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Editorial

Transportation and Infrastructure for Sustainability

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The transition towards sustainable development requires the integration of technological innovation, environmental responsibility, and effective governance. In this context, transport and infrastructure systems play a key role, as they determine not only the efficiency of mobility but also the environmental and socio-economic impact of modern societies. Achieving sustainability in this domain requires the ability to measure progress, adapt to emerging challenges, and transform existing systems into more resilient and future-oriented pathways. This transition is closely aligned with the broader global sustainability agenda emphasizing low-carbon development, energy transformation, and long-term environmental resilience [1,2].

This Special Issue, "Transportation and Infrastructure for Sustainability", was conceived as a platform to link knowledge with practical solutions and to foster cooperation among researchers working across different transport modes and infrastructure systems. The collected contributions show that sustainability is not limited to the development of entirely new solutions but also involves the reinterpretation and integration of existing approaches in new contexts and combinations.

This Special Issue brings together 15 published articles that demonstrate the multidimensional nature of sustainability in transport and infrastructure. Several studies focus on the environmental and energy transformation of transport systems, including the use of solar energy in maritime transport, the integration of ecological principles into transport operations, and the development of sustainable port systems. These studies highlight the growing importance of reducing the environmental impact while maintaining operational efficiency.

Another group of contributions addresses infrastructure and engineering solutions, emphasizing the role of materials, technologies, and system design. These include the use of mining waste in road construction, the application of BIM technologies in infrastructure planning, the development of sustainable railway systems, and approaches to enhancing the resilience of large-scale transport networks. Additional studies focus on safety and technical performance, such as tire configurations in freight transport, tractor safety, and navigation systems for inland waterways.

Finally, several articles explore governance, decision-making, and socio-economic aspects of transport and infrastructure systems. These include models linking transport development with quality of life, frameworks for evaluating transport alternatives based on passenger behavior, airport classification systems for better planning, and innovative financing mechanisms such as crowdfunding for sustainable transport projects.

Taken together, the contributions illustrate a clear shift from isolated technical solutions towards a more integrated understanding of transport and infrastructure sustainability,

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where environmental, technological, and socio-economic dimensions are closely interconnected. This reflects an evolving paradigm in which sustainable transport is viewed as a complex system requiring coordinated action across multiple domains.

To provide a structured overview of the contributions, the articles in this Special Issue were organized into three thematic groups based on their primary research focus. This classification reflects the dominant perspective adopted in each study and allows for a more coherent presentation of the published work.

Several contributions to this Special Issue focus on the environmental dimension of transport and infrastructure, particularly addressing the transition towards low-emission and resource-efficient systems. These studies emphasize the urgent need to decarbonize transport while maintaining operational efficiency and technological feasibility.

The study by Petrychenko et al. explores the potential of solar energy as an alternative to conventional fuels in maritime transport, identifying both technological opportunities and existing barriers, such as storage and economic constraints. The paper highlights promising directions for integrating renewable energy solutions into shipping, contributing to the broader goal of reducing greenhouse gas emissions.

Corazza advances the discussion by proposing a comprehensive framework for integrating ecological principles into transport operations. The study demonstrates that environmental considerations—such as mitigating wildlife–vehicle collisions—can simultaneously generate economic benefits, thereby reinforcing the practical value of sustainability-oriented approaches.

The role of innovation in enhancing sustainability is further examined in the context of port infrastructure. Vaca-Cabrero et al. analyze how technological advancements and collaborative strategies can improve operational efficiency while reducing environmental impact in port systems. Similarly, Paulauskas et al. propose a methodology for assessing port sustainability, focusing on optimizing port operations, reducing emissions, and ensuring safe and efficient vessel handling.

Together, these contributions highlight that the environmental transformation of transport and infrastructure is not limited to energy substitution but also requires a comprehensive approach, integrating technology, operational practices, and regulatory frameworks.

Another group of articles addresses the technological and engineering foundations of sustainable transport and infrastructure. These studies demonstrate how innovations in materials, design, and digital tools can significantly enhance system performance, safety, and resilience. Contemporary infrastructure research increasingly emphasizes resilience, lifecycle efficiency, and sustainability-oriented performance metrics as key criteria for long-term transport system development [3,4].

Galhardo et al. investigate the reuse of mining waste in road construction, showing that such materials can improve mechanical properties while reducing the environmental burdens associated with waste disposal. This approach represents a practical contribution to circular economy principles in infrastructure development.

