ON STRUCTURE-FOUNDATION INTERACTION DURING EARTHQUAKES

by

Kaufman B.D.[I], Savinov O.A.[II], Uzdin A.M.[III], Shulman S.G.[IV]

To determine seismic loads on structures with consideration for their interaction with the foundation, studied is a succession of the design schemes which simulate the effect of energy dissipation into the foundation in the form of elastic waves.

For a linear oscillator, interacting with a semi-infinite homogeneous foundation, studied as a one-dimensional problem, the equation of seismic vibrations will assume the shape:

$$\ddot{y} + 2(\varepsilon + \lambda)\dot{y} + \omega^2 y = \ddot{Y}_0$$

in which

ω - the oscillator natural frequency; ε - internal friction coefficient (as given by Foight); λ - coefficient, characterizing energy losses resulting from the energy emission in the form of longitudinal (or transverse) waves.

For rigid structures (concrete dams, buildings of atomic power stations) $\lambda > \varepsilon$ which tends to a substantial decrease of seismic loads. Problems of a multimass system under various hypotheses of internal friction are studied in a similar way. For an oscillator, interacting with a layered foundation, the value of λ depends on the relation of seismic stiffnesses in the layers. When a structure is idealized as a rod executing longitudinal or shear oscillations, the solution for a standing wave becomes $y(x,t) = y(x)\exp(-\alpha t)\exp(i\omega t)$ where coefficient α characterizes the energy transmitted into the foundation.

A more profound estimation of the foundation damping effect may be obtained when the foundation is idealized as an elastic half-plane and a half space.

With the Lambe solution and its modifications, studied are problems of harmonic and unstationary vibrations of an oscillator and a rod interacting with the foundation.

I Engineer
II D. Sc. (Eng.)
IV D. Sc. (Eng.)

The B.E. Vedeneev All-Union Research Institute of Hydraulic Engineering, Leningrad, USSR.

III Engineer

The Leningrad Institute of Railway Transportation Facilities, Leningrad, USSR.