Research article, Type: Subscription *Volume: 09*

Big data analytics in urban flood prediction

Musdalifah Djamaluddin, Haedar Akib, Anshari, Andi Kasmawati & Wahira, Hamsu

Research article Page: 01-12

High-rise implementations, such as twin tower studies, demonstrate comparable carbon footprints and seismic performance Sustainable design of recycled aggregate concrete (RAC) in high-rise structures promotes environmental benefits by reducing landfill waste and virgin resource extraction through the reuse of construction and demolition debris. Performance evaluations reveal that RAC maintains adequate compressive strength and durability for structural applications when replacement levels shows slightly lower modulus of elasticity compared to natural aggregate concrete. High-rise implementations, such as twin tower studies, demonstrate comparable carbon footprints and seismic performance with optimized mixes incorporating supplementary cementitious materials. ……. [For more click here]

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

E. Sharath Kumar, K. Kiran

Research article Page: 13-24

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: 25-41

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]

Hybrid Fiber Reinforcement Strategies for Improving Ductility in High-Strength Concrete

Yuhedur Rahman & Ismoth Zerine

Research article Page: 42-58

Hybrid fiber reinforcement strategies combine macro-fibers like steel (for bridging large cracks) with micro-fibers such as polypropylene or natural fibers (for controlling microcracks), synergistically boosting ductility in high-strength concrete. In ultra-high-performance concrete (UHPC), hybrid systems achieve strain-hardening behavior with post-crack ductility indices exceeding 3-5 times that of plain mixes, alongside compressive strengths over 100 MPa. Optimal volumetric fractions—typically 0.5-1.5% steel and 0.1-0.5% synthetic fibers—enhance flexural toughness by 40-60% and shear capacity by up to 8 times, as validated in beam tests. These improvements stem from multi-scale reinforcement that distributes stresses, delays brittle failure, and improves energy absorption for seismic-resistant structures…… [For more click here].

Life Cycle Assessment of Green Roofs for Urban Heat Island Mitigation

Jan Holnicki-Szulc, Mohammed Nijr Dughaylib Alotaibi, Mana Aziz Awadh Alharbi, Naif Hiji Alrasheedi & Abdulrahim Owaidh Saud Aloufi

Research article Page: 59-72

Life cycle assessment of green roofs reveals substantial environmental benefits over conventional roofs, with reductions in global warming potential by 1-5% and energy savings up to 6% for cooling over a 50-year lifespan. These systems mitigate urban heat islands by lowering roof surface temperatures by 30-56°F through evapotranspiration and shading, while reducing peak ambient air temperatures by up to 20°F. LCA studies account for material production, installation, maintenance, and disposal, showing green roofs offset initial higher costs via extended durability and stormwater management gains. Additional advantages include GHG sequestration, pollutant filtration, and biodiversity enhancement, making them ideal for heat-vulnerable urban areas. …… [For more click here]

Fracture Mechanics Analysis of Cracked Asphalt Pavements under Heavy Traffic Loads

Abdulwahab Owaidh Saud Aloufi, Eisi Ghanem Aljohani, Abdulmajeed Aouidh Alaofi & Amani Abdulmunaem Alhaisoni

Research article Page: 73-89

Fracture mechanics analysis of cracked asphalt pavements under heavy traffic loads employs 3D finite element models to predict crack initiation, propagation, and fatigue life, focusing on top-down cracking mechanisms. Linear elastic fracture mechanics (LEFM) and viscoelastic cohesive zone models characterize stress intensity factors and energy release rates at crack tips, revealing tensile strains from radial tire pressures as primary drivers of surface cracking. Heavy axle loads accelerate damage accumulation, with simulations showing crack growth rates increasing 3-5 times in wheel paths compared to non-trafficked areas, exacerbated by aging and poor interlayer bonding. Mitigation strategies, such as polymer-modified binders (e.g., PG76-22) and thicker asphalt layers (>18 cm), can extend fatigue life by 34-41% by enhancing fracture energy thresholds…… [For more click here].