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Seismic Upgrading of School Buildings

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A number of buildings in the elementary and secondary schools in Taiwan have suffered damages of various degrees during earthquakes in past decades. Taiwan was so fortunate that the most devastating Chi-Chi earthquake occurred in late night otherwise the casualties could have been much more. From the past earthquakes, school building was found the most vulnerable category in public buildings. However, school buildings are usually assigned as emergency shelters. Therefore, seismic upgrading of school buildings becomes a stringent issue.

Since Chi-Chi earthquake in 1999, the National Center for Research on Earthquake Engineering (NCREE) has been devoted in the research and development on seismic evaluation and retrofit of school buildings. After a series of investigation through theoretical derivation, numerical simulation, laboratory experiment and in situ experiment, technology handbook on seismic evaluation and retrofit of school buildings was published for engineers.

In order to effectively tackle the seismic deficiency problems for school buildings in Taiwan, three stages have been proposed for screening, including simple survey, preliminary evaluation and detailed evaluation. All the data are submitted to the NCREE through internet. Seismic performance of school building is graded according to the ratio of seismic capacity and demand. Statistical analysis is carried out and the results are used for decision making by the education officials. The first stage of screening, simple survey is conducted by school administrators. School data and building data are collected. The second stage of screening, preliminary evaluation is conducted by professionals. It takes about half a day and costs about NT$6000 for preliminary evaluation of a school building. The third stage of screening, detailed evaluation is the conducted by

professional engineers. It takes about 45 to 60 days and costs about NT$150 per square meter of floor area for detailed evaluation of a school building.

Retrofit design is conducted by professionals. It takes about 45 to 60 days and costs about NT$150 per square meter of floor area for retrofit design of a school building. Detailed evaluation and retrofit design must be reviewed by a panel to guarantee the quality of engineering works. Retrofit implementation is conducted by qualified contractors. It takes about 60 days and costs about NT$4000 per square meter of floor area for retrofit implementation of a school building. Inspection is required.

In response to financial tsunami, NT$558.3 billion was allocated for strengthening local infrastructure to expand domestic demand and for economy stimulus to expand investment in public works. Out of NT$558.3 billion, NT$18.3 was billed for seismic upgrading of buildings in elementary and secondary schools in four years, from 2009 to 2012. In this project, thousands of school buildings will go through the processes of preliminary evaluation, detailed evaluation, retrofit design and retrofit implementation. About 1500 school buildings will be retrofitted.