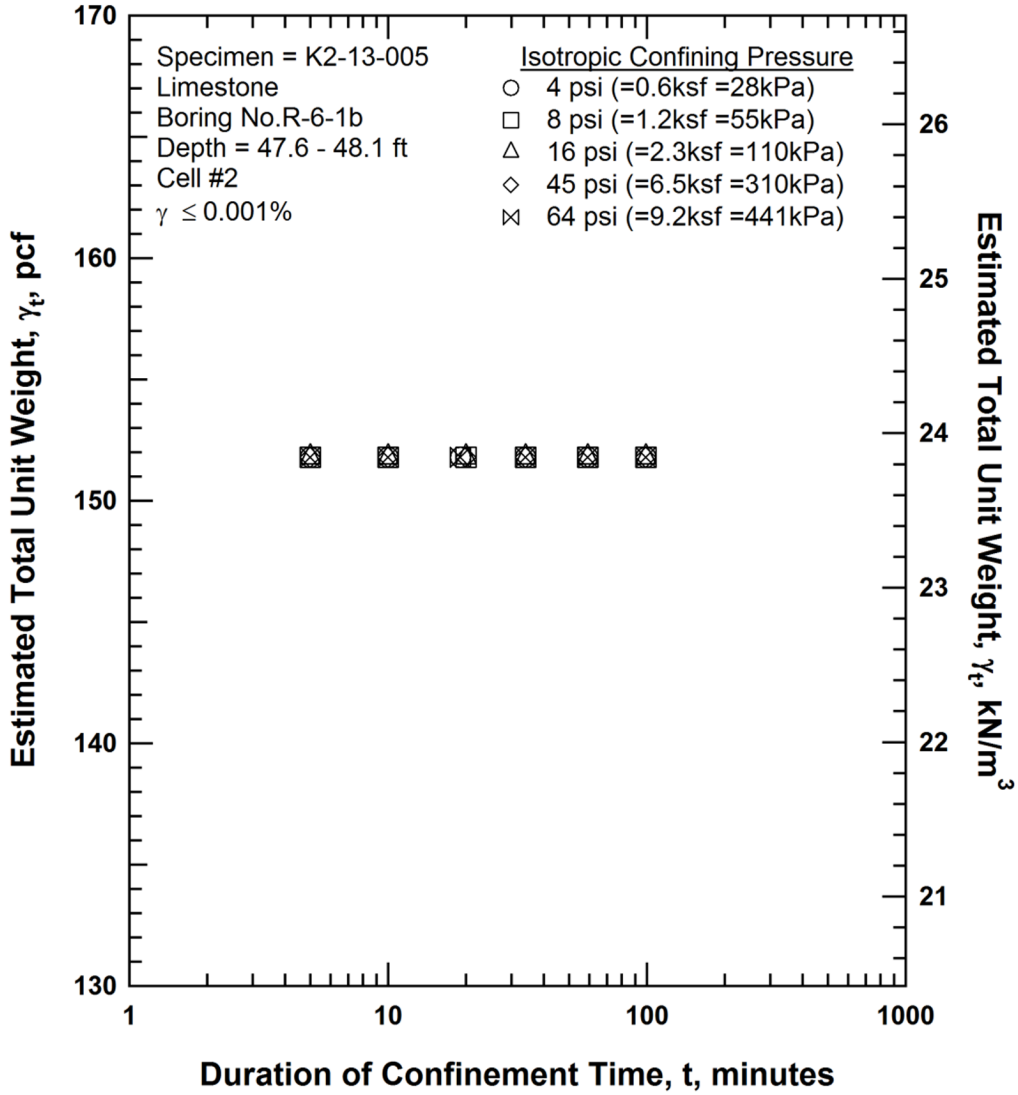


Figure F.4 Variation in Estimated Total Unit Weight with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-005

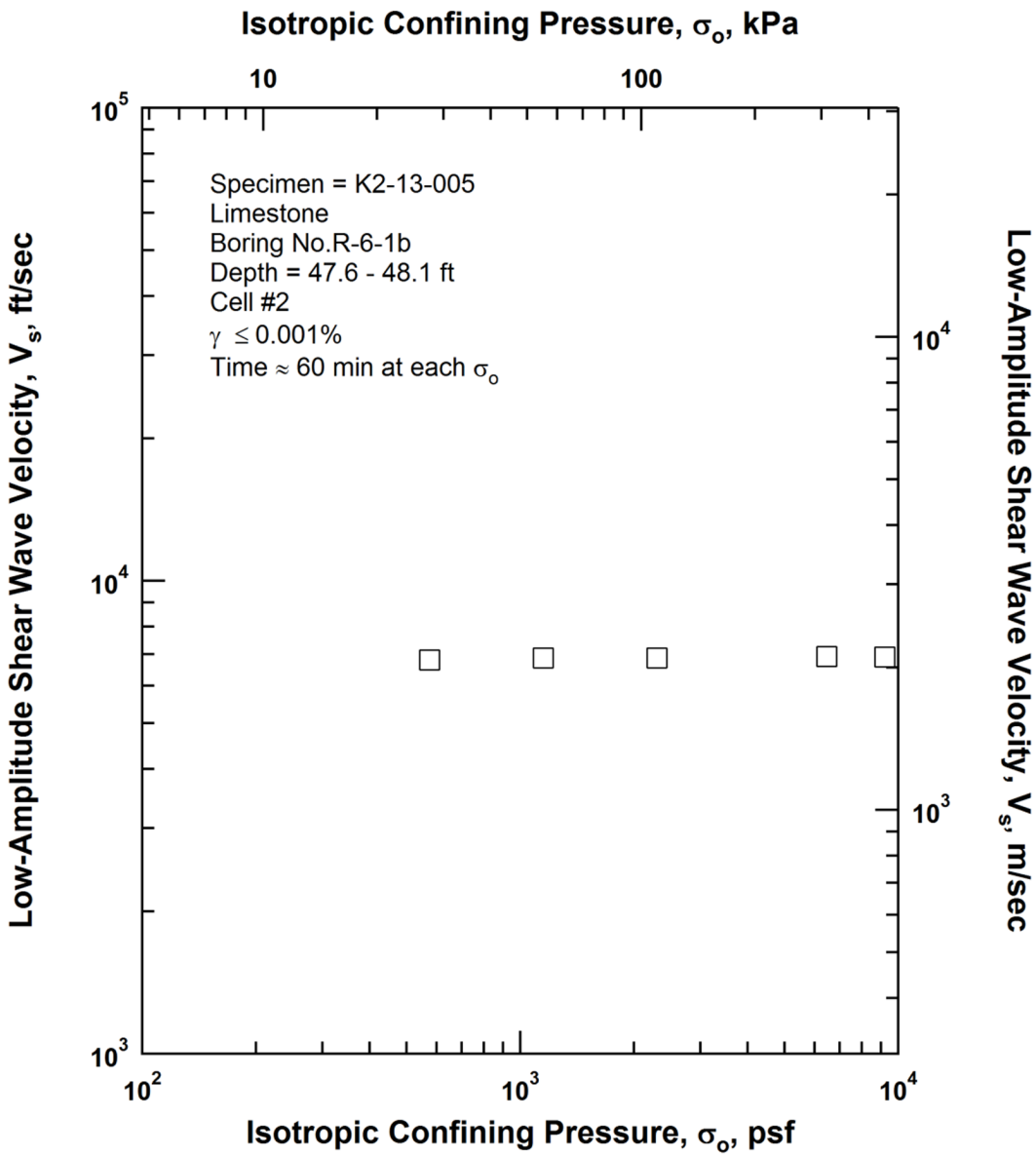


Figure F.5 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-005

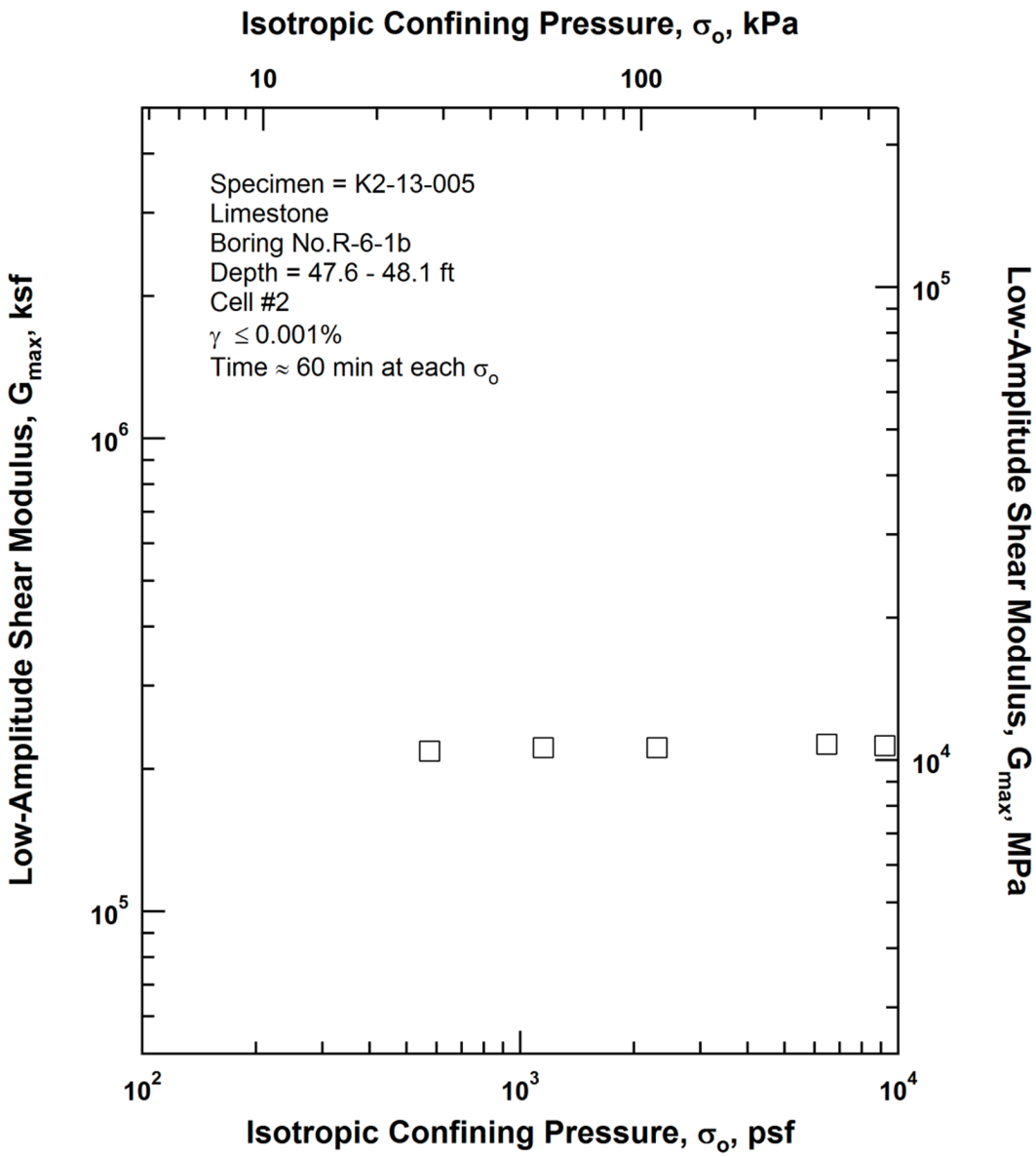


Figure F.6 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Test of Specimen K2-13-005

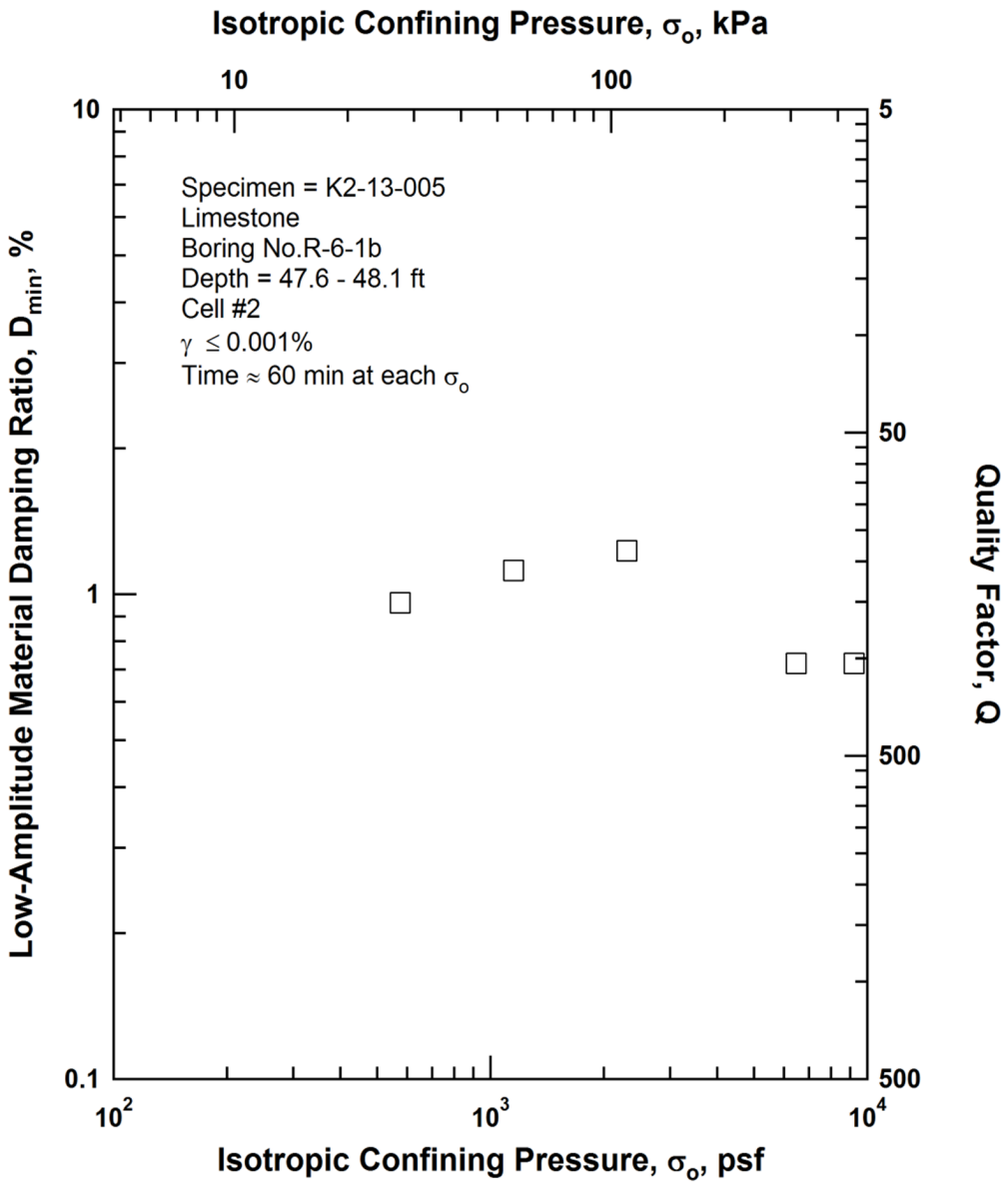


Figure F.7 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-005

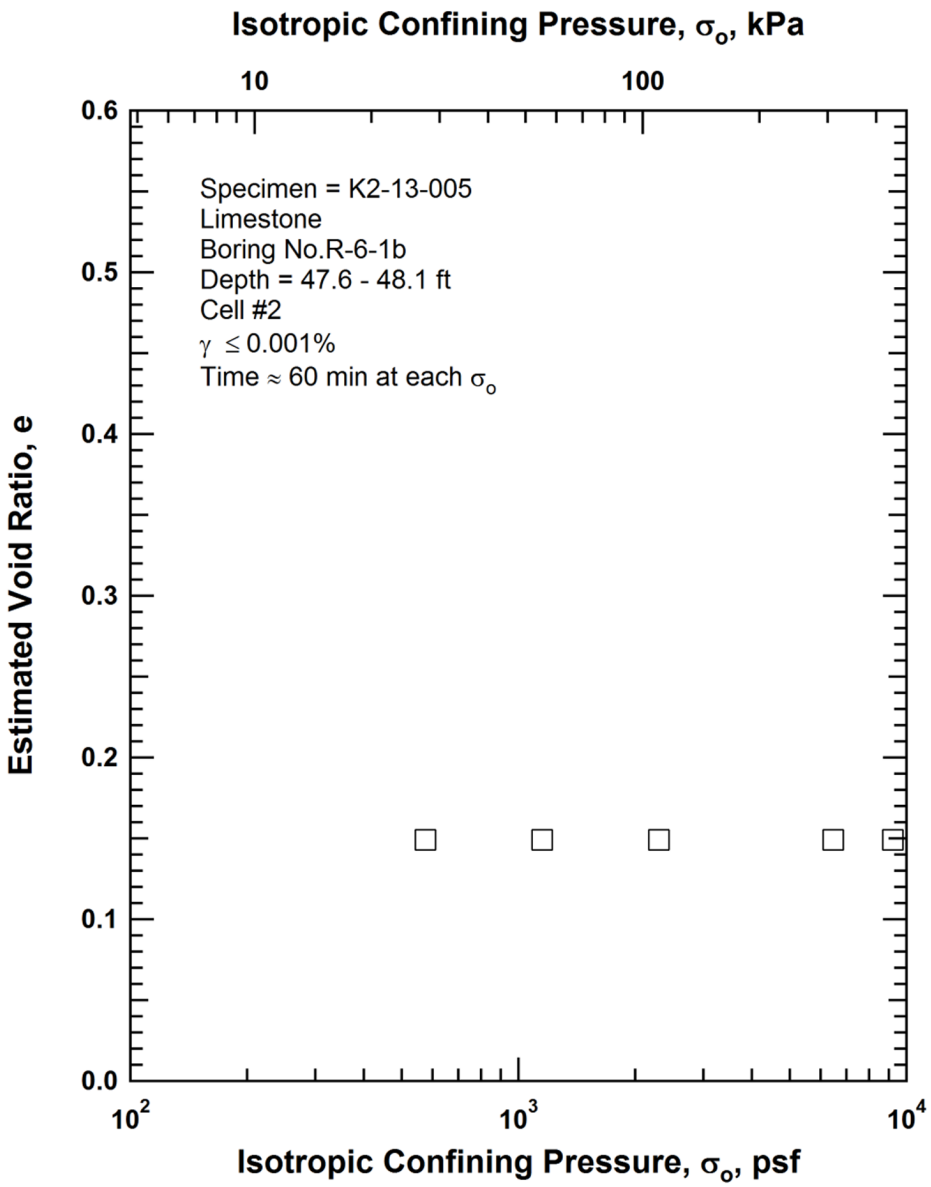


Figure F.8 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-005

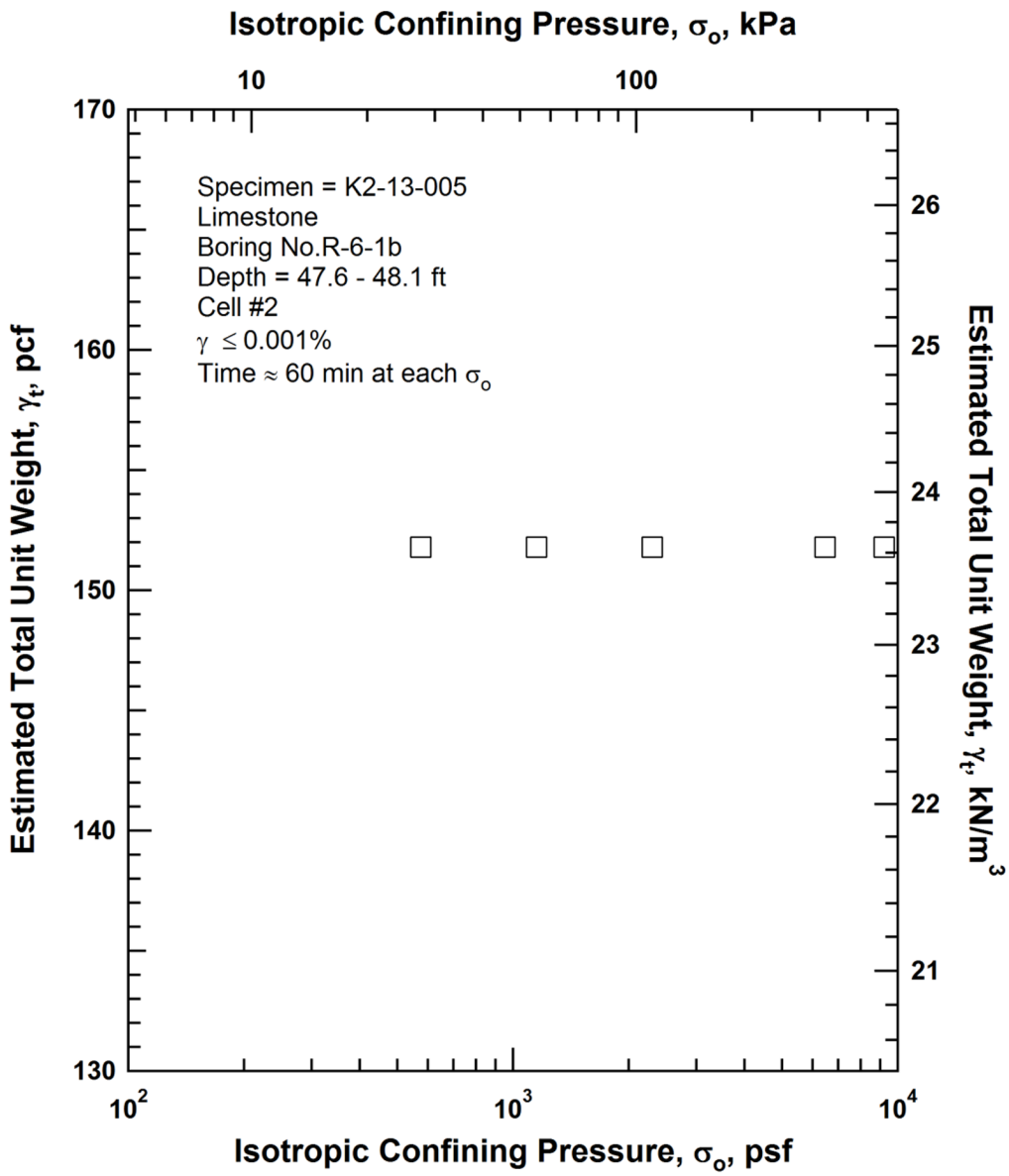


Figure F.9 Variation in Estimated Total Unit Weight with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-005

