

Shear Buckling Test and Prediction of Shear Load-carrying Capacity for Steel Girder Bonded CFRP on Its Web

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Summary

Loss of cross section due to corrosion is a main factor in deterioration of steel bridges. Therefore, carbon fiber reinforced plastic (CFRP) is paid to attentions for repairing and reinforcing the steel bridges since CFRP is light weight, high strength and high durability. Although many researches relating to this topic have been reported so far, previous researches mainly focused on the application of CFRP to axial or bending members. On the other hand, most of the corrosion is found on web at the end of main girders. Investigations on repairing and reinforcing corroded web using CFRP have been reported few. In this research, shear buckling test for steel girder bonded by CFRP sheets on web is carried out. Low elastic putty layers are inserted between steel and CFRP sheets in order to improve the performance of out-of-plane deformation. An evaluation method of shear strength of the girder is also proposed.

Keywords: Carbon Fiber Reinforced Plastic (CFRP); steel girder bridges; corrosion; shear buckling; repair; reinforcement.

1. Introduction

Recently, corrosion of steel bridge girders became a common problem in many countries. In Japan, the number of aging bridges steadily increases in the near future. The breakings of members in two steel truss bridges have already been found. Therefore, maintenance of existing bridges is important issue.

Loss of cross section due to corrosion is a main factor in deterioration of steel bridges. As the conventional repairing and reinforcing method, steel plates have been attached on corroded members. However, this method is restricted under service time because attachment works require heavy machineries. Therefore, efficient and rational method for repairing and reinforcing damaged steel bridges is strongly needed.

In this situation, Carbon Fiber Reinforced Plastic (CFRP) has been paid to attention because it is light weight, high strength and high durability. Many researches relating to the application of CFRP to steel structures have been reported [1]-[3]. Previous researches mainly focused on the members subjected to normal stress, flanges in steel girder bridges and chord members in steel truss bridges.

In general, corrosion is mostly found on web at the ends of the steel girders where out-of-plane deformation is dominant under shear force at the ultimate state. Although debonding of CFRP under large deformation becomes a problem, investigations on this countermeasure are few [4], [5].

Therefore, the objective of this study is to investigate the reinforcement effect and debonding behaviours of CFRP bonded on web in a steel girder. For this purpose, shear buckling test is carried out. Based on the test results, an evaluation method of ultimate strength is proposed.