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Seismic Performance of Buckling-Restrained Braces in Steel Frames

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Research article Page: 01-21

Buckling-restrained braces (BRBs) in steel frames provide stable hysteretic behavior in both tension and compression, achieving ductility factors exceeding 4-7 without post-buckling strength degradation, unlike conventional braces. BRBFs dissipate seismic energy through core yielding within a restraining casing (mortar/concrete-filled tube), enabling response modification factor R=8 per ASCE 7 and AISC 341 for high-seismic design. Full-scale tests confirm cumulative strain capacities >20% and energy dissipation 2-3 times higher than CBFs, with low residual drifts (<0.5%) and reliable performance under near-fault motions. Design requires core slenderness <0.2-0.3 and restraint ratios >2.5-4.0 to prevent buckling, with beam/column checks for 1.1-2.0 times brace yield strength. ……… [For more click here]

Thermal Cracking Control in Mass Concrete Foundations Using Cooling Pipes

E. Hernández-Montes

Research article Page: 22-48

Thermal cracking in mass concrete foundations arises from hydration heat causing temperature gradients up to 20-30°C, inducing tensile stresses exceeding concrete's early-age strength and leading to random cracks. Cooling pipes (typically ¾" HDPE or steel) embedded in a grid pattern (1-1.5 m spacing) circulate chilled water (5-15°C inlet) to extract internal heat, limiting peak temperatures to 65-70°C and differentials (ΔT) below 20°C. FEM simulations like ANSYS or ADINA optimize pipe layout, flow rates (0.5-1.5 L/min per pipe), and duration (7-14 days), ensuring cooling rates <2°C/day to prevent thermal shock. Field monitoring with embedded sensors validates control, achieving crack-free pours in dams and foundations while minimizing energy use…… [For more click here].

Behavior of Recycled Aggregate Concrete under Biaxial Compression

L. M. Gil-Martín, Isabirye Edward Kezron & Nabirye Gretah Namukuve

Research article Page: 49-64

Recycled aggregate concrete (RAC) under biaxial compression exhibits lower strength enhancement ratios (1.1-1.3 vs. 1.2-1.6 for natural aggregate concrete) due to higher porosity and interfacial transition zones in recycled aggregates. Experimental tests on steel fiber-reinforced RAC show biaxial peak stresses 10-20% below uniaxial values, with failure modes shifting from splitting to shear bands, improved by 5-15% fiber volume fractions. Modified Kupfer-William-Warnke failure envelopes fit RAC data well, accounting for aggregate replacement ratios up to 100%, with bilinear strength criteria predicting dynamic biaxial performance. RAC columns under bi-eccentric loading demonstrate ductile behavior comparable to normal concrete when confined, validating use in sustainable structures. …… [For more click here]

Numerical Modeling of Blast-Resistant Reinforced Concrete Slabs Using Finite Element Analysis

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Research article Page: 48-65

Numerical modeling of blast-resistant reinforced concrete slabs using finite element analysis (FEA) employs three-dimensional Lagrangian models with fluid-structure interaction to simulate TNT explosions, air dynamics, and structural responses. Tools like ABAQUS or LS-DYNA incorporate concrete damage plasticity models, Johnson-Holmquist for brittle failure, and hexahedral elements for rebar-concrete separation, accurately predicting peak pressures matching Henry's formula and damage patterns validated against field tests. Parametric studies reveal that slab thickness above 80 mm, standoff distances over 500 mm, and TNT masses below 1 kg limit damage to low-moderate levels, with collapse radius and mid-span deflection scaling inversely with thickness and distance. Validated models show FEA captures crack propagation, spalling, and rupture effectively, aiding design optimization for military and civilian infrastructure under close-in blasts…… [For more click here]

Time-Dependent Creep Behavior of Polymer-Modified Asphalt Mixtures for Pavement Applications

Binod Kumar Sah, Suresh Kumar Sahani & Huanjun Jiang
Research article Page: 66-87

Time-dependent creep behavior of polymer-modified asphalt mixtures for pavement applications exhibits viscoelastic-plastic deformation, with initial instantaneous elastic strain followed by decelerating primary and steady-state secondary creep, transitioning to tertiary acceleration under prolonged high stress. Polymers like styrene-butadiene-styrene (SBS) or high-elasticity modifiers create time-dependent microstructures, reducing permanent deformation by 20-50% compared to neat asphalt via enhanced elasticity and delayed flow at elevated temperatures. Modified time-hardening models incorporating logistic functions outperform Burgers models in capturing consolidation effects, accurately fitting creep compliance with $R^2 > 0.99$ and lower RMSE, especially under stresses of 0.55-1.00 MPa and 20-60°C. These mixtures show superior rutting resistance, with stress impacting creep rates more than temperature (99% vs. 65% strain increase), supporting durable pavements in high-traffic scenarios. …… [For more click here]

Optimization of Bamboo-Reinforced Beams for Eco-Friendly Low-Cost Housing in Seismic Zones

Chattopadhyay & J. L. Walsh
Research article Page: 88-104

Optimization of bamboo-reinforced beams for eco-friendly low-cost housing in seismic zones involves selecting treated bamboo species like Dendrocalamus giganteus for tensile strengths up to 300 MPa, comparable to mild steel, while ensuring lightweight designs reduce inertial loads during earthquakes. Treatments such as boron, epoxy, or lime-water soaking minimize moisture absorption below 10% and enhance bamboo-concrete bond strength by 20-50%, preventing long-term degradation and improving ductility. Finite element analysis and experimental tests optimize reinforcement ratios at 1-2% cross-sectional area, with mesh configurations yielding flexural capacities 40% higher than plain concrete and 56% lighter weight versus brick beams, cutting costs by 40%. These beams excel in seismic performance through high strength-to-weight ratios and energy absorption, ideal for prefabricated panels in rural, disaster-prone regions like India. …… [For more click here]