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DEVELOPMENT OF AMPLIFICATION FACTORS FOR THE DIABLO CANYON NUCLEAR POWER PLANT: SITE WIDE PROFILES

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1.0 INTRODUCTION

Amplification factors for horizontal component 5% damped pseudo absolute response spectra (PSa) were developed for the Diablo Canyon Nuclear Power Plant (DCPP). The amplification factors were based on range of measured shear-wave velocity profiles at the plant site extended to about 2.8 km depth (Norm Abrahamson, personal communication November 6, 2015). The range of total kappa values was provided by Norm Abrahamson, personal communication September 29, 2015. Lastly, only calculations using the **M** 7.0 2-corner model were performed (Norm Abrahamson, personal communication November 6, 2015). These amplification factors were developed relative to a generic rock shear-wave velocity profile with a $\overline{V_S}$ (30m) of 760m/s. This report compliments earlier reports submitted to Pacific Gas and Electric (Silva and Darragh, 2015a, 2015b) and was initiated as part of the response to requests for additional information (RAIs) from the Nuclear Regulatory Commission (NRC).

Epistemic uncertainty in the site-specific profile, kappa, and potential nonlinear site response was accommodated through multiple models. For each model considered, distinct suites of amplification factors were developed along with relative weights recommended to accommodate a realistic range in dynamic material properties.

Potential nonlinear site response at higher loading level was approximately accommodated with the equivalent-linear approach implemented with Random Vibration Theory (RVT) (EPRI, 1993; Silva et al., 1996). A range of loading levels defined by the reference site ($\overline{V_S}$ (30m) of 760m/s) median peak acceleration ranging from 0.01g to 3.00g at fifteen discrete values was used to accommodate the hazard at the site.

2.0 SHEAR-WAVE VELOCITY PROFILES

At the DCPP site measured shear-wave velocities were extended to a depth of about 2.8 km (Norm Abrahamson, personal communication November 6, 2015). To accommodate epistemic uncertainty in the mean profile across the site, three base-case profiles were provided: Lower, Central, and Upper (Norm Abrahamson, personal communication November 6, 2015). The profiles for each base-case profile were merged with the generic rock reference site profile (Kamai et al., 2014) near a depth of 2.8 km.

Figure 1 illustrates all three base-case profiles to 8 km depth (source depth) along with the reference rock ($\overline{V_S}$ (30m) of 760m/s) generic profile. Figure 2 shows these profiles to a depth of 3 km, slightly greater than the depth to which velocities were provided (Norm

Abrahamson, personal communication November 6, 2015). Figure 3 shows the upper portion of the profiles to a depth of 600 m. In this Figure, the reference rock profile and Lower range profile are similar at depths less than about 30 m. At greater depths (30 to 300m) the Lower range profile is significantly softer than the reference rock profile. In contrast, the reference site profile is generally softer than the Central and Upper range profiles below a depth of about 300 and 175m, respectively. Table 1 lists the properties of the three base-case profiles (thickness, Vs and density) from the surface to a depth of 8 km. The densities were obtained following the guidance provided in the SPID (EPRI 1025287, 2013).

Amplification factors were developed for each of these site wide profiles.

3.0 CONSIDERATION OF NONLINEAR SITE RESPONSE

To accommodate uncertainty in potential nonlinear dynamic material properties at the site at high loading levels, two cases were run: the equivalent-linear approximation to nonlinear response and fully linear response (referred to as M1). For the equivalent-linear analyses, because the dynamic material strain dependencies of firm rock are poorly known, two sets of modulus reduction and hysteretic damping curves were used: EPRI (EPRI, 1993) rock (referred to as M2) (Figure 4) and Peninsular Range (PR) (Silva et al., 1996) (referred to as M3) (Figure 5). For all nonlinear cases, linearity was assumed for depths exceeding 152.4 m (500 ft) (Silva et al., 1996) with the detailed depth range used in the analyses for each set of curves given in Table 2 and shown in Figures 4 and 5. Table 2 lists the PR (M3) curves and the EPRI rock (M2) curves at the ten cyclic strain levels listed at the bottom of the table. In addition, for all equivalent-linear cases the hysteretic damping was limited to 15% (Table 2).

The EPRI rock curves were used to reflect an upper range of potential nonlinear response. The EPRI rock curves are model based and were developed by Dr. Robert Pyke as part of the EPRI (1993) Siting Project. The curves reflect the assumption that intact rock behaves similarly to highly nonlinear gravels. The Peninsular Range (PR) curves were selected to reflect the potential for significantly more linear response than the EPRI rock curves. The Peninsular Range curves are a subset of the EPRI (1993) cohesionless soil curves and were selected to represent a potential central case of nonlinearity between EPRI rock curves and linear response. It is recognized the Peninsular Range curves, as a subset of the EPRI (1993) soil curves, were developed for cohesionless soils however the general shape of the curves is quite similar to the EPRI (1993) rock curves. Additionally at cyclic shear strain where significant nonlinearity may exist, laboratory testing results are sparse and currently quite limited in strain range. Following generally the guidance provided in the SPID (EPRI 1025287, 2013), the implementation of linear and equivalent-linear analyses was intended to accommodate a realistic range in dynamic material properties at high loading levels, ranging from highly nonlinear to linear response.

Recommended weights for the nonlinear dynamic material properties assume equal weight for linear and equivalent-linear analyses. Additionally equal weights are recommended for the two sets of curves, EPRI Rock (EPRI, 1993) and Peninsular Range (Silva et al., 1996). The weights for the nonlinear dynamic material properties are summarized in Table 3.

4.0 KAPPA

Based on evaluations at the site, kappa (κ_o) at low cyclic shear strains was estimated at 0.042s (PG&E, 2011) taken as 0.040s for these analyses. Uncertainty in kappa was addressed with the same range in values (Norm Abrahamson, personal communication, September 29, 2015) as in the previous report (Silva and Darragh, 2015b). The range of kappa values used in the first report Silva and Darragh (2015a) was larger. The best-estimate value of kappa was again 0.040s (referred to as K1). The upper and lower range estimates are 0.050s (K2) and 0.030s (K3) respectively. The recommended weights are 0.4, 0.3, and 0.3 for the best estimate, upper, and lower ranges respectively. The relative weights are listed in Table 3.

In developing the distribution of shear-wave damping with depth, the low-strain damping from the respective curves (Table 2) was used over the top 152.4m (500 ft) for the nonlinear cases (M2 and M3). Below that depth, and recognizing that the detailed distribution of shear-wave damping with depth has little impact on amplification (Section 5.0), the low-strain damping was continued until the target kappa value was reached. This was followed for the Peninsular Range curves (M3) with the 15.5m (51 ft) to 152.4m (500 ft) damping of 0.6% (Q_S=83) assumed for depths below 152.4m (500 ft). For the EPRI rock curves (M2) with the damping in the deepest layer of 3.186% (Q_S=15.7) a lower damping of 1.25% (Q_S=40) was assumed for depths greater than 154.2m (500 ft). This case reflects the possibility that a more significant contribution to kappa occurs over the top 152.4m (500 ft) for EPRI rock (M2) curves compared to Peninsular Range (M3) curves. For the linear analyses (M1), the shear-wave damping was assumed to be independent of depth at 1.25% (Q_S=40) (SPID (EPRI 1025287, 2013)). For both the linear and nonlinear cases the damping below 152.4m (500 ft) was depth independent and continued until the target kappa values were reached, typically about 2 km to about 4 km depth, below which Q_S was set to 5,000.

Table 4 lists the distribution of kappa in two depth ranges for the three base-case profiles (Lower, Central and Upper), three models for linear\nonlinear response (M1, M2 and M3) and three kappa values (K1, K2 and K3). The depth ranges are from 0 to 152.4 m (500 ft), the nonlinear depth range for models M2 and M3 (Section 3.0); and from 152.4m (500 ft) to 8.0 km (source depth (Section 2.0)).

5.0 DEVELOPMENT OF AMPLIFICATION FACTORS

For the profiles considered: Lower, Central, and Upper amplification factors were developed (5% damped pseudo absolute acceleration, PSa) relative to a generic firm rock reference profile reflective of $\overline{V_S}$ (30m) at 760m/s (Kamai et al., 2014). To accommodate uncertainty in the site-specific profile (Section 2.0), the site profile was merged with the reference rock profile at depths of 2.84 km for the Lower profile, 5.49 km for the Central profile and 7.39 km for the upper profile. Using the point-source ground motion model (Boore, 1983), motions were simulated from source depth (8 km) to the surface for both the reference and site-specific profiles, consistent with point-source validation exercises (EPRI 1993; Silva et al., 1996). The distances used for the double-corner model are shown in Table 6. This approach also easily and realistically accommodates a range in site-specific kappa values by varying the damping in the deep portions of the profile (Section 4.0).

Control motions consisted of **M** 7.0 with a stress parameter of 50 bars and included only the double-corner (Atkinson and Silva, 1997) source model (Norm Abrahamson, personal communication November 6, 2015) along with a kappa value of 0.030s. The kappa estimate of 0.030s for the reference site profile was based on inversions of the suite of NGA West-2 GMPEs (Walt Silva, personal communication, 2015) which included $\overline{V_S}$ (30m) scaling (Abrahamson et al., 2014; Boore et al., 2014; Campbell and Bozorgnia, 2014; and Chiou and Youngs, 2014). To accommodate potential nonlinear response in the reference site profile ($\overline{V_S}$ (30m) 760m/s) Peninsular Range curves (Figure 5) were used over the top 152.4m (500 ft) with linear analyses below. The remaining model parameters are listed in Tables 5 and 6. Table 7 lists the directory and file structure for the amplification factors computed in these analyses.

To accommodate a wide range in loading levels conditional on median estimates of reference rock ($\overline{V_S}$ (30m) 760m/s) peak accelerations, fifteen epicentral (hypocentral) distances were used to provide a range in expected peak accelerations from 0.01g to 3.00g (Table 6). At each distance thirty realizations were used varying site-specific shear-wave velocity and G/G_{max} and hysteretic damping curves. The profile randomization reflected the footprint correlation model with ± 2σ bounds (SPID, EPRI 1025287, 2013). For each realization ratios were taken of RVT response spectral estimates (5% damped PSa at 100 frequencies per decade) to the median reference rock PSa (5% damped). As such the variability of the median amplification, assumed lognormally distributed, reflects variability of the shear-wave velocities and G/G_{max} and hysteretic damping curves across the site.

To examine trends in the amplification factors Figure 6 shows results computed for the Central base-case profile (Figures 1-3), linear analyses (M1), a best estimate kappa of 0.040s (K1), and using a double-corner source model. The Figure shows slight deamplification over much of the frequency range with a small amplification at near 1 Hz. The change in amplification over very high loading conditions is due to the assumed nonlinearity in the reference site profile characterized with Peninsular Range G/G_{max} and hysteretic damping curves (Figure 5).

Examining the effects of kappa, Figures 7 and 8 show amplification factors for the Central base-case profile (P1) Central, linear analyses (M1) and upper- and lower-range base-case kappa values of 0.050s (K2) and 0.030s (K3) respectively. Compared to Figure 6, with the best estimate kappa of 0.040s (K1), the upper-range kappa of 0.050s shows lower amplification for frequencies exceeding about 2 Hz. Conversely Figure 8, with the lower-range kappa of 0.030s, as expected, shows higher amplification at higher frequencies, particularly above about 10 Hz.

To examine the effect of upper range nonlinearity Figure 9 show results with the same profile and kappa as Figure 6 but with equivalent-linear analyses using the EPRI rock G/G_{max} and hysteretic damping curves (Figure 4). At loading levels above about 0.2g to 0.3g (reference site $\overline{V_S}$ (30m) 760m/s) the impact of nonlinearity characterized with EPRI rock curves is apparent in increasingly lower amplification as loading levels increases, particularly at frequencies exceeding a few Hz. The effect of nonlinearity using the Peninsular Range curves (Figure 10) (M3) is, as expected, intermediate between the linear analysis (M1) shown in Figure 6 and the equivalent-linear analysis using the ERRI curves (M2) shown in Figure 9.

To compare Lower- and Upper-range velocity profiles with the Central profile (Figure 6), Figure 11 and 12 show amplification factors computed for Lower base-case (Figures 1 to 3) and Upper base-case (Figures 1 to 3) respectively, linear analyses (M1), and a best estimate kappa of 0.040s. The lower-range profile, Figure 11, shows slightly higher amplification particularly at lower frequency (≤ 1 Hz) while the upper-range profile shows the converse with median amplification less than one throughout the frequency range.

6.0 REFERENCES

Abrahamson, N.A., Silva, W.J., and Kamai, R., 2014, "Summary of the ASK14 ground motion relation for active crustal regions." *Earthquake Spectra* 30(3), 1025-1055.

Atkinson, G.M and W.J. Silva (1997). "An empirical study of earthquake source spectra for California earthquakes." *Bull. Seism. Soc. Am.* 87(1), 97-113.

Boore, D.M., Stewart, J.P., Seyhan, E., and Atkinson, G.M., 2014, "NGA-West2 equations for predicting PGA, PGV and 5% damped PSA for shallow crustal earthquakes." *Earthquake Spectra* 30(3), 1057-1085.

Boore, D.M. (1983). "Stochastic simulation of high-frequency ground motions based on seismological models of the radiated spectra." *Bull. Seism. Soc. Am*., 73(6), 1865-1894.

Campbell, K.W. and Bozorgnia, Y., 2014, "NGA-West2 ground motion model for the average horizontal components of PGA, PGV, and 5% damped linear-acceleration response spectra." *Earthquake Spectra* 30(3), 1087-1115.

Chiou, B. -J., and Youngs, R. R. (2014). "Update of the Chiou and Youngs NGA ground motion model for average horizontal component of peak ground motion and response spectra." *Earthquake Spectra* 30(3), 1117-1153.

Electric Power Research Institute (2013). "Seismic evaluation guidance: screening, prioritization and implementation details (SPID) for the resolution of Fukushima near-term Task Force Recommendation 2.1 – Seismic," 1025287.

Electric Power Research Institute (1993). "Guidelines for determining design basis ground motions." Palo Alto, Calif: Electric Power Research Institute, vol. 1-5, EPRI TR-102293.

vol. 1: Methodology and guidelines for estimating earthquake ground motion in eastern North America.
vol. 2: Appendices for ground motion estimation.
vol. 3: Appendices for field investigations.
vol. 4: Appendices for laboratory investigations.
vol. 5: Quantification of seismic source effects.

Kamai, R., N.A. Abrahamson, and W.J. Silva (2014). "Nonlinear horizontal site amplification for constraining the NGA-West2 GMPEs." *Earthquake Spectra* 30(3), 1223-1240.

PG&E (2011). "Report on the Analysis of the Shoreline Fault Zone, Central Coastal California.", dated January 7, 2011, Appendix L.

Silva, W.J., N. Abrahamson, G. Toro, C. Costantino (1996). "Description and validation of the stochastic ground motion model." Report Submitted to Brookhaven National Laboratory, Associated Universities, Inc. Upton, New York.

Silva, W. J. and R. B. Darragh (2015a). “Development of amplification factors for the Diablo Canyon Nuclear Power Plant.” Report Submitted to Pacific Gas and Electric Company, San Francisco, California.

Silva, W. J. and R. B. Darragh (2015b). “Development of amplification factors for the Diablo Canyon Nuclear Power Plant: Updated Properties.” Report Submitted to Pacific Gas and Electric Company, San Francisco, California. October, 2015.

