Development of technology to support judging the robustness of local government buildings immediately after an earthquake

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1. Introduction

Government buildings often become core bases of disaster management to facilitate quick restoration from earthquake damage. In past earthquakes, it took too long for experts to check whether government buildings were robust enough for people to enter them (Figure 1), which slowed down restoration processes.

This study aims to present technical references about structures and non-structural members of buildings that are necessary for building administrators to judge whether people can enter the building.

Figure 1: Robustness is unclear immediately after an earthquake

2. Contents of the study

This study aimed to solve the following two points.

a) The use of devices such as accelerometers is a possible option in quickly judging the robustness of a building structure immediately after an earthquake without depending on experts. However, there are no common engineering evaluation criteria to use.

b) Technical references used in the visual inspection of the robustness of non-structural members immediately after an earthquake are not yet available.

The following studies were implemented to address these issues.

(i) Present engineering criteria for structural robustness evaluation with accelerometers (Figure 2) based on structural analysis of building models. Organize technical precautions for practical applications.

(ii) Develop visual inspection guidelines for non-structural members (including evaluation of damage to suspended ceiling materials [Figure 3]).

In (i), standards were prepared for judging the robustness of a structure by using acceleration sensors installed in the structure to numerically capture properties that go through rapid changes during an earthquake (Figure 4). Specifically, the robustness of a structure was estimated based on the level of changes in the natural period of the structure during an earthquake. In (ii), current situations of earthquake damage evaluations of

non-structural members were organized. Standards for robustness judgment were then prepared after conducting experiments on the evaluation of damage to suspended ceilings, for which there is a shortage of knowledge and insight.

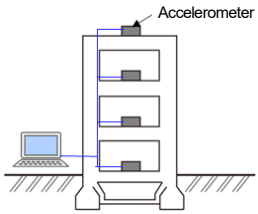

Figure 2: Practical application of a robustness judgment system in a building

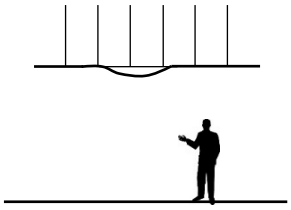

Figure 3: Damage to a suspended ceiling

Examples of subjects examined

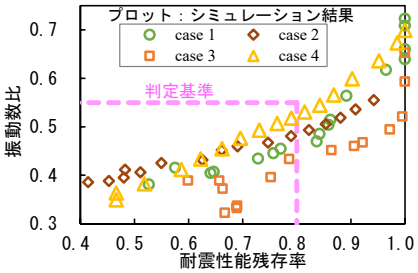

Figure 4: Robustness judgment criteria for structures