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KEYNOTE LECTURE:

Data-Driven Bridge Analysis Using Traffic Load Measurements

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Dr. Žnidarič holds a degree in structural engineering from the University of Ljubljana and currently serves as the director of the Slovenian National Building and Civil Engineering Institute. With more than 35 years of experience, he has worked extensively as a researcher and practitioner in bridge condition assessment, structural safety, bridge loading, weigh-in-motion (WIM) technology, and bridge monitoring. He has contributed to over 25 national and international research projects, coordinating several of them. As one of the pioneers in bridge WIM technology, he played a key role in its development—a technology now used worldwide. He was also part of the team that established Slovenia's national bridge inspection and condition assessment methodologies and led the development of national procedures for evaluating bridge safety. Throughout his career, he has authored 33 SCI-indexed journal papers and more than 150 conference publications (Google Scholar).

He is currently the president of FEHRL, the Forum of European National Highway Laboratories. This Brussels-based organisation brings together the most prominent institutes and universities in the field of transport infrastructure from Europe, the USA and Korea. He is a long-standing board member and the current treasurer of ISWIM, the International Society for Weigh-in-Motion, a member of PIARC (World Road Association) bridge committees since 1997, and a member of several other national and international committees and associations.

He is an elected Fellow of Engineering Mechanics Institute (EMI) of American Society of Civil Engineers (ASCE). He is the recipient of ASCE Walter L. Huber Research Award (2022), Rutgers Outstanding Engineering Faculty Award (2023),

Abstract: Bridge management requires accurate information on bridge status to optimally balance among maintenance costs, potential risks, and overall bridge performance. One of the main performance indicators is structural safety, which requires in-depth knowledge of traffic loads and structural resistance to those loads. Advanced assessment is particularly beneficial for ageing or deteriorated bridges approaching the end of their service life, as precise knowledge of loading conditions and structural performance can determine whether extensive interventions or more moderate rehabilitation measures are appropriate..

Demonstrating structural safety for such bridges is challenging using traditional analytical methods alone. Therefore, incorporating structural and material testing, along with traffic load monitoring, helps prevent unnecessary interventions, such as strengthening or complete replacement.

The paper demonstrates the potential of using bridge weigh-in-motion technology to measure critical parameters for optimising bridge safety assessment: axle loads and spacings of all heavy goods vehicles on the loading side, and influence lines, girder distribution, and dynamic amplification due to the traffic loads on the bridge performance side. Knowing their actual, not assumed, values significantly improves structural modelling and reduces uncertainties and risks associated with the load effects used in safety assessment. Finally, it supports more optimal decision-making and efficient use of infrastructure maintenance funds.