The Instrumentation and monitoring of the Vårby Bridge

Mattias NILSSON
Bridge Engineer, M.Sc.
Ramböll Sverige AB/LTU
Luleå, Sweden
Mattias.nilsson@ramboll.se

Kjell ERIKSSON
Associated Professor
Luleå Univ. of Tech (LTU)
Luleå, Sweden
Kjell.eriksson@ltu.se

Gerard JAMES
Consulting Engineer, Ph.D
Projektengagemang AB
Stockholm, Sweden
Gerry.james@glocalnet.se

Peter COLLIN
Professor
Ramböll Sverige AB/LTU
Luleå, Sweden
Peter.collin@ramboll.se

Summary

Numerous cracks have been discovered in the Vårby Bridge near Stockholm, Sweden. All cracks are found at the junctions between the cross girders and the main girders, more specifically, at the welds connecting the vertical web stiffeners to the top flanges of the main girders. The cracks might possibly be causing serious problems if they are allowed to propagate through the entire length of the weld, thereby permitting out-of-plane bending of the main girder web. In order to identify the reason for the observed cracks, an ongoing investigation under the commision of the bridge owner was started in the spring of 2009. One conclusion so far, is that the observed cracks conclusively are a result of fatigue

As a part of a master thesis, FEM-modelling is currently under way. As the fatigue process is distortional, the propagation phase of the observed cracks might slow down or even stop. One task will be to determine the stress intensity factor versus crack length relationship in order to model a growing crack. The final chosen method of refurbishment will be based upon the results of the study and will be implemented in cooperation with the bridge owner.

Keywords: fatigue, steel, composite bridges, design, bridge measurements, maintenance, distortion, fracture mechanics, FE-modelling, fatigue tests,

1. Introduction

In the summer of 2006 during a routine inspection of the Vårby bridge, numerous cracks were found [1]. Generally, all the cracks occurred at the junctions between cross girders and the main girders, specifically at the welds connecting the vertical web stiffeners to the top flanges of the main girders. All the cracks were located in the spans of the bridge, i.e. at cross girders with a single one side vertical main girder web stiffener, and none were observed at the supports (where the web of the main girders is fitted on both sides with stiffeners).

The reason for the observed cracks was believed to be secondary effects of restraint when the rigid concrete deck is rotating above the main steel girders.

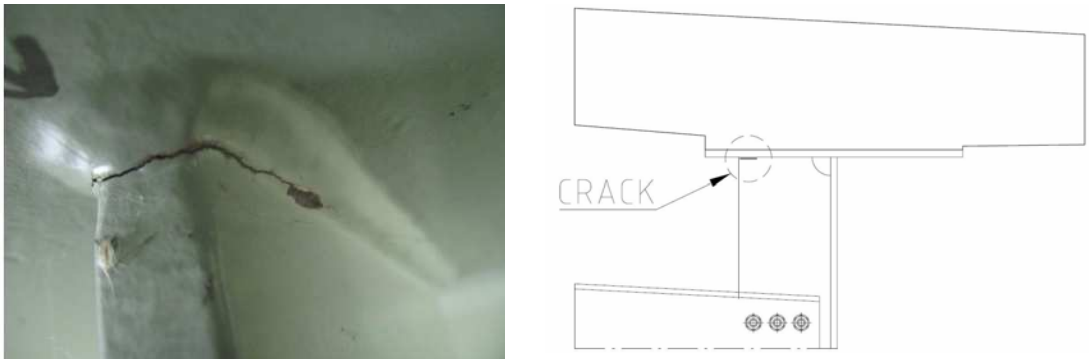

Fig. 1: One of the observed cracks

https://doi.org/10.2749/222137810796024628
Distributed by structurae