

# SELF-COMPACTING CONCRETE BASED ON SIKA SUPERPLASTICIZERS FOR BRIDGES STRUCTURES

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## **Анотація**

*Ця наукова робота описує застосування та рецептуру приготування самоущільнюючих бетонів на основі суперпластифікаторів швейцарської фірми Sika для залізобетонних мостових конструкцій. Окреслено причини застосування самоущільнюючих бетонів, а, також, раціональну область використання у мостовому будівництві. Також наведено приклад запропоновану рецептури бетонної суміші.*

**Ключові слова:** мостова споруда, пролітна будова, накладна плита, масивна мостова залізобетонна опора, самоущільнюючий бетон, суперпластифікатор.

## **Abstract**

*This scientific work describes the application and formulation of preparation of self-compacting concrete based on superplasticizers of the Swiss company Sika for reinforced concrete bridge structures. Have been outlined the reasons for the use of self-compacting concrete and the rational field of use in bridge construction. Also have been given an example of the proposed concrete mixture recipe.*

**Key words:** bridge structure, span structure, overlay plate, massive reinforced concrete bridge support, self-compacting concrete, superplasticizer.

## **Introduction**

Bridge structures are key objects on roads of state, regional and local importance. The importance of bridge structures increases significantly in times of military conflicts to ensure appropriate military logistics [1, 2]. Monolithic reinforced concrete is mainly used for new construction, major repairs and reconstruction of bridge structures. This effective building material has a number of advantages over its main competitors – metal structures and brick structures. One of these advantages is the possibility of forming an arbitrary structure in shape. However, this advantage is, at the same time, a disadvantage of monolithic reinforced concrete, because there is a need to create complex formwork systems and the need to compact concrete mixtures in compressed construction or reconstruction conditions with vibration energy. Therefore, the creating such concrete mixtures that would be easy to form with minimal energy consumption is an important and urgent task [1]. This task especially applies to span structures and massive bridge supports. Today, this scientific task is solved in various ways, including the use of self-compacting concrete (SCC) [1, 3, 4].

## **Main part of research**

Self-compacting concrete (SCC) is most appropriate to use in the repair and reconstruction of high, massive, densely reinforced bridge piers, where the height of the subgrade sometimes reaches ten or more meters.

At the same time, the hydraulic pressures are so significant, due to the high density of the concrete mixture and its great height, that any additional effects, for example, during vibration, can lead to the destruction of formwork systems (fig. 1).

In addition, for the formation of an ideal planar surface of overhead slabs of span structures, it is also advisable to use self-sealing solutions with micro-flavored fiber (fig. 2).

The main advantages of self-compacting concrete over heavy concrete of the classic recipe are its easy ability to self-form, the absence of shrinkage cracks with proper care, and the absence of the need for vibration. All this is achieved by reducing the viscosity of the concrete mixture without adding excess water by introducing superplasticizers into the concrete mixture (fig. 3).



Figure 1 – Example of a high-rise formwork system for the reconstruction of a bridge supports. Concreting works were carried out using SCC



Figure 2 – Concreting of the overhead slab of the girder structure using SCC based on superplasticizer

In the superplasticizers market of Europe, the recognized leader is the Sika company, which offers a number of highly effective plasticizers, including for the formation of SCC (for example - Sika ViscoCrete-20 HE, fig. 3) [1].

The practical experience of the real use of SCC based on superplasticizers and air-entraining additives from the Sika company has proven their effectiveness and compliance with project requirements.



Figure 3 – Self-compacting concrete (SCC) based on Sika ViscoCrete-20 HE superplasticizer. Cone slump test of concrete

### Conclusions

The method of creating new effective structures from reinforced concrete for road bridge structures has gained further development. Have been offered to use Self-compacting concrete (SCC) for the construction and reconstruction of high bridge supports in the formwork, which is subjected to large hydrostatic pressures from heavy concrete. The Swiss company Sika has proven itself to be the most effective on the market of Ukraine today, according to the recipe of which many SCC for bridge structures are manufactured, therefore these materials, including superplasticizers and air-entraining additives, are recommended for use in bridge construction projects.

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