Proposition of an equation for evaluating the use of adhering gel sheets to hold informational equipments

Masaru Nakano[1]; Yoshinari Hayashi[2]; Reo Kimura[2]

[1] Sch. Env., Nagoya Univ; [2] Disaster Management Office, Nagoya Univ.

Falling of furnitures will occur on large earthquakes not enough to harm houses. Many instruments to hold furnitures exists. Adhesive gel sheets are good for holding informational devices such as PC or HDD, since they are not only be able to hold instruments for quick motion but also easily removed if pulled slowly. It also repeatedly used.

On this work, we propose an equation for evaluating the use of adhering gel sheets to hold informational equipments based on simple modeling of instruments and experimental results. The effect of an amplification of seismic motion by resonance is important and included on the equation. We have done shaking experiment to investigate the effect of the gel sheets. On the experiment, we use a standard middle-tower PC. We also investigate how to hold PC when it has legs thicker than gel sheets. Three cases as follows are investigeted: 1) Piling gel sheets to increase thickness. 2) Using more thicker gel bodies. 3) Using acrylic boards for spacers to increase thickness. These cases are expected to the same effect if the area of gel sheets are the same, since they have same adhesive force to hold instruments.

On the experiment of falling PC, the gel sheets truely have holding effect of instruments, but the effect is smaller than expected from adhesive force they have. In the cases of thicker gels have smaller effect on holding instruments than the case of using spacers. Since the gel sheets are soft, the seismic motions may be amplified by resonance of the instrument-gel system. Therefore we have also done resonance experiments to investigate the effect of amplification of seismic motions by a resonence.

The resonance frequency and maximum amplification factor depends on the use of gel sheets. On the case of using spacers, the resonance frequency is about 6 Hz, and on the case of using thicker gel bodies, it is about 2 to 3 Hz. On higher frequency than 4 Hz, the instruments used here does not fall. Therefore, the maximum amplification to be considered is about twice for the case of using gel sheets with spacers, while it is about 4 times for the case of using thicker gel bodies.

We have developed an equation to estimate the suitable size of adhering gel sheets including the effect of resonance. This equation can well explain the experimental results. This equation can be used for general equipments since it is based on a simple physical model and parametrized. Substituting suitable parameters to this equation, we can obtain the size of gel sheets for the instrument. Parameters of the equation is as follows: Weight, width, position of the center of mass (height and horizontal distance from the edge), the adhesive force of gel sheets, maximum amplification of the resonance.