Research article, Type: Subscription *Volume: 08*

Implementation of IoT sensors for real-time traffic management

Ali Al Yami, Fayez Ali Ali Alsawidan & Ahmed Abdulsalam

Research article Page: 01-17

Implementation of IoT sensors for real-time traffic management involves deploying inductive loops, cameras, and radar units at intersections to collect live data on vehicle counts, speeds, and occupancy. Cloud-based platforms process this data using edge computing to dynamically adjust traffic signals, prioritizing high-flow directions and reducing average wait times by 25-35% in congested urban areas. Integration with V2I communication enables predictive rerouting via mobile apps, while anomaly detection flags accidents or breakdowns for rapid response. Cities like Copenhagen and Mumbai demonstrate scalability, achieving 20-40% congestion reductions through adaptive algorithms and environmental sensor fusion. This supports sustainable infrastructure by optimizing flows and lowering emissions, complementing your interests in resilient urban systems.…… [For more click here].

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

Katrin Wieneke, S. Shao & D. Carsten

Research article Page: 18-38

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]

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

Yuhedur Rahman & Ismoth Zerine

Research article Page: 39-57

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: 58-72

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].

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

Albert A. Groenwold & L. F. P. Etman
Research article Page: 90-102

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 $\phi_s = 0.8$-1.0 for soil friction and $\gamma_{eq} = 1.3$-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].