

Aerodynamic Characteristics of the PCT Girder Bridge under Construction by Free Cantilever Method

Younghak KWAK

Senior Researcher
Daewoo E&C CO., Ltd.
Suwon, Korea

younghak.kwak@daewooenc.com

Young-Min KIM

Principal Researcher
Daewoo E&C CO., Ltd.
Suwon, Korea

ymkim@daewooenc.com

Seung-Hwan SIN

Researcher
Daewoo E&C CO., Ltd.
Suwon, Korea

seunghwan.sin@daewooenc.com

Summary

The PCT girder is composed of a PC slab lower deck, a RC slab upper deck and steel diagonals. For the light self-weight and relatively strong bending rigidity, the span length can be extended the longer and it is possible to reduce construction cost. The PCT girder can be applied to various structures and construction methods. Because it is a new type of superstructure, there is no specified design code for bridges.

In this study, the design wind load is calculated and the aerodynamic stability of the PCT girder bridge is investigated by wind tunnel test that are carried out using bridge deck section and aeroelastic models. It is evaluated that the wind load from the wind tunnel test is lower than that from Korea roadway bridge design guide for this type of bridge.

In addition, there are no terms about the lift force and pitching moment of wind load in the Korea roadway bridge design guide for the general girder bridge design. Since, the span length of bridge which is constructed on the mountain region gets longer, the effect of lift and moment gets bigger. Thus, the proper estimation of wind load should be calculated by wind tunnel test or CFD analysis considering reasonable terrain and guest factors.

Keywords: Aerodynamic characteristics; PCT girder bridge; aeroelastic model test; FCM construction; erection stages.

1. Introduction

The PCT girder can be applied to various structures and construction methods. The PCT girder bridge can be applied to a wide range of span length for the light self-weight and relatively strong bending rigidity. Recent cases of applying PCT girder are increasing rapidly. Because there is no specified design code for bridges, most PCT girder bridge is designed according to the conventional design guide. Thus, verification in various aspects is required

In this study, the reliability of the design wind load and the structural stability of the bridge are investigated. The target structure is a parallel bridge which is constructed by FCM method on a valley. The bridge is comprised of 5 spans and the total length of the bridge is 450m. The maximum span length is 110m. The height of pier varies from 47m to 67m.

The design wind load of bridge is estimated according to the Korea roadway bridge design guide. In addition, 2-D sectional test and 3-D aeroelastic model wind tunnel tests are carried out to calculate the static coefficient and to confirm the wind resistance stability of the bridge respectively.

2. Description of the PCT Girder Bridge

The PCT girder is a newly developed girder type that is composed of a PC slab lower deck, a RC slab upper deck and steel diagonals. There is little restriction to plan the plane and vertical layout. The construction cost of PCT girder is about 85~90% of general box girder.

The applicable span length is 130m and 250m for simple beam bridge and continuous bridge respectively. The PCT girder bridge can be constructed by various erection methods such as crane method, ILM, FCM, MSS and span-by-span method. Moreover, the wind load of the PCT girder is lower than general plate girder or box girder.