

Development of a Computer Simulation System to Evaluate Difficulty of Earthquake Evacuation considering Street Blockades caused by Collapsed Buildings

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[SYNOPSIS]

The aim of this study is to develop a computer simulation system to evaluate the difficulty of evacuation at a great earthquake considering street blockades caused by collapsed buildings and by obstacles in streets, especially cars.

The evacuation plan by Tokyo Metropolitan Government at a great earthquake consists of the following two steps: evacuation to temporary places of refuge and group evacuation to refuge places for a large area. However, experiences in the past great earthquakes show that streets expected to be evacuation routes are often unavailable due to street blockades. This danger may increase human damage in a great earthquake. That is the reason why estimation of decrease in neighborhood safety caused by the damage of evacuation routes in a great earthquake is important. For this estimation, the evaluation of the probability of the damage in evacuation routes is necessary. This probability is affected by various detailed factors of streets and buildings, and thus the consideration of these factors will increase the precision of the estimation.

Therefore, this study was conducted to estimate the difficulty of evacuation in neighborhood areas at a great earthquake using the following two types of detailed information: 1) the information of buildings which may collapse and block streets obtained from GISes, such as their roof plans, numbers of floors, types of structure and ages; 2) the locations of cars in streets which cannot be obtained from maps and thus which are determined by a stochastic model. To this end, this study proposed a method to determine automatically whether collapsed buildings block streets or not, which is called line polygon method, and developed its software system based on GISes. This system can also find out street blockades caused by cars in streets in a small area automatically.

Comparison of the result obtained from this study with that of an existing study which had detected street blockades manually showed that the line polygon method proposed by this study is a practical algorithm.