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corner vertical spectra show trends relative to the horizontals that are similar to the WUS but shifted to higher frequencies, as expected.

In general, both WUS and CEUS V/H ratios provide smooth and reasonable vertical motions when applied to the recommended spectral shapes for horizontal components.

4.8 Intermediate Rock Site Conditions

For rock site conditions intermediate to the CEUS and WUS (which have kappa values of 0.006 sec and 0.04 sec respectively), an appropriate mix of the WUS and CEUS shapes should be based on a site specific kappa value. Weights for the WUS and CEUS rock shapes can easily be determined using the following equations:

$$\kappa_s = \kappa_W W_W + \kappa_E W_E \qquad (4\text{-}10)$$

$$W_W + W_E = 1 \qquad (4\text{-}11)$$

where κ_S is the site specific kappa value, W_W and W_E are the WUS and CEUS shape weights, and κ_W and κ_E are the WUS and CEUS rock kappa values. For κ_s values outside κ_W and κ_E, the shape for the closest kappa value should be used.

If a site specific kappa value is not available, a reasonable approach would be to use the inverse of the average shear-wave velocity over the top 30m in Equation 4.10 in lieu of the kappa values (see Equation D5, Appendix D). Appropriate average shear-wave velocity values for the WUS and CEUS rock sites are 520m/sec and 2,800m/sec respectively. The weights used for the CEUS and WUS shapes should also be used for a weighted V/H ratio.

4.9 Estimation of Spectra For Other Dampings

Several methods are available to estimate design response spectra for dampings other than 5%. All are based on scaling the 5% damped spectrum higher or lower. The scaling factors are a function of natural frequency.

4.9.1 Random Vibration Methods

The most theoretically consistent method of accounting for damping is through random vibration theory. The recommended procedure is as follows.

For frequencies $1 \leq f < 5$ Hz, the procedure of Rosenblueth (1980) should be used. This scales the spectral acceleration SA at any frequency f and damping ξ by spectral acceleration at $\xi = 0.05$ by:

$$SA\ (f,\ \xi) = SA\ (f,\ 0.05) \left[\frac{1 + 4.9\ \xi f D}{1 + 4.9\ x\ 0.05\ f D}\right]^{-0.41} \qquad (4.12)$$

where D is strong motion duration. For frequencies of 5 Hz and above, the recommended procedure is based on the concept of Vanmarcke (1976) that the response is controlled by a static portion (governed by PGA) and a dynamic portion (governed by equation 4.10). This procedure provides a transition to the peak ground acceleration (PGA)-controlled portion of the spectrum in a realistic way as follows:

$$SA\ (f,\xi) = \left\{ PGA^2 + \left[SA\ (f,\ 0.05)^2 - PGA^2\right] \left[\frac{1 + 4.9\ \xi\ f\ D}{1 + 4.9\ x\ 0.05\ f\ D}\right]^{-0.82} \right\}^{1/2} \qquad (4.13)$$

where the second term on the right-hand-side (involving a subtraction) should not be less than 0.

The strong-motion duration D is distance dependent. For the WUS, D can be estimated from Abrahamson and Silva (1997). For the CEUS, D can be estimated from Atkinson and Boore (1997).

The two equations above allow estimation of dampings in the range of 0.5% to 20% from a design spectrum that is developed for 5% damping. These equations are applicable to both horizontal and vertical motion.

For frequencies below 1 Hz, equation (4.10) can be used as an approximation, but at very low frequencies (0.2 to 0.1 sec) it should be checked to ensure that spectral displacements are approaching the peak ground displacement for all dampings.

4.9.2 Empirical Methods

Several empirical methods have been developed based on recorded motions in California and these can be used to produce spectra at dampings other than 5%.

Abrahamson and Silva (1996) developed a model of the effects of damping based on statistical analyses of strong motion records. Their scaling factor is as follows:

$$\ln\left[\frac{SA\ (f,\ \xi)}{SA\ (f,\ 5\%)}\right] = \begin{cases} c_1(f,\ \xi) & \text{for } f>1.43\text{Hz} \\ c_1(f,\ \xi) + g_2(f,\ \xi)(M-6) + g_3\ (f,\ \xi)(8.5-M)^2 & \text{for } f<1.43\text{Hz} \end{cases} \qquad (4.14)$$

Coefficients for equation 4.12 are listed in Tables 4-6 through 4-8. Separate coefficients are given for horizontal and vertical motions, and scaling factors are reported for periods of 5 sec to 0.02 sec (0.2 Hz to 50 Hz). They are applicable to damping values between 0.5% and 20%.

