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## PARTIAL REPLACEMENT OF NATURAL RIVER SAND WITH CRUSHED ROCK SAND IN CONCRETE PRODUCTION

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### ABSTRACT

The use of crushed rock sand as a partial replacement of river sand in concrete production was investigated. Water cement ratio varied between 0.55 and 0.59 for 0 % to 100 % natural sand replacement. The slump ranged between 49 and 60 mm for 0 % to 100 % natural sand replacement. The average compressive strength of the control concrete (C20) was 22.5 N/mm<sup>2</sup>. The effective natural sand (RS) replacement ranged between 0 and 60 % with the best results achieved at 20 % replacement. The peak compressive strength and indirect tensile strength values of 23.2 N/mm<sup>2</sup> and 1.42 N/mm<sup>2</sup> respectively were obtained. Modulus of elasticity of concrete increased from 22 KN/mm<sup>2</sup> to 23 KN/mm<sup>2</sup> with 20 % replacement of natural sand. Also, the indirect tensile strength increased from 1.28 N/mm<sup>2</sup> to 1.42 N/mm<sup>2</sup> with 20 % river sand replacement. The beam deflection ranged between 0.25 mm and 0.4 mm with the lowest deflection recorded at 20 % CRS and highest deflection of 0.4 mm with the control mix (0 % CRS). The whole range of natural sand replacement (0 to 100 %) improved the beam deflection. The 20 % CRS content recorded the highest flexural strength of 686.7 N/mm<sup>2</sup> beyond which the strength decreased to 80 % CRS after which there was a constant value in strength up to 100 % CRS.

**Keywords:** Fine Aggregates, Natural River Sand, Concrete, Crushed Rock Sand.

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### 1.0 INTRODUCTION

Concrete is generally composed of aggregates, cement and water. The aggregates are usually coarse and fine aggregates. Cement is used for binding the concrete materials together. Coarse aggregates have particles bigger than 5 mm in diameter while fine aggregates have particles smaller than 5 mm in diameter. Cement is hydrated to form a gel around aggregates which sets thus binding the concrete mass. The aggregates should have good mechanical properties in terms shape, density, grading, hardness, purity to achieve the required strength and durability. The cement commonly used in Kenya is categorized as 32.5 or 42.5 also referred to as power plus (Manguriu *et al.*, 2013). The Coarse aggregates which are generally crushed rock are mainly produced mechanically by crushers but it is also manually produced on small scale in areas with no other source of income. Generally concrete has high compressive strength with low tensile strength. Essential properties for concrete are strength, durability, and flexure, workability, drying shrinkage, cracking and permeability. Aggregates reactivity potential should be low by controlling the deleterious material content. Good quality water for is used for mixing concrete materials. The quality of concrete produced depends on the quality of constituent materials and the way they are proportioned and mixed. The fine aggregate is usually sand sourced from river banks or pits. Coarse aggregates may be classified as normal, light or heavy weight aggregates. Aggregates should be clean and free from organic impurities. Sand should be clean and free from clay, organic content, silt and other inferior materials.

### 2.0 LITERATURE REVIEW

Conservation of river sand in addition to better ways of disposing wastes from the quarry sites are some of the merits of using CGF reported by Manasseh (2010). Indirect tensile strength value increased with CGF content up to 20 %, after which a decline in indirect tensile strength was observed. Peak indirect tensile strength value of

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