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# Multi-criteria location model of earthquake evacuation shelters to aid in urban planning

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## Abstract

Earthquakes are serious natural disasters that can result in significant fatalities and economic loss. The building of earthquake evacuation shelters is an effective way to reduce earthquake disaster risk and protect lives. Current studies on facility location models commonly overlook multiple optimal criteria from an urban planning perspective and are not suited to planning earthquake evacuation shelters. In this study, we describe seven principles for locating earthquake evacuation shelters. Following these principles, we propose a multi-criteria constraint location model that can be used to solve the location problem. We then present an iterative method to solve the model. With the support of a geographic information system (GIS), the method is composed of three steps: select candidate shelters, analyze the spatial coverage of candidate shelters and determine the shelter locations. Finally, a case study is used to demonstrate the application of the multi-criteria model and the corresponding solution method for its effectiveness in planning urban earthquake evacuation shelters. We conclude that the evacuation shelter location model and solution method are effective and suitable to solve the multi-criteria shelter location problem from an urban planning perspective.

## Keywords

emergency facility location, earthquake evacuation shelter, geographic information system (GIS),

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