

## About the Building Health Investigation using a weak earthquake ground motion: From the long-term observation by using

Kiyoshi Takano<sup>1\*</sup>, Takamori Ito<sup>1</sup>, Yasuhisa IKEDA<sup>2</sup>

<sup>1</sup>ERI The University of Tokyo, <sup>2</sup>Tokyo Gas Co. Ltd.

The earthquake-proof performance of building structures decreases after the completion from damages by natural disaster such as earthquakes and typhoons, or from the crack of a component, the slack of degradation and a junction part, etc. The structural health monitoring is a technology that investigates the health of the structures of these damage and deterioration, etc. with various sensors.

In past research on the health investigation of the building, there are mainly study examples using microtremor observation carried out in the silent environment without the earthquake.

The microtremor observation is often carried out in the midnight with small unsteady vibrations as a noise, and it is the observation with the high mobility, because it can be carried out, when there is no earthquake. However, since the input vibration to the building is very weak, it is indicated that only the vibration characteristic unlike vibration characteristic in the earthquake is obtained in the complicated building. For example, Ikeda 2009 shows that the transfer function of the building changes in case of microtremor observation and felt earthquake observation in the building with the complicated vibration characteristic.

After all, for the health investigation of the building for the earthquake, it is insufficient only in the microtremor observation, and it is important to observe how the building shakes in actual earthquake. However, though so many seismometers have been installed until now in many buildings, there are not so many research reports for the health investigation by the measurement of the building in weak earthquake ground motion of about seismic intensity of 1, since many observation systems can record only in the strong earthquake ground motion.

We have developed the IT Kyoshin (strong motion) seismometer system for the building which investigates the vibration characteristic of the building by weak earthquake ground motion, installed many ITK sensors in some buildings of the University of Tokyo and observed in long term.

The ITK sensor is the network connective seismometer which the development and standardization are made in IT Kyoshin consortium, it is not expensive but the noise level is very low about 0.1 or 0.2 gal, and it can record very weak earthquake ground motion of about seismic intensity 0 or 1 for the sufficient analysis.

In this system, the data is preserved in the continuous record, and it is available by specifying appropriate record period. The total recorded period is dependent on the capacity of the storage device, it can be preserved at least several months.

The earthquake event records are also stored, and there are about 300 event records of the vibration of each buildings in the earthquake of the seismic intensity 0, 1 or more from the beginning of the observation at about 4 years.

In this presentation, we report on the some important records, and discuss the effectiveness of the building health investigation by using weak earthquake ground motion with the problem for the popularization.

Keywords: IT Kyoshin Seismometer, Structural Health Monitoring, Building Health Investigation