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A Review of Near-Fault Ground Motion Issues and Future Studies

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Abstract

Taiwan is one of regions with very high seismicity in the world because it is located in the Pacific Ring of Fire. The well-know Chi-Chi earthquake (Mw7.6) caused by the reverse Chelungpu Fault with a surface rupture length of around 100 km. The largest coseismic slip was in the north end cutting through the Shigang Dam and resulted in an uplift of almost 10 meters on the hanging wall. Many TSMIP stations observed powerful near-field seismic waves during the earthquake. The station TCU068 recorded horizontal acceleration with PGA of about 0.53 g and the peak value of integrated horizontal velocity is around 390 cm/s. The station TCU052 recorded horizontal acceleration with PGA of about 0.5 g and the peak value of integrated horizontal velocity is around 260 cm/s. The two records are still the largest seismic velocity record in human's seismic observation history. Seismologists and earthquake engineers in Taiwan have to face and prepare for next near-fault strong ground motions in the future. Therefore NCREE is constructing a long-stroke, high-speed shaking table for simulating near-fault ground motions on infrastructures. This study gave a brief review and explanation on distinctive effects of near-fault ground motions as well as several research topics of the subproject of strong ground motion division. The distinctive effects of near-fault strong motions, such as hanging wall effect, velocity pulse, and fling, may cause severe damages on infrastructure. For example, peak value and period of a pulse-like velocity record are special concerns of earthquake engineers owing to a potential high spectral value at long period. In order to further understand near-fault strong motions, constructing a near-fault strong motion database is the first essential work and then we are able to study details of

distinctive characteristics of near-fault strong motions and provide input motions for the shaking table. We preliminary figured out several important issues for the future studies on near-fault strong ground motions. 1. Conduct PSHA and PFDHA for near-fault areas in Taiwan as well as develop programs for the hazard analyses. 2. Analyze effects of different baseline correction techniques. 3. Develop a GMPE consists of near-fault effects. 4. Numerical simulation for near-fault strong motions. 5. Make a comprehensive suggestion for the seismic design code on near-fault conditions accordingly.