APPENDIX A

NONLINEAR ANALYSES FOR GENERIC SOIL PROFILES

Nonlinear model calibrations were performed using the generic soil profiles for each category. The initial loading or backbone curves were established by matching the G/G_{max} versus shear strain curves. The one-dimensional program DESRA-MUSC was used for the nonlinear analyses.

For Category C, EPRI cohesionless soil, the nonlinear analyses results are presented in Figures A1 to A6. Figure A1 shows acceleration time histories at the ground surface for the seven shaking levels: 0.05g, 0.1g, 0.2g, 0.3g, 0.4g, 0.5g and 0.75g. Amplification of peak ground acceleration occurred at all of the shaking levels. Figure A2 shows the acceleration response spectra at the ground surface for all shaking levels. Figure A3 shows the shear stress-shear strain loops at the selected depth under the shaking level of 0.75g. The maximum shear strain is about 0.09%. No yielding occurred.

Figures A4 to A6 present the nonlinear analysis results for Peninsular Range Category C cohesionless soils. The results are similar to that for EPRI soils. The soils remain in the elastic range, with a small shear strain of 0.08% occurred under the 0.75 shaking. Amplification of peak ground acceleration occurred under all shaking levels.

Shear wave velocities for Category D are lower than that for Category C. For EPRI cohesionless soils, amplification of peak ground accelerations occurred under the shaking levels of 0.05g to 0.2g, while attenuation occurred under the shaking levels of 0.3g to 0.75g, as shown on Figure A7. Figure A8 shows the acceleration response spectra at the ground surface for all shaking levels. The maximum shear strain under the shaking level of 0.75g was about 2.4% at a depth of 17 ft. The shear strains were very small at deeper depths, as shown on Figure A9.

For Peninsular Range cohesionless soil, Category D, the results from the nonlinear analyses show the amplifications of the peak ground acceleration for the shaking levels of 0.05g to 0.5g, and attenuation for the shaking level of 0.75g only, as shown on Figure A10. Figure A11 shows the acceleration response spectra at the ground surface for all shaking levels. Soil behavior is more linear as expected. The maximum shear strain under the 0.75g shaking level was less than 1% at a depth 17 ft, as shown in Figure A12.

For soft clay, presented in Category E, the acceleration time histories (Figure A13) at the ground surface show the longer period motion and attenuation of the peak ground acceleration occurred for the all shaking levels, except the lower ones, i e., 0.05g and 0.1g. Figure A14 shows the acceleration response spectra at the ground surface for all shaking levels. The maximum shear strain developed at a depth of 14 ft was about 12% under the 0.75g shaking, 2.8% at a depth of 35 ft and less than 1% at the deep depths, as shown on Figure A15.

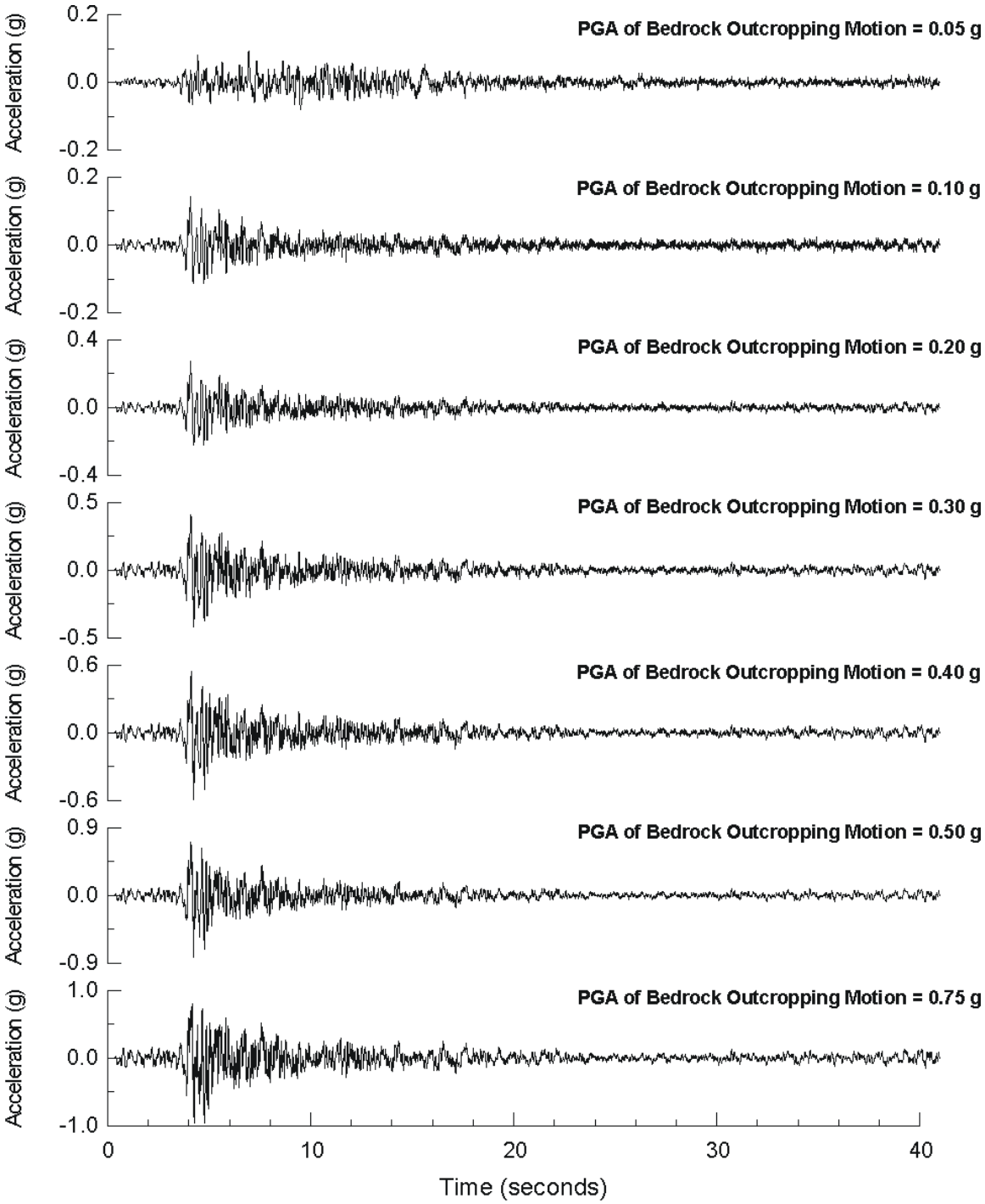

Figure A1. DESRA-MUSC Results: Acceleration Time Histories at Ground Surface Category C, EPRI Curves, Generic Soil Profile, WUS.

