Impact of Plastic Cells and Fly Ash on the Compressive Strength of Concrete: An Empirical Investigation

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Plastic cell-filled concrete, an innovative construction material, harnesses the strength of traditional concrete while incorporating recycled plastic cells for improved performance. This technology offers a sustainable solution, combining the durability of concrete with the versatility of plastic in various construction applications. This research endeavor involved a series of experiments designed to scrutinize the influence of plastic cells (specifically, the effect of confinement due to plastic cells) and fly ash on the compressive strength of concrete. Specifically, the laboratory investigation involves evaluating the compressive strength of concrete grades M20 and M25 at three specific time intervals: 3 days, 7 days, and 28 days, under conditions with and without the incorporation of plastic cell confinement. Furthermore, the study extends to comprehend the impact of replacing cement with fly ash on strength characteristics using the same intervals and conditions. The plastic cell unit had dimensions of 150 mm x 150 mm x 150 mm, and the composition of fly ash in the concrete was systematically altered within the range of 0% to 50%. For both concrete grades and across all variations of fly ash content, it was observed that the inclusion of plastic cell confinement led to superior compressive strength compared to conventional concrete without plastic cells at each time interval. Additionally, the outcomes of this experiment revealed that the 3 days and 7 days compressive strength of concrete, whether with or without plastic cells, declined with an increase in fly ash content. Conversely, in the range of 0% to 30% replacement of cement with fly ash, the 28-day compressive strength of both conventional and plastic cell-filled concrete increased with the fly ash content, peaked at 30% but decreased with further additions of fly ash. Therefore, replacing 30% of cement with fly ash is deemed the optimal fly ash content to attain the highest level of compressive strength. Moreover, by introducing 30% replacement of cement with fly ash, the compressive strength of plastic cell filled concrete enhanced by approximately 10% compared to conventional concrete.

Keywords: Plastic cell; optimum fly ash content; confinement effect; concrete