

MESH-BASED SCENARIO SIMULATION TO EVALUATE THE SEISMIC RESISTANT CAPACITY SUBJECTED TO VARIOUS LEVELS OF EXCITATIONS FOR METROPOLITAN CITIES

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Abstract: *The disaster vulnerability has increased in recent years because of population concentration and complex infrastructures constructed in Taiwan. If a large-scale earthquake like the Chi-Chi earthquake occurred near metropolitan cities, the induced casualty and loss would be more extensive than those in 1999. Therefore, the seismic resistant capacity subjected to large-scale earthquakes under current environment conditions in metropolitan cities should be evaluated for disaster mitigation planning.*

We developed a mesh-based scenario simulation tool, Taiwan Earthquake Impact Information Platform (TERIA), to assess the seismic impact based on variety of inventory database collected from government agencies. TERIA is capable of analyzing the ground motion, soil liquefaction potential, casualty, and damages of buildings, roads, bridges, portable water system, power supply system and displaying those results in 500 m x 500 m meshes on interactive interfaces. Various levels of excitations, consisting of extreme and operational scenarios, were utilized to disclose the weak items of exposures as well as their spatial distribution quantitatively. We present major theme maps for disaster mitigation planning, including seismic impact on buildings, emergency rescue, medical care, shelter, and government operation. Two examples are given to illustrate the practical application of our research achievement on disaster mitigation planning. (1) Scenario simulation of the Shanchiao fault in the northern Taiwan (Figure 1): Theme maps for emergency rescue and shelter with integration of casualty and damages of buildings, roads, bridges, and lifeline systems interpret the disaster scenario and their influences on emergency operation (Figure 2). Based on our analytical results, 23 mitigation strategies were formulated by central ministries and local governments. (2) Impact analysis in shaking intensities V, VI, VII, representing extreme and operational scenarios, for Taipei metropolitan city: The functionality of rescue, medical care, shelter, transportation, and lifeline systems were diminished as the shaking intensity increases (Figure 3). Policy suggestions in 4 aspects were proposed by the Disaster Prevention and Protection Expert Consultation Committee to enhance the disaster resilience and improve the disaster management system in Taiwan.

Keywords: *Earthquake, Scenario Simulation, Impact Assessment, Mitigation Planning*

Conclusion

The mesh-based earthquake assessment tool, TERIA, can be applied to evaluate the seismic impact to exposures and reveal their spatial distribution in details for hazard mitigation planning. Scenario simulations under various levels of excitations allow the disaster resistant capacity of organizations to be examined. According to quantitative distribution of damages in details, local governments may draw corresponding countermeasures and allocate limited resources more effectively. The practical application of scenario simulation could be helpful to elaborate a thorough mitigation planning for reinforcing the disaster resilience against future major earthquakes.

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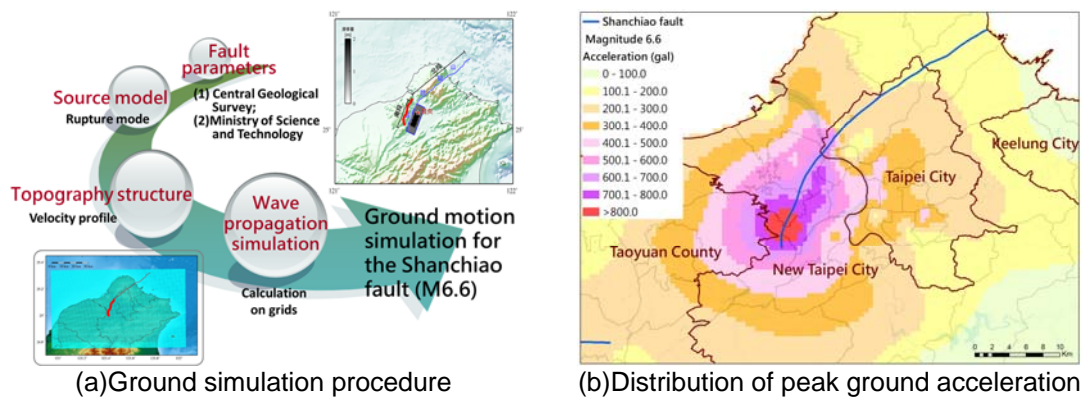


Figure 1. Ground simulation for the Shanchiao fault in the northern Taiwan.

