A Short Note for Dr. Ishihara's Review in 1974

In the paper written in the 1970s by Prof. Kenji Ishihara, case histories for the 1964 Niigata earthquake and preceding earthquakes were addressed followed by overviews on laboratory studies, in situ investigations, and analyses of liquefaction. The research efforts overseen by Prof. Ishihara have been developed considerably since then for reliably evaluating liquefaction potential for a variety of soils under different geotechnical and seismic conditions and for mitigating liquefaction failure through ground improvement.

Despite great advances in this aspect of liquefaction research, problems vital to reasonable design methodology remain. One is postliquefaction soil behavior, which plays an important role in soil-structure interactions in performance-based design of buildings and civil structures. Unlike other earthquake failures, serious damage often occurs in the postliquefaction phase due to static and monotonic straining by dead loads in liquefied soil where little residual shear strength remains. Great uncertainties remain on how to evaluate postliquefaction ground deformation, together with soil-structure interactions, concerning differential settlement, uplift, and lateral displacement. Current engineering practices tend to avoid uncertainties by employing soil treatment or rigid foundations to prevent soil liquefaction in advance. However, with design earthquakes becoming larger, it becomes unrealistic to depend too much on such costly measures.

In contrast to the paper by Prof. Ishihara, the preceding paper has addressed liquefaction-induced structural damage during recent earthquakes from the 1964 Niigata earthquake to the present. Typical failure modes associated with damage have been identified from the viewpoint of their mechanisms and mitigation measures. Among them, the postliquefaction lateral flow mechanism, which still seems quite controversial, has been discussed in detail by introducing different views on soil behavior causing lateral flow or spreading. Special emphasis has been placed on recently evolving research results considering the effect of void redistribution due to soil stratification.

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