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Bridge engineering and health monitoring

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Review Paper Page: 01-14

Bridge engineering incorporates health monitoring to continuously assess structural integrity, detect damage early, and enable proactive maintenance, extending service life beyond traditional visual inspections. Structural health monitoring (SHM) systems deploy sensors such as strain gauges, accelerometers, fiber-optic Bragg gratings, and GNSS for real-time data on vibrations, displacements, corrosion, and environmental factors like temperature and humidity. Data transmission via wireless networks (e.g., Wi-Fi, LoRa) feeds into AI-driven analytics for anomaly detection, modal analysis, and predictive …… [For more click here]

Wind-induced vibrations and control in tall structures

Prakash Dev & C. Fleury

Research article Page: 15-28

Wind-induced vibrations in tall structures arise primarily from dynamic wind loads like across-wind gusts, vortex shedding, and buffeting, which can cause occupant discomfort through excessive accelerations and sway. Control strategies include aerodynamic shaping (tapered forms, chamfered corners, or openings to disrupt vortex formation), mass and stiffness modifications via outriggers or belt trusses, and supplemental damping devices. Passive systems dominate practical applications: tuned mass dampers (TMDs) reduce peak responses by 30-50% by counteracting motion at the fundamental frequency, …… [For more click here]

Non-destructive testing techniques for concrete structures

Hikaru Nakamura & Sahil Rajput

Research article Page: 29-42

Non-destructive testing (NDT) techniques for concrete structures evaluate strength, durability, uniformity, and internal defects without damaging the material, making them vital for in-service assessments. Primary methods include rebound hammer testing, which gauges surface hardness to estimate compressive strength; ultrasonic pulse velocity (UPV), measuring sound wave travel time to detect cracks, voids, or honeycombing; and penetration resistance tests like the Windsor probe, embedding steel pins for relative strength correlation. Additional approaches such as ground-penetrating radar …… [For more click here]

Post-cracking shear strength and deformability of HSS-UHPFRC beams

G. B. Rudraksh, Narasimha Murthy & Pravin Kadam

Research article Page: 43-59

Post-cracking shear strength and deformability of HSS-UHPFRC beams refer to the enhanced performance of beams made with High-Strength Steel (HSS) and Ultra-High Performance Fiber-Reinforced Concrete (UHPFRC) after initial cracking under shear loading. UHPFRC's dense matrix and steel fibers (typically 1-2.5% by volume) bridge cracks, transferring tensile stresses and preventing brittle shear failure, achieving residual shear capacities 20-100% higher than normal concrete with significant ductility. HSS reinforcement (yield strength >690 MPa) complements this by providing high elastic ….[For more click here]

Passive and semi-active vibration control systems

Amir Hussain, V. Krishnan & M. Życzkowski
Research article Page: 60-74

Passive and semi-active vibration control systems mitigate dynamic responses in structures like buildings and bridges by dissipating energy without requiring external power sources. Passive systems, such as tuned mass dampers (TMDs), viscous dampers, and base isolators, rely on inherent material properties like friction, viscosity, or mass tuning to counteract wind or seismic excitations through proven, low-maintenance mechanisms. Semi-active systems enhance this adaptability by using sensors and minimal electronics to adjust damping or stiffness in real-time …… [For more click here]

Corrosion protection measures for reinforced steel

M. Prathap, Ramesh Kumar & Ajeet Kumar
Research article Page: 75-82

Full-scale lateral impact testing of prestressed concrete girders replicates over-height vehicle collisions on bridge undersides using specialized outdoor facilities, such as elevated tracks with impact carts to deliver controlled kinetic energy (e.g., 74 kip-ft from a 9000 lb cart dropping 10 ft). In a 2016 University of Tennessee study, an AASHTO Type I beam (56 ft long, 0.7-inch strands, f'c=14,100 psi) was struck at midspan bottom flange, causing severe local spalling, flange rotation, strand rupture, and total flexural failure within 0.08 seconds, despite simple supports from Jersey barriers. Instrumentation including strain gauges, accelerometers (10 kHz sampling), …… [For more click here]

Long-term aging effects on tensile characterization of steel fibre reinforced concrete

Ravindra Kute, Tapan Kumar, W. Stadler & Arifuzzaman Tapash
Research article Page: 83-97

Long-term aging effects on tensile characterization of steel fibre reinforced concrete (SFRC) primarily involve assessing changes in post-cracking residual tensile strength due to environmental exposure, hydration progression, and potential fiber-matrix interface degradation over years. Studies reveal that while pre-cracking tensile strength may stabilize or slightly increase from enhanced bond strength, residual post-cracking performance can decline in some SFRC mixes due to fiber corrosion or embrittlement, though macro-synthetic alternatives show minimal loss. Temperature cycling from -15°C to 60°C over 180-360 days typically preserves flexural capacity, …… [For more click here]