A Parametric Study on the Ultimate Behaviors of Multi-Span Suspension Bridges

Dong-Ho CHOI
Professor, Ph.D.
Dept. of Civil Engineering, Hanyang University, Seoul, Korea
samga@hanyang.ac.kr

Ho-Sung NA
Ph.D. Student
Dept. of Civil Engineering, Hanyang University, Seoul, Korea
saintna@hanyang.ac.kr

Sun Gil GWON
Master Student
Dept. of Civil Engineering, Hanyang University, Seoul, Korea
verysoon@hanmail.net

Dong Ho YOO
President, P.E.
ENVICO Consultant, Seoul, Korea
dyoo@envico.biz

Chang MOON
Senior Engineer
ENVICO Consultant, Seoul, Korea
doorwin@envico.biz

Summary

Multi-span suspension bridges show greater vertical deflection of the girders and greater longitudinal displacement of the towers, as compared to typical three-span suspension bridges with the same center span length. These characteristics are affected by the sag ratio of the main cable, live load conditions, the strength of the main cable and the boundary conditions between the tower and girder. Therefore, to demonstrate the structural characteristics of the entire system, we analyzed the ultimate behavior of multi-span suspension bridges by considering these parameters.

Keywords: multi-span suspension bridges; ultimate strength; boundary condition; sag ratio.

1. Introduction

The multi-span suspension bridge structure is more effective than the typical three-span suspension bridge when an ultra-long span length is required [1]. These bridges are commonly constructed because it is not necessary to have large center anchorages, unlike a typical three-span suspension bridge. A multi-span suspension bridge has a smaller main cable section and a shorter tower than a typical suspension bridge.

In spite of these advantages, multi-span suspension bridges can experience large deflections at the girder and center tower due to live loads because of the center tower's lower rigidity. This problem has been recognized as a significant design issue [2,3,4,5], but there has been little research to clearly define the structural characteristics of multi-span suspension bridges.

We built parametric study models to clarify the structural characteristics of the multi-span suspension bridge by referring to a three-span suspension bridge with a main span length of 1545 m being constructed in Korea. Parametric analyses were performed while considering various main cable strengths and sag ratios, live load conditions, and the boundary conditions between the tower and girder. We analyzed the ultimate behaviour of the entire system.

2. Parametric study model for multi-span suspension bridge

2.1 Design specifications

Korean Highway Bridge Design Specifications (2005) were applied to the design of the girders and towers, and the Korean Steel Cable Bridge Design Guidelines (2006) were referred to when designing the main cables and hangers.

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