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INTELLIGENT BRIDGES - ADAPTIVE CONCEPTS FOR HOLISTIC CONDITION EVALUATION

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Summary: Bridge structures within the German highway network are facing new challenges. These include increasing traffic loads, effects of climate change, modifications in design codes and new sustainability-related requirements. Ageing of bridge structures and insufficient financial means for maintenance add significant logistic dimensions to these challenges. To guarantee a reliable highway network, it will be crucial to adopt and enhance innovative approaches that support the current -rather reactive and damage based - maintenance management. In the German federal highway research institute (BASt), comprehensive R&D work is being carried out to evolve a system for real-time information processing and reliability-based evaluation of bridge structures - Intelligent Bridges. This system follows a preventive strategy based on the early detection and evaluation of condition changes within a bridge structure as well as the prediction and evaluation of further condition development. Three main components characterize the architecture of an intelligent bridge system: intelligent sensor networks and data analysis methods, reliability-based evaluation methods/models and intelligent maintenance management. In this paper, the concept of Intelligent Bridges will be described and results achieved so far within internal and external research analyzed. Special attention hereby will be paid to sensor technologies and networks, methods of data processing, validation and fusion as well as reliability-based evaluation. Demonstration activities in this context will be emphasized. Future work and plans regarding the implementation of the developed techniques and methods in a first prototype will also be discussed.