第 I 部門 **ESTIMATION OF STRONG GROUND MOTIONS OF THE 1995 HYOGO-KEN NANBU EARTHQUAKE IN THE AKASHI KAIKYO AREA**

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1.- INTRODUCTION

The Earthquake Engineering Laboratory of Kyoto University has been monitoring the seismic activity in the Akashi Kaikyo area for analyzing the seismic design of Akashi Kaikyo bridge. Unfortunately, during the 1995 Hyogo-ken Nanbu Earthquake the pick-ups of the Akashi Kaikyo Array Observation System were set up for low amplitude levels, and they were not able to record the mainshock's signals. Therefore, the aim of this research, is to obtain synthetic strong ground motions of this event at the array's stations, which will be utilized to investigate the seismic performance of the Akashi Kaikyo Bridge.

2.- THE AKASHI KAIKYO ARRAY OBSERVATION SYSTEM

The Akashi Kaikyo Array Observation System consists of a set of four servo-velocimeters, two of them located in Honshu island and the other two in Awaji Island. Fig. 1 shows the location of this array along with the Akashi Kaikyo bridge. After the Hyogo-ken Nanbu Earthquake occurred, the velocity ranges of the pick-ups were increased, and many aftershocks, with magnitude as large as 4.9 could be recorded. These data are used in this research to synthesize the mainshock's signals.

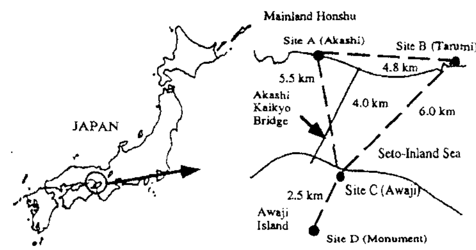

Fig. 1: Location of Array Observation System and Akashi Kaikyo Bridge.

3.-SYNTHESIZED STRONG GROUND MOTIONS USING EMPIRICAL GREEN FUNCTION METHOD

The simulation method proposed by Irikura (1986) is used to synthesize strong ground motions, using aftershock events as empirical Green functions. The JMA-Kobe station is used as a reference station to calibrate the source parameters by comparison between the synthetic and observed signals. First, a simple fault source mechanism for the mainshock is assumed, and the strongest aftershock, the February 18, 1995 (M_{JMA} 4.9) aftershock, is used as the empirical Green function. The synthetic acceleration waveforms have about the same amplitudes than those of the observed ones; however, they present higher frequency content, and the complexity of the observed acceleration waveform cannot be reproduced by this model.

Secondly, a multi-fault source mechanism composed of three faults, as proposed by Kikuchi (1995) is assumed, and two aftershocks, [February 18 (M_{JMA} 4.9) and January 23 (M_{JMA} 4.5)] are used as empirical Green functions (Fig. 2). The NS component of the synthetic accelerograms thus obtained, is shown along with the observed one in Fig.. 3, and their corresponding response spectra in Fig. 4. As can be seen in these

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figures, there is a better fitting between the waveforms and response spectra of synthetic and observed signals when the multi-fault rupture model is assumed.

This source model and its fault parameters are used to synthesize strong ground motions at each array's station. Thus, peak accelerations of 750 gal and 990 gal were obtained at Monument and Tarumi stations, and of 490 gal and 320 gal at Akashi and Awaji stations, respectively. These values are comparable with those observed in the surrounding area. The NS components of the synthetic accelerograms at Tarumi and Akashi stations are shown in Figs. 5 and 6 respectively, and their response spectra are shown in Fig. 7.

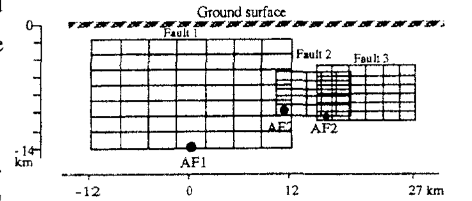

Fig. 2 Multi-fault rupture model and location of rupture starting points (Source mechanism after Kikuchi, 1995)

The results found at this stage will be used in further research for estimating multiple-support seismic inputs for Akashi Kaikyo Bridge, since for the seismic design of large-scale structures it is important to consider the spatial variation of free-field ground motions. These results will be presented in future papers.

4.- CONCLUSIONS

- Assuming a simple fault rupture model for the source mechanism of this earthquake, the waveform complexity and its frequency content cannot be reproduced by the synthesizing procedure. A better fitting between synthetic and observed signal is obtained when a multi-fault rupture model is assumed.
- Synthetic strong ground motions were obtained at the location of the Akashi Kaikyo array's stations. Their peak accelerations are comparable with those observed in the surrounding area.

REFERENCES

- Irikura, K. (1986), "Prediction of Strong Acceleration Motions using Empirical Green's Function". Proc. 7th Japan Earthquake Engineering Symposium, pp 151-156.

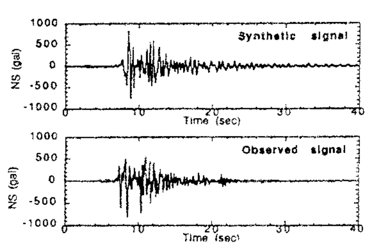

Fig. 3: Synthetic and observed accelerograms at JMA-Kobe station

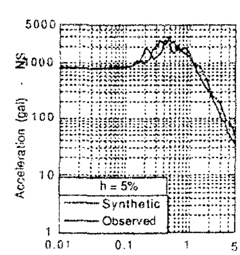

Fig. 4: Acceleration response spectra of Synthetic and observed signals at JMA-Kobe station. Multi- fault rupture model.

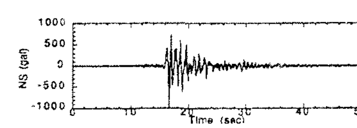

Fig. 5: Synthetic accelerograms at Tarumi station

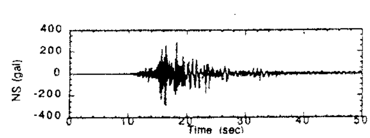

Fig. 6: Synthetic accelerograms at Akashi station

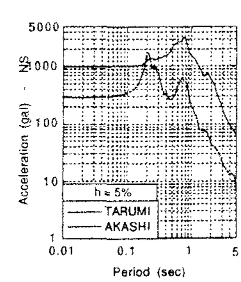

Fig. 7: Acceleration response spectra of synthetic signals obtained at Tarumi and Akashi station.