SELECTION OF THE OPTIMAL REFUGE DURING THE DISASTER USING GIS

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ABSTRACT: In Japan, government proceeded with an effort on Geographic Information System (following abbreviated as GIS.) from the Han-Shin Awaji Earthquake disaster. However, some issues such as using a different map for each local self-governing body remain. Therefore in this study, we understand the current state of disaster prevention in the local community and make a database using GIS, and then select the optimal refuge during the disaster by analyzing the data and verify the usefulness of GIS. We chose a local community, Fujimi Tsurugashima-shi in Saitama in Japan. We collected the geographic information for the location, visualized of the information and selected the optimal refuge. In conclusion, we were able to visualize the optimal refuge. Moreover, we verified usefulness of GIS. It is easy to edit and manage large amounts of data and could visualize data therefore it is more useful than previous method such as using papers.

1. INTRODUCTION

Disaster sometimes occurs in the world. Especially in Japan, earthquakes occur frequently and major earthquake may occur sometimes. If people are hit by a disaster, must go to the refuge. In order to evacuate, you need to know the evacuation routes and refuge locations. To record the geographic information need a lot of paper and waste of time. Because many of the geographic information be changed in a short period of time. Previous method such as using papers costs a lot.

The purpose of this study is; to understand the current state of disaster prevention in the local community and to make a database of electronic geographic information such as population or area with GIS, and then to select the optimal refuge during the disaster by analyzing the data and to verify the usefulness of GIS.

We could visualize clearly intermediate area from the each refuge. GIS can be managed large amounts of data at low cost than traditional methods. Thus, visual cues can be intuitively visualized of accurate information in a database and to manage geographic information. These are proven effectiveness of GIS.

2. METHOD

In this study, we define optimal refuge that is the nearest refuge for people. Chome is a unit smaller than the town. We investigated the population, map, refuge location and refuge capacity of Fujimi.
Figure 1 and Table 1, 2 show the investigated data.

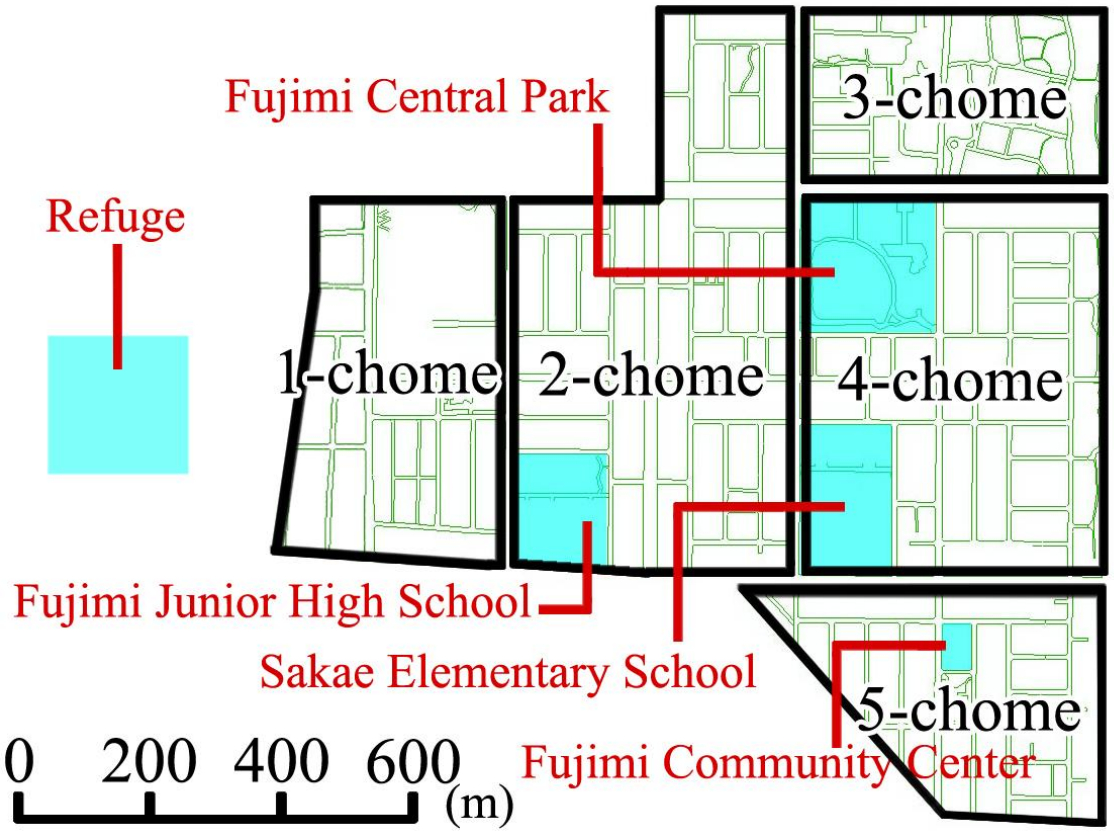

Figure 1 Target area information.

Table 1 Population, Household and Area on each chome of Fujimi.

Chome	Population	Household	Area (m^2)
1	1897	818	137000
2	2193	911	234000
3	2067	813	88000
4	1411	591	210000
5	1606	636	98000

Table 2 Name of refuge and capacity.

Refuge	Capacity (outdoors)	Capacity (indoors)
Sakae Elementary school	8260	1200
Fujimi Junior High School	8050	1400
Fujimi Community center	660	740
Fujimi Central Park	15500	-

We created database by using GIS. We find intermediate area of each refuge.
Figure 2, 3 and Table 3 shows the processed data.

