

Examination of Issues in Tsunami Evacuation
Based on Derivation of Evacuation Zones
on Different Spatial Scales:
A Case Study of the Coastal Area of Hamamatsu City, Japan

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Abstract

The Great East Japan Earthquake that occurred on March 11, 2011 was a disaster that caused tremendous damage, which has not been seen in recent years. The tsunami that caused the devastating damage has pointed out the limitations on hard countermeasures such as the construction of seawalls, and conventional disaster prevention measures are being reconsidered. On the other hand, the countermeasure against a massive Nankai Trough earthquake and tsunami becomes an urgent issue, especially in the Pacific coastal areas.

Keeping the above in view, this study aims to derive the evacuation area by using the road network analysis method with geographic information system (GIS) and then to compare the results obtained from two different spatial scales to clarify the issues on tsunami evacuation that cannot be seen from only one scale. The study area is the coastal area of Hamamatsu City, Shizuoka Prefecture, which is expected to be severely damaged by the tsunami associated with the Nankai Trough Earthquake.

This study focuses on the results of evacuation areas based on two different spatial scales, “regional” and “tsunami evacuation facility”. Conventional research on tsunami evacuation has focused on two approaches: one is to analyze the actual situation of evacuation areas from a broad perspective, and the other is to analyze the tsunami evacuation decisions and behaviors of individuals and groups. The differences in spatial scales seem to appear as differences in tsunami evacuation issues, and this may make it difficult to solve tsunami evacuation issues. Thus, this study compares and discusses the results of evacuation zones derived from different spatial scales to clarify the issues of tsunami evacuation.

The first point is to derive the evacuation zone considering the load conditions such as reduced walking speed and traffic constraints in the plains. The second is to derive the evacuation zone based on the longest evacuation route distance, the area of the zone, and the estimated number of evacuees. Most of the existing studies derive the evacuation area based on one of the indices, but it is desirable to understand the results of the evacuation area from various scales in order to clarify the issues on tsunami evacuation.

The results of this study are as follows. In terms of tsunami evacuation issues, it was found that the evacuation area of Maisaka and Shinohara towns decreased and shrank when the load condition was considered, and it became clear that there were areas where tsunami evacuation was difficult. However, the effect of the load condition on the evacuation was small in each region, and it was shown that the evacuation area of the coastal area of Hamamatsu City could be explained by the network only (Chapter 4). On the other hand, the evacuation area of each tsunami evacuation facility varied greatly due to the impact of loading conditions. In other words, it is not

appropriate to disregard the effect of the loading condition on the evacuation area for each evacuation facility to consider the tsunami evacuation of individuals and groups. In addition, the change of evacuation area was not only a decrease or a contraction depending on the load condition, but also a complementary increase or expansion of the evacuation area depending on the location of the tsunami evacuation facilities and the load condition. This clearly indicates the need for individuals and groups to select an appropriate tsunami evacuation site based on the load conditions that may occur during the actual disaster and evacuation (Chapter 5).

This study aimed to clarify the issues of tsunami evacuation by comparing the evacuation zones derived from different spatial scales. As a result, it became possible to understand the issues of tsunami evacuation from multiple perspectives by analyzing the spatial scales of tsunami evacuation facilities.

Keyword: Tsunami Evacuation Zone, Regional Scale, Tsunami Evacuation Facility Scale, GIS, Hamamatsu City