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USE OF MODIFIED CONCRETE, LAYERS, PRIMERS
IN COMPOSITE CONCRETE CONSTRUCTIONS

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The issue of contact joints in composite reinforced concrete structures is considered. It is shown that there are many factors affecting the shear resistance of the contact joint. It is noted that the use of modified concrete, layers and primers increases resistance to shear of the contact joint.

Currently, the combined use of materials with different properties is a very relevant and promising aspect in construction, as it makes it possible to connect several elements with different characteristics in one design. At the same time, the positive properties of each material are used separately, reliable operation of the entire structure and its combined work is ensured.

Combined work of composite concrete and reinforced concrete structures and their reliable operation is impossible without ensuring the strength of the contact joint. A contact joint in general is a connection of at least two elements: the combination of new concrete (joint grouting) with the old (precast) concrete, during reconstruction; precast elements with monolithic concrete, in industrialized construction; connection of sections of monolithic with newly laid or after a technological break, in monolithic construction; as well as for embedment and joints, for prefabricated construction.

Basically, in most of the works available on this subject, only one contact joint is considered, however, it should be noted that when using primers and layers the structure is a system consisting of three layers with two joints (Fig. 1) [1].

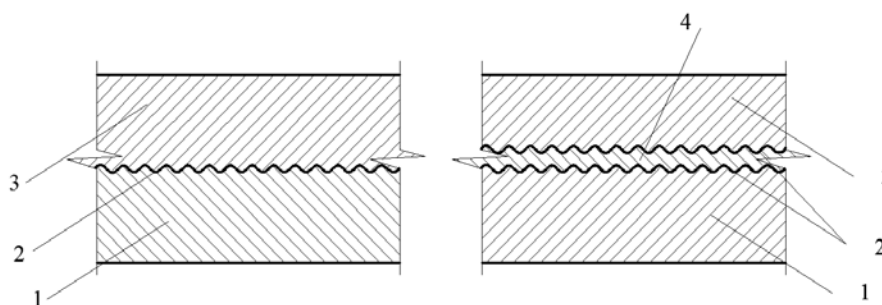


Fig. 1. Presence of concrete joint in the structure
1 – old concrete; 2 – contact joint; 3 – joint grouting; 4 – layers and primers

Resistance to shear of the contact joint depends on the surface preparation of the old (precast) concrete, and on the methods of concreting and concrete compositions and many other factors.

A large number of domestic and foreign works are devoted to the study of the contact seam in composite concrete and reinforced concrete structures [1–6]. In recent years, a lot of researches have been carried out by many different scientific-research, design and educational institutions of the Republic of Belarus: Belarusian National Technical University, Brest State Technical University, Republic Unitary Scientific-research Enterprise for Construction “Institute BelNIIS”, Polotsk State University and others; some institutes in the CIS. Thanks to these studies, the following conclusions can be drawn:

1. The joint surface of the new concrete with the old one should be clean, so that the surface contamination does not create an interlayer or a film that prevents the concretion of concrete. When concreting, the film of cement grout must be removed together with the underlying thin layer of porous concrete.
2. Often the surface of the structure should be rough, as a smooth surface does not create good adhesion.
3. For monolithic concrete, when conducting construction with interruptions, it is recommended to treat the surface with a strong stream of water immediately after setting the concrete.
4. Concrete is laid on a damp, but not very wet surface, as excess water reduces the adhesion strength.

5. Care of concrete is also important. To do this, it is recommended to maintain humid conditions for the new concrete. It is also recommended to keep the conjugate surfaces of elements in a wet state.

6. There is quite conflicting information about the effect of the concrete class on the shear resistance of the contact joint. However, according to different researches, it can be concluded that the higher the class of concrete is, the greater the resistance to shear is.

7. The mobility of concrete is recommended to choose P2-P3, as the use of "liquid" concrete reduces the shear resistance of the contact seam.

