Earthquake Response of Submarine Sediment

by

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ABSTRACT

In dealing with seismic stability of submarine slopes, we are concerned with the initial trigger mechanism as well as the resulting possible large movements leading to a flow slide.

The cyclic shearing induced by earthquake loading causes pore pressure rise which may directly induce a sufficient drop in strength and stiffness to trigger large movements, or the trigger may occur some time later, due to pore pressure build-up at strategic locations controlled by stratigraphy. This delayed trigger can occur because drainage is impeded by a barrier layer of low permeability causing the trigger and flow slide to occur, minutes, hours, days or, perhaps, years after the earthquake event. Once movement commences, the strength and stiffness may further reduce below the steady state strength due to mixing of soil layers.

These effects are illustrated using a coupled stress-flow dynamic time domain analysis procedure. A prescribed time history of acceleration is applied at the base and shear induced pore pressures are computed with time in all elements of the domain. The procedure is an effective stress one in which the rising pore pressures reduce the strength and stiffness of the elements. If the strength loss during the shaking is sufficient, a flow slide may be triggered during the earthquake. If not, pore pressure redistribution commences, and while excess pore pressures generally reduced with time, in some zones, pore pressures increase because flow is restricted by low permeability layers, and triggering can occur some time after the earthquake event. In addition, as movement commences, the strength may further reduce due to mixing effects. Example of the occurrence of such triggering and resulting flow slides will be presented.