

A Study on Street blockade by Rubble Flow considering Structure of Wooden Building in a Traditional District with Local Heritage

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1. Introduction

Traditional town with local heritage is very important for local city to protect as its cultural resource. Most of the traditional towns have narrower streets than 4.0 m that are extremely vulnerable to disasters that make buildings broken, but they have, nevertheless, traditional meanings to be preserved and we should find a method for residents of the traditional towns to evacuate. We aim at establishing a method to forecast the street blockade in an important preservation district of traditional buildings under the Act of Cultural Properties, which has some narrow streets of 1.7m in width. In this study, we show a method of predicting street blockades including building collapse directions of traditional wooden houses at a large earthquake.

2. Methodology

2.1 Study area

We study the problem of street blockade by broken buildings at a preservation district, named “Hamashozu Machi Hamakanaya Machi.” The area is a part of a traditional area “Hizenhama Shuku” located in the south of Kashima City, Saga Prefecture, Japan, and has been designated as an “important preserved district of traditional buildings” by the Japanese government since 2006. The lead author worked at Hizenhama Shuku as both an advisor and a planner to promote its preservation, cooperating with the city authorities and representatives of the residents.

The area historically had its origin in a local fisherman town faces the Ariake Sea and developed as a station town along the Nagasaki Road, which was built in the Edo era to connect Kokura and Nagasaki.

This study area has many traditional wooden townhouses with straw and tile roofs along narrow, congested streets. These buildings stand along not only the Nagasaki Road but also several streets narrower than 2m, which are easily blocked by rubbles of buildings broken at large disasters, such as strong winds and earthquakes. There is an active fault in the north side of Saga City, and the ground of the area is so soft that a seismic wave is not attenuated. Besides, most of the residents are older adults, and many of them have handicaps. There live few younger adults who can help the older adults, especially in the daytime. Thus, because of its great vulnerability, finding an evacuation way of the residents and a rescue way in consideration of street blockade is a necessity.

2.2 Direction of rubbles

In the former study, we have not considered the rubble flow¹⁾. Sakata and Teraki studied a simulation for road blockage considering direction of rubble flow, but they did not consider structure of traditional building. Regarding street blockade in the historic area, direction of rubble flow considering building structure is necessary to study.

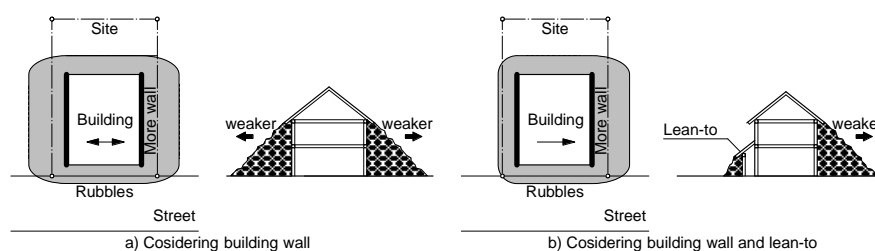


Fig. 1. Direction of rubble flow considering structure of traditional building

3. Street blockade by rubble flow

We calculated probability of street blockade in the study area by rubble flow considering structure of traditional buildings (see Fig.2). To calculate probability of rubble flow, we used the probability of complete destruction of wooden house issued by the Cabinet Office of Japan (<http://www.bousai.go.jp>). Probability of destruction of renovated traditional house was reduced to 30% (double of the number of house built after 1982).

4. Conclusion

In this study, we calculated the probability of street blockade considering structure of wooden building in a traditional district with local heritage to simulate evacuation time from each house to the evacuation places for persons in need of aids. We hope that this result will help us to develop a method of evacuation planning for this kind of traditional areas to disasters in conserving their heritages.