Idriss (1993) also developed empirical scale factors for damping based on ground motions during the 1971 San Fernando and 1979 Imperial Valley earthquakes. His scale factor is defined as:

$$\frac{SA\ (f,\ \xi)}{SA\ (f,\ 5\%)} = \begin{cases} a_1 - b_1\ \ln(\xi) & \text{for } \xi \le 5\% \\ a_2 - b_2\ \ln(\xi) & \text{for } \xi > 5\% \end{cases} \qquad (4.15)$$

The coefficients a_1, a_2, b_1 and b_2, are listed in Table 4-9 for a range of natural periods from 0.03 sec to 5 sec (33 Hz to 0.2 Hz). These scaling factors are applicable to horizontal motions and to damping values between 1% and 15% (Idriss, personal communication, 1999).

Newmark and Hall (1978) recommended scale factors for different damping values, but these were for different parts of the spectrum controlled by peak acceleration, velocity, and displacement. That is, separate scaling factors were not developed frequency-by-frequency, but were developed for the high-frequency range (3 to 8 Hz), the mid-frequency range (.3 to 3 Hz) and the low-frequency range (below 0.3 Hz). This worked well when scaling spectra from peak values but would leave discontinuities if applied to uniform hazard spectra. For this reason the Newmark and Hall damping factors are not recommended.

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Table 4-6a

Horizontal c_1 values for separate damping levels for equation (4.12), Abrahamson and Silva (1996)

Period (sec)	c1 (0.5%)	c1 (1.0%)	c1 (2.0%)	c1 (3.0%)	c1 (7.0%)	c1 (10.0%)	c1 (15.0%)	c1 (20.0%)
5.00	0.3698	0.2891	0.1830	0.1084	-0.0812	-0.1763	-0.2964	-0.3899
4.00	0.3955	0.3092	0.1957	0.1159	-0.0869	-0.1886	-0.3171	-0.4170
3.00	0.4233	0.3310	0.2095	0.1241	-0.0930	-0.2018	-0.3393	-0.4463
2.00	0.4526	0.3538	0.2239	0.1326	-0.0994	-0.2157	-0.3628	-0.4471
1.50	0.4667	0.3648	0.2309	0.1368	-0.1025	-0.2225	-0.3741	-0.4920
1.00	0.4780	0.3737	0.2365	0.1401	-0.1050	-0.2279	-0.3832	-0.5040
0.85	0.4801	0.3753	0.2375	0.1407	-0.1054	-0.2289	-0.3848	-0.5061
0.75	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.60	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.50	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.46	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.40	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.36	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.30	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.24	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.20	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.17	0.4808	0.3759	0.2379	0.1409	-0.1056	-0.2292	-0.3854	-0.5069
0.15	0.4616	0.3609	0.2284	0.1353	-0.1014	-0.2200	-0.3700	-0.4866
0.12	0.4327	0.3383	0.2141	0.1268	-0.0950	-0.2063	-0.3469	-0.4562
0.10	0.3885	0.3037	0.1922	0.1138	-0.0853	-0.1852	-0.3114	-0.4096
0.09	0.3630	0.2838	0.1796	0.1064	-0.0797	-0.1730	-0.2910	-0.3827
0.07	0.3193	0.2496	0.1580	0.0936	-0.0701	-0.1522	-0.2559	-0.3366
0.06	0.2654	0.2075	0.1313	0.0778	-0.0583	-0.1265	-0.2127	-0.2798
0.05	0.2212	0.1729	0.1094	0.0648	-0.0486	-0.1054	-0.1773	-0.2332
0.04	0.1673	0.1308	0.0828	0.0490	-0.0367	-0.0798	-0.1341	-0.1764
0.03	0.0933	0.0729	0.0462	0.0273	-0.0205	-0.0445	-0.0748	-0.0983
0.02	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 4-6b

Vertical c_1 values for separate damping levels for equation (4.12), Abrahamson and Silva (1996)

