Effect on buckling behavior and seismic performance of steel piers corrosion-damaged near ground

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Abstract

In Japan, many steel structures were constructed during the period of the high economic miracle, and they are now more than 50 years old and are aging. Corrosion has been confirmed at corners and the boundary of concrete-wrapped concrete in steel piers. It was found that corrosion damage at the corner of steel piers causes a decrease of seismic performance in our previous investigations that carried out seismic response analysis. Subsequently, in this study, the effect of corrosion damage at the near ground edge of steel bridge piers with a rectangular cross-section was investigated in detail on the buckling behaviour and seismic performance of structures. As a result, it is found that the buckling at the base causes a decrease in load bearing performance compared to the buckling in the entire panel. It is necessary to properly maintain to prevent buckling at the base caused by corrosion.

Keywords: seismic performance, buckling behavior, steel bridge pier, corrosion, nonlinear FEM

1 Introduction

Many earthquakes have occurred in Japan. In recent years, examples of such earthquakes include the 2004 Mid Niigata Prefecture Earthquake, the 2011 off the Pacific coast of Tohoku Earthquake, and the 2016 Kumamoto Earthquake. In addition, at the plate boundary from the Suruga Trough in Suruga Bay to the Nankai Trough off Shikoku, huge earthquakes of magnitude 8 class have repeatedly occurred every 100 to 150 years. Currently, more than 70 years have passed since the last Nankai Trough earthquake, and it is said that it is unknown when the next Nankai Trough earthquake will occur.

In Japan, many steel structures were constructed during the period of the high economic miracle, and they are now more than 50 years old and are aging. Corrosion has been confirmed at corners and the boundary of concrete-wrapped concrete in steel piers. Corrosion at the boundary of concrete-wrapped concrete is shown in Figure 1. Considering this situation, it is a social issue to ensure seismic safety of aging steel structures. However, it is very difficult to replace all of them and build a new one. Therefore, it can be said that it is important to extend the life of steel structures by performing appropriate maintenance [1].

https://doi.org/10.2749/ghent.2021.1392
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