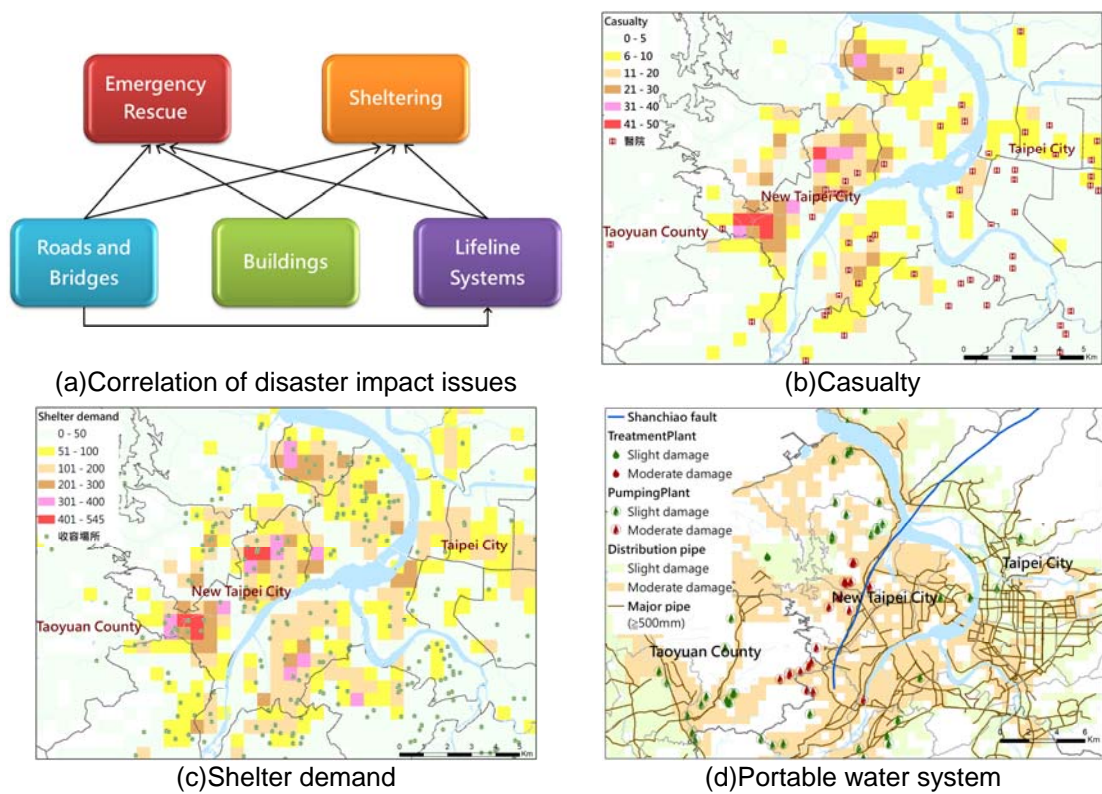


Figure 2. Impact analysis for the Shanchiao fault simulation.

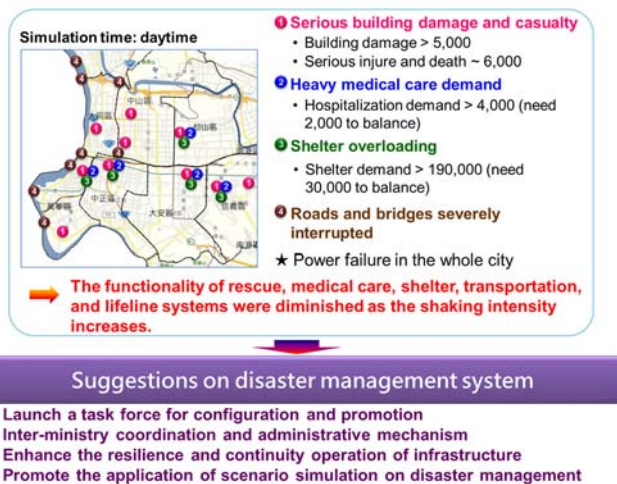


Figure 3. Application of scenario simulation on policy suggestion.