BUILDING AN UNIVERSITY ON LIQUEFIABLE SANDS USING DYNAMIC COMPACTION

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Abstract

A major University project spanning 511 acres with a total constructed area of 357 acres has recently been constructed in the state of Uttar Pradesh in North India.

Loose to medium dense 'clean' Yamuna sands belonging to the "*Indo-Gangetic Alluvium*" were encountered at the project site, which were found to be susceptible to liquefaction to about 8-12 m depth. To avoid the difficulties and high costs associated with high-quality soil sampling and advanced laboratory testing for determination of cyclic resistance ratio (CRR), field tests consisting of standard penetration tests (SPT) and cone penetration tests (CPT) were carried out.

Detailed liquefaction susceptibility studies were carried out at each of the structure locations based on SPT and CPT data to assess the liquefaction potential at the site. The methodology is based on the simplified procedure developed by Seed & Idriss (1971), as described in the NCEER Summary Report (1971).

Dynamic compaction was carried out at each of the structure locations to densify the soils and mitigate the risk of liquefaction. The weight of the pounder and the height of fall required to achieve the required depth of improvement were estimated using empirical correlations (Mitchell & Katti, 1981). Sufficient relaxation time was given to allow pore pressures to dissipate between passes. A second geotechnical investigation was then done to assessthe extent of improvement achieved.

Field tests (SPT and CPT) carried out before and after dynamic compaction indicated that the ground improvement has been successful to the desired depth. The liquefaction susceptibility of the improved ground under the design earthquake conditions was found to be negligible. Open foundations bearing on the improved ground could now be provided in place of piles, resulting in enormous cost-saving for the owner.

The authors have executed a major geotechnical investigation program at the project site, and collected a plethora of data from over 700 boreholes and 200 cone penetration tests (CPT) completed at the various structure locations across the site. The paper shall illustrate the successful mitigation of liquefaction potential at the project site through a few case studies.