Inspection of a Bridge

Digital Image Correlation: A powerful solution for Bridge Inspection and Monitoring

Service life of a bridge

Bridges are typically designed and constructed with a limited lifetime in mind, for example, 100 years. However, such lifetime objectives can be difficult to achieve due to unforeseeable environmental damage, higher than expected traffic loads or planning and construction errors.

These factors lead to a reduced safety classification (e.g. the Structural Evaluation Scale), which often means that speed or weight limits must be put on the bridge to ensure safety, or in the worst case requires extensive repair or a total rebuild.

Image 1: Experimental assessment of a bridge

For example, in December 2008, 72,868 bridges in the United States were categorized as structurally deficient, representing an estimated $48 billion in repairs, and 89,024 [1] were rated functionally obsolete, representing an estimated $91 billion in replacement costs.

Recent research has demonstrated that some bridges can be reclassified to higher safety levels based on experimental assessments, therefore extending the service life of the bridge and thus conserving ecological and economical resources[2].

[1] *https://en.wikipedia.org/wiki/National_Bridge_Inventory*

[2] *DGZfP Report Volume 66 CD EXTRA II Experimental Structural Safety Evaluation of Bridges*

Conventional measurement

Current bridge inspection technologies are typically based on strain gauges, accelerometers or distance meters. Such instruments have the weakness that they need to be mounted on the bridge, which can be very time consuming and costly, depending on accessibility to the bridge.

Image 2: Strain gauge measurement system mounted to bridge

Optical measurement solution

Dantec Dynamics is one of the leaders in non-contact optical surface measurement technologies.

Image 3: Speckle recognition

The Digital Image Correlation (DIC) technology has successfully been applied for evaluation of large structures such as bridges. The technology is based on recognition of speckle patterns naturally occurring on the object and

allows measuring displacements and deformations of the object under inspection with submillimeter accuracy.

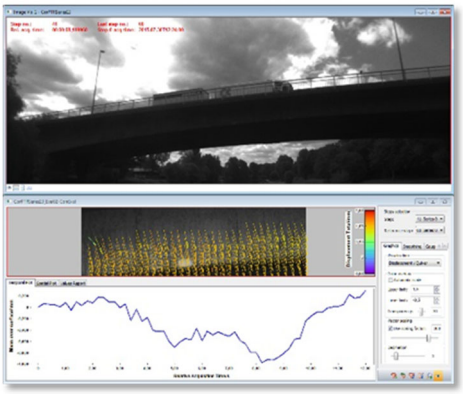

Image 4: Load test results - truck passing bridge

Benefits of Dantec Dynamics' optical measurement system

- Quick and easy setup with remote observation of the object to be inspected. The system also enables operation from long range
- Whole areas are evaluated, removing the disadvantages of single-point measurements
- With multiple cameras large areas can be evaluated
- Quick and easy analysis of displacements, strains, and cracks on-site and in real-time
- Various export formats to support post processing for country specific procedures and standards (e.g. BMVBS Nachrech-nungsrichtlinie)
- Works with natural surface structures, adding a simple marking, e.g. with a paint roller, increases the measurement resolution
- Accuracies approx. 0.1 mm for evaluation areas in the range m^2

Image 5: Load testing of Adenauer Bridge in Ulm, Germany at night

Q-400 Portable Digital Image Correlation

Q-400 Digital Image Correlation (DIC) is a 3D, full-field, non-contact optical technique to measure shape, deformation, vibration and strain on almost any material and shape.

Its flexible design opens a wide range of applications from microscopic investigations up to large-scale civil engineering measurements.

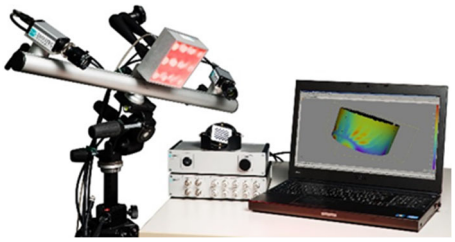

Image 6: Q-400 DIC System with two cameras and illumination option

DANTEC DYNAMICS Turn Measurements into Knowledge

Application Note_367_v1

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