# Retrofitting of old steel railway truss bridges by implementing new concrete deck slab

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## Abstract

This paper presents one idea for prolonging life time of old steel railway truss bridges by replacing the steel open deck elements with a concrete slab and ballastless track system. The authors believe that the idea could be beneficial for those steel railway truss bridges that have a track on the top chord level and in which the main trusses are in a relatively good condition. The effect of the additional weight of the concrete on the main trusses on the one hand is "compensated" by transforming the steel trusses into composite ones. On the other it could be reduced by optimization of the section of the new concrete deck elements by using UHPC precast elements and the introduction of the balastless track systems. The influence of the new concrete deck in the static and dynamic behaviour of such bridge is illustrated in the paper by an elaborated example.

**Keywords:** retrofitting, truss bridges, open deck, precast UHPC deck, balastless track.

## 1 Introduction

In the European railway network there are a lot of old steel bridges built more than 60-70 or more years ago. The portion of the steel truss bridges from them varies from country to country. For example in Austria they are 139 from 870, for Bulgaria their number is 228 from 327. Usually these bridges are carrying one track and have open deck (cross beams and stringers). The most common statical system used is simple beam and the spans are ranging between 20-50m.

The main problems that are recognized, by the relevant authorities, during their exploitation are related with difficulties in maintenance, high noise emissions and vibrations, fatigue problems mainly found in the element of the open deck (cross girders and stringers) and their connections while the main load bearing elements (trusses) still have some capacity.

Replacement of these bridges, because of the mentioned problems, with a new one in a short period of time is sometimes not possible or economically feasible. Moreover most of these bridges have not yet fulfilled their design life and in some cases their main trusses are in a good condition and are able to bear the loads even from recent standards.

One possibility for prolonging the life time of these bridges is by implementation of a new concrete deck, which is directly connected to the main trusses. In this way they are transformed from steel to composite steel-concrete ones. The idea is related with additional dead load, which looks controversial to the conventional methods focusing on relieving/unloading the old bridges. In order to keep this additional load to the possible minimum the following measures are foreseen: using precast UHPC deck elements and implementation of balastless track system(s).



https://doi.org/10.2749/stockholm.2016.1988