DETERMINATION OF THE BEARING CAPACITY OF FLEXIBLE REINFORCED CONCRETE BEAMS OF RECTANGULAR SECTION WITH A ONE-SIDED COMPRESSION FLANGE ON THE BOUNDARY CONDITIONS OF CONCRETE AND REINFORCEMENT

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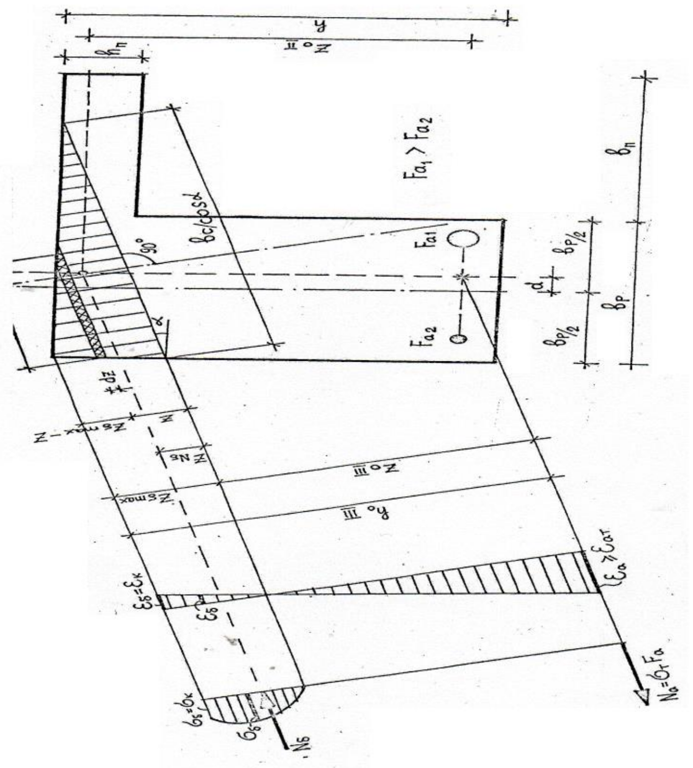
ABSTARCT

The development of a production base in residential, civil and industrial construction, as well as in many engineering structures, is important with the use of simple and prestressed reinforced concrete structures. Improving the quality and reducing the specific weight of reinforced concrete structures has always been an urgent problem. The solution to this problem is solved through the use of effective reinforced concrete structures, namely high-strength concrete, high-strength reinforcement, lightweight aggregates and similar factors.

In construction practice, the use of simple and prestressed reinforced concrete structures with modified design solutions requires clarification and addition of calculation methods, as well as an in-depth study of cases of stresses and deformations of reinforced concrete elements.

Cross-sectional shapes have a large influence on the stresses and strains of flexible reinforced concrete elements during use, preparation and restoration. Taking into account the influence of cross-sectional dimensions on the stress and strain state is one of the most important issues today.

Consider a bending reinforced concrete element with a one-sided cross-section of a rectangular cross-section with reinforcement, a flow area. In such elements, the neutral line is in the deflection position. (Picture 1.). when the section is reinforced symmetrically to the shell relative to the vertical axis of symmetry I (most of the reinforcement As1 is located on the right side of the shell, As2 is on the left) and since the flange is compressed unilaterally, the internal forces in plane II do not coincide, but are parallel to each other.



Picture: 1. Calculation of a flexible element of a one-sided compressed flange of rectangular section.

I-symmetry and plane of action of external forces; II - the plane on which the internal forces act; III - plane on which the maximum bending moment acts.
The direction of the II axis is determined by the dimension d in the section of the element (see Picture 2). Shelf resolution and As1; Depending on the As2 ratio, the II axis can shift to the right or left relative to the I axis.
Thetensilestateofcompactedconcreteatanypointisrepresentedbyreference.

$$N = \int_0^{z6\,max} G_s(\varepsilon_s)\cdot dA \qquad (1)$$

$$dA = B_z d_z$$

Theequaleffectofcompressivestressesonconcreteinthecompactedareaisdeterminedasfollows:

$$\left.\begin{aligned} B_z &= \frac{B_c}{\cos\alpha}\cdot\frac{Z_{6max}-Z}{Z_{вmax}} = \frac{B_c}{\cos\alpha}\left(1-\frac{Z}{Z_{6max}}\right) \\ Z &= \frac{Z_{вmax}}{\varepsilon_k}\cdot\varepsilon6;\ dz = \frac{Z_{6\,max}}{\varepsilon_k}\cdot d\varepsilon_6 \end{aligned}\right\} \quad (2)$$

for the elementary dA surface we write the following

$$dA = \frac{B_c}{\cos\alpha}\left(1-\frac{Z_6}{Z_{6\,max}}\right)\frac{Z_{6max}}{\varepsilon_k} = \frac{B_c}{\cos\alpha}\,\frac{Z_{в\,max}}{\varepsilon_k}\cdot d\varepsilon_6\,\frac{Z_{6\,max}}{\varepsilon_k^2}\,\varepsilon_6 d\varepsilon_6 \Big\} \qquad (3)$$