Period (sec)	c1 (0.5%)	c1 (1.0%)	c1 (2.0%)	c1 (3.0%)	c1 (7.0%)	c1 (10.0%)	c1 (15.0%)	c1 (20.0%)
5.00	0.4135	0.3230	0.2033	0.1196	-0.0871	-0.1872	-0.3114	-0.4065
4.00	0.4462	0.3485	0.2193	0.1291	-0.0940	-0.2020	-0.3359	-0.4385
3.00	0.4814	0.3760	0.2366	0.1393	-0.1014	-0.2180	-0.3625	-0.4372
2.00	0.5186	0.4050	0.2549	0.1500	-0.1093	-0.2348	-0.3904	-0.5097
1.50	0.5365	0.4190	0.2637	0.1552	-0.1131	-0.2429	-0.4039	-0.5273
1.00	0.5511	0.4304	0.2709	0.1594	-0.1161	-0.2495	-0.4149	-0.5417
0.85	0.5538	0.4325	0.2722	0.1602	-0.1167	-0.2507	-0.4169	-0.5443
0.75	0.5548	0.4333	0.2727	0.1605	-0.1169	-0.2512	-0.4177	-0.5453
0.60	0.5548	0.4333	0.2727	0.1605	-0.1169	-0.2512	-0.4177	-0.5453
0.50	0.5548	0.4333	0.2727	0.1605	-0.1169	-0.2512	-0.4177	-0.5453
0.46	0.5548	0.4333	0.2727	0.1605	-0.1169	-0.2512	-0.4177	-0.5453
0.40	0.5548	0.4333	0.2727	0.1605	-0.1169	-0.2512	-0.4177	-0.5453
0.36	0.5548	0.4333	0.2727	0.1605	-0.1169	-0.2512	-0.4177	-0.5453
0.30	0.5548	0.4333	0.2727	0.1605	-0.1169	-0.2512	-0.4177	-0.5453
0.24	0.5647	0.4411	0.2776	0.1634	-0.1190	-0.2557	-0.4252	-0.5551
0.20	0.5776	0.4511	0.2839	0.1671	-0.1217	-0.2615	-0.4348	-0.5677
0.17	0.5920	0.4623	0.2910	0.1713	-0.1247	-0.2680	-0.4457	-0.5818
0.15	0.5965	0.4658	0.2932	0.1726	-0.1257	-0.2701	-0.4491	--0.5862
0.12	0.5880	0.4593	0.2890	0.1701	-0.1239	-0.2662	-0.4427	-0.5780
0.10	0.5732	0.4477	0.2818	0.1658	-0.1208	-0.2595	-0.4316	-0.5634
0.09	0.5471	0.4273	0.2689	0.1583	-0.1153	-0.2477	-0.4119	-0.5378
0.07	0.5062	0.3954	0.2488	0.1464	-0.1067	-0.2292	-0.3811	-0.4976
0.06	0.4615	0.3604	0.2268	0.1335	-0.0972	-0.2090	-0.3475	-0.4536
0.05	0.4216	0.3293	0.2072	0.1220	-0.0888	-0.1909	-0.3174	-0.4144
0.04	0.3751	0.2930	0.1844	0.1085	-0.0790	-0.1698	-0.2824	-0.3687
0.03	0.2507	0.1958	0.1232	0.0725	-0.0528	-0.1135	-0.1887	-0.2464
0.02	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 4-7a
Horizontal g_2 values for separate damping levels
for equation (4.12), Abrahamson and Silva (1996)

Period (sec)	g2 (0.5%)	g2 (1.0%)	g2 (2.0%)	g2 (3.0%)	g2 (7.0%)	g2 (10.0%)	g2 (15.0%)	g2 (20.0%)
5.00	0.0214	0.0168	0.0106	0.0063	-0.0047	-0.0102	-0.0172	-0.0226
4.00	0.0189	0.0148	0.0094	0.0055	-0.0042	-0.0090	-0.0152	-0.0199
3.00	0.0157	0.0122	0.0078	0.0046	-0.0034	-0.0075	-0.0126	-0.0165
2.00	0.0111	0.0087	0.0055	0.0032	-0.0024	-0.0053	-0.0089	-0.0117
1.50	0.0078	0.0061	0.0039	0.0023	-0.0017	-0.0037	-0.0063	-0.0083
1.00	0.0033	0.0025	0.0016	0.0010	-0.0007	-0.0016	-0.0026	-0.0034
0.85	0.0014	0.0011	0.0007	0.0004	-0.0003	-0.0007	-0.0011	-0.0015
0.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4-7b
Vertical g_2 values for separate damping levels
for equation (4.12), Abrahamson and Silva (1996)

