Multiple linear regression model for mechanical properties and impact resistance of concrete with fly ash and hooked-end steel fibers

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Abstrak

Concrete is a composite building material. Due to its increasing demand in the construction industry, its basic ingredients such as cement, fine aggregate and coarse aggregate have become extremely costly. Studies have been carried out to find better and more economical alternatives to these conventional building materials. One such alternative is fly ash, which can be used to partially replace cement. The main disadvantage of conventional concrete is its brittle failure, which can be avoided by using steel fibers. This study identifies the behavior of concrete with regard to impact resistance and its mechanical properties by adding hooked-end steel fibers at levels of 0, 0.75, 1.15 and 1.55% and partially replacing 40% of the cement with 40% fly ash. In addition to the control concrete, there has been four mixes with respective addition of steel fibers. The behavior of normal and fly ash concrete with steel fibers was compared. The combination of fly ash and steel fibers provided a homogeneous and very rich mix, with a delay in the setting time of the concrete. Of all the mixes, the one containing 40% fly ash and 1.55% steel fibers proved to be the best, with a maximum increase in strength of 17% in compression, 25% in split tension, 30% in flexure and 95% in impact energy at 56 days. A multiple linear regression model was also formulated using SPSS (Statistical Package for Social Sciences) software, through which corresponding equations were developed to predict the strength and energy at 28 and 56 days. The equations were also used to predict the strength of the mixes from other researchers' experimental work. The predicted results corresponded well with the experimental results and the percentage difference was found to be less than 5%.