TIME-DEPENDENT SAFETY OF STEEL BRIDGE GIRDERS DUE TO THE FATIGUE AND CORROSION

by

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Over time, corrosion can deeply affect the service life of the steel bridges. In previous research, the corrosion models were based on the mean value of corrosion penetration without consideration for their standard deviation. The research discussed herein will develop a methodology to take into account the uncertainty of the corrosion penetration.

In bridge design standard (AAHSTO LRFD 2012), the fatigue limit states which are based on the stress in girders are very convenient for bridge design. However, it is impossible to investigate the safety level of girders over time, based on the code prescribed fatigue limit state functions. Therefore, this research will develop two time-dependent fatigue models. The first model is developed based on the damage accumulation index, which is proportional to the annual daily truck traffic (ADTT), equivalent moment in girders, numbers of cycles per truck, etc. In this model, the equivalent moments and numbers of cycles per truck are obtained from weigh-in-motion (WIM) data nationally. The second model is based on the strength margin function in which it is assumed that the

yield strength of steel is inversely proportional to the damage accumulation index. Graphs of reliability indices over time will be plotted for two fatigue models.

It is well-known that the deterioration of steel girders can reduce the fatigue capacities of bridges. This work will investigate both the effects of corrosion and fatigue of steel girders on the performance of the bridges. Based on the reliability analysis of corrosion-fatigue models, this research will develop the time-dependent reliability indices of steel girders in bridges due to the combined effects of corrosion and fatigue. These indices represent the time-variant safety of steel girders subjected to both corrosion and fatigue.

I would like to dedicate this work to my parents, Thai Hang and The Viet, and my brother Viet Cuong

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