Proceedings of the 11th International Conference On Civil Structural and Transportation Engineering (ICCSTE 2026)
June, 2026 - Barcelona, Spain
DOI: 10.11159/iccste26.004

Towards the Design of Sustainable and Resilient Highway Bridge Infrastructure: From Theory to Code Implementation

Zoubir Lounis, Ph.D., P.Eng., F.CAE
Principal Research Officer, National Research Council Canada, Ottawa, Ontario, Canada
Zoubir.Lounis@nrc.ca

Extended Abstract

The design of highway bridges that are sustainable and resilient is a challenging task that involves a broad range of performance indicators that include safety, service life, functionality, greenhouse gas emissions, and life cycle cost. In existing bridge codes, the focus is on life safety with limited considerations for sustainability and resilience. Climate change presents new challenges for the design of bridges to ensure they remain resilient under changing climate. The need to decarbonize the construction sector requires the design of bridges that have low embodied and life cycle carbon emissions. Sustainability indicators address economic, social, and environmental performance metrics with a focus on durability, greenhouse gas emissions and life cycle cost. Resilience indicators address safety, functionality, and recovery-time metrics. Considerable uncertainties are associated with the performance of highway bridges, which require the use of risk-informed decision-making approaches to identify cost-effective risk management strategies. A risk-informed decision-making framework for the design of sustainable and resilient bridges is presented with examples of design of reinforced concrete bridge structures that satisfy the requirements of sustainability and resilience under a changing climate. The design of bridges for sustainability and resilience is implemented in the 2025 edition of the Canadian Highway Bridge Design Code.