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ON THE REDUCTION OF MATERIAL CONSUMPTION AS A RESULT OF THE USE OF HIGH STRENGTH CONCRETE IN CENTRAL COMPRESSION REINFORCED CONCRETE COLUMNS

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Abstract

The cross-sectional surfaces of compressible reinforced concrete elements are generally assumed to be rectangular. According to the loading scheme, compressible elements are divided into central and non-central compressible elements.

Introduction

If the longitudinal force N acts along the axis passing through the center of gravity of the cross-section of the element, central compression occurs. For some reasons, random eccentricity is formed in the central compressive elements. Therefore, random eccentricity e_a must be taken into account in the calculations. Random eccentricity is not taken into account in the calculation of statically uncertain constructions. But the value of the calculated eccentricity is not taken less than the random eccentricity, i.e $e_{oN} \geq e_a$.

Compression reinforced concrete columns and supports of industrial and civil buildings, as well as vertical reinforced concrete cores used in buildings with brick walls, in most cases work with random eccentricity. In cases where the amount of load falling on such elements is large (multi-storey industrial buildings, residential and public buildings with 7 or more floors, etc.), durability is ensured by increasing the cross-sectional dimensions of the lower floor structures and increasing the amount of reinforcement. Concretes of class B15-B25 in terms of compressive strength are mostly used in such elements. Theoretical and practical studies were carried out in order to determine the possibility of using high-strength concrete to reduce the material consumption, reduce the cost, and increase the efficiency of reinforced concrete structures operating under the influence of such large loads. It was based on the rules and calculation methods specified in the current construction standards and regulations.

Calculations were made for columns with a cross-section size of 30x30, 40x40 and 50x50 cm. The class of heavy concrete used in this was taken from B12.5 to B45. Calculation of all columns was carried out for the case where reinforcement of class A-III was used. The value of longitudinal force is constant – N=4700kN. The height of the column is also unchanged - 4.8 m.

Calculations show that for columns with a cross-sectional surface of 30x30 cm and 40x40 cm, the concrete class increases from B15 to B45, while the compressive force that the concrete part of the column section can take increases three times on average. In columns with a section size of 50x50 cm, the increase of the concrete class from V15 to V25 leads to a doubling of the load that the concrete part of the column can take (Fig. 1).

The obtained results show that regardless of the class of concrete, the size of such columns does not meet the requirements of 30x30 cm, and the amount of reinforcement is required several times more than the limit values. When the cross-section of the column is 40x40 cm, it is effective to use only concrete of classes B40 and higher. For columns of 50x50 cm, it is appropriate to use concrete of class B20-B35.

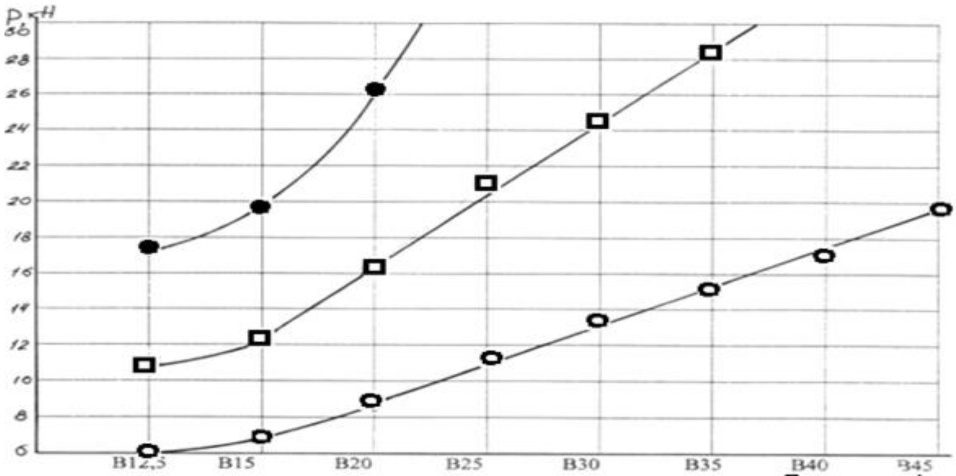

Figure 1. The graph of the change of the compressive load that the section can take with the increase of the concrete class

Approximate calculations show that the use of high-strength concrete can significantly reduce the consumption of reinforcement in columns with random eccentricity, receiving large loads. Of course, to increase the grade of concrete, it is necessary to increase the consumption of cement. However, in general, the cost of the manufactured compressible element is significantly reduced and economic efficiency is achieved.

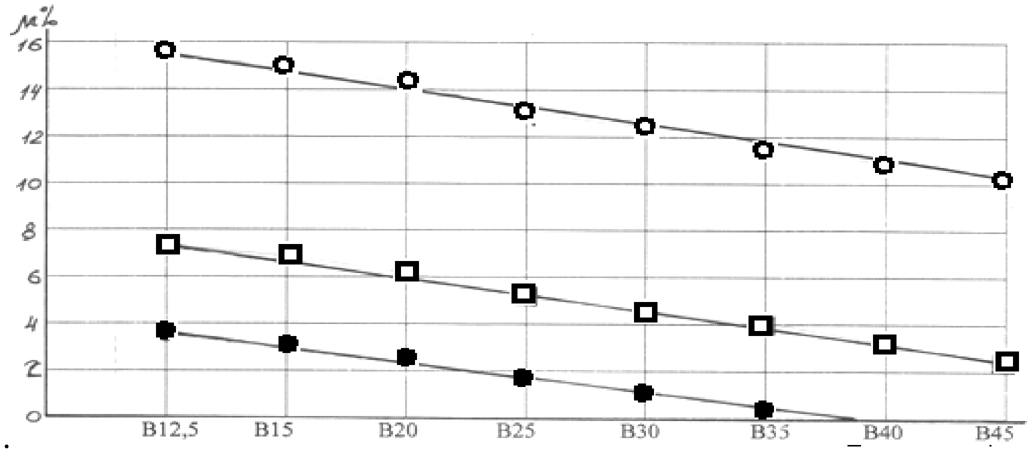

Figure 2. The graph of the influence of the concrete class on the reinforcement coefficient

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