

Estimation of Maximum Ground Motions in the Form of ShakeMaps and Assessment of Potential Human Fatalities from Scenario Earthquakes on the Chishan Active Fault in southern Taiwan

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Historically, there were many damaging earthquakes in southern Taiwan during the last century. Some of these earthquakes had resulted in heavy loss of human lives. Accordingly, assessment of potential seismic hazards has become increasingly important in southern Taiwan, including Kaohsiung, Tainan and northern Pingtung areas since the Central Geological Survey upgraded the Chishan active fault from suspected fault to Category I in 2010. In this study, we first estimate the maximum seismic ground motions in term of PGA, PGV and MMI by incorporating a site-effect term in attenuation relationships, aiming to show high seismic hazard areas in southern Taiwan. Furthermore, we will assess potential death tolls due to large future earthquakes occurring on Chishan active fault. As a result, from the maximum PGA ShakeMap for an Mw7.2 scenario earthquake on the Chishan active fault in southern Taiwan, we can see that areas with high PGA above 400 gals, are located in the northeastern, central and northern parts of southwestern Kaohsiung as well as the southern part of central Tainan. In addition, comparing the cities located in Tainan City at similar distances from the Chishan fault have relatively greater PGA and PGV than those in Kaohsiung City and Pingtung County. This is mainly due to large site response factors in Tainan. On the other hand, seismic hazard in term of PGA and PGV, respectively, show that they are not particular high in the areas near the Chishan fault. The main reason is that these areas are marked with low site response factors. Finally, the estimated fatalities in Kaohsiung City at 5230, 4285 and 2786, respectively, for Mw 7.2, 7.0 and 6.8 are higher than those estimated for Tainan City and Pingtung County. The main reason is high population density above 10000 persons per km² are present in Fongshan, Zuoying, Sanmin, Cianjin, Sinsing, Yancheng, Lingya Districts and between 5,000 and 10,000 persons per km² are present in Nanzih and Gushan Districts in Kaohsiung City. Another to pay special attention is Kaohsiung City has more than 540 thousands households whose residences over 50 years old, including bungalows and 2-3 stories houses. Many of them are still in use. Even more worry some is that in Kaohsiung many of these old structures are used for shops in the city center where population is highly concentrated. In case of earthquake, the consequences would be unthinkable. In light of results of this study, we urge both the municipal and central governments to take effective seismic hazard mitigation measures in the highly urbanized areas with large number of old buildings in southern Taiwan.