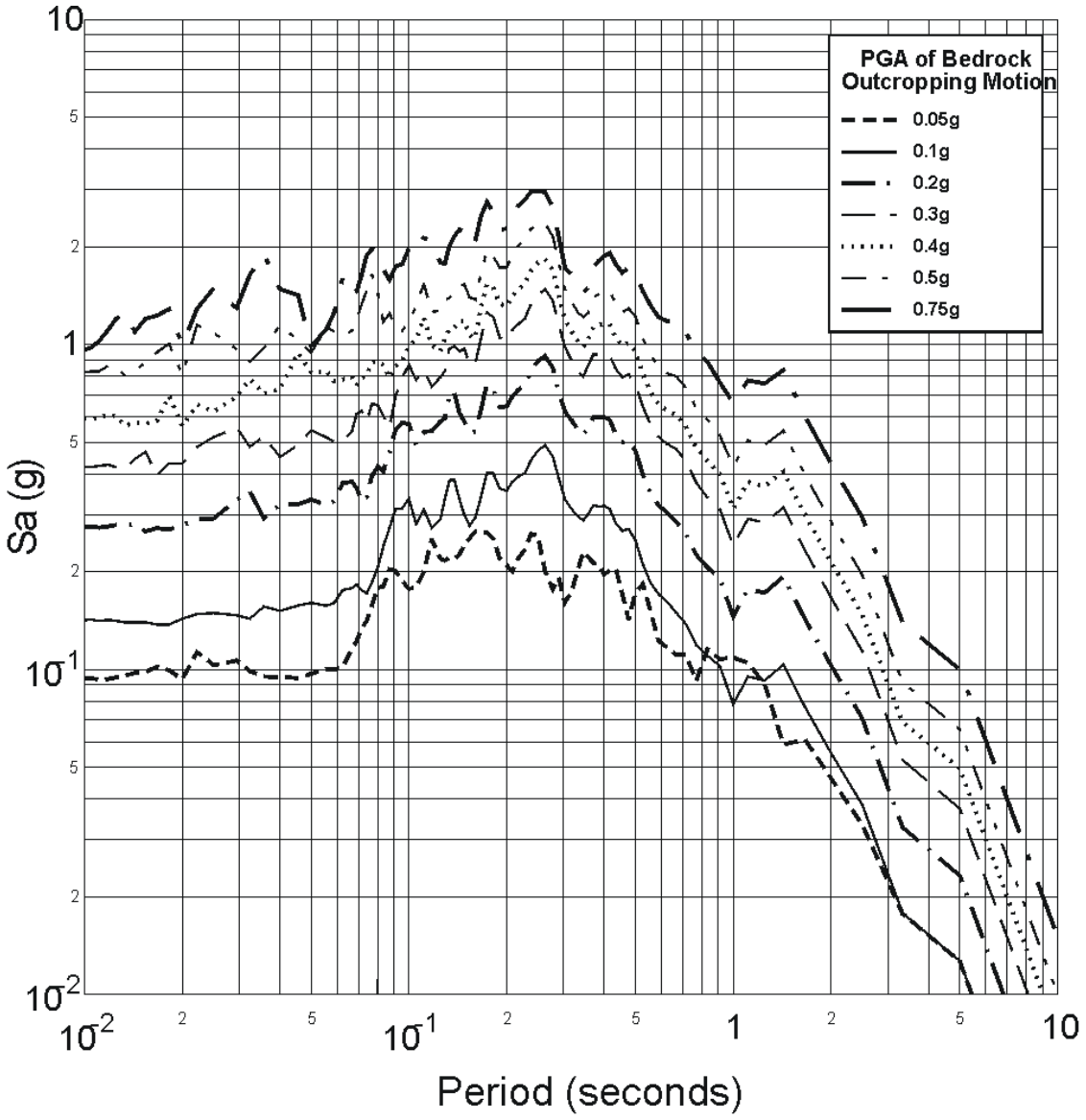

Figure A2. DESRA-MUSC Results: Response Spectra at Ground Surface Category C, EPRI Curves, Generic Soil Profile, WUS.

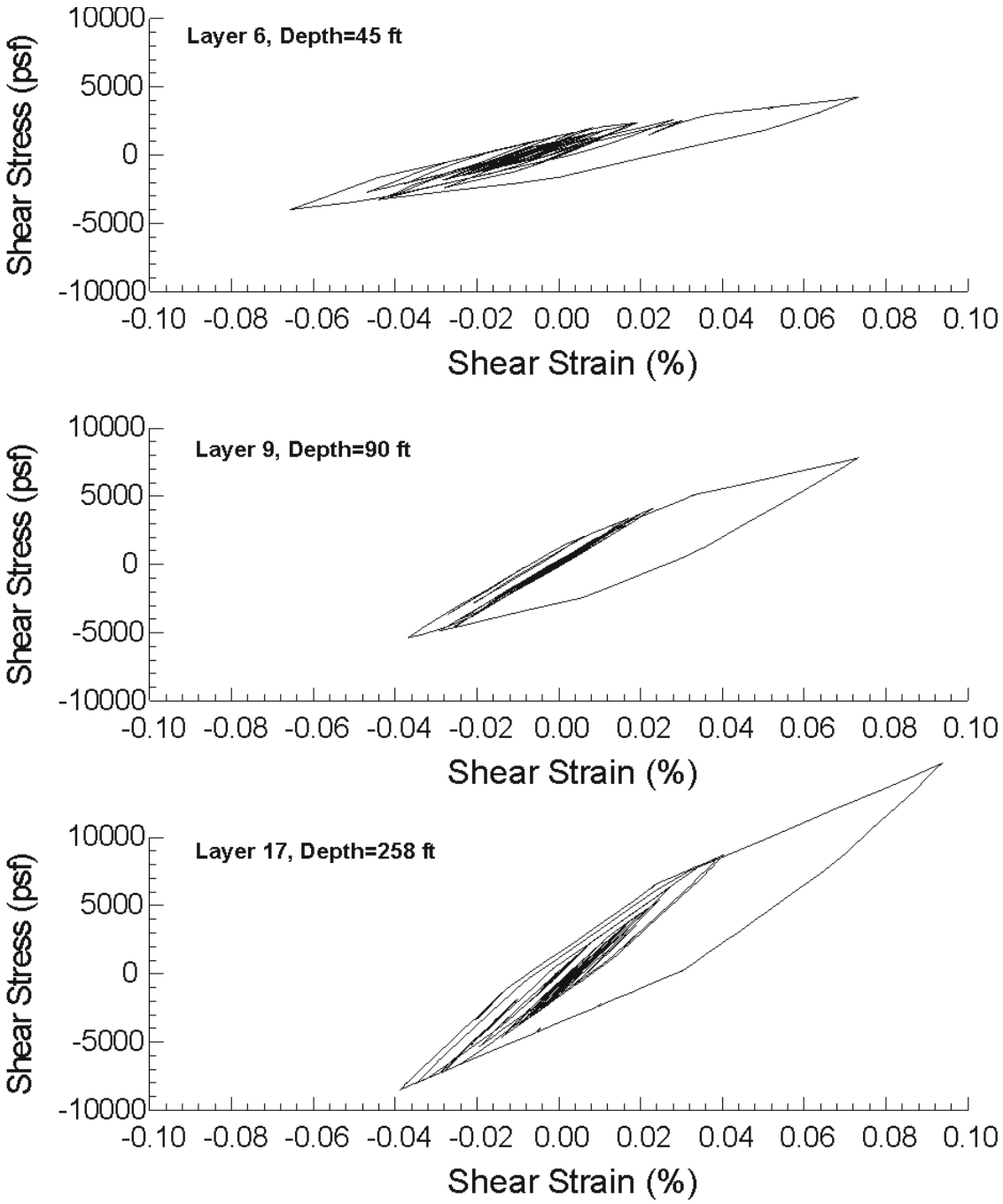

Figure A3. DESRA-MUSC Results: Shear Stress–Shear Strain Loops, PGA=0.75g Category C, EPRI Curves, Generic Soil Profile, WUS.

