ASSIGNING DIMENSIONS OF THE FOOTING OF ECCENTRICALLY LOADED FOUNDATIONS

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A procedure is suggested for determining the minimum dimensions for the footing of eccentrically loaded foundations with different shapes in plan, by graphoanalytic means. It is based on the functional relationship of static and structural parameters (vertical forces, moments of forces, shape of the foundations' footing, etc.), expressed in relative amounts, and can take into account the action of several combinations of loads in the calculation. The procedure is most effective in solving problems connected with designing the foundations of buildings (structures) to be reconstructed.

In calculating eccentrically loaded foundations, difficulties arise in assigning the dimensions of their footing, especially under the action of several combinations of loads and with a nonrectilinear shape of the foundations in plan. At present, the dimensions of the footing of eccentrically loaded shallow foundations are assigned based on the following conditions:

\[ P \leq R; \]
\[ P_{\text{max}} \leq 1.2R; \]
\[ P_{\text{max}}^S \leq 1.5R, \]

and for certain types, also on the condition

\[ e \leq e_0, \]

where all of the notations and terms are adopted according to \([1, 2]\).

The dimensions of foundations obtained in this case must satisfy the requirements of calculations of the base's deformations, which are not considered in the present work. In view of the different values of solutions of (1)-(4), the dimensions of the footing are usually determined by successive approximations, which does not allow for the choice of economical solutions.

A procedure is suggested below for determining the minimum dimensions of the footing of eccentrically loaded foundations with various shapes in plan. It is based on the functional relationship of static and structural parameters (vertical forces, moments of forces, shape of the foundations' footing, etc.), expressed in relative amounts, and can take into account the action of several combinations of loads (static, dynamic, or static and dynamic together). In its assumption of a linear distribution of contact pressures over the foundations' footing, the suggested procedure does not contradict Construction Standards and Rules (SNiP) 2.02.01-83 \([3]\). In this case, the form of the diagram of contact pressures can be rectangular.
Fig. 1. Calculation scheme for eccentrically loaded foundation.

Fig. 2. Region of relative strength (linear deformability) of base soil compressed by pressure from the foundation.

trapezoidal, triangular, or triangular with a shortened length [1, 3, 5]. Then, for an eccentrically loaded foundation we can write two conditions (Fig. 1):

\[
\alpha_n = \frac{N_o}{R_A} = \frac{1 + \varphi R}{2} \psi_R;
\]

\[
\alpha_m = \frac{M_o}{W_R} \leq \frac{1 - \varphi R}{2} \psi_R.
\]

where \( \alpha_n \) is the relative vertical force acting at the level of the foundation's footing (the degree of compression of the base soil by vertical force \( N_o \) over an area equal to the area of the foundation's footing); \( \alpha_m \) is the relative moment of forces acting at the level of the foundation's footing (the degree of compression of the base soil by the moment of forces \( M_o \) over...