

Structural Lessons from Wenchuan 5-12 for Disaster Risk Reduction

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Summary

The immediate response to a disaster is emergency rescue and relief, followed by rebuilding communities and physical infrastructure to a standard sufficiently robust to survive a similar event in the future with little loss. The building of resilience into neighbouring communities which did not suffer the disaster in order to achieve a similar robustness is equally important but it is often delayed, perhaps indefinitely, during the recovery process. Retrofitting deficient structures is a more sophisticated task than rebuilding to modern standards. There is insufficient research and training of structural engineers in structural risk assessment and methods of retrofitting. Wenchuan 5-12 provided a valuable field laboratory (at horrendous cost) for identifying good and bad features of common structures. These features will be discussed for the dominant forms of reinforced concrete and load bearing masonry construction. The implementation of a comprehensive risk reduction program will require cooperative engagement of local communities, government, professionals and contractors which presents yet more challenges to the structural engineer.

Keywords: Disaster reduction, risk assessment, earthquakes, seismic resistant design, retrofitting

1. Introduction

When a major natural disaster strikes there are four phases of response.

The first phase is emergency response – evacuation, food, shelter, medical and health services.

The second phase is recovery – rebuilding social cohesion, dignity, self respect, habitat and infrastructure, and rehabilitating ecosystems.

The third phase is the development of a disaster management plan. This addresses mitigation of the disaster through early warning systems and community education, identifying exposure to hazards and fragility of social and physical infrastructure. The assessment of exposure and vulnerability is followed by the development of feasible methods of retrofitting or rebuilding with adequate resilience. The disaster management plan is essentially dynamic, continuing to evolve during the fourth phase of response to a disaster. The plan needs to be incorporated in the recovery phase – building back better – so that risk of disaster is reduced.

The fourth phase is disaster risk reduction (DRR) – the implementation of the disaster management plan.

Disaster risk reduction is a critical factor in the global effort to reduce poverty. Affluence is no protection from disaster. However, a disaster is a temporary setback to economic growth in rich countries, but a permanent setback in poor countries. It is clear that it is immensely cost effective and beneficial to global sustainability to invest in DRR *before* disaster strikes, so that only the third and fourth phases outlined above are activated without the pain and suffering of the first two.

A major challenge in the development of a disaster management plan in the absence of an actual