

## Geological Interpretation of a Liquefied Area by 'i-Bido': A Case Study in Urayasu City, Japan (2)

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The Great East Japan Earthquake that occurred in 2011 off the Pacific coast of Tohoku caused the formation of two long cracks (crack 1 and crack 2) at Urayasu High School in Chiba Prefecture, Japan. Iwamoto et al. (2014) classified the survey area into different parts by examining the reclamation history and found the following three areas: A, 'Kaimenka-tochi'\*; B, reclaimed land from dredged seabed deposits; and C, the embankment and its surrounding zone. Crack 1 was situated between areas A and B, and crack 2 was between areas B and C.

Based on the investigation, the authors conducted micro-tremor observations at the three reclaimed land areas and Alluvial area. These measurements were conducted to reveal the area's geophysical aspects and to extrapolate three-dimensional data of the subsurface geology from two-dimensional data. At each measurement position, the results of micro-tremor observation were analyzed to give H/V spectra and the relationship between the site's geology and physical data. Field measurements of micro-tremors were performed with JU310, which was designed by the National Research Institute for Earth Science and Disaster Prevention. Measurements and analysis were performed using the i-Bido system (Senna et al., 2011), named after the Japanese word for micro-tremor, which was designed by the same institute.

Analysis revealed that the micro-tremors in areas A, B, and C had clear peaks at 1 Hz or slightly higher. This result corresponds to the impedance ratio at the boundary between the Holocene and Pleistocene deposits. Additionally, the micro-tremors observed at area B, which contains land reclaimed in 1965-1971, had peaks from approximately 4-5 Hz. These peaks were not observed or were unclear in areas A and C. For both crack 1 and crack 2, the peak was clear on one side but not on the other. The interval across a crack was only a few meters; therefore, these peaks depend on the impedance ratio between the silt bed, which was reclaimed by dredging from the seafloor, and the Holocene deposits. Additionally, the Nd-value\*\*of the silt bed was 0, as determined by a survey of the subsurface geology.

The analytical results determined using i-Bido supported the physical aspect put forth by Iwamoto et al. (2014) as the reason and mechanism by which the two cracks formed. Each frequency peak also showed the individual geological unit in the reclaimed bed, further supporting Iwamoto et al. (2014). The i-Bido system was very useful for analysis of the relationship between the site's geology and physical characteristics and for extrapolation of three-dimensional data from two-dimensional data. The authors hope that the methods discussed here will aid the progress of disaster prevention.

\* 'Kaimenka-tochi' means land below sea level literally. Before reclamation, it was located in front of seashore, and it was in the possession of the private owner. and was used to reed cultivation etc.

\*\*Nd-value is brought by Dynamic Cone Penetration Test, which has the following conditions: a slide hammer with a weight of 5kg falling through a distance of 50cm, and diameter of 2.5cm cone. The number( i.e. Nd-value) of blows needed for the cone to penetrate each 10cm is recorded.

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### References:

Hiroshi IWAMOTO, Masashi HIGASHI, Shigeo HIGUCHI, Akira INADA, Akihide ITO, Satoshi KAMIKASEDA, Kenichi KAWASAKI, Keiko KUSUNOKI, Shinji SATO, Shoichi SHINADA, Kazuyuki SUENAGA, and Takumi WATANABE (2014) Recent Geological Interpretation of Liquefied Area: A Case Study in Urayasu City, Japan(1). Japan Geoscience Union Meeting 2014.

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Keywords: liquefaction, crack, micro tremor, i-Bido, Urayasu, reclaimed land

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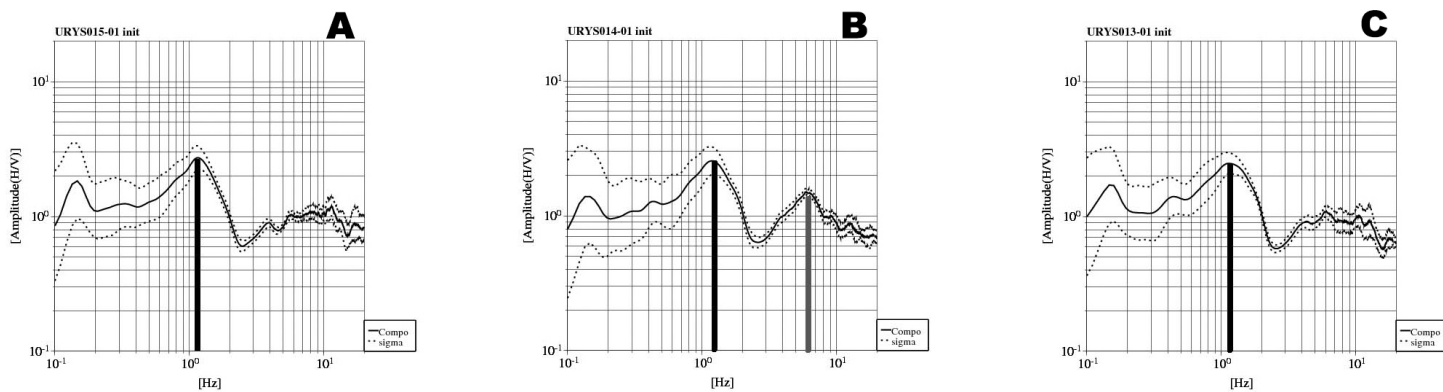


Fig.1 H/V Spectra of A, B, and C Areas