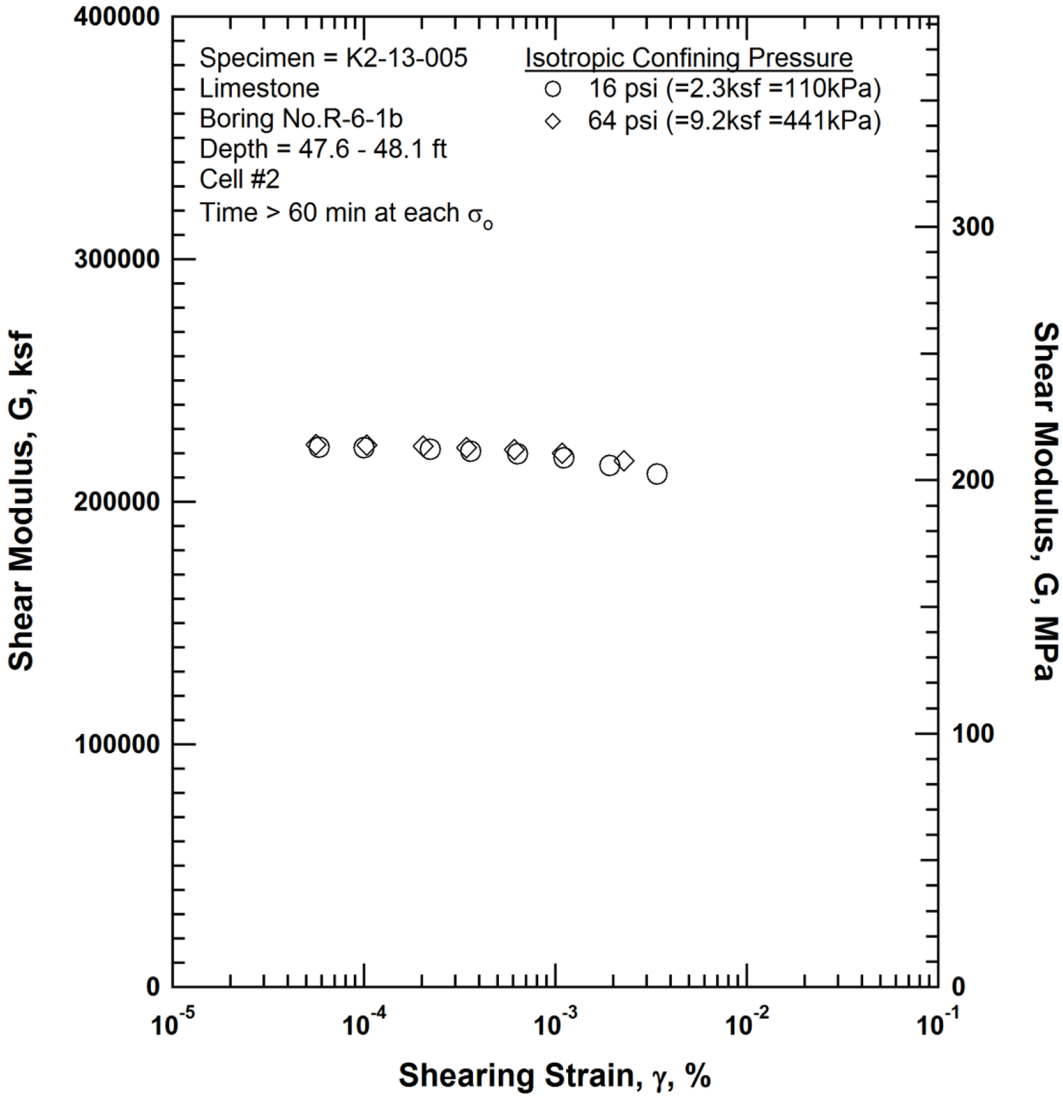


Figure F.10 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests of Specimen K2-13-005

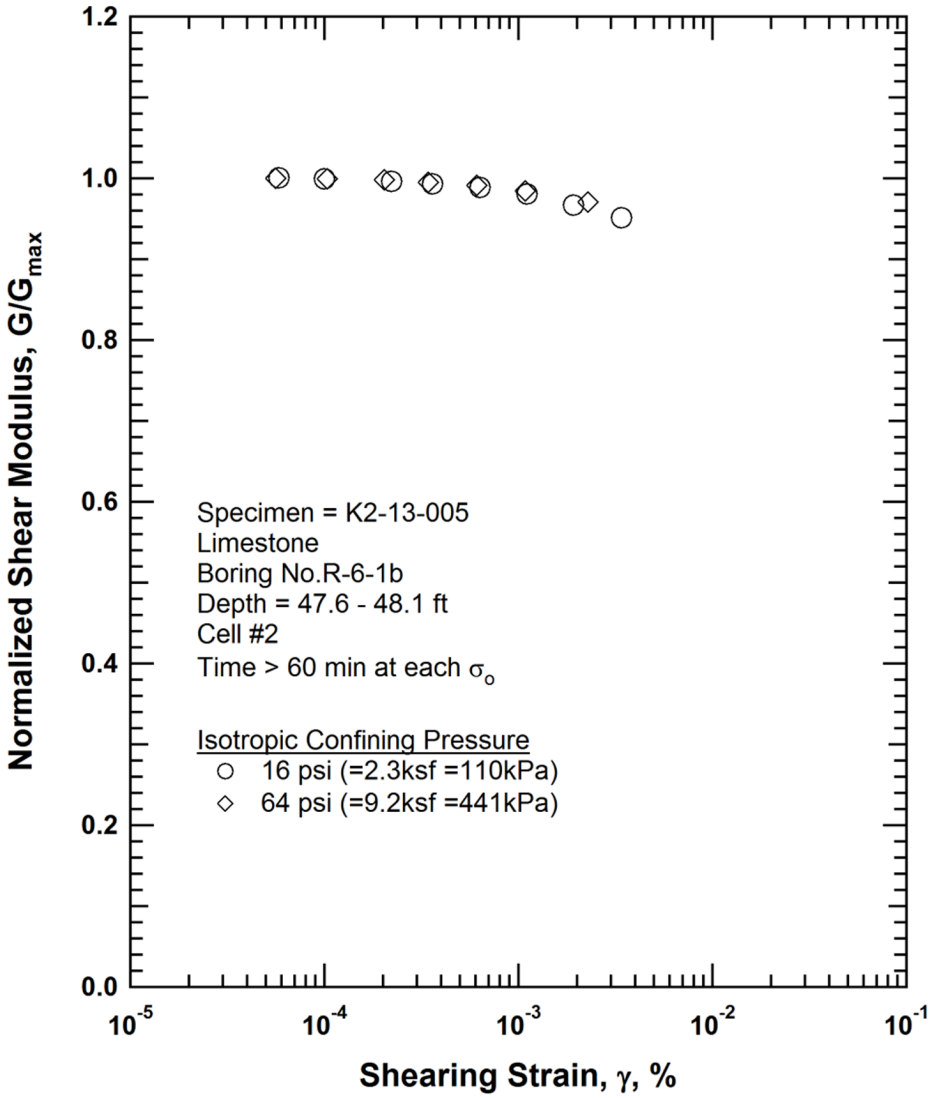


Figure F.11 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests of Specimen K2-13-005

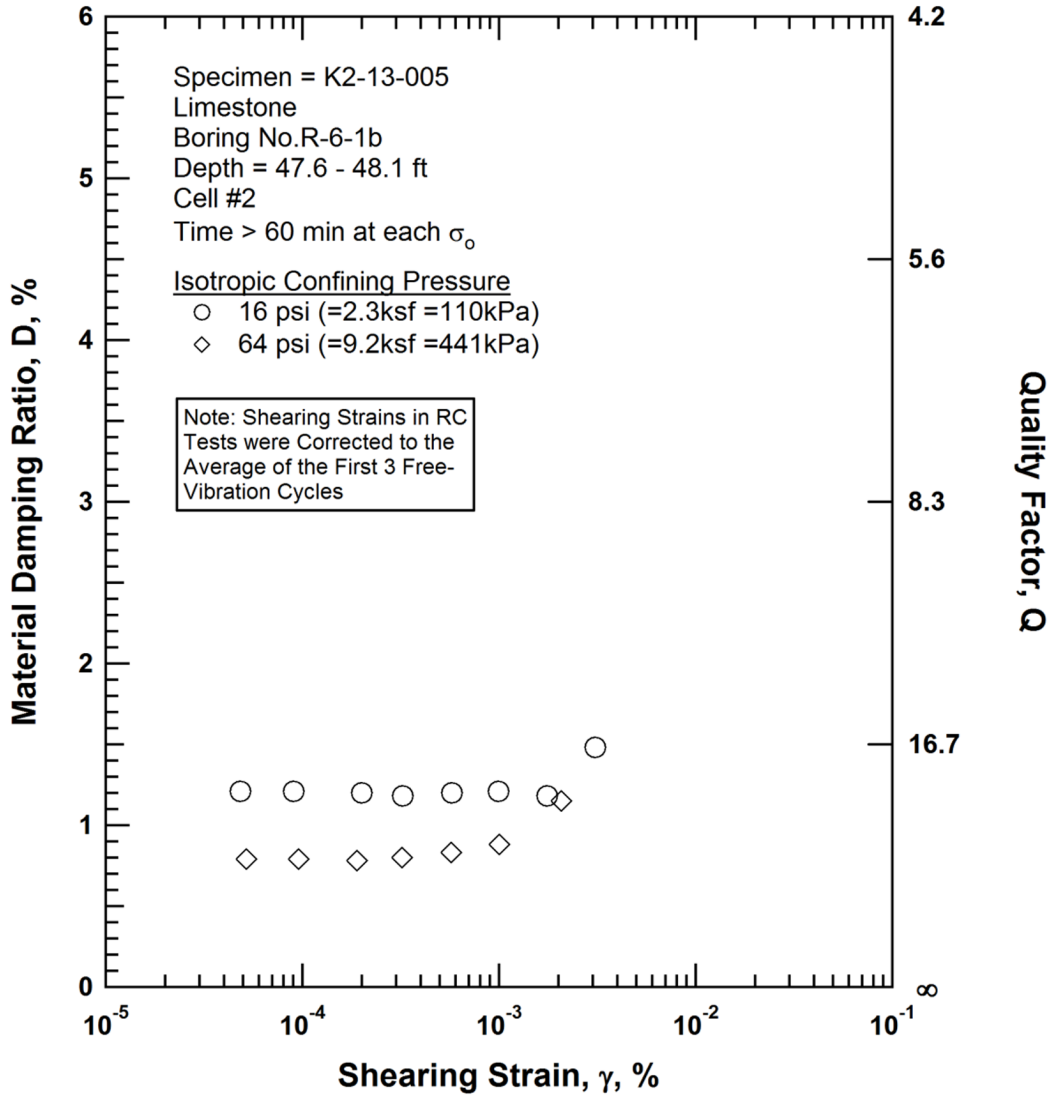


Figure F.12 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests of Specimen K2-13-005

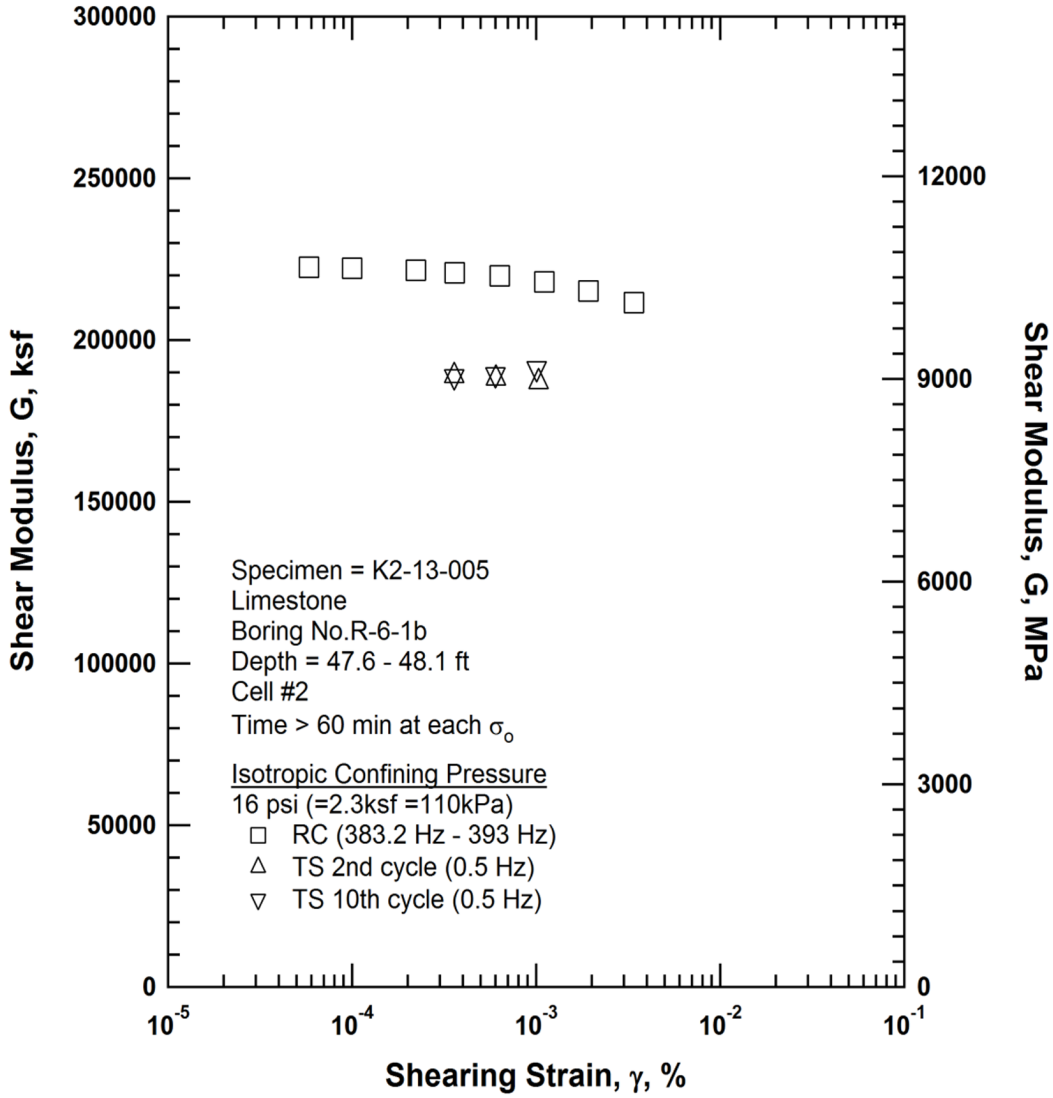


Figure F.13 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 16 psi (=2.3ksf =110kPa) from the Combined RCTS Tests of Specimen K2-13-005

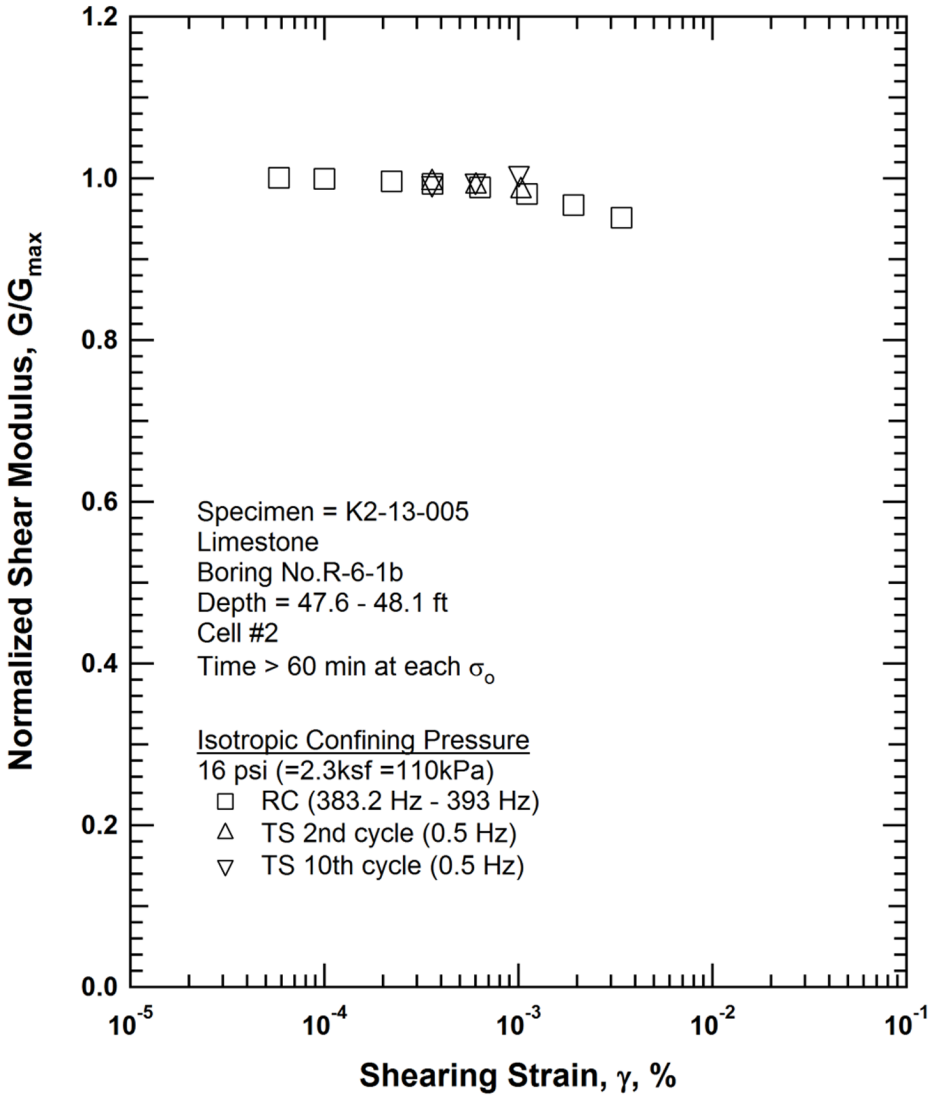


Figure F.14 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 16 psi (=2.3ksf =110kPa) from the Combined RCTS Tests of Specimen K2-13-005

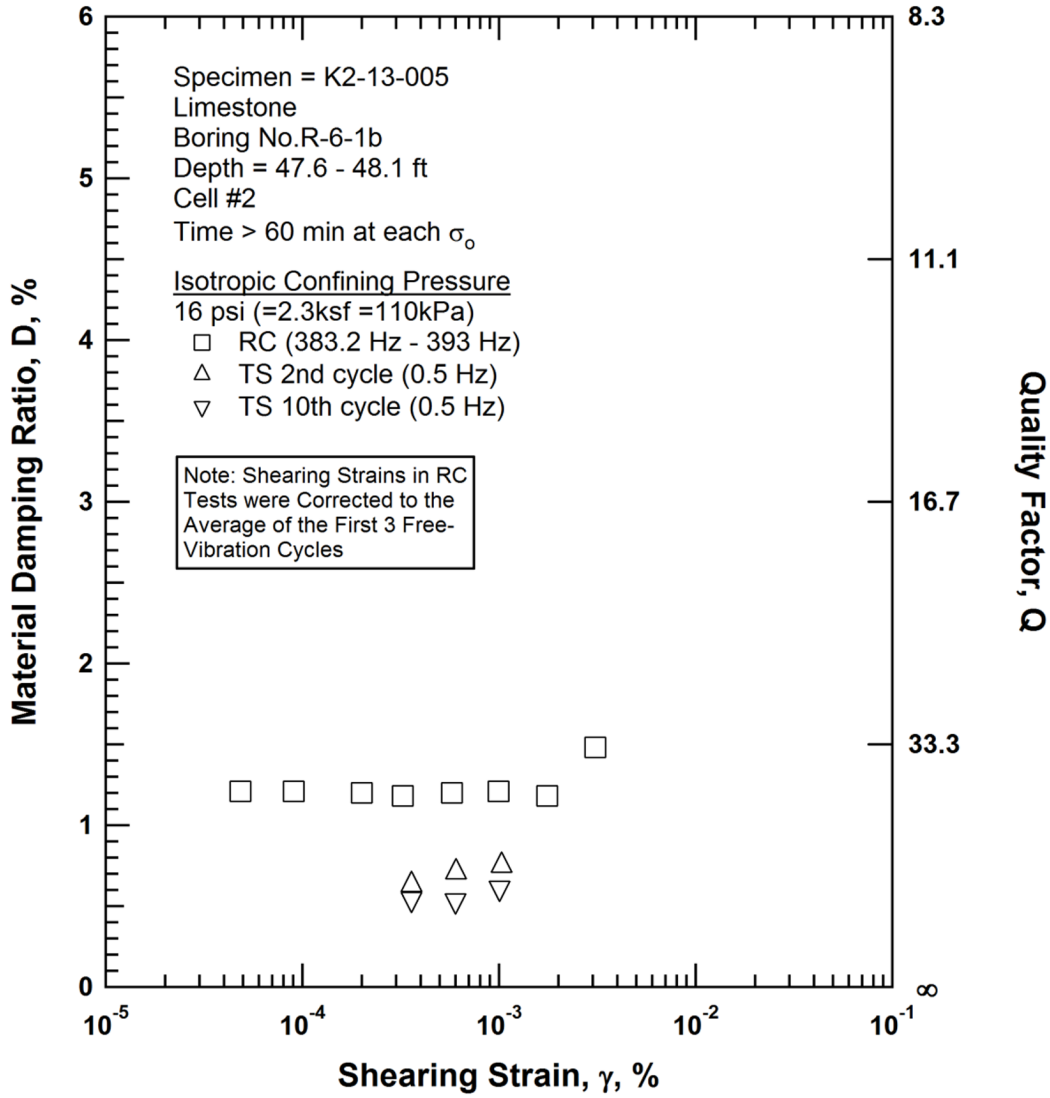


Figure F.15 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 16 psi (=2.3ksf =110kPa) from the Combined RCTS Tests of Specimen K2-13-005

