Evaluation of Flood Damage/Countermeasure Effects of Cities Based on Building Models

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Climate Change Adaptation Research Group
Urban Planning Department — Nozomu Kiuchi, Head, Doctor of Engineering, Urban Planning Division
Shuichi Takeya, Head, Doctor of Engineering, Urban Disaster Mitigation Division
River Department — Yoko Yamamoto, Senior Researcher, Kazuhiro Yanagawa, Researcher
Kazuhiko Fukami, Research Coordinator for Integrated Water Disaster Management, River Division

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1. Introduction

Taking into account the future increased flood damage risks due to climate change, the suggestion is to provide countermeasures in collaboration with various community level efforts, in addition to conventional flood control facilities. Especially in the cities, where a variety living styles and business activities are laid out, evaluating the risks to human lives and properties due to various expected hazards based on neighborhood characteristics and showing flood damage risks and countermeasure effectiveness are believed to increase the awareness of residents and business operators, achieving smooth consensus formation.

In this article, based on the concept of building model under development, a method for evaluating flood damage risks and countermeasure effectiveness, in combination with flood hazard characteristics are introduced.

2. Evaluation of flood damage risks based on building model

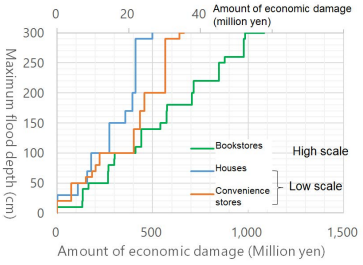
Most of the flood damage to general properties in cities occur in buildings, such as houses and business facilities, and adjacent sites, varying by building uses and business types. We developed the patterns of such damage based on model buildings[1] and set typical layouts of properties, such as components, equipment, furniture, and fixtures of buildings in the vertical direction for each pattern using the ground level as standard, based on actual condition surveys and national statistics. This corresponds to the costs of property damage that could occur depending on the flood depth in the water disaster event (Figure 1) by multiplying the probabilities of the occurrence of each flood depth at the location and identification of the flood damage risk (expected value) according to the characteristics of buildings is enabled.

In addition, we also developed a spreadsheet software that analyzes the characteristics of the flood damage risk in certain neighborhoods by placing building models and combining them with flood hazard characteristics of the region using GIS data containing detailed information about the building, such as location, building use, business category, and floor number.

3. Determination of countermeasure effects against floods by residents and business operators

Based on the concept of the building model, it is possible to determine the effect of flood countermeasures. The effects achieved by the improvement of flood control facilities, for example, can be evaluated by inputting the variations in flood hazard characteristics. Figures 2–4 show the evaluation of property damage reduction effects from the countermeasures of installing water stop panels around a building and of raising building sites by residents and business operators. The effect of these countermeasures taken by a certain amount of houses and business facilities in a neighborhood can also be figured out using the spreadsheet software. Our next aim is to conduct an analysis considering climate changes.

1) Up to now, 14 basic patterns have already been set.



Compared to others, the estimated amount of economic damage of bookstores is very high.

Figure 2 Difference in flood damage characteristics

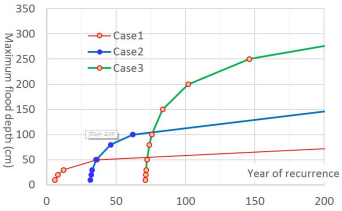
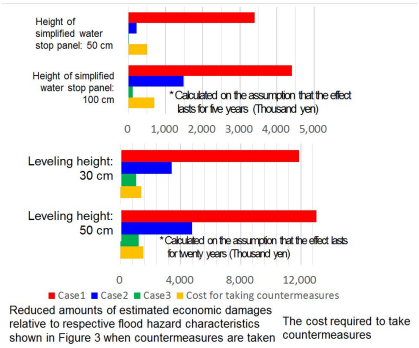


Figure 3 Flood hazard characteristics



Against flood hazard characteristics, effective countermeasures can be examined and proposed.

Figure 4 Difference in countermeasure effects

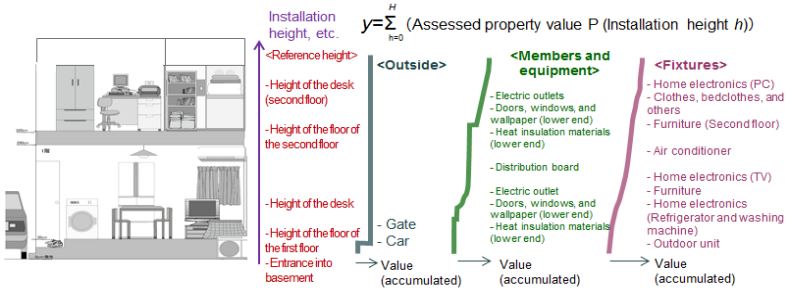


Figure 1 An image of vertical distribution of properties of a building model (detached house)