Full-scale fatigue testing with initial damage as validation of FRP road bridge design

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Abstract

Bridges built in fibre reinforced polymers (FRP) bring the important advantage of low-maintenance costs, thus reducing the total cost of ownership. Various kinds of FRP-constructions have been built hundreds of times in the last decade, the technology is now beyond the stage of infancy. The Province of Groningen has positive experiences with bridges and lock gates built in FRP. For a 8m span lifting bridge for road usage, the province prescribed FRP as the structural material for the deck, and in parallel required additional validation of the material's fatigue resistance through full-scale testing.

Keywords: Movable bridge; FRP; full-scale testing; impact damage; fatigue.

1 Introduction

In civil engineering FRP is a relatively new material. During the last decade, it is increasingly used in bridges and other civil engineering structures. As a result, frameworks for acceptance and quality assurance are in place or being established in various countries. Due to the relatively small number of FRP structures compared to those built in conventional structural materials and their large geographical spread, these frameworks still have a status of guidance and have not yet reached the status of standards, such as Eurocodes.

In order to progress rather than wait, the road authority of the Province of Groningen (the Netherlands) procured the FRP 'Pijlebrug' in a competitive market, giving room to the material and the FRP supply chain to prove itself. The client has been following the emergence of FRP as a structural material for multiple years, and already commissioned FRP lock gates in 2011. The key reasons for opting for FRP were to:

- obtain a relatively lightweight bridge deck. The architectural design of the bridge left a relatively small space for the counterweights in de towers of the bridge;

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