



Evaluation of Cable Force Changes Effects on Cable Stayed Bridge

Theint Theint Thu Soe ^{a*}, San Yu Khaing ^b

^a Civil Engineering Department, Mandalay Technological University, Mandalay, Myanmar.

^b Professor, Civil Engineering Department, Mandalay Technological University, Mandalay, Myanmar.

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Abstract

The proposed bridge, which is cable stayed bridge crosses the Hlaing River that flows through Western Yangon. It was completed in 2000 and is currently used to connect Insein Township with Hlaing Tharyar Township. It has the 20 years' service life. It requires the inspection and the evaluation of the real condition of the structure. As cable element plays an important role in cable structures, evaluation of the real state of the stay cable is one of the main focuses of the cable stayed bridge. Firstly, in the research work all cables are inspected to evaluate the current condition of the cables with included visual inspection and vibration-based cable force measurement method. With the help of static and moving load analysis, the effect of force change cables in which the successive force changes are considered, and the possible cable loss effect on the structural behavior of the bridge are also investigated. The finite element model of the cable stayed bridge is developed based on the geometric shape and material properties from MOC and is modelled with finite element software MIDAS Civil. The tension forces obtained by inspection over years (2000 to 2018) using vibration-based measurements method are compared with the measured intact cable forces. According to the results of the data analysis, it is observed that the cables force variations of the seven cables are abnormal conditions. In order to evaluate the condition of a bridge effected by cable force variation, the two parameters are considered; percentage increase in tension stress of all cables and percentage increase in deflection of the deck. The present study describes the structural response of the bridge in order to evaluate the actual safety of the bridge with abnormal force change cables, and also examines the consequences of one cable failure.

Keywords: Cable Stayed Bridge; Inspection; Cable Force Change; Parameters; Evaluate.

1. Introduction

The basic structural form of a cable-stayed bridge is a series of overlapping triangles comprising pylon, girder, cable stay and cable anchorage [1]. Cable element plays an important role in cable structures such as cable stayed bridge, suspension bridge and extradosed bridge, during their life, the cables which are frequently exposed to severe environmental conditions. In Myanmar, old cable supported bridges was affected by severer corrosion in main cable which caused the collapse of the entire bridge with the exception of pylons during its service life [2]. Moreover, stayed cables comprise the main structural components of a cable-stayed bridge, and the changes in inclined cable force significantly affect the state of the whole structure [3]. The inspection of a bridge, especially the inspection of cables, after its completion, is critical to locate unreliable components and to ensure restoring its stability. The common methods to evaluate the condition of cables include visual inspection, vibration-based cable force measurement, laser-based force measurement, ultrasonic assessment, etc. [4].

* Corresponding author: thutheinttheint@gmail.com

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