

Lessons Learned from Disastrous Earthquakes

Development of Collapse Assessment and Retrofit Strategies for Existing Mid-to-high rise Reinforced Concrete Buildings

Yuan-Tao Weng, Associate Researcher

National Center for Research on Earthquake Engineering, Taiwan

The M_w 6.6 Meinong earthquake occurred on 6 February 2016 in the southern region of Taiwan. The earthquake caused significant damage in and around Tainan city, with a number of collapsed and severely damaged buildings and 117 deaths. Building reconnaissance includes mid-rise to high-rise commercial/residential buildings and school buildings. The observed structural damage was characteristic of non-ductile and poorly configured buildings. The collapsed buildings all contained irregularities and soft-stories. The majority of older mixed-use buildings performed severe column failures were observed in several taller apartment buildings constructed in the 1990s. The building damage modes for the this earthquake can be summarized as follows: (1) presence of soft and weak first story, (2) lack of redundancy, (3) lack of lateral reinforcement, and (4) structural irregularities. Almost all of the collapsed and severely damaged buildings observed were constructed within a 10-year window between 1988 and 1998. The majority of the older mixed-use buildings appeared to be due to column failures on the ground floor due to a combination of poor structural configuration and detailing. In order to reduce the risk posed by critical structural weaknesses and improve the safety and resilience of these buildings, the efficient seismic performance evaluation and monitoring methods for mid-to-high rise buildings have to be developed for emergency need. As a result, two research topics are proposed as below:

1. Evaluation of the methodology to select and prioritize collapse indicators in existing mid-to-high rise RC buildings

A low-cost, easily implementable methodology for identifying the subset of concrete buildings in Taiwan that are particularly vulnerable to collapse has to be developed. Initial main efforts focused on the concept of “collapse indicators” in certain subclasses of older concrete buildings, with the goal of identifying and prioritizing vulnerable buildings based on building characteristics that could be quantitatively linked to collapse.

2. Seismic evaluation/retrofit of existing mid-to-high rise RC buildings for

collapse potential

Develop and Implement Evaluation/Retrofit Guidelines, Tools and Programs – To increase the popularization of seismic retrofitting among the older buildings, efficient and economical strategies for collapse prevention based seismic evaluation and retrofit of mid-to-high rise RC buildings in Taiwan have to be developed. In addition, it is urgent to establish prompt preliminary seismic assessment methods for the existing mid-to-high rise buildings, especially for the older mixed-use buildings in Taiwan.