Table 1 DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
0.51	505.2	1.92	640.5	1.92	812.2	2.10
0.51	519.3	1.92	657.7	1.92	832.9	2.10
0.50	534.7	1.92	675.7	1.92	853.8	2.10
0.51	541.2	1.92	688.3	1.92	875.3	2.10
0.51	559.3	1.92	707.8	2.10	895.6	2.10
0.51	572.8	1.92	724.4	2.10	916.0	2.10
0.51	573.9	1.92	733.7	2.10	938.0	2.10
0.50	573.5	1.92	742.5	2.10	961.3	2.10
0.51	568.7	1.92	749.1	2.10	986.8	2.10
0.51	569.0	1.92	759.0	2.10	1012.4	2.10
0.51	583.1	1.92	777.2	2.10	1035.9	2.10
0.51	582.4	1.92	785.7	2.10	1060.0	2.10
0.50	582.4	1.92	794.7	2.10	1084.5	2.10
0.51	584.0	1.92	804.4	2.10	1108.2	2.10
0.51	586.6	1.92	815.1	2.10	1132.6	2.10
0.51	591.1	1.92	827.1	2.10	1157.4	2.10
0.51	602.1	1.92	842.8	2.10	1179.9	2.10
0.50	621.5	1.92	863.5	2.10	1199.9	2.10
0.51	646.1	1.92	887.0	2.10	1217.8	2.10
0.51	672.1	1.92	910.6	2.10	1233.7	2.10
0.51	705.6	2.10	938.1	2.10	1247.3	2.10
0.51	739.0	2.10	965.5	2.10	1261.4	2.10
0.50	758.8	2.10	984.8	2.10	1278.2	2.10
0.51	768.8	2.10	998.2	2.10	1296.0	2.10
0.51	777.0	2.10	1010.3	2.10	1313.7	2.10
0.51	786.4	2.10	1022.9	2.10	1330.6	2.10
0.51	797.6	2.10	1036.0	2.10	1345.7	2.10
0.50	812.4	2.10	1050.1	2.10	1357.3	2.10
0.51	828.3	2.10	1064.8	2.10	1368.8	2.10
0.51	842.9	2.10	1078.5	2.10	1379.9	2.10
0.51	855.8	2.10	1089.7	2.10	1387.5	2.10
0.51	867.2	2.10	1099.5	2.10	1394.0	2.10
0.50	877.6	2.10	1108.5	2.10	1400.0	2.10
0.51	887.8	2.10	1116.5	2.10	1404.3	2.10
0.51	896.7	2.10	1123.5	2.10	1407.5	2.10
0.51	905.3	2.10	1130.1	2.10	1410.6	2.10
0.51	913.6	2.10	1135.9	2.10	1412.3	2.10
0.50	920.0	2.10	1140.5	2.10	1413.9	2.10
0.51	926.9	2.10	1145.5	2.10	1415.7	2.10
0.51	935.5	2.10	1151.4	2.10	1417.0	2.10
0.51	946.5	2.10	1158.1	2.10	1417.1	2.10

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
0.51	955.6	2.10	1163.7	2.10	1417.3	2.10
0.50	963.0	2.10	1168.5	2.10	1417.8	2.10
0.51	969.6	2.10	1172.7	2.10	1418.4	2.10
0.51	974.0	2.10	1175.6	2.10	1418.9	2.10
0.51	974.1	2.10	1175.8	2.10	1419.4	2.10
0.51	974.3	2.10	1176.2	2.10	1419.8	2.10
0.50	975.8	2.10	1177.8	2.10	1421.7	2.10
0.51	979.0	2.10	1181.5	2.10	1426.0	2.10
0.51	982.8	2.10	1185.8	2.10	1430.6	2.10
0.51	987.5	2.10	1191.1	2.10	1436.7	2.10
0.51	991.2	2.10	1195.9	2.10	1442.9	2.10
0.50	991.5	2.10	1199.1	2.10	1450.1	2.10
0.51	991.5	2.10	1202.3	2.10	1457.9	2.10
0.51	990.0	2.10	1205.5	2.10	1467.9	2.10
0.51	987.1	2.10	1208.2	2.10	1478.7	2.10
0.51	985.8	2.10	1211.9	2.10	1489.8	2.10
0.50	984.6	2.10	1216.3	2.10	1502.5	2.20
0.51	984.1	2.10	1220.8	2.10	1514.5	2.20
0.51	984.0	2.10	1225.8	2.10	1526.9	2.20
0.51	984.0	2.10	1231.2	2.10	1540.7	2.20
0.51	982.9	2.10	1236.4	2.10	1555.3	2.20
0.50	980.6	2.10	1240.9	2.10	1570.2	2.20
0.51	979.8	2.10	1245.9	2.10	1584.3	2.20
0.51	978.1	2.10	1250.5	2.10	1598.8	2.20
0.51	976.9	2.10	1255.3	2.10	1613.2	2.20
0.51	975.0	2.10	1259.2	2.10	1626.3	2.20
0.50	973.0	2.10	1262.7	2.10	1638.7	2.20
0.51	970.8	2.10	1266.1	2.10	1651.2	2.20
0.51	967.7	2.10	1267.6	2.10	1660.6	2.20
0.51	964.3	2.10	1268.7	2.10	1669.2	2.20
0.51	960.9	2.10	1269.7	2.10	1677.6	2.20
0.50	957.2	2.10	1269.2	2.10	1682.9	2.20
0.51	953.5	2.10	1268.5	2.10	1687.5	2.20
0.51	949.9	2.10	1267.7	2.10	1691.8	2.20
0.51	945.2	2.10	1265.3	2.10	1693.7	2.20
0.51	941.6	2.10	1262.7	2.10	1693.5	2.20
0.50	938.4	2.10	1260.8	2.10	1694.1	2.20
0.51	935.1	2.10	1258.9	2.10	1694.7	2.20
0.51	931.5	2.10	1256.7	2.10	1695.4	2.20
0.51	929.1	2.10	1255.2	2.10	1695.7	2.20
0.51	924.9	2.10	1252.3	2.10	1695.6	2.20

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
0.50	920.8	2.10	1249.3	2.10	1694.9	2.20
0.51	917.6	2.10	1246.3	2.10	1692.7	2.20
0.51	914.4	2.10	1242.3	2.10	1687.8	2.20
0.51	911.0	2.10	1237.9	2.10	1681.9	2.20
0.51	909.0	2.10	1233.5	2.10	1673.8	2.20
0.50	907.9	2.10	1228.3	2.10	1661.6	2.20
0.51	907.0	2.10	1222.6	2.10	1647.9	2.20
0.51	906.4	2.10	1216.1	2.10	1631.7	2.20
0.51	906.6	2.10	1207.9	2.10	1609.4	2.20
0.51	907.5	2.10	1199.3	2.10	1584.9	2.20
0.50	907.6	2.10	1190.3	2.10	1561.1	2.20
0.51	906.5	2.10	1180.3	2.10	1536.7	2.20
0.51	906.4	2.10	1170.5	2.10	1511.5	2.20
0.51	906.6	2.10	1160.9	2.10	1486.5	2.10
0.51	906.7	2.10	1151.4	2.10	1462.2	2.10
0.50	907.0	2.10	1142.2	2.10	1438.4	2.10
0.51	907.2	2.10	1133.4	2.10	1416.1	2.10
0.51	908.1	2.10	1125.7	2.10	1395.5	2.10
0.51	908.4	2.10	1117.8	2.10	1375.5	2.10
0.51	908.2	2.10	1110.0	2.10	1356.5	2.10
0.50	908.6	2.10	1103.5	2.10	1340.1	2.10
0.51	908.8	2.10	1097.1	2.10	1324.4	2.10
0.51	910.1	2.10	1091.6	2.10	1309.3	2.10
0.51	911.5	2.10	1087.2	2.10	1296.8	2.10
0.51	912.7	2.10	1082.9	2.10	1284.8	2.10
0.50	914.6	2.10	1079.4	2.10	1273.9	2.10
0.51	916.5	2.10	1077.0	2.10	1265.7	2.10
0.51	919.1	2.10	1075.1	2.10	1257.5	2.10
0.51	922.8	2.10	1074.0	2.10	1250.0	2.10
0.51	927.2	2.10	1074.4	2.10	1245.1	2.10
0.50	930.4	2.10	1074.3	2.10	1240.5	2.10
0.51	934.3	2.10	1074.9	2.10	1236.5	2.10
0.51	939.0	2.10	1076.8	2.10	1234.8	2.10
0.51	944.6	2.10	1079.3	2.10	1233.1	2.10
0.51	952.0	2.10	1083.4	2.10	1232.9	2.10
0.50	957.4	2.10	1086.6	2.10	1233.3	2.10
0.51	961.9	2.10	1089.3	2.10	1233.6	2.10
0.51	967.3	2.10	1092.8	2.10	1234.7	2.10
0.51	972.1	2.10	1096.2	2.10	1236.1	2.10
0.51	976.3	2.10	1099.2	2.10	1237.7	2.10
0.50	981.0	2.10	1103.2	2.10	1240.6	2.10

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
0.51	985.4	2.10	1106.9	2.10	1243.3	2.10
0.51	990.5	2.10	1111.2	2.10	1246.5	2.10
0.51	994.9	2.10	1115.2	2.10	1250.1	2.10
0.51	999.1	2.10	1119.0	2.10	1253.4	2.10
0.50	1002.6	2.10	1122.5	2.10	1256.7	2.10
0.51	1005.5	2.10	1125.4	2.10	1259.5	2.10
0.51	1008.5	2.10	1128.6	2.10	1263.1	2.10
0.51	1011.6	2.10	1131.9	2.10	1266.5	2.10
0.51	1014.9	2.10	1135.5	2.10	1270.3	2.10
0.50	1018.8	2.10	1138.9	2.10	1273.2	2.10
0.51	1022.2	2.10	1142.2	2.10	1276.2	2.10
0.51	1027.4	2.10	1146.5	2.10	1279.3	2.10
0.51	1031.4	2.10	1150.0	2.10	1282.2	2.10
0.51	1035.2	2.10	1153.4	2.10	1285.2	2.10
0.50	1038.5	2.10	1156.4	2.10	1287.6	2.10
0.51	1042.7	2.10	1159.8	2.10	1290.2	2.10
0.51	1047.5	2.10	1163.8	2.10	1293.0	2.10
0.51	1051.5	2.10	1167.0	2.10	1295.3	2.10
0.51	1055.3	2.10	1170.1	2.10	1297.4	2.10
0.50	1059.1	2.10	1172.7	2.10	1298.5	2.10
0.51	1063.0	2.10	1175.3	2.10	1299.6	2.10
0.51	1066.4	2.10	1178.6	2.10	1302.5	2.10
0.51	1069.2	2.10	1181.6	2.10	1305.9	2.10
0.51	1071.1	2.10	1183.8	2.10	1308.3	2.10
0.50	1073.3	2.10	1186.2	2.10	1311.0	2.10
0.51	1075.6	2.10	1188.7	2.10	1313.7	2.10
0.51	1077.6	2.10	1190.9	2.10	1316.2	2.10
0.51	1079.1	2.10	1192.6	2.10	1318.0	2.10
0.51	1080.7	2.10	1194.3	2.10	1319.9	2.10
0.50	1082.2	2.10	1196.1	2.10	1321.8	2.10
0.51	1083.3	2.10	1197.2	2.10	1323.1	2.10
0.51	1084.2	2.10	1198.2	2.10	1324.3	2.10
0.51	1085.3	2.10	1199.4	2.10	1325.6	2.10
0.51	1086.1	2.10	1200.3	2.10	1326.6	2.10
0.50	1086.4	2.10	1200.7	2.10	1327.0	2.10
0.51	1086.2	2.10	1200.5	2.10	1326.7	2.10
0.51	1086.2	2.10	1200.4	2.10	1326.7	2.10
0.51	1086.9	2.10	1201.3	2.10	1327.6	2.10
0.51	1087.8	2.10	1202.2	2.10	1328.7	2.10
0.50	1088.6	2.10	1203.1	2.10	1329.6	2.10
0.51	1089.4	2.10	1204.0	2.10	1330.6	2.10

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
0.51	1090.9	2.10	1205.6	2.10	1332.4	2.10
0.51	1091.2	2.10	1205.9	2.10	1332.7	2.10
0.51	1091.7	2.10	1206.5	2.10	1333.4	2.10
0.50	1092.5	2.10	1207.4	2.10	1334.4	2.10
0.51	1093.0	2.10	1208.0	2.10	1335.0	2.10
0.51	1094.3	2.10	1209.3	2.10	1336.5	2.10
0.51	1095.7	2.10	1210.9	2.10	1338.3	2.10
0.51	1097.2	2.10	1212.6	2.10	1340.1	2.10
0.50	1098.6	2.10	1214.1	2.10	1341.8	2.10
0.51	1100.3	2.10	1216.0	2.10	1343.9	2.10
0.51	1101.3	2.10	1217.1	2.10	1345.1	2.10
0.51	1102.5	2.10	1218.5	2.10	1346.6	2.10
0.51	1104.0	2.10	1220.1	2.10	1348.4	2.10
0.50	1105.5	2.10	1221.8	2.10	1350.3	2.10
0.51	1107.7	2.10	1224.2	2.10	1352.9	2.10
0.51	1109.5	2.10	1226.1	2.10	1355.1	2.10
0.51	1111.3	2.10	1228.1	2.10	1357.3	2.10
0.51	1113.0	2.10	1230.0	2.10	1359.4	2.10
0.50	1115.0	2.10	1232.3	2.10	1361.9	2.10
0.51	1116.0	2.10	1233.4	2.10	1363.1	2.10
0.51	1117.6	2.10	1235.1	2.10	1365.0	2.10
0.51	1119.6	2.10	1237.4	2.10	1367.5	2.10
0.51	1121.3	2.10	1239.2	2.10	1369.6	2.10
0.50	1122.4	2.10	1240.4	2.10	1370.9	2.10
0.51	1123.4	2.10	1241.5	2.10	1372.1	2.10
0.51	1124.4	2.10	1242.7	2.10	1373.4	2.10
0.51	1125.1	2.10	1243.4	2.10	1374.2	2.10
0.51	1126.5	2.10	1245.0	2.10	1375.9	2.10
0.50	1127.7	2.10	1246.3	2.10	1377.4	2.10
0.51	1129.5	2.10	1248.3	2.10	1379.6	2.10
0.51	1130.7	2.10	1249.6	2.10	1381.1	2.10
0.51	1131.6	2.10	1250.6	2.10	1382.1	2.10
0.51	1132.6	2.10	1251.8	2.10	1383.4	2.10
0.50	1134.1	2.10	1253.3	2.10	1385.2	2.10
0.51	1135.2	2.10	1254.6	2.10	1386.5	2.10
0.51	1136.8	2.10	1256.3	2.10	1388.5	2.10
0.51	1138.4	2.10	1258.1	2.10	1390.4	2.10
0.51	1140.2	2.10	1260.1	2.10	1392.7	2.10
0.50	1142.0	2.10	1262.1	2.10	1394.8	2.10
0.51	1143.7	2.10	1263.9	2.10	1396.9	2.10
0.51	1145.7	2.10	1266.2	2.10	1399.3	2.10

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
0.51	1148.0	2.10	1268.7	2.10	1402.1	2.10
0.51	1150.1	2.10	1271.0	2.10	1404.7	2.10
0.50	1152.3	2.10	1273.5	2.10	1407.5	2.10
0.51	1154.6	2.10	1276.0	2.10	1410.2	2.10
0.51	1156.3	2.10	1277.9	2.10	1412.2	2.10
0.51	1157.1	2.10	1278.8	2.10	1413.3	2.10
0.51	1158.8	2.10	1280.7	2.10	1415.4	2.10
0.50	1159.9	2.10	1281.9	2.10	1416.7	2.10
0.51	1160.5	2.10	1282.6	2.10	1417.5	2.10
0.51	1161.4	2.10	1283.6	2.10	1418.6	2.10
0.51	1162.1	2.10	1284.3	2.10	1419.4	2.10
0.51	1162.5	2.10	1284.8	2.10	1419.9	2.10
0.50	1163.1	2.10	1285.4	2.10	1420.6	2.10
0.51	1164.1	2.10	1286.5	2.10	1421.8	2.10
0.51	1165.0	2.10	1287.5	2.10	1422.9	2.10
0.51	1166.0	2.10	1288.6	2.10	1424.1	2.10
0.51	1166.7	2.10	1289.4	2.10	1425.0	2.10
0.50	1166.8	2.10	1289.5	2.10	1425.2	2.10
0.51	1167.1	2.10	1289.8	2.10	1425.4	2.10
0.51	1167.5	2.10	1290.3	2.10	1426.0	2.10
0.51	1167.7	2.10	1290.5	2.10	1426.2	2.10
0.51	1167.8	2.10	1290.6	2.10	1426.4	2.10
0.50	1167.9	2.10	1290.8	2.10	1426.5	2.10
0.51	1167.3	2.10	1290.1	2.10	1425.8	2.10
0.51	1166.6	2.10	1289.3	2.10	1424.9	2.10
0.51	1166.3	2.10	1288.9	2.10	1424.5	2.10
0.51	1166.6	2.10	1289.2	2.10	1424.8	2.10
0.50	1167.0	2.10	1289.7	2.10	1425.3	2.10
0.51	1167.3	2.10	1290.0	2.10	1425.7	2.10
0.51	1167.2	2.10	1290.0	2.10	1425.7	2.10
0.51	1167.4	2.10	1290.1	2.10	1425.8	2.10
0.51	1167.1	2.10	1289.9	2.10	1425.5	2.10
0.50	1167.1	2.10	1289.8	2.10	1425.5	2.10
0.51	1167.3	2.10	1290.1	2.10	1425.7	2.10
0.51	1167.6	2.10	1290.4	2.10	1426.1	2.10
0.51	1167.8	2.10	1290.7	2.10	1426.4	2.10
0.51	1168.1	2.10	1291.0	2.10	1426.8	2.10
0.50	1168.3	2.10	1291.2	2.10	1427.0	2.10
0.51	1168.7	2.10	1291.6	2.10	1427.4	2.10
0.51	1168.8	2.10	1291.7	2.10	1427.6	2.10
0.51	1168.7	2.10	1291.6	2.10	1427.4	2.10

