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Wildfire-resistant materials and building techniques

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Research article Page: 01-14

Wildfire-resistant materials and building techniques prioritize non-combustible options like fiber cement siding, metal roofing, and stucco exteriors to withstand ember showers and radiant heat exceeding 1000°C. Insulated concrete forms (ICF) and fire-rated gypsum sheathing create thermal barriers in walls, while ember-resistant vents with 1/8-inch mesh prevent ignition from airborne debris. Construction methods emphasize defensible space with gravel perimeters, double-pane tempered glass windows, and sealed eaves to block fire entry paths. These strategies, proven in California's WUI codes, reduce ignition risk by 70-90% when combined with site grading and vegetation management.…… [For more click here].

Innovative flood barrier designs for urban rivers

Ali Haroobi, Bajad Hamidan Hilal & Ibraheem Almhitheef

Research article Page: 15-29

Innovative flood barrier designs for urban rivers incorporate self-closing, ultra-high-performance fiber-reinforced concrete (UHPFRC) elements that automatically float and deploy during floods, providing robust protection without power dependency. Modular systems like AquaFence use interlocking panels for rapid deployment along riverbanks, reducing setup time to minutes while handling water pressures up to 1m depth. Nature-based solutions integrate vegetated permeable barriers with traditional walls to attenuate wave energy and filter sediments, enhancing biodiversity in constrained city spaces. Sensor-equipped smart barriers predict overflows via real-time river level monitoring, automatically adjusting heights for dynamic flood scenarios. These designs balance functionality, aesthetics, and cost, supporting resilient urban planning in flood-prone regions. …… [For more click here]

Use of machine learning in predicting landslide risks

Z Al Ruqi, Salem Maddah Alharbi & Abdul Kareem

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probabilistic models to integrate flood susceptibility, climate projections, and vulnerability indices for assets like roads, power grids, and water systems. Key parameters include rainfall intensity, elevation, slope, drainage density, land use, and proximity to rivers, with rainfall weighted highest (25%) in AHP frameworks identifying 20-30% of areas at high compound risk. Global assessments reveal ~27% of road/rail assets exposed to multi-hazards, with cascading failures disrupting 30-50% network capacity from 10% component damage in urban settings. Standardized fragility curves and Monte Carlo simulations quantify direct/indirect losses, prioritizing reinforcements in zones vulnerable to floods, cyclones, and erosion.…… [For more click here]

Development of tsunami-resistant coastal infrastructure

Anand Prakasy, Manju Bhardwa, Rohit Singh & Prashant Badar

Research article Page: 48-62

Development of tsunami-resistant coastal infrastructure emphasizes vertical evacuation structures and breakwaters designed to ASCE 7-16 standards, which specify hydrostatic, hydrodynamic, and debris impact loads for the maximum considered tsunami event. Reinforced concrete towers elevated above inundation levels (typically 10-15m) provide life-safety refuge, incorporating open ground floors to minimize uplift forces and deep pile foundations to resist scour. Breakwaters and seawalls use rubble-

mound designs with armor units sized for overtopping waves, incorporating two-level tsunami criteria: frequent events for functionality and extreme events for no-collapse performance. Bridge piers prioritize substructure survival through breakaway bearings and scour countermeasures, ensuring post-event restorability for emergency access. These strategies integrate probabilistic hazard modeling with performance-based engineering to balance cost and resilience in coastal cities. ……. [For more click here]

Community-based disaster preparedness planning

Faisal Maush N. Alanazi, Fahd Jaber K. Al-Anazi & Talal Saeed Al Shehri
Research article Page: 63-79

Community-based disaster preparedness planning empowers local residents to identify hazards, map vulnerabilities, and develop tailored response strategies through participatory processes like transect walks and seasonal calendars. Key components include forming task forces for evacuation, resource inventorying, and conducting regular mock drills to build cohesion and self-reliance. This approach reduces external dependency by mobilizing internal capacities, such as volunteer training and early warning dissemination, enhancing resilience in earthquake-prone urban areas like Delhi. Effective plans integrate simulations for task allocation and GIS mapping to optimize coordination during multi-hazard events. ……. [For more click here]

Probabilistic risk assessment under multiple hazards

Tisva abdullah saleem Alsobhi, Yahya Alhasan Ibrahim Abu Mansour & Waleed Abdu Mohammed
Research article Page: 80-97

Probabilistic risk assessment under multiple hazards quantifies the likelihood and consequences of combined events like earthquakes triggering landslides or floods by integrating hazard probabilities, dependencies, and vulnerabilities into a unified framework. Methodologies employ Monte Carlo simulations or Bayesian networks to model cascading effects, calculating joint return periods and expected losses rather than treating hazards independently. Event trees and fault trees capture trigger sequences, while vulnerability surfaces account for structure-specific capacities across hazard intensities. This approach supports resilience planning for tall buildings by prioritizing retrofit investments based on exceedance probabilities exceeding tolerable thresholds. Outputs guide multi-hazard design codes, balancing life-safety and economic risks in urban seismic zones.……. [For more click here].

Seismic performance of self-centering steel frames

Malkawi , Manar Saeed & Bani Mustafa
Research article Page: 98-112

Seismic performance of self-centering steel frames excels in earthquake resistance through post-tensioned tendons or shape memory alloys that enable recentering after large deformations, minimizing residual drifts to under 0.5% while dissipating energy via friction or buckling-restrained fuses. Shaking table tests on 3-story prototypes demonstrate flag-shaped hysteresis loops, with interstory drift ratios reduced by 30-50% compared to conventional frames under design-basis earthquakes. These systems maintain elastic behavior in main members, concentrating damage in replaceable devices for rapid post-event recovery, achieving ductility factors exceeding 4 without column buckling. Hybrid variants combining self-centering braces with viscoelastic dampers further control accelerations and higher-

mode effects in tall buildings. This aligns with performance-based seismic design goals, supporting resilience in urban structures prone to multi-hazard loading…… [For more click here].

Structural health monitoring of aging bridges using IoT

N. Bhai & Mahadev S.

Research article Page: 112-128

Structural health monitoring of aging bridges using IoT deploys networks of wireless sensors such as accelerometers, strain gauges, and tiltmeters to continuously track vibrations, cracks, and deflections in real-time, replacing labor-intensive manual inspections. Cloud-connected platforms analyze data via machine learning algorithms to detect anomalies early, predicting maintenance needs and reducing costs by up to 38% through predictive analytics. Protocols like MQTT and NB-IoT ensure low-power, scalable data transmission from remote locations, integrating with digital twins for virtual stress testing. Case studies on cable-stayed bridges demonstrate enhanced safety during construction and service life by alerting to overloads or environmental degradation. This technology supports resilient infrastructure management, aligning with vibration control interests for urban bridges. …… [For more click here]