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論文要約

THESIS OUTLINE

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要約

Thesis Outline

The increasing frequency of powerful earthquakes highlights the urgent need for effective and safe evacuation planning. However, despite significant contributions on ‘efficiency’, prior research is limited in addressing ‘safety’ during evacuation. Also, it has not sufficiently explored uncertainty in demand. Therefore, this research includes various kinds of risk in model to ensure safety, on the other hand, it addresses uncertainty by adopting a new model formulation. In detail, this thesis develops hierarchical short-term and long-term shelter planning models under uncertainty, focusing on shelter locations, capacities, and evacuee allocation. For short-term shelter planning, a deterministic risk-based model and a stochastic programming approach are compared, the results show that in the case of Ogu, risk-based model can, in most situations, reduce the risk level during the evacuation process and improve evacuation efficiency and success rate without significantly increasing the total evacuation distance. It proves to be superior to the traditional distance minimization model, which prioritizes minimizing the total distance as the objective function. For long-term shelter planning, robust optimization with different ambiguity sets addresses long-term uncertainties. This model aims to ensure that shelters are optimally located, and evacuees are efficiently allocated, even under the most challenging scenarios. In the case study of Ogu, the results demonstrate that the objective value obtained by this model is higher than a stochastic programming model while lower than the worst-case robust model, indicating a more balanced approach to managing uncertainty. In total, these proposed models offer practical frameworks to enhance disaster preparedness, balancing risk reduction and efficiency for resilient urban and rural evacuation strategies.
