

## NOVEL STRUCTURAL ENGINEERING TECHNOLOGIES TO SERVE HERITAGE BRIDGES

E. Brühwiler<sup>1</sup>

<sup>1</sup>Swiss Federal Institute of Technology (EPFL), Maintenance and Safety of Structures (MCS), Lausanne, Switzerland.

e-mail: [eugen.bruehwiler@epfl.ch](mailto:eugen.bruehwiler@epfl.ch)

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### SUMMARY

Bridges of high cultural value and aesthetic quality deserve respectful treatment, and consequently, construction interventions must balance these assets with the severe requirements of utilisation. This is particularly relevant to structural engineers and bridge owners involved in rehabilitation or modification interventions. This paper presents examples of how interventions are performed with adequate respect to cultural value. It is argued that the preservation of cultural value may go hand-in-hand with socio-economic, environmental and technical requirements following the principles of sustainable development. These requirements are met through the application of advanced structural engineering methods, including monitoring of structural behaviour and using the UHPFRC Technology. Extending the service duration means adding value to bridges as well as appreciating the art of structural engineering and the identity of structural engineers.

**Keywords:** *Heritage Bridges, UHPFRC, Monitoring, Updating, Restoration, Non-Invasive Intervention.*

### 1. INTRODUCTION

With the exception of structures with recognised historical and technical importance, bridges have yet to find adequate consideration as objects of high cultural value. Until today, interventions of bodies for the preservation of monuments have been limited in the domain of bridges, focusing mainly on riveted steel or masonry bridges built prior to the 20<sup>th</sup> century. Only in exceptional cases are bridges from the 20<sup>th</sup> century considered as structures of high value. Examples of these in Switzerland include the bridges of the world-famous Swiss engineer Robert Maillart who was active between 1900 and 1940. The determining factor may be that most bridge engineers are not educated to recognise cultural value and aesthetic qualities of bridges and in particular fail to acknowledge them as contemporary monuments.

Consequently, many bridges of high cultural value have already been subjected to interventions based purely on technical criteria without any consideration given to cultural value. Due to this ignorance, many of the less well known, nevertheless valuable, bridges have been defaced. For example, a bridge's appearance can be disfigured by adding new structural elements, removing or modifying details or erasing structural age indicators. Therefore, the bridge's identity and historical features are damaged.

To prevent further loss of cultural value, bridge engineers, owners, preservation authorities as well as the public need to be encouraged and empowered to give adequate esteem and importance to bridges. Former IABSE Working Group 9 „Construction History” elaborated and published in 2017 an IABSE Structural Engineering Document [1] that has the objective to increase awareness of historical and cultural aspects of structures and structural engineering. By means of sometimes opposed viewpoints on Construction History, a discussion within the structural engineering community is stimulated and a series of case studies are described to demonstrate how aspects of construction history can guide interventions on bridges and buildings of high cultural value.

This paper presents some basic principles when dealing with bridges of high cultural value. By means of the example of railway viaduct from the 19<sup>th</sup> Century, examination and the planned intervention for its restoration