I - 694

Preliminary Study of Local Site Effects Based on Microtremor Measurements in Tehran

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INTRODUCTION:

Damage patterns in Mexico City (1985), Loma Prieta(1989) and Manjil (1990) earthquakes clearly revealed the significant effects of local site conditions on ground seismic response. Therefore, seismic design should incorporate these effects. How to do this effectively is a central problem in seismic microzonation and design especially in urban area. For this purpose, microtremors have been utilized as an effective tool to estimate local site effects. However, source effects can obscure microtremor response of site. Then, the analysis of microtremor measurements should be done carefully.[1]

Tehran, with more than ten million inhabitants, is the most populated city in Iran. Seismically, the area of concern lies on Alpine-Himalayan seismic belt and has been frequently struck by catastrophic earthquakes during recorded history. According to the seismotectonic and probabilistic seismic hazard analysis, occurrence of earthquakes with magnitude Ms=7 is expected in Tehran. In this way, the evaluation of site effects is an important effort for hazard mitigation in Tehran.

DATA MEASUREMENTS AND ANALYSIS:

The simultaneous microtremor measurements that were conducted at nine sites by International Institute of Earthquake Engineering and Seismology are used.[2] Fig.1 shows the distribution of measuring points and geological parameters in the area under study. The data were collected using three sets of recording systems comprising of a lap top computer, SSR-1 seismometer (solid state RAM and 16-bit A to D convertor) and SS-1 velocity meter with one-second natural period and a damper of 0.7 critical damping.

At each station two components (one horizontal in NS direction and one vertical) of microtremors were simultaneously recorded on three rock sites and six soil sites at every 1/100s for 180s . The measurements were repeated five times at a point to secure the higher quality of recording . For spectral analysis, one part of 20.48s long simultaneous recording was selected from the stationary part of 180s long recording. The autocorrelation and power spectra were calculated for the selected recording and smoothed by spectral window. The pseudo transfer function (squared) was calculated to demonstrate the soil amplification parameters. The calculation is based on the spectral amplitude ratios between horizontal (H) and vertical (V) components of microtremors at each site, (Fig.2).[1]

CONCLUSIONS:

According to Fig.2, the high difference between the predominant period in DAR, SOH and SAM sites (0.05~0.1 sec.) and soil sites can be detectable. In addition , the predominant period of soil sites ranged over 0.2 to 0.8 sec. which corresponds to two to ten stories building. Therefore, response of these buildings may be in resonance with the ground motion during future earthquakes.

REFERENCES:

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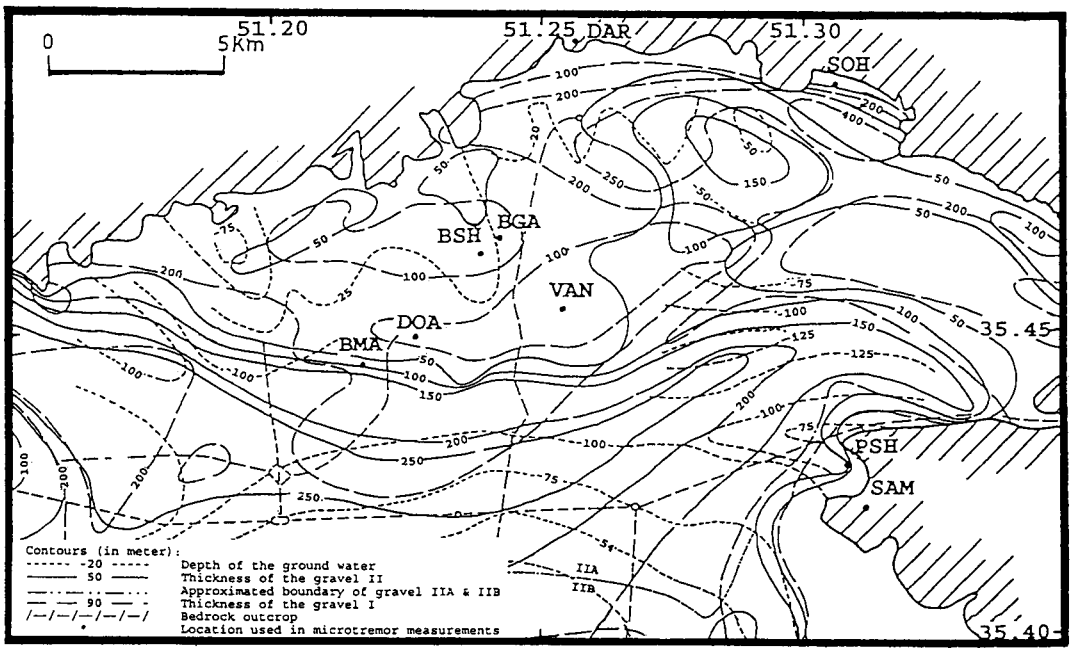

Fig.1 Map of the alluvial deposits and water table in Tehran region (with changes, [3])

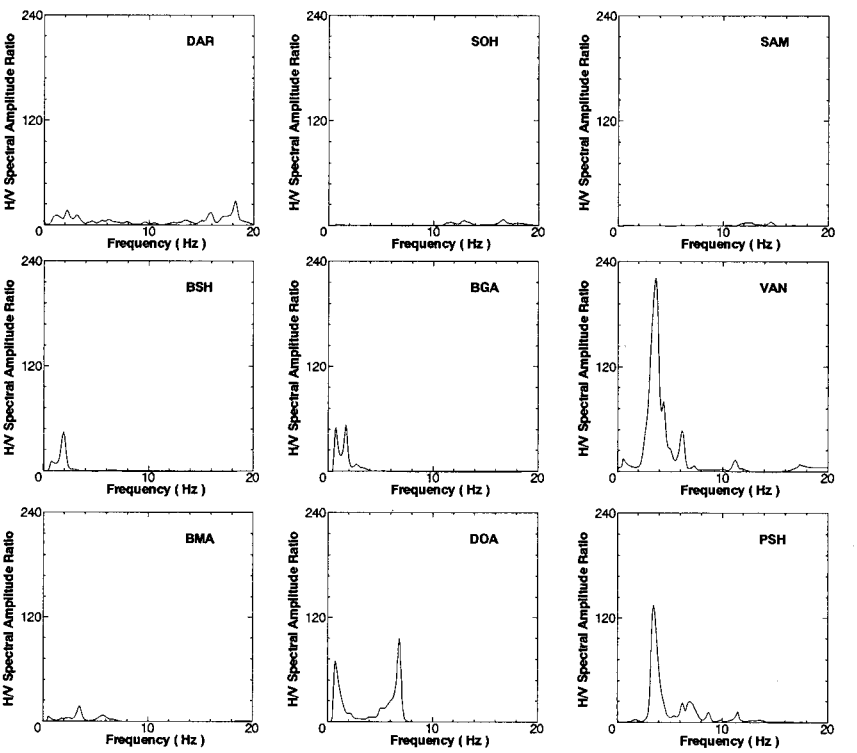

Fig.2 The pseudo transfer function (squared) at rock and soil sites