Monitoring of railway-bridges – an advanced component of maintenance and sustainability

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Summary

A lot of the older German railway bridges are made of steel and have reached or exceeded the planed duration of use. Because it’s impossible to renew all these bridges at once, concepts for extension of duration of use without a decrease of safety are necessary. The paper shows the determination of load capacity of railway bridges using a combination of measurement and calculation procedures, that includes the detection of bearing reserves. Special procedures of short and long time measurements, which are contained in the standard of German Railway, will be explained.

Based on a current project, the structural monitoring of a railway bridge in Chemnitz, the use of measurement procedures in combination with statically calculations is demonstrated. Particularly the concept for realistic determination of remaining life is explained and significant results are presented.

Keywords: steel bridge, monitoring, remaining useful life time, railway bridge, measurement

1. Introduction

The rail network of DB AG contains currently about 29.200 railway bridges. In addition, approximately 860 viaducts and 1.300 gantries, cable links and other bridges belong to the asset of railway property. The average age of the railway bridges is approx. 70 years. The eldest of them which are still in use – arch bridges made of natural stone – are up to 170 years old. Most of all railway bridges were built on the occasion of rapid expansion of the railway network in the years between 1900 and 1920. Another focal point of bridge building is to be found between 1970 and 1995 (figure 1).

Arch bridges make up the largest part (28%) of the whole asset. Steel bridges (25%) mark also an important part of bridge asset. In the seventies reinforced concrete and prestressed concrete structures became more and more important. Combined they constitute approx. 22% of the total stock of railway bridges. In road bridge construction there are to be found very often composite bridges recently, but they are of nearly no importance in railway bridges construction up to now.

In difference to road bridges the railway bridges of DB AG are characterised by small and medium spans (figure 2). Bridges with a span up to 30 m have a part of 96% in the total amount, in inner-city areas even approaching 100%. The limitation to small spans also affects the large part of lately built railway bridges.

In the past partial renewals had a considerable value within the whole construction volume. Nevertheless, during the past years their scope has strongly gone back while complete renewals of buildings predominate (figure 3).

https://doi.org/10.2749/222137807796120463