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Nonlinear Site Response Analysis in Tokyo Meteropolitan Area Using Equivalent Linear Approach

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Nonlinear site effect analysis was carried out for 210 simulated strong ground motion records in the Tokyo Metropolitan area. The simulated strong motion records synthesized for two scenario earthquakes, i.e. plate-boundary and intra-slab ones, were the outputs from the Special Project for Earthquake Disaster Mitigation in Tokyo Metropolitan Area. Fault plane of plate boundary earthquake extends along the surface of subducting Philippine Sea Plate (PHS), located beneath the northern part of Tokyo bay area. Its presumed magnitude of M_w 7.3. The fault plane of intra-slab earthquake is expected within the PHS at a focal depth of 50 km, extended beneath Chiba and Ibaraki prefectures. Its presumed magnitude of M_w 7.1. All waveforms were synthesized on engineering base of shear-wave velocity 500 m/s.

Site response analyses were achieved by an equivalent linear method using DYNEQ program developed by Yoshida and Suetomi (1996). G-γ and h-γ relationships of Central Disaster Mitigation Council are recognized to express the shear deformation of soil (clay, sand, and gravel). Resultant waveforms on free surface shows a systematic dependence on thickness of the soft structure above the engineering base. Large amplification is dominant at corresponding short periods above shallow soft structure, whereas the peak amplitudes shifted to longer periods for sites located above deep soft structure. Nonlinear site effects were typically obvious at short periods of approximately 0.2 s and shorter. The deformations mostly concentrated in the shallow 20 m of the soil inferred from maximum shear strains analysis. Our analysis showed the considerable effects of the non-linear response of surface layers to large seismic inputs on the engineering base.

キーワード: Nonlinear site effect, Plate boundary earthquake, Intra-slab earthquake
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