## Ground motion amplification on heavily damaged zone in the Mashiki town during the 2016 Kumamoto Eartuquake

\*Hiroyuki Goto<sup>1</sup>, Masayuki Yoshimi<sup>2</sup>, Yoshiya Hata<sup>3</sup>

1. Disaster Prevention Research Institute, Kyoto University, 2. National Institute of Advanced Industrial Science and Technology, 3. Osaka University

Severe ground motion damages occurred in the downtown area of the Mashiki town, Kumamoto Prefecture, during the 2016 Kumamoto earthquake, Japan, and several heavily damaged zone appeared in the center of the downtown. Nonlinear site response for the first (14th Apr., 2016) and main shocks (16th Apr., 2016) is important factors to explain the reason why the heavily damaged zone appeared. We analyzed the soil nonlinearity by using the surface and borehole records at KiK-net KMMH16 (Mashiki) station. Optimal S- wave velocity models clearly depended on the amplitude of input ground motions. Strain dependent shear stiffness and damping ratio were estimated to explain the S-wave velocity dependence on the input motion amplitudes. We conducted nonlinear analyses at KMMH16 site on the basis of the nonlinear model. The synthetic surface ground motions agreed well with the observed ones, especially at S-wave amplitude and phase for the first and main shocks. In addition, we also conducted the same analyses at TMP3 site, which was located in the heavily damaged zones. The synthetic motions well represented the observed ones, and difference of spectral accelerations was well explained by the analyses. The results indicated that the soil nonlinearity played a big role to cause the difference of ground motions, and thus the damaged zone appeared in the downtown of the Mashiki town.

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