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The Influence of Coarse Aggregate Morphology on Concrete Workability: A Case Study with Algerian Crushed Limestone

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Abstract : This research aims to elucidate the role of coarse aggregate in influencing the fresh properties of normal-strength concrete. Specifically, it is aimed to identify the optimal gradation of coarse aggregate to enhance workability. While existing literature discusses the impact of aggregate granularity on concrete workability, more numerical data or models need to quantify the relationship between workability, granularity, and coarse aggregate shape. The main objective is to create a model that describes how coarse aggregate morphology contributes to fresh concrete properties. To investigate the effect of coarse aggregate gradation on Normal Strength Concrete (NSC) workability, various combinations of coarse aggregates (4/22.4 mm) were produced in the laboratory, utilizing three elementary classes: finer coarse aggregate 4/8 mm (Fca), medium coarse aggregate 8/16 mm (Mca), and coarser coarse aggregate 16/22.4 mm (Cca). We introduced a factor, FCR (Finer to Coarser coarse aggregate Ratio), as a numerical parameter to provide a quantitative evaluation and more detailed results analysis. Quantitative characterization parameters for coarse aggregate morphology were established, exploring the influence of particle size distribution, specific surface, and aggregate shape on workability. The research findings are significant for establishing correlations between coarse aggregate morphology and concrete properties. FCR emerges as a valuable tool for predicting the impact of aggregate gradation variations on concrete. The results of this study create a valuable database for construction professionals and concrete producers, affirming that the fresh properties of NSC are intricately linked to coarse aggregate morphology, particularly gradation.

Keywords : morphology, coarse aggregate, workability, fresh properties, gradation
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