A method for replacing lower flange splice plate of a steel I-girder connection using BPL

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Abstract

In recent years, corrosion damages of the steel I-girder bridge joints have been reported. With the increasing demand for the replacement of splice plates of the damaged joints, good workability without using temporary supports is required when considering the cost and time necessary to execute such works. In the present study, FEM analysis has been conducted in order to propose a new replacing method for the lower flange splice plates in steel I-girder, which uses a bypass device of steel plate named BPL that is attached to the web panel. From the analytical results, it has been confirmed that using the BPL and replacing the lower flange splice plates, the stress at the lower flange splice plates is transferred to the BPL and redistributed to the new lower flange splice plates after the removal of BPL. It has also been clarified the geometrical configuration of the BPL that can reduce the stress at the web effectively during replacement of the lower flange splice plates.

Keywords: *bypass method, FEM analysis, replacement of lower flange splice plate*

1. Introduction

It is difficult to secure the thickness of the corrosion protection at the protruding corner parts of the bolt heads and nuts in high-strength bolt friction joints of steel I-girders, and corrosion damages, such as shown in Figure 1 have been reported [1]. In particular, corrosion damages may occur in the splice plate, where high-strength bolts are located and where rainwater tends to accumulate, resulting in a decrease of the net section yield strength, due to the reduction in cross-sectional area and a decrease in the sliding resistance, due to the reduction in the bolt axial force. In case the thickness of the splice plate is significantly reduced by corrosion, its replacement will be necessary. In order to replace the splice plates, it is necessary to share the stress acting on the plates with other members. For example, it is well known that the auxiliary member (hereinafter referred to as "bypass device") as shown in Figure 2 is often installed to the corroded damaged part of the main girder, and then the corrosion damaged part is replaced by a new member. This method (hereafter referred to as "bypass method"), has been already adopted and its effectiveness also proven in past researches [1-2]. However, this method requires a large bypass device to be installed under the bottom flange, and it might be difficult to install it if the space under the girder is limited. Therefore, it would be more desirable if corrosion damage at the joints of steel I-girders could be easily repaired

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