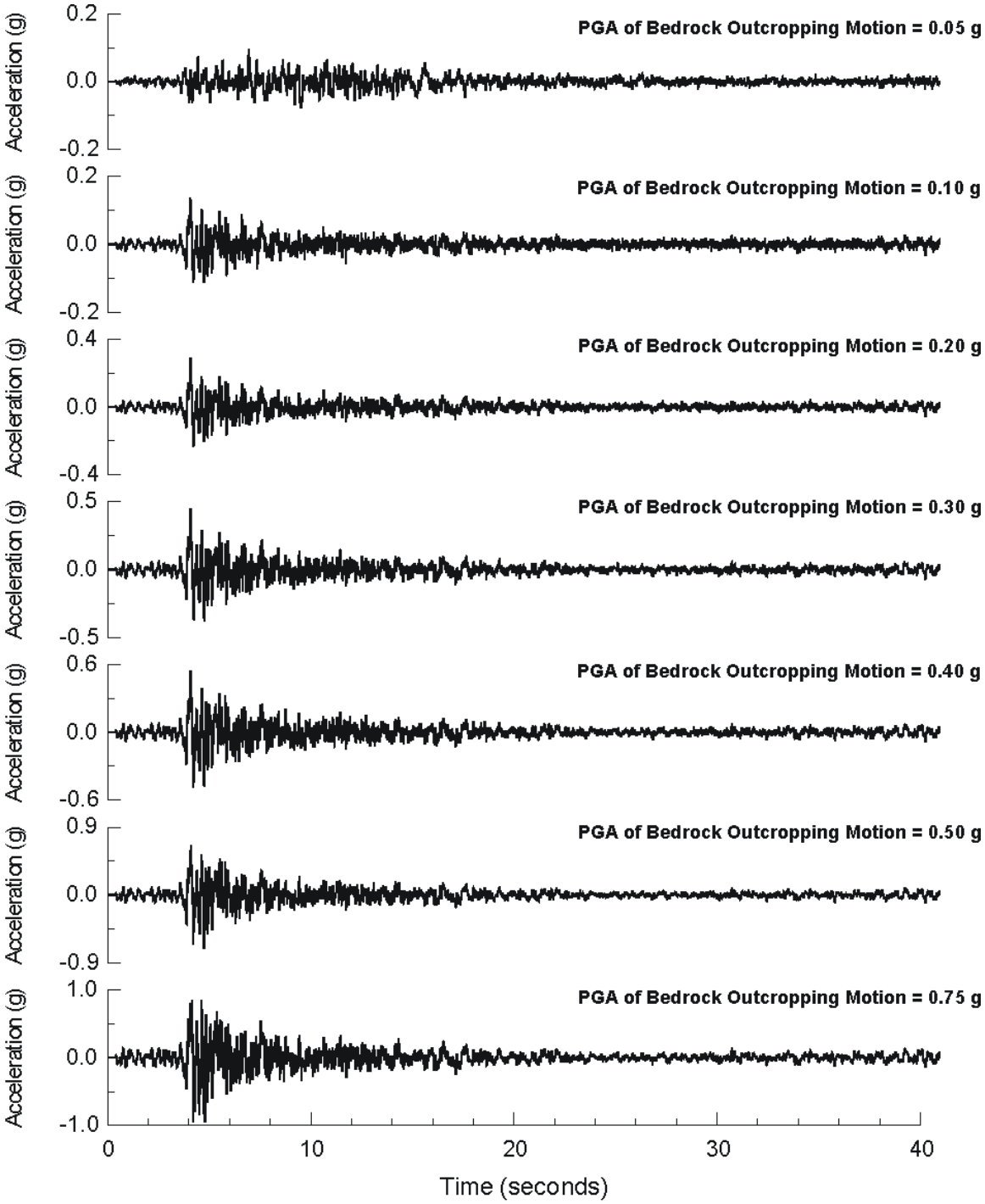

Figure A4. DESRA-MUSC Results: Acceleration Time Histories at Ground Surface Category C, Peninsular Range Curves, Generic Soil Profile, WUS.

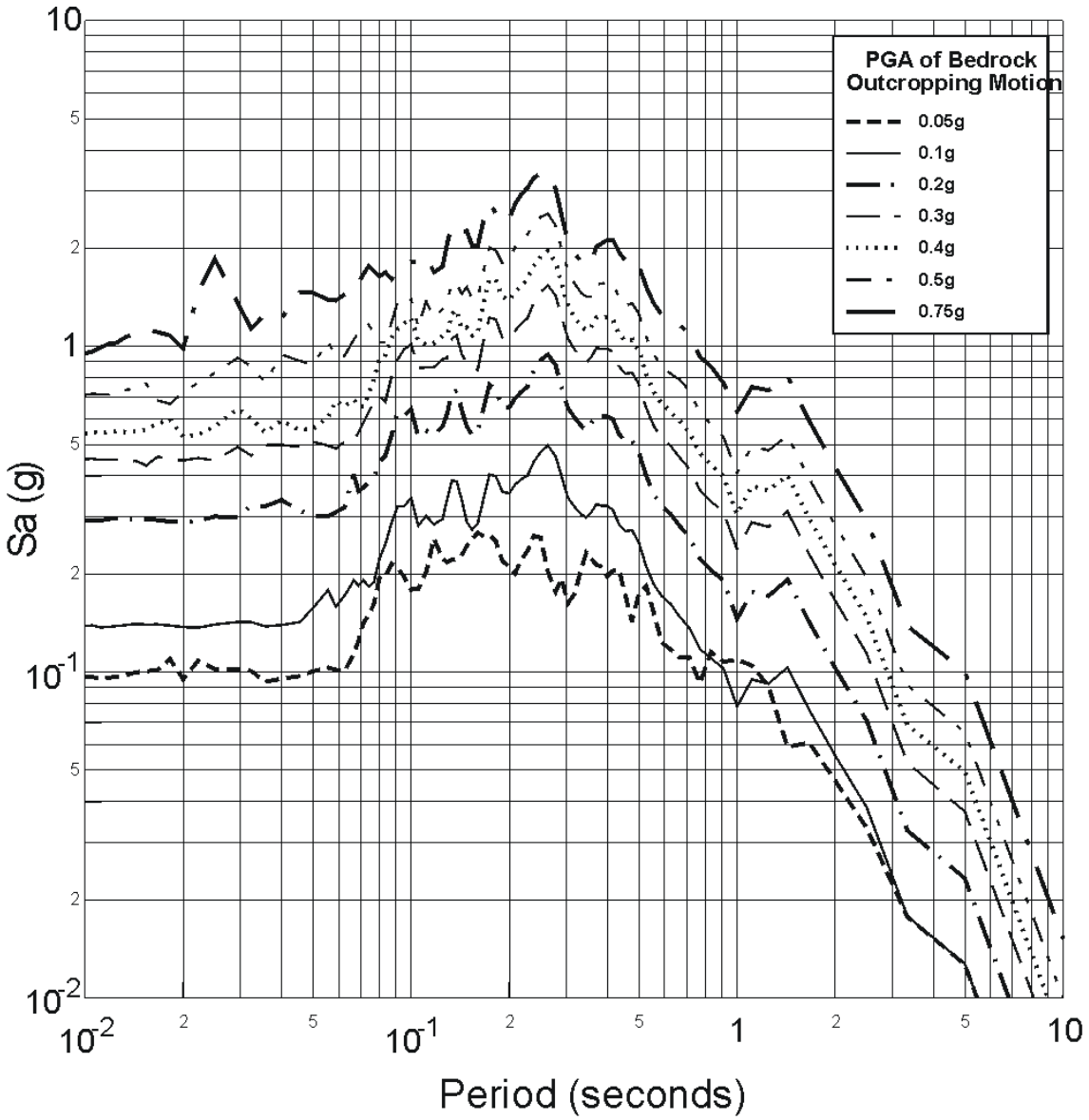

Figure A5. DESRA-MUSC Results: Response Spectra at Ground Surface Category C, Peninsular Range Curves, Generic Soil Profile, WUS.

