Seismic vulnerability assessments of the 2018 PNG Earthquake for building structures in Central Highlands, Papua New Guinea

（パプアニューギニア，中央高地の建築構造物のための 2018 年 PNG 地震時脆弱性評価）

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Background: In 2018 a huge earthquake of magnitude 7.5 occurred in the Central Highlands of Papua New Guinea. The disaster event destroyed many buildings in Tari, Mendi, and the Oil and Gas areas. The impact was so devastating that it left around 54,000 homes destroyed in the area. This study looked into ways that can help investigate the reasons these buildings were destroyed. It also presented the associated limitations in technical and geotechnical aspects of the buildings. The findings in this research can significantly reduce the cost of damages to buildings, save lives and prevent loss of economy in the area.

Method: This research employed two seismic vulnerability models. These models specifically targeted building structures under stress from earthquake events. First is the Level 1 Method (LM1) from the European Microseismic Scale 98(EMS-98). It uses the PNG 2018 post-earthquake data to calculate the damage cumulative percentages and the degree of damage level for buildings against the earthquake's intensity. The calculation specifically; targets the floor types and the building types. The second method is the Multi-Criteria Decision-Making Model (MCDM). It evaluates two factors of geotechnical and structural significance. It also integrates easily into GIS by providing an interface for the analyzed values for MCDM in a geospatial environment. The GIS then depicts these values on the maps as the seismic vulnerability of the building structures. The data used in these two methods were obtained through the United States Geological Survey (USGS), Papua New Guinea Mineral Resources Authority (PNG MRA), and OpenStreetMap (OSM).

Results and Discussion: The results indicated a strong correlation between Peak Ground Acceleration (PGA), and the damage degree of timber buildings in particular. Furthermore, the results pointed out that highly vulnerable buildings are timber buildings with floors above the ground. In this case, the geotechnical factor played a limited role. Structural factors such as the floor types and the material types are so significant. They highly influenced the damage degree and the seismic venerability of the buildings in the study areas during the 2018 PNG Earthquake.