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Circular economy principles in construction waste management

S. Govindarajulu & K. Sudheer

Research article Page: 01-18

Circular economy principles in construction waste management prioritize waste prevention through design-for-deassembly, modular prefabrication, and material passports that track component lifecycles for reuse. The 10R framework (Refuse, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, Recover, Regenerate) shifts from linear demolition to selective deconstruction, recovering 70-90% of aggregates, metals, and timber for new projects. Digital tools like BIM enable waste audits and reverse logistics, while supplier take-back programs close loops on concrete and steel, cutting landfill use by 50%. This approach reduces embodied carbon by 20-40% and supports eco-friendly binders in recycled applications. Implementation requires stakeholder collaboration from architects to recyclers, aligning with sustainable urban infrastructure goals. ……. [For more click here]

Eco-friendly binders reducing CO2 emissions by 30-60%

E. Sharath Kumar, K. Kiran

Research article Page: 19-34

Eco-friendly binders like geopolymers, limestone-calcined clay cement (LC3), and alkali-activated materials replace Portland cement in roller-compacted concrete, slashing CO2 emissions by 30-60% through lower clinkering temperatures and industrial byproducts like fly ash or slag. These binders maintain comparable compressive strengths (25-40 MPa) while accelerating setting times, ideal for pavements in high-traffic urban areas. Biochar-amended variants achieve carbon negativity by sequestering CO2 in stable soil matrices, enhancing durability against freeze-thaw cycles. Implementation reduces lifecycle impacts without additives, supporting sustainable practices aligned with your materials research focus. Field trials confirm 50% emission cuts with no performance loss in eco-friendly roller-compacted concrete pavements.…… [For more click here].

Biomimicry in structural design for energy performance

Ravi Kumar & S. Raheem

Research article Page: 35-48

Biomimicry in structural design for energy performance draws from nature's efficient systems, such as termite mounds for natural ventilation or pinecone-inspired facades that open and close to regulate airflow and solar gain. These bio-inspired envelopes reduce mechanical cooling needs by 30-50% through passive thermoregulation, mimicking animal fur for insulation or lotus leaves for self-cleaning surfaces that minimize maintenance energy. Eastgate Centre in Zimbabwe exemplifies this by using termite mound chimneys for stack ventilation, cutting HVAC costs by 90% while maintaining comfort. Lotus-effect coatings and whale-fin turbines further enhance envelope efficiency and wind energy capture in high-rises. This approach aligns with sustainable materials research, optimizing lifecycle energy in urban structures.…… [For more click here].

Rainwater harvesting optimization in high-rise buildings

S. Govindarajulu & B. Anusha

Research article Page: 49-61

Rainwater harvesting optimization in high-rise buildings maximizes collection from expansive rooftops and terraces using modular storage tanks integrated into mechanical floors, achieving 30-50% non-

potable water needs through gravity-fed distribution. Pre-filtration with first-flush diverters and UV disinfection ensures quality for toilet flushing and irrigation, while hybrid systems blend harvested water with greywater recycling to enhance yield during dry spells. Computational modeling optimizes tank sizing based on local rainfall patterns and occupancy, incorporating green roofs to boost evapotranspiration and reduce runoff volumes by 40-70%. Building codes in water-stressed cities mandate these systems, supporting sustainability goals aligned with resilient urban design. Pump-free designs leverage height differentials for energy efficiency, minimizing operational costs over decades…… [For more click here].

Resilient infrastructure design for extreme weather events

Raheem Basha & V. Karthik
Research article Page: 62-81

Resilient infrastructure design for extreme weather events incorporates redundancy, modularity, and adaptive materials to withstand floods, hurricanes, and heatwaves while ensuring rapid recovery. Elevated foundations, permeable pavements, and vegetated buffers attenuate flood forces, while fiber-reinforced polymers and corrosion-resistant coatings enhance durability against erosion and thermal expansion. Real-time sensor networks enable predictive monitoring, integrating climate projections for dynamic adjustments like automated flood gates. Case studies from flood-prone regions demonstrate 40-60% reduction in downtime through nature-based solutions combined with elevated roadways. These strategies align with multi-hazard resilience for urban structures in earthquake-prone areas …… [For more click here]

Early warning systems for multi-hazard scenarios

João Franco, Pasqualoto T., Julio Cezar Mairesse
Research article Page: 82-101

lightweight foamed concrete for energy-efficient building envelopes involves incorporating surfactants to generate stable air bubbles in cement paste, achieving densities of 300-800 kg/m³ and thermal conductivities as low as 0.06-0.15 W/m·K. This porosity enhances insulation performance, reducing building energy consumption by 30-50% for heating/cooling compared to normal concrete, while maintaining compressive strengths of 1-10 MPa suitable for non-loadbearing walls. Optimized mixes with lightweight aggregates, phase-change materials (PCMs) in micropores, and polymer fibers provide acoustic damping, fire resistance, and up to 75% porosity without compromising handling or durability. Prefabricated panels integrate foamed concrete with steel frameworks, minimizing embodied carbon (302-508 kg CO2/m³) and enabling rapid assembly for sustainable envelopes…… [For more click here]