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Effect of concrete rheological properties on quality of formed surfaces cast with self-consolidating concrete and superworkable concrete

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1 **EFFECT OF CONCRETE RHEOLOGICAL PROPERTIES ON QUALITY OF FORMED**
2 **SURFACES CAST WITH SELF-CONSOLIDATING CONCRETE AND**
3 **SUPERWORKABLE CONCRETE**

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9 **ABSTRACT**

10 An experimental program was undertaken to evaluate the effect of rheology of self-consolidating
11 concrete and superworkable concrete on formed surface quality. In total, 31 mixtures with different
12 workability and rheological properties were cast in a specially designed Z-shaped column without any
13 mechanical consolidation. Surface defects, including surface air voids, signs of bleeding, segregation,
14 and low filling ability were evaluated using a proposed image analysis methodology. The proposed
15 method was successfully compared to other approaches that mainly target the detection of surface voids.
16 Statistical models were developed between surface defect characteristics of formed surfaces cast with
17 self-consolidating concrete and superworkable concrete and the rheological properties of the concrete.
18 Concrete mixtures with yield stress lower than 25 Pa were found to develop superior surface finish. It
19 was also observed that a prolonged delay in cement hydration of mixtures with yield stress lower than
20 50 Pa could lead to surface defects associated with bleeding. Mixtures with yield stress greater than
21 100 Pa exhibited considerable surface defects caused by insufficient filling ability of the concrete in the
22 absence of mechanical consolidation. Finally, surface defects resulting from segregation were found
23 with flowable concrete with plastic viscosity lower than 10 Pa.s and yield stress lower than 100 Pa.

24 **Keywords:** bleeding; bugholes; image analysis; rheology; segregation; surface air voids; surface
25 quality.

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