



## Strengthening of Concrete Bridges in Germany

Ioannis Retzepis

KREBS+KIEFER Ingenieure GmbH, Karlsruhe, GERMANY

Contact: [retzepis.ioannis@kuk.de](mailto:retzepis.ioannis@kuk.de)

### Abstract

In the past decades much has been undertaken in Germany in the field of sustainable infrastructure due to limited natural and financial resources. The focus is more on strengthening and retrofitting of an existing infrastructure than on its renewal. Many concepts for strengthening have been developed in Germany and these have been successfully applied in many cases. However, every single case of retrofitting of an existing structure requires an individual concept. Nevertheless, the established concepts can still be applied with certain modifications.

**Keywords:** Bridges; concrete; retrofitting; sustainability.

### 1 Introduction

In the past decades much has been undertaken in the development of strengthening and retrofitting concepts for concrete bridges in Germany. It is the aim of the German Government to preserve an existing infrastructure rather than to renew it. In fact, it is an economical decision which governs the aspects of sustainability due to limited natural and financial resources. A variety of strengthening and retrofitting concepts for concrete bridges have been developed and have been successfully applied in many cases. However, most bridges require a combination of different concepts to ensure that all deficits are covered.

The existing structural codes (Eurocodes) for new constructions cannot be applied to existing structures without any modifications; these modifications include the experience with existing structures and take into account the previous design regulations. The first code for the recalculation of bridges is the railway code DB-Ril 805 [1] established in 1999. Twelve years later, in 2011, a new code for the recalculation of highway bridges, the so called "Nachrechnungsrichtlinie"

[2] was introduced. It is based on the code for railway bridges and accurately describes the strategy to be taken. In addition, this code includes sustainability aspects.

The recalculation code takes the specific characteristics of existing bridges into account. These are:

- Old codes at the time of the bridge construction concerning loading, materials, design and construction.
- The well-known existing structural system and the materials used, which can be tested.
- The actual state of the construction.
- The practical experience concerning such construction types.

Furthermore, the code describes a three-block strategy:

- Block 1 – Calculations of the structure, taking into account the results of the former bridge investigations and the available records of the structure.
- Block 2 – Feasibility study.
- Block 3 – Cost-efficiency study.