LIQUEFACTION POTENTIAL OF ALLUVIAL DEPOSITS

P. Nandakumaran[I], S. Mukerjee[I] and Anand S. Arya[I]

Determination of liquefaction potential of alluvial deposits consists in comparing the ratio between the shear stresses and effective normal stresses at various depths with the ratio between the two stresses that would cause liquefaction. The former stress ratio is obtained from the knowledge of the time history of ground accelerations during the expected earthquake and the bore-log data at site while the latter is obtained from laboratory tests on the soil samples obtained from the site. Various types of laboratory tests namely dynamic triaxial, dynamic simple shear and shake table tests have been adopted in various countries and the number of tests necessary have been reduced by understanding the influence of various parameters affecting the strength of saturated sands.

When a site is to be analysed for liquefaction potential during future earthquakes, a serious problem is faced regarding the possible amplification or attenuation of waves in the top soil layers. Since it cannot be determined beforehand upto what extent the shear modulus values would be gradually modified during the earthquake-induced vibrations and the resulting pore pressures, it cannot be ascertained as to what the time history of earthquake accelerations would be. This places a serious drawback on the application of the simplified procedure (1) for alluvial deposits to be analysed for future shocks.

From the data reported by Arango and Dietrich (2), it is observed that for a 33% reduction in the value of shear modulus, the maximum ground surface acceleration is reduced by 61% for a base-rock input acceleration of 0.3g. This shows that due to a reduction in the shear modulus the stresses induced at any depth during an earthquake, will also be reduced; the amount of reduction being a function of the vibration-induced pore pressure rise. The acceleration time history used in the simplified procedure should be modified to account for this reduction of induced stresses or the corresponding stress ratio causing liquefaction be multiplied by a suitable factor. This factor for stress ratio causing liquefaction works out to be 1.64 for an input base-rock acceleration of 0.3g. These factors for different base-rock accelerations and varying reductions in shear modulus can readily be found out.

For laboratory testing, the shake table tests have the advantage of the table motion and hence the stresses not being influenced by the modification of shear moduli. A correction factor of 2.2 for the stress ratio causing liquefaction, as obtained from shake table tests, was found necessary where input accelerations are taken corresponding to the unaffected soil deposit (3).

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[I] School of Research and Training in Earthquake Engineering, University of Roorkee, Roorkee, INDIA