Software for safe bridges

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Cracks in bridges are far from unusual. A new software program can now help to identify such damage at an early stage. Credit: Fraunhofer ITWM

Spanning deep gorges, rivers and freeways, bridges are an indispensable part of the traffic network. Yet their condition in Germany is appalling: In a survey carried out by the German automobile club ADAC in 2007, one in ten bridges out of the fifty that were inspected failed the test; a total of four were rated "poor" and one was even rated "very poor". The changing effects of weather and temperature, road salt and the increasing volume of traffic all take their toll on the material – quickly causing damage such as hairline cracks, flaking concrete, and rust penetration. If the bridge engineers fail to recognize these in time,

motorists, cyclists and pedestrians are endangered.

Until now, inspectors have always examined a bridge for visible damage directly on site. They cover cracks, for instance, with adhesive strips that expand if the crack gets larger. A new image processing program is set to make these inspection measures unnecessary in future.

Research scientists at the Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern have developed this software jointly with fellow scientists from the Italian company Infracom. "The software automatically examines the photos of a bridge for certain characteristics and irregularities, for instance marked discoloration," explains ITWM scientist Markus Rauhut. "Unlike a human, the tool doesn't miss any abnormalities – even minor damage is identified and signaled."

The challenge is that no two bridges are alike. They differ in terms of their shape, construction material and surface structure, while the color depends on the material, the dirt or fouling, and the degree of humidity. The software has to be able to handle these discrepancies. To make this possible, the researchers have extracted metrics from photographs that include the characteristically elongated shape of a hairline crack, the typical discoloration in damp places, and the structures of the material – which are different for a concrete bridge than for a steel bridge. All of this information is now stored in a database.

When the researchers load a photo into the program, the software compares the features of the new image with those of the saved images. If it detects any irregularities, it marks the respective area on the photo. The bridge inspector can now decide how serious the damage is. Does something need to be done? The faster any damage is identified and clearly categorized, the simpler and less expensive it is to repair it. The engineers have been using the new software successfully for the past six months to inspect bridges in Italy.

Source: Fraunhofer-Gesellschaft

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