THE EXPERIMENTAL METHOD FOR PREDICTION OF SOIL-STRUCTURE INTERACTION UNDER SEISMIC VIBRATIONS

by
V.A.Ilyichev[I], V.G.Taranov[II]

In the case of structure with a massive foundation the problem of soil-structure interaction under seismic vibrations may be solved if the transfer function (TF) for the system of weightless rigid plate-soil is known. The function TF determines the vertical vibration amplitude of a rigid plate w_p under harmonic vertical force $R \cdot e^{i\omega t}$

$$W_p = R\,[f_1(\omega) + i f_2(\omega)] \qquad \text{I}$$

It is proposed to determine TF by two methods based on the experimental data obtained for massive foundations at the construction site.

The first method. The size of foundation was the same as of the rigid plate mentioned above /I/:

$$f_1 = f_o \cdot \cos\alpha, \quad f_2 = f_o \cdot \sin\alpha, \quad \alpha = \operatorname{arctg}\left[P \cdot \sin\gamma \,(m\omega^2 W_o + P \cdot \cos\gamma)^{-1}\right] \qquad (2)$$

$$f_o = W_o\left[(m\omega^2 W_o)^2 + 2m\omega^2 W_o \cdot P \cdot \cos\gamma + P^2\right]$$

where

w_o – vibration amplitude of the foundation

m – mass of the foundation and the vibrator

p – exciting force amplitude of the vibrator

γ – phase between the exciting force and foundation displacement

The second method. The dimensions of a weightless rigid plate are large or its base is of a complex shape. It is difficult to carry out experiments with such massive foundations. Therefore in such a case the TF and the contact pressures may be found by means of some calculation procedure using the influence function which has been determined by experiments with small foundations.

According to the exposed methods the tests have been performed and the function TF was found. This method permitted to evaluate the vibration parameters of a massive block. The comparison with the experimental data obtained for large foundation proved the method to be satisfactory.

(1) Ilyichev V.A., Taranov V.G. Experimental investigation of interaction between vertically oscillation foundation and soil base, Журнал "Основания, фундаменты и механика грунтов", 1976, № 2.

[I] Head of Soil Dynamic Laboratory, Doctor of Tech.Science

[II] Engineer, Research Institute of Bases and Underground Structures Gosstroy USSR, Moscow