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The comparison of different approaches to establish the vulnerability of brick buildings to debris flow hazards

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The destruction of buildings in debris flow events was most related to inundation height and velocity of debris flow. Previous studies had established building vulnerability curves either from inundation height or impact force. However, high velocity with low inundation height might have the similar impact as low velocity, high inundation flows. This study aims to compare the result of two different approaches, considering inundation height and considering impact forces (velocity and height), and discuss the difference and similarity.
When a building struck by debris flow, the impact force would transform to the displacement of building structure, and would further resulted in the collapse of walls. In this study the fragility curve of brick building to spectral displacement was based on HAZUS damage state probability studies, the according dynamic impact force of debris flow to generate the displacement was based on the study of Haugen and Kaynia (2008), we combined the different probabilities curves into a unitary curve for different velocity (2 to 20 m/sec) on the most common size of brick wall resident house in Taiwan (10m*6m width with 3.5m of ceiling), with inundation height as X-axis and damage ratio as Y-axis the vulnerability curve was plotted.
The result was compared with the debris flow vulnerability studies of Lo et al. (2012) and Fuchs (2008), in which the inundation height was the main concern. The preliminary result shows that at lower range (velocity 2 to 5 m/sec) and higher range (greater than 15 m/sec) the difference of brick building damage ratio between two approaches was greater, within the range of 5 to 15 m/sec the difference is much smaller. However, the collection of building loss ratio and debris flow velocity cases would be necessary for improvement and verification of the model in future studies.

Key Words: debris flow, vulnerability, impact force