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Editorial: Disaster risk and resilience assessment of multi-utility transportation infrastructure and urban projects

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Editorial on the Research Topic
Disaster risk and resilience assessment of multi-utility transportation infrastructure and urban projects

Introduction

Sustainable and innovative infrastructure drives economic growth and resilience, particularly within expanding urban transportation networks. This Research Topic explores the seismic risks to tunnels and railway tracks, addressing challenges such as slope failures and network disruptions caused by earthquakes and landslides. By presenting new approaches, methodologies, and case studies, it aims to enhance the resilience and sustainability of multi-utility transportation infrastructures in seismically active regions. This is divided into the following two major sections.

Seismic and structural resilience in challenging environment

The first section highlights research aimed at improving the seismic safety and structural resilience of tunnels and rail systems under complex geological conditions. The study "Unveiling the seismic sensitivity of the Himalayan tunnels: a comprehensive assessment through analytical and numerical exploration of p-wave dynamics" conducted by Abdullah Ansari, Pranjal Mandhaniya, and Bilal Ahmad Malik, provided an analytical and numerical evaluation of P-wave dynamics, focusing on seismic hazard zones with PGAs ranging from less than 0.3 g to over 0.5 g, Ansari et al. This research offered design and retrofitting guidelines for tunnels in mountainous terrains, addressing landslide-prone areas. Complementing this, the numerical investigation "Crack influence and fatigue life assessment in rail profiles: a numerical study" performed by Patrick Urassa, Haileleoul Sahle Habte, and Awel Mohammedseid, revealed that crack orientation significantly impacts contact stresses, fatigue life, and damage evolution, with oblique cracks presenting the highest severity, Urassa et al. These findings underscore the need for innovative strategies to enhance the reliability and safety of underground and rail systems in seismically active and geotechnically complex areas.

Innovations in rail infrastructure monitoring and reinforcement

The second section emphasizes advancements in rail infrastructure monitoring and foundation reinforcement for high-speed railway systems. Zhicheng Hu, Albert Lau, Jian Dai, and Gunnstein T. Frøseth, in their study "Identification of Optimal Accelerometer Placement on Trains for Railway Switch Wear Monitoring via Multibody Simulation" utilized multibody simulations to identify optimal accelerometer placement on trains, advocating strategic sensor positioning to capture critical data with precision, Hu et al. Additionally, the research "A Comparative Study of Geosynthetically Reinforced Earth Foundations in Multi-Utility Transportation Infrastructure for High-Speed Railways" compiled by Pranjal Mandhaniya, Anish Kumar Soni, Kirti Choudhary, and Abdullah Ansari, demonstrated how facing wall support and geosynthetics improve lateral resistance in high-speed railway tracks, with potential resistance increases of 40%–57%, Mandhaniya et al. These studies collectively contribute to the development of smart, sustainable, and robust rail systems capable of meeting modern transportation demands while ensuring structural integrity and safety. Aslan et al. evaluated the seismic performance of transportation structures along the Tarsus-Adana-Gaziantep (TAG) motorway in Gaziantep, emphasizing the importance of material choice, geotechnical assessments, and spatial analysis for ensuring operational continuity and emergency response during future earthquakes.

These studies collectively advance the understanding of resilient and sustainable transportation infrastructure.

Conclusion

In wrapping up this Research Topic, it becomes apparent that the featured studies make significant contributions to advancing seismic resilience and sustainable transportation infrastructure. The exploration of P-wave dynamics in Himalayan tunnels offers critical insights into mitigating seismic risks in complex geological settings. Research on rail profile fatigue and optimal accelerometer placement enhances monitoring precision and rail system reliability. Additionally, innovations in geosynthetic reinforcement demonstrate improved foundation designs for high-speed railways. Together, these studies provide valuable solutions for safer, more efficient, and resilient transportation systems, aligning with sustainable development goals and fostering global infrastructure reliability.

Author contributions

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