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Monitoring System of Kao-Ping-Hsi Cable Stayed Bridge

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Abstract

This paper presents the items and configurations of monitoring project of Kao-Ping-Hsi Cable Stayed Bridge (Fig.1). The monitoring of critical structural performance during the service life is an essential part of the maintenance program. The instrumentations of monitoring system, not only provide some important information such as wind speed and direction, seismic acceleration, and pylon movements for the traffic control center when the bridge opens to traffic, also provide data of the bridge behaviour during construction stages.

In order to monitor the bridge behaviour during construction and service stages, the items included are the strains of concrete and reinforcing bars in PC girder and pylon, the strains of steel girder, the strains of cable anchorage zone (Fig.2), cable forces (Fig.3), acceleration of ground and the selected locations of structure under seismic, the speed and direction of wind; the displacement of pylon and the variation of forces in earth anchor at abutment, etc.

During construction, the data are collected manually, and after the bridge opens to traffic, they will be collected by automatic data acquisition system. The monitoring system will send the data periodically to traffic control center and the remote research center. In case of unusual structural performance occurred due to the actions of earthquake, strong wind and larger movement of pylon, the automatic data acquisition system will be triggered using shorter scanning period to collect data immediately. The outline of instrumentations of this project is presented.

The measured strains of concrete and steel at the various locations of pylon reasonably reflect the behaviour of pylon during each corresponding construction stage. The temperature distribution in the selected section of the pylon is also presented. The variations of force in the six load cells installed with some of the earth anchors in the abutment were also well correlated with the in-situ conditions. The above data collected during the construction stages are also included.
The Kao-Ping-Hsi Cable Stayed Bridge crossing the main riverbed is one of the special projects of the Second Freeway being constructed and is the largest cable stayed bridge built in Taiwan.

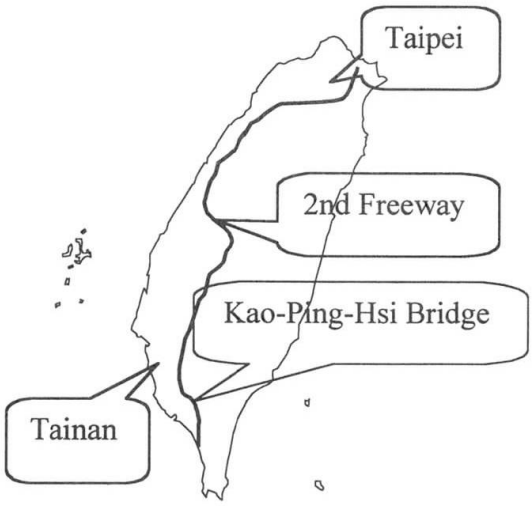

Fig.1 The location of the Kao-Ping-Hsi Bridge

It has a 183.5m high inverted Y shape pylon with varying cross sections and a semi fan type single plane stays with 14 paired cables on each side of pylon. The girder is 45 meters above the riverbed. It is featured with 6-lane 34.4m wide girder which is composed of 180m prestressed concrete (PC) box girder on the side span and 330m steel box girder on the main span. The PC box girder is designed with cast in place concrete and constructed by the advanced shoring technique, whereas the steel box girder is designed with in-situ whole welding for all segments. It has been constructed since April, 1996 and is scheduled to be finished in October. 1999.

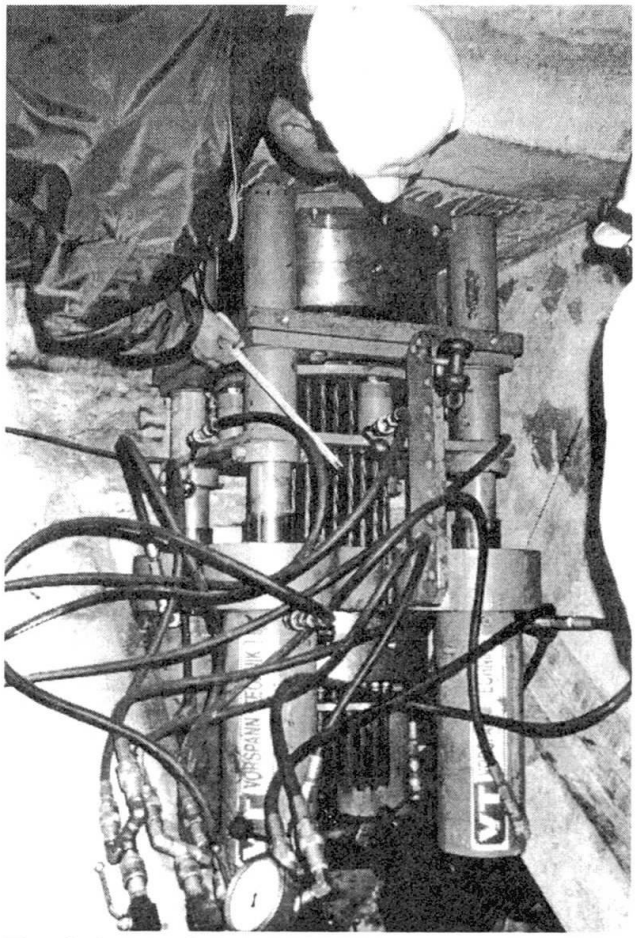

Fig. 2 One-end prestressing of stayed cable in PC box girder

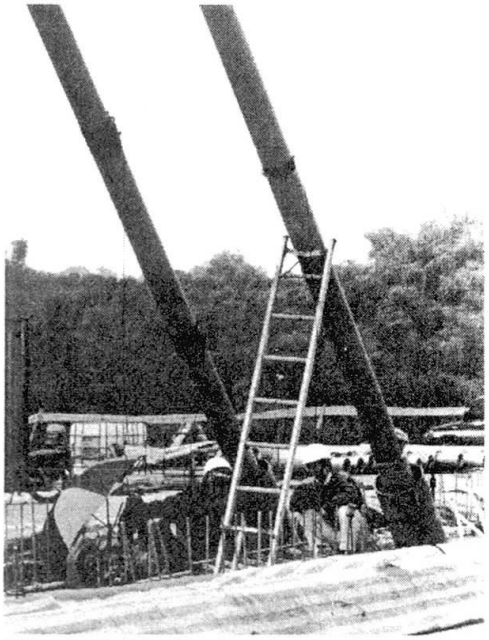

Fig. 3 Cable forces checked by ambient vibration method