

Suggestion of Methodology to Detect Building Damage Level Collectively with Flood Depth Utilizing Geographic Information System at Flood Disaster in Japan

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Abstract : In Japan, we were suffered by earthquake, typhoon, and flood disaster in 2019. Especially, 38 of 47 prefectures were affected by typhoon #1919 occurred in October 2019. By this disaster, 99 people were dead, three people were missing, and 484 people were injured as human damage. Furthermore, 3,081 buildings were totally collapsed, 24,998 buildings were half-collapsed. Once disaster occurs, local responders have to inspect damage level of each building by themselves in order to certificate building damage for survivors for starting their life reconstruction process. At that disaster, the total number to be inspected was so high. Based on this situation, Cabinet Office of Japan approved the way to detect building damage level efficiently, that is collectively detection. However, they proposed a just guideline, and local responders had to establish the concrete and infallible method by themselves. Against this issue, we decided to establish the effective and efficient methodology to detect building damage level collectively with flood depth. Besides, we thought that the flood depth was relied on the land height, and we decided to utilize GIS (Geographic Information System) for analyzing the elevation spatially. We focused on the analyzing tool of spatial interpolation, which is utilized to survey the ground water level usually. In establishing the methodology, we considered 4 key-points: 1) how to satisfy the condition defined in the guideline approved by Cabinet Office for detecting building damage level, 2) how to satisfy survivors for the result of building damage level, 3) how to keep equitability and fairness because the detection of building damage level was executed by public institution, 4) how to reduce cost of time and human-resource because they do not have enough time and human-resource for disaster response. Then, we proposed a methodology for detecting building damage level collectively with flood depth utilizing GIS with five steps. First is to obtain the boundary of flooded area. Second is to collect the actual flood depth as sampling over flooded area. Third is to execute spatial analysis of interpolation with sampled flood depth to detect two-dimensional flood depth extent. Fourth is to divide to blocks by four categories of flood depth (non-flooded, over the floor to 100 cm, 100 cm to 180 cm and over 180 cm) following lines of roads for getting satisfaction from survivors. Fifth is to put flood depth level to each building. In Koriyama city of Fukushima prefecture, we proposed the methodology of collectively detection for building damage level as described above, and local responders decided to adopt our methodology at typhoon #1919 in 2019. Then, we and local responders detect building damage level collectively to over 1,000 buildings. We have received good feedback that the methodology was so simple, and it reduced cost of time and human-resources.

Keywords : building damage inspection, flood, geographic information system, spatial interpolation

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