# Structural Performance of UHPFRC Wild Bridge during Construction Using the Advanced Bridge Monitoring

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## Summary

Ultra High Performance Fibre Reinforced Concrete (UHPFRC) presents one of the superior classes of new cement base composites with the potential to archive the requirements for bridge constructions of the future. Not only the advantage of leading to a high economy in condition contribute to the objective but the advantage of reaching high service life and a reduction of maintenance will contribute as well. Nevertheless, only few prototypes have been built up now by using this material.

This paper is aimed to highlight the use of structural health monitoring system to analyse the structural performance of the UHPFRC Wild Bridge during construction. This leads to gain practical experience regarding the performance of UHPFRC structures, and to help in spreading the use of this profitable concept concrete and to the standardisation.

The designed Structural Health Monitoring (SHM) concept will be carried out by using distributed fibre optic strain and temperature sensors, in combination with dynamic non-destructive measurements for obtaining periodically updated information and an inverse FEM for developing actual performance life cycle models. To consider stress distributions in the arch due to the dead loads from the bridge deck, the monitoring starts from the construction stage. The main goal is the analysis of the structural performance under different life cycle operational environments. The long term objective is developing performance based models for improving present UHPFRC design tools but also those regarding optimised prognosis strategy for maintenance planning in the field of transportation infrastructure.

**Keywords:** UHPFRC, SHM, structural performance, dynamic maintenance tools, operational condition assessment

## 1. Introduction

### 1.1 Non destructive testing methods – Structural health monitoring

The majority of the existing European transport infrastructure was built forty to sixty years ago. The increasing traffic and ascending heavy loads are the major cause for the growing costs to maintain the existing transportation infrastructures. Extending infrastructure lifecycles together with reducing maintenance costs by selective measures is still a challenge for research scientists. Solutions may be seen in developing new sustainable materials and infrastructure components as well as in assessing the structural condition in real time. The latter option is common research area to investigate and develop the non-destructive testing methods (NDT) as well as the structural health monitoring systems (SHM). According to [1], there is a wide range of NDT methods, which are used in the civil engineering structures, and examples of these techniques appropriate to bridges are summarised in Table 1.

The SHM process consists of permanent, continuous, periodic or periodically continuous recording

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