



CONSTRUCTION FEATURES OF PERFORMING EXTERNAL REINFORCEMENT FROM COMPOSITE MATERIALS

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Abstract

This article presents methods for applying modern methods to increase the bearing capacity of existing buildings using carbon fiber, which are relevant today.

Keywords: load-bearing structure, carbon tape, composite materials, reinforcement methods, technology.

Introduction

The design of the external reinforcement elements (shape, dimensions, number of layers) is assigned on the basis of calculations and is determined by the reinforcement project.

The maximum number of layers of canvas or laminate is limited only by the calculated bond strength to the surface of the substrate.

The element of external reinforcement must extend beyond the calculated reinforcement area, forming an anchoring zone. The length of the anchoring zone is assigned according to the developed external reinforcement project and cannot be less than 150 mm.[2][25][26]

With a multilayer structure of the external reinforcement element, the latter is made in the form of a spring, which ensures the gradual inclusion of individual layers in the work.[3]

In order to prevent violation of the anchoring of the elements of external reinforcement, the longitudinal reinforcement must be supplemented with transverse reinforcement (installation of clamps).

It is necessary to alternate the installation of longitudinal layers and clamps so that each subsequent longitudinal layer is intercepted by a clamp.[1]



If the length of the external reinforcement elements is more than 3 meters, in order to facilitate the laying process, the canvases can be laid in separate segments, which must be joined together along the length. In this case, the length of the overlap must be at least 100 mm. The overlap can be carried out both on a wet adhesive layer and on an already hardened one. In the latter case, the overlap zone should be processed with sandpaper and wiped with a rag moistened with acetone.[4]

The overlap is performed along the canvases in the direction of the reinforcing fibers. In the case of a multilayer structure of external reinforcement, docking should be carried out in a run-up along the length (in different sections).

In beam structures, vertical or inclined clamps can be installed in the support zone to absorb the transverse force. Clamps are glued over the longitudinal reinforcement to provide better anchoring.[6][18][19][20][21][22][23][24]

Vertical clamps are made from one piece of canvas. The workpiece is glued (fixed) along the entire length, and then it is rolled from the center to the edges (Fig. 1)

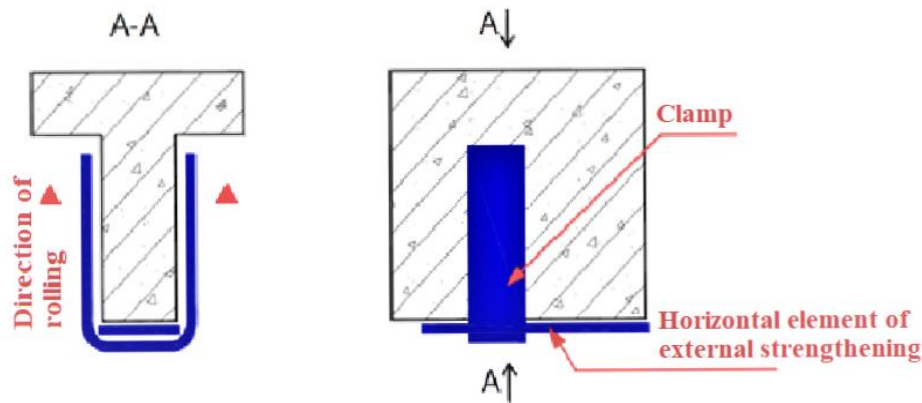


Figure 1 - Scheme of installation of vertical clamps in beam structures

Inclined clamps are made of two pieces of canvas, joined along the lower (ceiling) surface of the rib. First, one half is glued, its rolling is carried out, after which the opposite part is glued (Fig. 2). The overlap of inclined clamps is carried out along the bottom, for their entire width.[10]

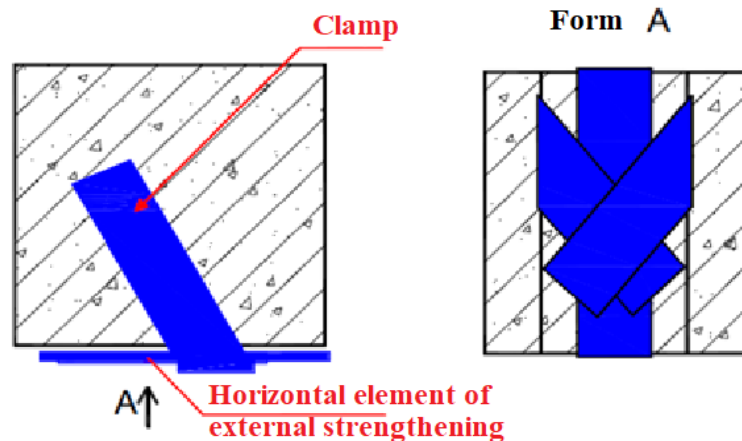


Figure 2 - Scheme of installation of inclined clamps in beam structures



When reinforcing beam structures in bending, in order to improve anchoring conditions and prevent peeling of the protective layer, it is recommended to place a canvas on the side surfaces of the rib. In this case, the canvas is glued to the side surface of the rib, after which it is wound onto the lower (ceiling) surface and the opposite side surface of the rib (Fig. 3).[8][15][16][17] For structures operated in conditions of variable humidity, the elements of external reinforcement must be designed in such a way as to ensure the possibility of moisture vapor migration from the concrete body. Otherwise, the adhesion between the external reinforcement element and the base may be broken (element separation). As a rule, in slab structures with external waterproofing, it is possible to glue individual strips with gaps between them. Solid gluing of external reinforcement elements over the entire plane of the slab is not allowed.[7][27][28][29]

