

21.2.1 Probabilistic (MCE_R) Ground Motions

The probabilistic spectral response accelerations shall be taken as the spectral response accelerations in the direction of maximum horizontal response represented by a 5 percent damped acceleration response spectrum that is expected to achieve a 1 percent probability of collapse within a 50-year period. For the purpose of this standard, ordinates of the probabilistic ground motion response spectrum shall be determined by either Method 1 of Section 21.2.1.1 or Method 2 of Section 21.2.1.2.

21.2.1.1 Method 1

At each spectral response period for which the acceleration is computed, ordinates of the probabilistic ground motion response spectrum shall be determined as the product of the risk coefficient, C_R , and the spectral response acceleration from a 5 percent damped acceleration response spectrum having a 2 percent probability of exceedance within a 50-year period. The value of the risk coefficient, C_R , shall be determined using values of C_{RS} and C_{RI} from Figs. 22-3 and 22-4, respectively. At spectral response periods less than or equal to 0.2 s, C_R shall be taken as equal to C_{RS} . At spectral response periods greater than or equal to 1.0 s, C_R shall be taken as equal to C_{RI} . At response spectral periods greater than 0.2 s and less than 1.0 s, C_R shall be based on linear interpolation of C_{RS} and C_{RI} .

21.2.1.2 Method 2

At each spectral response period for which the acceleration is computed, ordinates of the probabilistic ground motion response spectrum shall be determined from iterative integration of a site-specific hazard curve with a lognormal probability density function representing the collapse fragility (i.e., probability of collapse as a function of spectral response acceleration). The ordinate of the probabilistic ground motion response spectrum at each period shall achieve a 1 percent probability of collapse within a 50-year period for a collapse fragility having (i) a 10 percent probability of collapse at said ordinate of the probabilistic ground motion response spectrum and (ii) a logarithmic standard deviation value of 0.6.

21.2.2 Deterministic (MCE_R) Ground Motions

The deterministic spectral response acceleration at each period shall be calculated as an 84th-percentile 5 percent damped spectral response acceleration in the direction of maximum horizontal response computed at that period. The largest such acceleration calculated for the characteristic earthquakes on all known active

faults within the region shall be used. For the purposes of this standard, the ordinates of the deterministic ground motion response spectrum shall not be taken as lower than the corresponding ordinates of the response spectrum determined in accordance with Fig. 21.2-1, where F_a and F_v are determined using Tables 11.4-1 and 11.4-2, respectively, with the value of S_S taken as 1.5 and the value of S_1 taken as 0.6.

21.2.3 Site-Specific MCE_R

The site-specific MCE_R spectral response acceleration at any period, S_{aM} , shall be taken as the lesser of the spectral response accelerations from the probabilistic ground motions of Section 21.2.1 and the deterministic ground motions of Section 21.2.2.

21.3 DESIGN RESPONSE SPECTRUM

The design spectral response acceleration at any period shall be determined from Eq. 21.3-1:

$$S_a = \frac{2}{3} S_{aM} \quad (21.3-1)$$

where S_{aM} is the MCE_R spectral response acceleration obtained from Section 21.1 or 21.2. The design spectral response acceleration at any period shall not be taken as less than 80 percent of S_a determined in accordance with Section 11.4.5. For sites classified as Site Class F requiring site response analysis in accordance with Section 11.4.7, the design spectral response acceleration at any period shall not be taken as less than 80 percent of S_a determined for Site Class E in accordance with Section 11.4.5.

21.4 DESIGN ACCELERATION PARAMETERS

Where the site-specific procedure is used to determine the design ground motion in accordance with Section 21.3, the parameter S_{DS} shall be taken as the spectral acceleration, S_a , obtained from the site-specific spectra at a period of 0.2 s, except that it shall not be taken as less than 90 percent of the peak spectral acceleration, S_a , at any period larger than 0.2 s. The parameter S_{D1} shall be taken as the greater of the spectral acceleration, S_a , at a period of 1 s or two times the spectral acceleration, S_a , at a period of 2 s. The parameters S_{MS} and S_{M1} shall be taken as 1.5 times S_{DS} and S_{D1} , respectively. The values so obtained shall not be less than 80 percent of the values determined in