Fraunhofer IPM

FRAUNHOFER-INSTITUTE FOR PHYSICAL MEASUREMENT TECHNIQUES IPM

PRESS RELEASE

Tunnel inspection 4.0: Multisensor system for efficient condition monitoring of tunnels

In the future, a compact multisensor system should provide precise and objective measurement data of tunnel constructions. The system will collect data on geometry, surface structure and water inlet in tunnels in a single measuring procedure and will provide the measurement data in digital format, compliant with BIM. The German AKG company group, Amberg Technologies AG from Switzerland and Elaborarium SL from Spain are working with Fraunhofer IPM as research partner in a joint project for the integrated inspections process for which a novel multisensor system will be developed.

Tunnels are critical components of transport infrastructure. Structural defects in tunnel constructions, such as cracks or water inlets, pose great risks. To ensure sufficient security, legislation stipulates regular condition monitoring. Today, inspections are carried out using various measuring techniques such as cameras and tactile measuring instruments. The processes are tedious and cost up to several thousand euros per square meter of tunnel wall. The resultant data are available in a wide range of different formats and the degree of digitalization is minimal. However, digital measurement data play an important role for long-term structural monitoring as well as for optimized construction planning in line with Building Information Modeling (BIM).

The aim of the "OpOrTunIty" (Operation Oriented Tunnel Inspection System) project, which started in October 2018, is an all-embracing process for the inspection of tunnel systems – from data collection to automated data analysis up to integration into a BIM-compliant planning system. The core technology is a novel multisensory system collecting high-resolution and georeferenced data on construction geometry, surface structure and humidity of the tunnel wall in a single measurement run. A high-speed scanner records the entire tunnel wall using several lasers with different wavelengths. A completely new deflection unit will be developed to ensure efficient and comprehensive detection. The laser provides photorealistic 2D images also displaying small objects or cracks of less than one millimeter. The system is eye-safe and works independently of lighting conditions. Moreover, an additional multispectral measuring unit will detect water inlets. In the future, the project partners will for the first time offer inspection services based on the multisensory system as a completely integrated, objective process.

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Eurostars E!12267 OpOrTunIty
In the framework of the Eurostars Program, the Federal Ministry of Education and Research (*BMBF*) is supporting German SME in developing innovative products in European project cooperation. The "E!12267 OpOrTunIty" Eurostars project is co-financed by the European Union.

Project partners

AKG-Group, Heitersheim (Germany)
With "VESTRA", AKG offers a BIM-capable software for infrastructure planning and road construction. The applications include road, railway, measurement, land acquisition and property management. The company employs over 80 staff at the Heitersheim location (near Freiburg i. Br.), Berlin, Hamburg, Cologne/Frechen, Vienna and Chur.

Amberg Technologies AG, Regensdorf-Watt (Switzerland)
Since 1987, Amberg Technologies has been the first choice for collection and refinement of information on civil infrastructures. Amberg Technologies is the world market leader in the field railway and tunnel measurements and sells its products and services through a network of over 30 distribution partners in more than 40 countries.

Fraunhofer-Institute for Physical Measurement Techniques IPM, Freiburg (Germany)
The Fraunhofer IPM develops tailor-made measurement techniques for industry. Many years of experience with optical technologies form the basis for high-tech solutions in production control, object and shape reconstruction, gas and process technology and in the field of thermal energy conversion.

Elaborarium SL, Madrid (Spain)
Elaborarium offers innovative technological solutions for inspection and monitoring in the fields civil engineering, mining and the environment. The company represents important companies and internationally acknowledged innovative institutions in Spain and Latin America. The TRACK portfolio includes application systems for management and maintenance of roads, railway infrastructures, bridges, tunnels, dams, embankments and slopes.

A novel measuring system should significantly simplify the inspection of tunnel constructions in the future: geometry, surface structure and water inlet are recorded by a single sensor system. The measurement data are made available in digital form and can be used for BIM processes. © Amberg Technologies AG | Image in print quality at www.ipm.fraunhofer.de.

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