Increasing the Safety of Railway Bridges by Continuous Monitoring

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Summary

In complicated cases the design criteria for railway bridges have to be verified by experimental results to guarantee the necessary high safety standards. Examples of such cases are new structural systems which go beyond established design rules, temporary bridges in a row or difficult foundation conditions. Here, reliable continuous monitoring systems in combination with immediate response control systems are required. Systems for such purposes are presented in the article and recent applications of these systems are shown which increase the safety of railway bridges.

Keywords: Monitoring; railway bridges; running stock; safety.

1. Introduction

For railway bridges high security standards concerning the serviceability and the ultimate limit state are set. To fulfil these standards rather restrictive regulations have to be applied for the design of railway bridges in Germany [1, 2, 3], and intensive regular inspections of these structures are carried out. The DB-Ril 804, module 8001 describes the inspections rules for railway bridges [4], which is based on the DIN 1076 code for highway bridges [5]. However, in complicated cases or for new innovative structures, the design data based on calculations are not sufficient and need to be combined or verified with experiments in laboratories or measurements at the construction site. Some examples of complicated cases are new structural systems which go beyond the very strict design rules for railway bridges, temporary bridges in a row, difficult foundation conditions or cases for which no or very limited experience exists.

In the past the velocity of trains passing such critical areas had to be reduced and the geometry of the railway grillage needed to be frequent controlled. The necessary track geometry control has neither been carried out continuously nor had dynamic effects been taken into account. It was a simple registration of track deflection after a number of trains had passed. Although it was a very easy way to gain information about the behaviour of the track it was also of a rather poor quality. In cases were more detailed data were required, further extensive investigations had to be performed. An example is existing structures with extensive defects. These extensive investigations are mentioned in the DB-Ril 805 [6] (so called ‘stage four’) and they are carried out using specific trains with measurement units on board. These specific trains run at different speeds over the critical areas and register all relevant data, like all three dimensional deflection and acceleration. It needs to be mentioned, that a time-consuming assessment procedure of the selected data is necessary. Due to the high costs of these procedures, they can only be applied in very few cases.

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