OPTIMAL DESIGN OF A REINFORCED REINFORCED REINFORCED CONCRETE FARM

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Abstract: *The article provides information about the optimal design of a prestressed reinforced concrete truss truss, taking into account the robust, long-term reliable operation of the structure, the ease of preparation technology - the consumption of materials, cost and other indicators.*

Keywords: *reinforced concrete rafter farm, tensile elements, optimal design, construction strength, material consumption, weight reduction, joint condition.*

The most optimal design is the foundation of the inflow, bund, uning is strong, bottleneck, technological assembly, convenient calculation material, lifting, lifting and fastening.

Among the many issues discussed, we see that research has been conducted to reduce the weight and cost of the structure based on the strength conditions.

We present a calculation algorithm for optimizing the size of prestressed reinforced concrete truss truss nodes, taking into account the condition of uniformity, penetration and creep of concrete, and changes in prestressing over time [1-5].

It is required to reduce the theoretical size of the straw farm:

$$V = \sum_{(j)} F_j l_j = \sum_{(j)} K_1 h_j l_j \qquad (1)$$

the following limitations should be taken into account:

a) for compressible elements:

$$R_b - \left|\sigma_{ijk}^{b}(t)\right| \geq 0 \qquad (2)$$

b) for tensile elements:

$$R_s - \left|\sigma_{ijk}^{s}(t)\right| \geq 0 \qquad (3)$$

where: l_j - the length of the stern; V - size of the structure; F_j - stergen cross-sectional surface.

To solve the given problem, we reduce (1) the volume function to the Logrange function, taking into account the constraints (2) and (3):

$$\varphi = V + \sum_{(i)} \sum_{(j)} \sum_{(k)} U_{ijk} g_{ijk} \qquad (4)$$

or

$$\varphi = \sum_{(j)} k_1 h_j l_j + \sum_{(i)} \sum_{(j)} \sum_{(k)} U_{ijk} g_{ijk} \qquad (5)$$

where:

φ - Logrange function; U_{ijk} - additional acceptable unknown.

h_j to U_{ijk} find and we express (5) as follows:

$$\frac{\partial\varphi}{\partial h_j} = 2K_1 h_j l_j + \sum_{(i)}\sum_{(j)}\sum_{(k)} U_{ijk}\left(-\frac{\partial|\sigma_{ijk}|}{\partial h_j}\right) = 0$$

and (2) and (3) limitations:

$$g_{ijk} = \frac{\partial\varphi}{\partial U_{ijk}} = R_b - |\sigma^b_{ijk}| = 0;$$

$$g_{ijk} = \frac{\partial\varphi}{\partial U_{ijk}} = R_s - |\sigma^s_{ijk}| = 0,$$

where: $K_1 = \frac{b}{h}$ - the ratio of the width of the cross-sectional surface of the stern to its height; h - the height of the cross-section surface of the stern; b - cross section width; σ^b - stresses in concrete (in compressive elements); σ^s - stresses in reinforcement (in tensile elements); i - sections; j - Stergens; k - time [6-10].

The optimal quantities of unknowns are found by solving the Logrange formula iteratively:

$$h_j^{(t)} = \frac{1}{2K_1 l_j}\sum_{(i)}\sum_{(j)}\sum_{(k)} U_{ijk}\frac{\partial|\sigma^b_{ijk}|}{\partial h_j};$$

$$U_{ijk}^{(t)} = \max\left\{0 U_{ijk}^{(t-1)} - \rho(R_b - |\sigma^b_{ijk}|)\right\}.$$

Convergence in the iteration method is considered terminated when the following conditions are met:

$$|h_j^{(t-1)}| - |h_j^{(t)}| \le \xi;$$

$$|U_{ijk}^{(t-1)}| - |U_{ijk}^{(t)}| \le h,$$

where:

ξ and h - a measure of the accuracy of the account; ρ - the minimization step of the function.

Based on the developed calculation algorithm, a number of examples were viewed and the obtained results were analyzed. The problem is solved in a gradual approach.

As a result, the optimal size of the cross section of the farm sturgeons - h, volume of concrete, the cross-sectional area of the reinforcement is found.

The analysis of the obtained results shows that it will be possible to design economically efficient constructions of prestressed reinforced concrete truss trusses taking into account its nodes as single, taking into account the creep and creep of concrete and the change of prestress over time:

1) When the nodes of the truss are taken as single, the redistribution of stresses among the elements leads to a decrease in the amount of concrete by 6-15%, depending on the type of the truss and its spacing [11-20].

2) In order to reduce the tensile stresses generated by bending in single-knot trusses, it is advisable to reinforce the top girders and columns with prestressed reinforcement.

3) An increase in the percentage of reinforcement in trusses working under the same load leads to a redistribution of stresses.

4) Due to the increase in the percentage of reinforcement, the changes in the tension in the rods as a function of time are as follows:

a) 2-8% in the lower belt;

b) 0,5-3,5% in the upper belt;

c) 0,2 – 2,4% in drawers;

5) In the case of the most undesirable stress-deformation, the optimal cross-section of the trusses and the amount of necessary reinforcements are determined.

6) The cross-section of the trusses satisfying the strength condition and the theoretical volume of concrete are found.

7) The redistribution of stresses in the trusses due to the uniformity of the nodes leads to the reduction of the cross-sectional areas of the elements and, as a result, to the economy of the volume of concrete [21-23].

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