Effect of Unbonded Capping on Concrete Strength

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Introduction: The capping of concrete specimens before compression test is time consuming and, for sulphur mortar, dirty and often hazardous. Carrasquillo and Carrasquillo (1988) recently reported satisfactory results from their study of a new method of capping, in which an elastomeric pad was used as an unbonded cap. It is the aim of this study to furnish data on the feasibility of applying the principle of unbonded capping to the 100 x 200 mm cylinder specimens. To this end, 9 batches of 21 cylinders each were tested. The variables under study were the inside surface of the ring and the type and thickness of the rubber pad. The results indicate that unbonded capping yielded compressive strength results close to within 10 percent of those using cement paste cap while the within-test variation of the former were consistently lower than those of the latter.

Materials and method: Essentially, the method involved the use of an elastomeric pad acting as an unbonded cap, confined in a metal restraining ring, as shown in Fig.1. The set-up was then placed on the end of the test specimen before compression began. The rubber pad acted as a load tranfering cushion, so that the test specimen was subjected to a much more uniform loading than it would have been if no rubber pad had been used. The metal ring limited the lateral expansion of the pad. Two metal rings were used in this study. Both were made of steel. The inside surface of one ring was smooth. A series of concentric grooves were machined on the surface of the other ring. Two types of rubber pads were used. Type 1 was a Brigestone BSBR-200 with a JIS hardness number of 65. Type 2 was BSCR-100 with a hardness of 60. The designation of each combination of the variables studied is shown in Table 1. Nine batches of concrete were prepared. For each batch, three cylinders were tested in each steel ring-rubber pad combination. Three more cylinders were tested according to JIS-A-1108, having been capped by cement mortar.

Results and discussion: The results of the strength tests are shown in Figs. 2, 3 and 4. All the strength values are expressed as the ratio of the average strength of that group to the corresponding strength obtained from the standard method. It can be seen that most points fall within ten percent of unity with perhaps A1 set being the closest. It is noted that the two points at about 480 ksc in all three figures probably resulted from low test results of the standard group. As for an indication of the variations associated with each test method, a range value, that is, the difference between the maximum value and the minimum, can be a useful index. The ratios of the ranges obtained from the test methods A1 and A2, B1 and B2 and C1 and C2, to the corresponding range obtained from the standard methods are shown in Figs. 5, 6 and 7 respectively. It can be seen that most points fall below unity, indicating a more consistent test results than those from the standard test. Although the values are close, in relative term, set A1 yileds the lowest.

Conclusion: 1) While all the sets yield moderately good result, set A1 shows test results closest to those using standard method.

2) In terms of variations, set A1 shows significantly lower variation than those obtained from the standard method set. It is therefore recommended that while further study is needed, set A1 seems to have the highest potential for unbonded capping method.

Reference: 1. Carrasquillo, P. M. and Carrasquillo, R.L., "Effect of using Unbonded Capping System on the Compressive Strength of Concrete Cylinders," ACI Materials Journal, vol.85, no.3, 1988.

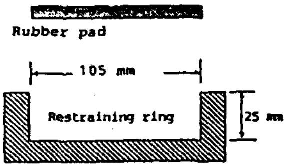

Fig. 1 Unbonded capping system set-up

Table 1 Designation of the combination of each variable studied.

Designation	rubber type	rubber thickness	ring surface
A1	type 1	10 mm	smooth
A2	type 1	10 mm	grooved
B1	type 1	5 mm	smooth
B2	type 1	5 mm	grooved
C1	type 2	10 mm	smooth
C2	type 2	10 mm	grooved

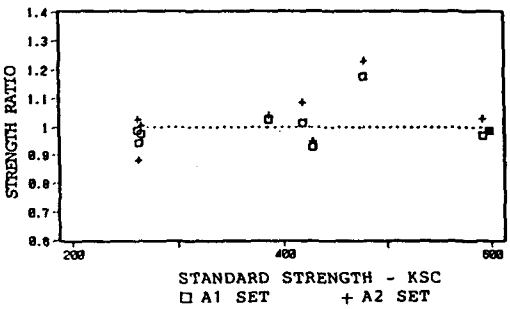

Fig.2 Ratio of strength results obtained from set A1 and A2 to those from standard method.

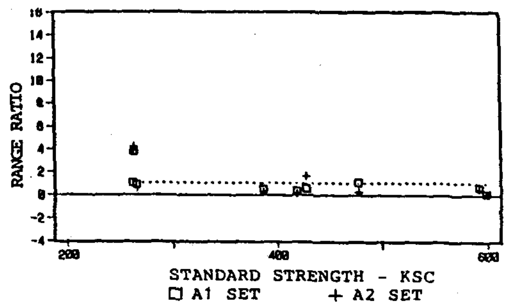

Fig.5 Ratio of the ranges of each group of results from A1 and A2 to those obtained from standard method.

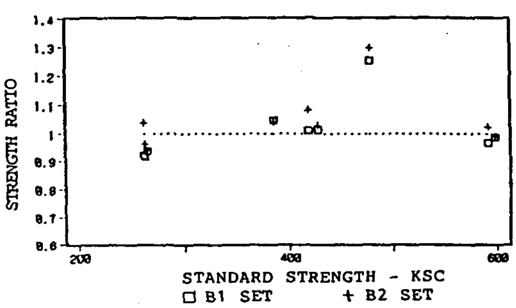

Fig.3 Ratio of strength results obtained from set B1 and B2 to those from standard method.

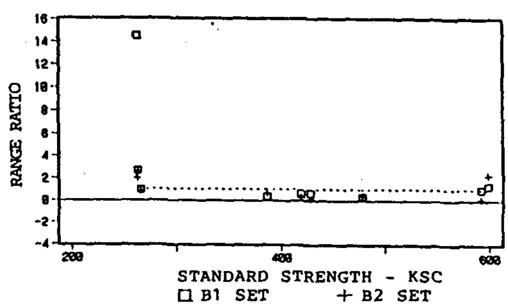

Fig.6 Ratio of the ranges of each group of results from B1 and B2 to those obtained from standard method.

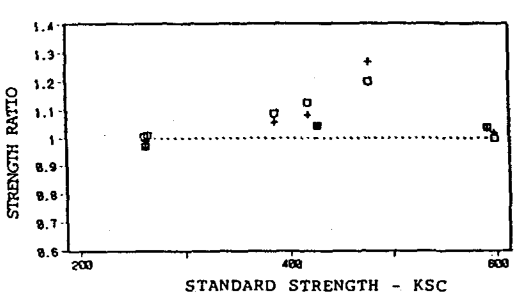

Fig.4 Ratio of strength results obtained from set C1 and C2 to those from standard method.

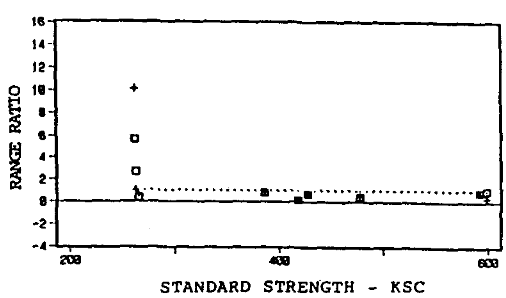

Fig.7 Ratio of the ranges of each group of results from C1 and C2 to those obtained from standard method.