Sustainable Concrete Incorporated with Recycled Polypropylene Plastic Waste as Coarse Aggregate

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The huge worldwide consumption of concrete and plastic creates environmental problems. For instance, overconsumption of concrete mainly increases CO_2 emissions during cement production and causes natural resource exploitation, energy consumption and harmful pollutants. Furthermore, the majority of plastic waste generated in Sri Lanka is openly dumped in landfills without any precautions. It badly affects the soil, water, human beings and the natural habitat. Hence, using recycled plastic waste as an alternative material for concrete constituents is emerging as an effective sustainable development technique in construction sectors. Even though broad research study has been done in this area all over the world, more experimental verification is essential to implement it in Sri Lanka using available own materials. The current study focuses on small-scale recycling centres where Polypropylene (PP) type plastic waste is mostly recycled. In this study suitability of PP-type recycled plastic waste as a partial replacement for natural coarse aggregate (NCA) in concrete is investigated through experimental work. Priority was given to major concrete properties such as workability and compressive strength. For this purpose, two series of concrete batches were cast with two different types of NCA having maximum nominal sizes of 8mm and 12.5mm. Each series contains one conventional concrete batch and another batch with 20% PP plastic aggregates (PPA) as partial replacement for NCA. Results showed that the compressive strength reduction in PPA concrete batches was almost same regardless of the NCA types used and the reduction percentage is approximately 11%. Further, it was found that the application of PPA concrete in non-structural construction is feasible.

Keywords: Compressive strength, Concrete, Natural coarse aggregate, Plastic coarse aggregate, Recycled polypropylene plastic

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