عنوان مقاله:

A Study on the Mechanical Properties of Green Concrete

محل انتشار:

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نویسندگان:

Kanmalai Williams

.Balamuralikrishnan R

Adams Joe

Shalin Prince

خلاصه مقاله:

Green concrete is a type of concrete that uses waste materials as one of its ingredients. Hazardous wastes like fly ash and silica fume can be used to partially replace cement in concrete, which varies in physical and chemical properties. On the other hand, the increase in automobiles in urban and rural areas has led to an increase in the number of waste tires, which promotes environmental pollution due to disposal issues throughout the world. This study aims to use waste materials which can partially replace cement and conventional aggregates in the concrete mix. Fly Ash (FA), Silica Fume (SF), and Plaster of Paris (PP) replaced cement, whereas Reclaimed Rubber (RR) partially replaced coarse aggregates by weight. This work is focused on experimentation and simulation of M ۴۰ grade mix using the above four materials. ۳۰۶ cubes were cast by replacing cement with FA, SF, and PP in ۳% increments up to ۲۴%. Similarly, coarse aggregates were replaced with RR using the same proportion. Compression tests were carried out using a Universal Testing Machine. ۱۲% silica fume replacement exhibited maximum strength during individual replacement of materials in concrete, which is selected as the optimum percentage replacement. FA and PP developed ultimate strength at ۹% replacement of cement in the concrete mix, which is considered the optimum replacement percentage. A Genetic Algorithm (GA) model was developed using a C++ program to simulate various combinations of FA, SF, PP, and RR based on individual optimum replacement percentage. Hence, ۱۶۰۰ combinations were identified with the above four materials. Hence, GA was used as a tool to simulate the compressive strength of concrete to reduce time and cost. During simulation of combined replacement using GA, very high and very low compressive strength values were neglected, and ۳۲ combinations were selected based on optimum compressive strength values. Finally, five combinations (C۱-C۵) were recognized, which resulted in higher compressive strength than individual optimum values after simulation. The GA-based numerical results were validated by casting ۱۵ cubes for all the five combinations. ۱۵ beam samples of size ۱۰۰ ۱۵۰ ۱۵۰۰ mm were cast with the above five combinations, cured and tested using a loading frame. A load-deflection curve was plotted, which showed that material replacement increased the flexural strength of the concrete mix. Doi : ۱۰.۲۸۹۹۱/CEJ-۲۰۲۲-۰۸-۰۵-۰۱۲ Full Text : PDF

کلمات کلیدی:

.Strength Prediction; Compressive Strength; Flexural Strength; Reclaimed Rubber; Admixtures; Genetic Algorithm