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
0.51	1168.4	2.10	1291.3	2.10	1427.1	2.10
0.50	1169.4	2.10	1292.4	2.10	1428.4	2.10
15.03	1170.0	2.10	1293.0	2.10	1429.0	2.10
16.47	1200.0	2.10	1320.0	2.10	1460.0	2.10
30.48	1262.3	2.10	1395.0	2.10	1541.7	2.20
30.48	1355.1	2.10	1497.6	2.10	1655.1	2.20
30.48	1408.9	2.10	1557.1	2.20	1720.9	2.20
30.48	1522.5	2.20	1682.6	2.20	1859.6	2.20
30.48	1629.3	2.20	1800.6	2.20	1990.0	2.20
30.48	1702.3	2.20	1881.3	2.20	2079.2	2.20
30.48	1783.9	2.20	1971.5	2.20	2178.8	2.20
30.48	1819.9	2.20	2011.3	2.20	2222.8	2.20
30.48	1880.3	2.20	2078.1	2.20	2296.7	2.20
30.48	1880.3	2.20	2078.1	2.20	2296.7	2.20
30.48	1942.0	2.20	2146.2	2.20	2371.9	2.20
30.48	1942.0	2.20	2146.2	2.20	2371.9	2.20
30.48	1995.5	2.20	2205.4	2.20	2437.3	2.20
30.48	1995.5	2.20	2205.4	2.20	2437.3	2.20
30.48	2045.0	2.20	2260.1	2.20	2497.8	2.20
30.48	2045.0	2.20	2260.1	2.20	2497.8	2.20
30.48	2112.3	2.20	2334.5	2.20	2580.0	2.52
30.48	2112.3	2.20	2334.5	2.20	2580.0	2.52
30.48	2199.4	2.20	2430.7	2.20	2686.3	2.52
30.48	2199.4	2.20	2430.7	2.20	2686.3	2.52
30.48	2283.4	2.20	2523.5	2.52	2788.9	2.52
30.48	2283.4	2.20	2523.5	2.52	2788.9	2.52
30.48	2285.7	2.20	2526.1	2.52	2791.8	2.52
30.48	2285.7	2.20	2526.1	2.52	2791.8	2.52
30.48	2252.4	2.20	2489.3	2.20	2751.1	2.52
30.48	2252.4	2.20	2489.3	2.20	2751.1	2.52
30.48	2232.2	2.20	2467.0	2.20	2726.5	2.52
30.48	2232.2	2.20	2467.0	2.20	2726.5	2.52
30.48	2232.7	2.20	2467.5	2.20	2727.0	2.52
30.48	2232.7	2.20	2467.5	2.20	2727.0	2.52
30.48	2250.9	2.20	2487.6	2.20	2749.2	2.52
30.48	2250.9	2.20	2487.6	2.20	2749.2	2.52
30.48	2281.2	2.20	2521.1	2.52	2786.2	2.52
30.48	2281.2	2.20	2521.1	2.52	2786.2	2.52
30.48	2319.2	2.20	2563.1	2.52	2832.7	2.52
30.48	2319.2	2.20	2563.1	2.52	2832.7	2.52
30.48	2363.0	2.20	2611.5	2.52	2886.2	2.52

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
30.48	2363.0	2.20	2611.5	2.52	2886.2	2.52
30.48	2408.9	2.20	2662.3	2.52	2942.3	2.52
30.48	2408.9	2.20	2662.3	2.52	2942.3	2.52
30.48	2453.9	2.20	2712.0	2.52	2997.2	2.52
30.48	2453.9	2.20	2712.0	2.52	2997.2	2.52
30.48	2493.7	2.20	2756.0	2.52	3045.9	2.52
30.48	2493.7	2.20	2756.0	2.52	3045.9	2.52
30.48	2526.1	2.52	2791.8	2.52	3085.4	2.52
30.48	2526.1	2.52	2791.8	2.52	3085.4	2.52
30.48	2547.8	2.52	2815.8	2.52	3111.9	2.52
30.48	2547.8	2.52	2815.8	2.52	3111.9	2.52
30.48	2557.4	2.52	2826.4	2.52	3123.7	2.52
30.48	2557.4	2.52	2826.4	2.52	3123.7	2.52
30.48	2572.1	2.52	2842.6	2.52	3141.6	2.52
30.48	2572.1	2.52	2842.6	2.52	3141.6	2.52
30.48	2588.6	2.52	2860.8	2.52	3161.7	2.52
30.48	2588.6	2.52	2860.8	2.52	3161.7	2.52
30.48	2608.1	2.52	2882.4	2.52	3185.5	2.52
30.48	2608.1	2.52	2882.4	2.52	3185.5	2.52
30.48	2627.6	2.52	2904.0	2.52	3209.4	2.52
30.48	2627.6	2.52	2904.0	2.52	3209.4	2.52
30.48	2646.0	2.52	2924.3	2.52	3231.9	2.52
30.48	2646.0	2.52	2924.3	2.52	3231.9	2.52
30.48	2666.3	2.52	2946.7	2.52	3256.6	2.52
30.48	2666.3	2.52	2946.7	2.52	3256.6	2.52
30.48	2684.5	2.52	2966.8	2.52	3278.8	2.52
30.48	2684.5	2.52	2966.8	2.52	3278.8	2.52
30.48	2703.2	2.52	2987.5	2.52	3301.7	2.52
30.48	2703.2	2.52	2987.5	2.52	3301.7	2.52
30.48	2721.8	2.52	3008.0	2.52	3324.4	2.52
30.48	2721.8	2.52	3008.0	2.52	3324.4	2.52
30.48	2737.9	2.52	3025.8	2.52	3344.0	2.52
30.48	2737.9	2.52	3025.8	2.52	3344.0	2.52
30.48	2755.0	2.52	3044.8	2.52	3365.0	2.52
30.48	2755.0	2.52	3044.8	2.52	3365.0	2.52
30.48	2773.6	2.52	3065.3	2.52	3387.7	2.52
30.48	2773.6	2.52	3065.3	2.52	3387.7	2.52
30.48	2789.5	2.52	3082.9	2.52	3407.1	2.52
30.48	2789.5	2.52	3082.9	2.52	3407.1	2.52
30.48	2803.8	2.52	3098.7	2.52	3424.6	2.52
30.48	2803.8	2.52	3098.7	2.52	3424.6	2.52

Table 1 (cont.) DCPP Site Wide Profiles						
	Lower		Central		Upper	
Thickness (m)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)	Vs (m/s)	Density (g/cm^3)
30.48	2815.0	2.52	3111.1	2.52	3438.3	2.52
30.48	2815.0	2.52	3111.1	2.52	3438.3	2.52
30.48	2825.2	2.52	3122.3	2.52	3450.7	2.52
30.48	2825.2	2.52	3122.3	2.52	3450.7	2.52
30.48	2837.2	2.52	3135.6	2.52	3465.4	2.52
30.48	2837.2	2.52	3135.6	2.52	3465.4	2.52
30.48	2853.9	2.52	3154.0	2.52	3485.7	2.52
30.48	2853.9	2.52	3154.0	2.52	3485.7	2.52
30.48	2860.2	2.52	3161.0	2.52	3493.4	2.52
30.48	2860.2	2.52	3161.0	2.52	3493.4	2.52
1100.0	2970.0	2.59	3161.0	2.52	3500.0	2.75
1550.0	3150.0	2.64	3161.0	2.52	3500.0	2.75
2400.0	3320.0	2.69	3320.0	2.69	3500.0	2.75
110.281	3500.0	2.75	3500.0	2.75	3500.0	2.75

Table 2

Modulus Reduction and Damping Curves*

PR GENERIC COHESIONLESS SOIL MODULUS REDUCTION CURVE (M3); 0 - 50 FT.									
1.0	1.0	1.0	0.97	0.87	0.68	0.43	0.22	0.09	0.05
PR GENERIC COHESIONLESS SOIL DAMPING CURVE (M3); 0 - 50 FT.									
1.0	1.0	1.2	1.64	2.8	5.49	10.2	15.0	15.0	15.0
PR GENERIC COHESIONLESS SOIL MODULUS REDUCTION CURVE (M3); 51 - 500 FT.									
1.0	1.0	1.0	0.99	0.95	0.852	0.65	0.41	0.20	0.10
PR GENERIC COHESIONLESS SOIL DAMPING CURVE (M3); 51 - 500 FT.									
0.6	0.6	0.6	0.81	1.2	2.5	5.3	10.27	15.0	15.0
EPRI GENERIC ROCK MODULUS REDUCTION CURVE (M2); 0 - 20 FT.									
1.0	1.0	0.9716	0.8614	0.6294	0.383	0.1747	0.0714	0.0238	0.0084
EPRI GENERIC ROCK DAMPING CURVE (M2); 0 - 20 FT.									
3.263	3.39	4.017	5.58	9.191	14.397	15.0	15.0	15.0	15.0
EPRI GENERIC ROCK MODULUS REDUCTION CURVE (M2); 20 - 50 FT.									
1.0	1.0	0.9801	0.8844	0.6653	0.4177	0.1967	0.0821	0.0277	0.0098
EPRI GENERIC ROCK DAMPING CURVE (M2); 20- 50 FT.									
3.245	3.339	3.869	5.25	8.55	13.532	15.0	15.0	15.0	15.0
EPRI GENERIC ROCK MODULUS REDUCTION CURVE (M2); 50 - 120 FT.									
1.0	1.0	0.9898	0.9121	0.7118	0.4655	0.229	0.0984	0.0338	0.012
EPRI GENERIC ROCK DAMPING CURVE (M2); 50- 120 FT.									
3.225	3.282	3.701	4.865	7.773	12.429	15.0	15.0	15.0	15.0
EPRI GENERIC ROCK MODULUS REDUCTION CURVE (M2); 120 - 250 FT.									
1.0	1.0	0.9997	0.9417	0.7667	0.5264	0.2735	0.1224	0.0431	0.0154
EPRI GENERIC ROCK DAMPING CURVE (M2); 120 - 250 FT.									
3.206	3.227	3.534	4.463	6.926	11.14	15.0	15.0	15.0	15.0
EPRI GENERIC ROCK MODULUS REDUCTION CURVE (M2); 250 - 500 FT.									
1.0	1.0	1.0	0.9668	0.8324	0.6119	0.3454	0.1649	0.0608	0.0222
EPRI GENERIC ROCK DAMPING CURVE (M2); 250 - 500 FT.									
3.186	3.167	3.348	3.995	5.881	9.398	15.0	15.0	15.0	15.0

* The ten cyclic strain levels are (percent):
1.E-4.0, 1.E-3.5, 1.E-3.0, 1.E-2.5, 1.E-2.0, 1.E-1.5, 1.E-1.0, 1.E-0.5, 1.E-0.0, 1.E+0.5.

Table 3 Relative Weights	
Profiles	
Case	Relative Weight
Lower range	0.2
Central	0.6
Upper range	0.2
Site Wide Profile (P1)	1.0
G/G_{max} and Hysteretic Damping	
Case	Relative Weight
Linear (M1)	0.5
EPRI Rock Curves (M2)	0.25
Peninsular Range Curves (M3)	0.25
Kappa(s)	
Case	Relative Weight
0.040 (K1)	0.4
0.050 (K2)	0.3
0.030 (K3)	0.3

Table 4 Kappa(s)				
Base-case Name	Profile Name	Kappa(s) Surface to 500 ft (152.4 m)* depth	Kappa(s) 500 ft (152.4 m) to 8.0 km depth	Total Kappa(s) at Surface
Lower	M1P1K1	0.005	0.035	0.040
	M1P1K2	0.005	0.045	0.050
	M1P1K3	0.005	0.025	0.030
	M2P1K1	0.011	0.029	0.040
	M2P1K2	0.011	0.039	0.050
	M2P1K3	0.011	0.019	0.030
	M3P1K1	0.002	0.038	0.040
	M3P1K2	0.002	0.048	0.050
	M3P1K3	0.002	0.028	0.030
Central	M1P1K1	0.004	0.036	0.040
	M1P1K2	0.004	0.046	0.050
	M1P1K3	0.004	0.026	0.030
	M2P1K1	0.009	0.031	0.040
	M2P1K2	0.009	0.041	0.050
	M2P1K3	0.009	0.021	0.030
	M3P1K1	0.002	0.038	0.040
	M3P1K2	0.002	0.048	0.050
	M3P1K3	0.002	0.028	0.030
Upper	M1P1K1	0.003	0.037	0.040
	M1P1K2	0.003	0.047	0.050
	M1P1K3	0.003	0.027	0.030
	M2P1K1	0.008	0.032	0.040
	M2P1K2	0.008	0.042	0.050
	M2P1K3	0.008	0.022	0.030
	M3P1K1	0.002	0.038	0.040
	M3P1K2	0.002	0.048	0.050
	M3P1K3	0.002	0.028	0.030

* Nonlinear zone for cases M2 and M3.

