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The Creep of Cement Paste with Addition of Fly Ash in Advanced Time of Old Age

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Abstract. The paper discusses the creep cement pastes with addition of fly ash. The evolution of the creep was observed in age of one year, for one month. The size of the creep is influenced by the amount the creep physically bound water. The material properties depend on the ratio of components from which the cement paste is composed. The paper presents the results for the ratio of cement and fly ash 70:30, 60:40 and 50:50.

Introduction

The cement paste is the basic part of the concrete. Its properties are crucial for the properties of concrete structures. The resulting material properties are improved by adding aggregates into the cement paste. Into concrete is a used aggregate with better mechanical properties than that of the cement paste in most cases.

The experiments were executed by using the cement paste with addition of fly ash. The components of cement paste were: Portland cement CEM I 42.5 R (according to European Standard), fly ash and water [1]. The cylindrical specimens were prepared from components and concreted into the plastic cylindrical moulds. Water/cement ratio (w/c) of the prepared cement paste was 0.4. The ratio between the amount of cement and fly ash is defined by c/fa ratio. The ratios c/fa 70/30, 60/40 and 50/50 were used for the production of the cement pastes with fly ash.

The specimens were shorted on the lengths near to 70 mm before testing. A diameter of all prepared cylinders was 10 mm. The six specimen were used for the all experiments. First two specimens were determined for a measurement of creep in drying condition. Other two specimens were used for a measurement of shrinkage. The last two specimens were used for a measurement of creep in water saturated condition. Shrinkage of the two cases (for c/f 60/40 and 70/30) was measured at one drained and second water saturated specimen. Shrinkage was measured on two specimens dried on the ratio c/f 50/50.

Creep Test

The age of the tested specimens was 1 year. The measurement of creep was realized in the lever mechanisms [2]. The total number of specimens was six of which two specimens were tested on shrinkage, only. Applied load on specimen achieved size 697N. This force was unchangeable during process of measurement.

The load is equal to the distance and size of weight from the centre of rotation of mechanism. All specimens were covered in the foil due to the guarantee condition of the

humidity. The lever mechanisms above the specimen were loaded by a plumbs after specimen placing in the lever mechanisms.

Test time of creep is selected usually 30 days [3]. The specimens that are loaded by plumbs are unloaded before end of the measurement. The measurement of shrinkage takes place throughout the test without load. The ambient temperature during the test is maintained at 20 °C [4]. The dried specimens were placed in a drying oven and heated to the temperature 24 hours before testing in compression and creep test [5, 6]. The strain was measured by strain gauge and from adequate strength the modulus of elasticity was calculated [7].

Results of Measurement

The cement paste with 50 % fly ash admixture reached a size of basic creep of 18 and 48 microns after 25 days, Fig. 3. The average value of the basic creep of the cement paste with 50 % fly ash is 33 microns. The basic creep of the cement paste with content of 40 % fly ash achieved average value of 16.5 microns, Fig. 2. Values of basic creep were 20 and 13 microns after 25 days from start of measurement.

The creep of cement paste with 30 % fly ash reaches of the average value of 7.5 microns, Fig.1. The creep value was 11 and 4 microns after 25 days. The increasing of the amount of fly ash in cement paste causes increasing the size of creep.

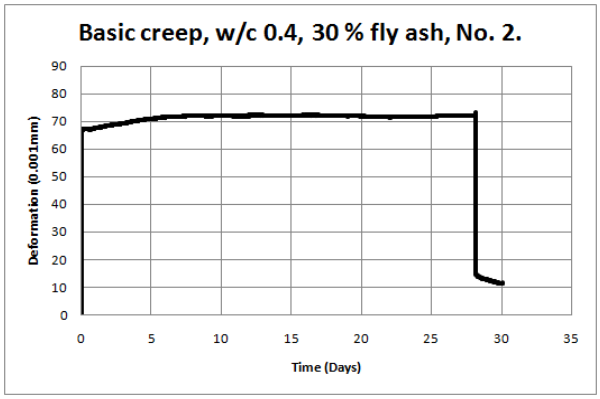

Fig. 1. Basic creep of cement paste with relation C/FA 70/30.

Fig. 2. Basic creep of cement paste with relation C/FA 60/40.

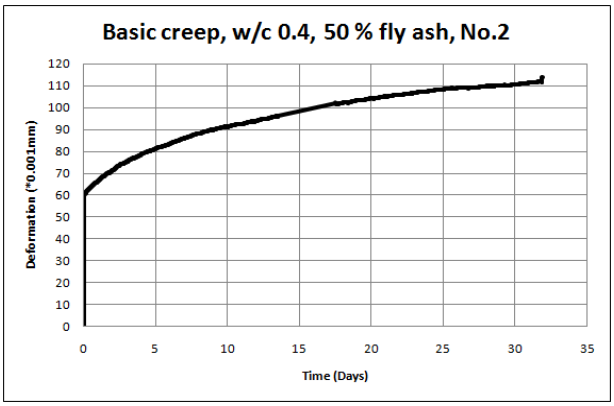

Fig. 3. Basic creep of cement paste with relation C/FA 50/50.

