

## The Spatial Accessibility of Emergency Shelter Assignment in Disaster situation

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**(1) Introduction:** Emergency shelter are the significant location to safeguard people from hazardous areas and disaster situation; however, the inequity of the shelter distribution and spatial heterogeneity of population are the critical issues that are limited the accessibility to the evacuation shelter in the real situation. This study, therefore, aims to develop the method to evaluate the emergency shelter assignment and identify the imbalance between the shelter distribution and the demand of the population during the flood disaster in terms of accessibility regarding to enhance disaster preparedness.

**(2) Method:** This study applied census data with the boundary data for the study case area in the scale of the smallest polygon mesh of 250 x 250 m resolution grid. For these smallest areas, the centroid features were calculated to represent as the population points and investigated the accessibility of emergency shelters. To estimate the accessibility based on the distribution of population and the designated emergency shelter, the travel route from each population points to the nearest shelters were calculated in terms of travel distance and duration. According to the guideline of the emergency evacuation that suggests the desirable distance of evacuation on foot shall be less than 2 km in all cases, a two-kilometers on the road network distance and travel mode of walking were considered appropriate for accessibility measurement and applied for the

Table 1: Spatial estimation of affected population

Data Information	Estimated amount affected from flood	Total amount	Percentile
Study case area (km <sup>2</sup> )	13.49	44.12	31%
Population	13,247	22,594	59%
Male	6,400	10,962	58%
Female	6,847	11,632	59%
Population over 65 years old	3,976	7,157	56%
Male	1,828	3,264	56%
Female	2,148	3,893	55%
Capacity of shelters	1,340	3,110	43%

case area analysis. In this research, the study case area is Mabi town, which is located in Kurashiki City, Okayama prefecture, the western region of Japan. For the comparison of the accessibility in the real disaster situation, the 2018 flood disaster which was the worst flooding in decades of the western part of the country, was also applied in the study. As the output, the total estimated population demand was calculated by merging all amount of accessed population points that can reach the shelters.

**(3) Result:** Figure 1 shows the results of the estimated route to the emergency shelter from each population points during the 2018 flood in Mabi town. Based on the methodology the total demands estimated from the flooded population were summarized and compared from the normal situation to access the nearest emergency shelter, as shown in Table 1.

**(4) Data:**

- Boundary data and the 2015 census data in 5th mesh level, Official Statistics of Japan
- Designated evacuation sites, Kurashiki City Open Data Portal

**(5) Acknowledgments :** This study was supported by JSPS KAKENHI Grant Number 18K19695.

**(6) Reference:**

Infrastructure Development Institute, J., Flood Hazard Map Manual for Technology Transfer. In Infrastructure and Transport, J., Ed. 2003; p 49.

Sritart, H.; Miyazaki, H.; Kanbara, S.; Hara, T. (2020) Methodology and Application of Spatial Vulnerability Assessment for Evacuation Shelters in Disaster Planning. *Sustainability*, 12, 7355.

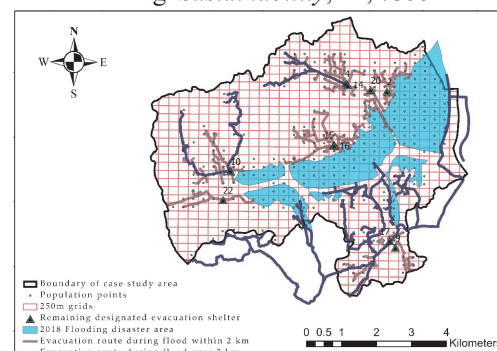


Figure1: Results of decreased spatial accessibility to designated shelters due to the flood