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

Katrin Wieneke, S. Shao & D. Carsten

Research article Page: 01-23

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]

Sustainability design of concrete structures

Thomaz Eduardo Teixeira Buttignol, Matteo Colombo & Marco di Prisco

Research article Page: 24-40

steel bridge decks under vehicular loading is critically assessed using high-fidelity 3D finite element models incorporating vehicle transverse distribution models (VTDM) to capture stress ranges at weld details like deck-to-ribbon joints and diaphragm cutouts. Traffic-induced cyclic stresses lead to premature cracking at vulnerable sites, with full-bridge Arlequin analyses revealing 30-40% higher fatigue stress ranges than local models due to global deformations and wheel clustering. Parametric studies show axle overloads reduce fatigue life linearly, while thicker plates (e.g., 20-22 mm) extend life by mitigating hot-spot stresses under Eurocode 3 or BS5400 loading spectra. Diaphragm cutouts emerge as most susceptible, necessitating routine inspections and mitigation via weld improvements or overlays to achieve 100+ year design lives. …… [For more click here]

Advanced earthquake-resistant designs for high-rise buildings

Thomas Zimmermann, David Lehký & Alfred Strauss

Research article Page: 41-50

Advanced earthquake-resistant designs for high-rise buildings employ performance-based seismic engineering with rocking core walls, outrigger systems, and high-performance dampers to achieve damage-free performance during major events. Rocking foundations combined with post-tensioned concrete cores allow controlled uplift and energy dissipation through boundary rocking, reducing base shears by 50% while maintaining drift limits below 2%. Distributed damping via viscous fluid dampers or shape memory alloy braces targets higher modes in slender towers (H/B > 6), ensuring accelerations stay under habitability thresholds. UBC's recent shake-table tests validated these systems for Cascadia subduction quakes, demonstrating intact functionality post M9.0 shaking. This evolution from force-based to displacement-based design supports resilient urban development aligned with your structural expertise. …… [For more click here].

Seismic retrofitting strategies for historic structures

Thomas Zimmermann, David Lehký & Alfred Strauss

Research article Page: 51-68

Seismic retrofitting strategies for historic structures prioritize minimally invasive techniques that preserve architectural integrity while enhancing ductility and energy dissipation. Base isolation using elastomeric pads or friction pendulum bearings decouples masonry buildings from ground motion, reducing base shears by 70-80% with minimal visual impact. Fiber-reinforced polymer (FRP) wraps applied to walls and vaults increase flexural and shear capacity by 2-4 times without added mass, though breathability concerns require lime-based matrices. Post-tensioning vertical rods through towers discreetly adds overturning resistance, while tuned mass dampers control dynamic amplification in slender minarets. These reversible interventions balance heritage preservation with life-safety per ICOMOS/ICCROM guidelines…… [For more click here].

Dynamic response of tall buildings to wind-induced vibrations

Yuan Jing, Zhongguo John Ma & David B. Clarke

Research article Page: 69-82

Dynamic response of tall buildings to wind-induced vibrations primarily involves across-wind excitation from vortex shedding and along-wind gusts, with slender structures experiencing accelerations up to 0.25g that affect occupant comfort. High-rise buildings amplify first-mode responses at 0.1-0.3 Hz, where peak accelerations correlate with building slenderness (H/B > 4), requiring damping ratios exceeding 1.5% for serviceability. Aerodynamic mitigation through tapering, twisting, or porosity reduces vortex correlation, cutting RMS responses by 30-50%, while TMDs provide supplementary control for lock-in phenomena. Wind tunnel testing with high-frequency force balance (HFFB) or rigid models validates design spectra against ISO 10137 habitability limits. This analysis complements your vibration control research for pedestrian structures. …… [For more click here].