

## Abstract

From time to time the condition of public infrastructure in Germany gets negative coverage in the media. The majority of the structures concerned have been constructed in the 1960s and 1970s and show more or less significant damages. The financial requirements for appropriate rehabilitation measures in the field of public transportation are estimated to a total of 34 billion € for the time period 2001 to 2015 by the Federal Ministry of Transport, Building and Urban affairs. In reality, upcoming rehabilitation measures must be prioritized with respect to the limited available funds in the public sector. Only urgent measures can be carried out.

In Germany, bridges are inspected by qualified inspectors mainly in visual inspections every three or six years. The structural assessment is based on standardized deterioration catalogues. The disadvantage of visual inspection and the lack of the actual assessment procedure is always the possible oversight of small deteriorations or the misinterpretation of their extensiveness. A possible improvement of the situation can be achieved by the application of the technologies of structural health monitoring (SHM). Measured data from monitoring can be used to recognize changes in the load bearing system of structures or the further increase of damage and deterioration. It can help the authorities to estimate the actual safety level of the structure and to decide whether a deteriorated structure can still be safely used. Despite the advantages of SHM for early damage recognition, in Germany the technology is mainly applied to heavily damaged structures to prolong their service life.

The subject of this work is the development of a methodology for the probabilistic assessment of structures basing on measured data from structural health monitoring. In a second step, the results from the probabilistic assessment are used to deduce information for the necessary amount of SHM. Apart from the assessment of the actual state of the structure, its development in the future is estimated from the measured data, too. These results are included in the decisions regarding the monitoring measures as well.

The assessment process is carried out using a probabilistic model of the structure and complex methods of system reliability analysis. The methods have been adapted and partially simplified for the usage with data from structural health monitoring. The developed methodology and the different procedures for the analysis of data as well as the decision support for the planning of SHM measures have been implemented into a program system called PROBI-LAS („Probabilistic Lifetime Assessment,“) to ensure a simplified and guided application. The architecture of the program system as well as special questions regarding the implementation were other aspects of this work. The application of the methods and the program system to a reality based structure is shown in the final chapter of this work.