Risk Assessment of Corroded Bridge Wires using 3D Laser Scanner

Kazuhiro Miyachi

Japan Construction Method and Machinery Research Institute, Fuji, Shizuoka, JAPAN

Shunichi Nakamura

Tokai University, Hiratsuka, Kanagawa, JAPAN

Marios Chryssanthopoulos

University of Surrey, Guildford, UK

Contact: snakamu@tsc.u-tokai.ac.jp

Abstract

Corroded galvanized steel wires were produced and the surface roughness was measured by a 3D laser scanner. The scanned data was analysed and the depth, shape and distribution of corrosion pits were recorded. The corroded wire specimens were then cyclically loaded and the breakage positions were found. The breakage positions agreed with the severest corroded part which were found by the 3D scanner. These experiments and measurements validate that the 3D scanner can detect the weakest part of corroded wires and can predict the possible breakage positions. A simple analytical method was proposed to predict the life of corroded wires using S-N curves of corroded wires at different corrosion levels. This method was applied to a cable-stayed bridge and the remaining life of stays was found. The measurement system with 3D scanner and the associated life prediction method can be practical and useful for risk assessment of corroded wires.

Keywords: bridge wires; corrosion; 3D laser scanner; cable breakage; life prediction, risk assessment.

1 Introduction

Cables and hangers of old suspension bridges and stays of cable-stayed bridges have been exposed to severe corrosive environment and often suffer from steel corrosion [1]. Some of the bridge wires can been broken, reducing the bridge's load bearing capacity.

For risk assessment of corroded wires, information on corrosion Is essential: such as depth, width, length and distribution of corrosion pits. This information would be very useful in assessing the risk of cable breakage. However, there is not an established technology so far to obtain sufficient data on the development and assessment of corrosion. In this study a 3D laser scanner was used to collect the required information of corroded wires, through which wire breakage positions were estimated and compared with fatigue test results.

This study was carried out in six steps. First, corroded wires were produced. Second, their surface roughness was measured with a 3D laser scanner. Third, the scanned data was analysed and the depth, shape and distribution of corrosion pits were obtained. Fourth, the corroded wire specimens were cyclically loaded and the breakage positions were found. Fifth, the breakage position was compared with the corrosion pit information obtained by the 3D

https://doi.org/10.2749/stockholm.2016.0098
Distributed by structurae