An Earthquake Engineering Focus on Australian Critical Infrastructure

Mark Edwards, Ammar Ahmed and Peter Row

The vulnerability of the Australian built environment to earthquake ground motion has been highlighted by several damaging earthquakes. Residential and commercial structures of masonry construction have in particular suffered significant damage due to a lack of seismic hazard considerations in their construction. Earthquakes have also impacted major infrastructure which includes essential utilities. While these facilities have generally had significant engineering input into their design and construction they are also vulnerable. Older utility structures have typically been designed without reference to seismic hazard and damage to these assets can have a much wider footprint of economic impact than just the facility itself. The same is true of components of the building stock in the central business districts of our State capital cities. Some of these house financial, telecommunication and electricity supply infrastructure that state and national economies heavily rely upon. Work is underway at Geoscience Australia to systematically study the vulnerability of Australian assets of these types which substantially underpins the impact analysis undertaken by the Critical Infrastructure Protection Modelling and Analysis program (CIPMA). The CIPMA program is co-funded and managed by the Critical Infrastructure Protection Branch of the Attorney General's Department and examines the relationships and dependencies between critical infrastructure systems and the flow-on consequences of events which impact upon those systems either directly or indirectly. This work involves the engagement of government, industry and Australian earthquake engineering expertise to understand assets, the nature of their components and the overall system vulnerability. The outcomes of this work are feeding into an impact modelling framework that provides a more holistic measure of community vulnerability and associated risk.

In this presentation two areas of this work program are described. In the first, counter terrorism drivers have afforded the opportunity to examine the composition of state capital city CBD building stock from an engineering perspective. Trans-Tasman workshop activity has been undertaken to categorise structural system types and to identify features understood to influence seismic response for survey capture. Façade types have also been categorised for systematic survey capture to enable vulnerabilities of some non-structural elements to be captured. The second area of research focuses on thermal power stations, in which the key components of these complex facilities are separately examined as to earthquake vulnerability. In turn these component vulnerabilities and associated uncertainties are being aggregated through a Monte Carlo sampling procedure to capture both direct damage and related system vulnerability. This approach is affording the opportunity, not only to identify physical vulnerability, but to quantify this in criticality and operational terms. This research is expected to lead to informed and targeted mitigation strategy development by industry.