# Wind Tunnel Tests of Vibration Control Devices for a Super Long Span Bridge

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## Summary

The efficiency of active damping devices for the control of wind-induced vibrations of a super long span bridge is investigated. Results of numerical simulations are presented and the preparation of wind tunnel tests is described. Both, the well-known linear-motion type active mass damper and the newly developed twin rotor damper are studied.

**Keywords:** Wind tunnel tests; numerical simulations; vibration control device; super long span bridge; active mass damper; twin rotor damper.

## 1. Introduction

Long span bridges are vulnerable to wind and need stabilizing measures to control vibrations. Moreover, a long span bridge during construction is more vulnerable to wind than in service. For example, when a cable-stayed bridge is built by the free cantilever erection method, stabilizing by temporary tie-down cables is generally needed to resist strong wind, specifically during the typhoon season. However, this measure requires temporary concrete blocks or pile foundations to install tie-down cables. Thus, it is a very expensive and time-consuming temporary method of construction.

As an alternative, a tuned mass damper could be used in a long span bridge or similarly slender structures to suppress wind-induced vibrations and to ensure aerodynamic stability. This passive type of damper does not need any temporary foundations and solves the economical and environmental problems associated with temporary tie-down cables.

However, a passive damper such as a tuned mass damper is of limited efficiency regarding the control of wind-induced long-period vibrations of super long span bridges. In this case, active mass dampers can be an interesting alternative due to their higher efficiency. The lack of practical applications of these devices underlines the need for research and development. The main issue in active control of structures is the difficulty of reliably generating adequate control forces with a low power demand. Furthermore, the additional weight resulting from the control device is to be kept small.

## 2. Description of the Bridge

In its preliminary design, the cable-stayed bridge considered here comprises one main span of 1,200 m and two side spans of 520 m. The total length of the bridge is 2,240 m. The layout of the prototype bridge is shown in Fig. 1. The bridge deck is a steel girder of the closed box type with a width of 29.0 m and a height of 4.0 m. This box girder has 4 traffic lanes. Fig. 2 shows the cross-section of the prototype bridge deck and its main dimensions [1], [2], [3].

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