Table 5 Control Motion Parameters	
Magnitude **M**	7.0
Stress Parameter	50 bars
Qo	250
Eta	0.40
Shear-wave velocity	3.50 km/s
Density	2.75 g/cm^3
Spectral Shape	2-corner
Kappa	0.030 sec

Table 6 Distances for **M** 7.0, Double-corner Point-source Ground Motion Model		
Loading Level (g)	Epicentral Distance(km)	Hypocentral Depth(km)
0.01	171.0	8.0
0.05	52.0	8.0
0.10	32.0	8.0
0.20	18.0	8.0
0.30	11.0	8.0
0.40	7.5	8.0
0.50	4.0	8.0
0.75	0.0	6.0
1.00	0.0	4.5
1.25	0.0	3.65
1.50	0.0	3.0
1.75	0.0	2.6
2.00	0.0	2.21
2.50	0.0	1.74
3.00	0.0	1.45

Table 7 Directory and File Structure	
Nonlinearity	
M1	Linear Analyses
M2	EPRI G/Gmax and hysteretic damping curves
M3	Peninsular Range G/Gmax and hysteretic damping curves
Kappa(s)	
K1	0.040
K2	0.050
K3	0.030
Profile	
C.28	Central (P1)
L.28	Lower (P1)
U.28	Upper (P1)
Control Motion	
2C	Double-Corner

C.28\M70\2C\M1P1K1\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M1P1K2\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M1P1K3\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M2P1K1\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M2P1K2\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M2P1K3\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M3P1K1\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M3P1K2\AMPFACT\AMPFACT.OUT
C.28\M70\2C\M3P1K3\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M1P1K1\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M1P1K2\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M1P1K3\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M2P1K1\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M2P1K2\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M2P1K3\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M3P1K1\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M3P1K2\AMPFACT\AMPFACT.OUT
L.28\M70\2C\M3P1K3\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M1P1K1\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M1P1K2\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M1P1K3\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M2P1K1\AMPFACT\AMPFACT.OUT

U.28\M70\2C\M2P1K2\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M2P1K3\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M3P1K1\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M3P1K2\AMPFACT\AMPFACT.OUT
U.28\M70\2C\M3P1K3\AMPFACT\AMPFACT.OUT

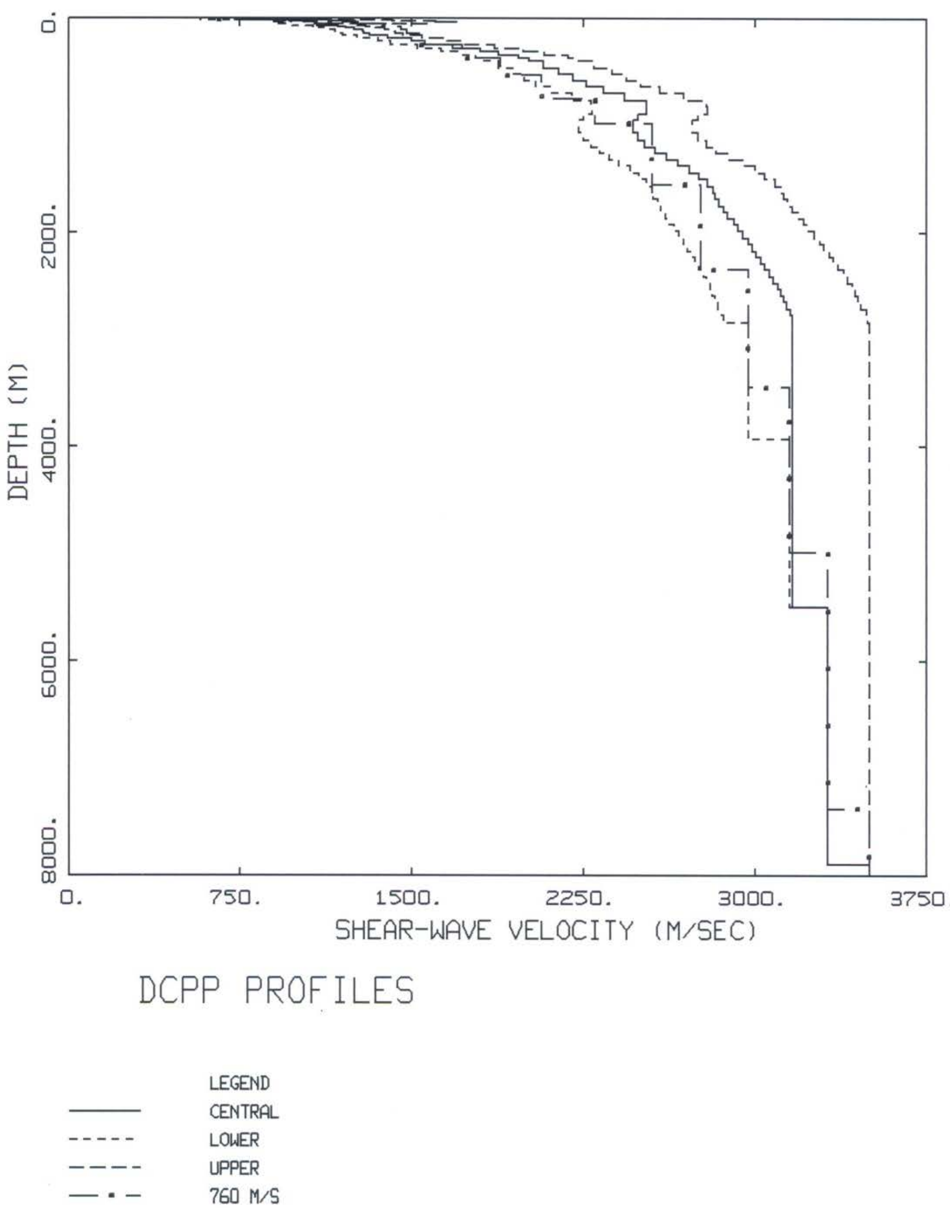


Figure 1. Lower, Central and Upper base-case shear-wave velocity profiles compared to the generic rock $\overline{V_S}$ (30m) 760m/s profile shown to a depth of 8 km (source depth). These profiles were merged with the generic rock profile at about 2.8 km depth.

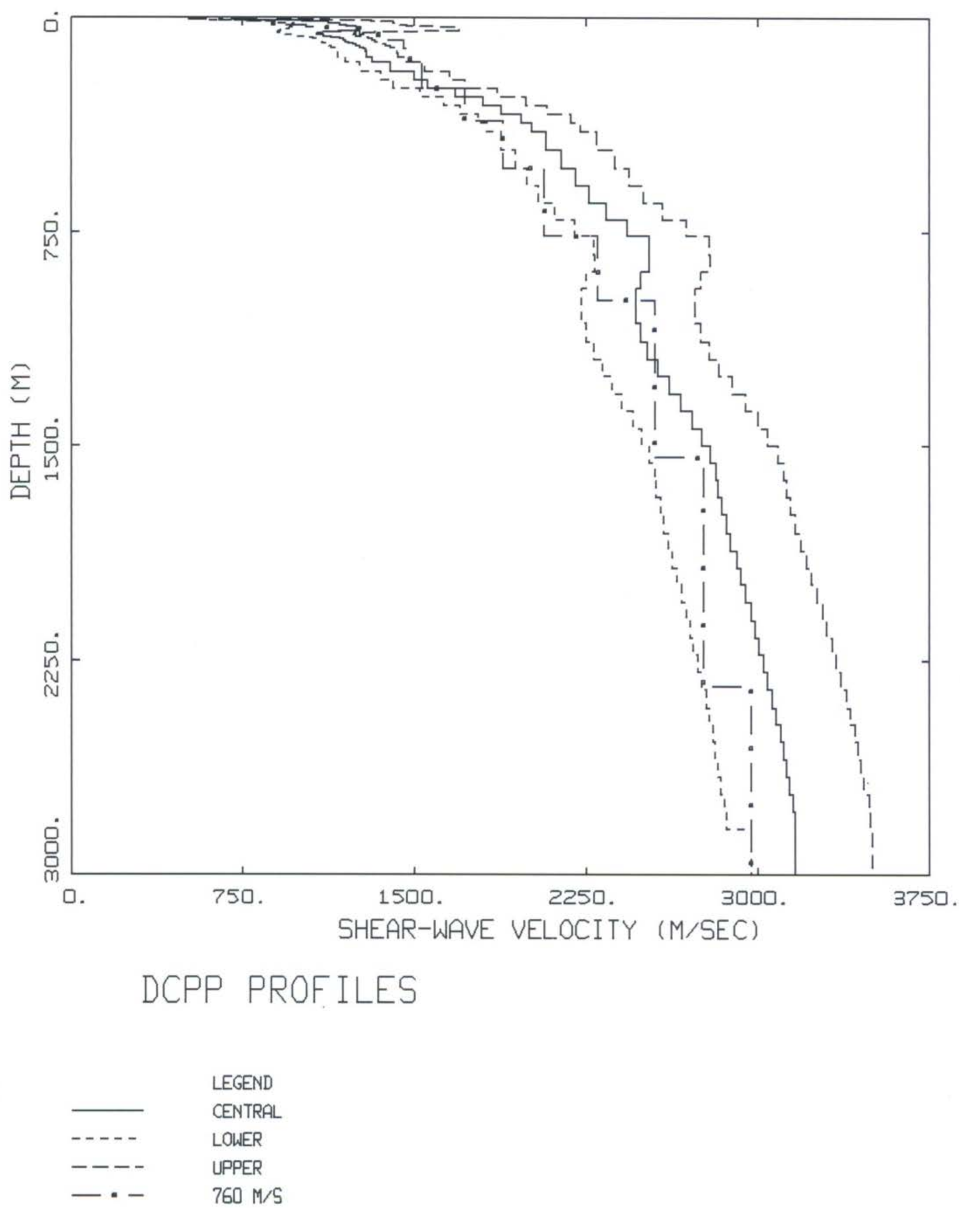


Figure 2. Lower, Central and Upper base-case shear-wave velocity profiles compared to the generic rock $\overline{V_S}$ (30m) 760m/s profile shown to a depth of 3 km. These profiles were merged with the generic rock profile at about 2.8 km depth.

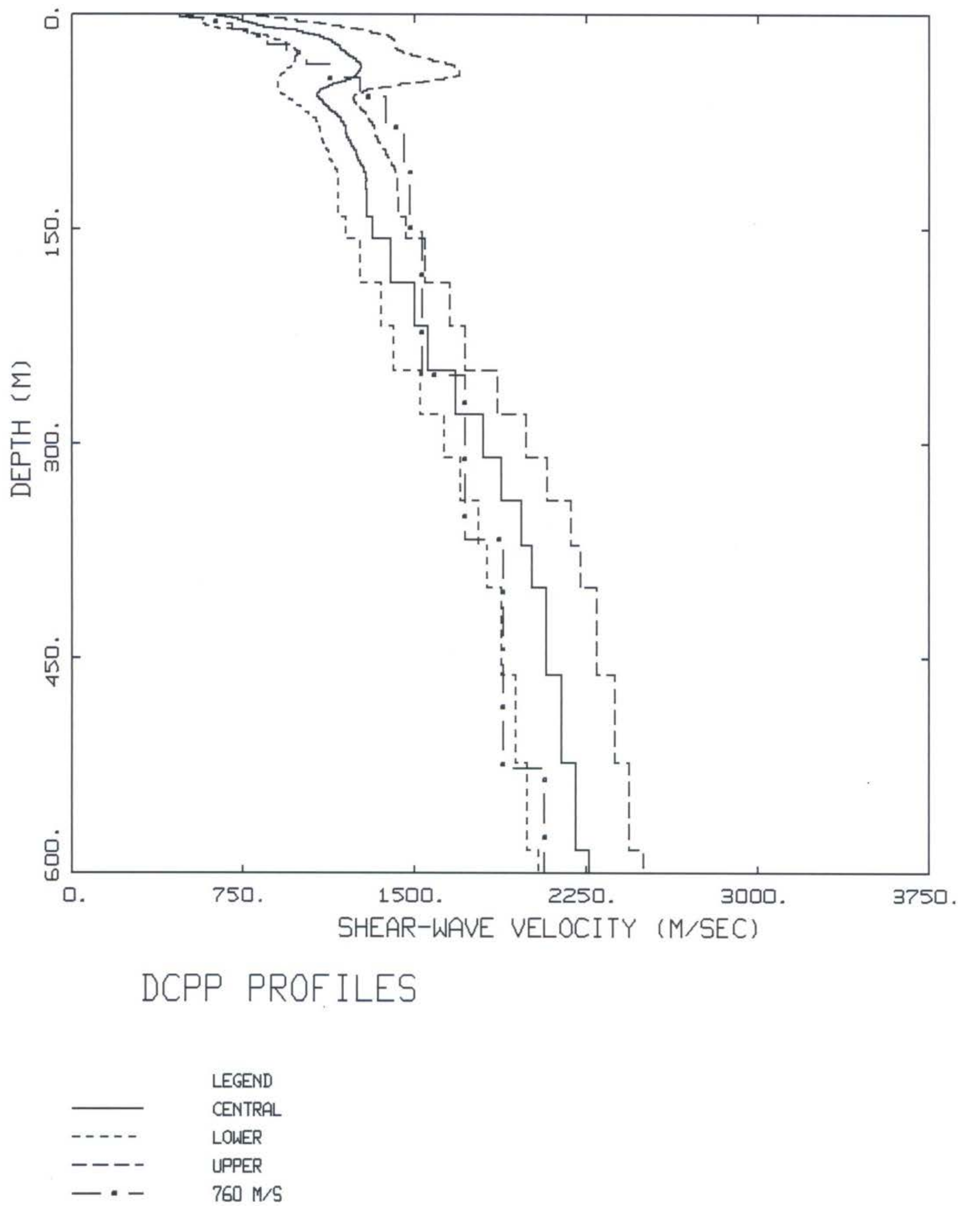


Figure 3. Lower, Central and Upper base-case shear-wave velocity profiles compared to the generic rock $\overline{V_S}$ (30m) 760m/s profile shown to a depth of 600 m.

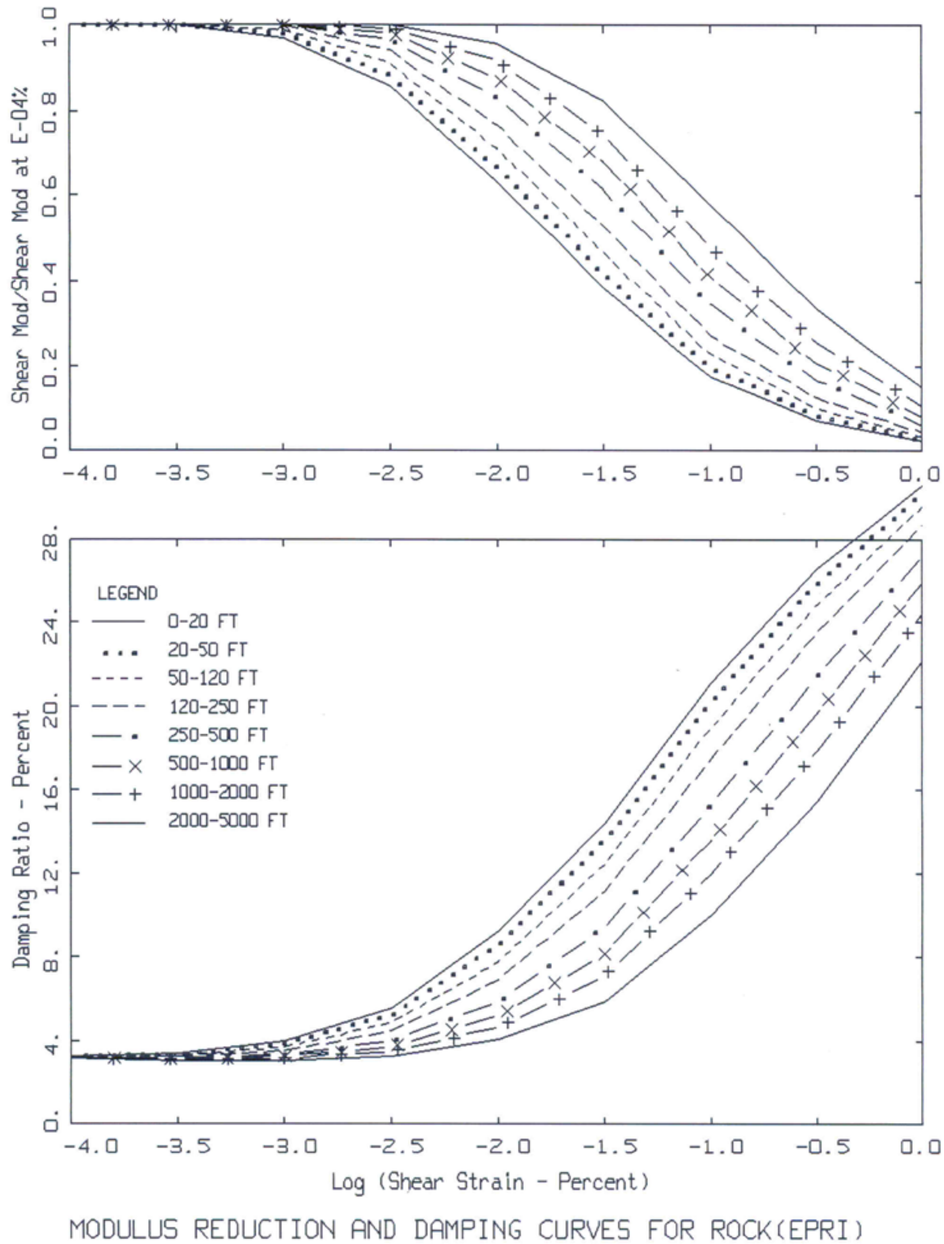


Figure 4. EPRI rock G/G_{max} and hysteretic damping curves (EPRI, 1993), hysteretic damping was limited to 15%.