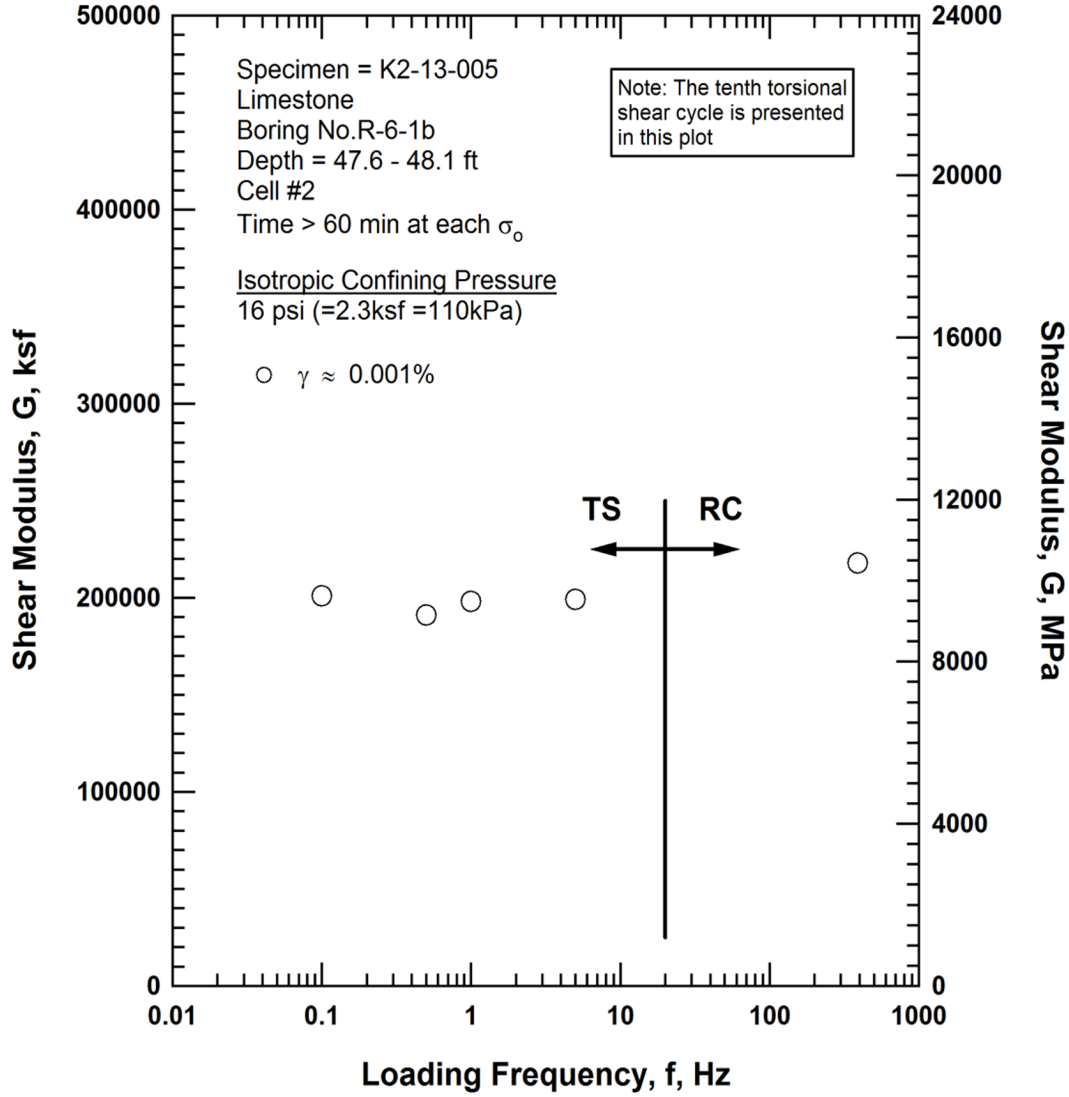


Figure F.16 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 16 psi (=2.3ksf =110kPa) from the Combined RCTS Tests of Specimen K2-13-005

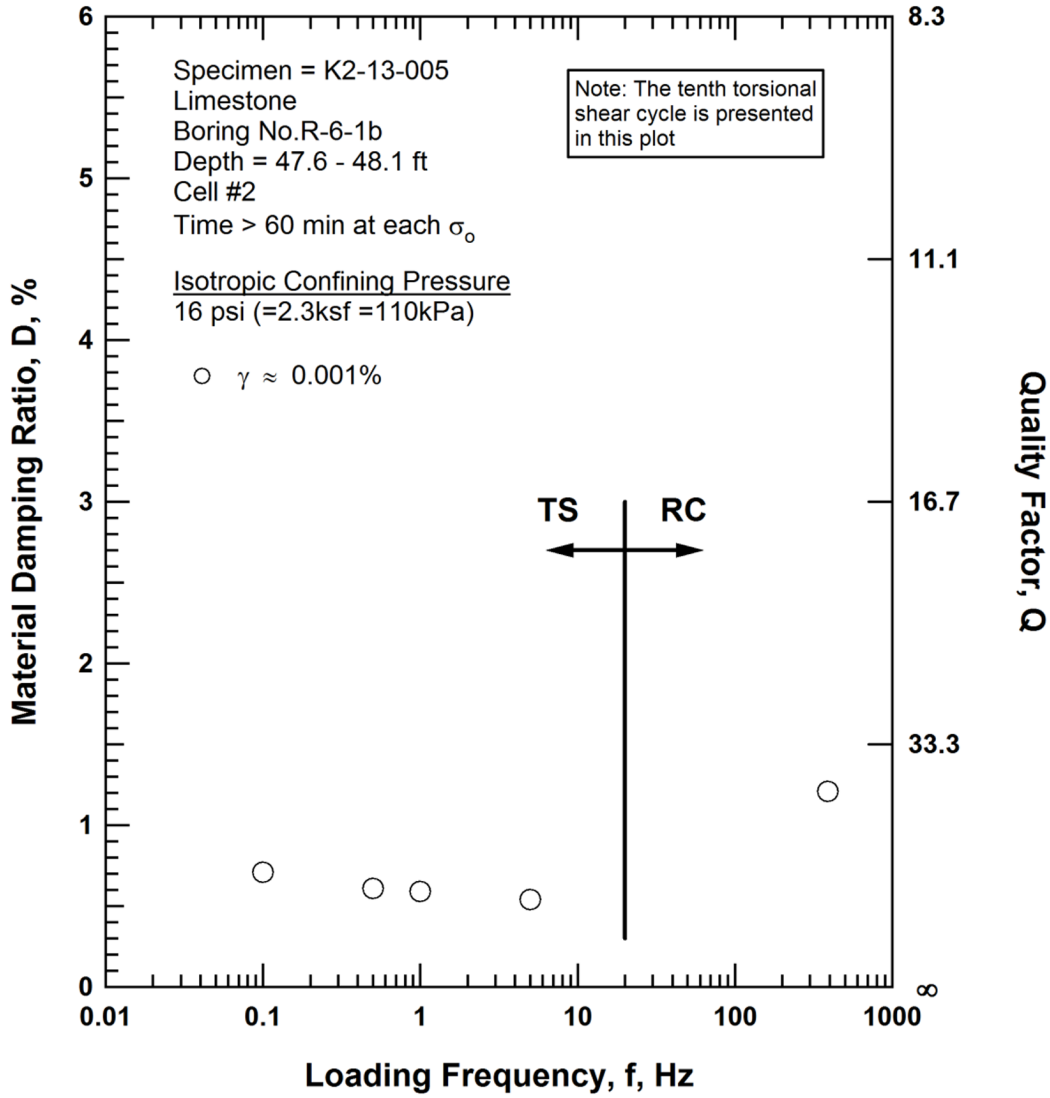


Figure F.17 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 16 psi (=2.3ksf =110kPa) from the Combined RCTS Tests of Specimen K2-13-005

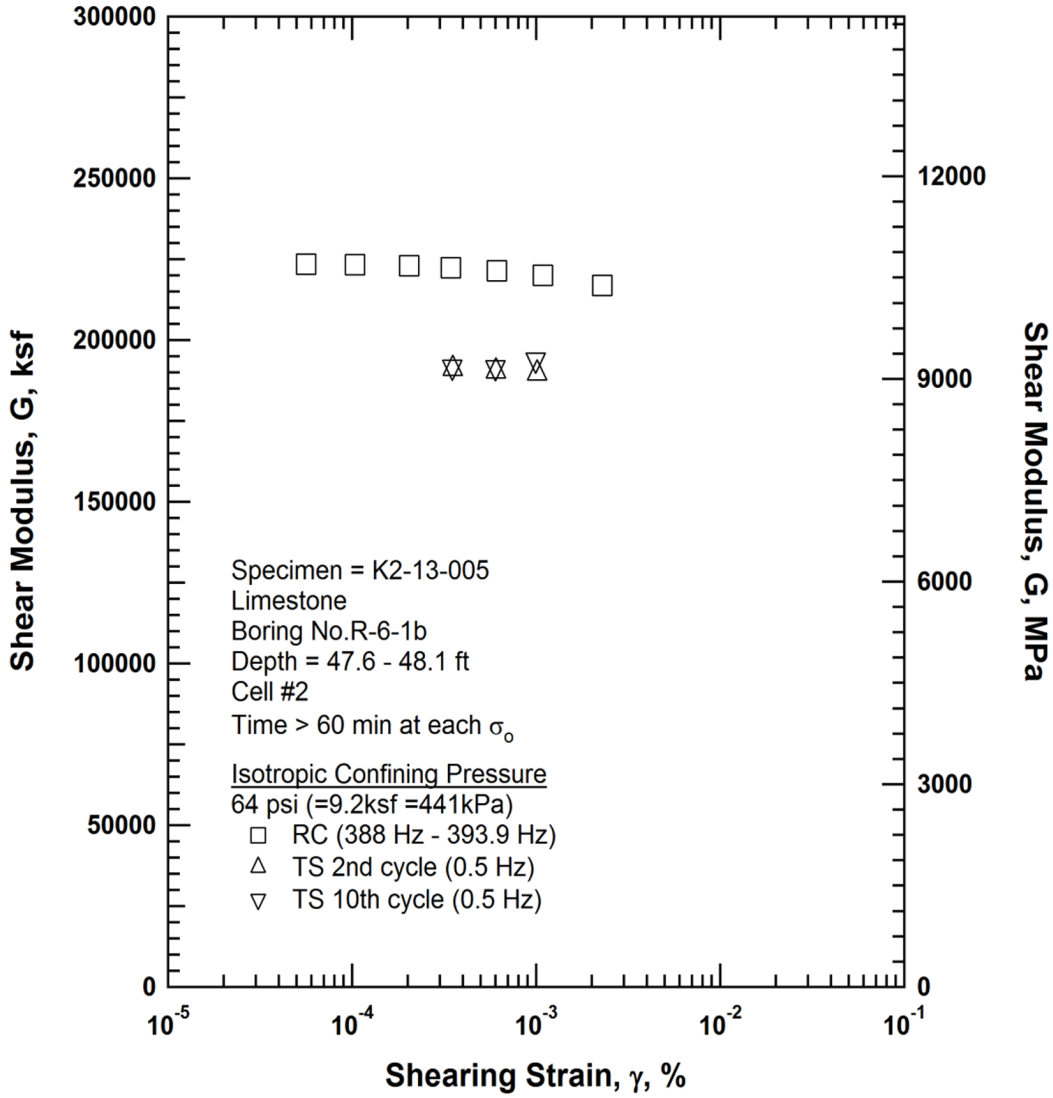


Figure F.18 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 64 psi (=9.2ksf =441kPa) from the Combined RCTS Tests of Specimen K2-13-005

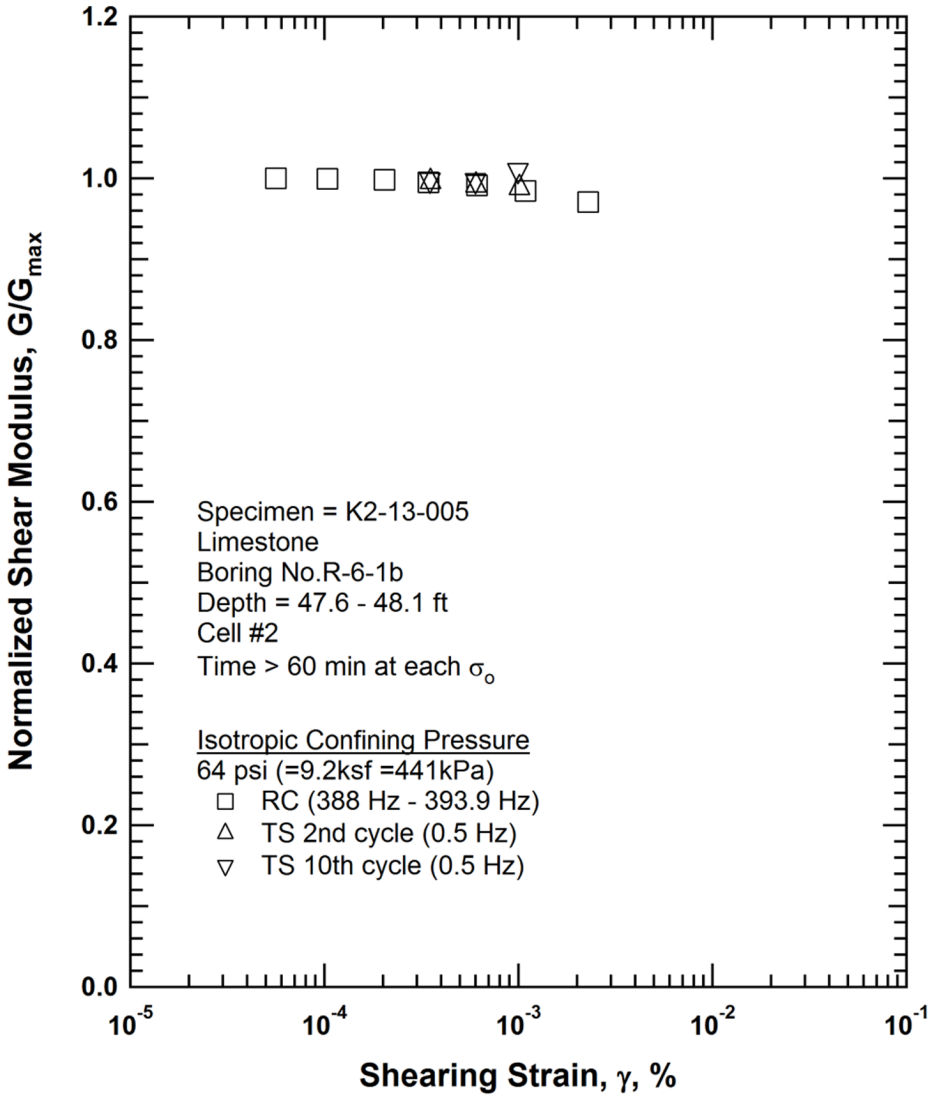


Figure F.19 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 64 psi (=9.2ksf =441kPa) from the Combined RCTS Tests of Specimen K2-13-005

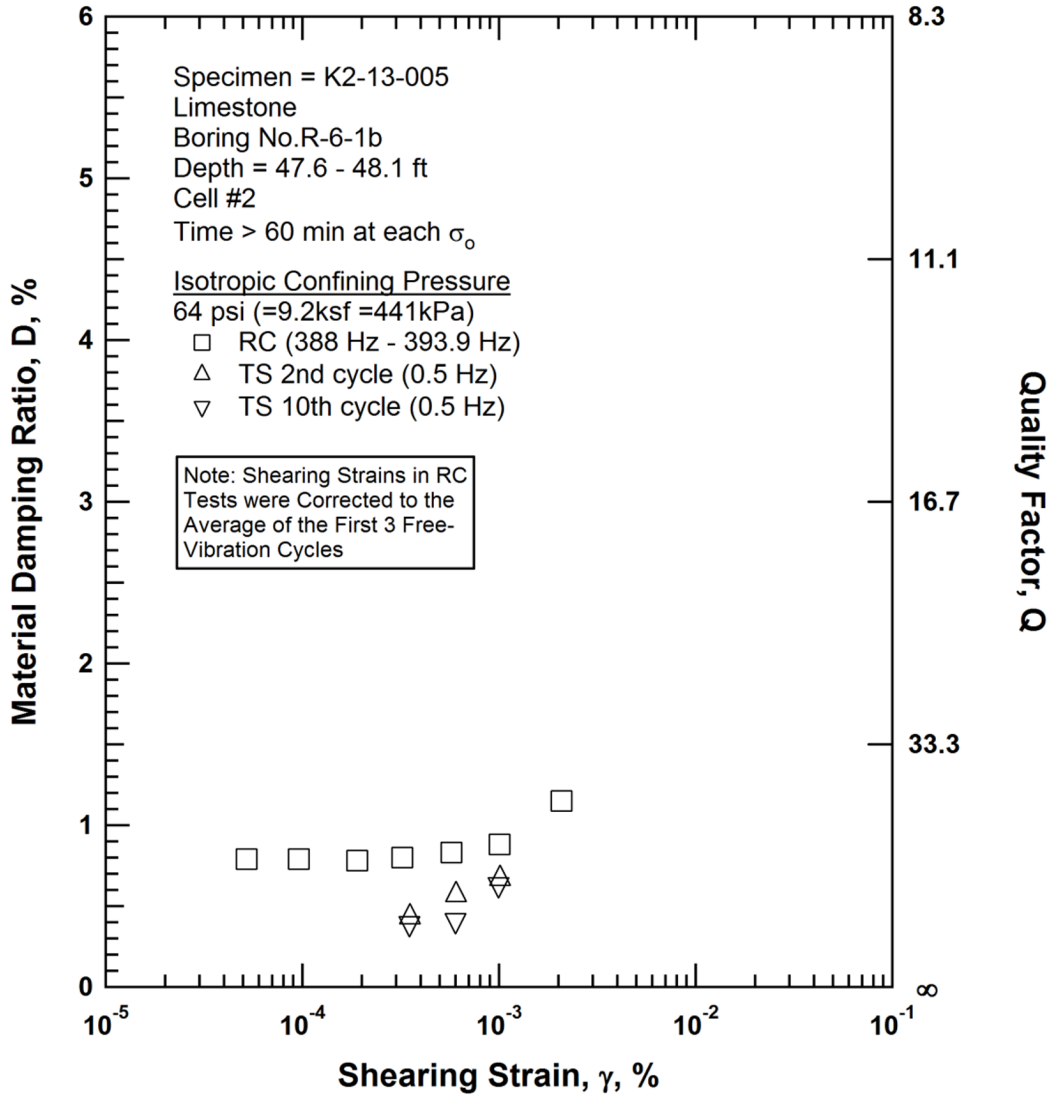


Figure F.20 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 64 psi (=9.2ksf =441kPa) from the Combined RCTS Tests of Specimen K2-13-005

