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Evaluation of liquefaction potential of sandy and silty soils of Defence-Clifton areas of Karachi and mitigation measures

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One of the most common causes of ground failure during earthquakes is the liquefaction phenomenon which has produced severe damages so far all over the world. Many factors govern the liquefaction process for in situ soil and the most important are intensity of earthquake and its duration, location of groundwater table, soil type, soil relative density, particle size gradation, particle shape, depositional environment of soil, soil drainage conditions, confining pressures, aging and cementation of soil deposits, historical environment of the soil deposit and building/additional loads of these deposits. Areas that may be prone to liquefaction hazard are those that may be subjected to moderate to very strong ground shaking, have young alluvial deposits consisting of sand and silt, and have shallow ground water (within 50 feet of the ground surface). Young deposits would be of Holocene to late Pleistocene in age. Determination of liquefaction potential of soil deposits due to an earthquake is a complex geotechnical problem since many factors including soil parameters and seismic characteristics influence this problem. There are two approaches to mitigate against liquefaction, soil improvement and foundation based mitigation. This paper summarizes results of some specific factors that control development of liquefaction of soil such as Standard Penetration test (SPT), grain size distribution of the soil mass, relative density of the soil deposits, depth and thickness of different soil strata, depth of groundwater table, etc. Tests were carried out on sandy and silty soils collected from different sites of the study areas because these areas may be prone to liquefaction due to having loose sand beach deposits, shallow ground water and a lot of construction over landfill deposits. The potential for liquefaction of these soils and its mitigation techniques are presented.