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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: 01-22

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]

Sustainable Design and Performance Evaluation of Recycled Aggregate Concrete in High-Rise Structures

Katrin Wieneke, S. Shao & D. Carsten

Review article Page: 23-39

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 stay below 30-50%, though it often 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]

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: 40-54

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].

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

auhedur Rahman & Ismoth Zerine

Research article Page: 55-69

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].

Reliability-Based Design of Retaining Walls Subject to Pseudo-Static Seismic Forces

Albert A. Groenwold & L. F. P. Etman

Research article Page: 70-82

Reliability-based design of retaining walls under pseudo-static seismic forces integrates probabilistic methods like First Order Reliability Method (FORM) to calibrate load and resistance factors, targeting a target reliability index ($\beta \approx 3.0$ for 50-year service life). Pseudo-static analysis applies horizontal (k_h) and vertical (k_v) seismic coefficients based on Mononobe-Okabe theory, where $k_h = 0.5 \times PGA/g \times \gamma_I / r$, with reduction factor r (1.0-2.0) depending on allowable wall displacements. For external stability (sliding, overturning, bearing), FORM optimizes factors such as $\varphi_s = 0.8\text{-}1.0$ for soil friction and $\gamma_{eq} = 1.3\text{-}1.5$ for earthquake loads, ensuring failure probabilities below 10^{-3}. This approach outperforms deterministic methods by accounting for soil variability, wall geometry, and seismic intensity uncertainties, particularly for reinforced soil and gravity walls…… [For more click here].

Rheological Properties of Self-Compacting Concrete with Mineral Admixtures

W. M. Rubio, Md Mainul Islam, Md Rakibul & Haque Pranto

Research article Page: 83-99

Rheological properties of self-compacting concrete (SCC) with mineral admixtures like fly ash, ground granulated blast furnace slag (GGBS), and micro-silica (MS) are characterized by yield stress (τ_0) typically 20-60 Pa and plastic viscosity (η) of 30-100 Pa·s to ensure high flowability without segregation. Mineral admixtures reduce water demand and improve particle packing, with GGFS and fly ash lowering yield stress by 20-40% at 20-40% replacement levels, enhancing slump flow diameters to 650-750 mm. Micro-silica increases viscosity but boosts cohesion, while marble dust or limestone powder optimizes rheology via filler effects, maintaining V-funnel times under 12 s. These admixtures enable sustainable SCC production, balancing fresh-state performance with hardened durability under ambient curing…… [For more click here].

Retrofitting strategies for existing buildings

N. Olhoff & C. Fleury, W. Stadler & Marta Rey-López

Research article Page: 100-115

Retrofitting strategies for existing buildings enhance seismic, wind, and energy performance while minimizing disruption and costs, often combining structural upgrades with sustainability measures. Global shear walls, steel bracing, and concrete jacketing add stiffness and strength, effectively reducing drifts in RC frames and masonry infills by 50-70% under design earthquakes. Advanced techniques like base isolation (rubber bearings), supplemental dampers (viscous, friction), and fiber-reinforced polymers (FRP) provide ductility and energy dissipation without heavy interventions…… [For more click here]

Spectral finite element methods in dynamics

Haojie Xu, Yuqian Fan

Research article Page: 116-134

Spectral finite element methods (SFEM) in dynamics extend classical finite element analysis by using exact wave solutions and frequency-dependent dynamic shape functions derived from governing differential equations, enabling precise modeling of wave propagation with minimal elements. Unlike polynomial-based FEM, which requires mesh refinement at high frequencies, SFEM employs Fourier transforms to handle broadband excitations, assembling exact spectral stiffness matrices at discrete frequencies for beams, plates, frames, and continua. This approach excels in transient dynamics, structural health monitoring, and seismic analysis, capturing all wave modes…… [For more click here]

A Comprehensive Examination of Zero Liquid Discharge Strategies for Water Sustainability

Nilesh pandey, Sachin Patnayak, Kuldeep Agarwal, Kuiming Wang, Pritam Ahuja, Ankit Shukla

Research article Page: 135-145

Sustainable water management practices have become increasingly important in the face of escalating global water scarcity. ZLD is emerging as a promising solution to eliminate liquid discharge from wastewater treatment and purification systems. It highlights the pivotal role ZLD plays in advancing sustainable water management by examining its principles, technologies, and applications. With a comprehensive assessment of ZLD technologies, a nuanced understanding of their diverse tools is provided through membrane processes, evaporation, crystallization, and biological treatment. As well as emphasizing ZLD's adaptability and effectiveness, the review points out successful applications across industries. ……[For more click here]