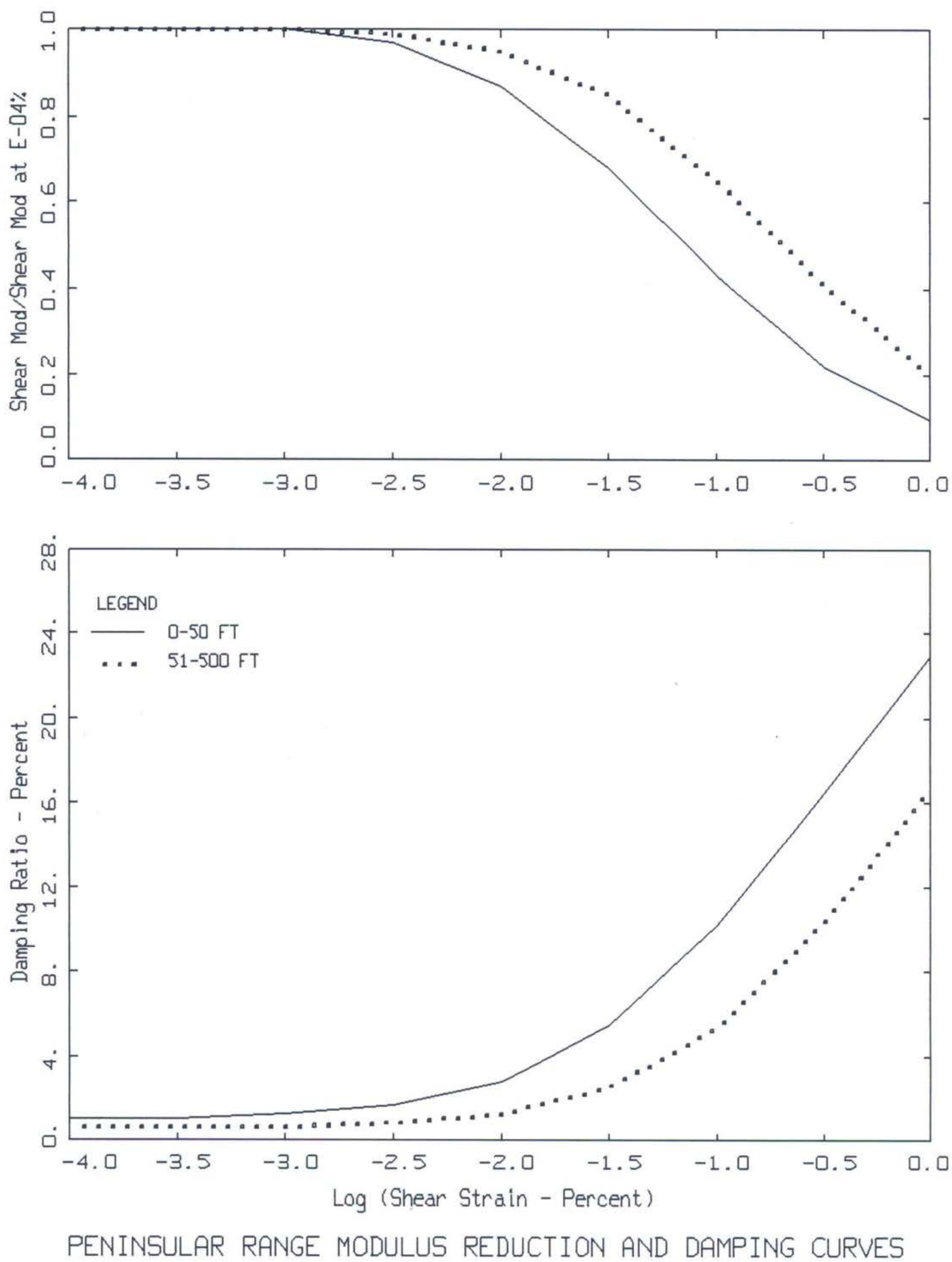


Figure 5. Peninsular Range G/G_{max} and hysteretic damping curves (Silva et al., 1996), hysteretic damping was limited to 15%.

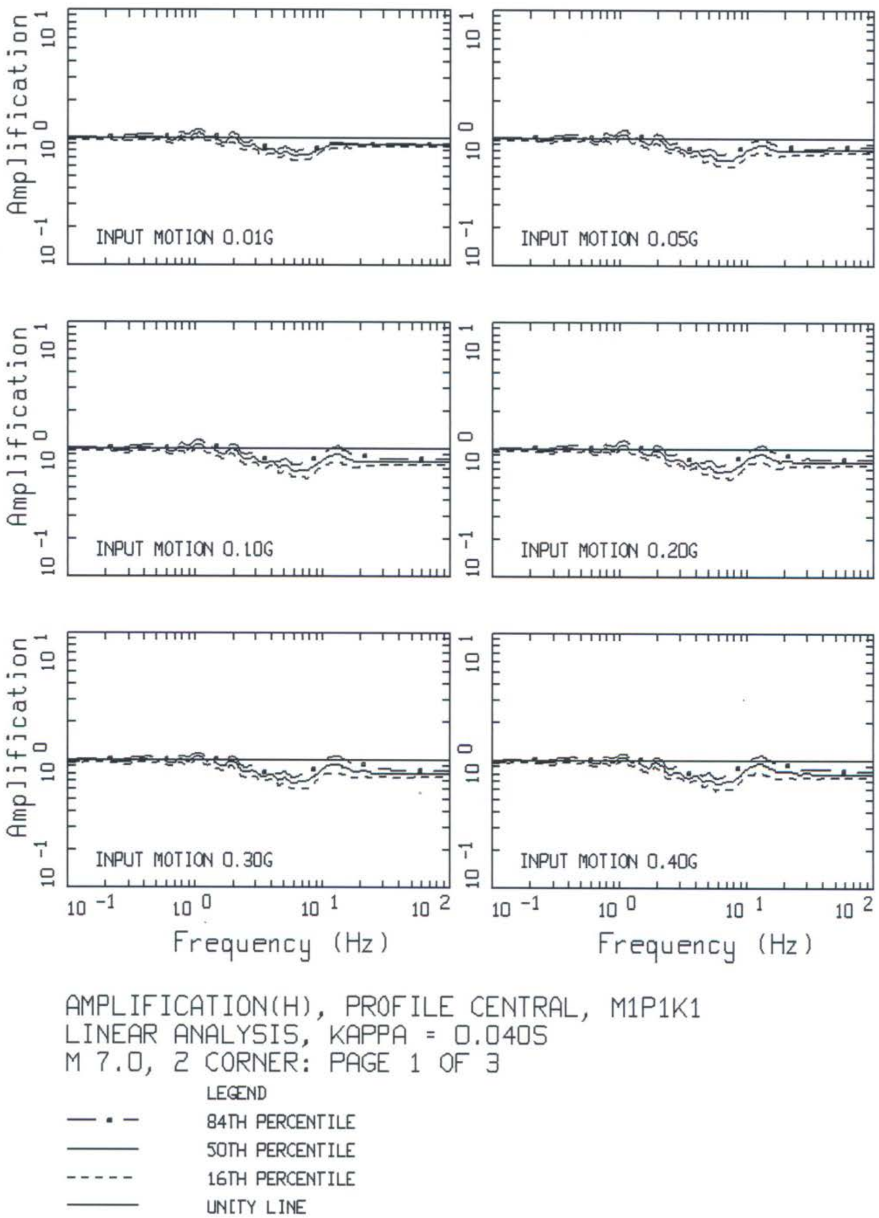


Figure 6. Example suite of amplification factors (5% damped PSa) relative to reference rock ($\overline{V_S}$ (30m) 760m/s): Profile Central, Linear Analysis (M1), kappa = 0.040s (K1).

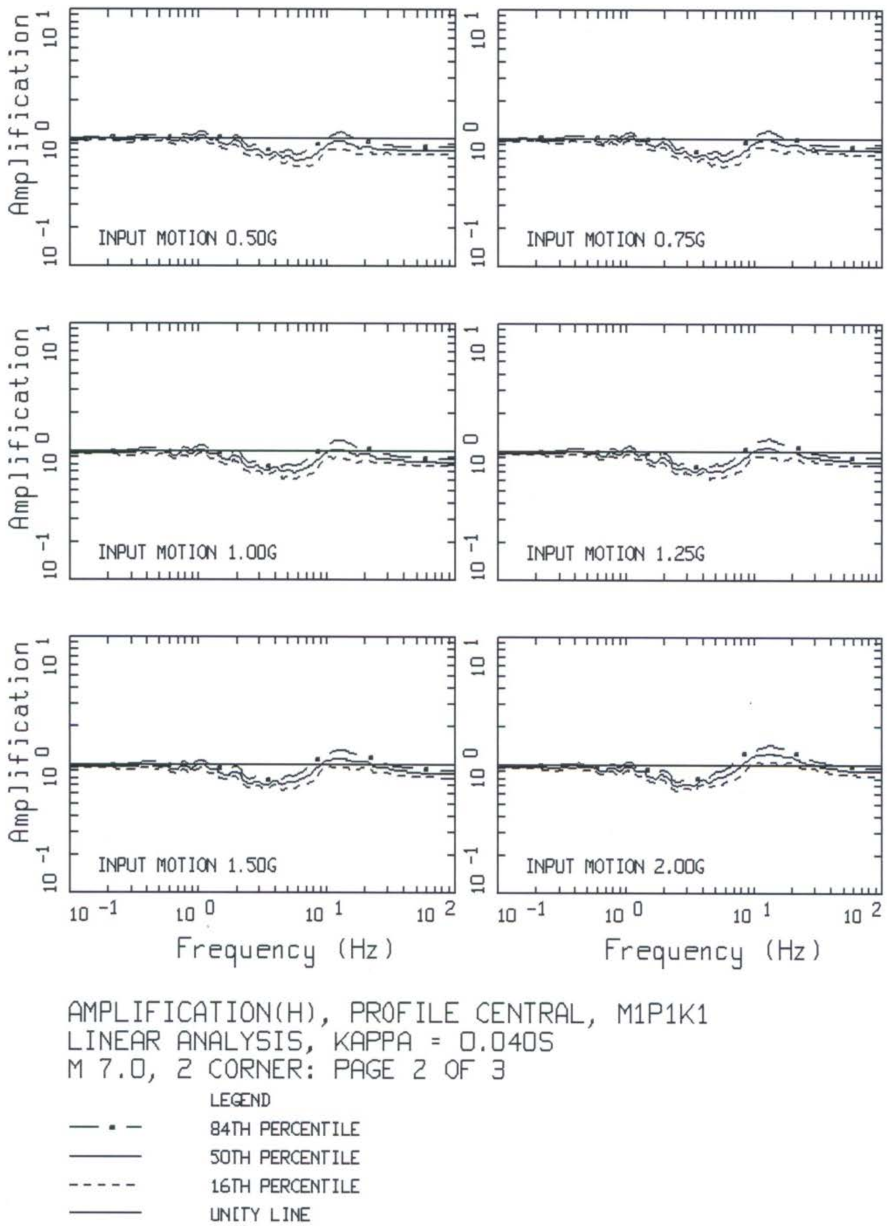
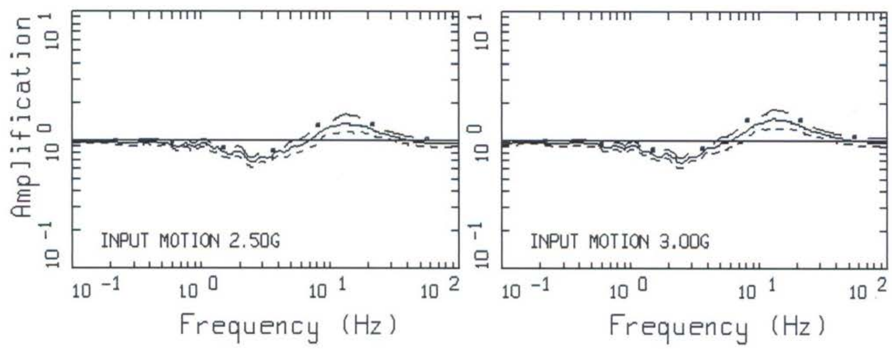


Figure 6 (cont.)



AMPLIFICATION(H), PROFILE CENTRAL, M1P1K1
LINEAR ANALYSIS, KAPPA = 0.040S
M 7.0, 2 CORNER: PAGE 3 OF 3

LEGEND

— · — 84TH PERCENTILE
——— 50TH PERCENTILE
- - - - - 16TH PERCENTILE
——— UNITY LINE

Figure 6 (cont.)

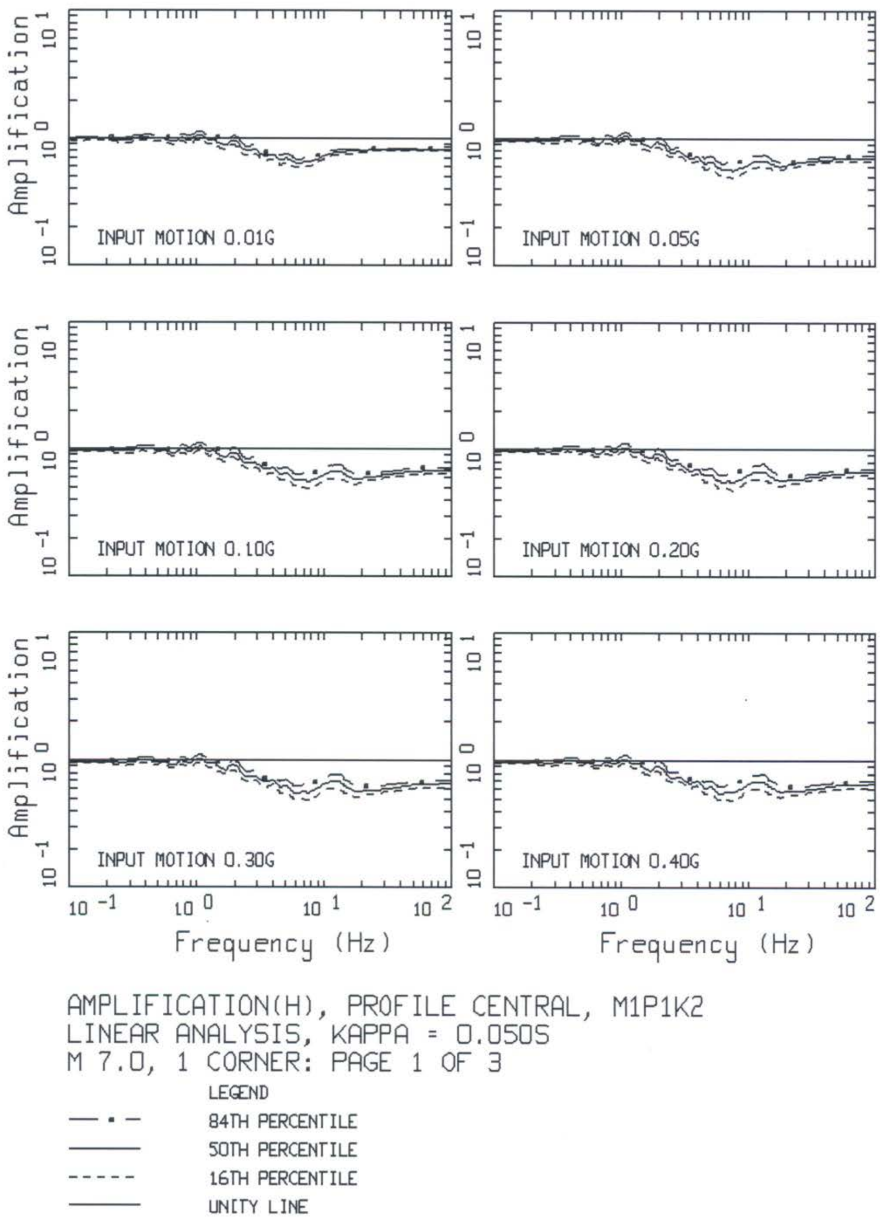


Figure 7. Example suite of amplification factors (5% damped PSa) relative to reference rock ($\overline{V_S}$ (30m) 760m/s): Profile Central, Linear Analysis (M1), kappa = 0.050s (K2).

