



Gaining a realistic fatigue load model using sensor-based measurements

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Abstract

In this article, fatigue calculations based on the modified fatigue load model 4 (ELM 4) of the recalculation guideline of BAST are compared with an object-specific calculation of sensor-based measurements, using the Lichfield Bridge in Limburg an der Lahn as an example. A central part of this contribution consists of the presentation of the data evaluation, with the help of which a weight distribution and the traffic composition of the five standard trucks of the modified ELM 4 could be evaluated. Another focus lies on the evaluation of the economic consequences of these modified damage calculations.

Keywords: fatigue load; recalculation, measurement; sensor system; object-specific calculation.

1 Introduction

More than half of the bridges in the German road network are now over 40 years old. In addition to the high average age, a retrospective assessment of the existing bridges on German freeways and federal highways is required, mainly due to the strong increase in traffic volumes and in particular the acting traffic loads (including heavy goods traffic) since their construction. Against this background, the Federal Highway Research Institute (BAST) introduced the post-calculation guideline [2] in 2011 and supplemented it for the first time in 2015 [3].

A systematic evaluation of this recalculation of 146 concrete bridges with a year of construction before 1988 has resulted in the fact that about 80 % of the structures in stages 1 and 2 of the recalculation guideline [2] show arithmetical deficits. In 43 % of the structures built before 1981, the computational deficiencies are due to the fatigue check of the prestressing steel in the area of construction joints, cf. [4]. This was also the case with the 11-span Lichfield Bridge in Limburg an der Lahn on Federal Highway 8, whose superstructures were each designed as two-span plate girders in 1968. Due to deficiencies in the fatigue design, a remaining service life (RND) had to be determined here based