

EDITORIAL ARTICLE

Towards Sustainable Construction: Challenges, Innovation, and Risk Evaluation

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SUMMARY

We are pleased to present the 2025 edition of the Current Problems in Research Journal. This second volume brings a strong focus on geotechnical challenges, soil settlement mitigation, asphalt innovation, and project risk evaluation within the road development. Through diverse contributions, this volume underscores the growing necessity for sustainable and resilient construction practices, especially in regions with complex ground conditions. We hope that the articles presented here will not only enrich academic discourse but also guide practitioners, policymakers, and industry stakeholders toward more informed decision-making and innovative engineering solutions.

Producing Hot Mix Asphalt (HMA) demands considerable energy and generates large quantities of greenhouse gases and harmful emissions, making it a major contributor to air pollution. In contrast, Warm Mix Asphalt (WMA) provides a more sustainable option because it can be mixed and produced at lower temperatures, resulting in reduced energy use and lower emission levels. In this context, Jayanti et al. [1] study and investigates Waste Motor Engine Oil (WMEO) as a sustainable modifier for Warm Mix Asphalt (WMA), aiming to reduce energy consumption and enhance pavement performance. At the laboratory, WMEO was added at 0%, 3%, 4%, and 5% by weight of bitumen, and its effects were evaluated through penetration, softening point, Marshall stability, flow, and stiffness tests. Their results show that 3% WMEO improves binder softness and increases stability to approximately 7000 N, representing the optimal balance between workability and strength. Higher dosages (4–5%) produced inconsistent effects, including undesirable stiffening or excessive softening, indicating potential performance risks. Softening point and flow results exhibited non-linear trends, emphasizing the sensitivity of asphalt behavior to WMEO dosage. Overall, the study identifies 3–4% WMEO as the most effective range for enhancing WMA performance while promoting waste valorization.

Embankment construction on soft ground remains a major geotechnical challenge due to low shear strength, high compressibility, and slow drainage of soft soils. Addressing this issue, Nasir et al. [2] review and examines three real-world case studies demonstrating different strategies to address settlement and stability issues. The first case, from Mozambique, applies wick drains and counterweight fills to accelerate consolidation and improve stability in deep soft clay deposits. The second case, from Egypt, integrates geosynthetic reinforcement with floating pile walls, achieving significant settlement reduction up to 94% according to numerical analyses, while optimizing construction costs. The third case focuses on urban environments, using lightweight fill materials such as EPS blocks combined with preloading to minimize stress on shallow soft soils and control post-construction settlement. A comparative analysis highlights the strengths, limitations, feasibility, and economic considerations of each method, offering practical insights for selecting the most effective soft-ground embankment solutions in diverse project conditions.

Soft ground construction continues to pose significant challenges due to the low shear strength, high compressibility, and poor drainage characteristics of soft soils, which often lead to excessive settlement and structural vulnerability. Against this background, Ni et al. [3] examine the key mechanisms driving soil settlement immediate deformation, primary consolidation, and secondary compression and highlight the need to understand these processes for safe and reliable foundation design. The authors investigate three principal ground improvement methods: preloading with Prefabricated Vertical Drains (PVDs) to accelerate consolidation; Deep Soil Mixing (DSM) to create soil-cement columns that increase strength; and geosynthetics to reinforce and stabilize weak ground. Drawing on case studies such as runway construction in Indonesia, the New Bangkok International Airport, the Boston Big Dig, and Kansai International Airport, the study demonstrates the practical effectiveness of each technique. Their comparative evaluation of feasibility, cost, environmental considerations, and performance offers engineers valuable guidance for selecting the most suitable mitigation strategies in soft-ground construction.

Soft ground construction faces ongoing challenges due to weak bearing capacity, high compressibility, and settlement risks. Considering these factors, Samni et al. [4] reviews sustainable methods to address these limitations while reducing environmental impact. Three key approaches are explored: recycled materials, including steel slag, fly ash, and crushed concrete; geosynthetics for reinforcement and drainage; and microbial-induced calcite precipitation (MICP), a bio-mediated technique that improves strength and reduces permeability. Real-world case studies demonstrate the effectiveness of each method in embankment construction, soil stabilization, and ground reinforcement. Comparative analysis shows that geosynthetics offer the best balance of practicality and performance, while recycled materials present a cost-effective and eco-friendly alternative. MICP shows strong potential but requires further optimization and understanding of microbiological interactions. The study provides valuable guidance for engineers and policymakers, highlighting how sustainable techniques can reduce carbon

emissions, improve soil stability, and support future infrastructure development in challenging soft-ground conditions.

Infrastructure development is a key driver of Indonesia's economic growth, especially in strategic and remote regions. Munawar et al. [5] examined the Aceh Besar-Lamno Border Road Project as a crucial effort to improve regional connectivity and stimulate socio-economic activities in Aceh Jaya. However, the effectiveness of such infrastructure projects relies heavily on the ability to manage potential risks. Their study applied a descriptive statistical method using SPSS to assess various risk factors influencing project execution. Nine risk categories were evaluated through field surveys and questionnaires involving 40 respondents directly involved in the project. The findings identified contractual risk (mean 26.65) as the most critical factor, followed by risks related to time and control, materials, equipment, environment, design changes, finance, labor, and government relations, the latter being the least influential. The research underscores the need to prioritize contractual clarity, supervision, and robust quality control systems. Unlike previous studies where financial or scheduling risks are typically dominant, this research highlights contractual risk as the most significant factor in Aceh's construction context, indicating the importance of developing localized mitigation strategies tailored to the region's unique socio-administrative challenges.

This volume underscores the critical importance of sustainability, technological innovation, and risk management in contemporary road and infrastructure development. The contributions within reveal that issues such as soft ground construction, soil settlement, asphalt performance, and project risk demand integrated and location-specific engineering approaches. Moving forward, future research should promote interdisciplinary collaboration among engineers, economists, environmental scientists, and policymakers to formulate comprehensive guidelines for sustainable road construction on soft ground.

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CONFLICTS OF INTEREST

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

AUTHOR CONTRIBUTIONS

Ramadhansyah Putra Jaya: writing, reviewing and editing. **Norhidayah Abdul Hassan:** writing, re-viewing and editing. **Reza Pahlevi Munirwan:** writing, re-viewing and editing.

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.

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