DYNAMIC PROPERTIES OF AN OVERCONSOLIDATED CLAY

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SYNOPSIS

Dynamic properties of the overconsolidated clay (CL; OCR -1.5 to 4) studied herein are found to be strain dependent and are similar to those of normally consolidated clays. The damping ratios had values of 4, 7 and 15 percent at 0.005, 0.1 and 1 percent shearing strain. The decrease in shear modulus was typically 5, 55 and 85 percent at the same strain amplitudes (reference strain - 10^{-4}%). Shear wave velocity measured in-situ by seismic methods increased from 1200 fps to 1500 fps as the depth increased from 50 to 200 ft.

In seismically active areas, the suitability of alluvium sites for important constructions depends on two major engineering considerations: (a) the dynamic stability of subsurface soil, e.g. liquefaction and dynamic settlement, and (b) the dynamic response of the site. When soils at the site are predominantly cohesive, dynamic response is of primary concern.

The alluvium at a proposed construction site consists of overconsolidated silty clays (CL) from depths 50 to 200 feet. Overconsolidation ratios (OCR) for these materials decreased from 4 to 1.5 as the depth increased from 50 to 200 feet.

Forty-five series of laboratory resonant column and cyclic triaxial test results indicated that the decrease in shear modulus at 0.005, 0.1 and 1 percent shearing strain was typically 5, 55 and 85 percent respectively. Viscous damping ratios at the same strain amplitudes were 4, 7 and 15 percent. The damping ratio had about the same value as those of the normally consolidated clays at 0.005% shearing strain and were about 25% lower at 1% strain. However, the shear modulus reduction factors were much less pronounced than those of the normally consolidated clays for which typical reduction factors at the above strain amplitudes are 35, 85 and 96 percent respectively.

Seismic tests performed at three different locations indicated that shear velocities increased from 1200 fps to 1500 fps in the clays as depth increased from 50 to 200 feet. Laboratory determined velocity values were typically 70-75% of the in-situ values. Both in-situ and laboratory determined velocity values were used together with the strain dependent dynamic properties for seismic ground response analyses. The calculated results using the vertically travelling shear wave approach with Taft N21E record normalized to a peak g = 0.25 as input motion showed no important difference with shear moduli normalized to either in-situ or laboratory values.

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