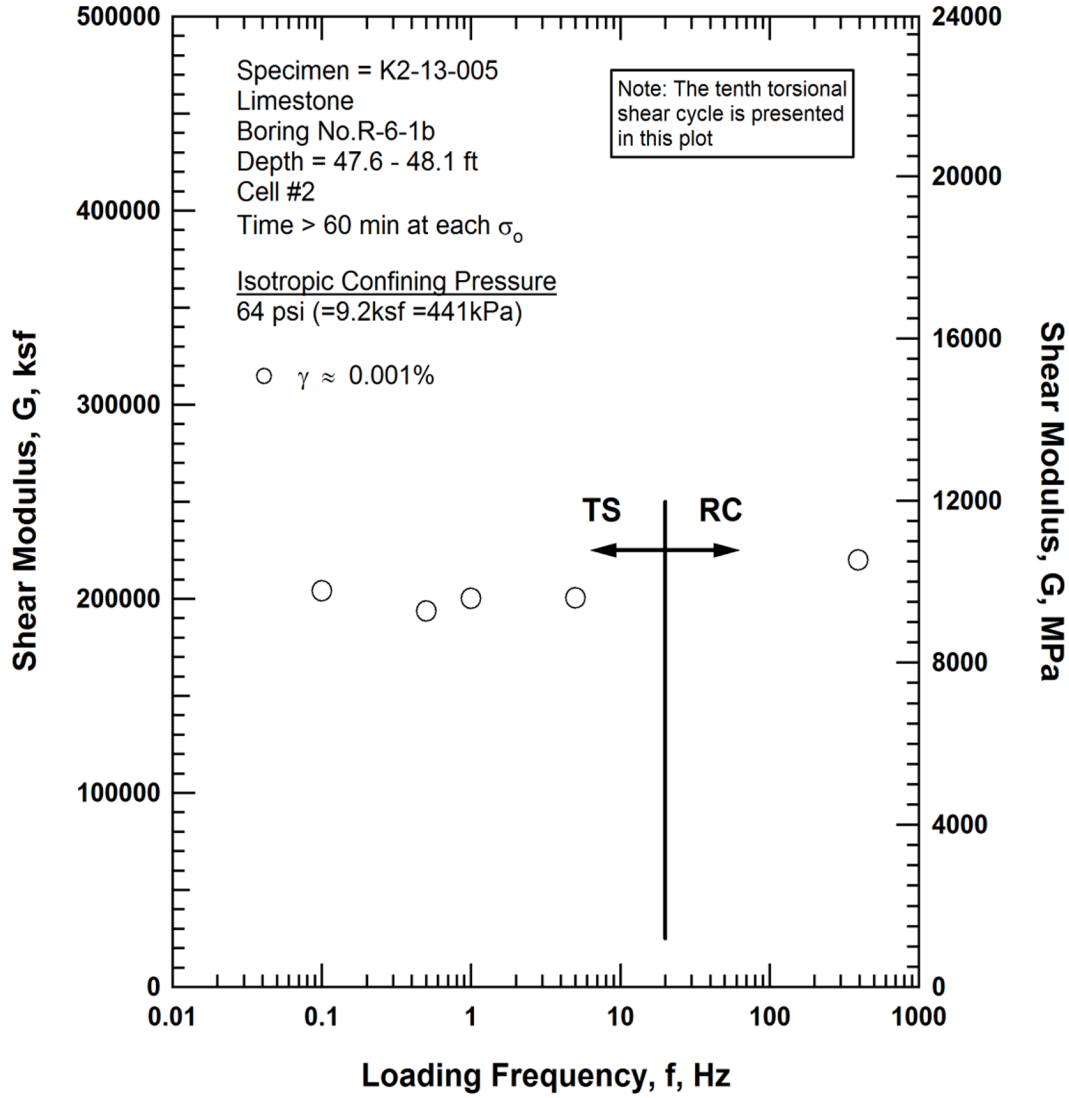


Figure F.21 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 64 psi (=9.2ksf =441kPa) from the Combined RCTS Tests of Specimen K2-13-005

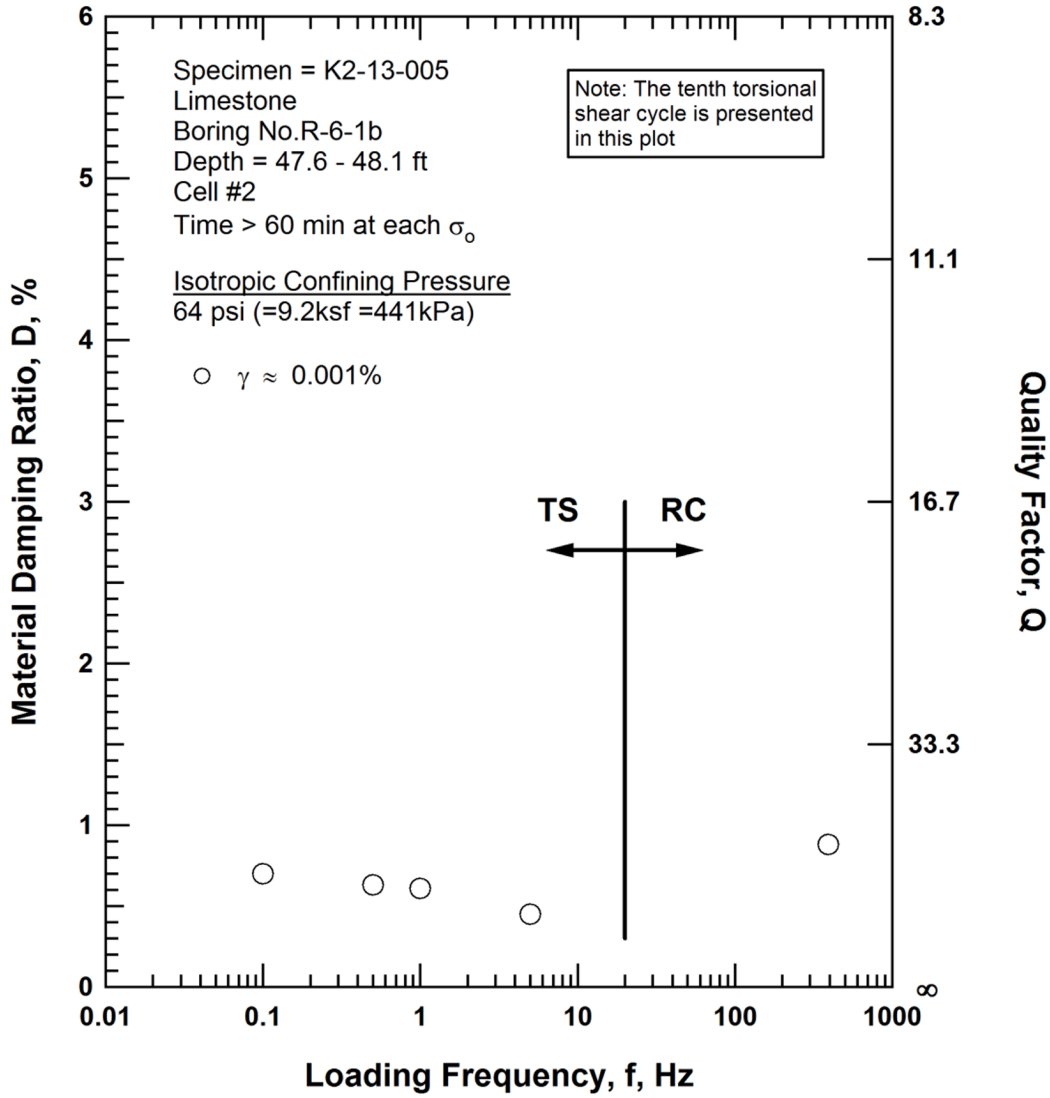


Figure F.22 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 64 psi (=9.2ksf =441kPa) from the Combined RCTS Tests of Specimen K2-13-005

Table F.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio, Estimated Void Ratio, and Estimated Total Unit Weight with Isotropic Confining Pressure from RC Tests of Specimen K2-13-005

| Isotropic Confining Pressure, $\sigma_o$ | | | Low-Amplitude Shear Modulus, $G_{max}$ | | Low-Amplitude Shear Wave Velocity, $V_s$ | Low-Amplitude Material Damping Ratio, $D_{min}$ | Estimated Void Ratio, e | Estimated Total Unit Weight, $\gamma_t$ |
|---|---|---|---|---|---|---|---|---|
| (psi) | (psf) | (kPa) | (ksf) | (MPa) | (fps) | (%) | (Unitless) | (pcf) |
| 4 | 576 | 28 | 217900 | 10433 | 6800 | 0.96 | 0.149 | 151.8 |
| 8 | 1152 | 55 | 221800 | 10621 | 6860 | 1.12 | 0.149 | 151.8 |
| 16 | 2304 | 110 | 222000 | 10627 | 6860 | 1.23 | 0.149 | 151.8 |
| 45 | 6480 | 310 | 225600 | 10801 | 6910 | 0.72 | 0.149 | 151.8 |
| 64 | 9216 | 441 | 223900 | 10720 | 6890 | 0.72 | 0.149 | 151.8 |

Table F.2 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen K2-13-005; Isotropic Confining Pressure $\sigma_o$ = 16 psi (=2.3 ksf = 110 kPa)

| Second Cycle | | | | Tenth Cycle | | | |
|---|---|---|---|---|---|---|---|
| Peak Shearing Strain, $\gamma$, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % | Peak Shearing Strain, $\gamma$, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % |
| 3.58E-04 | 188900 | 0.99 | 0.63 | 3.58E-04 | 188700 | 0.99 | 0.54 |
| 6.03E-04 | 188100 | 0.99 | 0.71 | 5.99E-04 | 189300 | 1.00 | 0.53 |
| 1.03E-03 | 187000 | 0.98 | 0.75 | 1.01E-03 | 191100 | 1.01 | 0.61 |

Table F.3 Variation in Shear Modulus, Normalized Shear Modulus, and Material Damping with Shearing Strain from RC Tests of Specimen K2-13-005; Isotropic Confining Pressure $\sigma_o$ = 16 psi (=2.3 ksf = 110 kPa)

| Peak Shearing Strain, $\gamma$, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Average Shearing Strain, %(1) | Material Damping Ratio, D, %(2) |
|---|---|---|---|---|
| 5.84E-05 | 222500 | 1.00 | 4.83E-05 | 1.21 |
| 1.00E-04 | 222200 | 1.00 | 9.03E-05 | 1.21 |
| 2.22E-04 | 221600 | 1.00 | 2.01E-04 | 1.20 |
| 3.61E-04 | 220900 | 0.99 | 3.25E-04 | 1.18 |
| 6.34E-04 | 219900 | 0.99 | 5.76E-04 | 1.20 |
| 1.11E-03 | 218000 | 0.98 | 9.96E-04 | 1.21 |
| 1.92E-03 | 215100 | 0.97 | 1.76E-03 | 1.18 |
| 3.40E-03 | 211500 | 0.95 | 3.09E-03 | 1.48 |

(1) Average Shearing Strain from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

(2) Average Damping Ratio from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

Table F.4 Variation in Shear Modulus and Material Damping with Frequency from RC/TS Tests of Specimen K2-13-005; Isotropic Confining Pressure $\sigma_o$ = 16 psi (=2.3 ksf = 110 kPa)

| Approximate Shearing Strain, $\gamma$, % | Frequency, Hz | Shear Modulus, G, ksf | Material Damping Ratio, D, % |
|---|---|---|---|
| 0.001 | 0.1 | 201100 | 0.71 |
| | 0.5 | 191100 | 0.61 |
| | 1.0 | 198100 | 0.59 |
| | 5.0 | 199100 | 0.54 |
| | 389.0 | 218000 | 1.21 |

Table F.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen K2-13-005; Isotropic Confining Pressure $\sigma_o$ = 64 psi (=9.2 ksf = 441 kPa)

| Second Cycle | | | | Tenth Cycle | | | |
|---|---|---|---|---|---|---|---|
| Peak Shearing Strain, γ, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % | Peak Shearing Strain, γ, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % |
| 3.51E-04 | 191200 | 1.00 | 0.43 | 3.51E-04 | 191600 | 1.00 | 0.39 |
| 6.03E-04 | 190300 | 0.99 | 0.57 | 6.00E-04 | 191400 | 1.00 | 0.41 |
| 3.51E-04 | 191200 | 1.00 | 0.43 | 3.51E-04 | 191600 | 1.00 | 0.39 |

Table F.6 Variation in Shear Modulus, Normalized Shear Modulus, and Material Damping with Shearing Strain from RC Tests of Specimen K2-13-005; Isotropic Confining Pressure $\sigma_o$ = 64 psi (=9.2 ksf = 441 kPa)

| Peak Shearing Strain, γ, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Average Shearing Strain, %(1) | Material Damping Ratio, D, %(2) |
|---|---|---|---|---|
| 5.63E-05 | 223400 | 1.00 | 5.20E-05 | 0.79 |
| 1.04E-04 | 223300 | 1.00 | 9.61E-05 | 0.79 |
| 2.05E-04 | 222900 | 1.00 | 1.90E-04 | 0.78 |
| 3.45E-04 | 222300 | 1.00 | 3.21E-04 | 0.80 |
| 6.11E-04 | 221400 | 0.99 | 5.72E-04 | 0.83 |
| 1.09E-03 | 220000 | 0.98 | 1.01E-03 | 0.88 |
| 2.29E-03 | 216800 | 0.97 | 2.08E-03 | 1.15 |

(1) Average Shearing Strain from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

(2) Average Damping Ratio from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

Table F.7 Variation in Shear Modulus and Material Damping with Frequency from RC/TS Tests of Specimen K2-13-005; Isotropic Confining Pressure $\sigma_o$ = 64 psi (=9.2 ksf = 441 kPa)

| Approximate Shearing Strain, γ, % | Frequency, Hz | Shear Modulus, G, ksf | Material Damping Ratio, D, % |
|---|---|---|---|
| 0.001 | 0.1 | 204300 | 0.7 |
| | 0.5 | 193800 | 0.63 |
| | 1 | 200300 | 0.61 |
| | 5 | 200600 | 0.45 |
| | 390.8 | 220000 | 0.88 |

# APPENDIX G

Results for Kleinfelder Specimen ID K2-13-006

- *Specimen Preparation Notes*
- *RCTS Testing Results*


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# SPECIMEN PREPARATION NOTES



**Specimen No.:** K2-13-006 **Project No :** 136473 **Page** 1 **of** 3

**Boring No.:** R-6-1b **Date of Preparation..:** 11/7/13

**Sample No..:** ST-1 **Depth..:** 136.0 – 136.5 feet

## Disposition of Sample

☒ No Apparent Disturbance ☐ Apparent Disturbance ☐ Compacted Sample

☐ Other (Describe)

## Specimen Preparation Notes

| | | | | | |
|---|---|---|---|---|---|
| **Preparation Method :** | Extruded from Shelby Tube with No Trimming | | **Affixation to Platens :** | 2.8-inch diameter platens, no adhesive used | |
| **Ave. Length (in.) :** | 5.5528 | **Ave. Diameter (in.):** | 2.838 | **L/D** | 2.0 |
| **Total Unit Weight (pcf) :** | 119.9 | **Moisture Content (%) :** | 26.7 | **% Saturation (Assume SG = 2.65):** | 91.6 |

## Specimen Testing Comments

1) Sample was extruded from the Shelby Tube directly into a latex membrane for testing on 11/7/13. No trimming of the sample was performed except to square the end.

2) Testing commenced on 11/7/13 and was completed on 11/10/13. The full test sequence was completed, with confining pressures ranging from 11 psi to 183 psi.

☒ **See Attached Photographs**

# SPECIMEN PREPARATION NOTES

**Specimen K2-13-006**



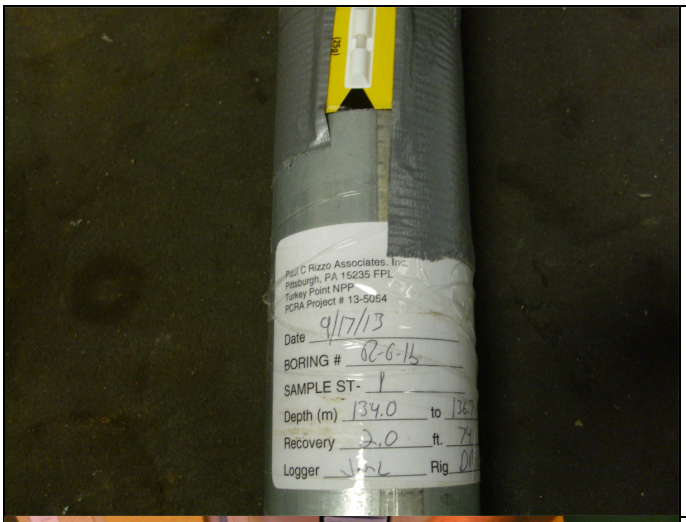


**Photo G.1**

Sample R-6-1b ST-1 after removal from the transport container. Note the shock indicator is untripped.

**Photo G.2**

Sample after subdividing the bottom 7-inches for testing.

**Photo G.3**

Specimen being extruded directly into latex testing membrane.

# SPECIMEN PREPARATION NOTES

**Photo G.4**

Trimming the bottom end of the specimen square before placement on base pedestal.

**Photo G.4**

Specimen after placement on base pedestal and vacuum pressure is applied.

**Kleinfelder Specimen ID:**

# K2-13-006

**Boring No: R-6-1b**
**Sample No: ST-1**

**Silty Sand (SM)**
**Depth = 136.0 ft – 136.5 ft (below existing ground surface)**
**Total Unit Weight = 119.9 lb/ft$^3$**
**Natural Moisture Content = 26.7%**
**Estimated In-Situ Mean Effective Stress = 46 psi**

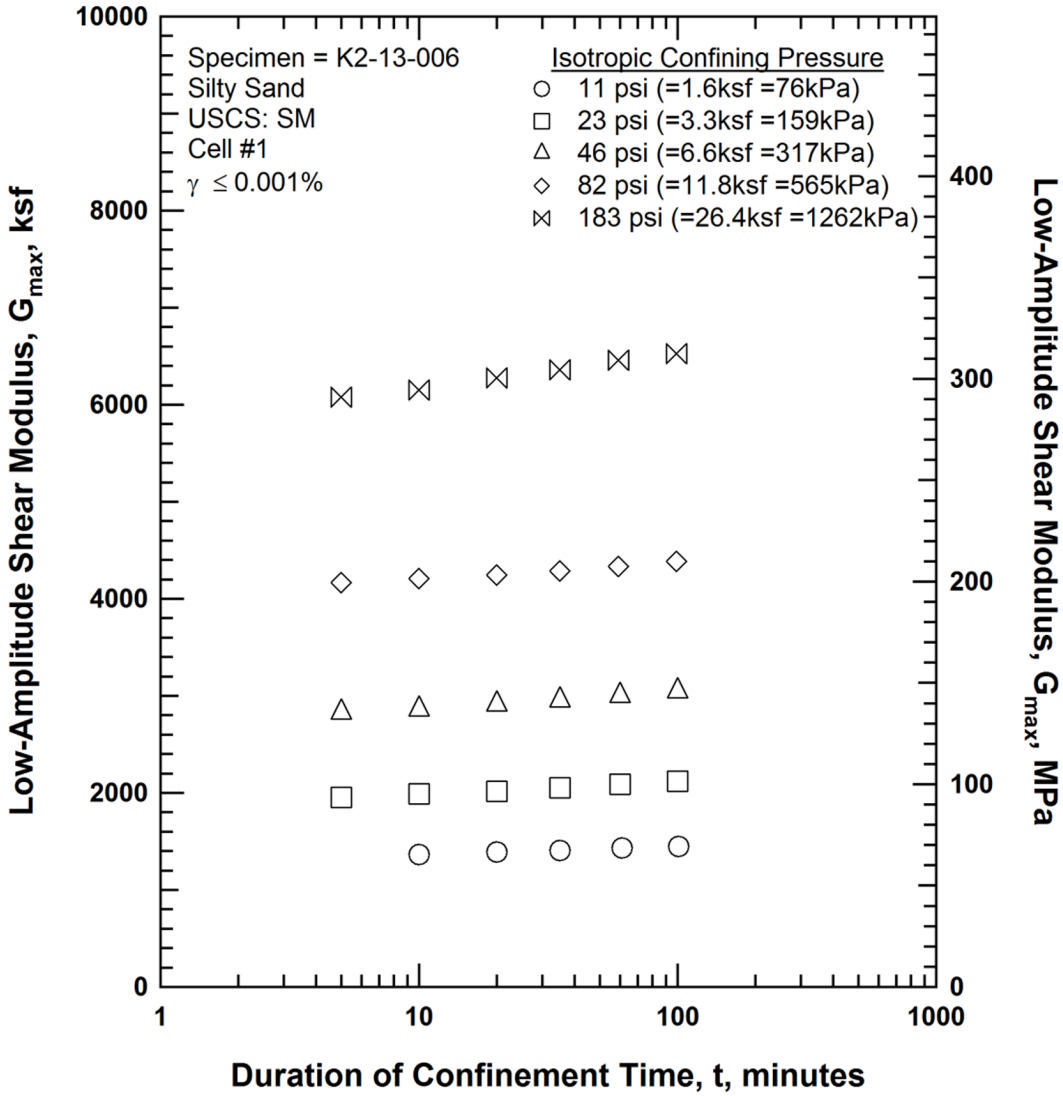


Figure G.1 Variation in Low-Amplitude Shear Modulus with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-006

