Detecting Cavities in a Tubular Bridge with Prestressing Channels

Overview

- Nebest were required to perform a structural re-assessment for the modification of a tubular bridge.
- The Pundit PD8050 ultrasonic imaging system was used to detect cavities in the prestressing ducts.
- The team successfully identified some cavities and structural risks from a limited sample.

Challenge

To perform a structural re-assessment for the modification of a tubular bridge from the 1980s, with a span of 150 m, it was necessary to map the state of the prestressing. The prestressing system consists of channels with riveted prestressing steel (strands), which are subsequently filled with injection grout.

The evaluating structural engineer determined which cables in the duct are risky and should be investigated based on a theoretical pre-tensioning study. This case study focuses exclusively on the detection of cavities and badly filled parts of the prestressing ducts, using ultrasonic pulse echo technology.

Solution

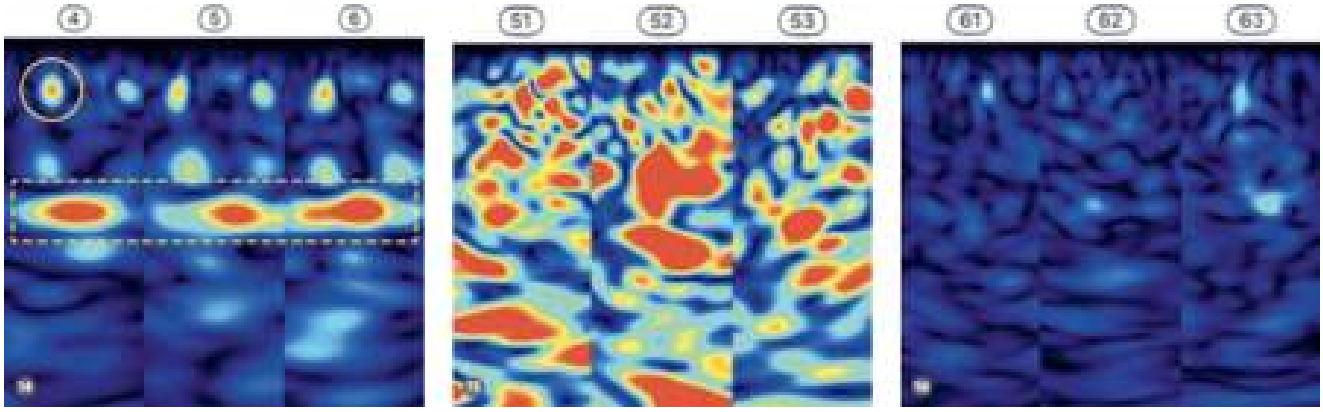
Ultrasonic pulse echo is a measurement technique suitable for carrying out one-sided measurements of concrete structures, to detect cavities and other defects non-destructively.

The Pundit PD8050 ultrasonic imaging system contains multiple transducers, which both transmit and receive. From the concrete surface, ultrasonic pulses are sent into the cross section, recording the returning echoes.

The engineer pressed the ultrasonic device against the concrete surface along the length of the prestressing channel at a fixed intermediate position repeatedly. Then all individual measuring points are software automatically put together to form a line scan.

Ultrasonic testing with the PD8050 enables the team to map relatively small cavities. In general, we can say that if the cavity cannot be found, it is probably too small to significantly affect the functioning of the structural component.

One of the results usually follows from the measurements as shown in the Figures below. These form the basis for interpretation of the measurements.



Measurement results from the PD8050

Results

The ultrasonic measurements showed various indications of the presence of cavities in the prestressing channels. The investigation carried out was based on a limited sample, with less than 1% of all prestank channels being investigated.

Even based on this very limited sample, some cavities and structural risks have been identified. Is this a "fluke" or will additional research reveal a generic problem? The initial results are currently being incorporated into the structural assessment. It will then be decided which follow-up steps are necessary.

Conclusion

Ultrasonic testing currently appears to be the only practical method for fast and accurate detection of cavities in prestressing channels.

The investigation shows that for the preservation of concrete structures with post-tensioned prestressing in channels with injection grout, performing only visual inspections is insufficient. For example, a bridge may look flawless on the surface, but under the skin, damage is present that can have a significant impact on the quality and residual life of the object.

By paying adequate attention to examination and using accurate investigation methods, unpleasant surprises can be avoided. Ultrasonic testing with the Pundit PD8050 can provide a solution here in detecting these cavities, which are a major risk for the development of corrosion on the prestressing steel.

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