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Comparative Study on Effect of Fine aggregates Grading and Shape on Fresh and Hardened Concrete Properties

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Abstract

Effect of grading and shape of fine aggregates on properties of concrete has been studied comparatively, at this paper. Aggregates in concrete occupy 60 to 80 percent's of the volume. It is frequently looked upon as inert filler and therefore much attention is required to be paid to its effects on properties of concrete. This paper mainly presents the key properties of fresh and hardened concrete with different kinds of fine aggregates. Concrete mixes were prepared in two different series to study the influence of fine aggregates grading and shape on concrete properties, comparatively. Series I concrete mixes were analyzed changing the standard fine aggregates grading with constant modulus of fineness. In series II specimens, concrete mixes contain different percentages of crushed sand and natural river sand (0%, 25%, 50%, 75% and 100%) were investigated. The slump and unit weight tests were achieved in all specimens. The all hardened concrete mixes were tested for compressive strength, splitting tensile strength, water permeability and water absorption. Both grading and surface shape and texture of fine aggregates influence the conventional concrete properties in fresh and hardened states. But, fresh concrete properties are more affected by fine aggregates shape and texture whereas the hardened concrete properties are more affected by fine aggregates grading, comparatively.

Keywords: Conventional Concrete, Fine aggregate Grading, Fine aggregate Shape, Fresh properties, Hardened properties.

1. INTRODUCTION

Aggregates constitute a skeleton of concrete. Approximately, three-quarters of the volume of conventional concrete is occupied by aggregates. It is inevitable that a constituent occupying such a large percentage of the mass should contribute important properties to both the fresh and hardened product [1].

Aggregate properties have profound influences on concrete properties, and these influences need to be understood and appreciated [2]. Aggregate characteristics that are significant for making concrete include porosity; grading or size distribution, moisture absorption, shape and surface texture, crushing strength, elastic modulus, and the type of deleterious substances present [3].

Sand as fine aggregate, has a significant influence on both rheological and mechanical properties of concrete.

Concrete codes and standards specify the fine aggregate requirements necessary to obtain homogeneous, workable and durable concrete of adequate strength [4]. The effect of shape and surface texture of the fine aggregates on mechanical properties is often not considered in conventional concretes mix design.

However, the use of crushed sands in Portland cement concrete has significantly increased over the last 25 years, especially in areas where natural river sands are scarce [5]. The shape of crushed fine aggregate is often more angular with rougher surfaces than natural fine aggregate which are rounder with smoother surfaces [6]. So, the shape and texture of crushed sand particles could lead to improvements in the strength of concrete due to better interlocking between particles.

However, angular fine aggregate produces concrete of lower workability than spherical sands for the same water content [7, 8, 9].

It seems that a deep and extensive study is required to conduct on the effect of fine aggregates shape and texture on fresh and hardened properties of conventional concrete.

The aggregate grading mainly influences the space filling or particle packing. Well-defined grading with an ideal size distribution of aggregate will decrease the voids in the concrete and hence the cement