

## Fragility curves of buildings during the 2011 Tohoku Earthquake using the damage data in the northern Miyagi Prefecture

WU, Hao<sup>1\*</sup> ; MASAKI, Kazuaki<sup>2</sup> ; IRIKURA, Kojiro<sup>3</sup> ; KURAHASHI, Susumu<sup>3</sup>

<sup>1</sup>Graduate School of Engineering, Aichi Institute of Technology, <sup>2</sup>Department of Urban Environment, Aichi Institute of Technology, <sup>3</sup>Disaster Prevention Research Center, Aichi Institute of Technology

Damage ratios in subdistricts of Osaki and Kurihara cities, northern of Miyagi Prefecture are obtained from the damage data provided by the local City Offices. Ground motions in these subdistricts are estimated by use of source model proposed by Kurahashi and Irikura (BSSA, 2013) and underground velocity structures identified from microtremor H/V spectral ratios. The estimated ground motion indices (PGA, PGV,  $I_{JMA}$ , and SI) are used to relate with the damage ratios to construct the fragility curves. It is found that the correlation in small subdistricts is improved, compared with that between the observed ground motion indices and corresponding damage ratios in a wider district.

In addition, we have added some microtremor measurement at plural sites inside each subdistrict, such as Furukawa, and Tajiri, in order to assess the representativeness of ground motions estimated at only one site for the entire subdistrict. We conducted such measurement at or near the preliminary schools inside the subdistricts. The ground motions during the mainshock are estimated with the identified velocity structures from the microtremor H/V spectra ratios. It is found that the variability of ground motions in the Furukawa subdistrict is relatively small. It suggests that the ground motions used for the fragility curves are representative for the entire subdistrict. In contrast, the variability of ground motions in Tajiri is relatively large. It may be caused by the limited numbers of preliminary schools with similar amplification factors.

**Keywords:** Fragility curve of buildings, microtremor H/V spectral ratio, underground velocity structure, representative of ground motions