Evaluation of site classification for soils in Lucknow urban centre And Correlation between SPT-N value and V_s

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Abstract

Evidences from past earthquakes clearly shows that the damages due to an earthquake and its severity are controlled mainly by three important factors i.e., earthquake source and path characteristics, local geological and geotechnical characteristics, structural design and construction features of structures. Generally, the soil layers over the firm bedrock may attenuate or amplify the bed rock earthquake motion depending upon geotechnical characteristics, their depth and arrangement of soil layers. Usually the younger softer soils amplify ground motion relative to older, more competent soils or bedrock. Local amplification of the ground is often controlled by the soft surface layer, which leads to the trapping of the seismic energy, due to the impedance contrast between the soft surface soils and the underlying bedrock. Many researchers have proved that site conditions play an important role in damage distribution as well as in the recorded strong motion records (Ishihara, 1997; Aki, 1998; Tertulliani, 2000; Hartzell et al., 2001, Ozel et al., 2002). It has been evident from the past earthquake events all over the world that the amplification of ground motion is highly dependent on the local geological, topography and geotechnical conditions. The determination of geotechnical site conditions requires identification of the soil stratification and properties of soil layers based on various in-situ tests and laboratory tests on soil and rock samples. The extent of area to be investigated for seismic microzonation generally spans over several kilometers unlike routine geotechnical site investigations and thus, geophysical tests are more reliable tools for understanding subsurface. They are based on the propagation of body waves and surface waves, which are associated to very small strain (< 0.001%). The geophysical tests are more advanced now a days, and these methods can be used more efficiently with less time to explore deeper depth and also larger aerial extent, which is quite needed mainly in deeper basins like Indo-Gangetic basin and large urban centre.

This paper presents Multichannel analysis of Surface Waves (MASW) tests carried out at Lucknow urban centre, capital city of Uttar Pradesh, which lies in Indo-Gangetic basin. 50 MASW surveys have been carried out and in addition, 12 numbers of conventional bore holes were drilled with SPT tests at different depth intervals. These tests were done as part of the study of seismic microzonation of Lucknow urban centre. Additional SPT data were also

collected from couple of geotechnical firms in the study area. Out of these data, 14 pairs of data consisting of MASW and SPT tests in boreholes were close to each other. Based on Vs profiles from MASW tests, it has been observed that Lucknow urban centre belong to site class D and C, as per NEHRP classification. Similar classification was also attempted from SPT data. Further, from these 14 sets, about 220 pair of data of uncorrected SPT-N value and V_s were compared and correlated. Through a regression analysis, an empirical correlation was obtained between SPT 'N' values and Vs values for the region under study. The summary of correlation developed and its comparison with similar correlation available in literature are also presented in the paper.

Keywords: *Site classification, Shear wave velocity, Multichannel analysis of Surface Waves (MASW) test, Standard Penetration Test (SPT)*

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