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Numerical Prediction of Scour around Bridge Piers in Non-Uniform Flows

Eckhard Finke, Rasha, N. Arafa, Sayed, A.A. Elsayh, Eman, H. Afifi, Rabab & W. El Aramany

Research article Page: 01-22

Numerical prediction of scour around bridge piers in non-uniform flows utilizes 3D CFD models like Flow-3D or FSUM to simulate horseshoe vortices, downflow, and bed shear stresses, capturing velocity gradients and sediment transport under live-bed conditions. These models predict maximum scour depths (y_s/D) at pier front edges, with rectangular piers (L/D=5-9) showing 10-25% deeper scour than circular due to enhanced downflow and turbulence intensity. Non-uniformity amplifies scour via shear stress peaks and asymmetric vortex shedding, validated against flume tests with RMSE <0.2 for equilibrium depths. Empirical corrections to HEC-18 equations improve predictions for skewed or compound piers in unsteady flows…… [For more click here].

Eco-Friendly Binders for Roller-Compacted Concrete Pavements

Christina Schäfer, Yasser, S.G. Abd Elaziz, Heba, M. Khater, Marwa, M. Abdalgaleel, Y. A. Abdel Mageed, Ahmed & A.M. Barakat, Ahmed

Research article Page: 23-48

Eco-friendly binders for roller-compacted concrete (RCC) pavements replace Portland cement with geopolymers, limestone-calcined clay cement (LC3), fly ash, or slag to cut CO2 emissions by 30-60% while maintaining compressive strengths above 25 MPa. Geopolymer RCC using fly ash and alkali activators with 100% recycled aggregates achieves flexural strengths of 2.8-3.56 MPa, outperforming OPC mixes in bonding and durability under traffic loads. LC3 at 50% substitution requires 7-22% less water than fly ash blends, yielding superior density and freeze-thaw resistance for sustainable pavements. These binders enable rapid construction with rollers, reducing lifecycle costs and environmental impact in highways and industrial floors. …… [For more click here]

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

W. Stadler & V. Krishnan

Research article Page: 37-49

Long-term aging generally modifies the tensile response of steel fibre reinforced concrete (SFRC) by altering both the cementitious matrix and the fibre–matrix interface. Over years of service, microstructural densification of the matrix can increase the limit of proportionality and initial tensile strength, while creep and shrinkage still promote crack development. Aging often enhances fibre–matrix bond, which may increase post-cracking residual tensile capacity, but corrosion of exposed steel fibres in aggressive environments can gradually reduce their bridging efficiency. Overall, the long-term tensile performance of SFRC depends on exposure conditions and temperature, with moderate environmental actions showing good retention of residual tensile capacity, whereas severe corrosion or high-temperature histories can cause notable degradation.…… [For more click here]

Structural reliability analysis under extreme loads

S. H. Han, P. B. Thanedar, R. H. Plaut & P. Morelle

Research article Page: 50-64

Structural reliability analysis under extreme loads evaluates the probability that a structure survives events like earthquakes, blasts, winds, or floods without failure. It models resistance (capacity) and load effects as random variables, computing failure probability via the limit state function where resistance exceeds demand. Common methods include First-Order Second-Moment (FOSM), First-Order Reliability Method (FORM), Monte Carlo simulation, and time-dependent approaches accounting for deterioration and load growth ……. [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: 65-81

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]