5. References

- [1] N. Mishima, N. Miyamoto, K. Kitagawa, Analysis of current two-way evacuation routes based on residents' perceptions in a historic preservation area, International Journal of Disaster Risk Reduction 8, 10-19, 2014
- [2] T. Sakata, and A. Teraki, A Study about Simulation for Road Blockage considering Directions of Rubble Flow, Proceedings of Institute of Social Safe Science, 25, 33-36, 2009

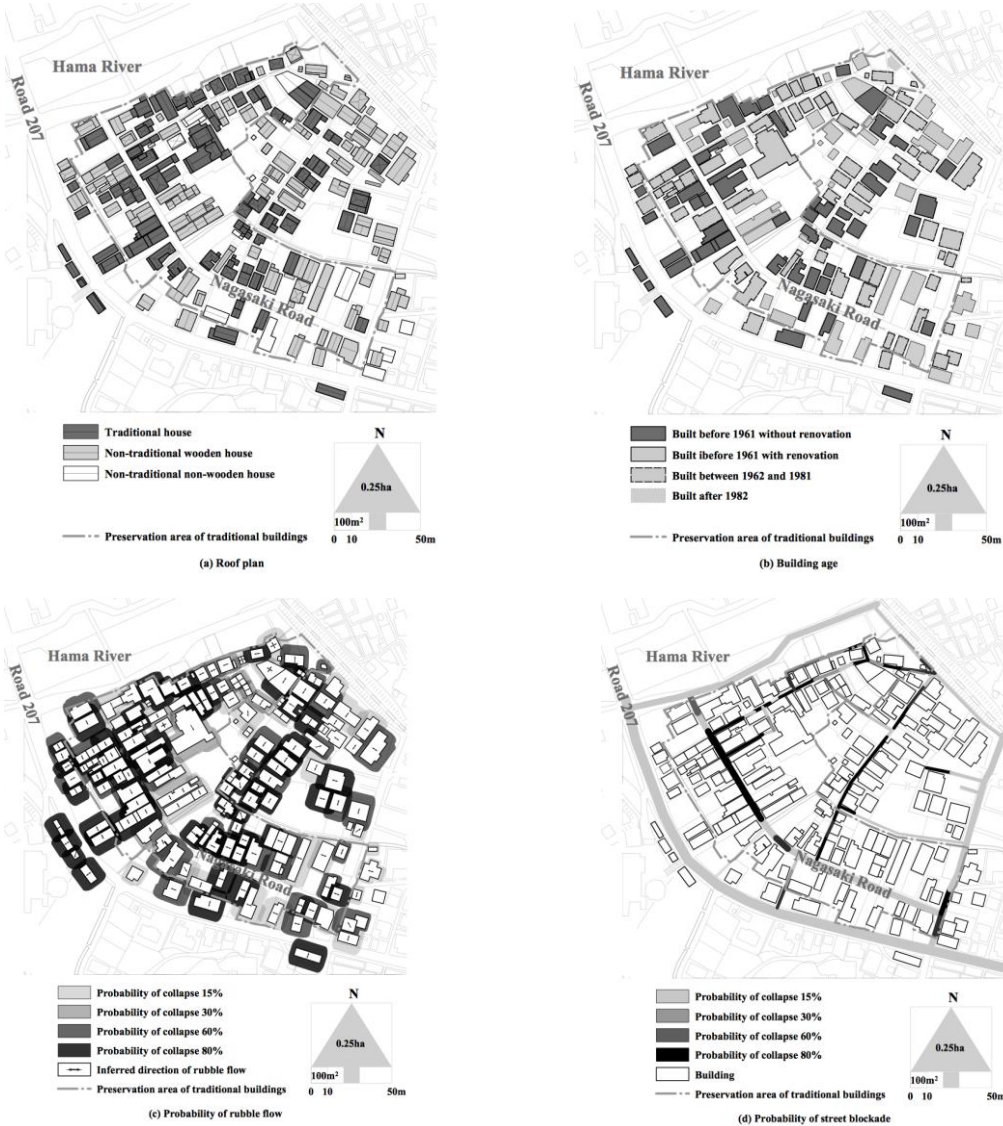


Fig. 2. Study of Probability of street blockade of the area