

Optimizing Self Consolidating Concrete Mix Designs Utilizing Fly Ash

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ABSTRACT

Self-consolidating concrete is a new and emerging technology to the construction industry. SCC is highly workable concrete that can flow through congested structural elements under its own weight and adequately fill voids without segregation or excessive bleed (i.e. concrete that is compacted by means of its own weight without the need for vibration). Such concrete should have a relatively low yield stress value to ensure high flowability, a moderate viscosity to resist segregation and bleeding, and it must maintain its homogeneity during transportation and placement.

Typical concrete is placed at a slump of 3 to 5 inches, and normally concrete has a maximum slump limit of 9 inches. If the flow of normal concrete is increased too much it will segregate; however, SCC is engineered to provide slump flows of up to 30 inches without segregation.

Paste viscosity is a key component in developing a self-consolidating concrete that will have high flowability without segregation. In accordance to Stokes law, settling is reduced with an increase in viscosity. To reduce settlement of aggregates in highly flowable concrete one must increase the viscosity of the concrete paste; higher cementitious and lower water contents are required. A typical self-consolidating concrete requires cementitious contents in the range of 700 to 900 lbs/yd³ with w/c ratios in the range of 0.30 to 0.40. The cementitious component may be comprised on cement and supplemental cementitious materials. The utilization of fly ash in self-consolidating concrete can economize and optimize its performance.

The incorporation on HVFA in self-consolidating concrete provides many benefits: reduced heat of hydration and permeability, along with improved resistance to alkali silica reaction, sulfate and chemical attack.