# A temporary evacuation area like open space analysis for disaster prevention town considering probability of street blockade-

Yutaro Hidaka* , Nobuo Mishima* , Hiroshi Wakuya* ,
Yukuo Hayashida*, Yasuhisa Okazaki*,
Keiko Kitagawa** , Sun-gyu Park , ***Yong-sun Oh***
*Ssga University , Japan **Seitoku University , Japan
***Mokwon University , Korea

ABSTRACT

Traditional town with wooden houses like Japanese historic local town is vulnerable to disaster. Wooden houses crowed in this study area, there is no gap between buildings and buildings. When disaster occurs, they can not use evacuation routes based on the value of probability of rubble flow. Disaster prevention design of traditional town using spatial information for residents is a modern idea in the field of disaster prevention study. Therefore, it is basically important and effective to create information, especially on the current situation such as dangerousness of the area. Here, we report on a disaster prevention design regarding probability of street blockade and probability of rubble flow at a large earthquake directly under our study area. In this study, we explain about necessity of temporary evacuation areas like open space. As a result, we found some ideas to secure evacuation routes from traditional houses to designated refuge places using temporary evacuation areas.

Keywords : temporary evacuation area, open space, probability of rubble flow, residents, traditional buildings

## 1. INTRODUCTION

It is important to analysis the evacuation routes and areas based on the calculation results of the probability of rubble flow (hereafter, PRF) and probability of street blockade (hereafter, PSB). These calculation results, it is possible to analyze the accessible area of the emergency vehicle. We must consider the evacuation routes the event of a disaster and provide civil information to residents. In this study, we analysed the safety of temporary evacuation areas where it contain the high value of PRF and PSB.

## 2. Methodology

### 2.1 Study model area

Our study model area is the whole of Hizenhamasyuku located in Kashima city, Saga prefecture, Japan. The boundry of the area we use is described in a survey report of Preservations District of Traditional Buildings for Hizenhamsyuku [1]. The town is partially preserved with two important preservation districts of traditional buildings. At the bottom of this target area, active fault called “Sae” fault (the maximum seismic intensity is 6-plus) exists.

### 2.2 Calculation of PRF and PSB

We calculate using PRF and PSB to analyse the safety of the temporary evacuation area. Based on the height of the building, we will calculate the width of rubble flow. This result of PRF considered from the collapse probability of earthquake. Finally, We analyse the overlap of PRF. The result is PSB.

### 2.3 The safety of temporary evacuation areas

In this study area, resident don’t want seismic strengthening because they want to protect the historical town feature. If they use seismic strengthening, it is possible to discourage historic atmosphere. From this reason, we must consider appropriate disaster prevention approach. In this study, we propose the placement of temporary evacuation areas as the preservation method.

## 3. Analysis of temporary evacuation areas

### 3.1 Problem of the study area with disaster

When we revealed the result of PSB and PRF, it’s difficult for us to find safer evacuation routes in this

study area. There are two problems when earthquake occurs. One is older houses with wooden. There are many historical houses which were built before 1980 with wooden in this area. Their structure is vulnerable to withstand an earthquake. Another one is historical narrow streets. Residents unable to use narrow streets as evacuation streets, because of the value of PRF and PSB is high.

### 3.2 Placement of temporary evacuation areas

We want temporary evacuation areas like open space to locate along historic narrow streets. So we should consider expansion of evacuation streets and safety routes to designated evacuation areas. In this study, we propose temporary evacuation areas as preservation design. Temporary evacuation areas have two functions. First, when earthquake occurs, residents go there. After they stay there safety until finishing the strong seismic stopped, they go to designated evacuation areas. Second, temporary evacuation areas replace expansion of narrow evacuation street and preserve its historic feature. If temporary evacuation areas are effective in this study area, seismic strengthening is unnecessary for residents. The purpose of this papers is proving the effective of temporary evacuation areas in historical town for disaster.

## 4. Summary

We calculated PRF of the whole area of Hizenhamasyuku, considering the Sae active fault that recently found near the area and structure of the traditional buildings. From these results, I reformed the analysis of evacuation routes and safe of temporary evacuation areas. In this paper, we analysed them based on the result of PFR and PSB. However, in this study stereoscopic issues excluded, further study is needed. We hope that the result of analysis the optimum evacuation routes for residents as well as fire rich in post-earthquake in the area. Additionally, the method of the analysis could be applied to the other traditional towns with local heritages.

## 5. Acknowledgements

This study is supported by the funds of Japan Society for Promotion of Science (JSPS) and National Research Foundation of Korea (NRFK)'s bilateral Joint Research Project during 2014 to 2016. We would like to thank all who understood and cooperated our on-site field work. We also wish to appreciate valuable discussions and comments with project members. The authors express gratitude also to the residents of our study area, especially non-profit organization Hizenhamashuku Mizutomachinami-no Kai.

## ▌References ▐

[1] Mishima, N., Miyamoto, N., Taguchi, Y. and Kitagawa, K.. Analysis of current two-way evacuation routesbased on residents' perceptions in a historic preservation area. International J. Disaster Risk Reduction, 8: 10-19,2014

[2] N. Mishima, Y. Taguchi, Y. Okazaki, H. Wakuya, K. Kitagawa, Y. Hayashida, Y.S. Oh and S.G. Park: Improvement strategy of open space at the center of a traditional lowland town with narrow paths for securing persons in need of aids viewing from evacuation time. Low land Technology International, 17(3), pp.197-206, 2015.12

[3] Kashima City, "Survey Report of Preservation Area of Traditional Buildings for Hizenhamasyuku", 1999

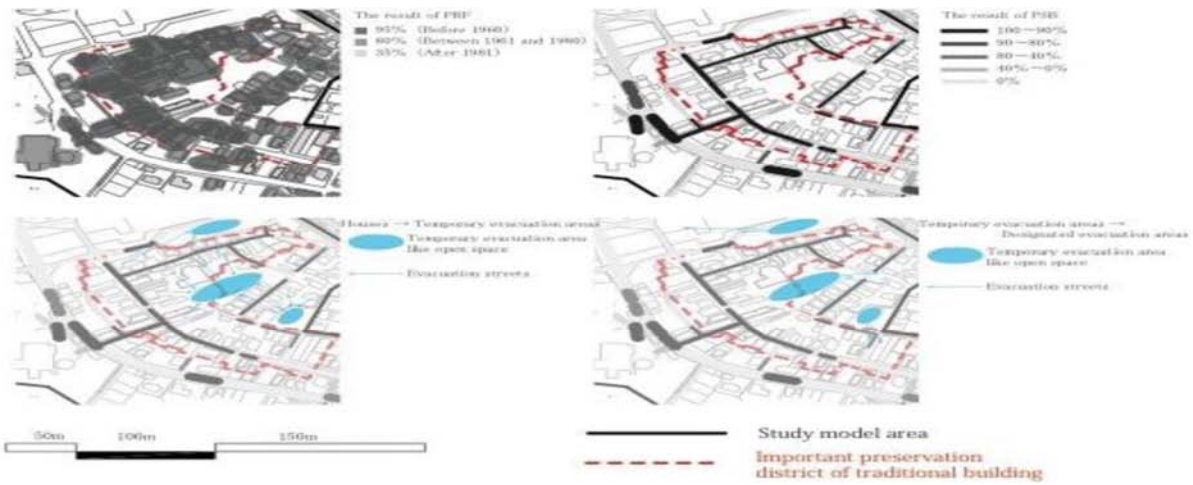


Figure 1. The result of PRF and PSB, temporary evacuation areas