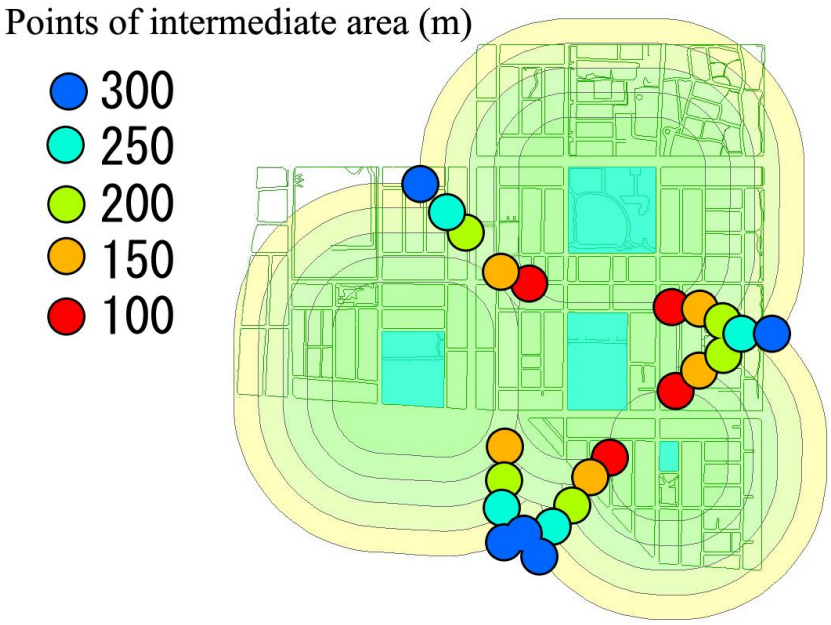

Figure 2 Points of intermediate area of each refuge.

Table 3 Optimal refuges.

Number	Optimal refuge	Distance (m)	Minutes
1	Fujimi Junior High School	330	4.9
	Fujimi Central Park	340	5.0
2	Fujimi Central Park	140	2.0
	Fujimi Junior High School	256	3.8
3	Sakae Elementary School	281	4.1
	Fujimi Central Park	345	5.1
	Fujimi Community center	346	5.1
4	Fujimi Junior High School	115	1.7
	Sakae Elementary School	142	2.1
5	Sakae Elementary School	191	2.8
	Fujimi Community center	230	3.4

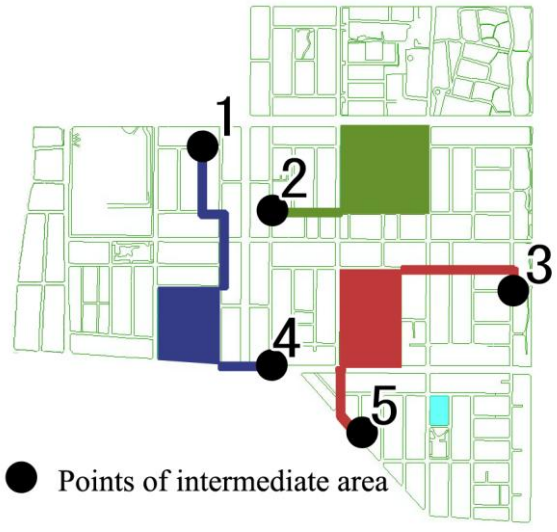

Figure 3 Route of Optimal refuge.

People can live in the refuge are limited. Because refuge cannot accommodates all residents.

Figure 4 shows percentage of capacity and population of Fujimi.

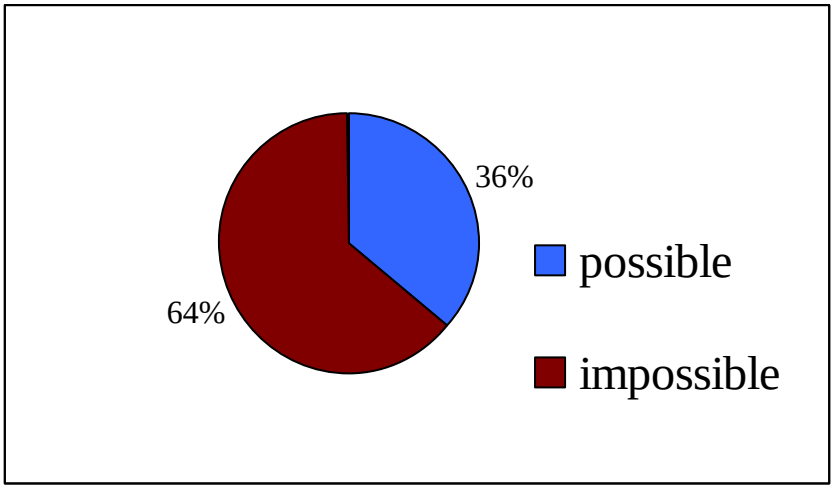

Figure 4 Percentage of capacity

3. RESULT

We could visualize clearly intermediate area from the each refuge.
Fujimi is located almost anywhere within 300 meters of each refuge. Therefore, there is no problem if a temporary evacuation. However if evacuation is prolonged, lack of the refuge is more capacity. That is, cannot accommodate all of the residents of Fujimi.

4. CONCLUSIONS

Analysis results, Fujimi is located almost anywhere within 300 meters of each refuge, therefore, people are able to evacuate quickly. Moreover it has been found that capacity in a temporary evacuate is enough.
We visualized intermediate area from the each refuge. Therefore, GIS show us the route to refuge from the intermediate area, and then we were able to determine the shortest escape route.
If evacuation is prolonged, refuge capacity is problem. That is to say, refuges cannot accommodate all of the residents of Fujimi. Graphing the data is easy for people to understand. It is found that refuge capacity is able to accommodate less than half of population in Fujimi.
Thus, visual cues can be intuitively visualized of accurate information in a database and to manage geographic information. Effectiveness of GIS is proven in this study.

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