Comparison of the compression zone dimensions determined by different methods

Oleh Malyshev [1], **Pavlo Oliinyk** [1]

[1] *Kyiv National University of Construction and Architecture, department of Geotechnics*

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One of the most important indicators, when determining the value of deformations, is the compression zone. Conditionally it is assumed that the deformation occurs to its lower limit.

Scientists have proposed many methods for determining the amount of subsidence and compression zone. But the results of these calculations are very different. Therefore, it is very important to conduct research and get closer to the true values.

Existing methods for determining the depth of the compressed zone can be divided into three groups [2].

By the methods of the first group, the lower boundary of the compression zone is determined at the level of a certain pressure.

According to DBN V.2.1–10–2009 [1]:

$$\sigma_{zp} = k\sigma_{zg}. \quad (1)$$

By the method of American engineers:

$$p_z \le 0.1p_0. \quad (2)$$

P. Kuzmin and V. Feronskiy recommend:
for strip foundations

$$p_z = 0.1\overline{N}, \quad (3)$$

for square foundations

$$p_z = 0.06\overline{N}. \quad (4)$$

By methods of the second group, the lower boundary of the compressive zone is determined at the level of a separate layer with a certain deformation.

N. Maslov suggested:

$$\Delta S \le 0.05S. \quad (5)$$

E. Vinokurov offers:

$$S_i \le 0.15S_1. \quad (6)$$

S. Tsymbal and Sheikhnazari Hamideza [3] offer:

$$S_i \le 0.001S_u. \quad (7)$$

The third group includes methods that are not included in the first two.

N. Cytovich accepted:

$$H = 2\frac{(1-\nu)^2}{1-2\nu}\omega b. \quad (8)$$

W. Plagemann, W. Langer offer:

$$H = 5b. \quad (9)$$

I. A. Rozenfeld proposed:

$$H = kb. \quad (10)$$

The authors of the article are proposed to determine the size of the compressive layer taking into account the dimensions of the foundation, additional pressure and soil characteristics:

$$H = b\sqrt{\frac{p_0}{(1+e)E_S}}, \quad (11)$$

where b – width of the foundation;

e – coefficient of porosity;

p_0 – pressure from the external load at the base of the sole, kPa;

E_S – start deformation module, MPa.

To compare the value of the compressive layer determined by different methods, the following data were adopted:

foundation – strip width b = 2м; p_0 = 350kPa;

base – fine sand average density, γ_I = 17.1kN/m^3, γ_{II} = 17.9kN/m^3, φ_I =29^0, φ_{II} =32^0, e = 0.65, E = 28 MPa, E_S = 20.07 MPa, ν = 0.3, S_u = 100mm.

In all cases, the calculations were performed using a calculation scheme in the form of a linear deformed half-space by the method of layer summation [1]. The results of calculations are given in the table 1.

Table 1. Comparison of the compression zone dimensions

Form number	H [m]	Form number	H [m]
1	10.4	7	24.3
2	12.6	8	12.8
3	6.4	9	10
5	1.0	10	12
6	4.2	11	6.5

Many scientists on the basis of experiments proved that the criteria laid down in the norms of determining the value of compressive thickness is conditional and does not reflect the actual change deformation in depth. Therefore, in determining deformations, the advantage must be given to methods in which compressive thickness is less than in DBN V.2.1–10–2009 [1].

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