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Spatiotemporal Distribution of Railroad Users with Difficulty in Returning Home after a Devastating Earthquake

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In recent years, interest in disaster prevention planning for a devastating earthquake directly below Tokyo has grown, and numerous investigations and studies have been completed that estimate fatalities from such an event. Most previous estimates of human casualties have been estimated based on static population distributions, such as the daytime population distribution or nighttime population distribution obtained from the national census or other sources.

However, the actual population distribution varies hourly, and the degree and spatial distribution of human damage are closely linked to the time when the disaster occurs. In particular, the temporal variation in the number of railroad users is extremely large in Tokyo metropolitan area, and cannot be ignored.

Consequently, the purpose of the current research is to build a model for estimating the spatiotemporal distribution of railroad users using the data extracted from the Tokyo Metropolitan Area Person Trip Survey of 1998 (hereafter referred to as "PT data"), and thereby develop a detailed understanding of the temporal and spatial variations in the number of railroad users as follows.

First, we construct a model for estimating the spatiotemporal distribution of railroad users using PT data, and develop an understanding of the time variation and the variation in location of railroad users by personal attributes and movement purposes. Using this model, we demonstrate that it become possible to understand factors that previously could not be understood such as the potential for human damage, and the specific profile of persons affected by an earthquake, which vary greatly with time and location.

Next, we demonstrate that it is possible to plan for disaster assistance and to allow for more detailed disaster prevention planning suited to particular time periods and locations, by combining the profiles of affected persons and their spatiotemporal distribution.

Finally, as an application of the spatiotemporal distribution of railroad users estimated by the proposed model, the advanced model developed in the current study examines the spatiotemporal distribution of people that would encounter difficulty in returning home after a disaster. In addition to the number of individuals with difficulty returning home, the people that remain within the city are also considered in the model. To demonstrate the ability of the constructed model to estimate detailed attributes and anticipated information, the current study includes individuals with a high possibility of remaining in the city in need of support, and discusses the spatiotemporal distribution of these residents in case of disaster.