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Site effect investigation using microtremor measurements in towns of Israel for development earthquake damage scenarios: the case study of Haifa Bay area

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The Haifa Bay area is one of the most densely populated and developing urban areas in Israel, where Haifa port (most large in Israel), Airport, large scale chemical industry and underground pipelines containing flammable gas or potentially pollutant liquids, coastal strip of Haifa town with about 50,000 inhabitants and four relative small towns with overall inhabitants of 150,000 are concentrated. This important area in terms of inhabitants, economic activity and administration is located close to a major seismogenic zone that constitutes the Dead Sea Rift and its branching faults. Several major historical earthquakes occurred during the present millennium in the distance range of 50-80 km from the investigated area. So, due to the concentration of population and taking into account the historical seismicity, this region, is considered as a high seismic risk zone.

Based on microtremor measurements conducted at 480 locations in an area of about 50 km^2H/V spectral ratios are derived. The results show two H/V peaks at frequencies related to resonances of deep and shallow structures. Spatial variations of frequency 0.5-5 Hz and 1-8 Hz and H/V amplitude level of 2-6 units and 2-10 units for the first and second peaks, respectively, reflect the geological complexity of the study.

Under the assumption that the H/V spectral ratios of microtremor agree with the am-

plification levels at the dominant frequency of the site response functions, we construct a simplified 3D model of the subsurface which is consistent with the H/V measurements. In the process of developing the subsurface models, we integrate the results of the V/H measurements with available well data (providing thickness of the sediments) with information about the regional geology and with limited geophysical data about shear-wave velocity for different lithological units of soil. The subsurface model serves as an input for computing the expected linear and nonlinear uniform hazard site-specific acceleration spectra using the procedure of Shapira and van Eck (1993) at the investigated sites. The final stage is generalizing the hazard by mapping zones that feature similar seismic hazard functions. The use of these zones in earthquake damage scenarios can help the respective authorities to set priorities in enforcing building codes, conducting seismic strengthening programs for existing structures, and in contingency planning for emergency response and long term recovery.