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INFLUENCE OF ADHESIVE-BONDED JOINT ON DEFLECTION OF COMPOSITE STEEL AND CONCRETE BEAMS WITH STRENGTHENING BY EXTERNAL STEEL REINFORCEMENT

Abstract. *This paper presents experimental and theoretical research for calculating of composite steel and concrete beams deflection strengthened bonded steel plates. The use of epoxy-bonded plates to strengthen existing or damaged reinforced or composite steel beams concrete beams has been extensively researched. It has been proven to be a useful and reliable method of increasing the ultimate flexural capacity of both damaged and undamaged members. The actual deflection behavior in beams is probabilistic in nature and requires statistical methods for a rational analysis.*

Keywords: *composite steel and concrete beam, adhesive-bonded joint, bearing capacity, deflection, external steel reinforcement.*

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ВПЛИВ КЛЕЙОВОГО З'ЄДНАННЯ НА ДЕФОРМАТИВНІСТЬ СТАЛЕЗАЛІЗОБЕТОННИХ БАЛОК ПІДСИЛЕНИХ ЗОВНІШНІМ СТАЛЕВИМ АРМУВАННЯМ

Анотація. *У статті наведено експериментальні і теоретичні дослідження для розрахунку прогинів сталезалізобетонних балок підсилених приклеєними сталевими листами. Широко досліджено застосування приклесних пластин для підсилення існуючих чи пошкоджених сталезалізобетонних балок. Було доведено доцільність і надійність наведеного методу підвищення максимальної деформативності як пошкоджених, так і неушкоджених елементів. Дійсна поведінка прогинів балок є імовірнісною за своєю природою і потребує статистичних методів для раціонального аналізу.*

Ключові слова: *сталезалізобетонна балка, клейове з'єднання, несуча здатність, прогин, зовнішнє сталеве армування.*

Any renovation or reconstruction of building, as a rule, is accompanied by changing of loadings on building structures, and the amendment of theirs primary design schemes.

The necessity of strengthening or renewal of building structures appears not only during the reconstruction or technical upgrading but also as a result of premature corrosion or mechanical deterioration.

The development of adhesives based on synthetic epoxy resins has created new possibilities in the structural strengthening field [5]. An attractive new alternative of structural repair is one which consists of bonding external reinforcement to the critical members by means of an epoxy adhesive. This technique requires a minimum increase in the member size, allows a larger contact area between the joined materials and solves the problem of high local stresses encountered in the traditional methods using bolting, riveting or welding. The operation is quick and easy to execute, economical and keeps the disruption on site to a minimum

Predominantly during the reconstruction process, the strengthening of an element is performed via building-up of cross-section of a structural element. Qualitative adhesion of a structure under strengthening and strengthening material (adhesive) as well as providing of their efficient interaction is an important problem [8-9, 10].

Because of the presence of points of stress singularities at the two ends of the adhesive/concrete interface and the concrete/plate interface, a fracture mechanics approach is more appropriate to predict crack propagation. The above mentioned information argues that the given problem is quite actual and of both practical and theoretical importance [1-4,6-7].

To determine the bearing capacity of the adhesive-bonded joint "steel-adhesive-steel" with-in the steel r/c structures, as well as its influence the strength and deformability, there were designed and manufactured the following specimens: steel r/c elements (beams), using different concrete mix-tures of different strength class; standard concrete prisms 100x100x400mm and cubes 100x100x100mm for determination of concrete strength and deformability.

The specimens of each series, in their turn, are differ one from another by the availability and type of the adhesive-bonded joint. The basic factors are: the geometrical characteristics of structure, concrete strength class, and availability of adhesive-bonded joint. Experimental specimens are represented in a form of steel r/c elements (beams), which are strengthened with glued steel plate in the tensile region: shaped tube 200x100x4. GOST 12336-66; channel 20. GOST 8240-89 filled up with concrete.

All the specimens are filled up with concrete mixture of class C20/25 and C25/30. Experimental specimens are represented in a form of steel r/c beams BC-1, BC-2, BSC-1, BSC-2. The load applied to the mid-point of the reaction beam is divided symmetrically into two concentrated loads and applied to the specimens. The ratio of the shear span length (800 mm) to the effective depth of the beam (200 mm) and is the same for all specimens.

All the beams are designed to fail in shear even after strengthening with steel plates. The ratio of shear span to effective depth is kept constant throughout the testing of all the beams. The load-deflection behaviour and ultimate load capacity for shear is observed through-out the testing to failure of beams.

The load-deflection curve of all the beams is shown in Figure 1. It is considered that the deflection of beams increased from the original beam BC-1.

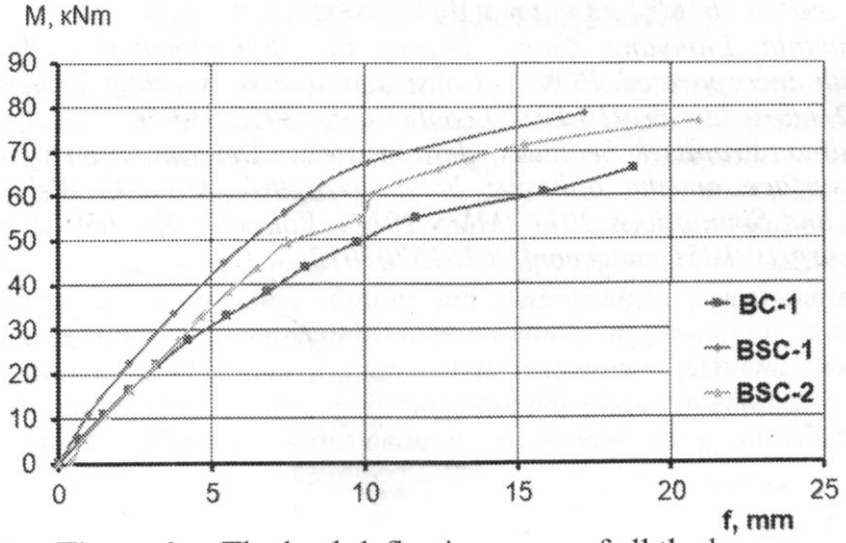

Figure 1 – The load-deflection curve of all the beams

However the beams with added plates show more ductility so that the ductility is observed to decrease as the reinforcement ratio increased.

Conclusion. The effectiveness of reinforcement of composite steel beams with steel plates in tensile zone is depended on the type of joint and steel plate thickness. From the obtained results it can be concluded that load-bearing capacity of beams, strengthened with steel plate is increased on 20% comparing with original beam.

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