# STABILITY OF MICROTREMORS FOR SOME SELECTED SITES IN TEHRAN

Farnaz KAMRANZAD
*M.Sc. Student of Mining Engineering, University of Tehran, Tehran, Iran*
*f_kamranzad@ut.ac.ir*

Laleh KHADANGI
*B.Sc. Student of Mining Engineering, University of Tehran, Tehran, Iran*
*laleh.kh1990@gmail.com*

Hossein MEMARIAN
*Professor of Geo-Engineering, University of Tehran, Tehran, Iran*
*memarian@ut.ac.ir*

Mehdi ZARE
*Associate Professor, IIEES, Tehran, Iran*
*mzare@iiees.ac.ir*

Masoud MOJARAB
*PhD of Mining Engineering, University of Tehran, Tehran, Iran*
*mmojarab@ut.ac.ir*

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Assessing local site effects reliably is one of the crucial aspects of seismic hazard, which usually cause amplification of ground motions and results in increasing the damage potential of a large earthquake (Atakan, 2007). Local site response can be investigated by theoretical and empirical methods. In the last decades, the empirical methods have been popularly developed and used for the purpose of site response evaluation studies. One of the early and widely known empirical methods is the horizontal to vertical (H/V) spectral ratio of ambient seismic noise, initially proposed by Nogoshi and Igarashi (1971), and popularized by Nakamura (1989). This method produces an estimate of site geological conditions. Ambient seismic noises called microtremors are short period vibrations that result from coastal effects, atmospheric loading, wind interaction with structures and vegetation, and cultural sources (Molnar et al., 2007).

Although there are ongoing discussions about the applicability of microtremors in the various site conditions and ground shaking levels, it have been widely used to estimate the dominant periods of soil deposits (Ventura and Thibert, 2007)

Before implementing the method for estimation of site responses in a crowded and noisy location like the city of Tehran with a wide range of local seismic noise sources, it is important to determine the temporal stability of H/V spectra of microtremors. Current study aims to analyze the stability of H/V spectra of microtremors in site response evaluation in the city of Tehran. For this purpose, ambient noises were recorded and analyzed in 6 selected sites throughout the city. Conditions of recording such as time duration and number of iterations and stations have been differently selected for each site (Table 1). For example, the time duration differs from a 3-hour recording for the site S to an 18-day recording for the site M. After the recording, data were processed and interpreted according to the SESAME European research project guidelines (2004) and the final H/V curves were obtained for each site (Figure 1). Then for each site, the similarities of its curves were compared using the correlations between them and producing correlation matrix. As an example, the correlation matrix for a sample site (site S) has been shown in Table 2. In addition, the variance of the correlations was calculated without considering the auto-correlations with the value of 1 (last column of Table 1). Consequently, the high correlations between the H/V curves for each site and low value of their variances showed that the H/V spectra of microtremors in site evaluation is stable in time and can be a reliable method for site response estimations in the city of Tehran.

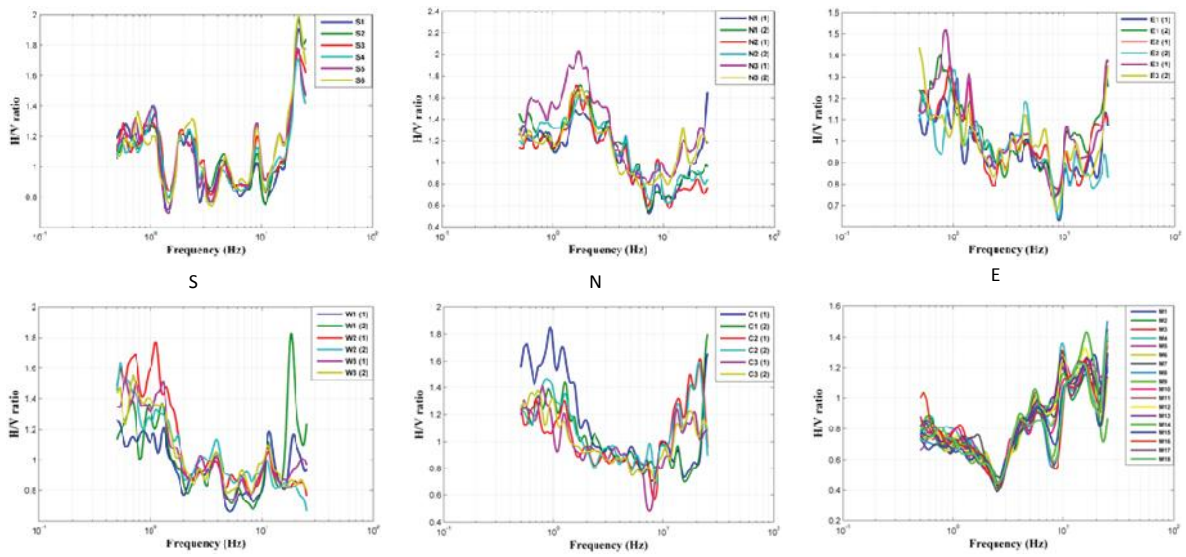


Figure 1. H/V spectral ratio curves for the 6 selected sites

Table 1. List of the 6 selected sites for microtremor measurements and the variance of correlation for each one

| Site Location | Date of recording | Time | Latitude (N) | | Number of Stations | Stations Spacing | Variance of Correlations |
|---|---|---|---|---|---|---|---|
| North 1 (N) | November 1, 2013 | 9-12 AM | 35.81 | 51.44 | 3 | 5 | 0.02 |
| North 2 (M) | July 23- August, 9, 2013 | 3-4 AM | 35.78 | 51.32 | 1 | - | 0.0133 |
| South (S) | November 3, 2013 | 0-3 AM | 35.58 | 51.43 | 1 | - | 0.00023 |
| East (E) | October 28,30, 2013 | 1-2:30 PM<br>6:30-8 AM | 35.73 | 51.51 | 3 | 5 | 0.039 |
| West (W) | October 24, 2013 | 0-3 AM | 35.73 | 51.30 | 3 | 5 | 0.12 |
| Center (C) | October 14,20, 2013 | 6-7:30 AM<br>4-5:30 AM | 35.73 | 51.39 | 3 | 90 | 0.14 |

Table 2. A sample of correlation matrix (Site S)

| | S1 | S2 | S3 | S4 | S5 | S6 |
|---|---|---|---|---|---|---|
| **S1** | 1 | | | | | |
| **S2** | 0.9966 | 1 | | | | |
| **S3** | 0.98674 | 0.98893 | 1 | | | |
| **S4** | 0.9723 | 0.97348 | 0.98362 | 1 | | |
| **S5** | 0.94342 | 0.94418 | 0.95775 | 0.98217 | 1 | |
| **S6** | 0.97077 | 0.97505 | 0.97918 | 0.98257 | 0.97764 | 1 |

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