Establishment of Seismic Behavior Observation System for the Entire System of Civil Engineering Structures

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1. Introduction

NILIM has been observing seismic behaviors since 1958 with the aim to rationalize / upgrade the seismic design standards for civil engineering structures and clarify their seismic behaviors.

In recent years, structures having complicated seismic behaviors in the entire system are increasing. To improve the earthquake countermeasure technology for such structures, proper evaluation of behaviors in the event of earthquake is required. Accordingly, the NILIM has been working for establishment of a system that can observe behaviors of the entire system of structures (the "observation system") by conducting simultaneous seismological observations at many points in structures.

2. Experiment for sending / receiving observation records using wireless communication

As means of communicating records from multiple sensors that constitute to the observation system, wireless communication was used for convenience. Wireless communication technology has been applied to seismic observation inside buildings, etc. but has never been applied to outdoor observation such as for civil engineering structures. Therefore, observation records were sent and received in wireless transmission on the NILIM's test course, over 1 km in a linear distance, to check transmission distance and communication intensity (Fig. 1). The result of the experiment showed that observation records can be satisfactorily transmitted and received in wireless communication even in outdoor environment.

3. Construction and observation system

In order to detect issues in establishment of observation system using wireless communication, a system was temporarily installed on the elevated bridge. This observation system consists of sensors for observing seismic behaviors of the structure, an antenna for receiving observation records sent from the sensor in wireless communication, and a logger for recording / processing observation records. A total of about 50 sensors were installed on the bridge, 575 m in length, in order to observe the behaviors in the entire system of the structure (Fig. 2). We intend to continue observation to check communication intensity and recording accuracy.

4. Conclusion

In order to establish a technology using results of this study as a model case and obtain seismic records that contribute to further rationalize / upgrade the seismic design standards for civil engineering structures, we intend to improve seismic behavior observation in the NILIM.

Fig. 1: Experiment using wireless communication

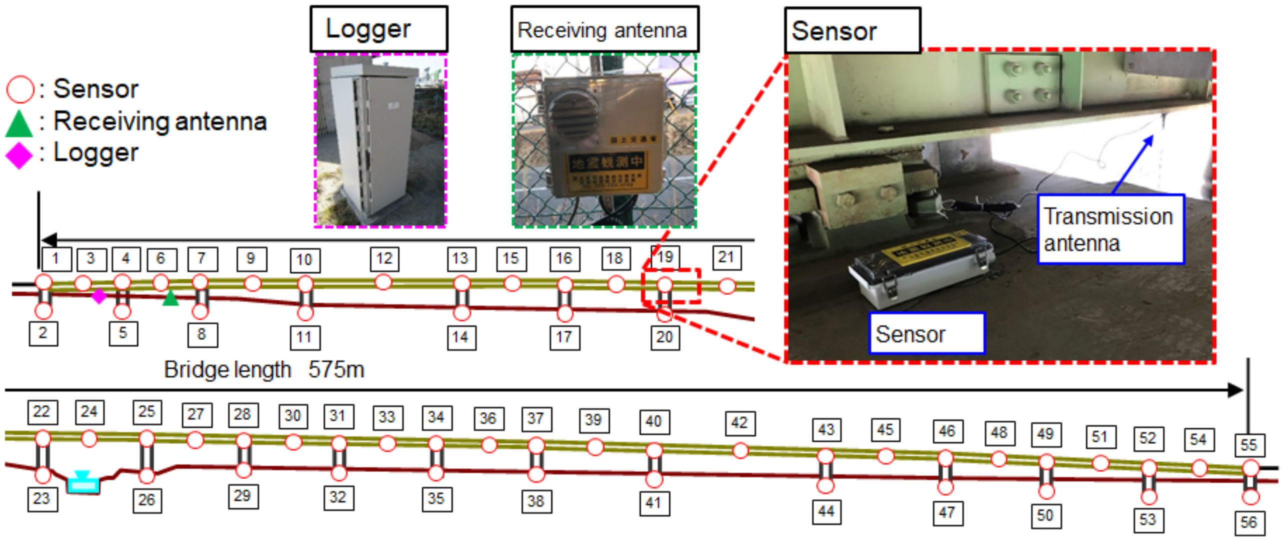

Fig. 2: Provisional installation on the elevated bridge