Research article, Type: Subscription ***Volume: 11***

Use of recycled materials in earth-retaining structures

Ali Delnavaz & Mohammad Hamidnia

Research article Page: 01-23

Use of recycled materials in earth-retaining structures replaces traditional aggregates with reclaimed concrete, asphalt pavement (RAP), scrap tires, and plastics to create sustainable mechanically stabilized earth (MSE) walls and gabion systems. Recycled concrete aggregate (RCA) serves as reinforced backfill with adequate friction angles (32-38°) and drainage superior to virgin gravel, though tufa precipitation requires filter compatibility testing. Scrap tire bales or shredded tires form lightweight, resilient cores that absorb seismic energy, reducing lateral pressures by 20-30% while diverting landfill waste. Geogrids reinforce these marginal fills, enabling 5-15m high walls with site-won materials that cut costs 40-60% versus quarried stone. This circular approach aligns with your eco-friendly binders research, enhancing urban geotechnical sustainability……… [For more click here].

Innovative foundation solutions for permafrost regions

Koji Sakai, Othman Omikrine Metalssi, Stéphane Lavaud & Bruno Godart

Research article Page: 24-39

Innovative foundation solutions for permafrost regions prioritize maintaining frozen ground conditions to prevent thaw settlement, using elevated designs like post-and-pad systems or ventilated crawlspaces that allow cold air circulation beneath structures. Thermosyphons—passive heat pipes filled with CO2 or ammonia—extract ground heat during warmer months, stabilizing temperatures within 1-2°C of ambient permafrost while requiring no power. Pile foundations driven to stable permafrost layers (10-20m depth) incorporate gravel pads or insulated slabs to distribute loads above the active layer, minimizing seasonal heave. Emerging hybrid approaches combine refrigeration with lightweight fill materials like geofoam, reducing thermal disturbance by 40-60% compared to traditional methods. These techniques ensure long-term structural integrity amid climate warming, aligning with resilient geotechnical practices. ………. [For more click here]

Eco-friendly binders for roller-compacted concrete pavements

Othman Omikrine Metalssi

Research article Page: 40-54

Eco-friendly binders for roller-compacted concrete (RCC) pavements, such as limestone-calcined clay cement (LC3) and geopolymers from fly ash or slag, replace 30-60% of Portland cement to drastically cut CO2 emissions while maintaining pavement durability. LC3 blends achieve comparable 28-day compressive strengths (25-35 MPa) with lower water demand and improved early-age properties, ideal for rapid construction of industrial roads and parking areas. These binders enhance freeze-thaw resistance through refined pore structures and reduce heat island effects with lighter surface colors versus asphalt. Field applications demonstrate lifecycle cost savings of 20-40% due to minimal maintenance and high abrasion resistance under heavy loads. This aligns perfectly with your sustainable materials research focus. ………. [For more click here]

Effect of elevated temperatures on ultra-high performance fiber concrete

Badreddine Kchakech

Research article Page: 55-69

Elevated temperatures significantly degrade the residual compressive strength of ultra-high performance fiber concrete (UHPFC), though bilinear models show initial strength increases up to 1.09-1.13 times room temperature values before rapid declines beyond 400°C. Steel fibers maintain tensile capacity better than conventional concrete due to their high melting point, preserving ductility and limiting spalling through vapor pressure relief channels formed by melting polypropylene hybrids. Post-fire residual flexural strengths retain 40-70% capacity at 600°C, outperforming normal-strength concrete thanks to fiber bridging across microcracks. Microstructural changes include silica fume dehydration and interfacial transition zone weakening, accelerating above 200°C. These behaviors inform performance-based fire design for UHPFC in high-rise applications. ………. [For more click here]

Recycled aggregate concrete under biaxial compression

Alejandro Pérez Caldentey

Research article Page: 70-89

Recycled aggregate concrete (RAC) under biaxial compression shows lower strength enhancement ratios (1.1-1.3) compared to natural aggregate concrete (1.2-1.6), attributed to higher porosity and weaker interfacial transition zones from adhered mortar. This reduced biaxial efficiency stems from increased microcracking under multi-axial loading, though steel fibers mitigate failure by bridging cracks and improving ductility. Failure envelopes follow a parabolic meridian shape with reduced peak stresses at 15-30% replacement levels, validated through specialized test rigs measuring principal stress ratios. RAC maintains adequate ductility for structural use when limited to 50% substitution, aligning with sustainable material practices in your research focus. These properties inform design codes for seismic regions where biaxial demands dominate. ………. [For more click here]

Development of carbon-negative concrete mixtures

Katrin Wieneke, Durai J, C. Anil Kumar & Chandrasekhar G L

Research article Page: 90-109

Development of carbon-negative concrete mixtures incorporates CO2-sequestering agents like biochar from agricultural waste or mineral carbonation to actively capture more emissions than produced during manufacturing. Biochar-augmented formulations replace 10-30% cement volume, achieving negative GWP through permanent sequestration while maintaining 90-100% compressive strength via optimized particle packing. Seawater magnesium-based cements react with CO2 to form stable carbonates, eliminating clinker production and yielding strengths comparable to Portland cement. Algae-enhanced geopolymers mineralize atmospheric CO2 during curing, supporting scalable production for pavements and structures. These innovations align with your eco-friendly binders research, reducing construction's carbon footprint by 100-150%..……… [For more click here]

Graphene-enhanced concrete for improved strength

Shrinivas A. Patil

Research article Page: 110-128

Graphene-enhanced concrete improves strength by incorporating graphene oxide or nanoplatelets at 0.01-0.3% by cement weight, achieving 30-50% higher compressive strength (up to 80 MPa gains) and 50-150% flexural improvements through superior dispersion and crystal nucleation. The nanomaterial bridges microcracks, densifies the cement matrix, and reduces porosity by 40%, enhancing durability against sulfate attack and chloride penetration. Optimal dosages minimize agglomeration while cutting cement content by 20-30% for sustainability, though uniform mixing requires high-shear processing. Applications include thin overlays and seismic retrofits, aligning with your UHPFC and sustainable materials interests. Field trials confirm 2.5x overall robustness with 4x less water permeability. ………
[For more click here]