Digital transformation is addressed by Castañeda et al., who examine the application of Building Information Modeling (BIM) in road construction planning. Their findings demonstrate how BIM enhances coordination, reduces scheduling errors, and supports more efficient project management, thereby contributing to both economic and environmental sustainability.

Large-scale infrastructure resilience is the focus of Rehak et al., who propose a systematic framework for assessing and developing the sustainability of Trans-European Transport Network (TEN-T) infrastructure. Their work emphasizes the importance of integrating legislative, technical, and technological dimensions to ensure long-term system robustness.

Railway infrastructure modernization is explored by Bondarenko, who addresses the challenges of integrating different railway gauge systems. The study proposes innovative conceptual approaches to harmonizing technical parameters, thereby contributing to the long-term sustainability and interoperability of railway systems.

Several contributions focus specifically on safety as a critical component of sustainable infrastructure. Žuraulis et al. analyze the impact of tire configurations on freight transport safety, demonstrating how optimized technical choices can reduce both the accident risks and environmental impacts. Simović et al. examine tractor safety in rural transport systems, showing that relatively simple visibility improvements can significantly reduce crash risks and associated resource losses. In the context of inland waterways, Pieron et al. propose improvements to navigation marking systems, contributing to enhanced safety and operational efficiency.

Overall, these studies demonstrate that engineering innovation plays a key role in achieving sustainable transport and infrastructure, enabling both performance improvements and risk reduction.

The third thematic group focuses on the governance and socio-economic aspects of transport and infrastructure systems, emphasizing that sustainability depends not only on technological solutions but also on effective decision-making and strategic planning.

Sivilevičius and Žuraulis develop a multi-criteria model that links transport system characteristics with quality-of-life indicators. Their findings highlight that infrastructure quality, safety, and environmental factors have the most significant impact on societal well-being, providing valuable insights for policy development.

Decision-making processes in public transport systems are examined by Şimşek et al., who propose an integrated framework combining multiple analytical methods to evaluate transport alternatives. The study demonstrates how incorporating passenger behavior into planning can lead to more effective and sustainable mobility solutions.

Strategic planning at the infrastructure level is addressed by Khanjanasthiti et al., who propose a new classification system for airports. By introducing a structured framework based on functional and operational criteria, the study supports more coordinated and sustainable infrastructure development.

The issue of financing sustainable transport innovations is explored by Mańkowska et al., who analyze the role of crowdfunding as an emerging mechanism for supporting high-risk and early-stage projects. Their findings highlight the potential of digital finance to complement traditional funding sources and accelerate innovation in the transport sector.

Collectively, these contributions underline that achieving sustainability in transport and infrastructure requires a holistic approach, where technological advancements are complemented by effective governance, informed decision-making, and innovative economic mechanisms. In this context, governance mechanisms, strategic planning, and stakeholder coordination are increasingly recognized as essential components for implementing sustainable mobility policies and achieving long-term development goals [5,6].

The contributions presented in this Special Issue highlight the evolving nature of sustainability in transport and infrastructure, demonstrating that its achievement requires the integration of environmental, technological, and socio-economic dimensions. Rather than addressing isolated challenges, the collected studies emphasize the importance of coordinated and system-oriented approaches that link innovation, infrastructure development, and governance mechanisms.

A key insight emerging from this Special Issue is that sustainable transport and infrastructure cannot be achieved solely through technological advancements or policy interventions taken separately. Instead, progress depends on the interaction between

engineering solutions, environmental strategies, and decision-making frameworks that together shape resilient and adaptive systems.

The findings presented across the articles also underline the growing role of digitalization, alternative energy sources, and advanced analytical methods in addressing current and future challenges. At the same time, they point to the need for continued interdisciplinary collaboration and the development of integrated methodologies capable of responding to the complexity of transport systems.

This Special Issue contributes to the ongoing scientific discourse by providing both theoretical insights and practical solutions, and it is expected to support further research and informed decision-making in the field of sustainable transport and infrastructure.

Ultimately, the transition towards sustainable transport and infrastructure should be understood not as a set of isolated improvements but as a continuous and systemic transformation shaping the future of mobility and society as a whole. We are confident that the insights gleaned from these studies will inspire further research and accelerate the transition towards knowledgeable, sustainable, and equitable transportation systems. We extend our sincere gratitude to all the authors, reviewers, and the editorial team of *Sustainability* for their invaluable contributions to this successful endeavor.

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