Full model wind tunnel test of the Akashi Kaikyo bridge

Autor(en): **Miyata, Toshio / Akiyama, Haruki / Sato, Hiroshi**

Objekttyp: **Article**

Zeitschrift: **IABSE reports = Rapports AIPC = IVBH Berichte**

Band (Jahr): **79 (1998)**

PDF erstellt am: **27.06.2024**

Persistenter Link: https://doi.org/10.5169/seals-59839

Full Model Wind Tunnel Test of the Akashi Kaikyo Bridge

Toshio MIYATA
Prof.
Yokohama National Univ.
Yokohama, Japan

Haruki AKIYAMA
Gen. Mgr, Mukaishima Constr. Office
Honshu Shikoku Bridge Authority
Hiroshima, Japan

Hiroshi SATO
Head, Structure Div.
Ministry of Construction
Tsukuba, Japan

Ryuichi TORIUMI
First Design Div.
Honshu Shikoku Bridge Authority
Kobe, Japan

Summary

The aerodynamic stability of the Akashi-Kaikyo Bridge was evaluated through wind tunnel tests using full model. The test results were compared with analytical results, and there were new findings in the flutter characteristics and gust response characteristics, e.g. contribution of drag of unsteady aerodynamic force to flutter, effect of spatial correlation of turbulence on gust responses, etc.

1. Introduction

In the design of a long-span bridge, aerodynamic stability is a very important item. In the case of Akashi-Kaikyo bridge, a suspension bridge with main span length of 1990.8m, wind tunnel tests using full model were conducted as well as section model test. The geometric scale of the model was 1/100. The wind tunnel tests using the 40m long model (Picture-1) were conducted at a wind tunnel which has a test section of 41m wide, 30m long and 3m high.

2. Flutter Characteristics

In smooth flow, the damping of torsional mode becomes negative at the wind speed of 8.4 m/s (Fig.1). In the vibrational shape during flutter (Fig.2), vertical component was not negligibly small and was complicated. This means the flutter observed was coupled flutter and multiple vertical bending modes contributed to.

The results of first 3-dimensional flutter analysis, where moment and lift of unsteady aerodynamic forces due to torsional and vertical vibration were considered, did not agree with test results (see Fig.1). The result of second analysis, where all the unsteady aerodynamic forces were considered, agreed with test results (see Fig.1). From parametric study, drag of unsteady aerodynamic force due to vertical and torsional vibration was found to be effective.

3. Gust Responses Characteristics

As an example of observed gust response in turbulent flow, horizontal component at the center of center span when the intensity of turbulence was 9.6% is shown in Fig.3.

The results of conventional gust responses analysis did not agree with test results well (Fig.3). From parametric study, major reason of the difference between test results and analytical result were found to be as followed including other components.

① Horizontal component: difference in spatial correlation of turbulence between measured and used in the analysis.
② Torsional component: aerodynamic damping which was usually neglected in the analysis.
③ Vertical component: difference in spatial correlation and aerodynamic admittance.

The result of the second analysis where above mentioned factors were considered, agreed with test results fairly well (Fig.3).

4. Closing Remarks

Through wind tunnel tests using full model of the Akashi-Kaikyo Bridge, various aerodynamic characteristics of long span bridge was found.

Photo.1 Full Model of the Akashi-Kaikyo Bridge

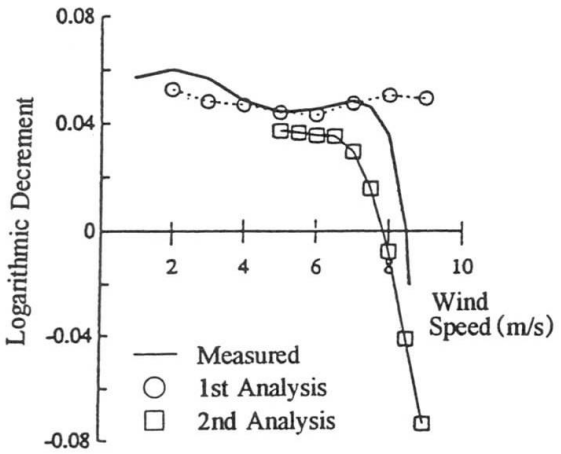

Fig.1 Damping of the Model

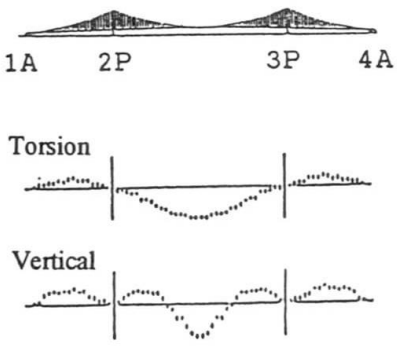

Fig.2 Vibrational Shape during Flutter

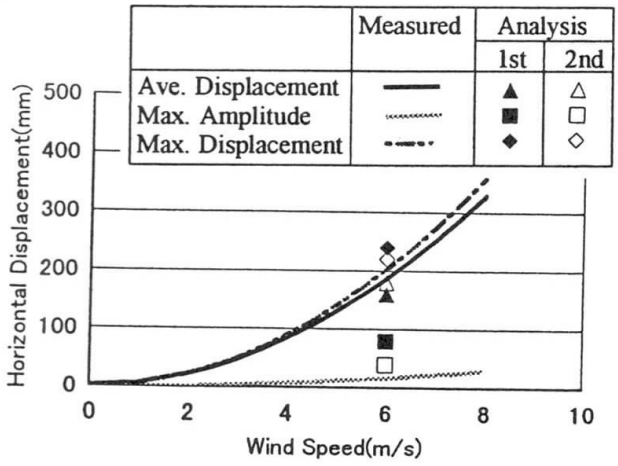

Fig.3 Horizontal Gust Responses