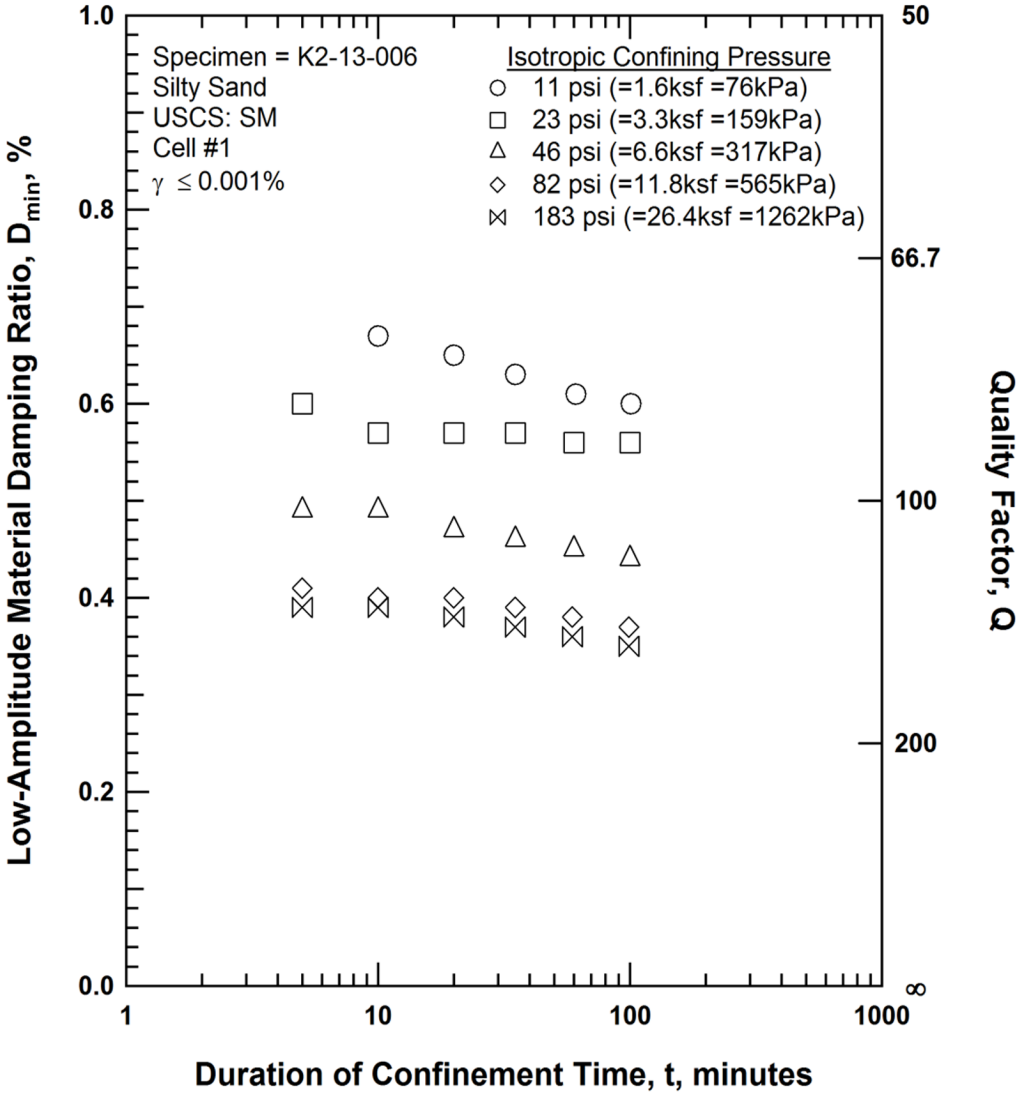


Figure G.2 Variation in Low-Amplitude Material Damping Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-006

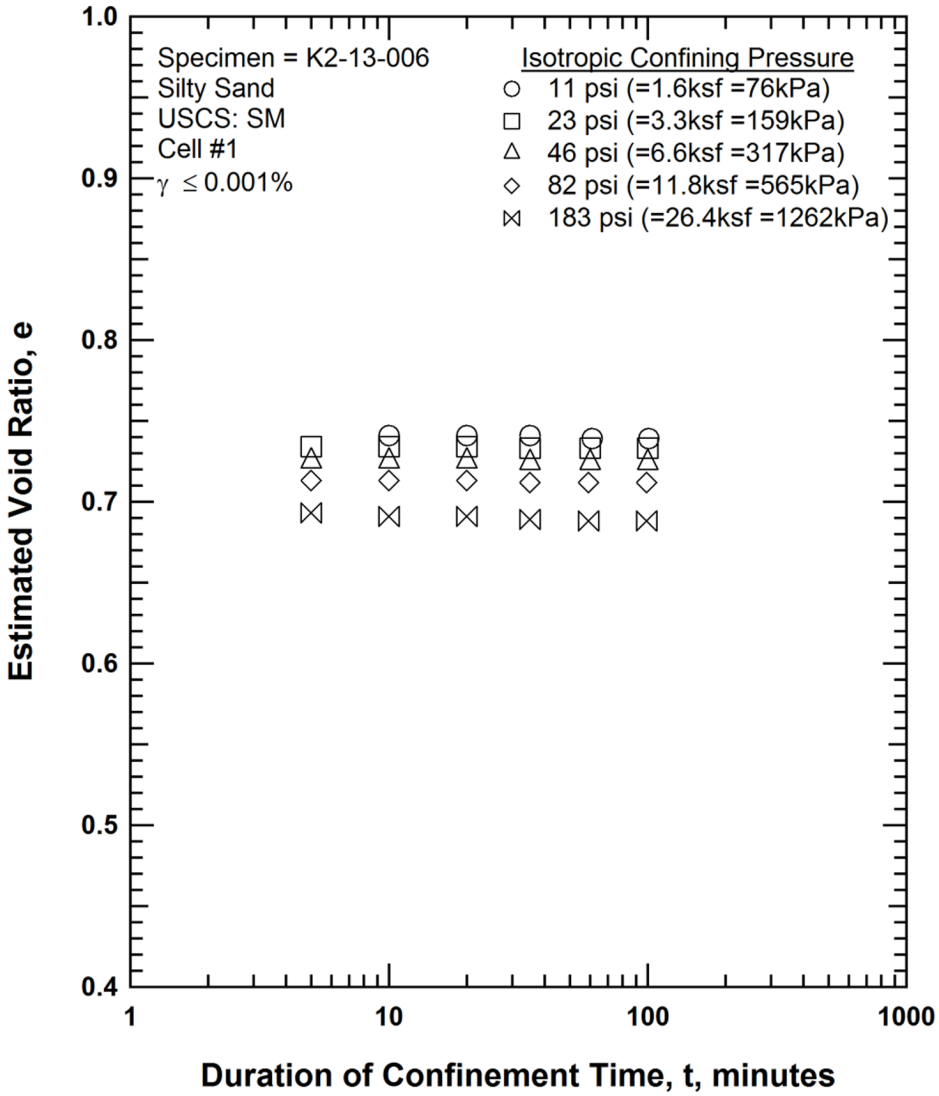


Figure G.3 Variation in Estimated Void Ratio with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Test of Specimen K2-13-006

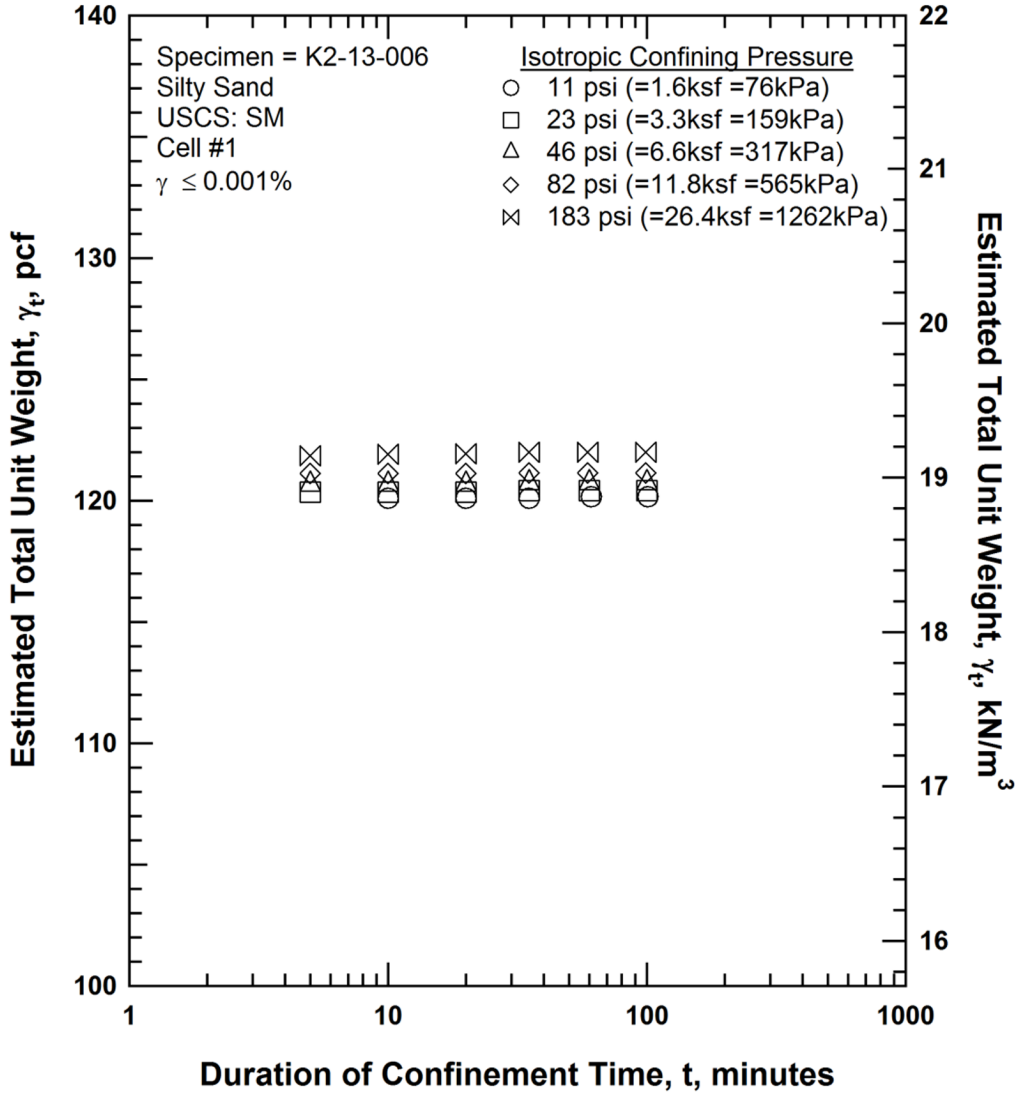


Figure G.4 Variation in Estimated Total Unit Weight with Magnitude and Duration of Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-006

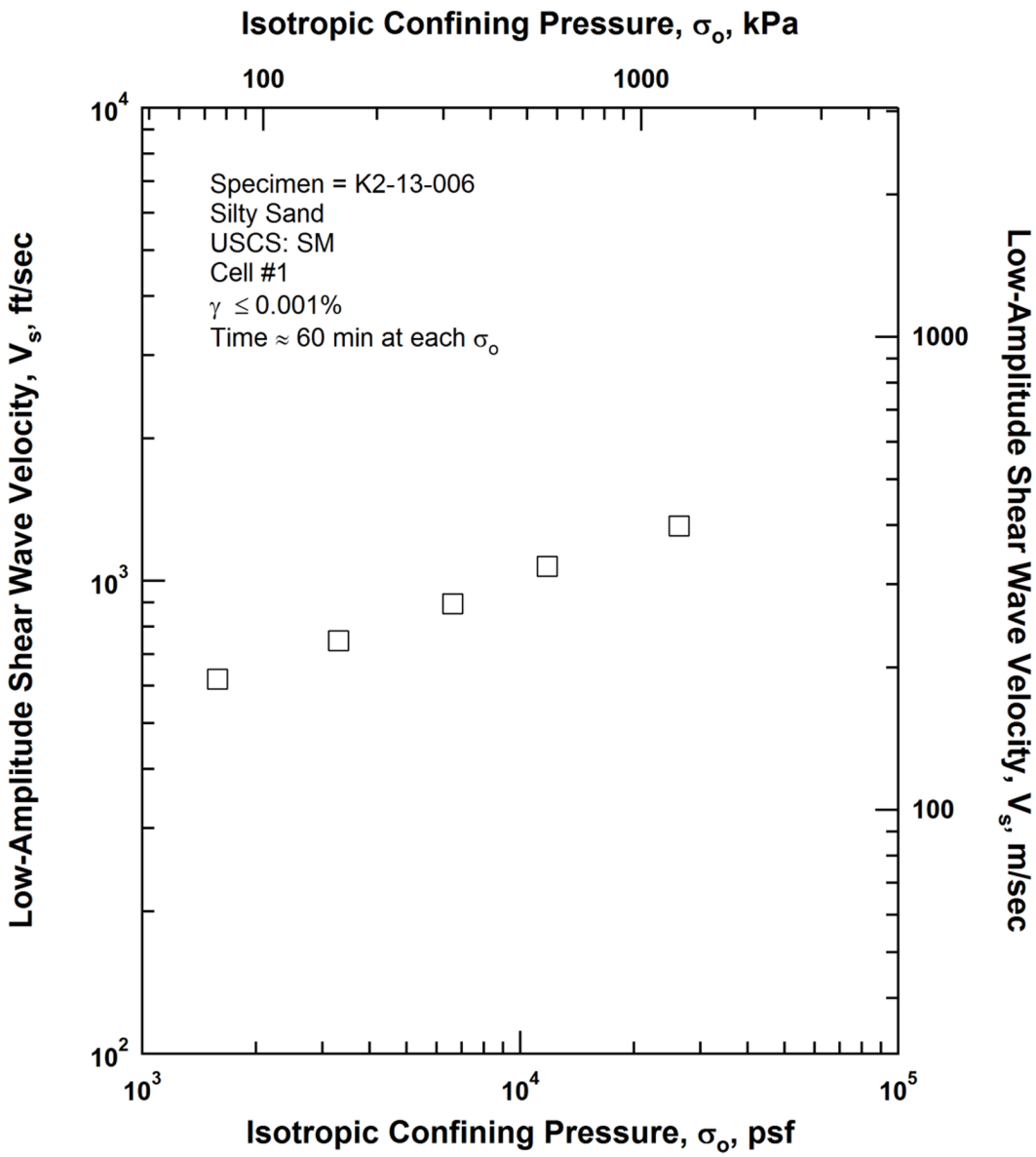


Figure G.5 Variation in Low-Amplitude Shear Wave Velocity with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-006

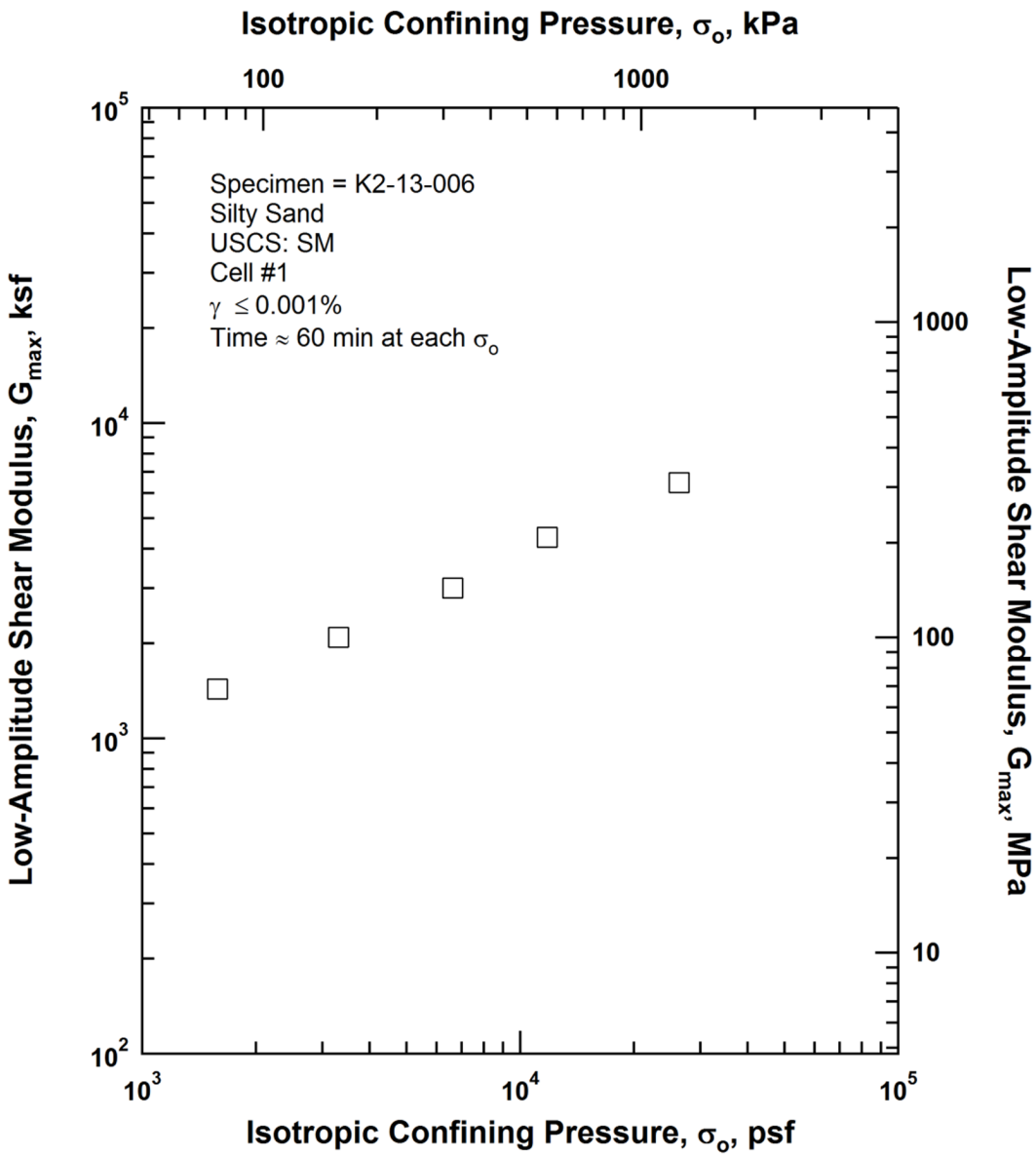


Figure G.6 Variation in Low-Amplitude Shear Modulus with Isotropic Confining Pressure from Resonant Column Test of Specimen K2-13-006

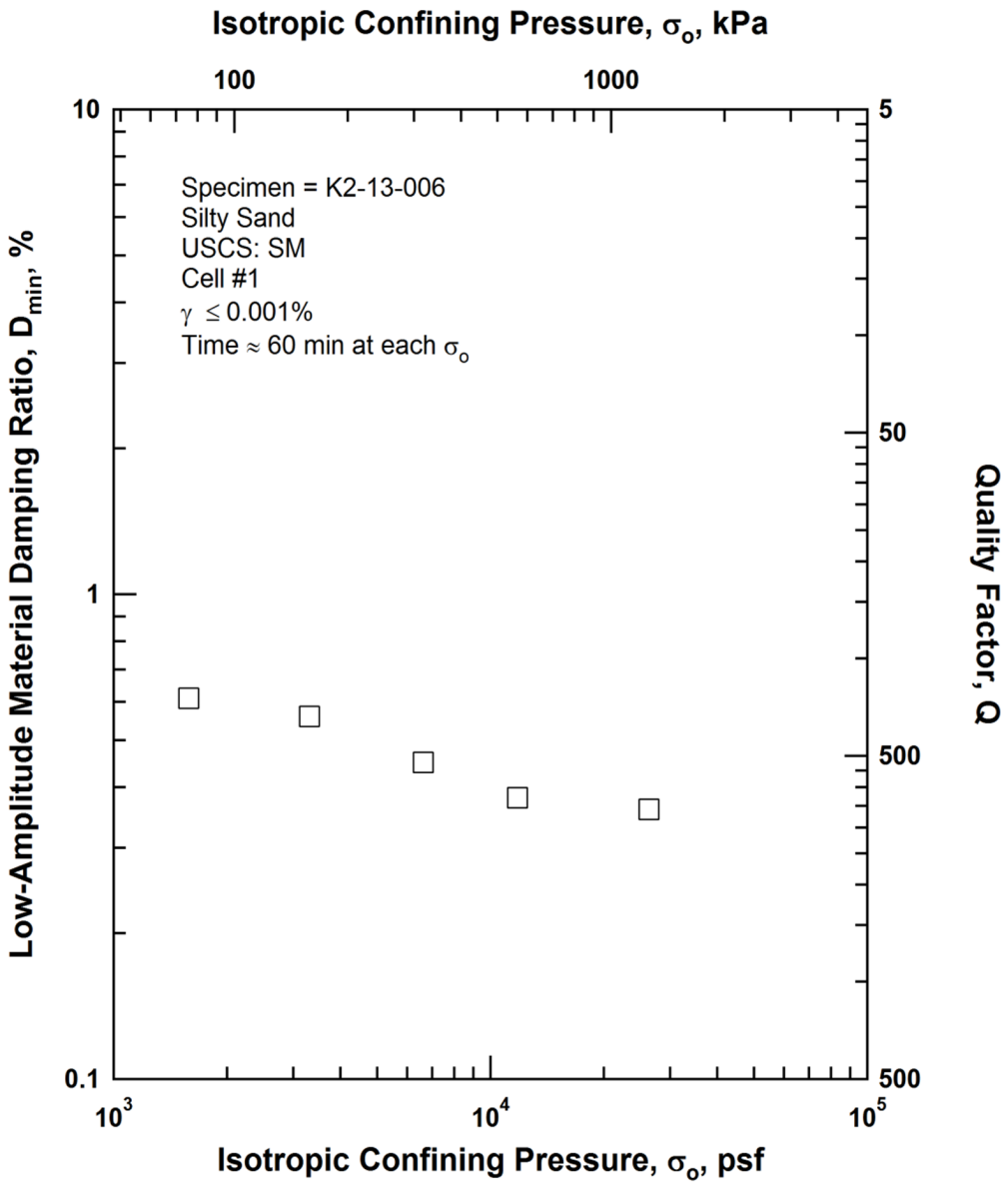


Figure G.7 Variation in Low-Amplitude Material Damping Ratio with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-006

