

## PROPOSAL OF METHOD OF EVALUATING LOCATION RISK OF WELFARE FACILITIES IN DISASTER

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**ABSTRACT:** At the disaster, special consideration is necessary for vulnerable people, the place in which they gather is dangerous. Therefore, it is necessary to think about disaster prevention and the disaster mitigation measures that vulnerable people can live safely. And it pays attention to the location place of the welfare facility and the method of evaluating the location risk of the welfare facility in the disaster is examined. It pays attention to the characteristic of the welfare facility manager in facilities, people in facilities and person who lives in the vicinity of facilities. It aims to think disaster prevention and disaster mitigation measures. The present study did the analysis and the site investigation by GIS and, in addition, executed the hearing investigation to the object municipality. Moreover, the evaluated space level was set, the disaster location risk of each space level was evaluated, and consideration and the examination of the evaluation examined disaster prevention and the disaster mitigation measures furthermore. The method of evaluating five was made for the earthquake flood damage and the sediment disaster. The method of evaluating five was applied to the vicinity of the welfare facilities of Saga City, and it evaluated it. As a result, it has understood the location in a dangerous place in view of the disaster. The problem of examination of safety for the life after it had taken shelter as a disaster mitigation measures not to expand disaster of it arose.

**Keywords:** Vulnerable people, Spatial level, Disaster prevention, Locational risk evaluation system for disasters

### INTRODUCTION

In Japan, the typhoon, the downpour, the heavy snow, the flood, the sediment disaster, the earthquake, the tsunami, and the volcanic eruption are generated easily from the locations, geographical features, geological features, and the weather, that is efficient disaster measures are necessary.

With Nagano City Mt.Jizuki landslide disaster that 26 senior citizens who existed in the welfare facility in July, 1985, become alive the burials, the consideration of the necessity of the approach for the support of senior citizen and handicapped person's "Vulnerable people" has risen starting. Recently, there are a lot of victims of vulnerable people. They delay taking shelter so that time may require it to take shelter, and suffer damage.

Therefore, it is necessary for them special consideration like information transmission that promptly and is certain for shelter and the assistance of shelter, etc. Therefore, the place in which they gather is dangerous. It pays attention to the location place of the

welfare facility in which they gather. The risk evaluation manual of the earthquake is shown in "Disaster prevention performance evaluation technique developed by a disaster prevention city planning total professional" (Ministry of Land, Infrastructure, Transport and Tourism 2003) that the Ministry of Land, Infrastructure and Transport recommend at each space level (municipal level and district level). However, it is a manual that applies to all the people, and little is known about consideration of the vulnerable people.

In this paper, we discussed the evaluation of the stability of the disaster of the welfare facilities in which vulnerable people gather of each disaster according to the spatial levels. In addition, disaster measures are made easy to lead by building the evaluation into the correspondence behavior of the victim different times wise and true time phase. Then, this paper takes Saga City as a case study to carry out evaluation of welfare facilities.

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## SPATIAL DISTRIBUTION OF WELFARE FACILITIES

Fig. 1 shows that welfare facilities were widely distributed in Saga Prefecture. Fig. 2 shows a situation of maximum inclining degrees were located where their welfare facilities, and Fig. 3 shows a situation of ground elevations were located where welfare facilities in Saga Prefecture. If an inclining degree and a ground elevation are high, it is a hazard to both sediment disaster and earthquake. As a diagram indicates, it is almost built on gentle incline but it is built more than place with an inclination of 22 degrees. In the same way, it is almost built on low altitudes but it is built more than place which over 110 meters high.

Items of mud and rock slide hazard criteria are angle of inclination, ground elevation, overhang, topsoil thickness, sump water, and the collapse around, slope failure deterrent technological standard, abnormal construction. Their criteria are simple, but it is a problem to have nothing to do with downfall. As there are angle of inclination and ground elevation in items, if their marks are high, it seems to chance of being mud and rock slide. It seems that welfare facility in Saga is built in different place. That is, it requires that we approach evaluation method for adapt to a variety of aspects.

