Rail4Future

Projekttitel:	**Resilient Digital Railway Systems to enhance performance**
Projektnummer:	**882504**
Deliverable:	**3.1.2 Report on '3E' Structural Health Monitoring**

This deliverable outlines the current results on the work done to develop a '3E' Structural Health Monitoring (3E – Effective, Economic and Easy-to-use) with the aim to detect fatigue cracks and to monitor crack growth as well as the global structural response.

Experiences on advanced sensor systems from different project partners with know-how in monitoring and sensor technology was collected. Based on this information an application matrix was compiled with a classification of the different sensor technologies to their applicability for different monitoring objectives. This application matrix will be further updated in the next project steps to incorporate the latest findings from the scientific testing of sensor systems in the Bridge LAB and data evaluation.

In the so-called Bridge LAB the testing of sensor systems and their applicability was carried out on three different levels. Testing in the laboratory was conducted for basic testing of sensor systems e.g., distributed fibre optic sensing (DFOS) systems. For example, different glues for bonding the fibre to the base material were tested and compared for applicability. Testing in the secure environment was done with an extensive test series at the Pinkabachbridge, an out of service railway bridge that was brought to the bridge building facility of the ÖBB in St. Pölten. Here destructive testing was done to test and compare different advanced sensor systems. Fatigue cracks in the bottom chord of the bridge were generated using a large hydraulic shaker exciting the bridge structure in its first resonance frequency. Multiple advanced sensor systems from different project partners were used to measure crack initiation, crack growth and global behaviour of the structure. Testing on bridges in operation was done on two bridges, the bridge Eschenau on the route Salzburg – Wörgl representing a historical riveted truss girder bridge and on the bridge Mürz Kapfenberg representing a more recent welded girder bridge on the route between Vienna and Graz allowing for higher speed trains. Long-time monitoring was conducted on these two structures. The monitoring data are used for calibration of numerical models and to capture and validate the real loading on these structures.

Incorporation of the data from long time monitoring into the infrastructure provider's IT environment is done in close cooperation with Area 1.