DETERMINIG DESIGN SPECTRUM OF HORIZONTAL ACCELERATION FOR IRAN SOIL TYPE II AND COMPARING WITH THE REFLECTANCE SPECTRUM USED IN STANDARD 2800 (VERSION 3)

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Design spectrum of horizontal acceleration for Iran soil type II has been studied. The recorded accelerogram data was obtained from Building and Housing Research Center (BHRC). For more accurate preparation of design spectrum, the recordings with more than 50 Kilometers away from earthquake location was omitted since the frequency content is changed when seismic waves pass through the different layers of soil (Ambraseys and Douglas, 2003).

The high-frequency and low-frequency errors in accelerogram data was removed with filtering techniques. Determining highest frequency and lowest frequency (longer periods) help to specify the frequency range of processing operations (Douglas and M.Boor, 2011). In this study, the appropriate highest frequency was obtained from Amiri et.al. (2004) with 20 and 30Hz for SMA-1 and SMA-2, respectively. The signal to noise ratio was also used for obtaining lowest frequency. For finding low-frequency the ratio between 2-3 was selected and here the ration 3 was used.

In the beginning, a fast Fourier transform (FFT) of signal and noise was calculated in Fortran language base software. When the correction of recording was done, the SEISMO SIGNAL software was used for baseline correction. The results are spectrum of each recording scaled to 1g.

The final reflectance spectrum will be represented in three model using statistical relationships:

1. Average reflectance spectrum shown in equation 1.
2. Average reflectance spectrum with a standard deviation shown in equation 2.
3. Geometric average reflectance spectrum shown in equation 3

$$S_{50} = \frac{1}{N}\sum_{i=1}^{N} s_i = \mu \qquad (1)$$

$$S_{84} = \frac{1}{N}\sum_{i=1}^{N} s_i + \sigma \qquad \sigma = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(s_i - \mu)^2} \qquad (2)$$

$$S_{Gm} = \exp\left[\frac{1}{N}\sum_{i=1}^{N} \mathrm{h}\ s_i\right] \qquad (3)$$

Where N is number of accelerogram spectrum, Si and μ is the value of accelerogram spectrum No. I, and the value of average spectrum for a determined period, respectively.

After comprising the average and above average spectrum with the reflectance spectrum represented in Standard 2800, for the periods up to 0.2s they are almost matched as shown in Figure 1. Although increase in frequency period cause significant differences.

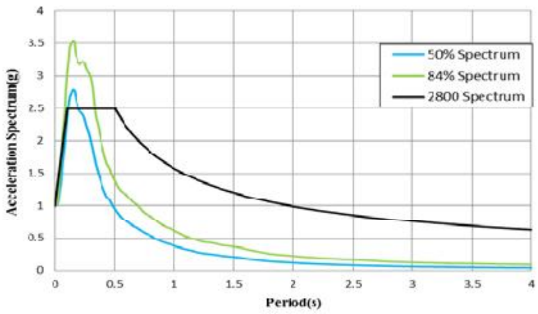

Figure 1. Comprise the average and above average spectrum with the reflectance spectrum represented in Standard 2800 (version 3)

For Iran earthquakes, the suggested model for soil type II in according to average spectrum (50% and 84% alignment) represented as equation 4 and 5. The results of comprising these models are shown in Figure 2., respectively.

$$\begin{cases} B = 1 + S\left(\frac{T}{T_0}\right) & 0 \le T \le T_0 \\ B = S + 1 & T_0 \le T \le T_S \quad , T_0 = 0.1 , T_S = 0.24 , S = 1.5 \\ B = (S+1)\left(\frac{T_S}{T}\right)^{(0.3T+0.8)} & T \ge T_S \end{cases} \tag{4}$$

$$\begin{cases} B = 1 + S\left(\frac{T}{T_0}\right) & 0 \le T \le T_0 \\ B = S + 1 & T_0 \le T \le T_S \quad , T_0 = 0.12 , T_S = 0.22 , S = 2.5 \\ B = (S+1)\left(\frac{T_S}{T}\right)^{(0.2T+0.8)} & T \ge T_S \end{cases} \tag{5}$$

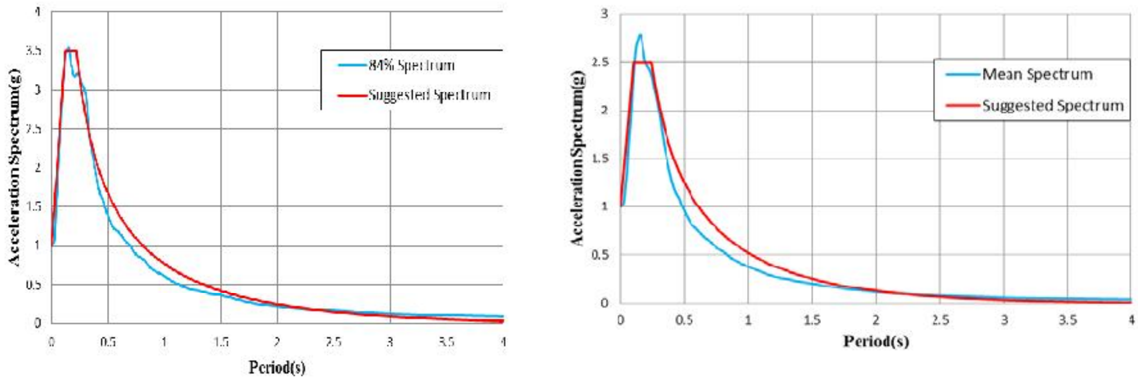

Figure 2. Comprise the model for soil type II according to average spectrum with the reflectance spectrum represented in Standard 2800 (50% alignment)(right)- Comprise the model for soil type II according to average spectrum with the reflectance spectrum represented in Standard 2800 (84% alignment)(left)

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