Experimental Study on Repairing Method for Corroded Steel Member by Carbon Fiber Sheets

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Summary

This paper describes the applicability of CFRP bonding to the repair of corrosion damaged steel members. Tensile and flexure tests using steel plate and steel girder with CFRP were carried out. It was confirmed, until the peeling of CFRP, that CFRP-steel composite action was ensured. Moreover, the effect of the design parameters such as, “amount of reinforcement”, “range of reinforcement” and “bonded length” on the stress reduction was made clear. Based on this experimental study, the design method for the repair of corroded steel members by CFRP bonding was proposed.

Keywords: corrosion, repair, carbon fiber reinforced plastic (CFRP)

1. Introduction

Steel members deteriorated due to the corrosion have been repaired by the combination of surface cleaning and repainting, however, when the corrosion has reached fairly advanced stage, causing overstress, this measure will be inadequate. The repairing method in this case will be the stress reduction measure such as steel plate attachment by bolting or welding to the corroded member, replacing the member and so on. However, the above measures need large-scale scaffold at the site.

In this situation, it is very useful to develop an effective repairing method for the actual structures in use. In recent years, for the repair/reinforcement of the corroded steel members, the bonding of carbon fiber reinforced plastic (Hereafter, we call “CFRP”) made of carbon fibers hardened by submersion in resin has been drawing attention[1]. It provides high elasticity and high strength, and is easy to handle because of lightness. Moreover, it has been reported that CFRP is the material with high durability.

This paper describes mechanical characteristics of CFRP bonded steel through experiment. Based on the experiment, the design method for the repair of corroded steel members is proposed.

2. Tensile Testing

2.1 Testing method

CFRP bonded steel plates are subjected to tensile force. The load-strain relationship is measured and, at the same time, the load when the peeling of CRFP from steel plate occurs is detected. Fig.1 shows a test piece whose width is 60 millimeters and length is 800 millimeters. The material grade of it is SS400 whose measured yield stress is given in Table 2. Table 1 shows the design parameters. Test pieces of Series-L have 3,5,7 and 10 layers of CFRP lamination on both sides of the steel plate

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