THE INFLUENCE OF THE METHODS OF ADJUSTMENT OF CONCRETE SPECIMENS ON COMPRESSIVE STRENGTH

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Summary: The samples for subsequent testing of compressive strength are obtained from cores drilled from the elements made of hardened concrete by drilling. Samples must meet the requirements of applicable standards in terms of dimensions and tolerance, and are thus prepared by cutting and grinding or by applying a leveling layer. Five series of samples (cylinders) whose ends were prepared in various ways by grinding or capping by: sulfur, sulfur and quartz sand, aluminous cement quick-setting mortar and epoxy adhesive were tested. Before that, compressive strengths of the materials used for making leveling layers were tested. Sample preparation by grinding is recommended.

Keywords: *concrete cores, compressive strength, preparation of sample ends*

1. INTRODUCTION

Samples of cylindrical shape for subsequent testing of compressive strength of concrete in structural elements are obtained by drilling of cores and their cutting at the right height d/h ≈ 1/1≈ 100/100 mm [1,2]. This method should be in accordance with: SRPS U.M1.049:2000 Cores of hardened concrete – Taking, examination and testing in compression; SRPS ISO 1920:1997 Concrete tests - Dimensions, tolerances and applicability of test specimens; SRPS ISO 4012:2000 Concrete – Determination of compressive strength of test specimens that is, SRPS EN 12390-3 (Annex) Testing hardened concrete – Part 3: Compressive strength of test specimens (Adjustment of test specimens). Samples whose dimensions and shape are not in accordance with the requirements given in SRPS ISO 1920 and SRPS EN 12390-3 (Annex A), since they exceed the corresponding tolerances, must be adjusted as follows: uneven surfaces can be leveled by grinding or by applying leveling layer, while deviations of angles are corrected exclusively by cutting and grinding [3,4]. According to SRPS ISO 4012, the materials

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used for making the leveling layer at the ends of the samples (surfaces on which the load is applied) must adhere well to the concrete and must not affect it in any way. At the time of testing, compressive strength of the leveling layer must not be less than the expected compressive strength of concrete. The thickness of the leveling compound must not exceed 2% of the diameter of the surface on which the load is applied [5]. According to SRPS EN 12390-3 (Annex A), methods of leveling uneven surfaces of the samples can be:

• Grinding (unlimited)
• Calcium aluminate cement mortar (up to approximately 50 MPa)
• Sulfur mixture (up to approximately 50 MPa)
• Sandbox (unlimited)

The thickness of the leveling layer must not be greater than 5mm [4].

2. EXPERIMENTAL PART

In order to determine the impact of treatment of the samples ends– cylinders on the compressive strength, five series of samples (three samples per series) were prepared. Samples were obtained by drilling cores from the concrete curbs placed on a vibrating table. In the same manner and from the same concrete concrete cubes are made in order to have strength values that can be expected on the cylinder. We believe that this is the same concrete batch. Results can be affected by: the moisture content of samples, drilling direction relative to the direction of installation, the dimensions of the cylinders (size, ratio of diameter and height), [6]. In terms of all the above parameters, all five series were equal. With the structural elements by using rebound hammer in places where the cores are drilled we can get approximate expected values of strength on the cylinder, so in relation to them we can apply the appropriate mass for leveling the ends of the samples [1].

Preparing the ends of the samples was performed by:

- Grinding
- Sulfur
- A mixture of sulfur and quartz sand in the ratio 1:1
- Quick-setting mortar based on aluminate cement
- Epoxy adhesive

Samples for testing compressive strength of the material for surface leveling is shown in Figure 1.

Figure 1. Samples for testing compressive strength of the material for surface leveling

Samples for testing compressive strength of the material for surface leveling were cast in metal molds with edge a = 20mm, six samples each for every material. On these samples, compressive strength of all the materials for leveling at the age of one day was determined.

Compressive strengths of the materials used for surface leveling were obtained as the mean value of six results and are shown in Table 1.

Table 1. Compressive strengths of the materials used for surface leveling

Material for processing the ends of the samples	The mean value of strength a = 20 mm (N/ mm2)
Sulfur	40.1
Sulfur and quartz sand	44.8
Fast-setting mortar	28.6
Epoxy adhesive	78.8

Based on the test results it can be seen that the compressive strength of fast-setting mortar based on aluminous cement is considerably lower, while the compressive strength of epoxy adhesive is significantly higher in comparison to the strengths obtained on samples made out of sulfur and sulfur and quartz sand. The reason for the lower strengths of the mortar based on aluminous cement is in the amount of water used for its preparation. When using fast-setting mortar based on aluminate cement there was a deviation from the manufacturer's recommendations regarding the amount of water used. A large quantity of water was added, due to the rapid solidification of mortar and impossibility of correct capping of the samples.