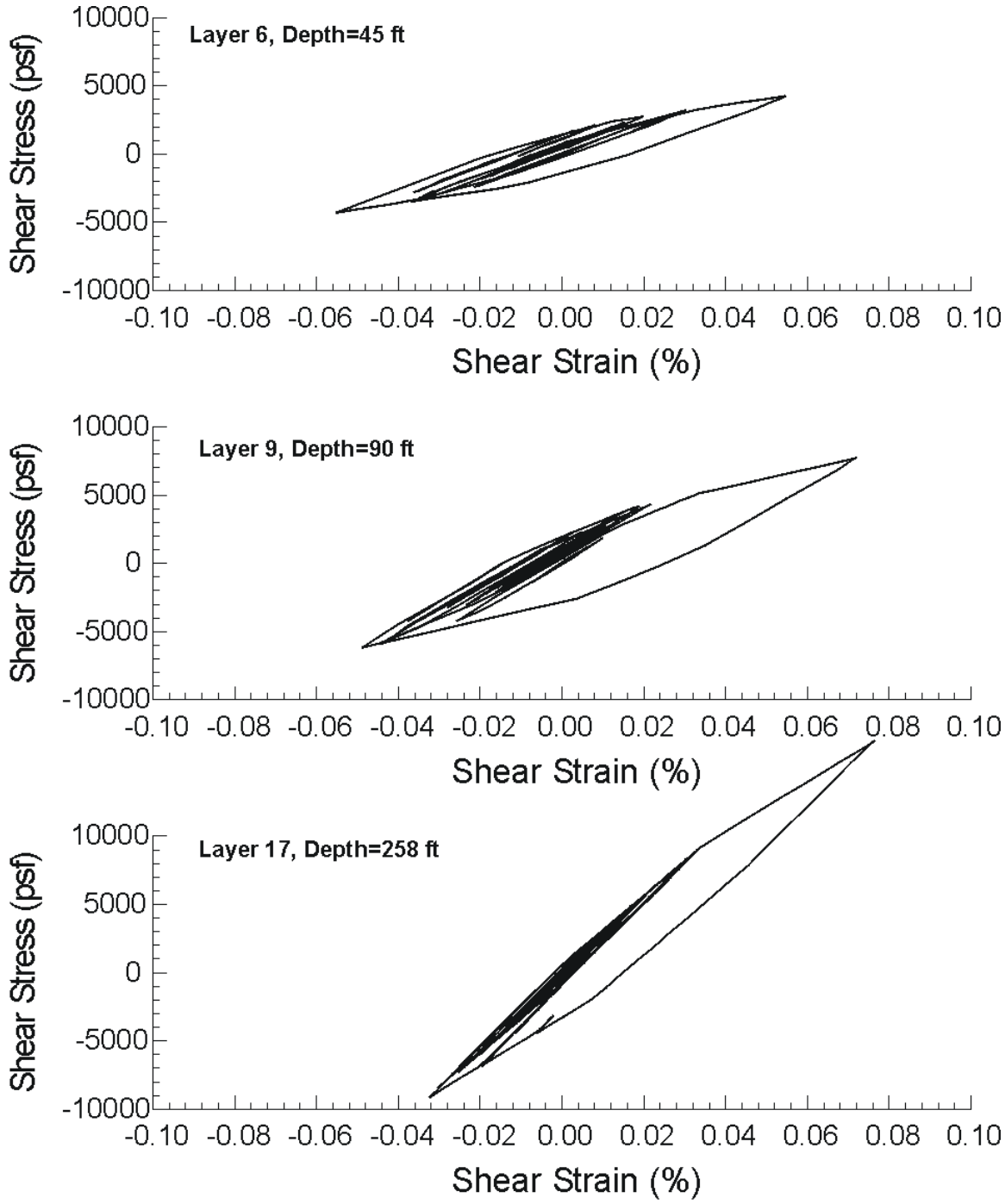

Figure A6. DESRA-MUSC Results: Shear Stress–Shear Strain Loops, PGA=0.75g Category C, Peninsular Range Curves, Generic Soil Profile, WUS.

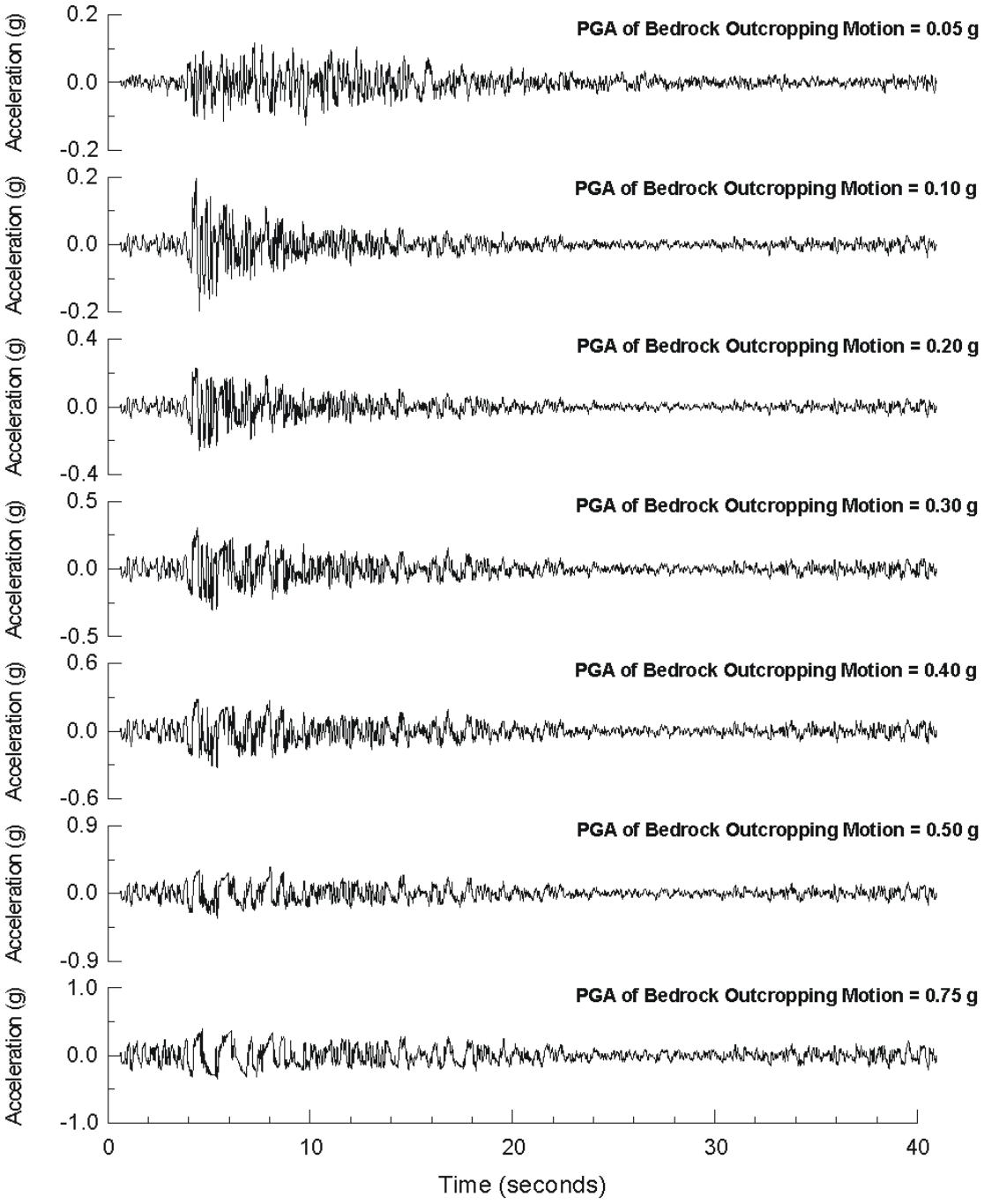

Figure A7. DESRA-MUSC Results: Acceleration Time Histories at Ground Surface Category D, EPRI Curves, Generic Soil Profile, WUS.