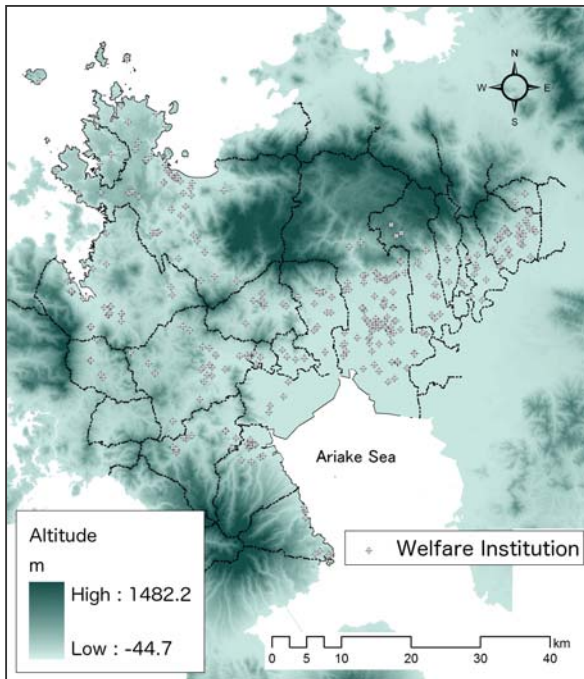


Fig. 1 Distribution of welfare facilities in Saga

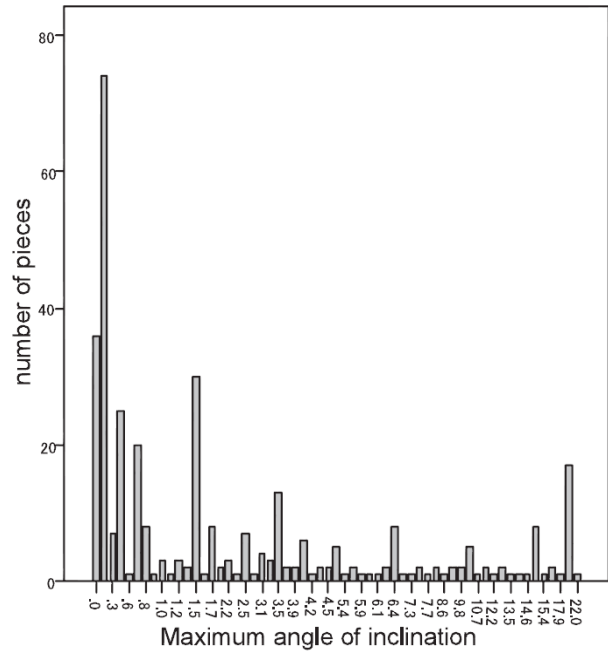


Fig. 2 Maximum angle of inclination of welfare facilities

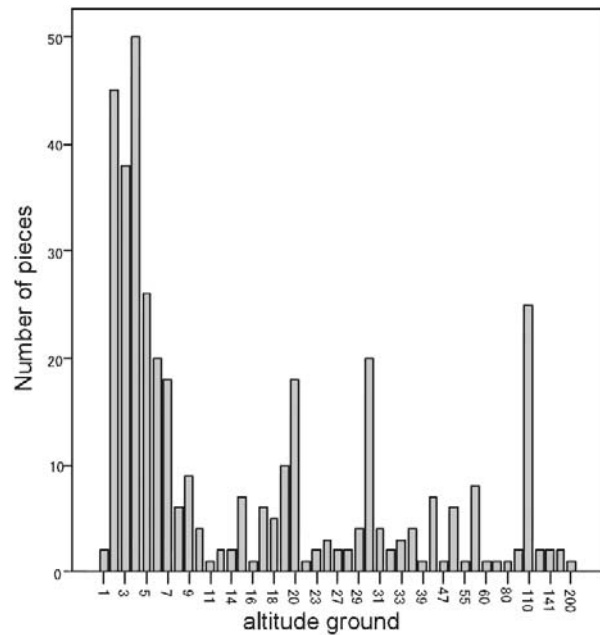


Fig. 3 Altitude ground of welfare facilities

## RESEARCH METHOD

This study was developed and analyzed by using GIS (Fig. 4). And defines space levels for measures, approaches evaluation method in space levels, checks up them. In addition, disaster prevention measures are made easier by building the evaluation according to different psychological time phases in correspondence behaviors.

