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Structural Health Monitoring of Adhesive Bonded Steel Patches for the Reinforcement of Fatigue-Damaged Bridges Using Distributed Fiber Optic Sensors

Tommaso Baudone
baudone@verrotec.de
Verrotec GmbH
Mainz, Germany

Hinrich Grefe
h.grefe@tu-braunschweig.de
Technische Universität Braunschweig, Institute of Joining and Welding
Braunschweig, Germany

Garnik Arutyunyan
arutyunyan@verrotec.de
Verrotec GmbH
Mainz, Germany

Mascha Baitinger
mascha.baitinger@verrotec.de
Verrotec GmbH
Mainz, Germany

Elisabeth Stammen
e.stammen@tu-braunschweig.de
Technische Universität Braunschweig, Institute of Joining and Welding
Braunschweig, Germany

Klaus Dilger
k.dilger@tu-braunschweig.de
Technische Universität Braunschweig, Institute of Joining and Welding
Braunschweig, Germany

ABSTRACT

In steel bridges, unforeseen fatigue damages can occur in structural details subjected to cyclic loads, making repair measures necessary. Adhesive bonding can provide a valid alternative to the traditional strengthening methods, resulting in an extension of the service life of the structures with lower costs and less material. In this context, adequate strain monitoring is a crucial tool in evaluating
the behavior of the adhesive bond and safety assessment of the repaired structure. In this study, the authors present the results of laboratory tests where steel plates are reinforced on one side using adhesively bonded patches and subjected to quasi-static load. Optical fiber sensors (FOS) were applied in different positions of the specimen (external surface of the plate, outer surface of the patch, embedded in the adhesive on plate-side and patch-side). The test objective is to confirm the ability
and good performance of the FOS to monitor fatigue damage occurring in the steel plate. The fatigue damage is simulated by reducing the cross section of the steel plates by means of holes of small diameter. The obtained results are analyzed to evaluate the capabilities of the sensors to capture the damage and choose the optimal fiber position among the four described above.

Keywords: Steel bridges, Adhesive-bonded joints, Fiber optic sensors, Structural health monitoring

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