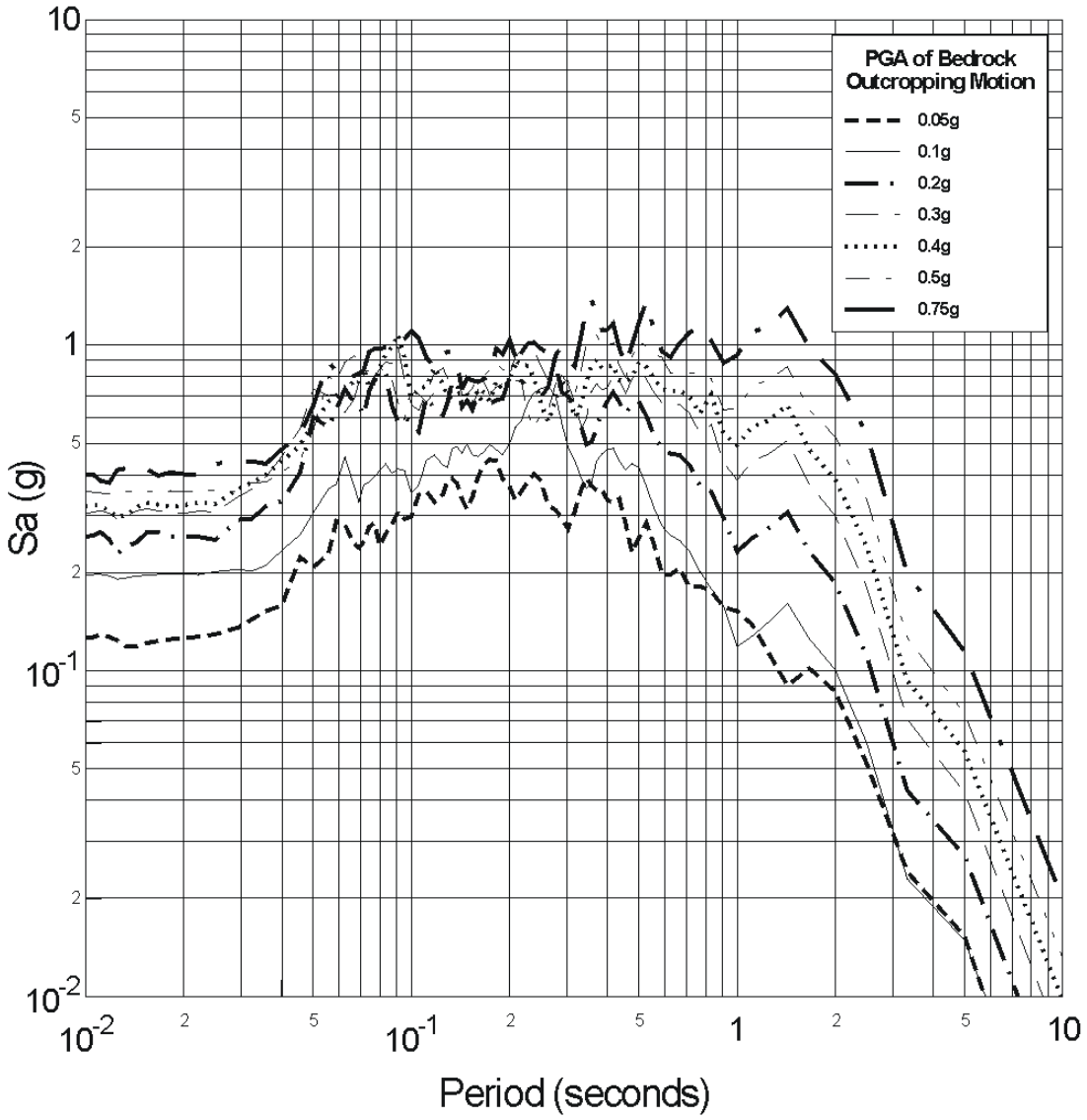

Figure A8. DESRA-MUSC Results: Response Spectra at Ground Surface Category D, EPRI Curves, Generic Soil Profile, WUS.

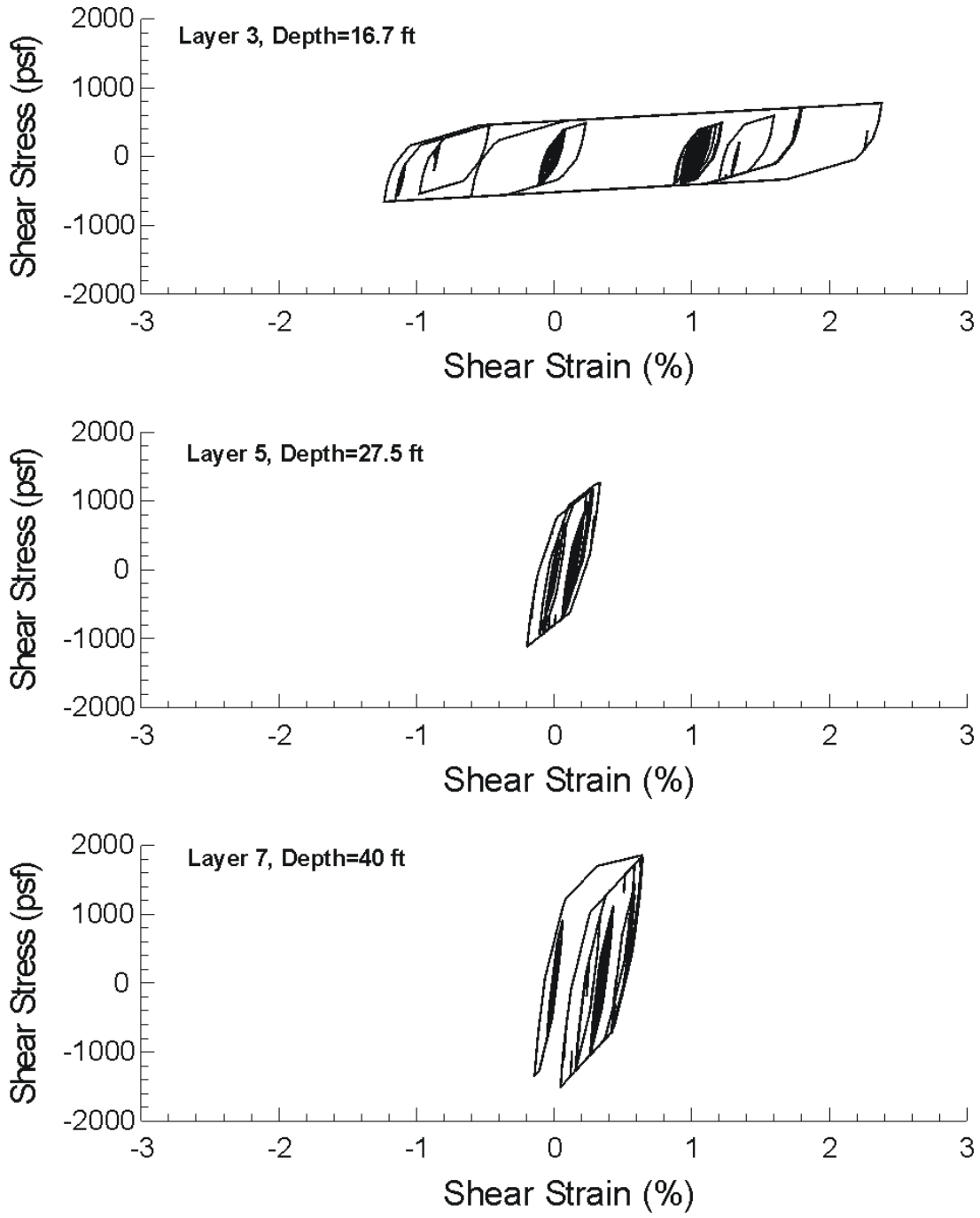

Figure A9. DESRA-MUSC Results: Shear Stress–Shear Strain Loops, PGA=0.75g Category D, EPRI Curves, Generic Soil Profile, WUS.

