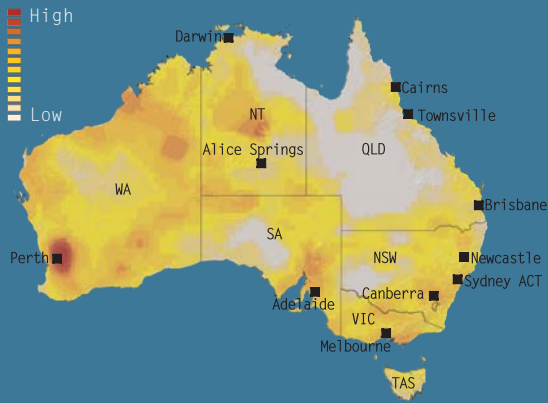




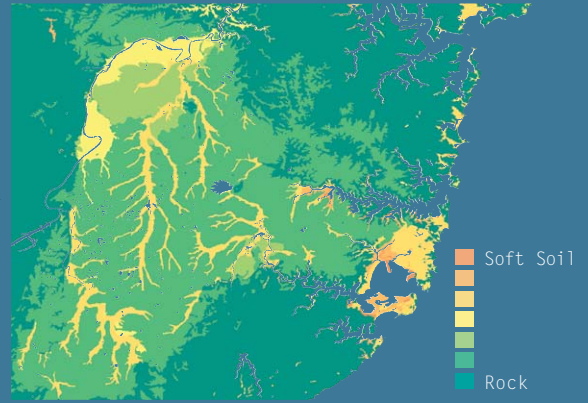
Australia Earthquake

Australia is one of the most seismically active intra-plate environments in the world. The RMS® Australia Earthquake Model combines the latest research on earthquake risk and ground motion attenuation with high resolution geotechnical data and spectral response vulnerability modeling to offer the most comprehensive tool in the market for assessing, underwriting, and managing earthquake risk across Australia.





Average annualized loss across Australia



High resolution soil data for Sydney

COMPREHENSIVE EARTHQUAKE SOURCE MODELING

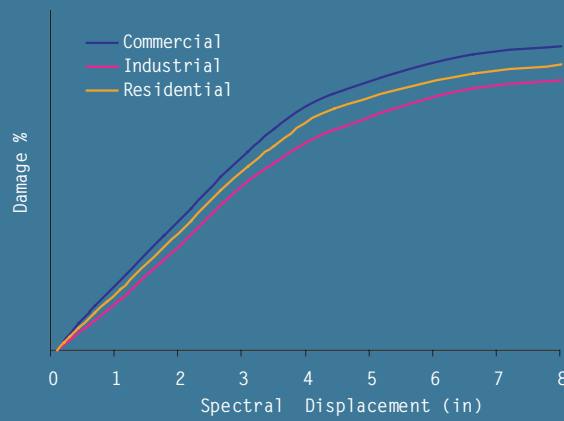
Intra-plate seismic activity is generally diffuse and a regional response to stresses from distant plate boundaries, rather than an indicator of major faults and active tectonic features. Australia's historic record is relatively short in comparison to other regions in Asia, particularly for smaller events. However, most of Australia's metropolitan areas have at least moderate seismic risk, and continuing urban development increases the probability of a major insured loss. The most recent reminder of this was the magnitude 5.6 Newcastle Earthquake of 1989, which resulted in 13 deaths and over 1 billion AUD in insured losses.

The RMS® Australia Earthquake Model combines historical seismicity with intra-plate seismotectonic models to generate a robust stochastic model covering all areas at risk from seismic activity in Australia.

HIGH-RESOLUTION GEOTECHNICAL DATA

Local geological conditions influence the amount of ground shaking felt at a site, as well as the potential for liquefaction or landslides. In collaboration with Geoscience Australia, RMS has brought together geological maps, borehole data, and other geotechnical information to create country-wide coverage of site amplification factors. High resolution soils data is available for 18 of Australia's key cities.

To optimize storage and delivery of the amplification factors, RMS uses its proprietary Variable Resolution Grid (VRG). VRG cell sizes range from 1 to 50 km, varying according to the level of seismicity, population density, and location of mining, oil, and gas facilities. The geotechnical data is aggregated to Postcodes and CRESTA Zones using the VRG and detailed underlying exposure data distributions.



Sample vulnerability curves for different occupancy types

ADVANCED APPROACHES TO DAMAGE ASSESSMENT

RMS has applied its spectral response methodology to Australia, providing the most advanced approach available for estimating building damage from earthquakes. The methodology links the earthquake source model and geotechnical data with the vulnerability module using a measure of shaking known as spectral acceleration. Spectral attenuations in Australia vary by geologic environment.

The response of buildings to an earthquake depends on both the structural characteristics of the building (height, construction type, etc.) and the distance and size of the earthquake. Spectral response quantifies building performance for a range of construction types to a spectrum of wavelengths produced by earthquakes of varying size and locations. RMS' global database of construction response has been applied to Australia and modified to reflect local building design and construction.

BUILDING VULNERABILITY AND INVENTORY

RMS has developed a suite of vulnerability functions to model Australia's wood, masonry, steel, and light metal construction types. Year modifiers are employed to reflect changes in building codes through time, while height modifiers capture the seismic period of each building type.

Vulnerability functions have been calibrated using engineering and loss data from the 1989 Newcastle Earthquake. Results have also been benchmarked against losses from similar intra-plate environments worldwide. The New Madrid region in the U.S. is one region for which this comparison was made to compensate for the relatively small amount of loss experience in Australia.

Eleven separate inventory classes distinguish similar areas of occupancy, construction types, and building heights for both urban and suburban areas. These inventory assumptions are applied when construction characteristics are unknown.

AUSTRALIA EARTHQUAKE MODEL

HISTORY

- Original release: 1994
- Most recent upgrade: 2005

GEOGRAPHIC SCOPE

Countrywide

EXPOSURE DATA RESOLUTION

Latitude/Longitude, Postcode, City, CRESTA

PROBABILISTIC EVENT SET

- Approximately 35,000 stochastic events from moment magnitude 5.0 to 7.7
- Up to 140 years of historical data used to calibrate earthquake frequency and severity
- Event probabilities based on exponential magnitude/frequency relationship and Poisson process

HAZARD MODELING

- Regionally-variable event depths
- Spectral acceleration attenuations considering Australia's intra-plate environment
- Three ground motion attenuation regions based on global and local parameters

- Country-wide soil and liquefaction data at VRG, Postcode, and CRESTA levels, with high resolution soil data for selected cities

VULNERABILITY MODELING

- Building response spectra methodology based on PEER approach modified for local design standards
- Building, contents, residential alternative living expenses, and business interruption losses
- Four height ranges and four age bands
- Eleven building inventory classes reflect building stock mix in urban and suburban areas, based on occupancy, height, and year built
- Secondary modifiers include shape configuration, soft story, torsion, construction quality, pounding, and mechanical/electrical equipment

SPECIAL FEATURES

- Reconstructions of 8 historical events
- Industrial Facilities Model available with separate license

ALM[®] PROFILES

- Resolution: CRESTA
- Lines of business: Residential, Commercial and Industrial

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