The characteristics of damaged buildings due to the 2016 Kumamoto Earthquake in Mashiki town

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The 2016 Kumamoto Earthquake caused huge damages to many buildings and infrastructures in Kumamoto city, Mashiki town and others inside of the area in Kumamoto plain, central Kyushu. These damages occurred along two active fault zones, Futagawa fault zone and Hinagu fault zone. Many faults or co-seismic surface ruptures appeared to large damages on many buildings in central Mashiki town, because this area situated a cross zone on the extended part of the two fault zone. This study reports some characters of damaged buildings which were obtained by the observation of more than 3,600 buildings in 1.43 km^2 of central Mashiki and reports some characters of more than 330 co-seismic surface ruptures occurred there.

We checked 6 items of each building character in the study area. They are damage degree, type of building use, building age, roofing material, building material and tilted building direction. The damage degree of buildings was classified to 5 sections, counted large damaged 409, middle damaged 464, small damaged 575, covered roof 349 and no damaged 1,427. The type of building use was separated to 3 sections, counted residence 2,456 buildings, warehouse 770 buildings and nothing or removed 352 buildings. The building age was classified to 4 sections, counted very old 118 buildings, old 1,652 buildings, new 1,172 buildings and very new 281 buildings. The roofing material was separated to 3 sections, counted ceramic tile 1,472 buildings, slate one 706 buildings and other 1,045 buildings. The building material was divided to 2 sections, counted combustibleness 2,439 buildings and incombustibleness 813 buildings. The tilted building direction was measured, counted the north direction 232 buildings, the east direction 374 buildings, the south direction 442 buildings and the west direction 442 buildings.

We calculated the percentage of degree of damage for each item, and then we found the characters of damaged buildings as follows. From the building use type analysis, we found the damage ratio of residence was higher than that of warehouse. From the roofing material analysis, we found the damage ratio of ceramic tile was higher than that of slate one or other. From the building material analysis, we found the damage ratio of combustibleness is higher than that of incombustibleness. From the tilted building direction analysis, we found majority of the direction was the east-west which showed close direction to the strike of the earthquake faults. From the damage degree analysis, we found the damage ratio was high when the building was old and the ratio was low when the building was new. In other words, the degree of building damage levels was lower when the building was new.

From these analyses, we reclassified damage degree of building into 5 degrees from 1 to 5, arranged from easy to heavy. Distributional map of the damage degree was made by using a spatial-filtering GIS function. Therefore the severely damaged zone was indicated clearly in this area. It is important that earthquake surface faults and/or co-seismic surface ruptures concentrated at the marginal area of this zone.

Keywords: the 2016 Kumamoto Earthquake, damaged building, earthquake fault, GIS

