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Editorial Article

Sustainable Infrastructure through Materials Innovation, Arti icial Intelligence, and Climate-Resilient Communities

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Summary

The Current Problems in Research, Volume 2, Issue 1 (2026), presents a collection of scholarly contributions that collectively demonstrate the evolving direction of civil engineering and infrastructure research. As societies face increasing challenges associated with rapid urbanization, climate change, aging infrastructure, resource scarcity, and digital transformation, engineering solutions must simultaneously improve structural performance, environmental sustainability, and societal resilience. The articles included in this issue exemplify this multidisciplinary evolution by integrating advanced construction materials, intelligent computational techniques, sustainable pavement technologies, and community-centered climate adaptation into a coherent body of knowledge.

The research presented in this issue highlights that future infrastructure development can no longer rely solely on conventional engineering practices. Instead, modern infrastructure requires innovations that optimize material performance, reduce environmental impacts, leverage artificial intelligence for decision-making, and actively incorporate community participation into environmental governance. Together, these studies demonstrate how engineering research is increasingly bridging laboratory innovation, computational intelligence, and real-world implementation to support sustainable development.

One of the major themes emerging from this issue is the continuous advancement of high-performance construction materials. As modern buildings and infrastructure are increasingly subjected to extreme loading conditions and elevated temperatures, conventional concrete often reaches its performance limitations. Noori et al. [1] investigate the incorporation of micro–Polyether Ether Ketone (PEEK) polymer into very-high-strength heat-resistant concrete

to reduce its brittleness while maintaining excellent thermal resistance. Their findings demonstrate enhanced tensile performance and reduced brittleness through improved microstructure, providing valuable guidance for concrete structures operating under high-temperature environments.

Structural resilience is further explored by Ali et al. [2] who examine externally bonded Ultra-High-Performance Fibre-Reinforced Concrete (UHPFRC) strips to improve the punching shear performance of reinforced concrete flat slabs. Their results indicate improved stiffness, punching shear capacity, and ductility while transforming brittle failure into a more desirable ductile failure mode. Such strengthening techniques offer practical solutions for extending the service life of aging reinforced concrete infrastructure.

Sustainable pavement engineering is represented by the study of Rosman et al. [3] which investigates sugarcane bagasse ash as an alternative filler in asphalt mixtures. By converting agricultural waste into engineering materials, the study demonstrates improvements in Marshall stability, indirect tensile strength, and moisture resistance, while supporting circular economy principles and environmentally responsible pavement construction.

The growing importance of digital transformation in civil engineering is illustrated by Che Mamat et al. [4] who integrate Adaptive Neuro-Fuzzy Inference System (ANFIS) models with Butterfly, Beluga Whale, and Golden Eagle optimization algorithms for concrete compressive strength prediction. Their comparative analysis demonstrates that intelligent hybrid models can substantially improve prediction accuracy, reduce design uncertainty, and support data-driven decision-making in concrete technology.

Beyond engineering materials and computational intelligence, sustainability also depends on effective environmental governance. Siharath et al. [5] present a participatory framework that integrates climate adaptation, wetland conservation, and policy development through community-based co-design at Sui Lake, Lao PDR. The study demonstrates the importance of local stakeholder participation in creating resilient environmental management strategies that align ecological protection with socio-economic development.

Collectively, the articles in this issue illustrate that future infrastructure must be sustainable, resilient, intelligent, and socially inclusive. Innovation increasingly emerges from interdisciplinary collaboration among civil engineers, material scientists, environmental researchers, computer scientists, and policymakers. Advanced materials, artificial intelligence, circular economy principles, and participatory governance together represent complementary pathways toward achieving sustainable infrastructure development.

The Editorial Board extends its sincere appreciation to all authors, reviewers, and editorial members for their valuable contributions. We hope that the research published in this issue will stimulate future collaboration, inspire innovative engineering solutions, and contribute meaningfully to the advancement of sustainable infrastructure and resilient communities worldwide.

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Author Contributions

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work, the authors used ChatGPT to enhance the clarity of the writing. After using the ChatGPT, the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

References

[1] R. Che Mamat, A. Ramli, and M. L. Kirunjisman, "Optimizing Concrete Compressive Strength Prediction Using ANFIS Models Enhanced by Butterfly, Beluga Whale, and Golden Eagle Metaheuristics" Current Problems in Research, vol. 2, no. 1, pp. 1-15, 2026, doi: http://dx.doi.org/10.70028/cpir.v2i1.66

[2] A.S. Ali, F. R. Karim, and S. K. Rafiq "Effect of Ultra-High-Performance Fibre-Reinforced Concrete Strip Thickness on the Punching Shear Performance of Reinforced Concrete Flat Slabs" Current Problems in Research, vol. 2, no. 1, pp. 16-34, 2026, doi: http://dx.doi.org/10.70028/cpir.v2i1.84

[3] Z. N. A. M. Rosman, W. N. H. Mior Sani, N. N. D. Nik Azmi, and I. Mawardi "Effect of Sugarcane Bagasse as a Filler on the Performance of Asphalt Mixtures" Current Problems in Research, vol. 2, no. 1, pp. 35-53, 2026, doi: http://dx.doi.org/10.70028/cpir.v2i1.91

[4] Z. A. Noori, F. R. Karim, and H. K. Karim "Improvement of Very-High Strength Heat-Resistant Concrete's Brittleness Index Including Micro Polyether Ether Ketone Polymer under High Temperature" Current Problems in Research, vol. 2, no. 1, pp. 54-73, 2026, doi: http://dx.doi.org/10.70028/cpir.v2i1.94

[5] P. Siharath, V. Nitivattananon, R. P. Shrestha, S. Vilaychaleun, and C. Sonemanivong "The Climate-Wetland-Policy Nexus: Advancing Community-Based Adaptation through Participatory Co-Knowledge Design at Sui Lake, Lao PDR" Current Problems in Research, vol. 2, no. 1, pp. 74-89, 2026, doi: http://dx.doi.org/10.70028/cpir.v2i1.89