A Comparative Study of Economic and Performance Parameters of Conventional Concrete and Recycled Concrete Aggregate Roller Compacted Concrete (RCA-RCC)

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Abstract

To reduce the environmental impact while encouraging recycling and reuse of materials on construction industry in Sri Lanka, effective construction waste management is essential. Using roller compacted concrete for pavement construction is an innovative alternative either it should be environmentally friendly if we can use waste concrete aggregate. The interesting world of RCC is explored in this abstract, along with its mechanical and physical characteristics when aggregates are completely substituted to waste concrete portions. The viability of this unique approach is explained in the paper, along with its consequences for sustainability objectives and infrastructure growth for the future Sri Lanka construction sector. However, the necessity for more environmentally friendly construction approaches and minimizing the industry's environmental impact have sparked interest in reassessing the materials used in preparation for RCC. Tons of waste are generated by rapid urbanization that leads to the demolition of structures reaching the end of their service life. Reusing recycled aggregates in concrete production reduces environmental pollution by decreasing the disposal of this waste material in landfills and preserving unreasonable exploitation of natural resources. To face this economic inflation in Sri Lanka, we should focus on these types of reuse methods for construction. This study focuses on the suitability of RCC as a sustainable and economical construction material. The first step is to identify the mechanical properties of the raw material and then do the mix design. The maximum dry density method was adopted to prepare RCC mixtures with 200 kg/m3 of cement content and coarse natural aggregates in the concrete mixture. Based on this purpose, our target 28-day strength is 30 N/mm2. Then ordinary concrete is made using normal course aggregates and waste materials, and also RCC is similarly made using normal raw materials and waste materials and then their samples are taken. The physical properties of RCC were evaluated by means of water absorption and gas permeability tests, while the mechanical properties were evaluated using compressive, tensile splitting and three-point flexural tests. The comprehensive analysis of the mechanical characteristics of RCC with full aggregate replacement is one of the study's main focuses. Among the important parameters evaluated are compressive strength, flexural strength, and tensile strength of both traditional concrete and RCC concrete with and without conventional aggregates. Tests done related to road pavements consist of the qualities of shrinkage, porosity, and density. The findings demonstrate that RCC maintains a desired density and low porosity even when all conventional materials are completely replaced. Additionally, RCC's shrinking behavior stays within acceptable bounds, proofing its long term stability and durability. The results of this study show that RCC may keep its strength and structural integrity even when aggregates are totally substituted. This finding challenges the standardized use of natural aggregates and has important implications for the use of RCC in a wider variety of construction objectives. RCC with fully replaced aggregates is a potential option that not only satisfies but also exceeds the industry's evolving needs while preserving the environment for future

generations as sustainability becomes increasingly important in construction practices in Sri Lanka.

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