EXPERIMENT AND ANALYSIS ON SEISMIC RESPONSE OF MENSHIN BRIDGES

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SUMMARY

To provide with realistic seismic response data of Menshin bridges, a series of shaking table tests were conducted at the Public Works Research Institute. Structural response characteristics were presented with emphasis on the effect of stopper and vertical excitation. Hysteretic behavior of Menshin bearings was studied by means of cyclic shear tests and a comparison with the seismic behavior during the excitation tests is presented. Analytical simulations are also presented for the excitation tests. Depending on the idealization of the nonlinear hysteretic behavior of the Menshin bearings, the equivalent linear analysis and the bilinear analysis were made. Analytical simulation for the effect of collision between the deck and the columns due to the stoppers was also presented.

INTRODUCTION

Seismic response of Menshin bridges subjected to significant earthquakes is of great interest for designing Menshin bridges in Japan. Because there have been so far no Menshin bridges which experienced significant earthquakes with the magnitude over 8, it is required to study their critical behavior carefully.

The most important issue in the structural response of Menshin bridges is the analytical idealization of the nonlinear hysteretic behavior of the Menshin bearings. Effect of stoppers which are provided to prevent excessive deck response is of another interest. When collision of deck with columns occurs, this would cause large impact force. Because bridges are subjected to large vertical excitation during destructive earthquakes, it is also important to study the response of Menshin bridges subjected to lateral and vertical excitations simultaneously.

For aiming to study the response of Menshin bridges, a series of excitation tests was made at the Public Works Research Institute. Two types of large scale model were used for the excitation tests. Analytical simulations by means of the equivalent linear analysis and bilinear analysis were made.

This paper shows structural response characteristic of Menshin bridges through shaking table tests and analytical simulation (Ref. 1,2,3).

STRUCTURAL RESPONSE OF MENSHIN BRIDGES THROUGH SHAKING TABLE TESTS

Model and Test Procedure To provide a realistic seismic response data of a Menshin bridge, a series of shaking table tests were made at the Public Works Research Institute. A Menshin bridge model tested which is referred as "model 1" is a simple girder bridge supported by two columns placed on a shaking table as shown in **Photo 1**. The span length is 6 m and the deck weight is 39.8 tf. Two

types of Menshin bearing, i.e.. lead rubber bearing (LRB) shown in **Photo 2** and high damping rubber bearing (HDR) shown in **Photo 3** were used. Two bearings were installed on each column, and totally four bearings supported the girder.

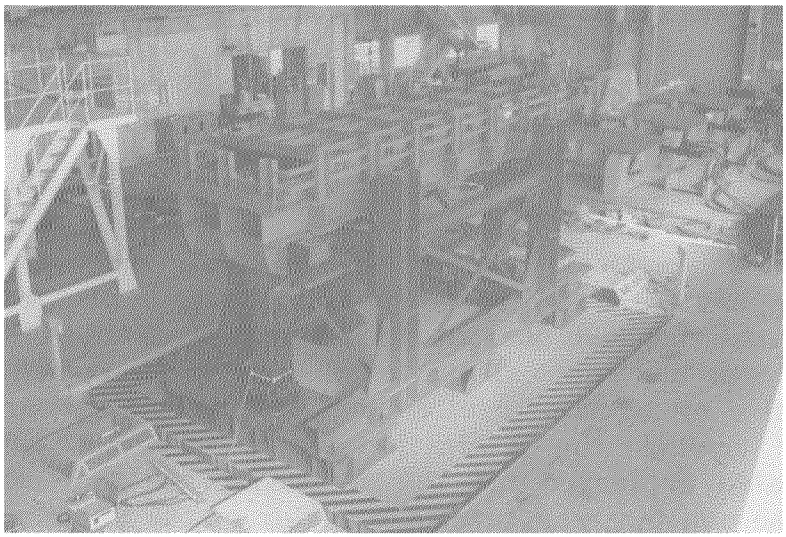

Photo 1 Setup of Shaking Table Test (Model 1)

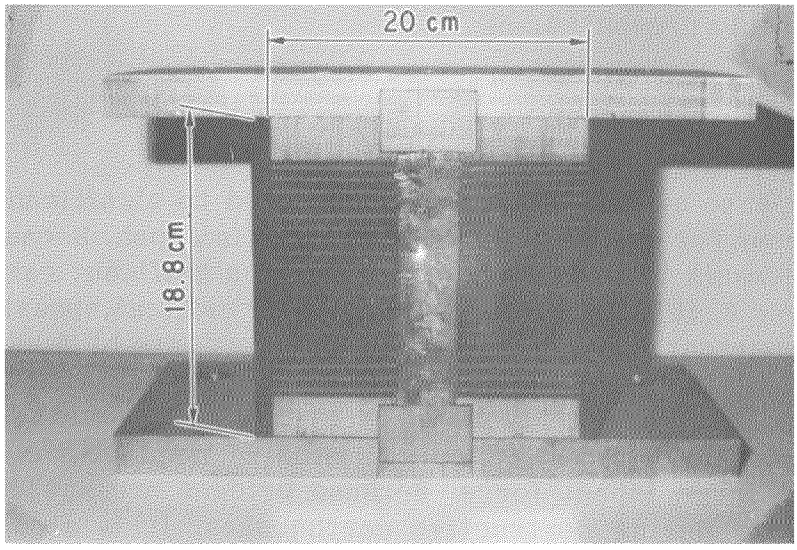

Photo 2 Lead Rubber Bearing

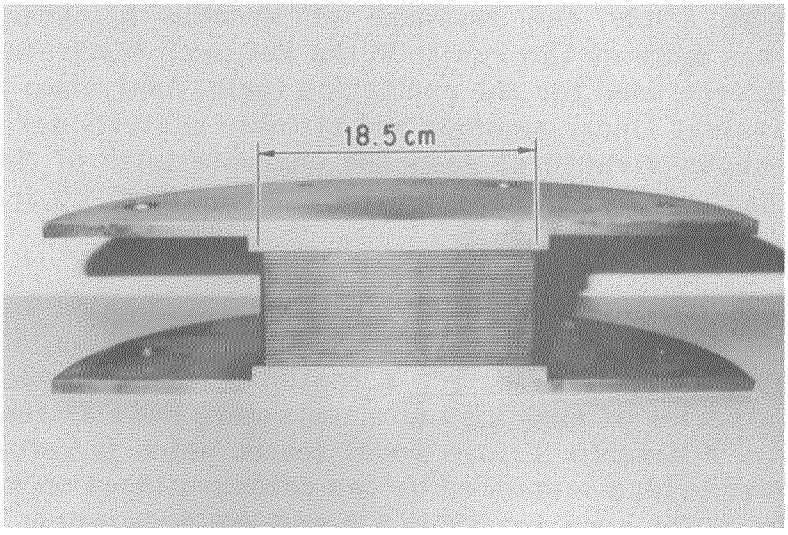

Photo 3 High Damping Rubber Bearing