

MANAGEMENT OF BRIDGE STRUCTURES – CHALLENGES AND POSSIBILITIES

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SUMMARY

Bridges are particularly vulnerable elements of transport infrastructures. In many cases, bridge structures may be subject to higher volumes of traffic and higher loads as well as more severe environmental conditions than it was designed. Sound procedures to ensure monitoring, quality control, and preventive maintenance systems are therefore vital. The paper presents main challenges and arriving possibilities in management of bridge structures, including: relationships between environment and bridge infrastructure, improvement of diagnostic technologies, advanced modelling of bridges in computer-based management systems, development of knowledge-based expert systems with application of artificial intelligence, applications of technology of Bridge Information Modelling (BrIM) with augmented and virtual reality techniques. Presented activities are focused on monitoring the safety of bridges for lowering the risk of an unexpected collapse significantly as well as on efficient maintenance of bridges as components of transport infrastructure – by means of integrated management systems.

Keywords: *Bridge, Management, Environment, Diagnostics, Bridge Information Modelling, Bridge Management System.*

1. INTRODUCTION

The number of new bridge structures designed and constructed during a year in each country is usually about 1% of the total number of existing bridge structures. It means that about 99% of bridge population needs efficient management of their operation and maintenance, which is a real challenge. The main tasks in the development of bridge management technologies can be defined as follows:

- a balance between environment condition and bridge infrastructure construction, operation and maintenance, including ecological requirements of sustainable development of transport infrastructure (e.g. [1], [2]),
- more and more precise diagnostics of bridge condition, based on results of advanced Non-Destructive (NDT) and Semi-Destructive Tests (SDT) as well as technical systems for continuous monitoring of structure response to loads and environmental influences, focused on detection and identification of bridge defects and degradation processes (e.g. [3]-[6]),
- innovative techniques of bridge structures modelling in computer-based Bridge Management Systems (BMS) with effective technologies of decision-support Expert Systems (ES), using resources of data and knowledge bases with application of Artificial Intelligence (AI) [7]-[15],
- development of modern Bridge Information Management (BrIM) technology with elements of Augmented Reality (AR) and Virtual Reality (VR), e.g. [16]-[18],
- effective integration of bridge management with other systems involved in the management of the whole transport network [19], [20].

Accomplishing the goals mentioned above seems to be realistic thanks to the quick development of digitalisation technologies as well as the application of new unconventional techniques of structure condition