Abstract

Aim of this study is the determination of an aggravation factor in order to consider the complex phenomena due to complex local geology as well as to quantify the factor's values and its spatial variation. In order to reveal the complex phenomena that form site response, the problem is approached with 1D and 2D analysis and weak earthquake recordings are used.

The site of study is the sedimentary valley of Volvi graben which is one of the two grabens that form the Mygdonian basin, some 25 km to the E – NE of Thessaloniki. The area combines high seismicity and great variation of the geological structures. In order to approach the site response theoretically, the cross-section A-A' of the basin is chosen (width almost 9km and max depth 400m). The cross-section that came from the process of experimental data, was constructed by the geologist Phd student M.Manakou and simulated by Dr K.Makra.

The 1D response due to S-wave vertically propagated is computed with the reflectivity – coefficient method (Kennett, 1983).The method computes 127 1D transfer functions that concern the corresponding 127 1D models that are extracted from the 2D model with constant step 70m along the surface.

The 2D model is excited by SH and SV waves vertically propagated with the shape of a Gabor pulse. The finite differences method used, proposed by Moczo, 1989, Moczo & Bard 1993, allows the computation of 2D seismograms from which 2D theoretical transfer function are then computed.

Synthetic response spectra were also computed for the 1D and 2D numerical results. The procedure was as follows. For each of the 12 selected events, each of the 2 horizontal components of the record(transversal and radial) obtained at the reference site was convolved with the numerical 2D SV and SH transfer function relative to the reference site respectively and with the 1D transfer function computed at the locations corresponding to each of the 127 sites. Then, synthetic accelerograms are obtained for each station for both transversal and radial component of motion, for each selected event, and for each of the two models considered. Finally, average response spectra were computed as well as their ratio 2D/1D for each station. This ratio reflects the aggravation factor at each station, that quantifies the additional to 1D resonance amplification due to complex local geology.

Results both in time and frequency domain indicate the deficiency that 1D approach has to describe the complex phenomena that govern the seismic response of irregular soil structures like in this case of the sedimentary basin. On the other hand, 2D analyses foresee the additional amplification due to the lateral propagation of surface waves that are generated at the edges of the basin (due to diffraction phenomena). This additional amplification is well quantified by the aggravation factor. Moreover, the slight spatial variation of this factor allows to adopt a constant and uniform value between 2.5~3.0 for the whole Mygdonian basin.

Results of the theoretical approach are also in good agreement with those obtained by experimental methods. In addition to that, the comparison between the seismic response of Mygdonian basin and other valleys that have been studied show that the site response of the Mydgonian basin can be representative for all shallow sedimentary basins, for which aggravation factor has a constant and uniform value around 2.5.

Although the high importance of site effects due to complex local geology has been recognized, current building codes ignore them. That is why it is proposed the introduction of site effects throu
ugh the aggravation factor.