

IB-ISEB

The acronym „**IB-ISEB**“ stands for „Intelligent Bridges - Information systems for Structural monitoring and preservation management of bridges“ („Intelligente Brücken - Informationssystem zum Strukturmonitoring und Erhaltungsmanagement von Brücken“), which is a national project funded by the BASt (Federal Highway Research Institute), started in July 2012 and ends in June 2015, aiming at the provisioning of a framework to constantly monitor bridges and allow better preservation strategies. The project's duration is 36 Months.

Currently there are more than 38,000 bridges on German federal highways where 90% are made of concrete. A large number is now used for about 40-50 years. So more and more effort in restoration is necessary and a significant amount of money is tied up. Continuous observation is very important but nowadays it is only done on regular basis every few years in an intense inspection. Since the traffic volume increased much faster in the last decades than foreseen bridges might be damaged much faster than expected and an impending structural collapse might be overlooked. By adding sensors to the bridge the condition of the building can be estimated much faster and more precise. Based in the permanently known status of a bridge inspection intervals might be handled more flexible. So bridges are of more interest only if the current situation becomes quite worse and not after a predefined time period.

The project is mainly divided in two parts, sensor network and data management. The sensor part has the mission to identify metrics, develop sensors for different points at the bridge and collect the information at a single point which also acts as relay to the outside world. Due to the large number of bridges and the fact that most bridges are not connected to any power source the sensor network has to be almost energy independent or even energy autarkic. After collecting the data it is send to a data centre, for further analysis. The sensor part is done by CMT, IMTEK and LITEF. For the project lifetime and especially the testing phase we will collect much more data than needed to get a good feeling about it so we assume that we need an additional power source which has to be replaces regularly especially for the unit storing and sending information since this part consumes much energy. The bridge for the testing phase will probably be a large autobahn bridge in Baden-Württemberg.

The second part in the project is data handling and visualization. After the data is received from the bridge it will be treated in way that sensor information is separated from status information. The sensor information will be analysed similar that it is currently done by ICT with their building process monitoring to have a clear view on the current state of the bridge and deviations from expected behaviour. This is the main view for an engineer to analyse the bridge condition and plan review and maintenance actions. The status information is led to a hierarchical monitoring system provided by HLRS to monitor the status of the sensor network itself. Malfunctions of sensors from low energy situations to even broken and detected hardware or values out of specification can lead to a misunderstanding in the sensor values. So we will create new status information about the health status and then add this unified information to the existing sensor values so that it can also be used. As consequence the quality of the overall information can be determined.

Based on these data the analysing engineer can see and compare the condition of bridges. Based on the same values a simulation about the future structural integrity of the bridge can be started and being integrated in the analysis. This might even be possible with changed assumptions about traffic volume or detected movements of the ground. It is then also possible to compare similar bridges to find if bridges of the same type are influences by a specific parameter like humidity nearby.

Project Partners

- ITC Engineering (Stuttgart, Germany) - coordinator
- High Performance Computing Center Stuttgart (HLRS), University of Stuttgart (Stuttgart, Germany)
- VMT (Bruchsal, Germany)
- Northrop Grumman LITEF (Freiburg, Germany)
- Department of Microsystems Engineering (IMTEK) University of Freiburg (Freiburg, Germany)

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