Grid Based Traffic Vulnerability Model Using Betweenness Centrality for Urban Disaster Management Information

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Abstract : We propose a technique to measure the impact of loss of traffic function in a particular area to surrounding areas. The proposed method is applied to the city of Seoul, which is the capital of South Korea, with a population of about ten million. Based on the actual road network in Seoul, we construct an abstract road network between 1kmx1km grid cells. The link weight of the abstract road network is re-adjusted considering traffic volume measured at several survey points. On the modified abstract road network, we evaluate the traffic vulnerability by calculating a network measure of betweenness centrality (BC) for every single grid cells. This study analyzes traffic impacts caused by road dysfunction due to heavy rainfall in urban areas. We could see the change of the BC value in all other grid cells by calculating the BC value once again when the specific grid cell lost its traffic function, that is, when the node disappeared on the grid-based road network. The results show that it is appropriate to use the sum of the BC variation of other cells as the influence index of each lattice cell on traffic. This research was supported by a grant (2017-MOIS31-004) from Fundamental Technology Development Program for Extreme Disaster Response funded by Korean Ministry of Interior and Safety (MOIS).

Keywords : vulnerability, road network, beweenness centrality, heavy rainfall, road impact
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