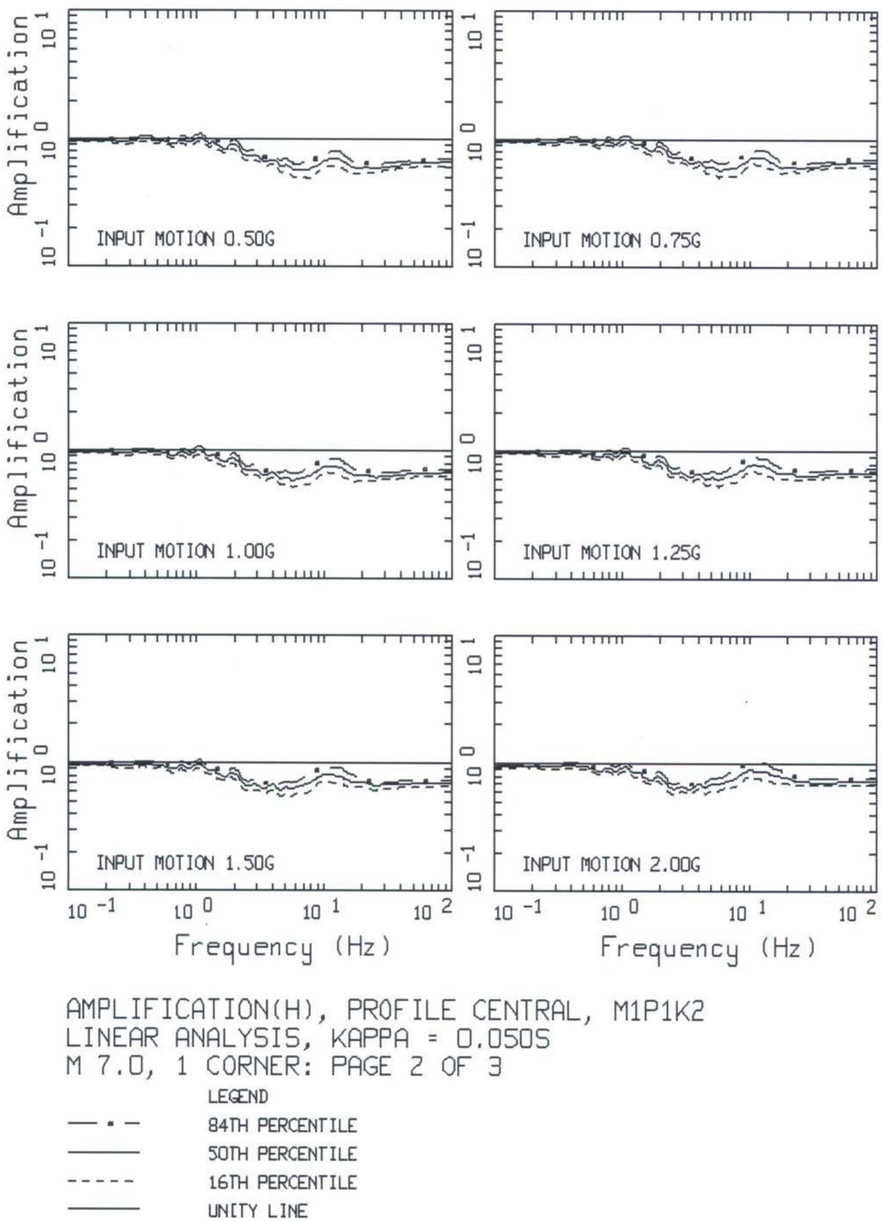


Figure 7 (cont.)

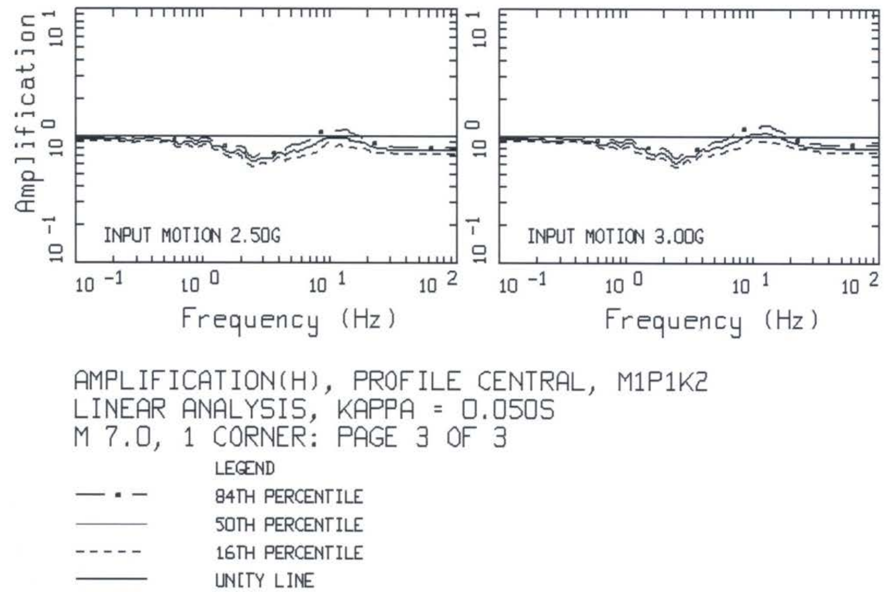


Figure 7 (cont.)

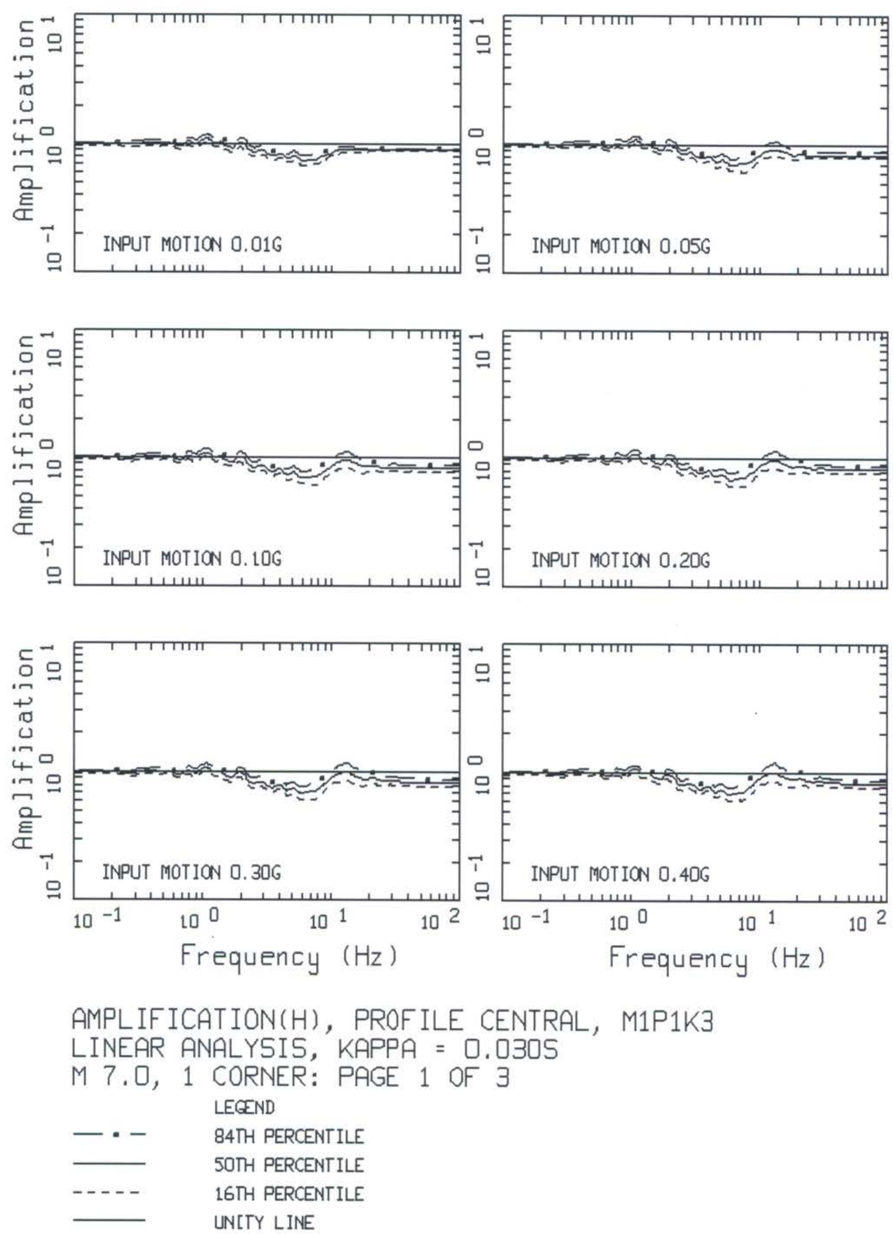


Figure 8. Example suite of amplification factors (5% damped PSa) relative to reference rock ($\overline{V_S}$ (30m) 760m/s): Profile Central, Linear Analysis (M1), kappa = 0.030s (K3).

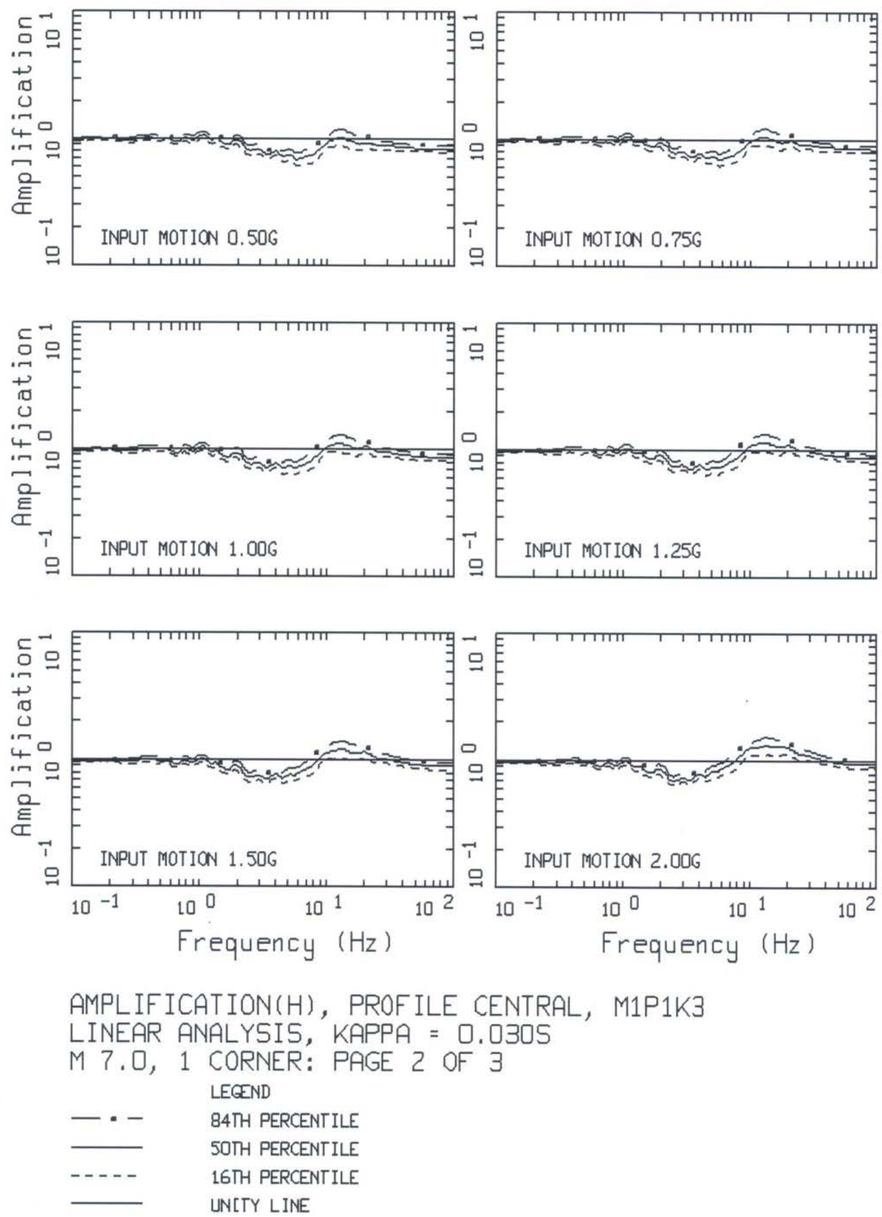


Figure 8 (cont.)

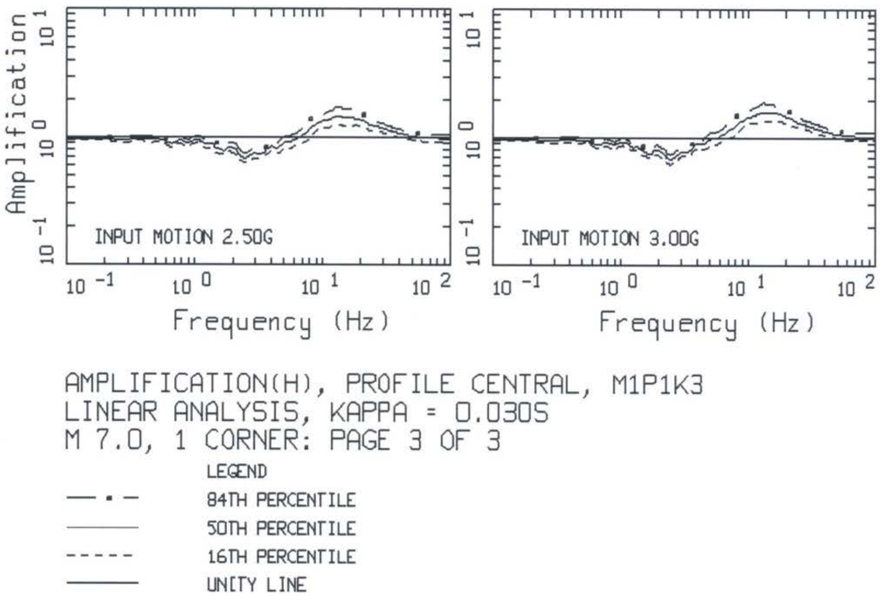


Figure 8 (cont.)

