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DEPARTMENT OF CIVIL ENGINEERING

SOCIALLY RELATED PROJECTS (2023-24)

Experimental Investigations on Thermal Performance of Stabilized Mud Block

The thermal performance of a building is crucial for understanding energy transfer between the structure and its environment. Stabilized mud blocks, made from locally sourced soil, M-sand, and cement, offer a sustainable building solution that minimizes costs related to acquisition and transportation. These blocks, produced using a Mardini stabilized mud block press, are designed to enhance durability and compressive strength.

In this project, blocks measuring 229x191x102 mm are tested for their thermal performance. An infrared thermometer measures temperature variations between the outer and inner surfaces of the blocks when exposed to sunlight, with a curing period of 28 days. A 3 x 3 x 3 ft room constructed with these blocks is also monitored to evaluate temperature differences compared to an outdoor environment.

The use of stabilized mud blocks can significantly reduce indoor temperatures during hot days, leading to lower energy consumption for cooling and contributing to a reduced carbon footprint. This sustainable approach not only enhances comfort but also promotes energy efficiency in building design.

Experimental Investigation on Use of Bamboo Mesh and Egg Shell Powder in Sustainable Ferrocement Elements

This investigation focuses on the experimental study of bamboo as a reinforcing mesh in sustainable ferrocement elements. By analysing the properties of key materials—cement, fine aggregate, and bamboo—the research aims to optimize a cement mortar mix to achieve a compressive strength of 50 MPa. The project involves casting ferrocement panels using both steel and bamboo meshes, followed by flexural strength testing to compare their performance.

The societal relevance of this project is significant. Utilizing bamboo, a renewable and locally available resource, can reduce reliance on traditional steel reinforcement, leading to more sustainable construction practices. This approach not only lowers material costs but also supports local economies through the promotion of indigenous materials. Additionally, the enhanced thermal and structural properties of bamboo-reinforced ferrocement can improve the durability and energy efficiency of buildings, contributing to environmentally friendly housing solutions. Overall, this research highlights the potential for sustainable materials to address housing needs while fostering community resilience and promoting ecological responsibility.

The comparative study of ferrocement elements shows that those reinforced with welded mesh have a 50% higher yield capacity and significantly greater stiffness, making them suitable for heavier loads. In contrast, bamboo mesh elements experience greater deflection and cracking after yield, indicating reduced load-carrying capacity. While bamboo mesh offers sustainability benefits, it is better suited for lighter loading conditions. These findings underscore the distinct applications and limitations of each reinforcing material in ferrocement construction.

Potential Use of Biofilters, Constructed Wetland and Solar Driven Disinfection for Grey Water Treatment in Rural Areas

The purpose of this project was to develop a solar water purification system aimed at treating biologically contaminated grey water using solar energy and UV disinfection. This innovative method has shown promise as a simple and reliable solution for water purification, particularly in rural areas where water quality is often compromised.

In the laboratory, prepared grey water samples were found to be alkaline, discoloured, and non-compliant with BIS standards, necessitating purification. Following treatment, the purified grey water met the quality parameters outlined in IS 10500-2012, including pH, turbidity, total hardness, total alkalinity, dissolved oxygen, and biological oxygen demand. While certain parameters like hardness and alkalinity increased post-treatment, they still fell within acceptable limits. The study highlights the versatility of this solar water purification system, demonstrating its potential for implementation beyond regions with consistent high solar energy. Designed to be sustainable, portable, cost-effective, easy to use, and scalable, the system effectively kills bacteria—reducing total coliform levels to zero after treatment.

Overall, this project confirms that the integration of biofilters, constructed wetlands, and solar disinfection can effectively remove contaminants from grey water while being eco-friendly and low-cost. This approach not only improves water quality but also offers a sustainable solution for rural communities facing water scarcity and contamination challenges.