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SPATIAL COMPARISON BETWEEN DENSELY BUILT-UP DISTRICTS FROM THE VIEWPOINT OF VULNERABILITY TO ROAD BLOCKADES WITH RESPECT TO EVACUATION BEHAVIOR

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Abstract. In a densely built-up area, it is conceivable that road blockades will occur widely because of building collapse caused by earthquakes. The road blockades on evacuation routes have a bad influence on earthquake evacuation behavior of residents. It is required for urban management to compare vulnerability to the road blockades between densely built-up districts. The purpose of this study is to discuss a methodology of comparison of the vulnerability based on road blockade risk between the districts. Behavior of the building collapse generally depends on a location of an earthquake's epicenter, intensity of an earthquake motion, and a type of tremor. Various kinds of simulation methods for reproduction of earthquakes have been developed, and estimation methods for damages have depended on the result of the simulation. In the comparison of the districts, an independent method however is also needed because of preventing the damages caused by an unexpected earthquake. We used building properties and Japan Engineering Geomorphologic Classification Map so that we calculated building collapse risk as a relative value. The risk was then applied to GIS analysis to determine risk of road blockade. We applied the road blockade risk as probability to the Monte Carlo simulation for making road blockade patterns. To transform the number of patterns to an index for the district comparison, we determined evacuation sites as key points, and we executed the network voronoi division along the road networks using every result of the simulation. The number of patterns based on the results of the network voronoi division was newly defined as a confusion index in a road-by-road basis: the index meant variations in a ranking of the shortest distance from the evacuation sites. We also calculated isolated roads from the evacuation sites using the results of the network voronoi division while the network spatial analysis was applied to the road blockade patterns from the view point of multidirectional evacuation. We discussed these analysis results using a land use map, historical properties of development, and other data of geographic information.

[Conference Paper](#) (PDF, 3264 KB)

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