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6. SEISMIC INTENSITY MONITORING SYSTEM

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ABSTRACT

A seismic intensity monitoring system has been installed at the Key Stone Project (KSP) sites around the Tokyo metropolitan area to monitor earthquakes in conjunction with space geodetic measurements. This system meets the standards set by the Japan Meteorological Agency. The seismograph monitors the occurrence of earthquakes and measures their instrumental seismic intensity, seismic intensity scale, and maximum acceleration. The information obtained by the system is transmitted both to the Koganei central station and to the Kashima sub-central station by computer network dedicated to the KSP.
Keywords: Earthquake, Seismograph, Seismic intensity

1. Introduction

The Communications Research Laboratory (CRL) started to development of a crustal deformation monitoring system using space geodetic techniques in the Tokyo Metropolitan Area in 1993[1]. This project was named the Key Stone Project (KSP), and both Very Long Baseline Interferometry (VLBI) and Satellite Laser Ranging (SLR) systems were installed at Kashima, Koganei, Miura, and Tateyama. In Japan and particularly in the Kanto area including the Tokyo metropolitan area, large and small earthquakes are common. The seismic intensity monitoring system was installed to investigate the relationship between earthquakes and crustal deformations detected by space geodetic techniques. Seismograph was installed at each KSP site and send information on them to the Koganei central station and to the Kashima sub-central station in real time. Thus an operator at either the central or sub-central station can monitor the occurrence of local earthquakes. Data is then used to compare earthquakes and crustal deformation. This paper explains the details of this seismic intensity monitoring system.

2. Structure of the Seismic Intensity Monitoring System

The seismic intensity monitoring system consists of four seismographs, two data display units, and a KSP digitalnetwork. A block diagram of the system is shown in Figure 1.

2.1 Seismograph

The seismograph is equipped with three acceleration sensors responsible for two horizontal and one vertical component. It also has an in-built data processing function. The seismograph is connected to a laptop personal computer (laptop-PC) by an RS232C cable. Hence, primary processing is carried out inside the seismograph, and results, such as instrumental seismic intensity, seismic intensity scale, and maximum acceleration, are output to the laptop-PC with a time label. A photograph of the seismograph is shown in Figure 2.

The laptop-PC interfaces the seismograph to the KSP digital-network. It was installed in each KSP station. We developed the software for the interface between the seismograph and the network ourselves.

The seismograph first converts the acceleration data

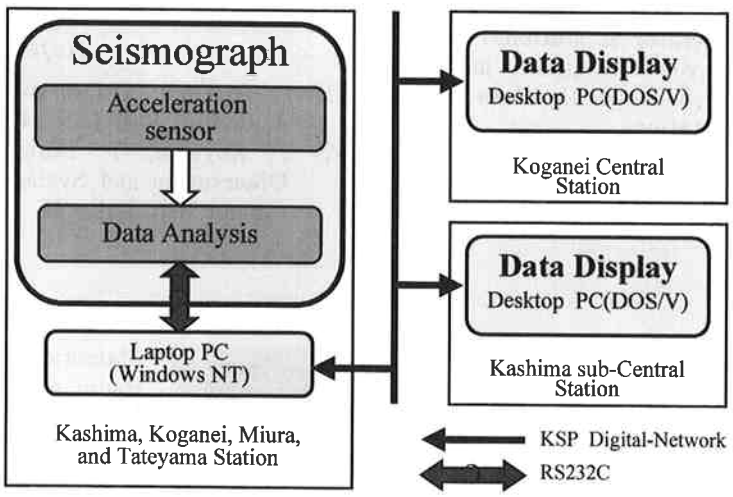

Fig. 1 Schematic diagram of the seismic intensity monitoring system.

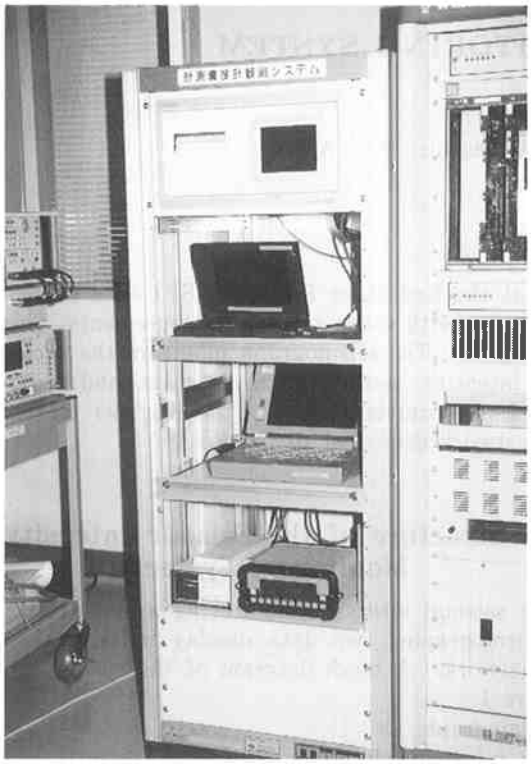

Fig. 2 Photograph of the seismograph. (Kashima station)

of the two horizontal components and the vertical component into digital data using 16-bit A/D converters for calculating seismic intensity. After detecting an earthquake, seismic intensity every 10 seconds, the maximum acceleration, and the earthquake oscillation frequency are stored in RAM in the seismograph, and they are transmited to data display units located at Koganei central station and Kashima sub-central station. Moreover, to keep the correct time, the seismometer is equipped with an automatic time-correction function using time standard signals broadcast in an LF radio wave. It also has a self-check function to identify failures.

2.2 Data display unit

A data display unit is installed at Koganei central station where at least one operator is stationed, and at Kashima sub-central station, which is usually unmanned except in emergencies. Figure 3 shows the data display unit at Kashima sub-central station.

The functions of the data display unit are summarized as follows;

- Displays the earthquake information transmitted from each KSP station

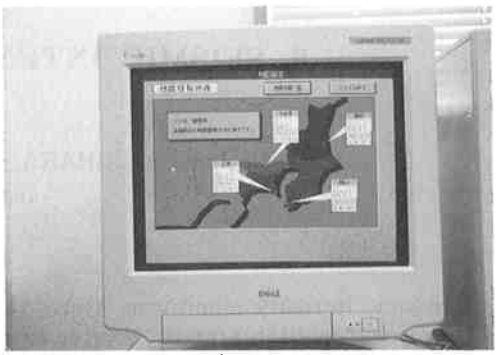

Fig. 3 The data display. (Kashima sub-central station)

- Prints out various earthquake information (instrumental seismic intensity, JMA seismic intensity scale, the maximum acceleration, and length of the earthquake)
- Creats the earthquake-information data base.

2.3 KSP digital network

A wide area network dedicated to theautomatic operation of KSP-VLBI observation[2] is also used as the KSP digital network for the seismic intensity monitoring system.

3. Summary

We have completed installation of a seismic intensity monitoring system to monitor earthquakes at KSP observation sites around the Tokyo metropolitan area, information on earthquakes is sent in real time to Koganei central station and Kashima sub-central station. The seismograph used in the system has been approved by the Japan Meteorological Agency. Future work will compare data on earthquakes at KSP observation sites and the results of crustal deformation detected by using regular VLBI and SLR observations.

Acknowledgments

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