CALCULATION OF MULTI-STORY REINFORCED CONCRETE STEEL FRAMES TAKING INTO ACCOUNT THE REAL WORK OF CONCRETE

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Abstract: *In the following article, a calculation algorithm was created and the results of numerical examples were analyzed, taking into account the real work of concrete in the calculation of multi-story cast reinforced concrete reinforced concrete frames.*

Key words: *creep of concrete, stress relaxation, penetration of concrete, uniformity of nodes, modulus of elasticity.*

The widespread use of concrete and reinforced concrete in construction and the design of integrated reinforced concrete structures and their prestressing require consideration of factors such as creep of concrete over time, stress relaxation, penetration of concrete, uniformity of nodes, increase in modulus of elasticity and strength over time. The investigation of the time-dependent processes of concrete and reinforced concrete structures will consist of two parts. First, to determine what this process consists of and to study its influence on the stress-strain state. Secondly, to create algorithms for calculation of reinforced concrete structures based on the laws of rheology, mechanics and mathematics of time-dependent variable processes.

Many experiments and researches have shown that the initial deformation of concrete develops nonlinearly due to the influence of creepage of concrete and the uniformity of nodes in reinforced concrete structures working under load. An increase in deformation in reinforced concrete structures leads to a redistribution of stresses between concrete and reinforcement. Taking into account the real work of concrete leads to the design of reinforced concrete structures. Considering the real work of concrete leads to the design of reinforced concrete structures [1-10].

Taking into account the real work of concrete, the cross-sectional uniformity of the elements is determined from the following expression:

$$D = EJ = E_b^{ин}\frac{bh^3}{12} + E_s A_s \frac{E_s}{E_b^{bp}}\left(\frac{h}{2} - a\right)^2 + E_s^{/} A_s^{/}\frac{E_s^{/}}{E_b^{bp}}\left(\frac{h}{2} - a^{/}\right)^2$$

$$E_b^{bp} = \left\{ \frac{\xi_y}{\sigma_b} + \frac{\left[1 + \eta_k \dfrac{\sigma_b}{R_b} m_k\right]}{E_m} - \frac{1}{\sigma_b}\sum_{j=1}^{i}\left[1 + \eta_n\left(\frac{\sigma_b^{cp}}{R_b}\right) m_n\right]\left[c\cdot(t_i, t_j) - c\cdot(t_i, t_{j-1})\right] \right\}$$

$$E_b^{ин} = \varphi E_b^{bp}$$

where:

$\eta_k, \eta_n m_k, m_n$ - nonlinear deformation parameters; E_s - modulus of elasticity of reinforcement; σ_b - stress generated in concrete; $c \cdot (t_i, t_j)$ - creep size;

$$\varphi = \frac{2(1+m)+n_\sigma}{1+2m+2n_\sigma}$$

where: n_σ - a nonlinear measure of normal stress $0 \le n_\sigma \le 1$;

m - voltage state parameter.

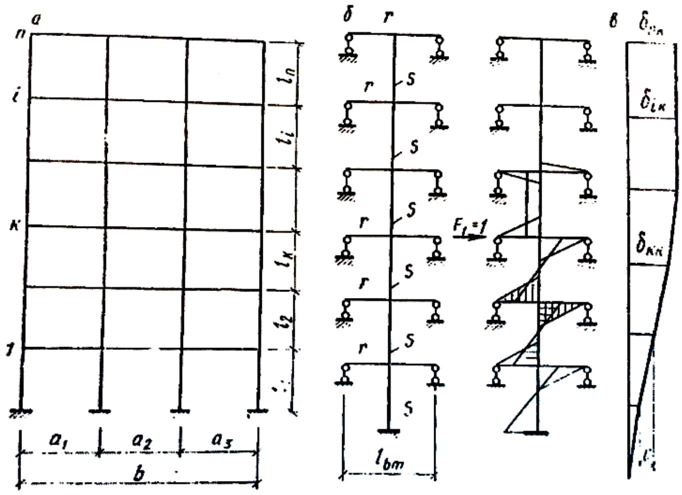
Research shows that the engineering method of calculating horizontal displacements is the equality of nodal angular deflections of multi-story frame layers, and this is given in the calculation scheme (Fig. 1). In this δ - the total uniformity of each length of the floor column; r - the general uniformity of girigels on the floor; l - column length; n - the number of floors.

Displacement in a multi-story frame from horizontal loads applied simultaneously to all floors:

$$y = \delta_{k1}F_1 + \delta_{k2}F_2 + \ldots + \delta_{kn}F_n$$

Displacement in $n \ge 6$ the frames when the number of floors, if we take into account the transverse forces in the tiers:

$$Q_k = \sum_{i=k}^{n} Fi, \qquad i \ge k$$



Picture 1. Calculation scheme and migration of a multi-story frame.

linear skew of each floor:

$$y = \sum_{i=1}^{k} \Delta i,$$

$$\Delta i = Q_i Ci,$$

$$y = \sum_{i=1}^{k} Q_i C_i$$

The shear strength of a multi-story frame is the horizontal force when the angle of inclination is equal to one:

$\varphi = K_c / 1 = 1$

$K = 1/c$

or $$K = 12/\left[1\left(S^{-1} + r^{-1}\right)\right]$$

The time-dependent modulus of elasticity of concrete is one of the conditions for considering its real work [11-23].

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