The evolution of creep of the saturated material has diametrically different course to the cement paste with fly ash in the dry state. Shape deformation is increased gradually. The

shape of the curve basic creep of cement paste with a lower content of ash is close to the shape of the line.

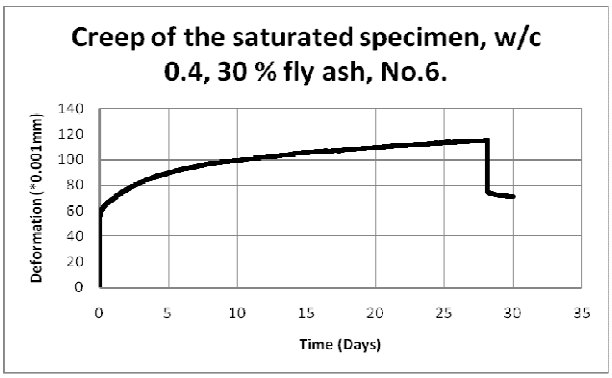

Fig. 4. Creep of cement paste with relation C/FA 70/30.

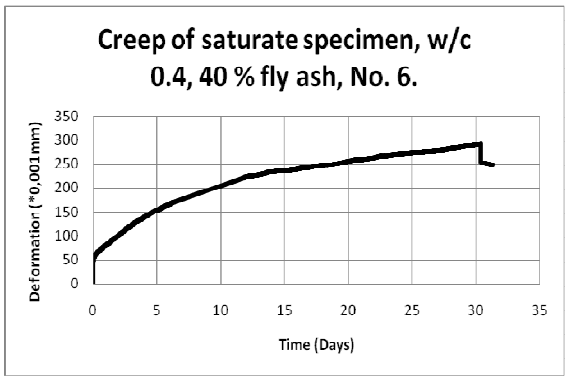

Fig. 5. Creep of cement paste with relation C/FA 60/40.

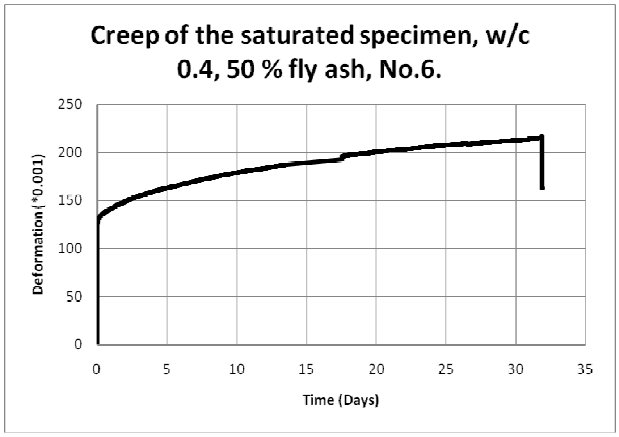

Fig. 6. Creep of cement paste with relation C/FA 50/50.

The cement paste with 50 % fly ash admixture reached a size of creep of 90 and 85 microns after 25 days as is displayed in the, Fig. 6. The average value of the saturated cement paste creep with 50 % fly ash is 87.5 microns. The creep of the cement paste with content of 40 % fly ash achieved average value of 147.5 microns, Fig. 5. Values of creep were 90 and 205 microns after 25 days from start of measurement. This material has the largest difference between the results achieved size creep.

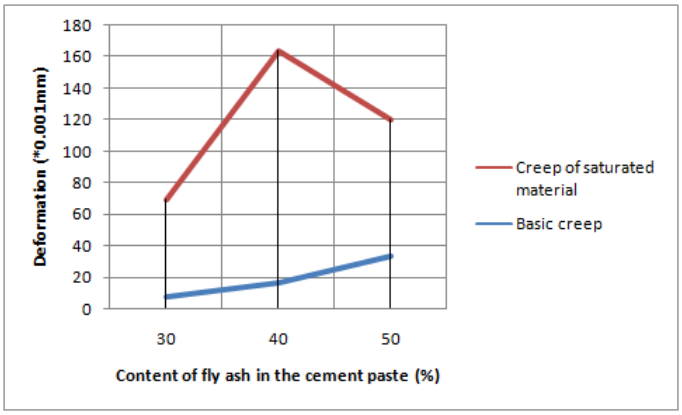

Fig. 7. Comparison of the basic creep and creep of the saturated cement paste.

The creep saturated cement paste with 30% fly ash reaches the smallest deformation after 25 days compared with the other two mixtures. The average value creep of after 25 days is 62 microns, Fig. 4.

Conclusions

The significant difference is between the dry and saturated cement paste with fly ash. The basic creep reaches values between 7-33 microns for a period of 25 days (see Fig. 7). The basic creep increases with the content of fly ash in the cement paste. The size of creep of the saturated cement paste does not have an upward or downward trend. The results show that the biggest creep arises for the cement paste containing 40 % fly ash. The material properties also depend on the amount of fly ash in the mixture, saturated materials [8].

Acknowledgements

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