

Correlation between the rust colour distribution rate and corroded surface characteristics of galvanized steel wires

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Abstract

This study investigated the correlation of the rust colour distribution rate provided by using a digital image colour analysis system and the corroded surface characteristics provided by using a non-contact surface mapping technique. The ratio of zinc-specific white rust to iron-specific red rust, which characterizes the corrosion status of bridge wires, can be quantified by introducing the digital image colour analysis system. Regarding the correlation between the rust colour distribution rate and the corrosion surface characteristics, it was found that the corrosion loss rate and the pit depth increase as the white rust rate decreases.

Keywords: suspended bridge cables; cable corrosion; appearance evaluation; inspection technique; digital image colour analysis; 3D laser scanner.

1 Introduction

Preventive maintenance against corrosion and breakage of suspended bridge cables is indispensable. In the main cable of the long-span suspension bridges, there is a measure to stop the corrosion process by cable dehumidification system, but effective countermeasures have not yet been established for cables of short and medium span suspension/cable-stayed bridges. Therefore, it is necessary to improve inspection and repair techniques to reduce the probability of cable failure [1, 2].

The objective of this paper is to clarify the correlation between the rust colour distribution rate and the corroded surface characteristics of high-strength galvanized steel wires used for suspended bridge cables. This study is organised as follows: Section 2 presents the specification of specimens and experimental methods employed to create corroded wires in a laboratory environment.

Section 3 presents a description and analytical methods of the rust colour distribution analysis undertaken. Section 4 presents a description of the surface roughness measurement undertaken. The corroded surfaces were analysed using spatial indicators in terms of sectional area loss and corrosion depth to explore correlation with the rust colour distribution rate observed in the rust colour distribution analysis. Section 5 summarises the main findings of the present work.

2 Corroded wire specimens

2.1 Galvanised steel wires

The galvanized steel wires with a diameter of 4.89 mm and tensile strength of 1,670 MPa were used in this study. The amount of the zinc galvanized layer is 300 g/m² which corresponds to about 50 µm layer in thickness. Figure 1a shows the appearance of un-corroded single wire specimen. This type of high-strength wires is mainly used for