The way of preparing ends of the samples by grinding is shown in Figure 2.

Figure 2. Preparation of the ends of the samples by grinding

After preparing the ends, the compressive strength of samples was tested, and the results are shown in Figure 3. The results were obtained as the mean values of the three test results. It may be noted that the samples whose ends are treated by grinding, sulfur, sulfur and quartz sand or epoxy adhesive have approximately equal strengths, while samples that are treated by quick-setting mortar showed significantly lower values of compressive strength. Test results show that if smoothing layers are used according to the above mentioned standards, they do not affect the compressive strength of concrete. It was shown that only in the case when this was not followed (quick-setting aluminous cement mortar that had less strength than the strength of the tested concrete, as it was made in a relation that was not appropriate), lower compressive strength of concrete samples was obtained.

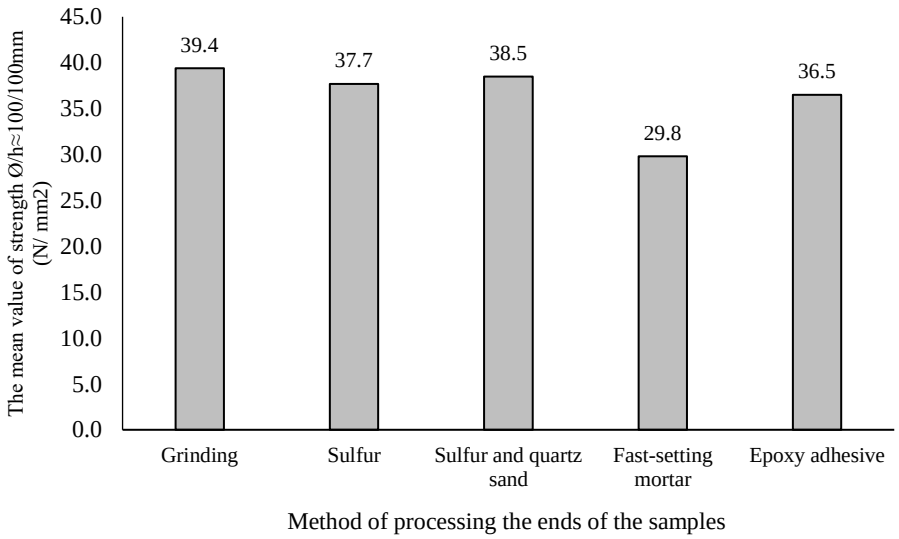

Figure 3. Compressive strength of the specimens (cylinders)

3. CONCLUSION

If possible, what is also recommended in the standards, the surfaces of the specimens to which the load is applied should be prepared by grinding, as this is the quickest and most reliable way. By using grinding as a way of preparing the ends of the samples, the time required for hardening the leveling layer is eliminated, as well as the possibility of using inadequate equipment for capping. Anyway, special attention should be paid to the physical, ecological, toxicological and other information in the field of health and safety standards.

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UTICAJ OBRADE KRAJEVA UZORAKA DOBIJENIH IZ JEZGARA OČVRSLOG BETONA NA ČVRSTOCU PRI PRITISKU

Rezime: *Uzorci za naknadno ispitivanje čvrstoće pri pritisku dobijaju se iz jezgara izvađenih bušenjem iz elemenata od očvrslog betona. Uzorci moraju zadovoljiti u pogledu mera i tolerancija zahteve odgovarajućih standarda, pa se u tom smislu pripremaju sečenjem i brušenjem ili nanošenjem ravnajućeg sloja. Ispitano je pet serija uzoraka (valjaka), čiji krajevi su pripremljeni na različite načine brušenjem ili nanošenjem ravnajućeg sloja od: sumpora, sumpora i kvarcnog peska, brzovezujućeg aluminatno cementnog maltera i epoksidnog lepka. Pre toga ispitane su čvrstoće pri pritisku materijala upotrebljenih za izradu ravnajućih slojeva. Preporučuje se priprema uzoraka brušenjem.*

Ključne riječi: *betonska jezgra, pritisna čvrstoća, priprema krajeva uzoraka*