Taking into account the geometric dimensions of the compression zone and the linear change in the deformation of the cross section in the plane of maximum stresses
We put the dependencies in the recommendation to these formulas. After we have performed the integration in the indicated interval, we determine the equal influence of the compressive forces.

$$N_6 = \frac{B_c}{\cos\alpha} Z_{6\,max}\gamma_1 - \frac{B_c}{\cos_\alpha} Z_{6\,max}\ \gamma_2 = \frac{B_c}{\cos\alpha} Z_{6\,max}(\gamma_1-\gamma_2) \qquad (4)$$

$$\gamma_1 = \frac{A}{2}\left(\frac{\varepsilon_k}{\varepsilon_м}\right) + \frac{B}{3}\left(\frac{\varepsilon_k}{\varepsilon_м}\right)^2 + \frac{C}{4}\left(\frac{\varepsilon_k}{\varepsilon_м}\right)^3 + \frac{D}{5}\left(\frac{\varepsilon_k}{\varepsilon_м}\right)^4 \frac{F}{6}\left(\frac{\varepsilon_k}{\varepsilon_м}\right)^5 \qquad (5)$$

The bending moment is determined from the following dependencies:

$$N = \int_0^{z6\,max} \sigma_6(\varepsilon_6)\, z dA \quad (7)$$

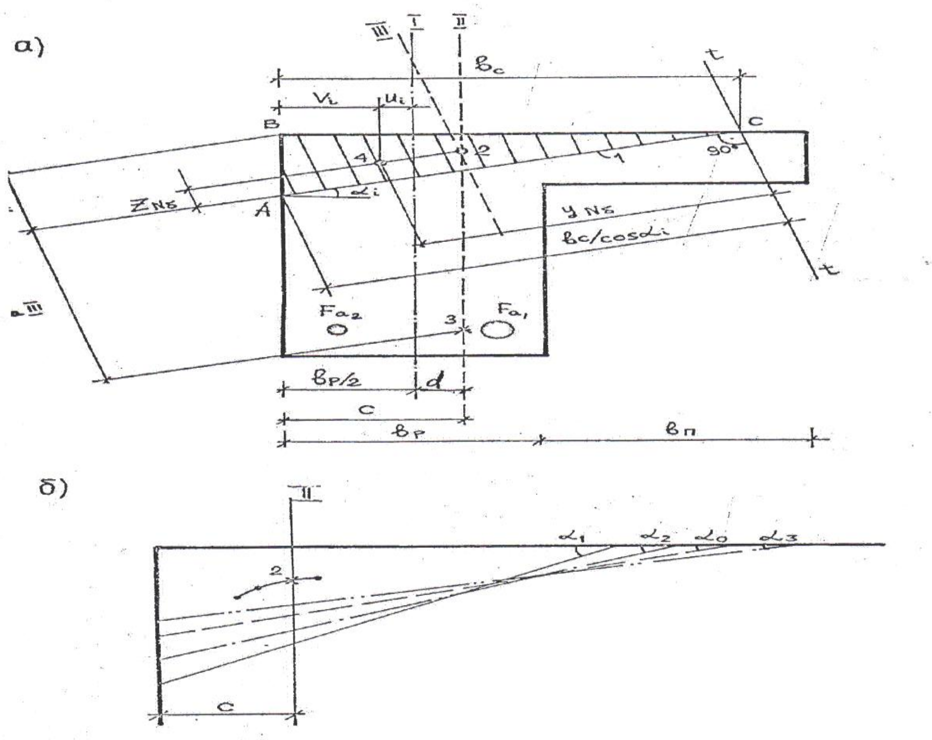
After we have completed the integration using dependencies (2), (3), we will have the following expression

$$M_{б} = \frac{B_c}{\cos\alpha} z^2_{б\max} V_2 - \frac{B_c}{\cos\alpha} z^2_{б\max} V_9 = z^2_{б\max}(V_2 - V_9) \quad (8)$$

$$z_{б\max} = \sqrt{\frac{\sigma_{ок} \cdot s \sin\alpha \cos\alpha}{V_1 - V_2}} \quad (9)$$

This expression contains two unknown quantities: the height of the compressed Z6max zone and the angle of inclination of the neutral axis a.

To determine the deflection angle of the neutral axis a, let us pay attention to the relationship between the displacement of the point to which an equal compressive force is applied and the change in the deflection angle. To do this, it is necessary to calculate the distances V1, V2, V3 from axis II to an equal axis at arbitrary angles a1, a2, a3 (Pic. 2).



Boundary states of the compressed section at angles a1, a2, a3.

Picture: 2. Regarding the calculation of the angle of inclination of the neutral axis

a) the cross section of the element; b) the ratio between the angles a and the displacement sizes V: I-symmetry and the plane of action of external forces; II-plane of influence of internal forces; Largest plane of curvature of element III. 1 border of the compressed zone; 2 - setting of the compressive stress compensator; 3 The position of the point at which the stress in the elongated armature deviates randomly from the axes.

The position of point 4, which is equal to the action of the stresses of the compressed zone, is determined by the deflection angle of the path ai. The intersection of the displacement path of the equator with plane II is determined by point 2, resulting in an angle ai.

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