Effectiveness of Demolished Concrete Waste for Resurfacing of Low Volume Roads in Sri Lanka Using Roller Compacted Concrete (RCC) Technology

W.R.A.N. Jayantha[1] and W.K. Mampearachchi[2]

Abstract

Roller Compacted Concrete Pavement (RCCP) is a type of zero slump concrete product, which has renewed the interests of sustainable pavement designers with its potential to reduce the total cementitious material content of the concrete mix. RCC is produced with the same ingredients as in conventional concrete paving, but with different proportions determined by a suitable mix design approach. RCCP construction procedure is similar to that of asphalt paving, where laying is performed using a modified asphalt paver and steel drum rollers follow the paver to ensure laid RCC mix to be compacted to its desired density. However, in low volume road construction, motor graders can be used in place of modified asphalt pavers for the laying process since the degree of precision required is low.

Even though concrete pavements are durable in the norm, owing to poor construction practices and improper maintenance, the concrete surfacing of low volume roads is at a stage in need of rehabilitation. The current rehabilitation practice of the damaged concrete roads in Sri Lanka is replacing the damaged pavement with a new surfacing, where the deteriorated concrete layer is removed as a landfill material or sometimes reused as a base for the new surfacing. However, full disposal of the damaged pavement and subsequent replacement with a new pavement is not an economically viable construction practice. The objective of this research is to evaluate the applicability of deteriorated concrete pavement for the reconstruction of new pavement in an economical and sustainable approach.

In this study, manually crushed concrete slabs were washed, sieved, and tested for aggregate strength to be used as a substitution of coarse aggregates (CA) in RCC. Control samples were cast with the use of virgin crushed aggregates (VCA) and test specimens were prepared with recycled concrete coarse aggregates (RCCA) in full replacement of CA. The mix proportions of the concrete mix were calculated using the soil compaction method, which focuses on the optimization of the dry density of the RCC mix. Vibratory hammer test – ASTM D7382 (VHT) was used in place of the modified proctor test – ASTM D1557 (MPT) in determining the optimum moisture content (OMC) of RCC concrete since an impact compaction test does not exactly simulate the actual site condition at the mix design stage.

The dry density of RCC test specimens was found to be very sensitive to moisture content when the compaction was coupled with vibration. VHT resulted in higher density and lower OMC while MPT produced almost the same density at a higher OMC. However, the actual site compaction practice involves a combined effect of vibration and impacts. A compressive strength over 20MPa can be easily achieved for RCC, even with full replacement of CA with RCCA. Therefore, the importance of incorporation of the VHT in the mix design process and the possibility of full replacement of CA of RCC by RCCA, are elaborated in this research.

Keywords: *Roller Compacted Concrete, Optimum Moisture Content, Vibratory Hammer, Soil Compaction Method*

Author Details

1. Graduate Research Assistant, Department of Civil Engineering, University of Moratuwa, Sri Lanka. wranjayantha@gmail.com
2. Professor of Civil Engineering, Department of Civil Engineering, University of Moratuwa, Sri Lanka. wasnthak@uom.lk