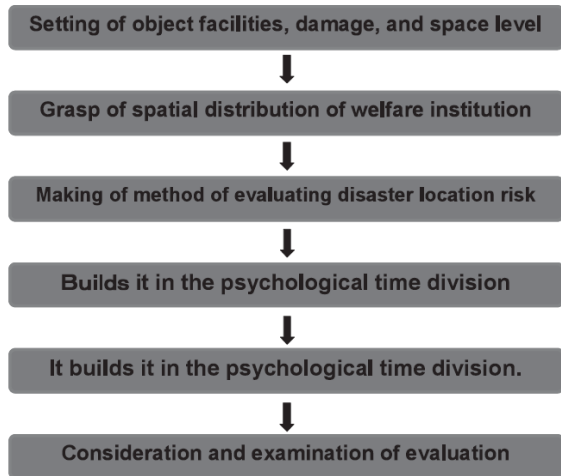


Fig. 4 Flow chart of research

#### TARGET FACILITIES AND SPATIAL LEVEL

In this study, target facilities are welfare facilities for elderly as vulnerable people for the disaster. This study deals with the earthquake damages: fire, collapsed building and landslide, and floods: flooding, inundation and sediment disaster.

Spatial levels in this study are 'Site level', 'Block level' and 'District level'. 'Site level' means a spatial unit as a site where was located a welfare facility. 'Block level' lays it down that 'the possible range of spreading fire' in *Building Standards Act*.

#### DIVISION OF PSYCHOLOGICAL TIME

There are three different time phases for actions of victims in the natural disaster: '10 hours', '100 hours' and '1000 hours' (Kimura et al. 1999).

'10 hours' during 'Disorientation period' is the first phase is at this time of not to recognize the situation and nearby rescue, safety confirmation and evacuation etc.

Then, '100 hours' during 'Formation period of stricken area society' is to recognize largely the situation and set up the evacuation center until some rescues arrive. 'To 1000 hours' during 'Stability period of stricken area society' is disaster relief work and volunteer activities etc. Furthermore, 'after 1000 hours' during 'Ordinary shift period to period' is routing rest in the disaster area returns to arrive for work, to be as per usual for lifeline restoration. These time phases had been adapted to evacuation methods and disaster prevention countermeasures in this study.

#### METHODS FOR EVALUATING LOCATIONAL CONDITIONS IN DISASTERS

##### ① Area Level Opinion (Earthquake)

It aims at the clarification of "Easiness to burn" in the entire district and "Difficulty of the fire-fighting operation". It refers to the disaster risk evaluation that the Ministry of Land, Infrastructure and Transport recommends in this study.

##### ② Block Level Opinion (Earthquake)

It aims at the clarification of spreading risk "Easiness to burn" and "Difficulty of the fire-fighting operation" in the vicinity of the object facilities.

The evaluation method requests a fireproof rate, "Fireproof rate = Proportion of residential house with fire protection system of buildings in all buildings", in the building of the object street district that is and the fire-fighting operation difficult district rate, "Fire-fighting operation difficult district rate = Proportion of fire-fighting operation difficult district of object street districts". In Criterion it is safe to fill 'Fireproof rate  $\geq 70\%$ ' and 'Fire-fighting operation difficult district rate  $< 20\%$ '.

##### ③ Facility Level Opinion (Earthquake)

It aims at the clarification of the safety of the shelter route of object original facilities. Because the object person of shelter is vulnerable people, the evaluation method makes a safe route that vulnerable people can pass. To improve disaster prevention, it makes it for two directions. The locale is surveyed, and whether there is actually dangerous part the made route is confirmed (Table 2).

##### ④ Facility Level Opinion (Flood Damage)

It aims to clarify the location risk of the object facilities of the flood damage by "Water on the inside" and "Water on the outside".

The evaluation method evaluates the risk of the flood damage with the inland water of the object facilities by using the data of damage with past water on the inside and the data of the altitude. The risk of the flood damage with the outside water of the object facilities is evaluated by using the hazard map.

