Prolife: Strengthening a Steel Railway Bridge with Deck Sections

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Abstract

Under funding of the European Union's Research Fund for Coal & Steel (Grant agreement no. RFSR-CT-2015-00025) the project ProLife (Prolonging lifetime of old steel and steel-concrete bridges) is undertaken to find innovative new ways how to extend the lifetime of existing bridges. Within ProLife many different strategies for strengthening old road and rail bridges are researched by different partners in the project. The goal of the project is to look at different strengthening measures and their influence on the remaining lifetime and life cycle costs of a bridge.

This paper is a continuation of the paper: "Prolife: Recalculating a steel railway bridge for determining strengthening measures, using an updated FEM model and site measurements" (YVR-0219-2017) of the 39th conference in Vancouver [1].

In this paper we will focus on rehabilitating a steel rail bridge with steel deck sections to strengthen the stringers and crossbeams in order to increase the remaining lifetime. These are the governing elements for the lifetime of regular bridges, since the main (truss) girders generally have a high enough capacity to cope with today's loads. Using the calibrated model (see [1]) it is possible to design the strengthening measurements. As a different strategy we explore advanced recalculation of the structure to prevent any strengthening in [2].

Keywords: Strengthening; recalculate; railway bridge; fatigue

1 Overview of results FLS, pre-strengthening

For chapter 1 and 2 we use the same case study (bridge over the river Waal near Zaltbommel in the Netherlands) as in [1].

Figure 1. Bridge over the river Waal

1.1 Locations

Fatigue is the governing factor for determining the remaining lifespan of a bridge. The fatigue life is calculated at the locations indicated in table 1, and the figures 2 and 3. Detail classifications for riveted structures are taken from [4].

1.2 Overview

In table 2 an overview of the fatigue life of different parts of the bridge is given. The standard time period in the Netherlands for rehabilitation of a bridge is 30 years, so the cumulative fatigue damage is given in 2017 (year of calculation) and 2047 (end of service). Assuming the desired end of lifetime is 2047, the bridge has had a total service

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