The area free from elements of the surface of the structure must be at least 50% of its total area. However, in the case of box sections, when vapor migration into the box is possible, continuous gluing of external reinforcement elements along the bottom surface of the slab can be performed (Fig. 4). In the case of external reinforcement of structures operated in conditions of constant humidity (indoors), canvases and laminates can be glued over the entire surface of the base (floor slabs, columns).[11][12][13][14]

In the case of using unidirectional and bidirectional meshes of high-strength fibers for external reinforcement, the preparation of the base is carried out in the same way as in the case of gluing canvases. The attachment of active grids should be carried out using a polymer-cement matrix and polymer solutions.

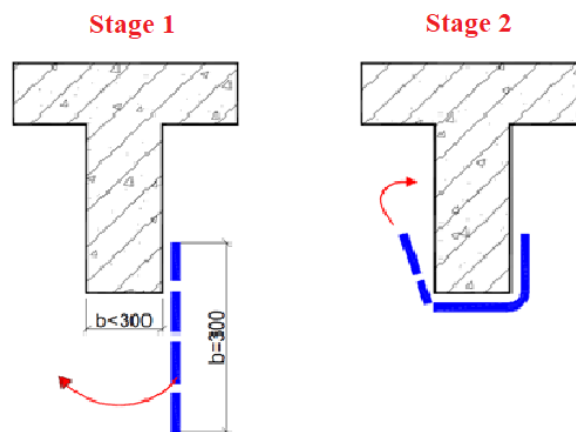


Figure 3 - External reinforcement of beam structures. The scheme of gluing canvases on the edge

Before installation, the meshes are treated with a low-viscosity adhesive composition. This is done in order to prevent the mutual displacement of fibers in bundles during deformation of structures during loading. The mesh is passed through a container with a low-viscosity adhesive and is squeezed out using special rolls. After that, for better adhesion to the mineral binder, the mesh surface is sprinkled with a thin layer of dry fine sand. During the polymerization of the adhesive, the fibers are bonded together in a tow, similar to how it occurs in laminates.

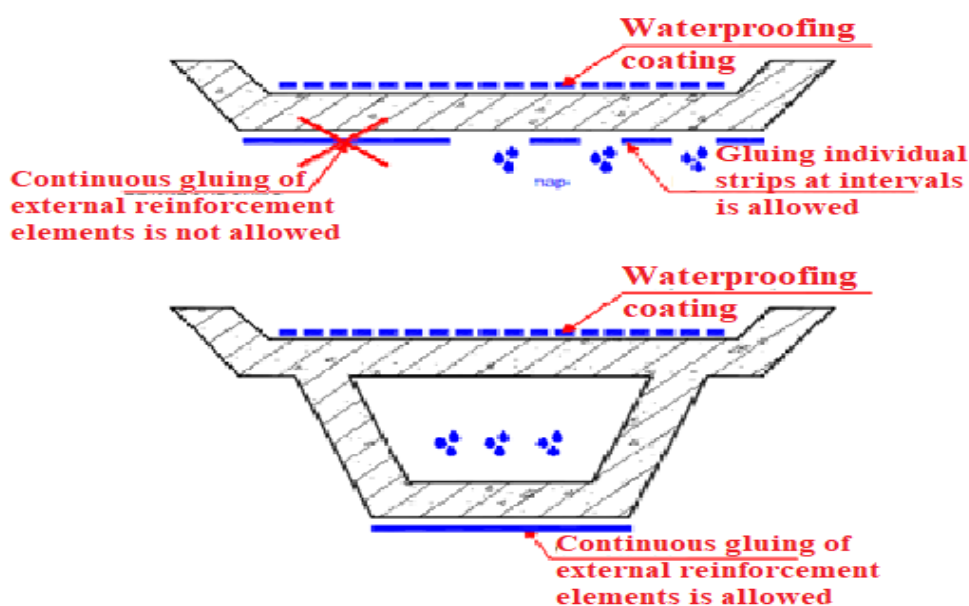


Figure 4 - Schemes for gluing elements of external reinforcement to ensure vapor permeability

If it is necessary to anchor the end sections of the laminates, the reinforcement is installed in pre-drilled holes and the pressure plates are mounted. The sequence of work on anchoring laminates: hole preparation by drilling, gouging or hydrojet processing, installation of a reinforcing bar and embedding with a special compound on a mineral or polymer base. After the installation of the releases of the reinforcing bars, the anchor plates are installed using nuts and washers. The addition of reinforcement fixed in preformed channels requires careful preparation of the hole and the maximum degree of filling it with a mineral or polymer-based mortar. This repair method can also be used in conjunction with the addition or replacement of embedded or external reinforcing bars and with the addition of concrete or mortar.

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