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Autor(en): **Mizoe, Minoru / Muroi, Sinji / Horii, Takashi**

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The Super High Damping Rubber Damper on the Stay-Cables of Meiko East Bridge

Minoru MIZOE
Mgr, Head Office
Japan Highway Public Co.
Tokyo, Japan

Sinji MUROI
Mgr, Civil Eng. Division
Nippon Steel Co.
Tokyo, Japan

Takashi HORII
Civil Eng.
Bridgestone Co.
Yokohama, Japan

Toshiyuki ISOBE
Mgr, Civil Eng.
Bridgestone Co.
Tokyo, Japan

Renji KIYOTA
Mgr, Civil Eng.
Yokogawa Bridge Co.
Funabashi, Japan

Yasuo IMADA
Civil Eng.
Yokogawa Bridge Co.
Funabashi, Japan

Abstract

1. Introduction

The Meiko East Bridge is one of the three cable stayed bridges to across the Ise Bay in Japan. The bridge has 700m in total length and center span length of 410m. The parallel wire strand coated with polyethylene tubes, is used to the cable. In Japan, since the rain vibration was recognized at Meiko West Bridge-1, in 1984, the rain vibration had been often observed in some stay cabled bridges. Therefore the countermeasure for rain vibration was required in Meiko East Bridge.

The damping countermeasure and also consideration for aesthetics point of view were required for this bridge. As the countermeasure, the cable damping device using SDR(Super Damping Rubber) that can be installed inside of a waterproof cover at the top of anchor pipe, was adopted. This paper gives an outline of the damping device and experimental results of the cable in Meiko East Bridge.

2. Outline of the Damping Device

This damping device is installed inside of a waterproof cover at the top of anchor pipe. One side of the SDR is connected to an anchor pipe and the other side to a cable. When the cable is excited, a relative displacement occurs between an anchor pipe and the cable, and SDR is distorted. SDR can absorb the vibration energy of a cable due to this shear distortion. This device is useful for all radial vibrations of a cable. Figure 1 shows the structure of the device.

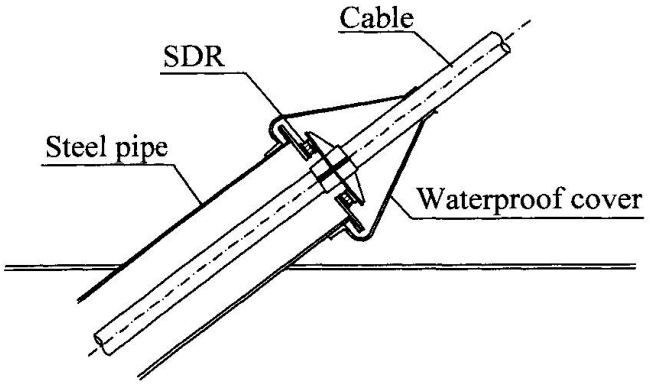

Fig.1 Cable Damping Device using SDR

The SDR used in the damping device has been developed to achieve the high damping properties. It has greater damping characteristic than HDR(High Damping Rubber) used for a seismic bearing of the bridge.

3. Confirmation of the Cable Damping

An additional damping decrement by the device was confirmed by experiments. The objective cables are two upper row cables. These cables were excited by using exciter. As a result, damping decrement of these cables were obtained from free vibration wave shape. Figure 2 shows typical examples of experimental results. The damping decrement of a cable without a device is 0.005-0.010. The average of damping decrement of a cable with the device is 0.033-0.045. The damping decrement of the other cable is 0.042-0.046. These damping exceed calculated value. Assuming the standards of Scruton's number required in order to prevent the rain vibration is 60, the required damping decrement of the cable is 0.018 in Meiko East Bridge. The damping obtained through the experiment exceeds required damping.

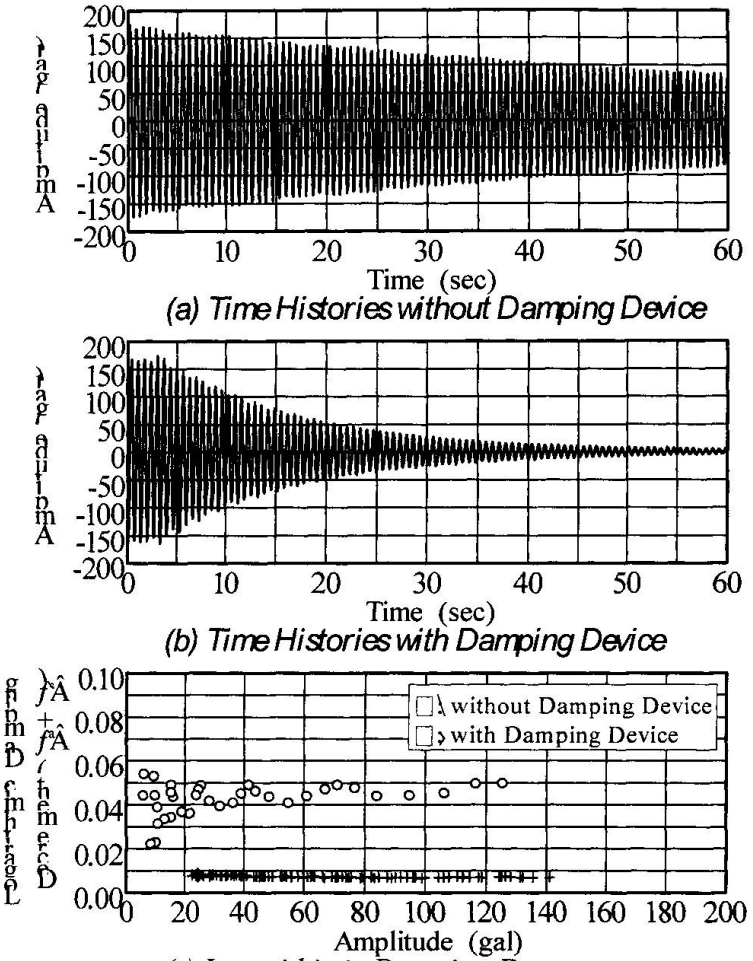

Fig.2 Typical Time Histories and Logarithmic Damping Decrement of C26N-Cable (3rd Mode)

4. Conclusion

In this paper, we described the abstract of a cable damping device using SDR(Super Damping Rubber) that was adopted to Meiko East Bridge and estimated the damping by calculation, and confirmed through the field experiment. Experimental results exceed calculated value, and the validity was confirmed. As a result, the damping devices were installed at all cables except some lower row cables. Since completion in April, 1998, wind induced vibration has not been observed. This device is able to keep the original design around the bridge owing to be closed by waterproof cover.