Second International Interactive Symposium on Ultra-High Performance Concrete
Extended Abstract (no paper submission)

Title: Effect of Binder and Aggregate Fineness on Ultra-High Performance Concrete

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Primary Topic Area: Developing Ultra-High Performance Concrete (UHPC) from New Jersey Aggregates

Secondary Topic Area: Use of Ultra-High Performance Concrete as a promising repair solution for concrete structures

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Non-Proprietary UHPC

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Extended Abstract

Ultra-High Performance Concrete (UHPC) is a high strength, self-consolidating, steel fiber reinforced, and very durable portland cement based composite material. UHPC differs from normal concrete in its low water-to-cement ratio with high-range water reducer, optimized use of fine aggregates and crushed quartz, inclusion of supplementary cementitious materials such as slag and silica fume, and the use of steel fibers for reinforcement. UHPC's superior compressive strength, higher ductility, and excellent freeze-thaw and scaling resistance are a direct results of these component differences. The objective of the current study is to study the effects of different types of binders and aggregates on compressive strength and flowability of non-proprietary

UHPC, focusing on fineness and gradation. The binders studied are two Type I of portland cement, densified and undensified silica fume, two different Grade 100 ground granulated blast furnace slags, and Class C fly ash. The aggregates are four types of silica sand, F35, F75, NJ0, and NJ00N, and a graded very fine concrete sand. Two type of high range water reducers were also used. The water-to-cement ratio ranges from 0.2 to 0.24. The mixing process that has been adopted and refined consists of four stages. The first stage is mixing the aggregates and silica fume at a constant rpm; stage two is mixing the cementitious materials at the same speed; stage three is mixing with water and water reducing admixture at a faster rpm; the final stage of mixing is with the steel fibers at the original speed. The typical turnover time is **2** minutes. Because of the varying mixture proportions and material types studied, the current results in flowability range from low (less than 8 inches) to 10 inches. The compressive strength when cured at room temperature at 28 days also varies from of very low (15ksi) up to 21 ksi. The strength and flowability greatly depends on water-to-cement ratio, aggregate packing, fineness of the binders, and the quality and type of materials.