Table 1 Division of psychological time and evaluation method

| Division at psychological time (h) | Time                                      | Situation of stricken area  | Evaluation method   | Understand from the evaluation   | Measures  |
|------------------------------------|---|---|---|--|---|
| 0                                  | Before the disaster happens               | Disaster measures   | ① District level evaluation<br>④ Facilities level evaluation<br>⑤ Facilities level evaluation | Seismic risk of district<br>Flood danger district<br>Sediment disaster dangerous district              | <ul style="list-style-type: none"> <li>• Fire drill</li> <li>• Earthquake-proof measures</li> </ul>   |
| ~10                                | Disorientation period                     | <ul style="list-style-type: none"> <li>• Confirmation of rescue and safety of the vicinity</li> <li>• Shelter</li> </ul>  | ② Block level evaluation<br>③ Facilities level evaluation                                     | Easiness of fire-fighting operation to do<br>Peripheral easiness to burn<br>The first shelter activity | <ul style="list-style-type: none"> <li>• The first shelter</li> <li>• Fire-fighting operation</li> <li>• Community activity</li> </ul>  |
| ~100                               | Formation period of stricken area society | <ul style="list-style-type: none"> <li>• Disaster information is received</li> <li>• Establishment of refuge</li> <li>• Assistance force and rescue supply</li> </ul> | ⑥ Facilities level evaluation   | Safety of secondary evacuation   | <ul style="list-style-type: none"> <li>• Secondary evacuation</li> <li>• Securing of secondary evacuation place</li> <li>• Volunteer work</li> <li>• Evacuation life</li> <li>• Shelter help</li> </ul> |

Table 2 Facility level opinion in earthquake

| Risk | Route to shelter  |
|------|---|
| 1    | Two directions and 250 m or less                                  |
| 2    | One direction is 250 m or more though it exists by two directions |
| 3    | 250 m or less only by one direction                               |
| 4    | 250 m or more though it exists by one direction                   |
| 5    | The shelter route does not exist                                  |

⑤ Facility Level Opinion (Flood Damage, Sediment Disaster)

It aims to clarify the location risk of the object facilities by the sediment disaster. Evaluating methods use and evaluate the landslide risk of digital national land information.

APPLICATION OF DISASTER LOCATION RISK EVALUATION

Actually, it applies proposal of method of evaluating location risk of ①-⑤. It shows distribution chart of Saga welfare facility (Fig. 3). It is located point where altitude is high, where inclination is sudden and various points in Saga welfare facility. The present study applies Fuji City Osoegawa in mountainous district and Honjou City Honjou where house has been overcrowded. First it applies in Honjou City Honjou.

①Both "Easiness to burn" in the entire district and "Fire-fighting operation difficulty" are safe. ② Both "Easiness to burn" and "Difficulty of the fire-fighting operation" in the vicinity of the object facilities are safe. ③The shelter route is risk 2. ④The flood damage by "Water on the inside" and "Water on the outside" are safe. ⑤The sediment disaster is safe. It is a region where the building has been overcrowded in Honjou City Honjou, but it is safe because it exists much effective

water supplies at earthquake and it is safe in the flood damage. In a word, there is a possibility to be refuge itself. Next, it applies in Fuji City Osoegawa.

①Both "Easiness to burn" in the entire district and "Fire-fighting operation difficulty" are safe. ② "Easiness to burn" is danger, "Difficulty of the fire-fighting operation" in the vicinity of the object facilities is safe. ③The shelter route is risk 3. ④The flood damage by "Water on the inside" and "Water on the outside" are safe. ⑤The sediment disaster is danger. There are a lot of mountains, and it is understood that the danger of the sediment disaster is higher than that of a fire and the flood in Fuji City Osoegawa. It is difficult for vulnerable people to live safe in five evaluations, and there is danger of the sediment disaster, it is necessary to think about shelter to another district. And they are each symptom in person who is moving in welfare facility.

Therefore, it is necessary to evaluate it according to the shelter ability level, and it is necessary to examine the effectiveness of the evaluation approach.

## CONCLUSION

It showed method of evaluating disaster location risk from five aspects in this study. By comparing the evaluation of five with the psychological time division, there is an effect of leading disaster measures easily. It

has understood to be same consideration for healthy person and vulnerable people. It is necessary for vulnerable people to be special consideration. When it applies to two facilities, it has understood that it is built dangerous point in sediment disaster. There is a necessity that it thinks safety of life after it takes shelter.

It is not possible for vulnerable people to endure live of a lot of barrier. And it is difficult movement to rest room, it keeps from water. Result there is many people it dies that the cold worsened and turned into pneumonia.

Therefore, there is a necessity that Welfare refuge was considered special for vulnerable people. As future tasks, there is a necessity to make method of evaluating disaster location risk to examine safety of shelter route for welfare facilities refuge each disaster.

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