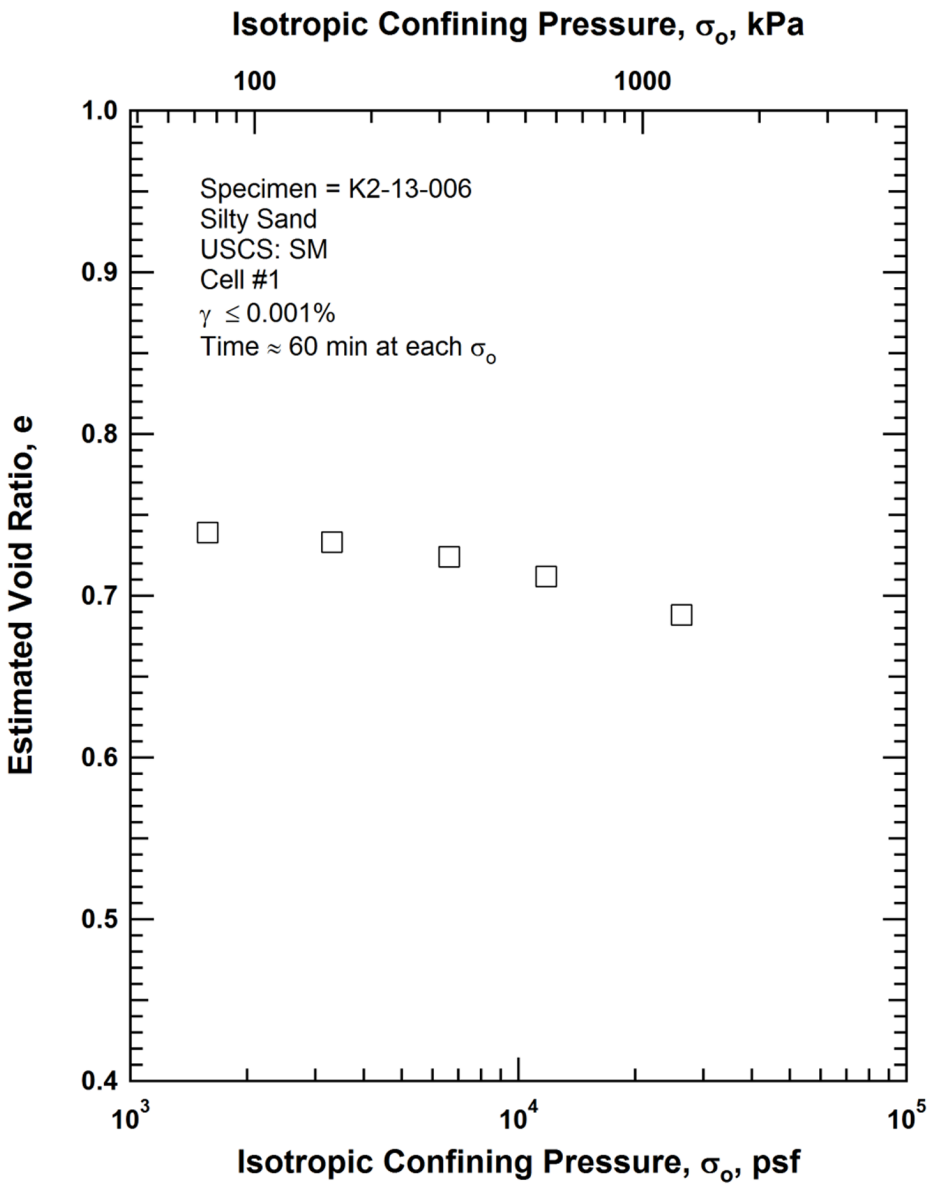


Figure G.8 Variation in Estimated Void Ratio with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-006

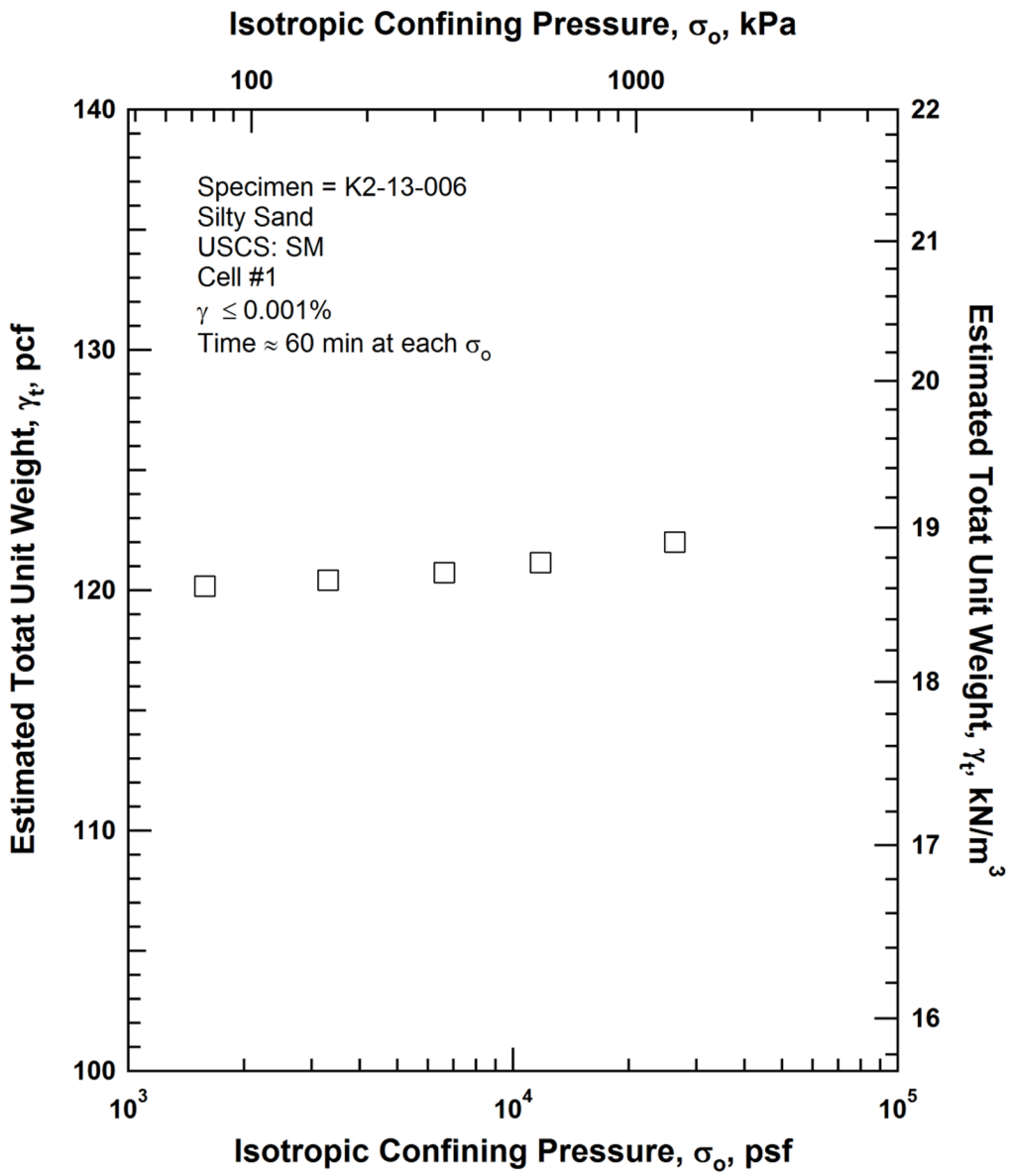


Figure G.9 Variation in Estimated Total Unit Weight with Isotropic Confining Pressure from Resonant Column Tests of Specimen K2-13-006

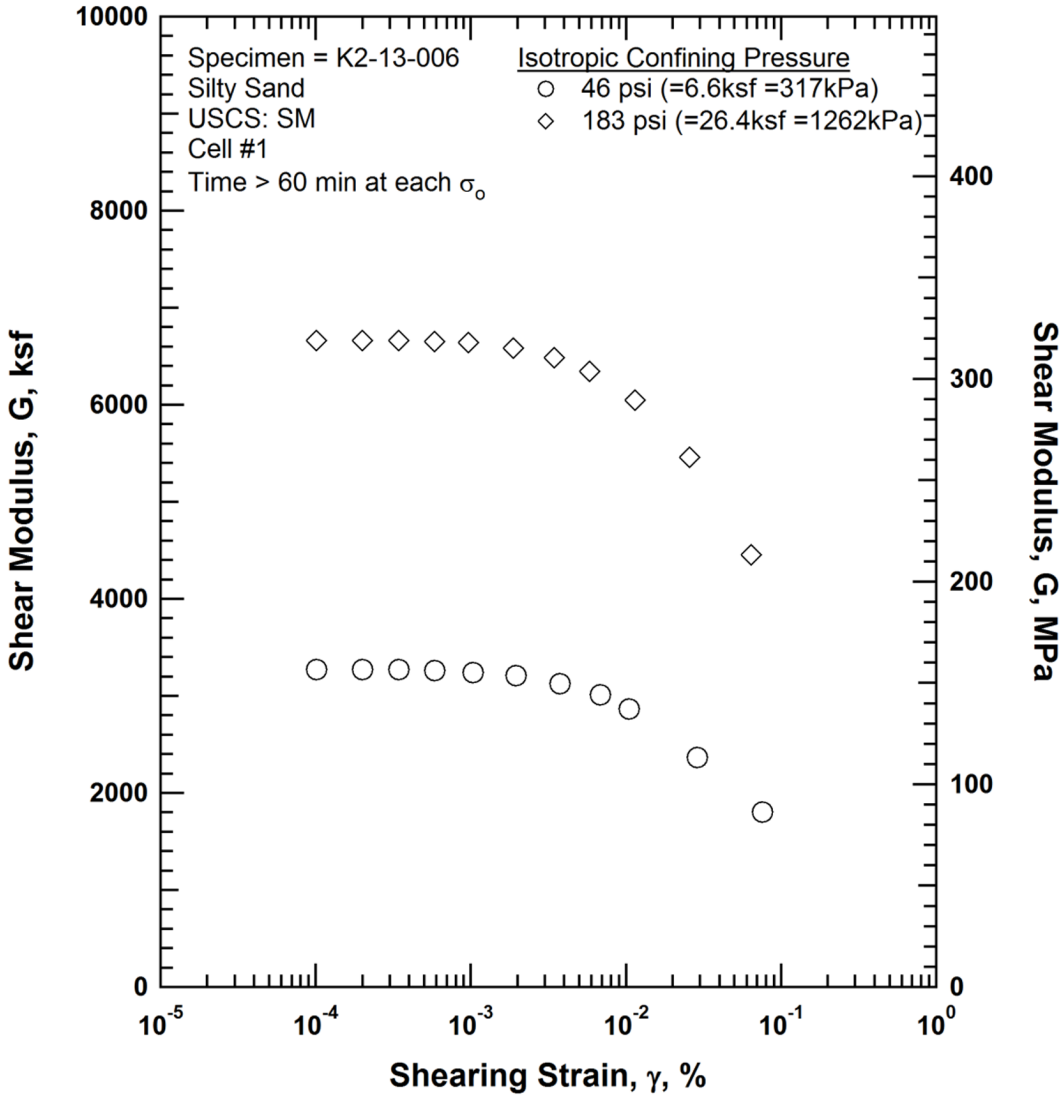


Figure G.10 Comparison of the Variation in Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests of Specimen K2-13-006

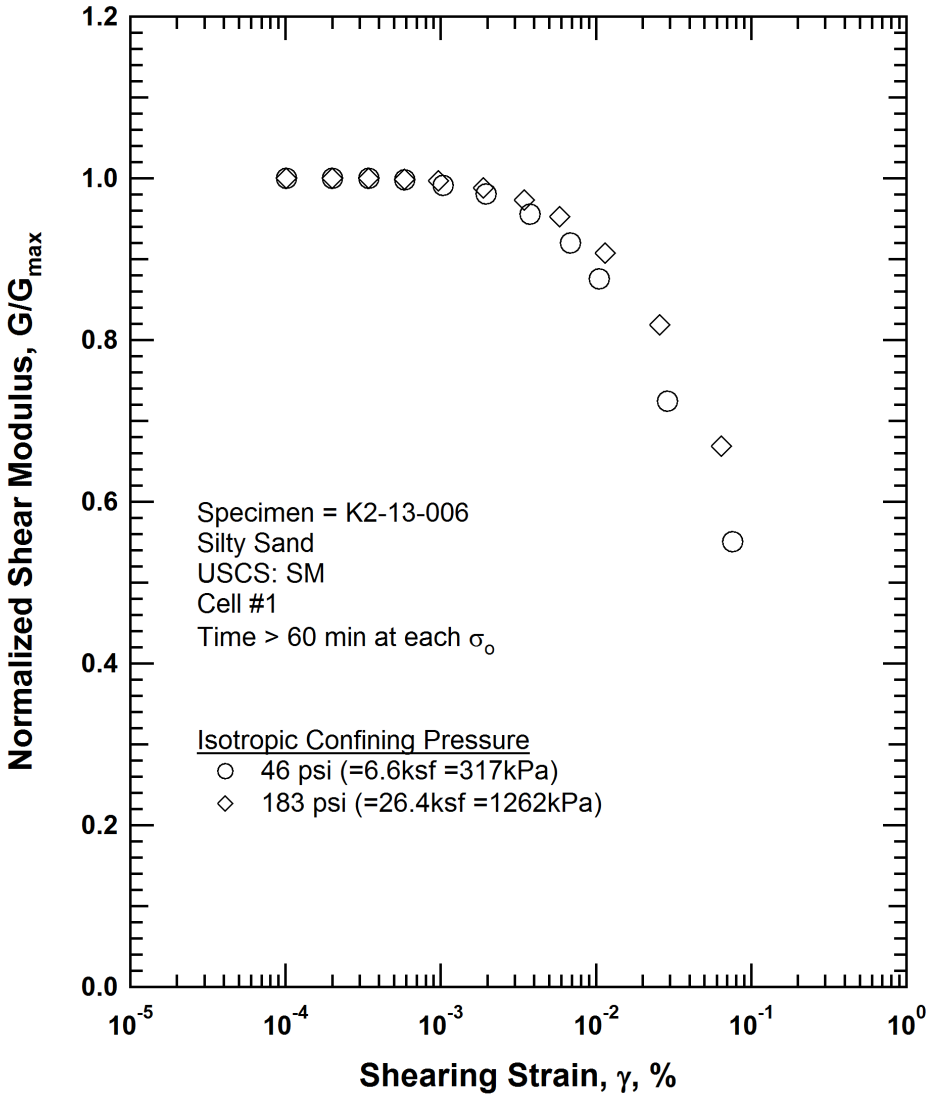


Figure G.11 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests of Specimen K2-13-006

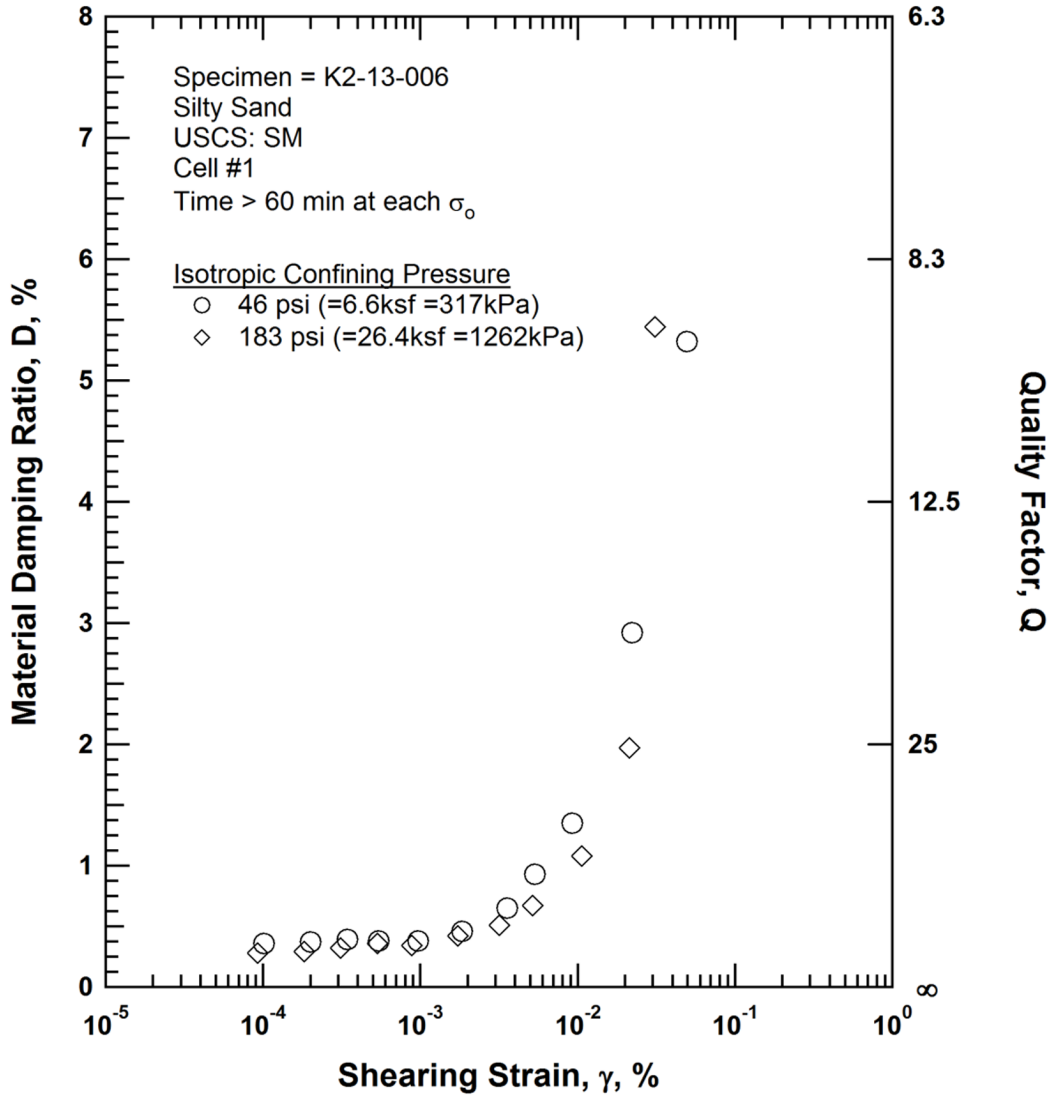


Figure G.12 Comparison of the Variation in Material Damping Ratio with Shearing Strain and Isotropic Confining Pressure from the Resonant Column Tests of Specimen K2-13-006

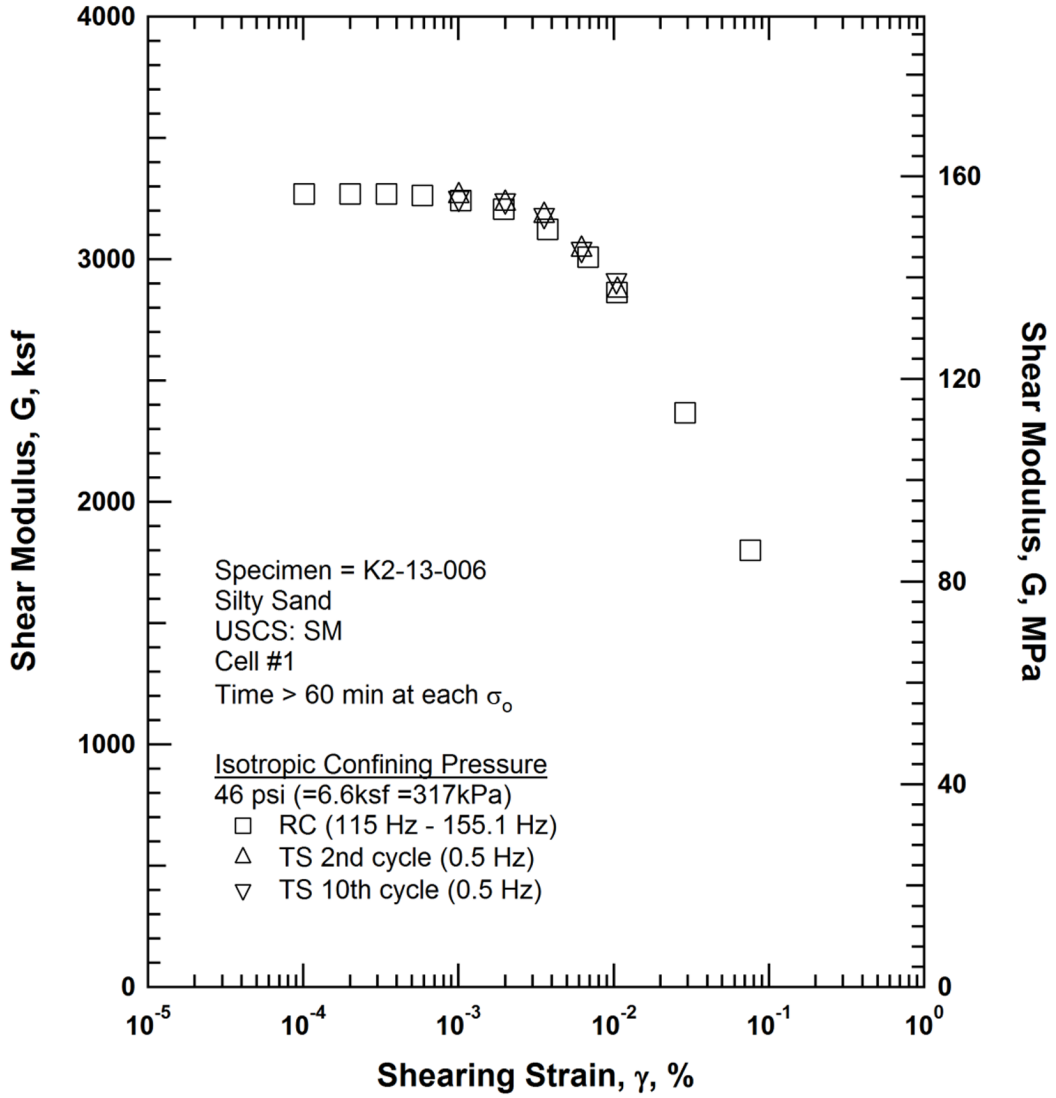


Figure G.13 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 46 psi (=6.6ksf =317kPa) from the Combined RCTS Tests of Specimen K2-13-006

