EFFECTS OF FLING STEP AND FORWARD DIRECTIVITY ON SEISMIC RESPONSES OF SOIL SITES

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During past earthquakes, it is found that ground motion on soft soil sites is generally larger than those located on rock outcrops (Idriss and Seed, 1968). Depend on type of ground motion such as near fault and far fault motion, there are different effects on seismic responses of soil. This study emphasizes on near fault motion with its wellknown effects like forward directivity and fling step on soil site response. In this way, significant earthquakes which near fault effects observed during their occurrence were selected. Two known earthquakes with mentioned characteristics are 1999 Kocaeli (Turkey) and Chi-Chi (Taiwan) earthquakes (Kalkan and Kunnath, 2006).

Directivity results from constructive interface of ground motion generated from different patches of slip located down strike for strike-slip faults or down dip for dip-slip faults (Abrahamson, 2001). The other hand, fling step is strong velocity pulse and permanent displacement shifting on its displacement time series. There are different ideas in association with correct (or not) of this effect on time series (Boore, 2001).

Site response analysis was evaluated for corrected and uncorrected fling step effect on earthquake time series. One dimensional equivalent linear earthquake site response analysis was implemented with simplified assumption of soil condition such as being horizontal soil layer in infinite extent (Bardet et al., 2000). Four types of site classes were built up based on ASCE07 site classification (ASCE07, 2010). For each type, a fixed model prepared and three kinds of acceleration time series including far-fault, near fault (forward directivity) and near fault (fling step) time series as input ground motion were applied to the base of soil column. Finally site response spectra were estimated on ground surface. For example site response spectra for site class 'C' presented in Figure 1. As illustrated in this figure, spectral values increased in long periods for near fault time series where high rise buildings are sensitive to spectral values of these range of periods (T>1). Also spectral values increased significantly in short periods for far fault time series as these kinds of effects are not considered in common seismic design codes like Iranian Building Code (2800) and sometimes seismic design based on these codes could result low factor of safety. So in seismic design of structure these significant effects should be considered and site specific studies have to be made for important projects.

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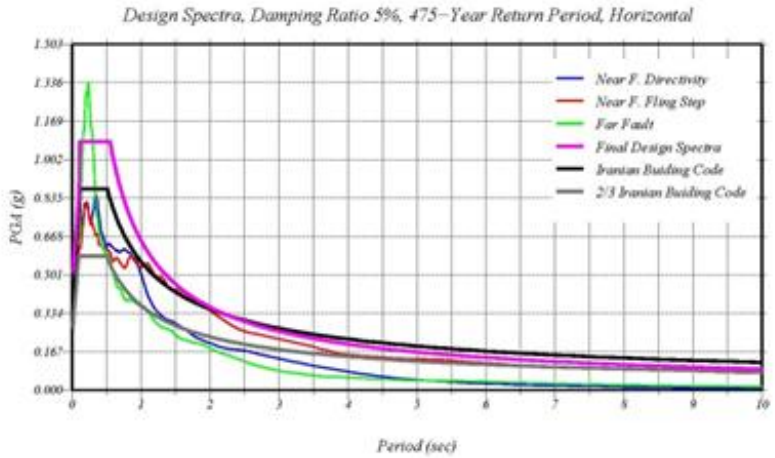

Figure 1. Site response spectra on ground surface caused by different input motions (PGA on Seismic Bedrock 0.30g, 475 years Return Period, Damping Ratio 5%)

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