THEME 9

FOUNDATIONS UNDER SEISMIC LOADS

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ABSTRACT

Shallow foundations may experience a reduction in bearing capacity and increase in settlement and tilt due to seismic loading. The reduction in bearing capacity depends on the (1) nature and magnitude of dynamic loads, (2) number of pulses and (3) the strain rate response of soil. Shallow foundations for seismic loads are usually designed by the equivalent static approach. The foundations are considered as eccentrically loaded and the ultimate bearing capacity is accordingly estimated. International Building Code generally permits an increase of 33 % in allowable bearing capacity when earthquake loads in addition to static loads are used in design of the foundation. This recommendation may be reasonable for dense granular soils, stiff to very stiff clays or hard bedrocks but is not applicable for friable rock, loose soils susceptible to liquefaction or pore water pressure increase, sensitive clays or clays likely to undergo plastic flow There is hardly any experimental verification of these theoretical solutions. There is a need for such validation.

In liquefying soils, the buildings on shallow footings may settle and tilt excessively which has been observed in the 1999 Turkey earthquake. Detailed scrutiny of the "Adapazari failures" showed that significant tilting and toppling were observed only in relatively slender buildings (with aspect ratio: $H / B > 2$), provided they were laterally free from other buildings on one of their sides. Further research on model and field tests on settlement and tilt of shallow foundations and their analysis are needed to develop reasonable design procedures for earthquake resistant design. The paper describes in deatil the various aspects of dynamic bearing capacity and settlement and of tilt of foundations due to seismic loading. A critical evaluation of different codal provisions for design of foundations in seismic areas is also presented.