Fatigue life of concrete bridges under consideration of increasing traffic loads

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Summary

Demands of bridge structures and their components by traffic loads are affected by many different parameters. Increasing traffic loads leads to higher fatigue stresses. Hereby, the effects on the stresses of the main load-bearing structure depend on the load models representing weight and the ratio of the load model length to the bearing distance of the superstructure. The different effects of varied load models are shown by opposing their influence lines. Axle loads and axle spacing are of vital importance to several components of the bridge structure. The consideration of more than one load cycle for each load model is relevant to local fatigue verifications.

Keywords: Fatigue life; concrete bridges; load models; heavy traffic; post-tensioned concrete; carriageway slabs.

1. Introduction

Carriageway slabs are either components of the main load-bearing structure (box girder or T-beam constructions) or form themselves the main load-bearing structure (slab constructions). To get information about the fatigue behaviour of carriageway slabs, it is necessary to examine first of all the whole main load-bearing structure.

With an expected increase of the heavy traffic loads, it is possible, that carriageway slabs would switch to cracked condition earlier. Higher stress amplitudes caused by cracked concrete members have an effect on the durability of concrete bridges.

The investigations [1] are carried out on a box girder, a slab and two girder bridges with T-beam elements. First of all the fatigue investigations of these existing bridges are performed by specified load combinations according to the technical report 102 [2] of the German Institute for Standardization. With these results sensitive sections with respect to fatigue shall be identified.

The future development of heavy traffic loads can be examined using different load models. Hereby, a 44 tons and an actual 60 tons load model as well as the FLM4 [3] and FLM3 [4] are taken into account.

2. Bridges selected for the numerical examination

The investigations are performed on a box girder, a slab and two girder bridges. These constructions

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