



Chain reaction failure analysis for tied arch bridge considering cable corrosion

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Abstract

Cable corrosion has been becoming significant issues for the bridge structures having with cable or hanger materials, such as suspension bridges, cable-stayed bridges, tied arch bridges and so on. Many of these bridges, which were built in 1980s and 90s, are possibly surviving under the cable corrosion. Existing tied arch bridge was collapsed in Taiwan in 2019. It is reported that cable corrosion is the one of the main reasons to trigger the entire bridge collapsed. In this study, the numerical bridge model inspired by the Taiwan arch bridge was designed for analyzing the dynamic analysis of chain reaction failure considering with the cable corrosion. The corrosion of cable is represented by the decreasing of yield stress and breakage strain, and the first ruptured cable which is represented by the decreasing tensile force instantly. According to this analysis, if the cables are corroded significantly, the chain reaction failure would be occurred.

Keywords: Cable-stayed bridge; cable corrosion; chain reaction analysis; dynamic analysis; FEM.

1 Introduction

Corrosion is one of the most significant issues for the steel structures, especially corrosion of the cables is critical to the bridges which have cables. Anti-corrosion and/or anti-rust are often painted on the surface of cables to avoid the cable corrosion, however, the painting would be peeled off due to aging. These cable corruptions led to significant accident including entire bridge

collapses in many countries, therefore cable corrosion should be determined and examined the effect to the bridges, especially built in 1980s to 1990s. For example, a tied-arch bridge in Taiwan was totally collapsed, which was reported the cause of bridge collapses was due to significant cable corrosion. This collapse was also pointed out that it was “zipper-type collapse”, which the first cable ruptured the second and third cables were ruptured one after the other [1].