Fatigue Evaluation of a Railway Steel Bridge Based on In-site Test Data

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Summary

The existing railway steel bridges are often required to carry an increasing volume of traffic, higher seep and heavier trains, so China bridge owners pay more attention to the actual fatigue life and service safety of such structures. Recently twenty three long fatigue cracks were found at the low flange connection plates between end cross-frames and main girders for each span of Wei River Bridge, a railway bolted and welded steel plate girder bridge. In current paper the fatigue damage initiation and propagation in connection plates are simulated by finite element models, and the fatigue and fracture safety of Wei River Bridge is evaluated based on field test data. According to the evaluation results, the retrofitting and strengthening strategy is recommended.

Keywords: bolted and welded steel bridges; finite element model; fatigue; fracture; evaluation; retrofitting and strengthening.

1. Introduction

Fatigue and fracture damage often leads to steel structures failure especially for existing steel bridges, so some researchers paid more attention to deal with fatigue and fracture evaluation of existing bridges [1,2,3]. Because of high economic increasing rate existing railway steel bridges in China are required to carry an increasing volume of traffic, higher seep and heavier trains [3]. So bridge owners pay more attention to the actual fatigue life and service safety of such structures. The case study structure, Wei River Bridge, a railway bolted and welded steel plate girder bridge with twelve simple supported spans of 12x26.15m, was built in 1982 using steel Q345 with yield strength of 345MPa (Fig. 1). Recently twenty three long fatigue cracks were found at the low flange connection plates between end cross-frames and main girders for each span. In order to prevent crack propagation, stop holes were drilled ahead the crack tips (Fig. 2). The strain histories near the crack was measured by strain gauges for one day (Fig. 2). In current paper the fatigue damage initiation and propagation in connection plates are simulated and analyzed by finite element models, and the fatigue and fracture safety of Wei River Bridge is evaluated based on field test data.

Fig. 1 *Wei River Bridge*