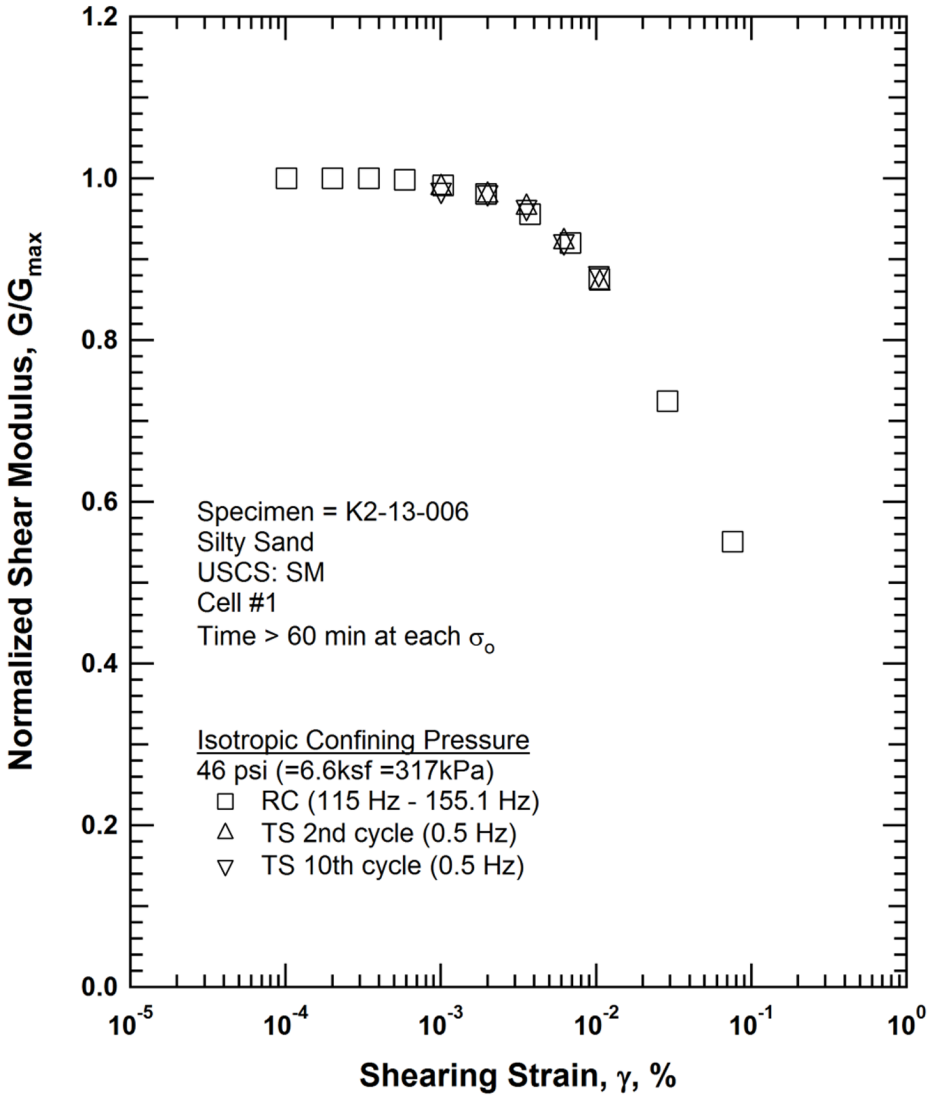


Figure G.14 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 46 psi (=6.6ksf =317kPa) from the Combined RCTS Tests of Specimen K2-13-006

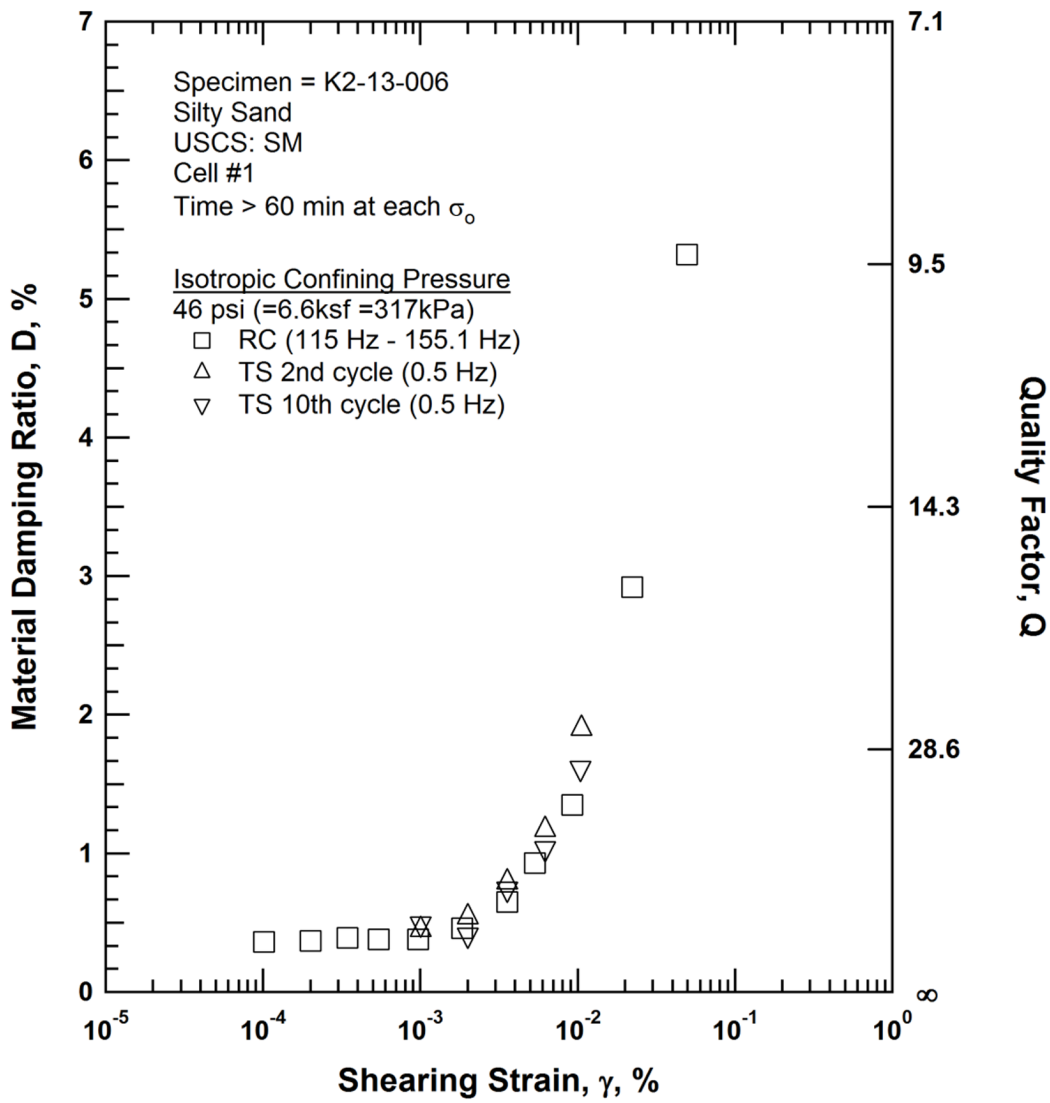


Figure G.15 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 46 psi (=6.6ksf =317kPa) from the Combined RCTS Tests of Specimen K2-13-006

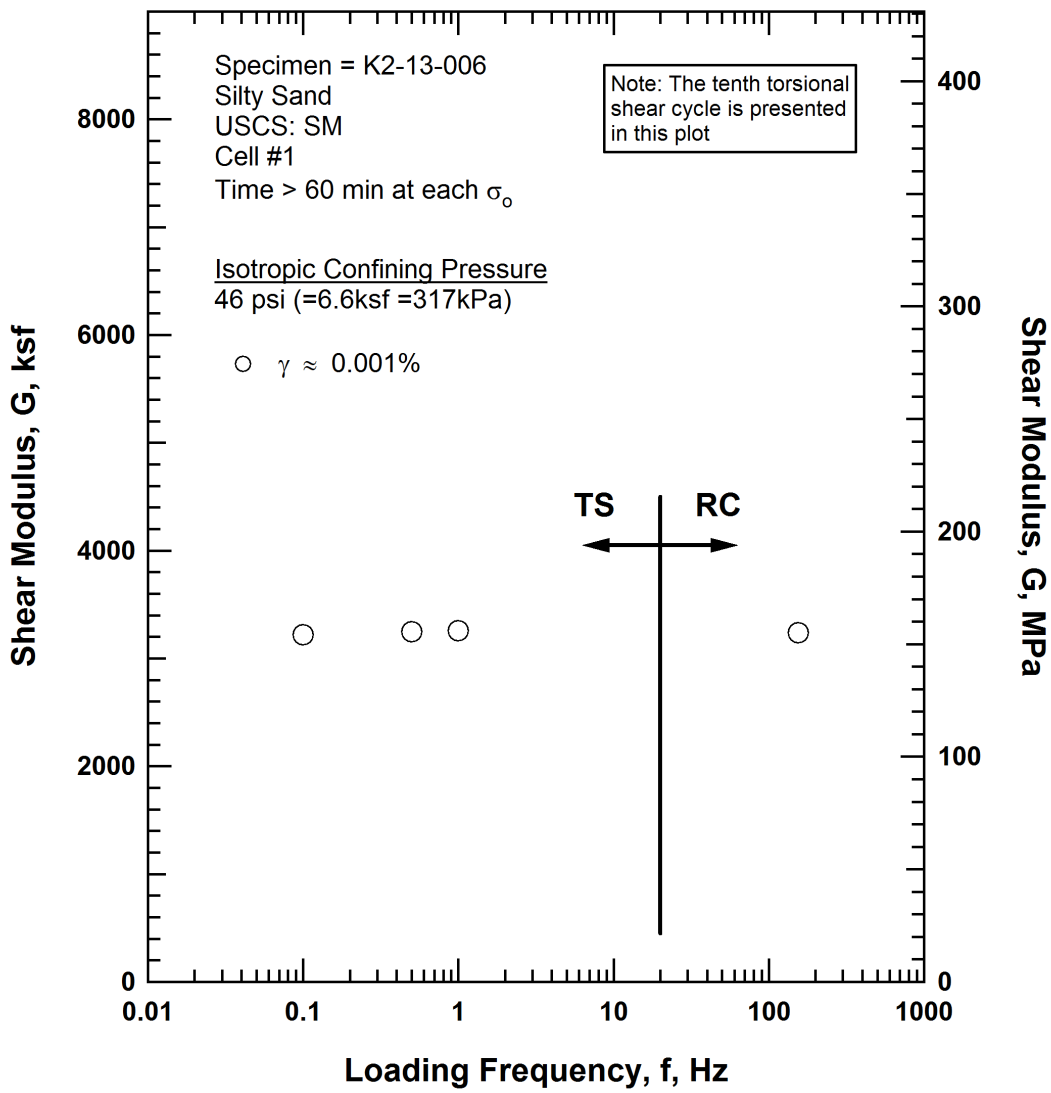


Figure G.16 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 46 psi (=6.6ksf =317kPa) from the Combined RCTS Tests of Specimen K2-13-006

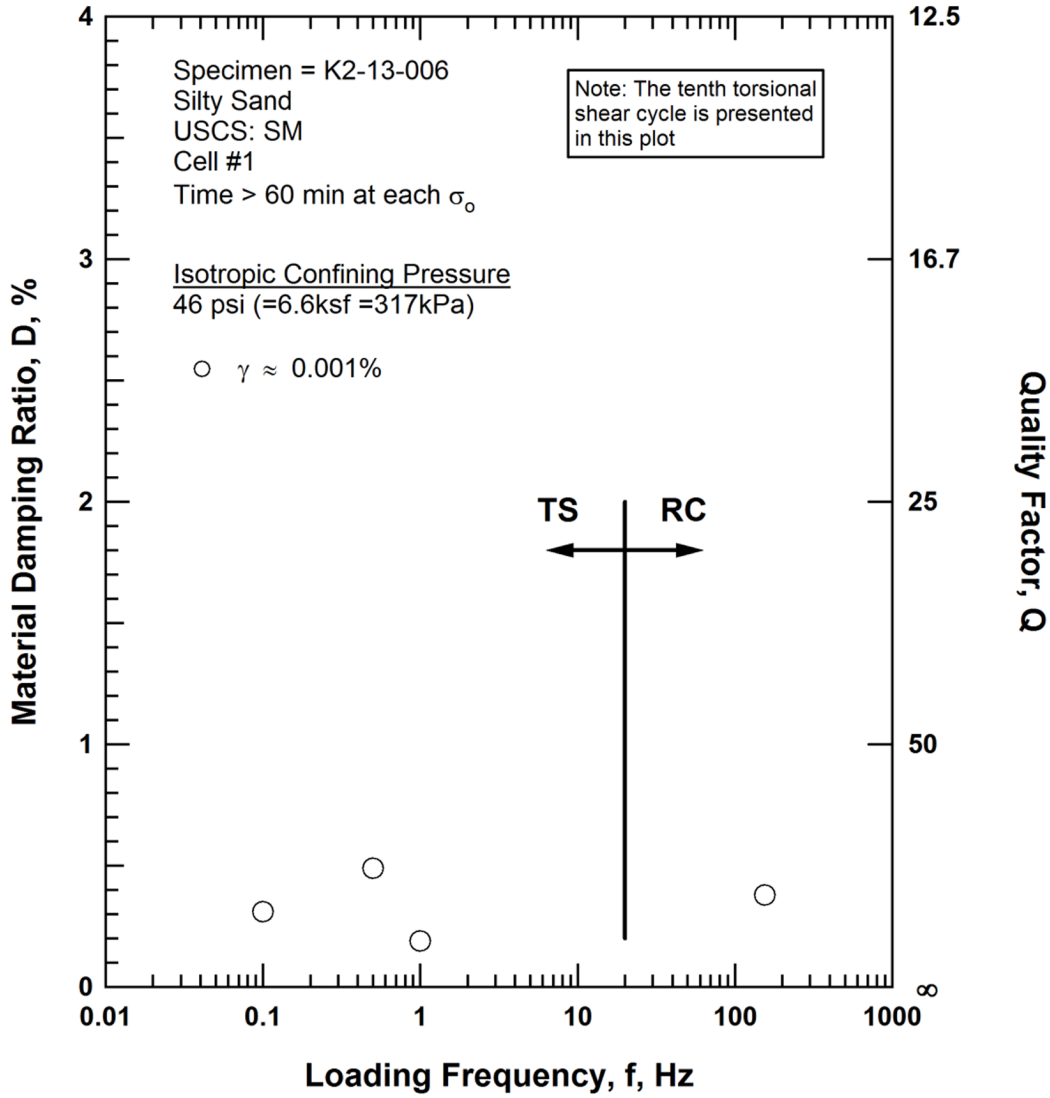


Figure G.17 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 46 psi (=6.6ksf =317kPa) from the Combined RCTS Tests of Specimen K2-13-006

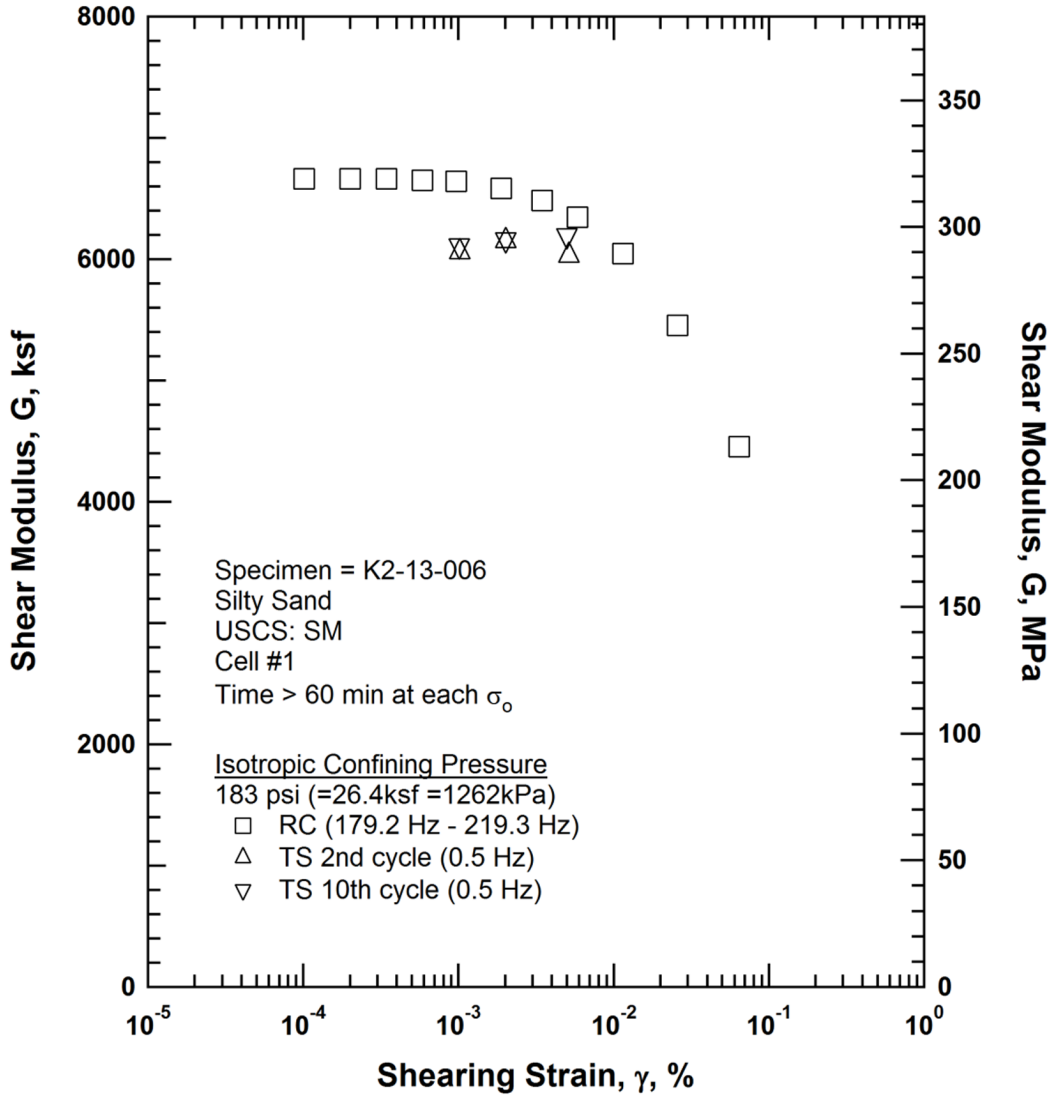


Figure G.18 Comparison of the Variation in Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 183 psi (=26.4ksf =1262kPa) from the Combined RCTS Tests of Specimen K2-13-006

