Site Amplification and Basin Structure of Dholera Special Investment Region in Gujarat, India

By

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Ambient vibration and earthquake recordings are used for preliminary site characterization of the Quaternary sedimentary basin in Dholera region, which is being planned as a Special Investment Region (SIR) of Gujarat (India). The microtremor array measurements have been carried out at 25 well distributed sites in an area of 600 km^2 to determine the site amplification corresponding to the amplified frequencies and the relevant shear wave velocity profile of the deep soil basin in the vicinity of the SIR. The measurements at all sites were taken using circular arrays (50-100 meter) which consists of three recording stations on the circumference of inner circle, three on outer circle and one in the centre of circle. Seven sets of Lennartz LE-3D-5sec seismometers with CityShark-II digital recorders are deployed. It also has a master remote control which is used to trigger all the seven stations at a time in order to avoid any phase shift. The phase velocity dispersion of Rayleigh wave is calculated from array data using spatial autocorrelation method, and a 1-D wave velocity structure is determined by means of inversion processes. The Neighbourhood algorithm (Sambridge, 1999) has been chosen as the core of the dispersion curve inversion in the present study. H/V spectral ratios at the central seismometer at all the sites indicate amplification of 5.9-14.28 and 3.5-5.2 for the frequency bands of 0.29-0.35 Hz and 4.0-6.0 Hz respectively. Further, CMG-3T 120s, three component seismometers are installed with REFTEK digital recording for local earthquake signals over a period of minimum two months at 11 sites. The 10 earthquakes ($M \geq 2.5$) were clearly recorded allowing a detailed analysis of both P- and S-wave in each sensor. Recordings were continuous at 100 sps. The time window of 10.5 seconds data starting 0.5 second before S-wave arrival is used for all components following Bonilla et al. (1997). The H/V using BBS earthquake records shows amplification of 2.75-3.5 and 4.0-6.02 for the frequencies band of 1.0-2.0 Hz and another at 4.0-6.0 Hz respectively. But there is no amplification peak observed below 1 Hz frequency, which may be due to the moderate size earthquakes used in the present study. A five layer model (one soil layer with the power law variation of the velocity over the substratum) was used as the initial model for the inversion. It is seen that the upper most layer up to 25 meters has the low shear velocity between 175-400 m/s. The second layer is to the depth of 30-40 meters with shear velocity 450-700 m/s and the third layer is to depth of 70-80 m with shear velocity 750-1250 m/s. These layers are Alluvium, Deluvium, Pleistocene and over- laying Tertiary. The last layer shear wave velocity is 1500-1700 m/s corresponding to Deccan Trap. The boundary of Pleistocene-Tertiary at around 80 m

is considered as Engineering Bed Layer (EBL). The EBL is uniformly distributed and under EBL there is less variation of structure and properties. The second layer is shift soil while the third layer is soft rock. The results of the single and array measurements and earthquake recordings have been compared with the results of the available N-value from SPT test and PS-logging data. The estimated site effects of the deep soil in the area shows a good correlation geomorphological data.