

## A Study on a Proposal-scheme for Evacuation Routes Planning at a Large-scale Disaster in a Historic Preservation Area

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### Abstract

Most of the Historic Preservation Areas are very weak to fire disasters. The aim of this study is to build a proposal-scheme for evacuation routes planning at a large-scale disaster in a historic preservation area. The study area is a preservation area called "Hizen-Hama-Shuku" which has many straw-roofed wooden houses in Kashima city, Japan. To achieve this aim, outline of the scheme is discussed. The proposal-scheme of evacuation routes consists of objectives to propose, target time to evacuate for the refuge place, evaluation method, and procedures. The existing condition and the measures are evaluated using the software "SimTread".

Keywords: Disaster Prevention, Historic Area, Simulation of Evacuation Routes.

## 1. Introduction

### 1.1 Background of Study

Most of the Historic Preservation Areas are very weak to fire disasters because of their problems, for example, wood structures, narrow streets, the old residents. Especially, in the preservation area, the streets are also important elements should be preserved even if they are have any problems for the refugees, for example narrower than 2m. In this issue, to secure two-way evacuation routes is one of the solutions, but how to plan them and to solve the problems on the routes are not clear. It would be necessary to build a proposal-scheme to plan the two-way evacuation routes.

### 1.2 Aim of Study

The aim of this study is to build a proposal-scheme for evacuation routes planning at a large-scale disaster in a historic preservation area.

### 1.3 Method of Study

The object area is a preservation area called "Hama-Shozu Machi Hama-Kanaya Machi" located in Kashima City, Saga Prefecture, Japan, which is one of the historic local town with many straw-roofed wooden houses. To achieve this aim, 1) outline of the scheme is discussed through some meetings and fire drills in the object area, 2) simulation methodology is considered with using software "SimTread" which can simulate the evacuation routes, time and etc., 3) the existing condition is analyzed using the method to find the measures of evacuation routes also for the old, and 4) the measures are evaluated.

## 2. Proposal Scheme of Evacuation Routes

The proposal scheme consists of main points (aim of proposal, goals of evacuation, and maintenance points), proposal flow of evacuation routes, and verification method.

### 2.1 Main Points

Aim of proposal: To propose principles of evacuation routes and measures for the disaster weak without damage to the historic characteristics of the object area.

Goals of evacuation: 1) to make at least two-way evacuation route from every house, and 2) to refuge to a primary evacuation place in 10 minutes after disaster broadcast (7 minutes in safe).

Maintenance place: 1) two-way evacuation routes to a safe place, 2) safe places to avoid a disaster, and 3) routes to a primary evacuation place.

### 2.2 Proposal Flow of Evacuation Routes

First, evacuation routes the residents guess are picked out by a hearing survey. Second, spatial survey with a staff of Kashima city is done to check the evacuation routes' effectiveness and countermeasures for the disaster prevention. Considering the results of hearing survey and spatial survey, the measures will be proposed.

### 2.3 Verification Method

Evacuation routes are simulated using a walking simulation software "Sim Tread" on Vector Works. The proposal scheme is discussed through the results of the simulation. The analyses are done in the case of normal person, the disaster weak I (possible to

walk), and the disaster weak II (impossible to walk). Thinking over a large-scale disaster, no street blockade, blockade of path A, blockade of path B, and blockades of path A and B are compared in the present and after the maintenance measure. Here, the path A is around 1.7 m wide, and the path B is around 2.4m wide.

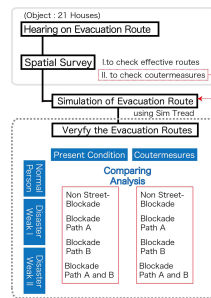


Figure 1. Flow of study

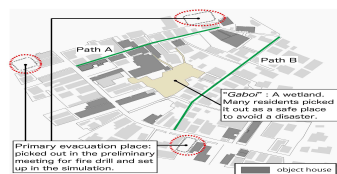


Figure 2. Study area  
Hama-Shozu Machi Hama-Kanaya  
Machi, Kashima City, Saga Prefecture

### 3. Analysis of the present situation

#### 3.1 Normal persons

In the case of normal persons and without street blockade, all of the refugees are finished in 10 minutes. But with the street blockade of path A or path B, some refugees can't be finished in 10 minutes. Most of them are the routes through the wetland "Gabo"(Figure 2).

#### 3.2 Disaster weak I (possible to walk)

In the case of the disaster weak I, even without street blockade, some refugees can't be finished in 10 minutes. With the street blockage of path A, the evacuation routes within 10 minutes are increased. This would be occurred by increase of the routes through "Gabo" (see Figure 3).

#### 3.3 Disaster weak II (impossible to walk)

In the case of the disaster weak II, with street blockade, nearly half of refugees can't be finished within 10 minutes. Almost all of the refugees are through "Gabo".

From these results, to maintain the wetland "Gabo" would be one of the best measures to the street blockade and also for the person taking refuge through "Gabo".

### 4. Analysis of a proposal of measure (maintenance of a open space)

Now, evacuation routes with maintenance of the

wetland "Gabo" are analyzed and verified.

#### 4.1 Normal persons

All of the refugees, even with the street blockade, could be finished within 7 minutes.

#### 4.2 Disaster weak I (possible to walk)

Without street blockade and with blockade of path A, all of the refugees could be finished within 7 minutes. With blockade of path B, within 10 minutes the refugees were finished.

#### 4.3 Disaster weak II (impossible to walk)

Many of the refugees couldn't be finished within 10 minutes. Especially with the blockade of path B, the impossibility was very remarkable.

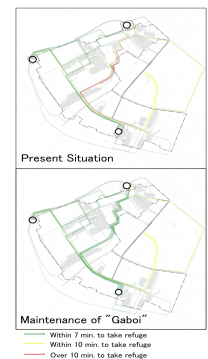


Figure 3. Verification of evacuation routes in the case of the disaster weak I and with the street blockage path B

### 5. Conclusion

#### 5.1 Effectiveness of the proposal of maintenance

Considering the circumstances mentioned above, the maintenance of the wetland "Gabo" is effective to make the two-way refugees in this area possible, without the case of the disaster weak who can't walk freely. Additionally, to make the maintenance of "Gabo" effective, it is also important to secure the ways from "Gabo" to the surrounding streets, for example to keep some open spaces such as parking spaces or to keep comings and goings of the borders.

#### 5.2 Effectiveness of the proposal scheme

In this study, a proposal scheme of evacuation routes at a large-scale disaster for a historic preservation area is built through simulating and analyzing the evacuation routes. This proposal scheme could be applied other historic areas considering their characteristics. Effectiveness of the proposal scheme could be showed here.

[1] M. Nobuo, T. Yoko, "A Study on a Proposal and its Evaluation of Fire Spreading Prevention in a Historic Area", Journal of Architecture Planning, AIJ, Vol.76, No.670, Dec. 2011, pp.2345-2351