Bridge Cables – Non-Desctructive Testing

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Abstract

Non-destructive testing (NDT) is essential for maintaining the safety and functionality of bridge cables. This paper reports about a research project investigating the potential of magnetic inductive testing (MIT) for non-destructive testing of bridge cables in free length in combination with ultrasonic testing (UT) in the area of the end connectors. The MIT method is non-invasive and uses magnetic fields to detect defects in metallic materials such as bridge cables and is accepted as testing method for running ropes since many years. The project evaluated the effectiveness of the MIT method in detecting defects such as broken wires, corrosion symptoms, and other imperfections. The results demonstrate that MIT is a promising NDT technique for bridge cables, providing valuable information for maintenance and repair purposes. The paper also highlights the need for further research to optimize the MIT technique and its applicability to different types of cables and conditions.

Keywords: NDT, non-destructive testing, MIT, magnetic inductive testing, UT, ultrasonic testing, bridge cable, wire

1 Introduction

When constructing bridges with large spans, there is virtually no alternative to the use of high-strength tension members. A distinction is made between suspension bridges, cable-stayed bridges and rope bridges, the latter being primarily reserved for non-motorized traffic due to the absence of a stiffening girder. As a rule, full-locked coil ropes are used here, although the use of parallel strand systems is becoming increasingly widespread. Both types of tension members are regulated for Europe in EN 1993-1-11 [1]. The corresponding protection goals are adequate safety of the bridge in the ultimate limit state, safety in use in the permanent design situation and adequate durability with low maintenance requirements.

The required robustness and sustainability are particularly sought in the use of tension members in bridge structures, since the tension members can either not be replaced at all or only at great expense. As one of the main components, the tension members therefore essentially determine the service life of a bridge structure.

Damage to the tension members used manifests itself in particular in the form of wire breaks, which can have various causes.

In order to ensure a consistent level of safety here, regular inspections are essential. Since visual inspections can, by their very nature, only detect surface damage (and may be subject to major limitations due to the presence of corrosion protection layers), magnetic inductive testing (MIT) is an option here, taking into account the technical and economic feasibility. The principle of MIT has been known for many decades and has been used in the past for testing tension members, especially in ropeway construction and in the testing of mining ropes.

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