

Support for the Formulation of Residents' Evacuation Action Plans Concerning the Sediment-related Disasters

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1. Introduction

In Japan, more than 1,000 sediment-related disasters have occurred annually on average over the past 10 years, and in the torrential rains that hit western Japan in July 2018, although awareness of the danger of the sediment-related disasters and evacuation advisories were generally issued before the disaster struck, many victims were killed, and the importance of residents making their own decisions and taking evacuation actions was pointed out. However, as a large number of victims occurred, the importance of residents making their own decisions and taking evacuation actions was pointed out. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) proposed sediment disaster countermeasures to ensure effective evacuation.

It was also pointed out that it is important to strengthen the support system for municipalities by providing expert support for the preparation of hazard maps, etc., and to enhance the decision support system and guidelines by the national and prefectural governments so that people can take disaster prevention actions such as evacuation using hazard maps and landslide disaster warning information, etc.

We report on the results of our study on residents' evacuation behavior in the event of the sediment-related disasters, which was examined through the efforts of the district disaster prevention plan, using the Obato district of Nakatsugawa City, Gifu Prefecture, as a model.

2. Materials and Methods

The Obato district of Nakatsugawa City, Gifu Prefecture, is located in the downstream area of Nakatsu River, a left tributary of the Kiso River, a first class river. In addition to the landslide hazard warning area, there is a relatively high risk of deep-seated landslides in the upstream area of the Nakatsu River.

To support efforts in the model district, a "study session on landslide disaster" was held in advance, multiple "discussions" were held in the form of workshops (twice), and a "town walk" was conducted to understand the hazardous areas in question, the assumed risks, and the routes to evacuation sites. In 2020, a district disaster prevention plan (evacuation actions during heavy rains, etc.) was reviewed and prepared, and in March 2021, it was positioned in Nakatsugawa City's regional disaster prevention plan.

In order to ensure its effectiveness, Nakatsugawa City issued an evacuation order during the August 2021 torrential rainfall, and some residents of the Ohato area carried

out evacuation actions. A questionnaire survey of residents was conducted to confirm the effectiveness of the district disaster prevention plan.

3. Results and Discussion

(1) Building Risk Survey

In the model district, evacuation centers outside the district are designated as evacuation sites for landslide disasters, but it was necessary to take the next best measure in case evacuation is delayed due to unexpected heavy rains. Therefore, a risk assessment survey was conducted on buildings located in the district to identify buildings that could be used as next best measures. The results are shown in Table 1.

(2) Evacuation route risk survey

While residents are at risk of being caught in a landslide on a road facing a boulder while evacuating to a safe place, the landslide hazard warning area, an indicator of landslide risk, may not be designated on a road where there are no houses. Therefore, we conducted a landslide risk survey on three roads that may be used as evacuation routes.

The results of the survey showed that all three roads have a risk equivalent to the Landslide Disaster Precaution Area and the Landslide Disaster Special Protection Area, and one of them is not used as an evacuation route due to its steep slope and long slope length. The one location was not used as an evacuation route due to its steepness and long slope.

(3) Evacuation Action Plan

In considering evacuation actions in the event of a landslide disaster, evacuation support for persons requiring special care in the district was examined. Among the persons requiring special consideration, for those requiring nursing care level 3 or higher, we considered using welfare facilities or similar facilities that are used during normal times as evacuation sites, instead of evacuation centers, in consideration of the facilities available at the evacuation sites.

In addition, the division of roles among evacuation support personnel, including support from the care manager in charge of securing an evacuation site, was determined.

(4) Verification of evacuation behavior

As shown in Table 2, the opinions of residents who did not evacuate indicate that residents in and outside of the landslide disaster prevention zone did not take evacuation action after confirming information on rainfall and water levels.

Before the evacuation order at 23:30, they decided to evacuate earlier to relatives' houses or hotels instead of Sun Life, the evacuation site, in consideration of the safe movement of the elderly and others.

The fact that 26 households responded that they have seen the current evacuation action plan but have never used it, and 28 households said they would like a simpler, individualized version, as shown in Figure 1, indicates that the low level of understanding of the contents of the evacuation action plan is not linked to evacuation actions. This is considered to be one factor.

One possible solution is to promote an evacuation action plan (individual version) that concisely outlines what each resident can confirm and act on as an individual or family so that each resident knows what to do at a glance, as shown in Figure 2.

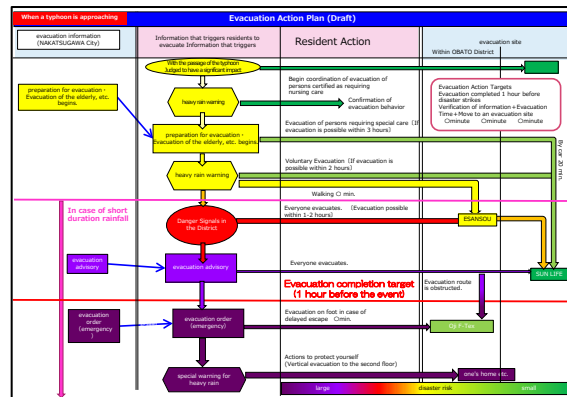


Figure 1. Evacuation action plan

Name		0000
Confirmation !	Obtaining Decision Materials Check rainfall in NAKATSUGAWA City on your computer.	
When ?	Time to run away (When what become?) If an evacuation order is issued by Nakatsugawa City.	
Where ?	Refugee destination (Where? By what route?) Daytime (when it is bright) SUN LIFE Night (when it is dark) Oji F-Tex cafeteria	
How ?	How to Evacuate (Who? On foot? By car?) Daytime (when it is bright) Call out to neighbors and drive. Night (when it is dark) Walking with family	
(Other Notes)		

Figure 2. Evacuation action plan (Version Proposal)

Table 1. Number of potential shelter units

Buildings where evacuation is possible	Number of houses
Buildings outside the sediment disaster prone areas	9
Buildings within the sediment disaster prone areas but with more than 2 floors	20
Buildings within the sediment disaster prone areas but non-timber buildings with more than 2 floors	1

Table 2. Questionnaire results (reasons for not evacuating)

Reasons for not evacuating	men
I was in a safe place other than my home.	0
I don't expect to be harmed.	1
Judging from the rainfall, river level, and current, it was deemed safe.	8
Judged safe based on TV and internet rainfall information, etc.	5
None of the neighbors were evacuated.	3
I didn't know that Nakatsugawa City had issued an evacuation order.	2
I thought it was more dangerous to evacuate in the middle of the night.	3
I thought that in case of emergency, I could escape to the second floor or something.	2
By the time they thought about evacuating, the situation was already dangerous.	0
I was worried about staying at the shelter (SUNLIFE).	2
I was worried about staying at the shelter (EISANSOU)	0
No one advised me to evacuate.	1

4. Conclusions

In this study, an evacuation action plan for a hypothetical landslide disaster was prepared by compiling the information necessary to make evacuation decisions in chronological order, evacuation actions according to the information, and evacuation sites inside and outside the district on a single sheet.

In order to improve the effectiveness of this evacuation action plan, we conducted a verification based on a questionnaire survey on residents' evacuation behavior during the August 2021 torrential rainfall, and found that many residents were not aware of the evacuation action plan, etc., and that it is necessary to improve their awareness. Therefore, we examined an evacuation action plan for each resident that would be more effective and easy to use.

In the future, it will be desirable to examine the process of incorporating the draft of the district disaster prevention plan prepared by the district into the local government's regional disaster prevention plan, and to provide support for the training of disaster prevention leaders and the establishment of a support system with experts so that residents can take the initiative in implementing the plan.