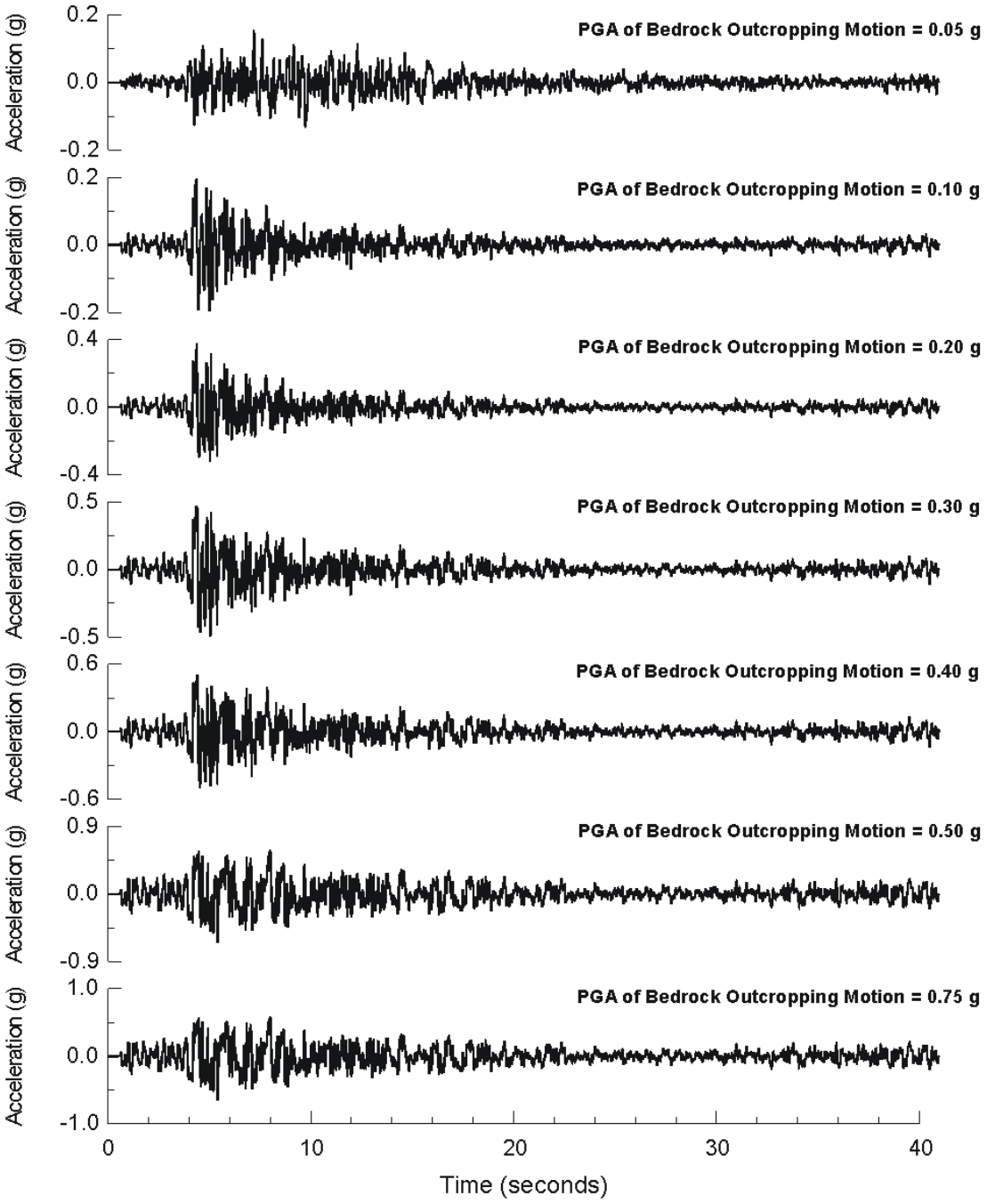

Figure A10. DESRA-MUSC Results: Acceleration Time Histories at Ground Surface Category D, Peninsular Range Curves, Generic Soil Profile, WUS.

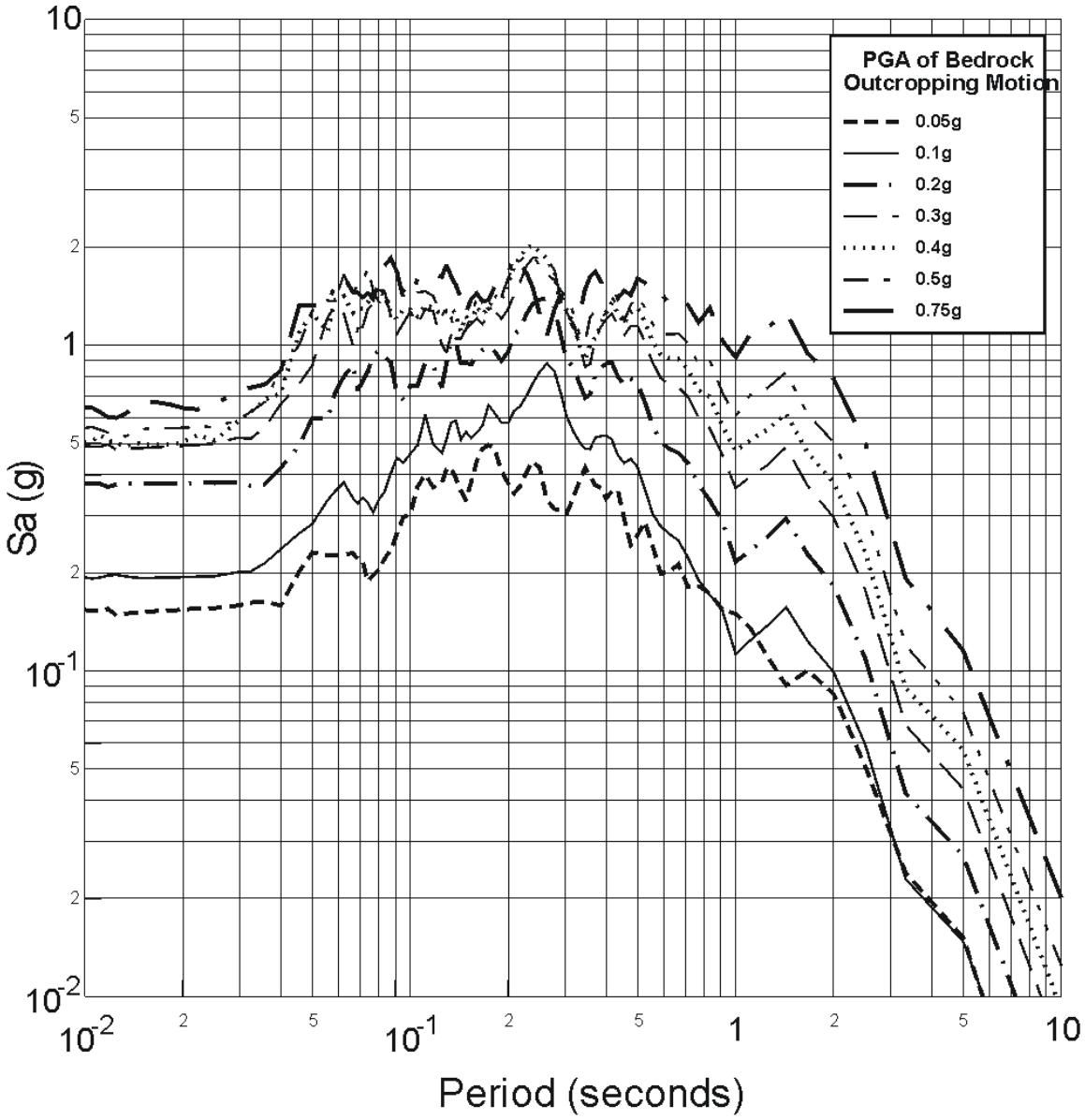

Figure A11. DESRA-MUSC Results: Response Spectra at Ground Surface Category D, Peninsular Curves, Generic Soil Profile, WUS.

