



# Study of Aerodynamic Performance on Concrete Deck Section in Stayed Cable Bridge

Tzyy Wooi Teh, Chun Kiat Lim, Wei Cheng Seah

H&T Consulting Engineers Sdn Bhd, Malaysia

Contact: ttw@hntconsultgroup.com

## Abstract

In this study, concrete deck section design is required for a harped shape type stayed cable bridge with total span of 800m with span configuration 200m-400m-200m located at open terrain crossing Sarawak River, East Malaysia. Desktop study are performed on two different type of concrete deck section i.e. monobox section and ladder deck section on their dynamic stability with respect to two mechanisms of divergent amplitude response, galloping and flutter in a stayed cable bridge. From wind climate study of site, the design wind speed for 120 years return period is 40m/s and the aerodynamic stability wind speed at deck level is 52.5m/s. The results show that monobox section is more stable with respect to aerodynamic torsional responses and is selected for deck section for the stayed cable bridge. Section model wind tunnel test was carried out on the selected monobox section, the results show that the section has good flutter and galloping stabilities up to the design wind speed.

**Keywords:** concrete deck section; aerodynamic; flutter and galloping.

## 1 Introduction

The cable-stayed bridge has been recognized as a very cost efficient and competitive design for bridges of span ranging from 200m to 800m. Based on the fast development of high-strength materials, new cable stays systems and new construction technologies, the trend of longer span length is quite remarkable in the design of cable-stayed bridge. The long span bridges which are flexible structures are more susceptible to the wind effects and the aerodynamic stability are often one of the governing criteria in the design.

The cross section of the bridge deck is an important parameter that affects the aerodynamic characteristics of the long-span cable stayed bridge. An assessment on the significance of wind effects to the deck section is conducted for a 3 spans cable stayed bridge consists of a 400m main span and

200m back spans. The deck width is approximately 23m. The aerodynamic stability of the long-span cable stayed bridge of different types of deck section is reviewed.

## 2 Assessment Methodology for Desktop Study

Wind climate study referred to records of extreme wind speeds of recent 30 years from Jabatan Meteorological Station of Malaysia (Cawangan Sarawak) near the bridge site, the design wind speed for 120 years return period is 40m/s. The aerodynamic stability design wind speed at deck level is approximately 52.5 m/s, which has been derived in accordance with the methodology provided in BS EN 1991-1-4:2005 and BD 37/01.

Two options of the bridge deck are considered in this study, which is monobox type and ladder deck type shown in Figure 1. The bridge model is