Factors controlling building damage distribution of the November 26 Mw 6.4 Albania earthquake

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On November 26, 2019, an earthquake struck the central western part of Albania. It was assessed as Mw 6.4. Its epicenter was located offshore northwestern Durrës, in a distance of about 7 km north of the city and 30 km west from the capital city of Tirana. Its focal depth was about 10 km. Based on the focal plane solutions provided by several seismological institutes and observations, the mainshock was generated by the activation of a NW-SE striking reverse fault. Unfortunately, the earthquake claimed the lives of 52 people. Few hours after the mainshock, the authors visited the earthquake affected areas in order to conduct a field macroseismic survey and geological reconnaissance for assessing the earthquake impact on the building stock. The dominant buildings in the affected area are buildings with load bearing solid brick walls and concrete floor slabs, precast concrete panel buildings and buildings with reinforced concrete (R/C) frame and infill and partition walls. The main characteristic in the majority of these structures is the presence of prefabricated concrete floor slabs with width of 0.7-1.0 m and no connections between them. Building damage was distributed along two ellipses, whose major axis is oriented generally NW-SE. The western ellipse of major damage was observed in Durrës city, located within the Periadriatic Depression, and the eastern one in Thumanë, Laç, Fushë-Krujë, Kamëz towns and Tirana city along the eastern margin of the Tirana Depression. This NW-SE orientation coincides with the strike of the seismogenic fault as it is derived from the fault plane solutions. The first building type presents slight non-structural and structural damage in Durrës city. However, buildings of this type in Thumanë suffered very heavy structural damage including partial collapse resulting in many fatalities. The second type did not suffer significant non-structural or structural damage. The majority of the observed R/C multistorey buildings in Durrës suffered damage to the lower three to four storeys, while the above storeys remained intact. Damage is attributed to the soft soils in the earthquake-affected areas, the undesired resonance phenomena in high buildings, the large duration of the earthquake shaking, the shallow water table in coastal and swamp areas, the pre-existing stress of buildings founded on soft soils characterized by differential settlements and possible liquefaction phenomena, the poor construction quality and workmanship of the affected buildings, the interventions made, the ageing of materials due to differential displacements of the foundation soil, the applicable antiseismic regulations of the time, if ever were applied, the lack of maintenance and inadequate repair after previous destructive earthquakes and the impact of the September 21, 2019 Mw 5.6 earthquake on the buildings of the affected area. The damage are
considered typical of an earthquake of this magnitude. The effect of the previous September 21, 2019 Mw 5.6 earthquake in the same area should be also taken into account. Based on the seismic zonation map of Albania, it is concluded that the resulted intensities from the 2019 earthquake are within the limits specified in the Seismic Zonation Map.