USE OF TILE WASTE AS AN INTERNAL CURING AGGREGATE (ICA) TO REPLACE COARSE AGGREGATES IN ROLLER COMPACTED CONCRETE (RCC) PRODUCTION

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Roller-compacted concrete (RCC) is gaining recognition for its economic and structural benefits, particularly in heavy-duty pavements, dams, and industrial flooring applications. Unlike traditional concrete, RCC is a low-water, zero-slump mix that can be compacted with vibratory rollers, reducing cement usage, costs, and environmental impact. However, RCC's low water content raises significant curing problems that could compromise the strength, durability, and overall performance of the concrete. Conventional surface curing methods often prove inadequate, leading to incomplete hydration and undesirable concrete properties.

This study explores an innovative approach to RCC production by incorporating clay tile waste as an Internal Curing Aggregate (ICA) to replace coarse aggregates. The aim is to improve hydration and enhance RCC's mechanical properties by addressing internal curing challenges. Clay tile waste, characterized by its porous structure and high-water absorption capacity, is proposed as a sustainable alternative to conventional aggregates, providing additional moisture during the curing process. This research investigates the effects of replacing coarse aggregates with clay tile aggregates (CTA) at 2.5%, 5%, and 7.5% on RCC's mechanical and durability properties.

The results show that a 2.5% replacement of coarse aggregates with CTA significantly improves early compressive strength, with notable gains observed at the 3-day mark. This early strength development is attributed to the effective internal curing provided by the tile waste, which facilitates continued hydration. At 28 days, RCC samples with 2.5% CTA replacement perform similarly to control samples in tensile strength, suggesting CTA's potential as an internal curing agent. Flexural strength tests further support these findings, with 2.5% CTA replacement yielding the highest strength among the tested samples. However, increasing the replacement ratio beyond 2.5% results in diminishing returns across all measured mechanical properties. This decline is likely due to the lower inherent strength of the clay tiles compared to traditional coarse aggregates. Results suggest that a 2.5% CTA replacement improves RCC's mechanical properties, supporting more sustainable construction.

The study provides important insights into using waste materials for sustainable RCC production. Incorporating clay tile waste as an ICA improves internal curing, enhancing hydration, early strength, and overall RCC performance. These findings support the development of sustainable construction materials and provide practical recommendations for optimizing RCC mix designs. Future work will involve field validation of these results and further exploration of long-term durability aspects under different environmental conditions.

Keywords: Clay tile aggregate, Concrete pavement, Internal curing aggregate, Roller compacted concrete

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Use of Tile Waste as an Internal Curing Aggregate (ICA) to Replace Coarse Aggregates in Roller Compacted Concrete (RCC) Production

BACKGROUND

Challenges in traditional curing methods

Depletion of natural resources

→ **Implementing internal curing and alternatives to traditional aggregates** → **Using clay tile as an Internal Curing Aggregate**

METHODOLOGY

Aggregate Preparation

- Crushing
- Sieving

Testing of Aggregates

- Water Absorption
- Water Desorption
- Relative Density

Determining the OMC

- For Conventional RCC
- For 5% CTA induced RCC

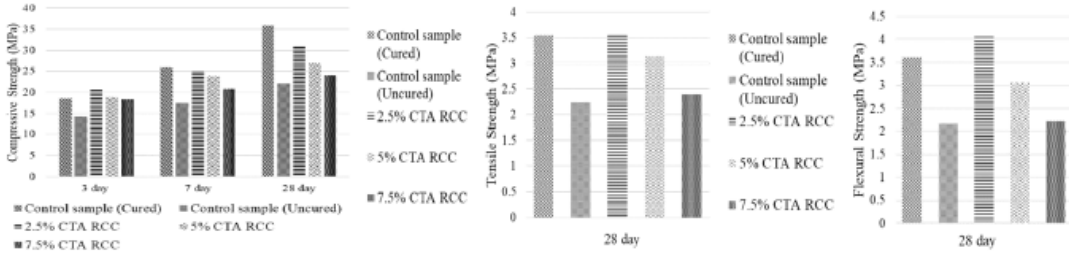
Casting of Concrete Samples

- Non-cured conventional RCC
- Externally cured conventional RCC
- Non- cured
  - 2.5% CTA induced RCC
  - 5% CTA induced RCC
  - 7.5% CTA induced RCC

Testing Samples

- Compressive strength
- Tensile strength
- Flexural strength

FINDINGS



2.5% CTA demonstrates the highest early strength, tensile strength, and flexural strength

Optimal Replacement → **2.5%**