

Seismic response characteristics in Fukuyama plain estimated by using the microtremor measurements

*Atsushi Mukai¹, Yukihiro Tsutsumi¹, Hiromu Ishio¹, Yuki Sawada¹

1. Faculty of Urban Management, Fukuyama City University

Fukuyama plain had been reclaimed from the lagoon and has the complicated underground structure with the former shore reef areas and the former river beds. We performed the microtremor measurements in the plain and estimated the spatial distribution of seismic response characteristics. Major part of the plain has the low dominant frequency due to soft surface layer in the thickness of a few 10 m, while the dominant frequency in the former shore reef area is high (over 10 Hz). The estimated dominant frequencies in the plain show the complicated spatial distribution.

Fukuyama plain had filled up the lagoon with some shore reefs in the Edo era. The river branch of the Ashida river in the city was reclaimed in Taisho era as well. In this way, the Fukuyama plain has the complicated geological structure, although the plain is flat less than 5m above the sea level.

We can list the human damage and the structure damage due to the amplified seismic motions and the liquefaction as the serious natural disasters in the reclaimed ground. It is necessary to predict the seismic response characteristics and the liquefaction risk in order to reduce the disaster damage for the inhabitants. The adjacent areas in the plain might have large discrepancy in such a risk because of the complicated underground structure. Therefore, we performed the microtremor measurements in Fukuyama plains and estimated the dense spatial distribution in the seismic response characteristics. The measurements were mainly executed in the parks which density is about 10 parks to a square kilometer. The outputs from the accelerometers were filtered through the low-pass filter with cut-off frequency 40 Hz and were recorded at 100 Hz for ten minutes.

We used the H/V spectrum method developed by Nakamura et al.(1986) to estimate the seismic response characteristics by using the microtremor measurements. The H/V spectrum ratio is the amplitude ratio between the horizontal motion and the vertical motion. We can find two dominant frequencies in the H/V spectrum ratio obtained in Fukuyama plain. The higher dominant frequencies show the wide range in 1-20 Hz and could vary greatly even in small areas. The frequencies in the skirts of mountains and the former shore reef areas were obtained to be higher than 10 Hz, while those in major part of the plain were just a few Hz. On the other hand, the lower dominant frequencies show similar values about 0.7-0.9 Hz at every points.

It is considered that the higher dominant frequencies are mainly affected by the soft surface layer. We estimated the geological structure by using the H/V spectrum ratios. The thickness in the surface layer was obtained to be about 1-10 m at the former shore reef areas, while that was about 40-50 m in other areas. We found the underground structure due to the former river beds as well. The Fukuyama plain has the complicated distribution of geological structure and seismic response characteristics.

Keywords: microtremor measurement, Fukuyama plain, seismic response characteristics