Period (sec)	g2 (0.5%)	g2 (1.0%)	g2 (2.0%)	g2 (3.0%)	g2 (7.0%)	g2 (10.0%)	g2 (15.0%)	g2 (20.0%)
5.00	0.0247	0.0193	0.0122	0.0072	-0.0052	-0.0112	-0.0186	-0.0243
4.00	0.0218	0.0170	0.0107	0.0063	-0.0046	-0.0099	-0.0164	-0.0215
3.00	0.0181	0.0141	0.0089	0.0052	-0.0038	-0.0082	-0.0136	-0.0178
2.00	0.0128	0.0100	0.0063	0.0037	-0.0027	-0.0058	-0.0096	-0.0126
1.50	0.0090	0.0071	0.0044	0.0026	-0.0019	-0.0041	-0.0068	-0.0089
1.00	0.0038	0.0029	0.0018	0.0011	-0.0008	-0.0017	-0.0028	-0.0037
0.85	0.0016	0.0013	0.0008	0.0005	-0.0003	-0.0007	-0.0012	-0.0016
0.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4-8a

Horizontal g_3 values for separate damping levels for equation (4.12), Abrahamson and Silva (1996)

Period (sec)	g3 (0.5%)	g3 (1.0%)	g3 (2.0%)	g3 (3.0%)	g3 (7.0%)	g3 (10.0%)	g3 (15.0%)	g3 (20.0%)
5.00	-0.0166	-0.0130	-0.0082	-0.0049	0.0036	0.0079	0.0133	0.0175
4.00	-0.0146	-0.0114	-0.0072	-0.0043	0.0032	0.0070	0.0117	0.0154
3.00	-0.0121	-0.0095	-0.0060	-0.0036	0.0027	0.0058	0.0097	0.0128
2.00	-0.0086	-0.0067	-0.0042	-0.0025	0.0019	0.0041	0.0069	0.0090
1.50	-0.0061	-0.0047	-0.0030	-0.0018	0.0013	0.0029	0.0049	0.0064
1.00	-0.0025	-0.0020	-0.0012	-0.0007	0.0006	0.0012	0.0020	0.0027
0.85	-0.0011	-0.0009	-0.0005	-0.0003	0.0002	0.0005	0.0009	0.0012
0.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4-8b
Vertical g_3 values for separate damping levels
for equation (4.12), Abrahamson and Silva (1996)

Period (sec)	g3 (0.5%)	g3 (1.0%)	g3 (2.0%)	g3 (3.0%)	g3 (7.0%)	g3 (10.0%)	g3 (15.0%)	g3 (20.0%)
5.00	-0.0191	-0.0150	-0.0094	-0.0055	0.0040	0.0087	0.0144	0.0188
4.00	-0.0169	-0.0132	-0.0083	-0.0049	0.0036	0.0076	0.0127	0.0166
3.00	-0.0140	-0.0109	-0.0069	-0.0040	0.0029	0.0063	0.0105	0.0138
2.00	-0.0099	-0.0077	-0.0049	-0.0029	0.0021	0.0045	0.0075	0.0097
1.50	-0.0070	-0.0055	-0.0034	-0.0020	0.0015	0.0032	0.0053	0.0069
1.00	-0.0029	-0.0023	-0.0014	-0.0008	0.0006	0.0013	0.0022	0.0029
0.85	-0.0013	-0.0010	-0.0006	-0.0004	0.0003	0.0006	0.0010	0.0012
0.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4-9
Coefficients for Equation (4.13), Idriss (1993)

Period - sec	a_1	b_1	a_2	b_2
0.03	1	0	1	0
0.05	1.1142	0.0709	1.0830	0.0505
0.075	1.3513	0.2183	1.2902	0.1803
0.1	1.4918	0.3056	1.4179	0.2597
0.15	1.5796	0.3601	1.4992	0.3102
0.2	1.6148	0.3820	1.5340	0.3318
0.25	1.6148	0.3820	1.5340	0.3318
0.3	1.6148	0.3820	1.5340	0.3318
0.35	1.6060	0.3765	1.5224	0.3246
0.4	1.5972	0.3711	1.5108	.03174
0.5	1.5796	0.3605	1.4992	0.3102
0.6	1.5445	0.3383	1.4876	0.303
0.7	1.5269	0.3274	1.4876	0.303
0.8	1.5094	0.3165	1.4760	0.2958
0.9	1.4918	0.3056	1.4690	0.2914
1	1.4742	0.2947	1.4644	0.2885
1.5	1.4391	0.2728	1.4644	0.2885
2	1.4216	0.2619	1.4644	0.2885
3	1.4040	0.2510	1.4644	0.2885
4	1.4040	0.2510	1.4644	02885
5	1.4040	0.2510	1.4644	0.2885