Calculating the service life of bridges

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David Sanio at the RUB dynamic testing device for fatigue tests. Credit: Gorczany

In future, the service life of bridges may be estimated more accurate than ever before. Engineers from the Ruhr-Universität Bochum (RUB) have refined mathematical models for calculating them. Unlike previous models, they take local conditions into consideration, rather than

depending on average default values. The RUB's science magazine RUBIN reports.

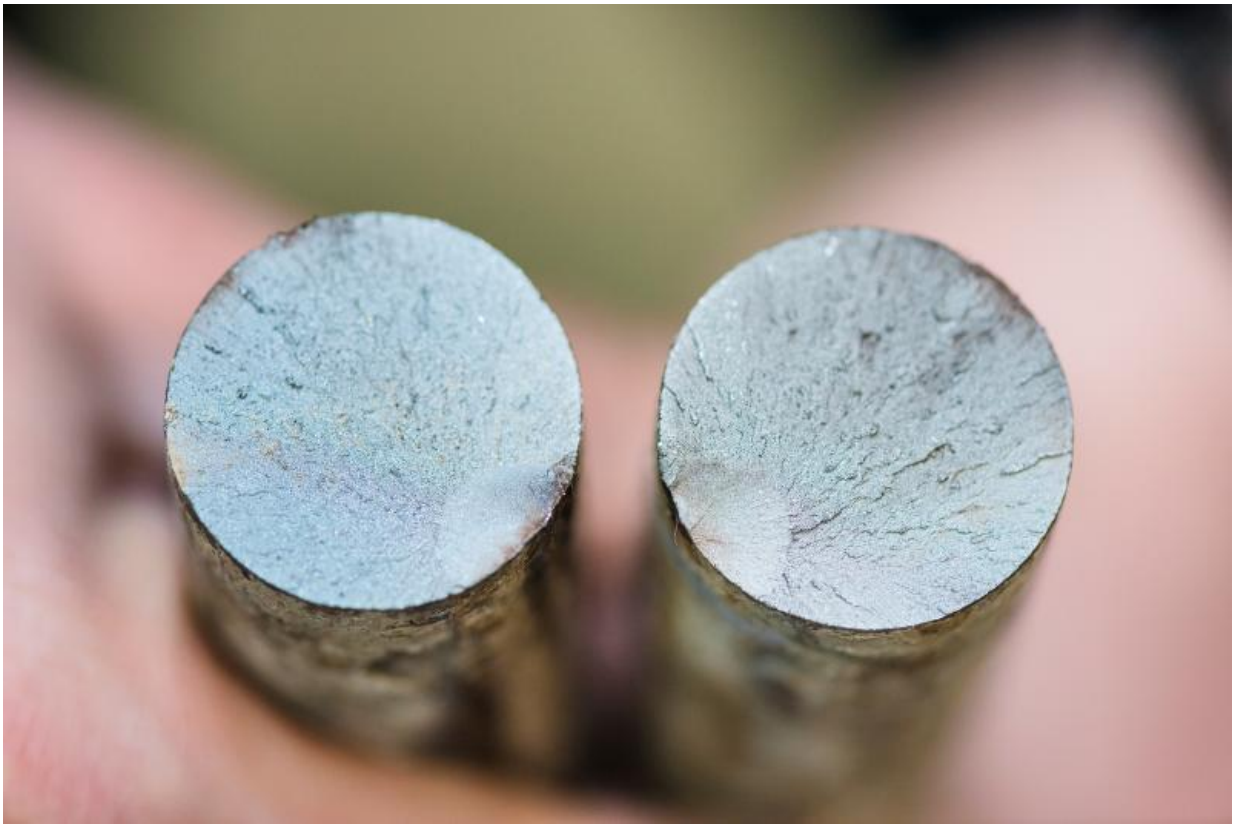
Comparison between the old and the new model: Service life 14 times as long

The team headed by Dr Mark Alexander Ahrens and David Sanio from the Institute of Concrete Structures spent two and a half years studying the flyover "Pariser Straße" at the junction "Heerdter Dreieck", in order to refine existing models for determining the service life of bridges. These models had been initially based on general assumptions that do not necessarily apply for each location in Germany, such as the number of heavy-duty vehicles crossing the bridge every day. The Bochum-based researchers wanted to know how much more precise the prognosis could become if they tailor-cut the model for one specific structure. The difference was considerable. According to the optimised arithmetical method, the service life would be 14 times as long as the one calculated using the previous model. One decisive factor was the fact that far fewer heavy-duty vehicles actually drive over the bridge than it has hitherto been assumed. In arithmetic terms, a heavy-duty vehicle with a load of 40 tons affects the structure in almost the same way as 100,000 passenger cars.

Long-term objective: The intelligent bridge

Following the tests carried out by the Institute of Concrete Structures and in collaboration with other institutes, a fundus of algorithms has been compiled which describe the various impacts affecting a structure. Traffic volume, temperature differences and construction materials, for example, play a role. Engineers can use that fundus like a modular kit to pick and choose the algorithms that are precisely suited for their individual application. The aim is to enable bridges to make these

calculations automatically one day. An intelligent bridge could continuously monitor its own condition and raise the alarm once it detects signs of serious damage. However, engineers currently still lack the relevant long-term experience with the measurement technology.



This pre-stressing steel sample broke during the fatigue test. Credit: Gorczany

Provided by Ruhr-Universitaet-Bochum