ASSESS THE IMPACT OF INTERNAL CURING IN ROLLER COMPACTED CONCRETE USING ROOF TILE WASTE AS FINE AGGREGATES

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The construction industry is increasingly prioritizing sustainable and eco-friendly practices, resulting in a growing interest in utilizing waste materials in concrete production. As environmental concerns continue to grow, innovative solutions are becoming essential to reduce waste and promote sustainability. One promising approach involves incorporating waste materials into concrete as internal curing agents (ICAs) to address the challenges associated with proper concrete curing. Proper curing is essential for enhancing the durability and mechanical properties of concrete, but conventional curing methods often have limitations, especially in concrete with a low water/cement ratio. This has led to a significant focus on exploring alternative methods, with internal curing gaining considerable attention. The concept of internal curing involves utilizing materials based on the ability to absorb and release water within the concrete matrix. This facilitates a more consistent and extended curing process. This research intends to address a gap in sustainable construction practices by assessing the feasibility of using roof tile waste as an internal curing aggregate (ICA) to replace fine aggregates in roller-compacted concrete (RCC). The utilization of roof tile waste not only encourages recycling and reduces landfill waste but also leverages its water absorption and desorption properties to improve the curing process.

The research involved a comprehensive series of laboratory experiments to assess the potential usage of roof tile waste as an ICA. Furthermore, the study evaluates the impact of roof tile waste on the mechanical properties of RCC, specifically focusing on compressive strength, tensile strength, and flexural strength. To achieve this, RCC samples were cast with varying percentages of roof tile aggregates (RTA) replacing fine aggregates: 5%, 10%, and 15%. Each sample was subjected to testing to assess its performance compared to externally cured conventional RCC and uncured conventional RCC.

The findings from the experiments revealed that the incorporating of roof tile waste as an ICA significantly affects the mechanical properties of RCC. The optimal performance for internal curing with RTA occurs at a 10% replacement level, balancing the benefits of internal moisture retention and the mechanical integrity of the concrete. The research emphasizes that utilizing 10% RTA replacement can lead to significantly improved early-age properties, demonstrating an 18% increase in 3-day compressive strength compared to traditionally cured RCC. This advancement is advantageous for pavement construction as it facilitates quicker access to traffic and shortens construction schedules. However, the study also identified certain constraints. Even though the early compressive strength displayed substantial enhancement, the tensile and flexural strengths of RCC samples with RTA were lower than those of conventionally cured RCC. This indicates that while roof tile waste is effective in enhancing early age compressive strength, further optimization is needed to improve its impact on tensile and flexural properties.

Keywords: Roof tile waste, Internal curing, Roller Compacted Concrete, Sustainable construction, Waste utilization

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BACKGROUND

Limitations in Conventional Curing → **Using Internal Curing Materials**

Problems in Natural Resource Depletion → **Utilizing Waste Materials**

Using Roof Tile Waste as an Internal Curing Aggregate

METHODOLOGY

Preparation of Aggregates

Aggregate Testing

1. Water absorption
2. Water desorption
3. Specific gravity

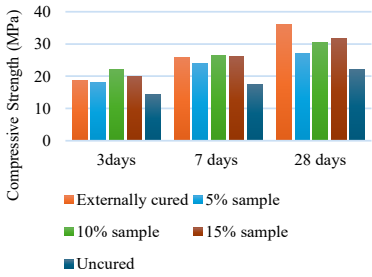
Concrete Sample Casting

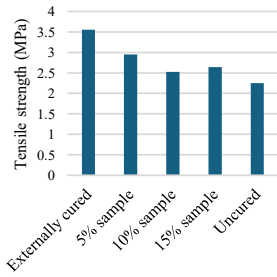
1.Externally cured conventional RCC
2.Uncured Conventional RCC
3. RCC with RTA (5%, 10%, 15% replacements)

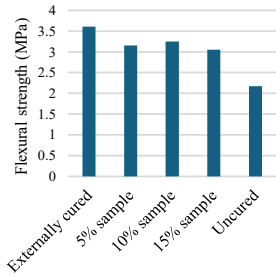
Concrete Testing

Compressive, Tensile, Flexural

FINDINGS







CTA Improves Early Strength Properties

Beneficial in pavement construction as it allows quicker access to traffic

Sample Type	Early strength gain (%)	
	3 Days	7 Days
Externally cured Sample	51.8	72.1
10% replacement	72.3	87.5

Optimal Replacement

10%