By the way, you already know our industrial grade accredited inspection services?

- Accredited laboratory in line with DIN EN ISO / IEC 17025, to qualify and validate new non-destructive testing (NDT) processes for industrial applications
- Accelerated time-to-market and opportunity for qualified, norm-compliant deployment in industrial applications as well as for complete new in-house developments or custom adaptation of innovative NDT technologies, even in fields where norms have not been established
- Certification of the corresponding quality management system in accordance with DIN EN ISO 9001

TÜV SAAR CERT ISO 9001

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-11140-09-00

Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren IZFP

Campus E3 1
66123 Saarbrücken

+49 681 9302 0

info@izfp.fraunhofer.de
www.izfp.fraunhofer.de

Fraunhofer IZFP

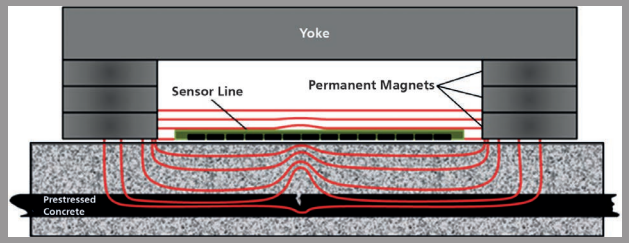
FRAUNHOFER INSTITUTE FOR NONDESTRUCTIVE TESTING IZFP

BETOFLUX

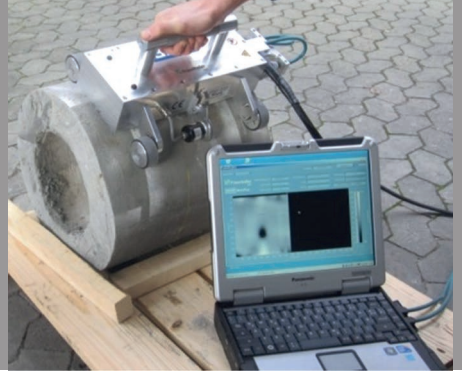
PORTABLE MAGNETIC FLUX LEAKAGE INSPECTION SYSTEM FOR DETECTING CORROSION DAMAGE IN PRESTRESSED CONCRETE POLES

BetoFlux in operation
© Uwe Bellhäuser

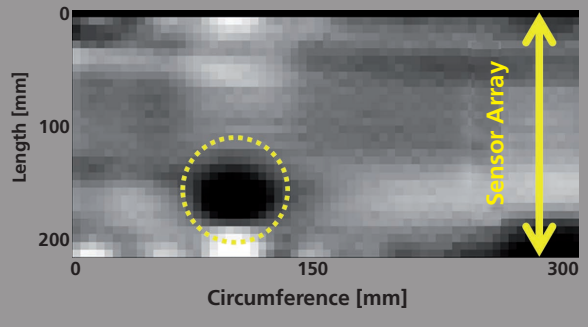
Concrete poles with railway overhead lines;
© Uwe Bumann - Fotolia



Magnetic field lines at damaged prestressing steel



BetoFlux system



Result representation of a defective concrete pole

Situation

For decades, prestressed concrete poles have been used on a wide scale in transport infrastructures to support railway and tram overhead lines among other things. The combination of static and dynamic loads and corrosive chemical environments makes ferromagnetic prestressing steels susceptible to stress corrosion cracking. This mainly affects the exposed area of the poles where animal excrement, road salt and leakage currents promote corrosion.

In the recent past, there have been instances of concrete poles buckling and shattering for no apparent reason. Upon examining the damage, engineers found indications of stress corrosion cracking, which is concealed by the outer concrete shell and only visible to the naked eye at an advanced stage. Existing inspection methods place mechanical stress on the poles, which can lead to further damage. In order to comply with radiation protection guidelines, X-ray-based testing, although a viable approach, requires significant effort.

Magnetic Flux Leakage Inspection

Magnetic flux leakage inspection is used to detect crack-like surface defects in ferromagnetic materials. The method is based on the same physical effect as magnetic particle testing, a widely used, standardized inspection method for steel components. When an external magnetic field is applied to the sharp-edged discontinuities of a component`s surface, additional magnetic dipoles form, which causes a near-surface magnetic leakage field. This effect can be exploited for the nondestructive defect testing of ferromagnetic prestressing steels.

BetoFlux – Portable Manual Inspection System

As a hand-held device that is guided around the circumference of the concrete pole, the BetoFlux inspection system was designed especially for portable applications. The prestressing steel is magnetized using an integrated permanent magnet yoke. The direction of the magnetic field lines depends on the degree of damage in the prestressing steel and indicates areas affected by fissures. The use of permanent magnets saves energy, an important aspect for portable applications.

A sensor array consisting of 32 low-noise Hall sensors detects the magnetic leakage field signals. The signals are then digitized and transferred to a laptop PC via a USB connection. The BetoFlux inspection system is completely powered by the laptop battery via the USB connection. The system uses special filters to highlight cracks and the location of the prestressing steels and thus helps identify the presence and analyze the condition of prestressing steel.

Benefits

- Fast inspection
- Intuitive representation of the location and condition of ferromagnetic prestressing steel
- Specifically designed for portable use
- Easily adapted to different concrete pole diameters
- Less effort compared to alternative inspection methods such as X-ray
- Minimal risk of additional pole damage

The underlying research project is being funded through the German Federal Ministry for Economic Affairs and Energy (BMWi) ZIM program based on a resolution passed by the German Bundestag. The research and development was performed in close cooperation with ZWP Anlagenrevision GmbH, a nondestructive testing specialist based in Beckingen, Germany.

Gefördert durch:

Bundesministerium für Wirtschaft und Energie

aufgrund eines Beschlusses des Deutschen Bundestages

ZWP ANLAGENREVISION