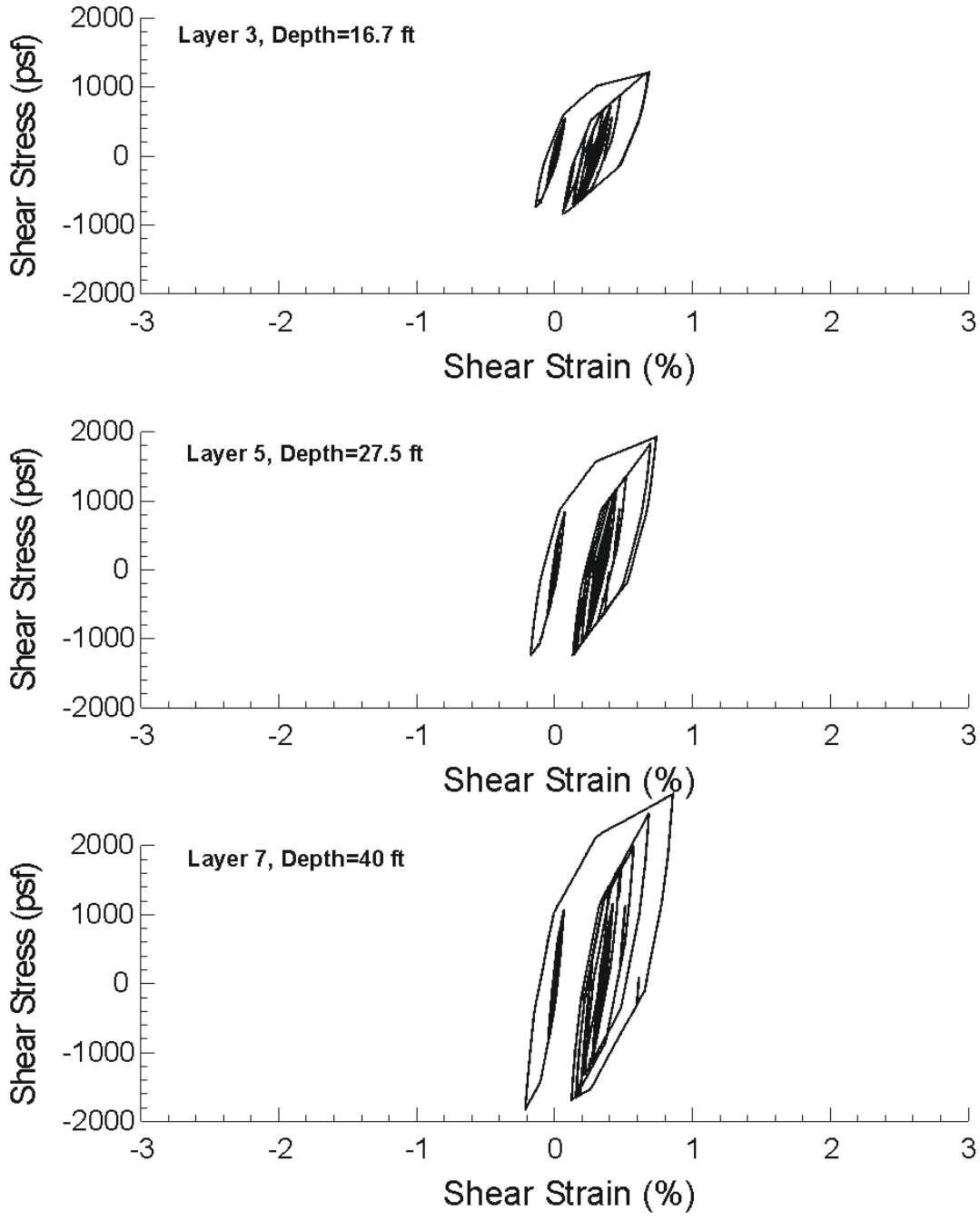

Figure A12. DESRA-MUSC Results: Shear Stress–Shear Strain Loops, PGA=0.75g Category D, Peninsular Range Curves, Generic Soil Profile, WUS.

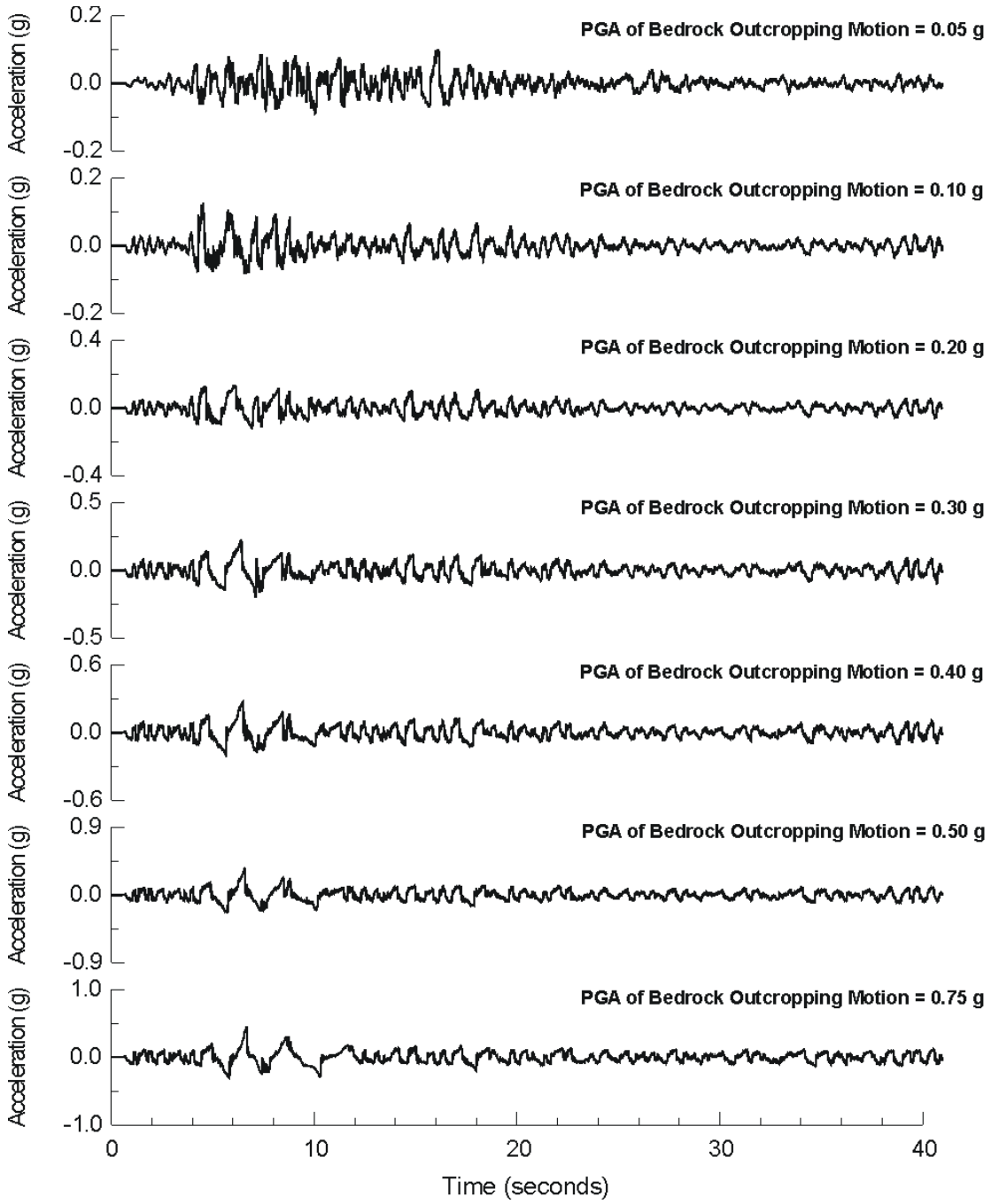

Figure A13. DESRA-MUSC Results: Acceleration Time Histories at Ground Surface Category E, Mixed Curves, Generic Soil Profile, WUS.