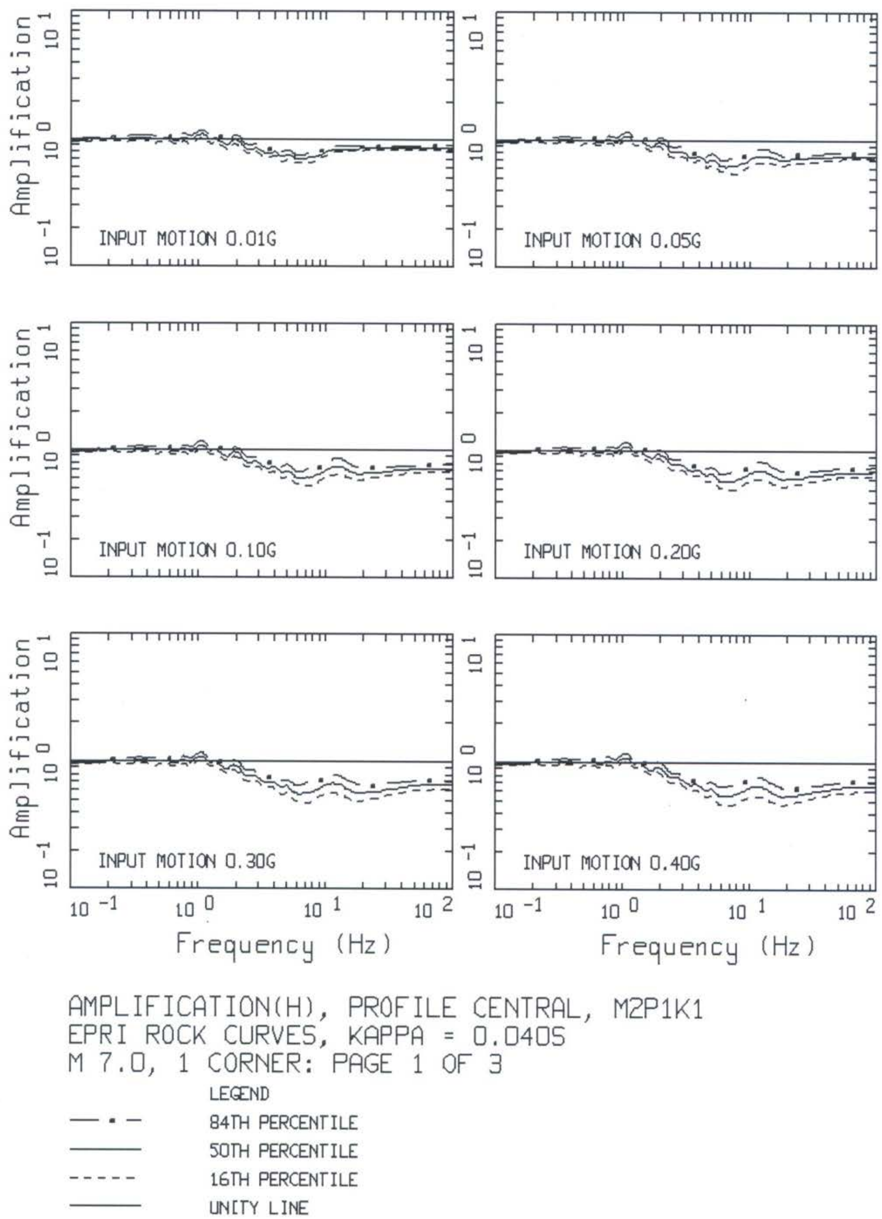
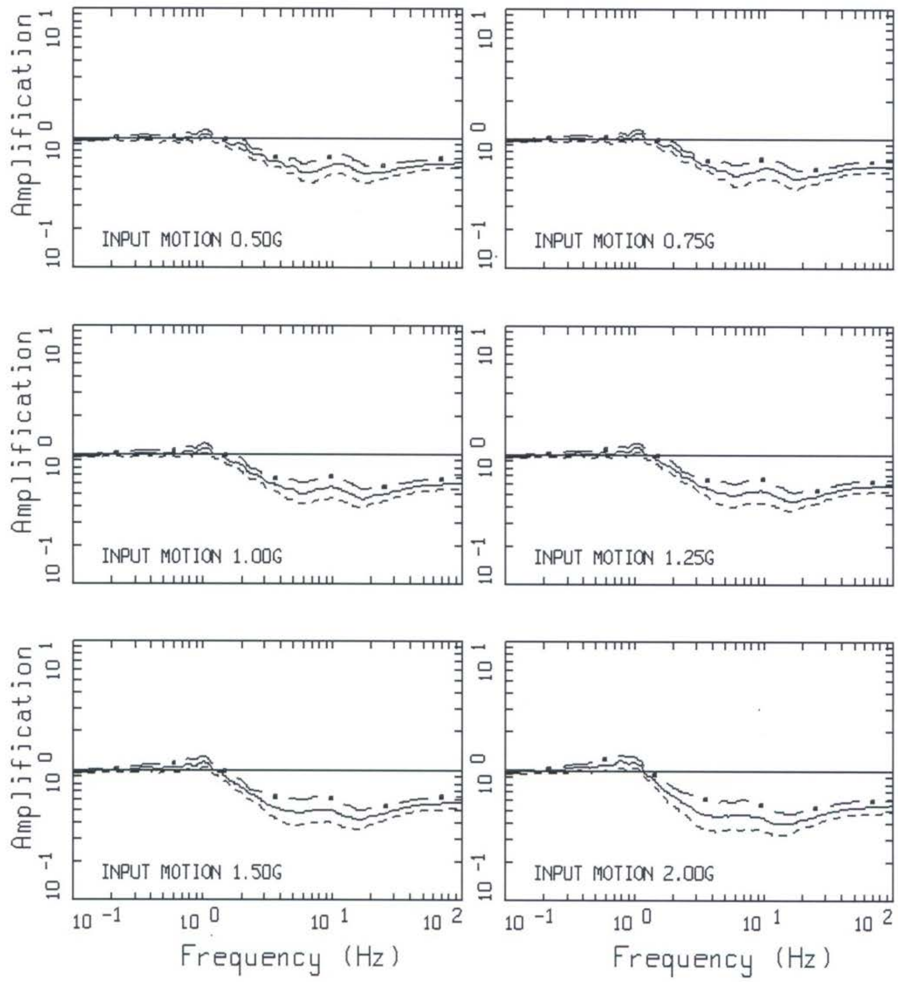


Figure 9. Example suite of amplification factors (5% damped PSa) relative to reference rock ($\overline{V_S}$ (30m) 760m/s): Profile Central, EPRI rock curves (M2), kappa = 0.040s (K1).



AMPLIFICATION(H), PROFILE CENTRAL, M2P1K1
EPRI ROCK CURVES, KAPPA = 0.040S
M 7.0, 1 CORNER: PAGE 2 OF 3

LEGEND

— • — 84TH PERCENTILE
——— 50TH PERCENTILE
- - - - - 16TH PERCENTILE
——— UNITY LINE

Figure 9 (cont.)

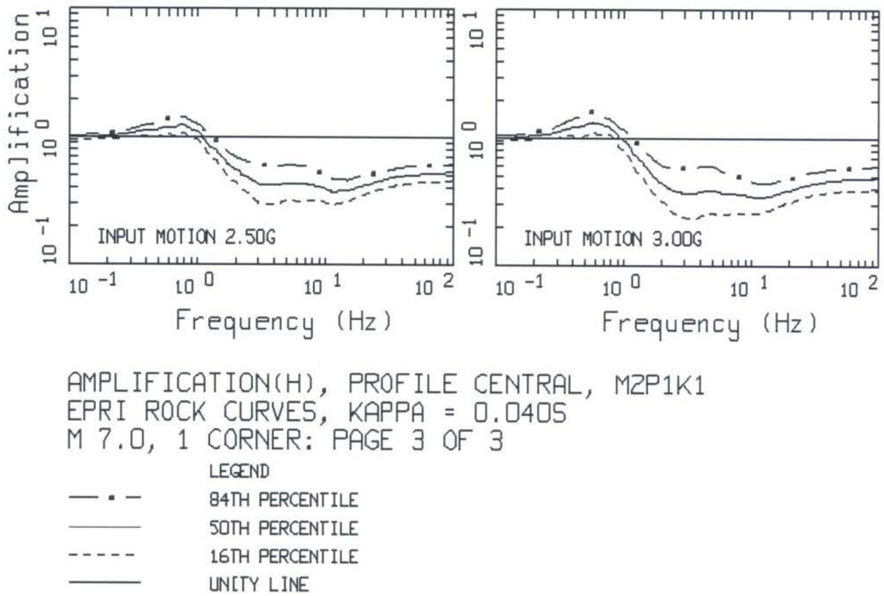


Figure 9 (cont.)

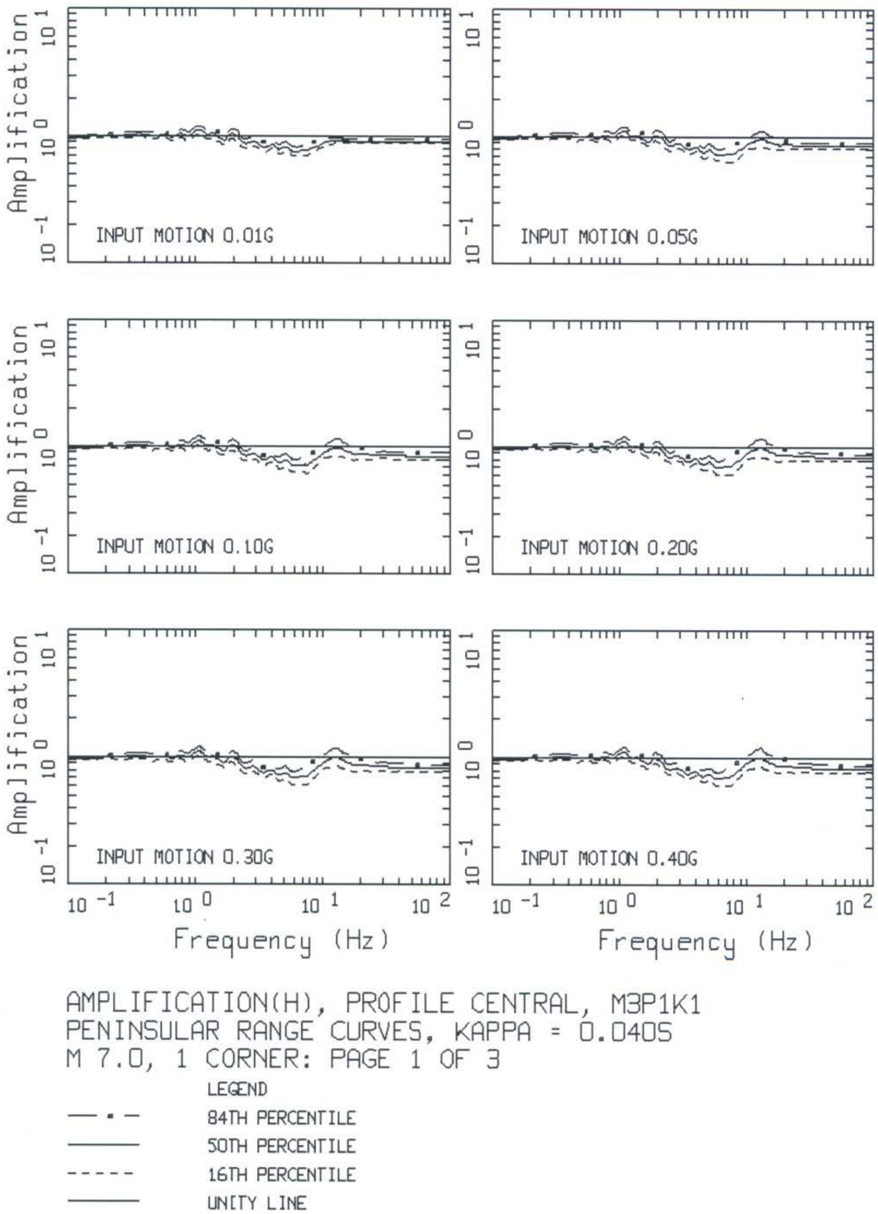
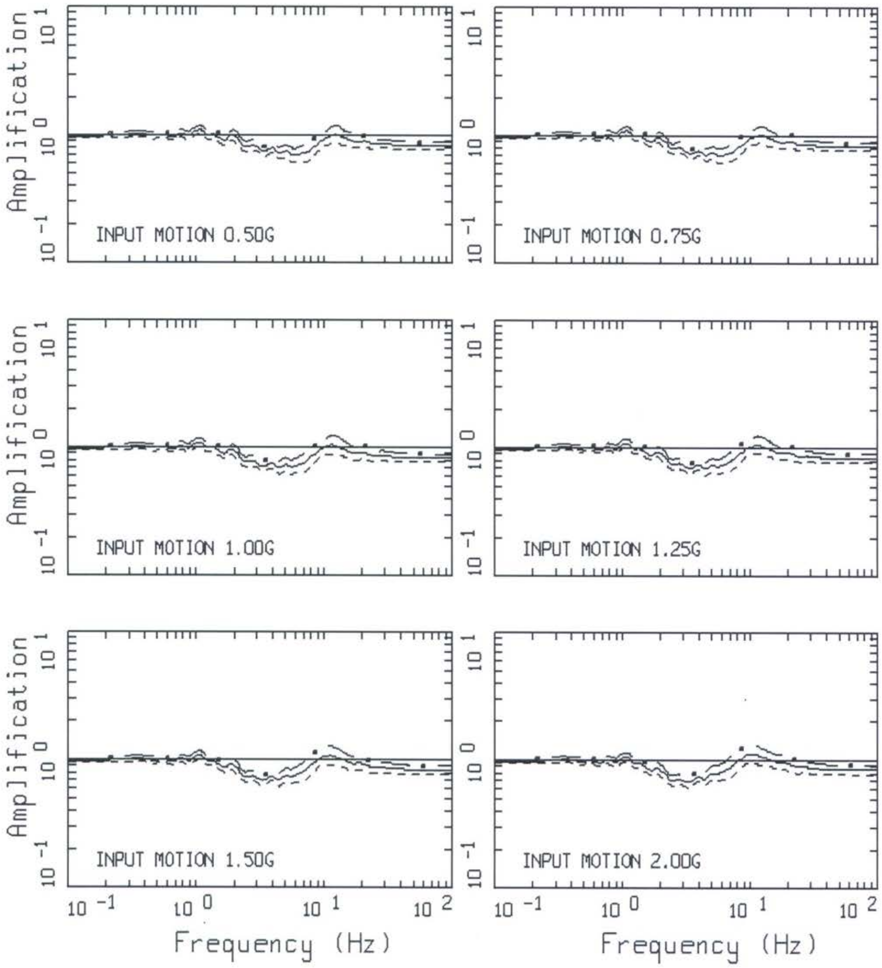


Figure 10. Example suite of amplification factors (5% damped PSa) relative to reference rock ($\overline{V_S}$ (30m) 760m/s): Profile Central, Peninsular Range curves (M3), kappa = 0.040s (K1).

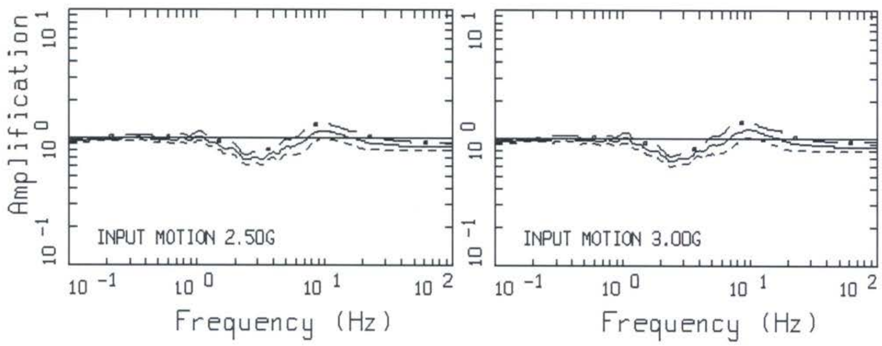


AMPLIFICATION(H), PROFILE CENTRAL, M3P1K1
PENINSULAR RANGE CURVES, KAPPA = 0.040S
M 7.0, 1 CORNER: PAGE 2 OF 3

LEGEND

— • —	84TH PERCENTILE
———	50TH PERCENTILE
- - - - -	16TH PERCENTILE
———	UNITY LINE

Figure 10 (cont.)



AMPLIFICATION(H), PROFILE CENTRAL, M3P1K1
PENINSULAR RANGE CURVES, KAPPA = 0.0405
M 7.0, 1 CORNER: PAGE 3 OF 3

LEGEND
— · — 84TH PERCENTILE
——— 50TH PERCENTILE
- - - - - 16TH PERCENTILE
——— UNITY LINE

Figure 10 (cont.)

