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Mixture design of concrete using simplex centroid design method

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Abstract: The primary goal of concrete mixture design is to strike a balance among workability, compressive strength, durability, economic efficiency and sustainability. In this paper, for a given strength grade, the optimum paste consisting of cement, fly ash and slag, and the optimum ratio among paste, fine aggregate and coarse aggregate were optimized using the simplex centroid design method based on rheological properties. Results showed that the optimum content of total cementitious materials in concrete could be obtained according to the relationships between the workability, yield stress, plastic viscosity and the paste volume fraction. The optimum replacement of supplementary cementitious materials could be determined according to the rheological properties and compressive strength of concrete with ternary cementitious components. It is an effective way to optimize the mixture design of concrete based on the rheological properties using the simplex centroid design method.

Keywords: concrete; mixture design; rheological properties; simplex centroid design; optimization

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