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Estimating the velocity model based on spatial autocorrelation (SPAC) method at a site in south of Tehran

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Tehran, capital of Iran, the economical and political centre of the country and one of the biggest and most populated cities in the world, is under the threat of large magnitude earthquakes (above 7) located on very near faults. The previous studies on the effect of local surface geology on earthquake ground motion, using 1D calculation of transfer function (Jafari et al, 2001; JICA & CEST, 2000) and experimental methods (Haghshenas, 2005), using earthquake and ambient vibration, result in very different and unexpected results. The 1D calculations based on the supposing a layer with the Vs = 700 m/s as seismic bedrock, show a weak amplification for the frequencies above 2 Hz, while the site to reference spectral ratios show a significant amplification (up to 8) for a large band of frequencies, beginning in very low frequencies (0.3 - 0.4 Hz).

In the current state of knowledge on the underlying structure of Teheran two explications can be proposed for describing the unexpected results observed in this experience: The existence of a very deep impedance contrast or a 2D /3D structural effect.

To confirm each one of these explanations we planned a series of studies on the velocity model of the underground structure of Tehran using the array measurements of seismic microtremors that are being currently employed as an easy and low-cost procedure for soil profiling. The SPAC (spatial autocorrelation) method introduced by

Aki (1957) was used to analyze ambient vibration records.

The vertical component of the seismic microtremor recorded at different configuration arrays is used with the possibility to obtain dispersion curve of Rayleigh waves. The resultant dispersion curve and the horizontal to vertical spectral ratio of the seismic microtremors can be used to calculate the S-wave velocities of the sediments. The underground model obtained from this methodology is compared with the geotechnical information available.