DETERMINATION OF PREDOMINANT PERIOD FOR A TUNNELING STRUCTURE IN THE NEW TOWN OF PARAND BY MICROTREMOR SURVEY METHOD

Sorour FATHALIZADEH
M.Sc. in Geophysics, PNU University, Tehran, Iran
s.f9075@gmail.com

Asghar AZADI
Assistant Professor, PNU University, Tehran, Iran
asghar_azadi_2007@yahoo.com

Amin ABBASI
Researcher, University of Tehran, Tehran, Iran
amabbasi@ut.ac.ir

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The new town of Parand is located at 30 km in south of Tehran. Determining of predominant period for some buildings in this area and presented a proper formula for calculate the period is important. In order to determine of predominant period, microtremor method is used. These studies are affected by different factors such as condition prevailing in the different regions, geological aspects in the site and type of structures. One of the easiest and most economical methods to determine the natural period of structures is microtremor method. Microtremors may be defined as continuous small ground vibrations resulting from uncontrolled natural or artificial excitation According to this method , stable estimation of the predominant frequency and amplification factor can be made even in the presence of a certain degree of artificial tremor and there is no need any more for time restriction on microtremor measurement. For the purpose of utilizing the microtremor in the engineering field, an observation of microtremor was made to identify the predominant frequency of structure.

Microtremor investigations were pioneered at Auckland University by Salt (1969) who developed slow motion magnetic tape recording equipment specifically for recording microtremors. Kani and Tanaka (1954) reported that the amplitude of these vibrations is in the range 0.1 to 1 µm while the frequency of the motion may be 0.5 to 20 Hz or more. Thus any seismograph with a magnification exceeding 1000 times will be capable of recording microtremors. Akamatu (1961) made tripartite recordings of microtremors and established that the recorded waves have the nature of surface waves being Rayleigh of Love waves or a combination of both. Aki (1975) recorded microtremor motions and computed the autocorrelation functions. Carder and Gilmore (1945) recorded microtremors at several locations in California. They reported that the nature of the ground influences the frequency and magnitude of the surface motion.

To examine the ground surface and structural seismic response characteristics in the stricken area, microtremor measurements were conducted on the ground surface in several locations in the tunneling structure in Parand town. In this study we use broad band seismic recorder and collect data simultaneously on the ground and top of the structure. After processing the data, the frequency of maximum amplitude shows the predominant period.

According to the Iranian code, the predominant period relates to the height of structure. The maximum 25 meters height of the buildings is on the top of Quaternary alluvium that is located at 35°24' 52" N, 50° 30' 6" E and 1100 m altitude. The predominant period of the structure calculated by the following formula;

$$T = a \, H^{3/4}$$

As we see in figure 1, the predominant period of this structure (the height of 25 m) is 0.78 seconds (f ≈ 1.28 Hz) and the "a" coefficient for the formula is;
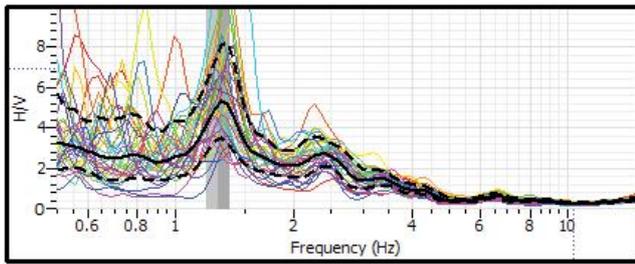
$$a = 0.07$$

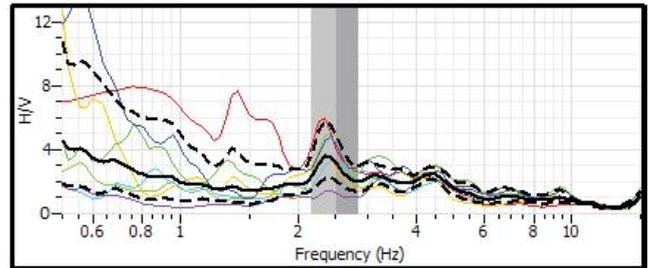Figure 1. Spectrum ratio of horizontal and vertical component of structure

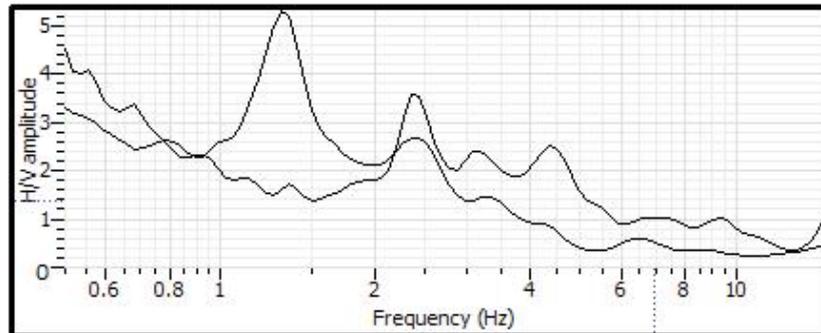Figure 2. Spectrum ratio of horizontal and vertical component of soil

Figure 3. Comparison between H/V amplitude of soil and structure

Soil-structure interaction has remarkable effect on structural damage, when the natural period of the structure is coped with the predominant period of the soil. Then, there is high possibility of resonance which is so serious danger for structure to be damaged, failed or collapsed. The type of soil is defined by studying the effect of soil on the structure.

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