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Development of Soil Amplification Factors Using 1D and 2D Ground Response Analysis

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Abstract

1D ground response analysis is quite popularly used for determining soil amplification numerically. 1D GRA works well for layered soil material with infinitely extending boundaries. However, in case of irregular ground, complex site stratigraphy, river basin, etc. 2D analysis or even 3D analysis is preferable where soil properties in all the corresponding direction is incorporated and thus depicts the real behaviour when it is subjected to an earthquake motion. In the present study, an attempt has been made to determine soil amplification using the 1D, and 2D GRA. The analysis is carried out on numerous multilayer real soil profiles taken from author's past work. As a first step, 1D EL GRA is conducted for 8 real sites from India, using the DEEPSOIL software. Spectrum compatible time histories matched with the Type I spectra of Indian code, corresponding to Effective Peak Ground Acceleration (EPGA) of 0.36 g are used. Deconvoluted motion of earthquakes are applied at the bottom of strata/ preferably on bedrock, and the response throughout the thickness of the strata is recorded in order to get the soil amplification profile. Later, using commercially available FEM software, ABAQUS 1D and 2D analysis is done where the layered soil medium is modelled using continuum approach. The results from 1D and 2D are compared together in terms of response spectra and amplification factors. This study brought forth the comparison of GRA results using discrete and continuum approach in 1D and 2D analysis.

Keywords: Soil amplification, Seismic response, Ground response analysis, 1D, 2D