

TO THE QUESTION OF STRENGTHENING BENDABLE REINFORCED CONCRETE ELEMENTS

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The article discusses options for strengthening the stretched zone of bent reinforced concrete elements. Timely work on the strengthening and repair of building structures is of practical importance. Also, reinforcement of building structures is often required for the technical re-equipment and modernization of industrial and civil buildings. Bent reinforced concrete elements often need to be strengthened, as a rule.

Introduction. At present, the reconstruction of buildings and structures is not inferior in relevance to new construction and even surpasses it. In the conditions of dense development, great attention is paid to ensuring reliable operation of existing structures. Often, the dismantling and replacement of certain structural elements is much more expensive than repairs, and sometimes even impossible. Most of the existing modern buildings and structures are made of concrete, reinforced concrete or brick. Their premature destruction, loss of bearing capacity or other performance characteristics may pose a threat to the integrity of the structure and entail undesirable consequences. Thus, timely work on the strengthening and repair of building structures is of practical importance. Also, reinforcement of building structures is often required for the technical re-equipment and modernization of industrial and civil buildings. For the most part, bending reinforced concrete structures, as a rule, require reinforcement.

Strengthening of reinforced concrete structures, in comparison with other types of structures (metal, wood), has some peculiarities associated with the difficulty of ensuring that the concrete structure in operation with the new concrete works together with increasing cross-section and difficulties with increasing the reinforcement cross section concrete [1].

Main part. The first step in designing the gain of existing structures is to assess the state. On the basis of the obtained results, a probabilistic scheme of destruction of the structure is established, thereby determining its so-called "weak zone". Based on the destruction schemes of reinforced reinforced concrete structures, we can conditionally separate the reinforcement methods. In the general case, the destruction of bending elements occurs in the stretched, compressed zones or in the shear zone due to the action of transverse forces [1]. Therefore, it is more expedient to design reinforcement of reinforced concrete structures in its weakest zone.

The choice of the method of strengthening the structure is also influenced by the conditions in which it is located: loads, aggressiveness of the environment, fire and explosion hazard of the structure being strengthened. Do not also neglect the manufacturability and efficiency of the selected method.

Strengthening the stretched zone of bent reinforced concrete structures is performed by increasing the cross-sectional area of the working reinforcement. Ensuring joint operation of reinforcement reinforcement is achieved by the following methods:

– by installing additional reinforcement with welding to the working reinforcement of the structure and subsequent wrapping;

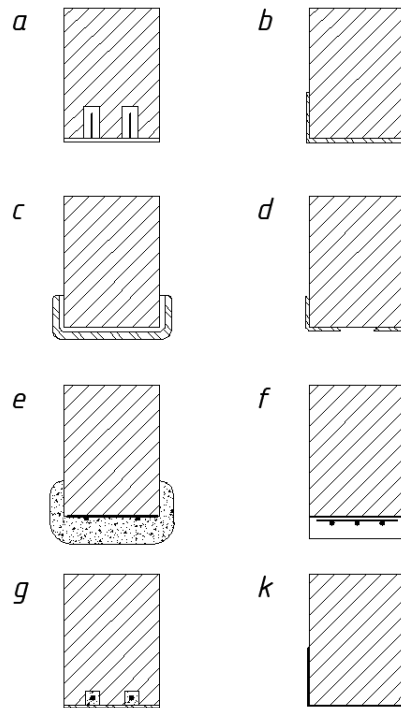
– by gluing additional elements in the stretched area.

The method of welding additional reinforcement to the existing one depends on the state and thickness of the protective layer of the existing structure. Welding can be done lap-jointed with striking the protective layer along the length of the additional reinforcement, with the aid of short legs, the diameter of which exceeds the thickness of the protective layer or using staples. The disadvantages of this method are the need to beat off the protective layer of the existing structure and the high complexity of the work carried out. The use of new materials in construction has pushed this method into the background.

Strengthening the stretched zone of structures by gluing additional elements has a number of options presented in Fig. 1 [5]. Each of these methods has its advantages and disadvantages, and each option is applicable in certain conditions. However, some of them are very expensive, due to the high intensity of metal. The most optimal in terms of "price - quality" can be considered the method of gluing an additional reinforced concrete element in the stretched zone. This method eliminates the need to expose the tensioned reinforcement of the existing structure. Additional reinforcement is protected from aggressive media, as it is in the body of concrete. The joint work of the reinforced structure with the new one is ensured by the reliable merging of old concrete with reinforcement concrete.

Currently, a number of experimental studies of the adhesion of new concrete with the old have been carried out. New design solutions are proposed to strengthen existing buildings and structures, modern building materials are used, and a number of factors affecting the adhesion strength of elements are being studied [2, 3,

4, 5]. Due to a large number of factors that may influence the magnitude of the adhesion forces, the question remains not fully understood.



a – sheet reinforcement with vertical anchors; b – sheet reinforcement with additional anchor plates;
 c, d – rolling profiles; e – sheet reinforcement with stamped reefs; f – reinforced concrete element;
 g – in grooves of rod fittings; k – gummed fiberglass.

Figure 1. – Strengthening the stretched zone of structures by gluing

Lack of adhesion in the seam can lead to a complete disruption of the connection between parts of the structure. Also, poor adhesion of the new concrete with the old can lead to premature cracking, which reduces the water resistance of structures and accelerates its destruction.

Conclusion. There are many technologies for laying new concrete and preparing the surface of the reinforced structure, the observance of which in one degree or another allows to increase the adhesion strength. However, many of them are not always applicable when strengthening bending structures. Studies of the strength of adhesion of new concrete with concrete of reinforced structure are mainly devoted to the study of strengthening the compressed zone by increasing. The question of the joint work of the existing structure and additional prefabricated elements in the stretched zone has not been fully studied.

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