Load Combination Related to Wind Load for the Design of Long-span Bridges

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Summary

Korean researchers and engineers are launching design guidelines of cable-supported bridges targeting a 200-year lifetime. The guidelines are based on reliability analysis and the wind load factor is also proposed by utilizing long-term wind speed data collected from 61 weather stations. This paper introduces the probability models and proposed load factors for the design of cable-supported bridges particularly for wind loads.

Keywords: long-span bridges; reliability analysis; wind load; probabilistic model, load factor

1. Introduction

In this paper, wind load is main interest among many loads and wind load factor will be introduced based on reliability theory. The axial- moment resistance at the bottom of reinforced concrete pylon for the transverse wind is the critical component in long-span bridges when wind is considered. The limit state at the bottom of pylon is focused and the probabilistic models of wind-related parameters and structural strength-related parameters of pylon are proposed. A wind load factor is proposed for satisfying the target reliability index. This paper introduces the updated results of the previous studies ([1], [2]).

2. Methodology

2.1 Reliability analysis

The limit state in reliability theory implies the boundary between safety and failure. The limit state equation expresses the limit state in the mathematical form. When the structure experiences large load effect exceeding structural resistances, the situation is regarded as a failure. The limit state can be expressed as Eq. (1) with resistance R and load Q.

$$g = R - Q \tag{1}$$

Based on this equation, the advanced first-order second moment reliability method (AFOSM) [3] is used for the reliability analysis.

2.2 Probabilistic models of resistance and wind load

The probabilistic model of resistance for the in-plane moment at the bottom of the reinforced concrete pylon is assumed to be a lognormal distribution with bias factor of 1.165 and COV of 12.5% [4].

The wind load can be defined as

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