8. Concrete shrinkage is one of the main factors influencing the shear resistance of the contact joint. The greater the shrinkage is, the lower the shear resistance of the contact joint is.

9. The use of various selected concrete compositions also has a positive affect on the shear resistance of the contact joint. For example, when modified additives are used in certain concentrations, such as C3, ATP, Stachament 2010, it is possible to reduce the mobility and shrinkage of concrete so that to increase the strength of the contact joint.

In modern economic conditions, with the increase in prices for basic building materials, shortage and high cost of energy, the problem of saving materials and resources, including in composite structures, is becoming more acute. That's why it is recommended to use the modified concrete, layers, impregnation [3-5].

Recently, modified concrete is widely used in new construction, during reconstruction and technical re-equipment, as they allow not only to reduce energy consumption and cement consumption, but also to reduce labour intensivity of placing concrete due to partial or complete exclusion of concrete consolidation. This is primarily due to the work in cramped conditions. The same concretes have also proved themselves in composite structures. So, in Polotsk State University, studies of modified concrete with the superplasticizer "Stakhament 2000M" were carried out. According to the results of the research, it is evident that the contact shear resistance has increased significantly (Fig.2.) [7]

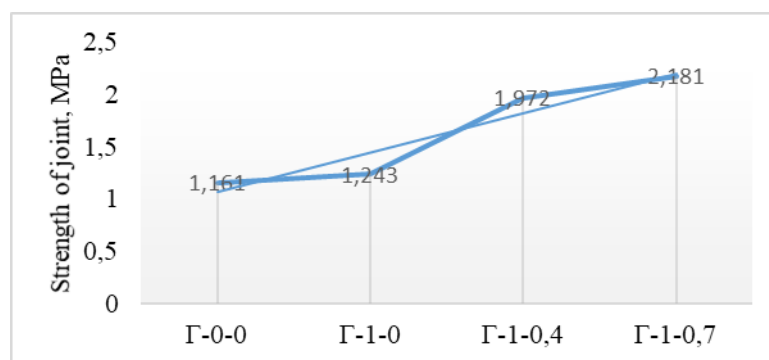


Fig. 2. The influence of the superplasticizer "Stakhament 2000M" on the joint (G-1-0 – 0% of additives; G -1-0,4 – 0,4% of additives; G -1-0,7 – 0,7% of additives)

Most modifiers are expensive, so it is more effectively to use them in layers. Thus, the modifiers "Stagement 2000 M" and C3 with the additive content of 0.7% can be added to a layer and new concrete requires the concentration according to the terms of the construction of [7].

The essence of interlayers is not only to save materials, but also to reduce shrinkage in the area of the contact joint. However, laying a thin layer 0.5 to 2 cm thick is very specific in construction and constant monitoring is required to perform a quality contact joint. Therefore, there is a question of using primers or impregnations, when the surface can be "impregnated" 2-4 times and to achieve an increase in the shear resistance of the contact joint. However, it is recommended to choose primers or impregnations carefully, since the application of them is different.

In connection with the above, Polotsk State University carry out the research on the possible use of primers to increase shear resistance of the contact joint. Tests of the "Typhoon Master No. 100" and "Ceresit ST19" primers have already been carried out. At present, there are researches of primers with dolomite powder and aluminum sulfate, which can increase the strength of the contact joint, by reducing shrinkage and increasing durability.

Conclusions:

1. Now there is a wide variety of types of joints of concrete and reinforced concrete structures, which differ in materials, connection technology and constructive solutions.

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2. There are many factors that affect the resistance of the contact shear, starting from the state of the surface of the old concrete and ending with the mobility and shrinkage of the new concrete mix.

3. The use of modified concrete and interlayers can significantly increase the resistance of the contact joint and reduce the shrinkage of the concrete, but they are quite expensive, in particular, the interlayers require the control of laying, so that the technological processes are not compromised.

4. It is necessary to use primers, as less time-consuming and economical material.

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