

An Analytical Formulation of Pure Shear Boundary Condition for Assessing the Response of Some Typical Sites in Mumbai

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Abstract : An earthquake event, associated with a typical fault rupture, initiates at the source, propagates through a rock or soil medium and finally daylight at a surface which might be a populous city. The detrimental effects of an earthquake are often quantified in terms of the responses of superstructures resting on the soil. Hence, there is a need for the estimation of amplification of the bedrock motions due to the influence of local site conditions. In the present study, field borehole log data of Mangalwadi and Walkeswar sites in Mumbai city are considered. The data consists of variation of SPT N-value with the depth of soil. A correlation between shear wave velocity (V_s) and SPT N value for various soil profiles of Mumbai city has been developed using various existing correlations which is used further for site response analysis. MATLAB program is developed for studying the ground response analysis by performing two dimensional linear and equivalent linear analysis for some of the typical Mumbai soil sites using pure shear (Multi Point Constraint) boundary condition. The model is validated in linear elastic and equivalent linear domain using the popular commercial program, DEEPSOIL. Three actual earthquake motions are selected based on their frequency contents and durations and scaled to a PGA of 0.16g for the present ground response analyses. The results are presented in terms of peak acceleration time history with depth, peak shear strain time history with depth, Fourier amplitude versus frequency, response spectrum at the surface etc. The peak ground acceleration amplification factors are found to be about 2.374, 3.239 and 2.4245 for Mangalwadi site and 3.42, 3.39, 3.83 for Walkeswar site using 1979 Imperial Valley Earthquake, 1989 Loma Gilroy Earthquake and 1987 Whittier Narrows Earthquake, respectively. In the absence of any site-specific response spectrum for the chosen sites in Mumbai, the generated spectrum at the surface may be utilized for the design of any superstructure at these locations.

Keywords : deepsoil, ground response analysis, multi point constraint, response spectrum

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