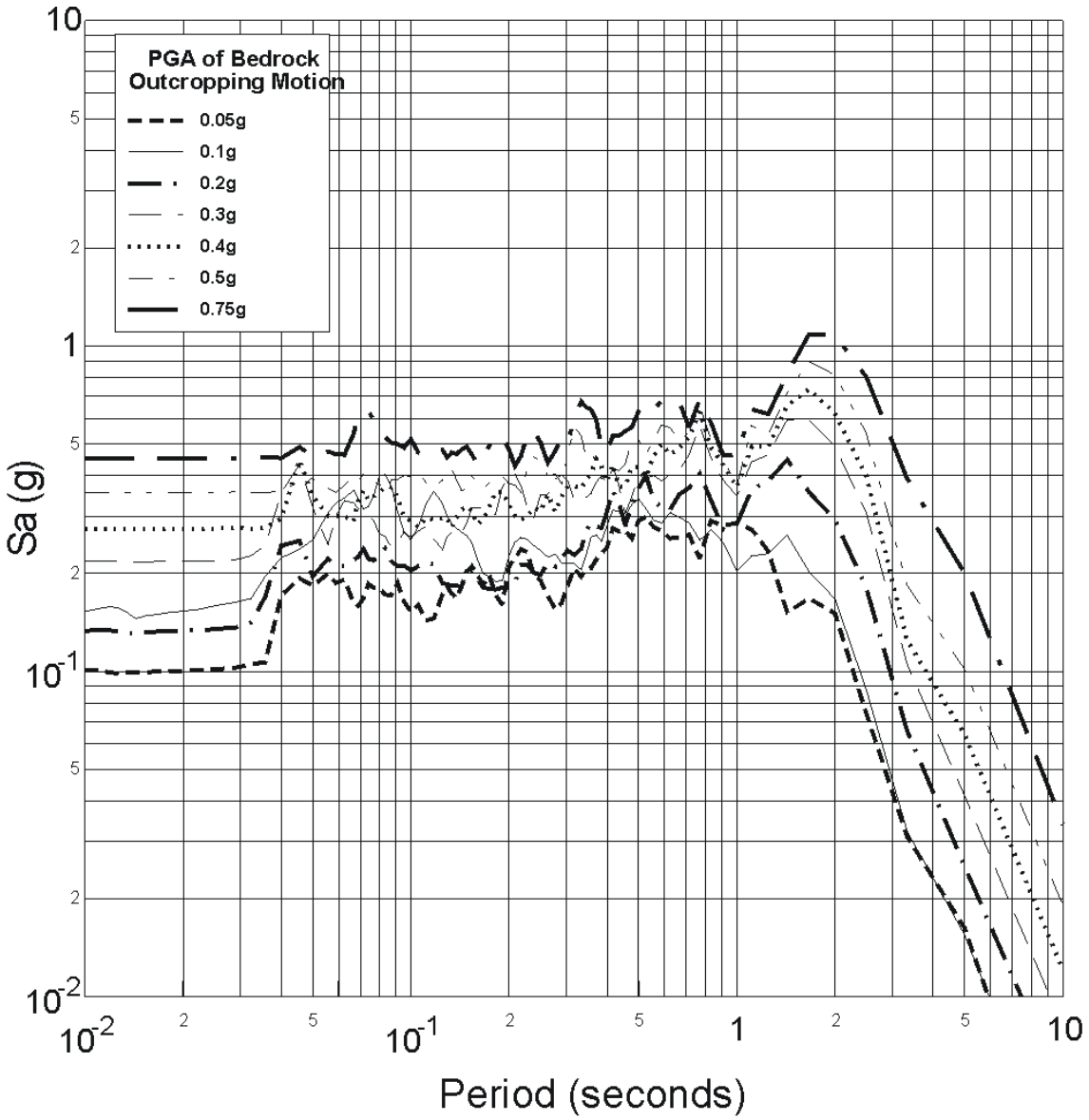

Figure A14. DESRA-MUSC Results: Response Spectra at Ground Surface Category E, Mixed Curves, Generic Soil Profile, WUS.

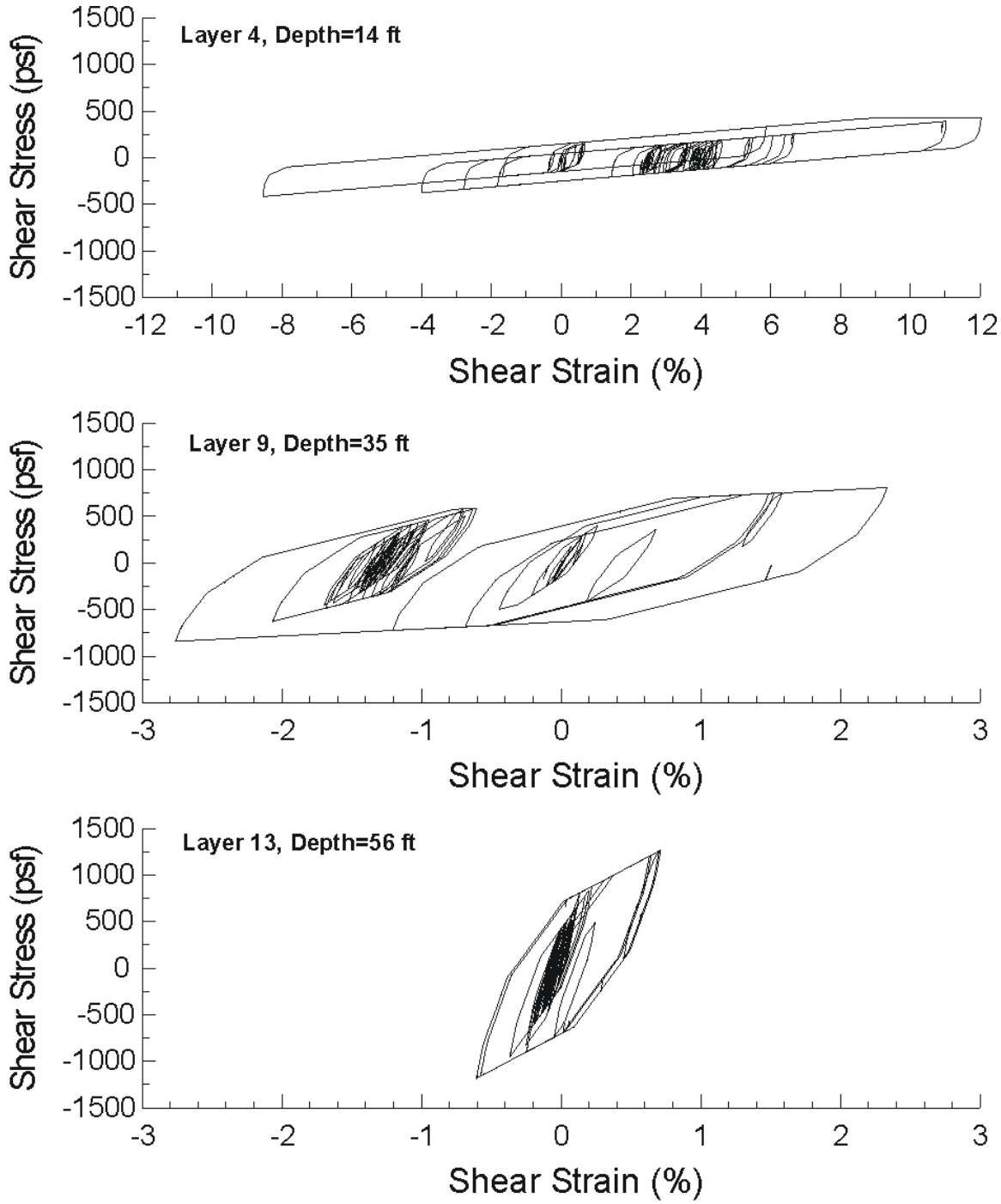

Figure A15. DESRA-MUSC Results: Shear Stress–Shear Strain Loops, PGA=0.75g Category E, Mixed Curves, Generic Soil Profile, WUS.