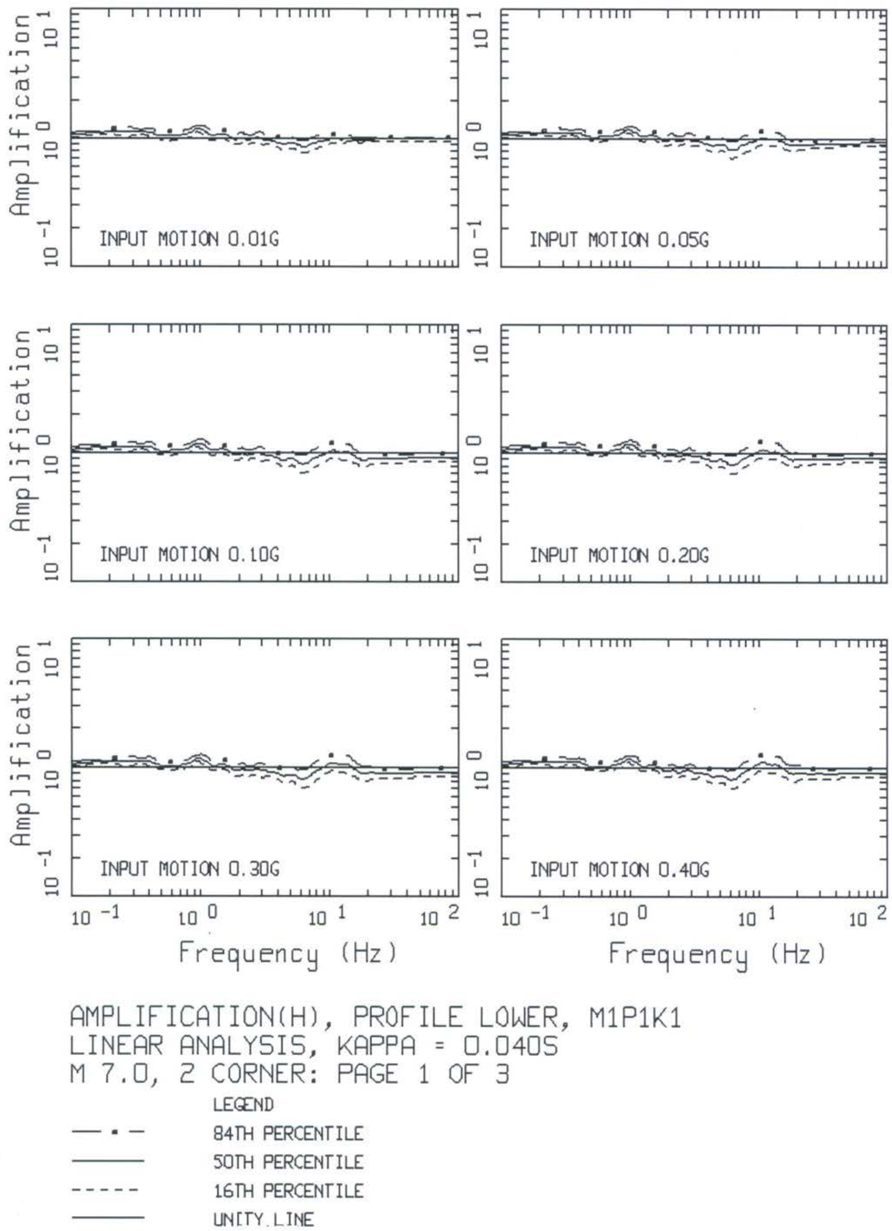


Figure 11. Example suite of amplification factors (5% damped PSa) relative to reference rock ($\overline{V_S}$ (30m) 760m/s): Profile Lower, Linear Analysis (M1), kappa = 0.040s (K1).

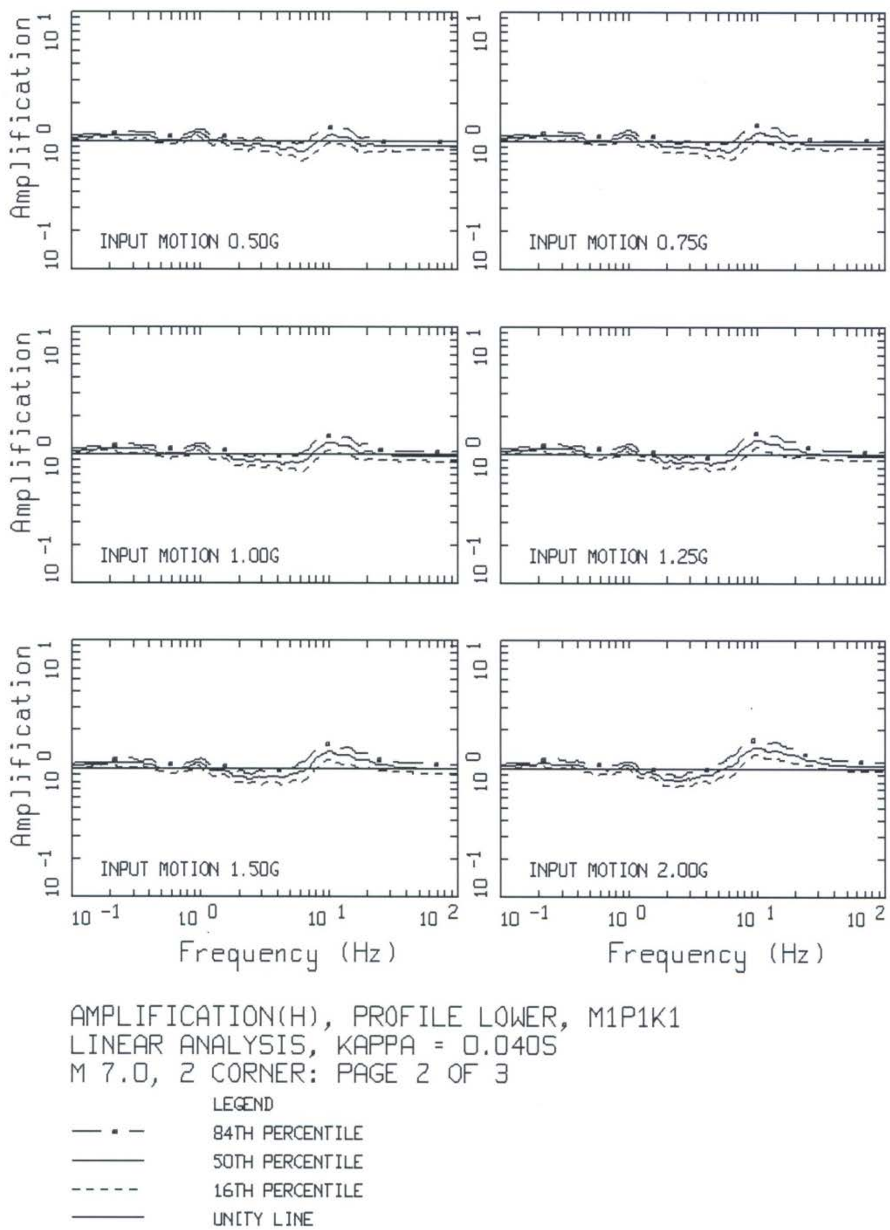


Figure 11 (cont.)

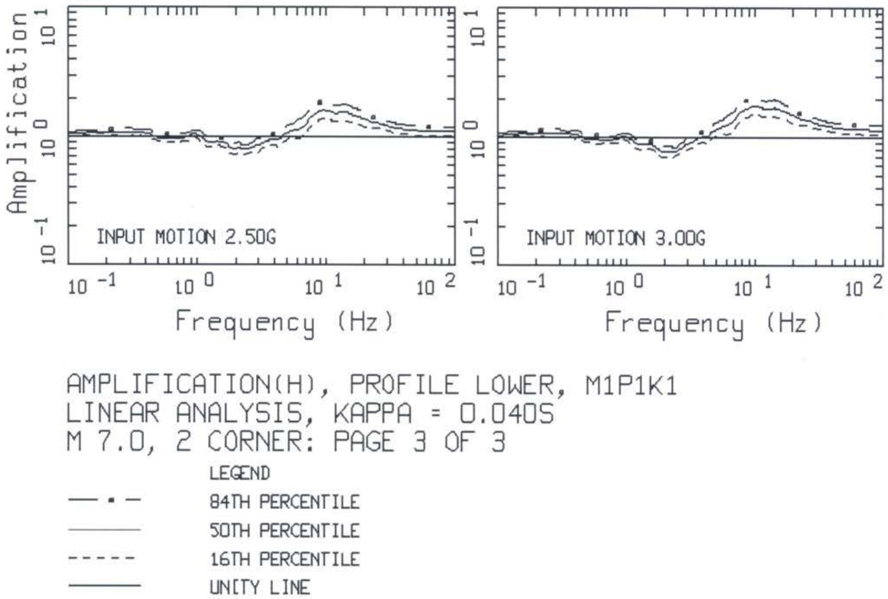


Figure 11 (cont.)

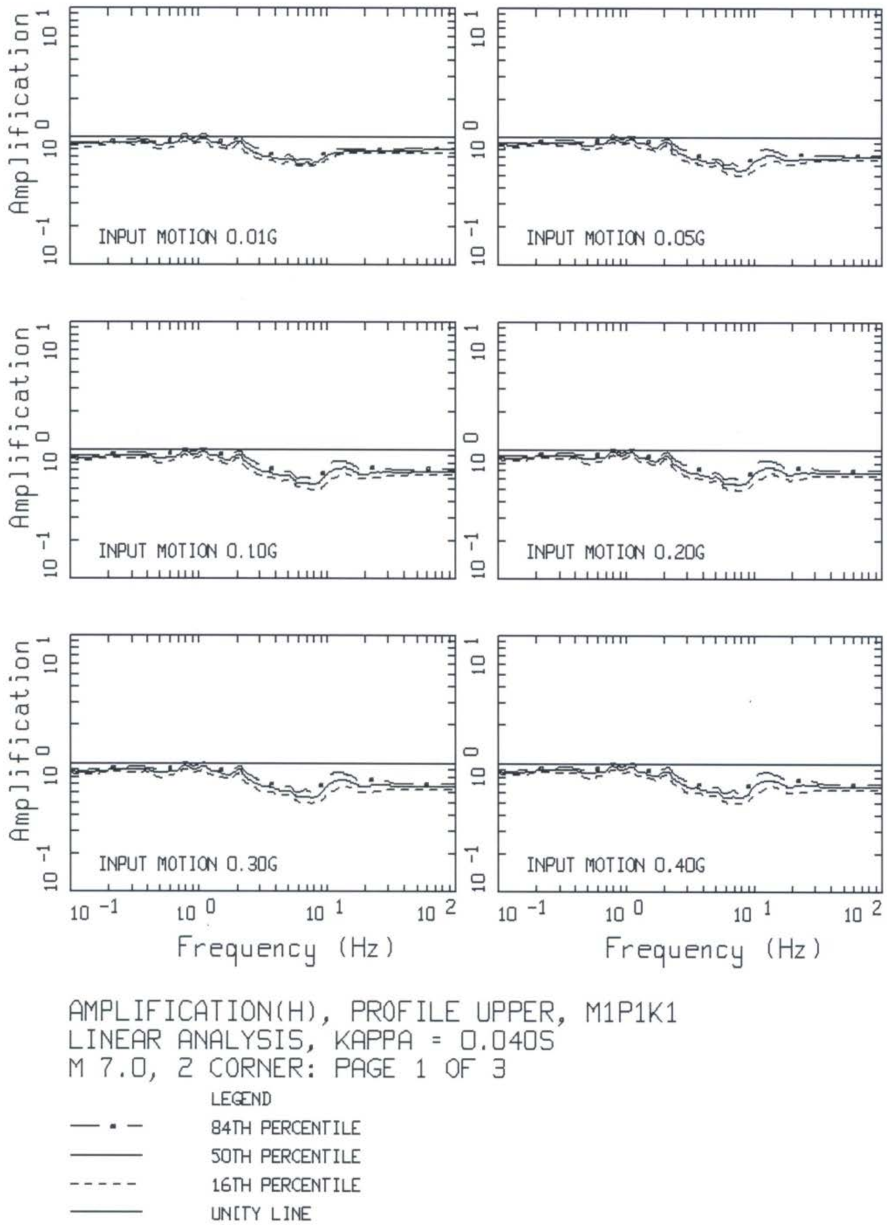
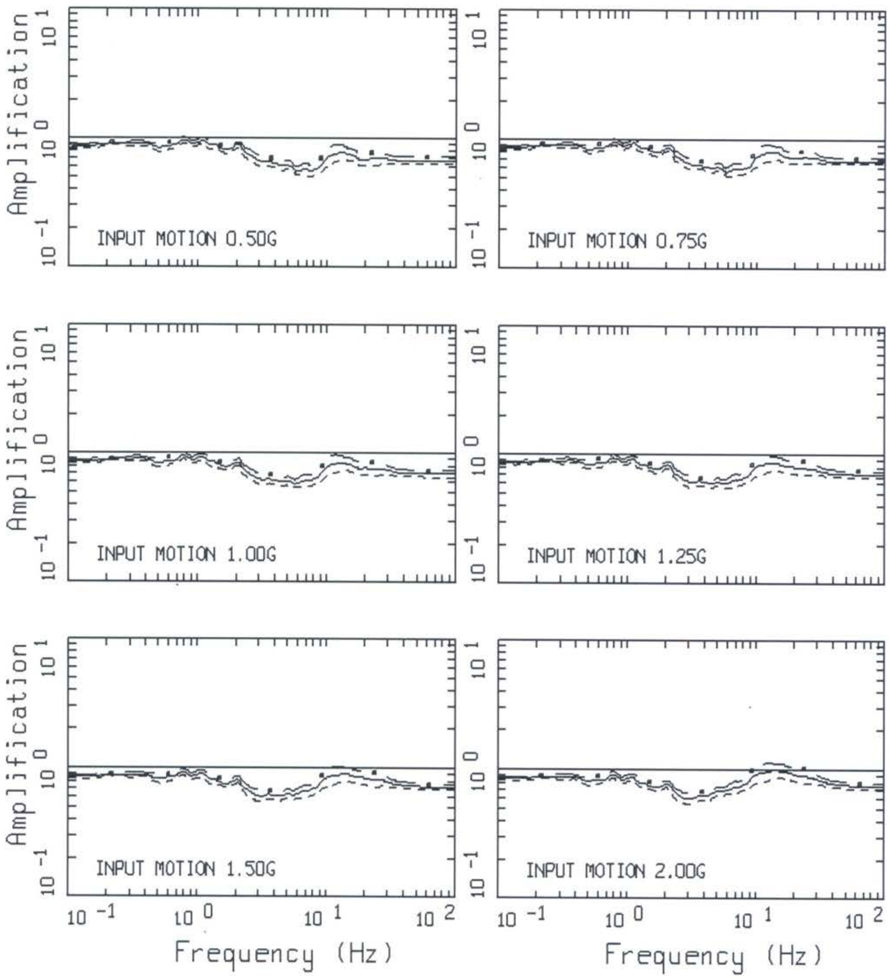


Figure 12. Example suite of amplification factors (5% damped PSa) relative to reference rock ($\overline{V_S}$ (30m) 760m/s): Profile Upper, Linear Analysis (M1), kappa = 0.040s (K1).



AMPLIFICATION(H), PROFILE UPPER, M1P1K1
LINEAR ANALYSIS, KAPPA = 0.040S
M 7.0, 2 CORNER: PAGE 2 OF 3

LEGEND

— • — 84TH PERCENTILE
——— 50TH PERCENTILE
- - - - - 16TH PERCENTILE
——— UNITY LINE

Figure 12 (cont.)

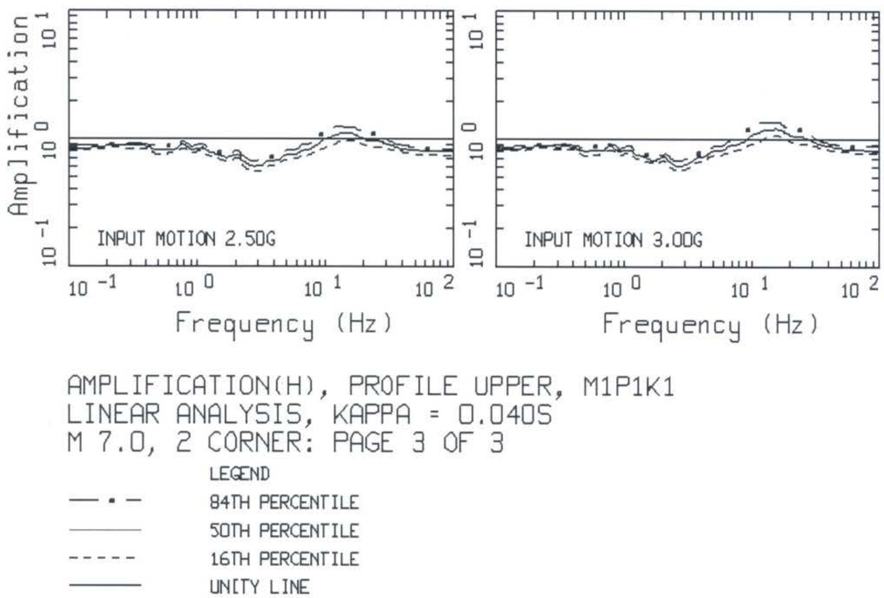


Figure 12 (cont.)