FEM based approach for development of a new high-speed load-model for railway bridges

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Abstract

The high-speed load model (HSLM), developed more than 20 years ago, is defined in the code "EN 1991-2" for a dynamic analysis of railway bridges - with respect to ballast destabilisation - within lines with a vehicle speed of more than 120 km/h. The compliance with the (dynamic) load bearing capacity and the serviceability acceleration must be verified for designing new bridges and assessing existing bridges, especially if a speed increase on the railroad is intended. New vehicle types, which are not always covered by the standardised load model, must be examined additionally. This leads to a clear and an urgent need for a revision of the existing high-speed load model. Within this paper, a large-scale dynamic FEM computation including 17 million train passages is presented as a basis for developing a new standard-compliant dynamic load model within the ongoing international project, commissioned by the German EBA (Federal Railway Authority).

Keywords: Railway bridges, bridge dynamics, FEM, dynamic load models.

1 Introduction

1.1 Overview

The compliance with the (dynamic) load bearing capacity and the serviceability acceleration limit of 3,5 m/s² must be verified for designing new bridges as well for assessing existing bridges, especially if a speed increase on the railroad is intended [1]. In order to avoid track ballast destabilisation on bridges, the standardized high-speed load models HSLM-A and HSLM-B, were developed about 20 years ago based on the so-called dynamic train signature[2]. These models are now provided in the code “EN 1991-2”[1] for a dynamic analysis of

https://doi.org/10.2749/ghent.2021.1614
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