EVALUATION OF VIBRATIONS, STRESS STATE AND STABILITY OF THE STRUCTURAL FOUNDATION SUBSOILS

by

Ju. M. Eskin[I]

Disturbance of the dynamic stability of soils, development of the irreversible strains in them and undue excessive pressures in the pore water may in many cases be responsible for failure of various structures, which either are themselves the source of vibration or are subjected to external dynamic impacts. Developed are methods and technique of dynamic soil tests simulating natural conditions of static and dynamic loading in terms of stress components. Successful advancement of the above methods is associated with the formulation and solution of problems on the dynamic loading of structural foundation subsoils. To this purpose vibrations, stress state of the foundation subsoils under dynamic effects is investigated within the scope of the plane elastodynamic theory.

The initial system of equations of the elastodynamic theory formulated in terms of stresses and displacement velocities is solved by the finite difference method with the explicit "cross" type scheme used for the difference approximation formulation. The obtained set of the finite difference equations permits to solve static and dynamic problems with due account for the peculiarities of the foundation geology (non uniformity, stratification) and the relations between the material deformation properties and the static stress state.

The elastostatic problem is solved by the iteration procedure with the addition of a term proportional to the displacement velocities into the impulse equation to speed up the convergence. The elastodynamic moduli are determined using the static stress state data, followed by the solution of the dynamic problem.

Calculation results of the dynamic stresses and strains together with the data on static loads in the foundation subsoils are employed for making up a program of the laboratory tests aimed at specifying the maximum permissible values of the dynamic strains which characterize the dynamic stability of the soil structure. The maximum permissible dynamic strains (stresses) obtained by the soil tests are compared with the analytical data and are used for the determination of the possible disturbances in the dynamic structural stability of saturated non-cohesive soils and their liquefaction.

Comparison of the calculation results with the maximum permissible stresses makes it possible to define measures for better foundation safety (soil stabilization, use of pile foundation, etc) which will contribute to the disappearance of the dangerous plastic deformation zones.

I Engineer, The B.E. Vedeneev All-Union Research Institute of Hydraulic Engineering, Leningrad, U.S.S.R.