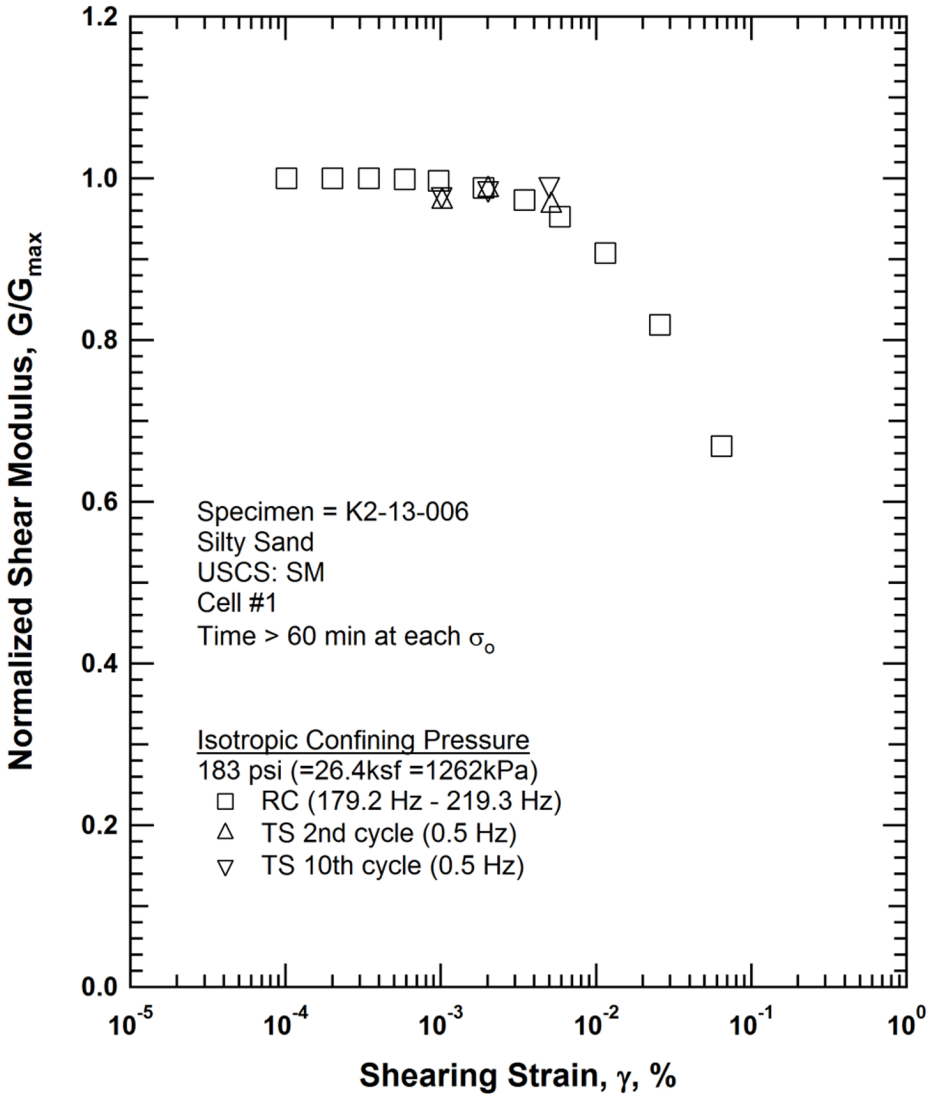


Figure G.19 Comparison of the Variation in Normalized Shear Modulus with Shearing Strain at an Isotropic Confining Pressure of 183 psi (=26.4ksf =1262kPa) from the Combined RCTS Tests of Specimen K2-13-006

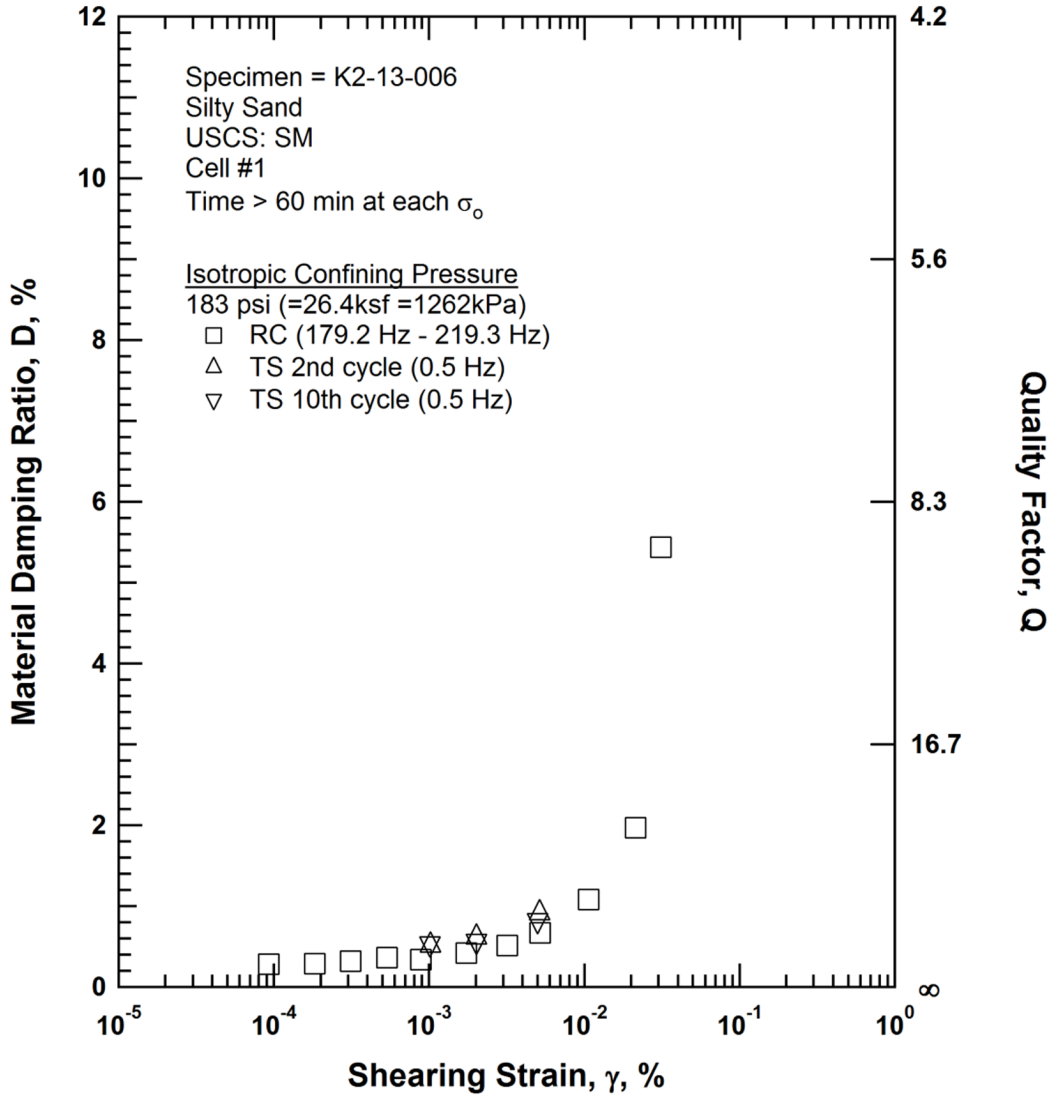


Figure G.20 Comparison of the Variation in Material Damping Ratio with Shearing Strain at an Isotropic Confining Pressure of 183 psi (=26.4ksf =1262kPa) from the Combined RCTS Tests of Specimen K2-13-006

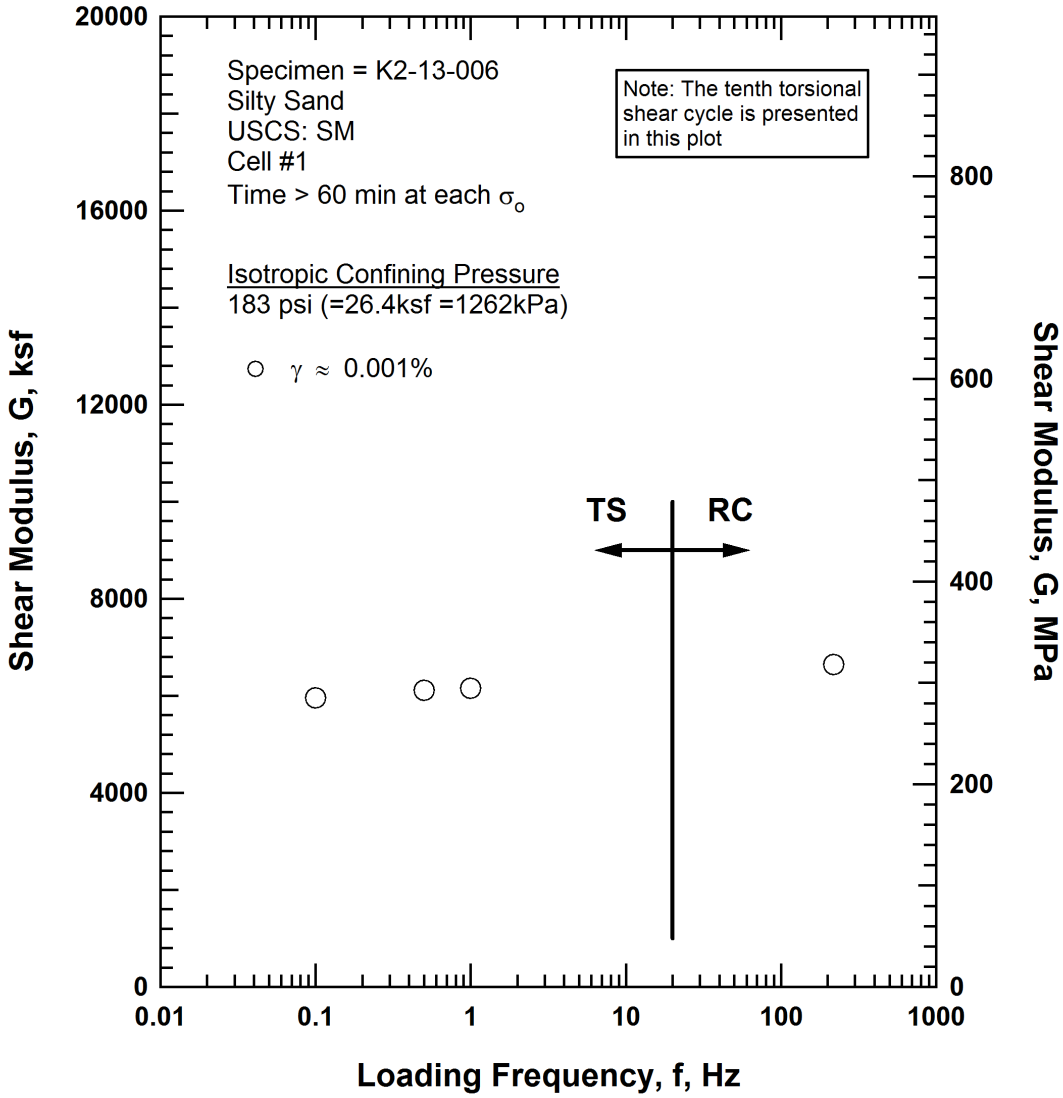


Figure G.21 Comparison of the Variation in Shear Modulus with Loading Frequency at an Isotropic Confining Pressure of 183 psi (=26.4ksf =1262kPa) from the Combined RCTS Tests of Specimen K2-13-006

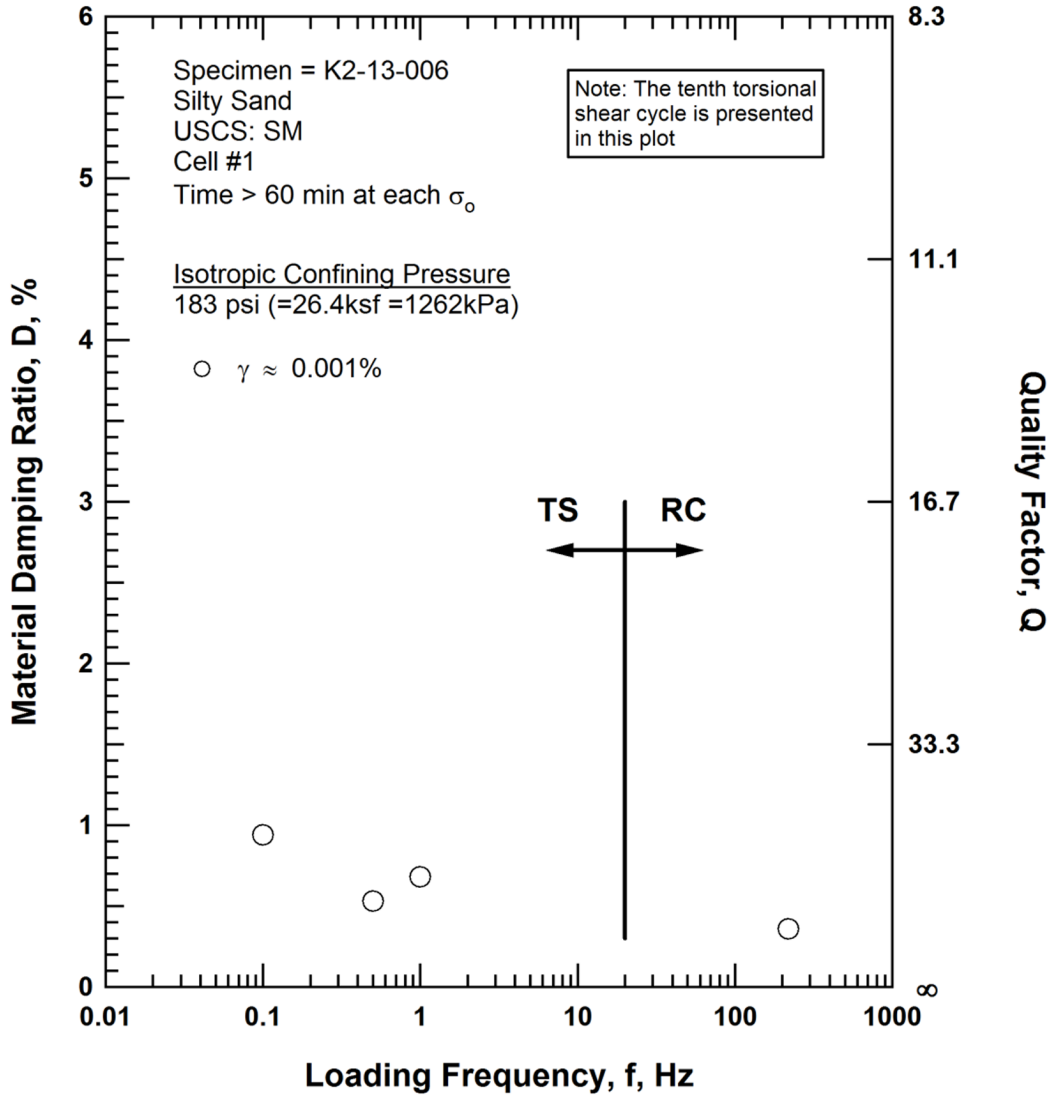


Figure G.22 Comparison of the Variation in Material Damping Ratio with Loading Frequency at an Isotropic Confining Pressure of 183 psi (=26.4ksf =1262kPa) from the Combined RCTS Tests of Specimen K2-13-006

Table G.1 Variation in Low-Amplitude Shear Wave Velocity, Low-Amplitude Shear Modulus, Low-Amplitude Material Damping Ratio, Estimated Void Ratio, and Estimated Total Unit Weight with Isotropic Confining Pressure from RC Tests of Specimen K2-13-006

| Isotropic Confining Pressure, $\sigma_o$ | | | Low-Amplitude Shear Modulus, $G_{max}$ | | Low-Amplitude Shear Wave Velocity, $V_s$ | Low-Amplitude Material Damping Ratio, $D_{min}$ | Estimated Void Ratio, e | Estimated Total Unit Weight, $\gamma_t$ |
|---|---|---|---|---|---|---|---|---|
| (psi) | (psf) | (kPa) | (ksf) | (MPa) | (fps) | (%) | (Unitless) | (pcf) |
| 11 | 1584 | 76 | 1430 | 69 | 620 | 0.61 | 0.739 | 120.2 |
| 23 | 3312 | 159 | 2090 | 100 | 750 | 0.56 | 0.733 | 120.4 |
| 46 | 6624 | 317 | 3000 | 144 | 890 | 0.45 | 0.724 | 120.7 |
| 82 | 11808 | 565 | 4340 | 208 | 1070 | 0.38 | 0.712 | 121.1 |
| 183 | 26352 | 1262 | 6460 | 309 | 1310 | 0.36 | 0.688 | 122.0 |

Table G.2 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen K2-13-006; Isotropic Confining Pressure $\sigma_o$ = 46 psi (=6.6 ksf = 317 kPa)

| Second Cycle | | | | Tenth Cycle | | | |
|---|---|---|---|---|---|---|---|
| Peak Shearing Strain, $\gamma$, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % | Peak Shearing Strain, $\gamma$, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % |
| 1.01E-03 | 3260 | 0.99 | 0.45 | 1.01E-03 | 3250 | 0.98 | 0.49 |
| 2.01E-03 | 3230 | 0.98 | 0.54 | 2.01E-03 | 3240 | 0.98 | 0.41 |
| 3.57E-03 | 3180 | 0.96 | 0.79 | 3.58E-03 | 3180 | 0.96 | 0.74 |
| 6.20E-03 | 3040 | 0.92 | 1.17 | 6.19E-03 | 3040 | 0.92 | 1.03 |
| 1.06E-02 | 2870 | 0.87 | 1.90 | 1.04E-02 | 2910 | 0.88 | 1.61 |

Table G.3 Variation in Shear Modulus, Normalized Shear Modulus, and Material Damping with Shearing Strain from RC Tests of Specimen K2-13-006; Isotropic Confining Pressure $\sigma_o$ = 46 psi (=6.6 ksf = 317 kPa)

| Peak Shearing Strain, γ, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Average Shearing Strain, %(1) | Material Damping Ratio, D, %(2) |
|---|---|---|---|---|
| 1.01E-04 | 3270 | 1.00 | 1.01E-04 | 0.36 |
| 2.00E-04 | 3270 | 1.00 | 2.00E-04 | 0.37 |
| 3.44E-04 | 3270 | 1.00 | 3.44E-04 | 0.39 |
| 5.87E-04 | 3260 | 1.00 | 5.45E-04 | 0.38 |
| 1.03E-03 | 3240 | 0.99 | 9.65E-04 | 0.38 |
| 1.95E-03 | 3210 | 0.98 | 1.84E-03 | 0.46 |
| 3.76E-03 | 3120 | 0.96 | 3.58E-03 | 0.65 |
| 6.86E-03 | 3010 | 0.92 | 5.33E-03 | 0.93 |
| 1.05E-02 | 2860 | 0.88 | 9.26E-03 | 1.35 |
| 2.89E-02 | 2370 | 0.72 | 2.21E-02 | 2.92 |
| 7.57E-02 | 1800 | 0.55 | 4.96E-02 | 5.32 |

(1) Average Shearing Strain from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

(2) Average Damping Ratio from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

Table G.4 Variation in Shear Modulus and Material Damping with Frequency from RC/TS Tests of Specimen K2-13-006; Isotropic Confining Pressure $\sigma_o$ = 46 psi (=6.6 ksf = 317 kPa)

| Approximate Shearing Strain, γ, % | Frequency, Hz | Shear Modulus, G, ksf | Material Damping Ratio, D, % |
|---|---|---|---|
| 0.001 | 0.1 | 3220 | 0.31 |
| | 0.5 | 3250 | 0.49 |
| | 1.0 | 3260 | 0.19 |
| | 154.4 | 3240 | 0.38 |

Table G.5 Variation in Shear Modulus, Normalized Shear Modulus and Material Damping Ratio with Shearing Strain from TS Tests of Specimen K2-13-006; Isotropic Confining Pressure $\sigma_o$ = 183 psi (=26.4 ksf = 1262 kPa)

| Second Cycle | | | | Tenth Cycle | | | |
|---|---|---|---|---|---|---|---|
| Peak Shearing Strain, γ, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % | Peak Shearing Strain, γ, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Material Damping Ratio, D, % |
| 1.02E-03 | 6060 | 0.97 | 0.51 | 1.01E-03 | 6110 | 0.98 | 0.53 |
| 2.02E-03 | 6150 | 0.99 | 0.61 | 2.01E-03 | 6160 | 0.99 | 0.56 |
| 5.15E-03 | 6030 | 0.97 | 0.91 | 5.01E-03 | 6190 | 0.99 | 0.82 |

(1) Results were Averaged for the First Ten Cycles at this Shearing Strain

Table G.6 Variation in Shear Modulus, Normalized Shear Modulus, and Material Damping with Shearing Strain from RC Tests of Specimen K2-13-006; Isotropic Confining Pressure $\sigma_o$ = 183 psi (=26.4 ksf = 1262 kPa)

| Peak Shearing Strain, γ, % | Shear Modulus, G, ksf | Normalized Shear Modulus, $G/G_{max}$ | Average Shearing Strain, %(1) | Material Damping Ratio, D, %(2) |
|---|---|---|---|---|
| 1.01E-04 | 6660 | 1.00 | 9.28E-05 | 0.28 |
| 2.00E-04 | 6660 | 1.00 | 1.83E-04 | 0.29 |
| 3.43E-04 | 6660 | 1.00 | 3.13E-04 | 0.32 |
| 5.86E-04 | 6650 | 1.00 | 5.34E-04 | 0.36 |
| 9.66E-04 | 6640 | 1.00 | 8.81E-04 | 0.34 |
| 1.88E-03 | 6580 | 0.99 | 1.73E-03 | 0.42 |
| 3.47E-03 | 6480 | 0.97 | 3.18E-03 | 0.51 |
| 5.84E-03 | 6350 | 0.95 | 5.17E-03 | 0.67 |
| 1.15E-02 | 6050 | 0.91 | 1.07E-02 | 1.08 |
| 2.57E-02 | 5460 | 0.82 | 2.14E-02 | 1.97 |
| 6.42E-02 | 4450 | 0.67 | 3.10E-02 | 5.44 |

(1) Average Shearing Strain from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

(2) Average Damping Ratio from the First Three Cycle of the Free Vibration Decay Curve or from Half Power Damping for shearing strains less than 0.001%

Table G.7 Variation in Shear Modulus and Material Damping with Frequency from RC/TS Tests of Specimen K2-13-006; Isotropic Confining Pressure $\sigma_o$ = 183 psi (=26.4 ksf = 1262 kPa)

| Approximate Shearing Strain, γ, % | Frequency, Hz | Shear Modulus, G, ksf | Material Damping Ratio, D, % |
|---|---|---|---|
| 0.001 | 0.1 | 5960 | 0.94 |
| | 0.5 | 6110 | 0.53 |
| | 1 | 6160 | 0.68 |
| | 218.9 | 6640 | 0.36 |