

Estimation of S-Wave Velocity Structure Using Array of Microtremors in Damascus City (SYRIA)

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Estimation of subsurface structure has been recognized as one of the important soil properties in earthquake and civil engineering. Therefore, accurate knowledge of geometry and shear wave velocities of soil deposits and basement are the key parameters controlling the amplification of seismic motion. Array of microtremors exploration method becomes very attractive and useful for microzonation and site effects studies due to its low cost compared with other conventional geophysical prospecting as well as its applicability even in big and crowded cities.

Damascus city is bounded by Qasyoun Mountain from the South West to North East where Paleogene and Cretaceous are appeared and from the South it is bounded by El-kalb, Tamouriyeh and Abou Attiz Mountains where Basalt rocks are appeared while, main part of the city is located on sedimentary basin along Barada river (Geological Map of Syria, Ministry of Industry, 1963). Array measurements of microtremors at 19 sites in Damascus city were carried out for estimation of Vs velocity of shallow soil formations for site effect analysis. The spatial autocorrelation method was used to determine the phase velocity dispersion curves. Genetic Simulated Annealing Algorithm technique, which is a hybrid method introduced by Yamanaka H. (2007), for Inversion of Rayleigh wave dispersion curves was applied to evaluate the VS profiles at all considered sites and theoretical site transfer functions were calculated by following one-dimensional shear wave propagation law for all sites.

Regarding our results, VS profiles are not uniform in Damascus city and this clear diversity in shallow soil layers corresponding to a clear variation in site response. By comparing soil classifications based on average shear wave velocity for the top 30 meters of soils (NEHRP site classification) with surface geological classifications (Geological Map of Syria, Ministry of Industry, 1963), VS,30 do not show any variation among these sites. That illustrate, VS,30 is not a good proxy of site amplification in the case of Damascus city since low velocity layers are very shallow for most regions in Damascus.

For more reliable estimation of site effects in Damascus city, 6 portable seismic stations will be installed and the obtained ground motions will be used to verify the most appropriate soil classification to present site amplification in Damascus city.

Keywords: Array of Microtremors, Phase Velocity Dispersion Curves, Inversion of Surface wave, Spatial Autocorrelation method, Estimation of shear wave velocity, Site effect and Microzonation studies