

Development of a Quick On-Site Pass/Fail Test for the Evaluation of Fresh Concrete Destined for Application as Exposed Concrete

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Abstract : The use of exposed concrete (sometimes referred to as architectural concrete), keeps gaining popularity. Exposed concrete has the advantage to combine the structural properties of concrete with an aesthetic finish. However, for a successful aesthetic finish, much attention needs to be paid to the execution (formwork, release agent, curing, weather conditions...), the concrete composition (choice of the raw materials and mix proportions) as well as to its fresh properties. For the latter, a simple on-site pass/fail test could halt the casting of concrete not suitable for architectural concrete and thus avoid expensive repairs later. When architects opt for an exposed concrete, they usually want a smooth, uniform and nearly blemish-free surface. For this choice, a standard 'construction' concrete does not suffice. An aesthetic surface finishing requires the concrete to contain a minimum content of fines to minimize the risk of segregation and to allow complete filling of more complex shaped formworks. The concrete may neither be too viscous as this makes it more difficult to compact and it increases the risk of blow holes blemishing the surface. On the other hand, too much bleeding may cause color differences on the concrete surface. An easy pass/fail test, which can be performed on the site just before the casting, could avoid these problems. In case the fresh concrete fails the test, the concrete can be rejected. Only in case the fresh concrete passes the test, the concrete would be cast. The pass/fail tests are intended for a concrete with a consistency class S4. Five tests were selected as possible onsite pass/fail test. Two of these tests already exist: the K-slump test (ASTM C1362) and the Bauer Filter Press Test. The remaining three tests were developed by the BBRI in order to test the segregation resistance of fresh concrete on site: the 'dynamic sieve stability test', the 'inverted cone test' and an adapted 'visual stability index' (VSI) for the slump and flow test. These tests were inspired by existing tests for self-compacting concrete, for which the segregation resistance is of great importance. The suitability of the fresh concrete mixtures was also tested by means of a laboratory reference test (resistance to segregation) and by visual inspection (blow holes, structure...) of small test walls. More than fifteen concrete mixtures of different quality were tested. The results of the pass/fail tests were compared with the results of this laboratory reference test and the test walls. The preliminary laboratory results indicate that concrete mixtures 'suitable' for placing as exposed concrete (containing sufficient fines, a balanced grading curve etc.) can be distinguished from 'inferior' concrete mixtures. Additional laboratory tests, as well as tests on site, will be conducted to confirm these preliminary results and to set appropriate pass/fail values.

Keywords : exposed concrete, testing fresh concrete, segregation resistance, bleeding, consistency

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