

Earthquake Hazard Risk Mitigation in Government Leasing

Scope

The aims of this guide note are to reduce risks related to:

- **life safety** – the minimisation of hazard to life by ensuring that the structure of buildings leased by government have a low probability of collapse in an earthquake; and
- **business continuity** – the reduction in risk of an earthquake interrupting the function of government by causing damage to agency tenancies.

Some agencies may elect to go further and request tenancies in buildings designed to higher standards than the minimums set out in this guide note.

The Earthquake Hazard

Despite our seemingly low seismic hazard, being in the middle of one of the earth's larger tectonic plates, Australia has been subjected to 17 earthquakes registering 6 or more on the Richter Scale in the last 80 years.

Adelaide has the highest earthquake hazard of any Australian capital city. It has experienced more damaging earthquakes in the past 150 years than any other capital. Several fault zones have been located in the Adelaide region that are likely to be associated with the higher seismic activity. Due to the shallow depth of most Australian earthquakes, even small magnitude earthquakes are often felt and heard and moderate earthquakes can cause damage.

Five major earthquakes that have been recorded in South Australia are:

- Beachport – M6.5 (1897)
- Warooka – M6.0 (1902)
- Adelaide (Darlington) – M5.5 (1954)
- Marryat Creek – M6.0 (1986)
- Ernabella – M5.4 (2012).

The most well known earthquake in Australia is the Newcastle earthquake of December 1989 which measured 5.6 on the Richter Scale. The Newcastle earthquake claimed 13 lives, caused 150 injuries and damaged 70,000 buildings. The estimated total damage caused by the Newcastle earthquake was \$4.5 billion (1997 values).

Earthquake Design Code History

The first Australian Standard for the design of earthquake resistant buildings was AS 2121-1979 The design of earthquake-resistant buildings (known as the SAA Earthquake Code). This standard was referenced in the South Australian Building Regulations in 1983.

The second Australian Standard dealing with earthquake design was AS 1170.4-1993 Minimum design loads on structures (Part 4: Earthquake Loads) and referenced in the Building Code of Australia Amendment of 1 January 1995.

The latest version of AS 1170.4-2007 Structural design actions (Part 4: Earthquake actions in Australia) was referenced in the Building Code of Australia Amendment of 1 May 2008. The

latest Building Code increased earthquake design loads for large office type buildings over the previous version.

Life Safety Standard

In recognition of the age and mix of commercial properties in Adelaide and the sometimes prohibitive cost associated with upgrading existing buildings for earthquake or relocating agencies and their fitouts, this guide note factors in less than full compliance with the current standard. This is consistent with Australian Standard AS 3826-1998 Strengthening existing buildings for earthquake.

This guide note requires that the structural strength of an existing buildings proposed to house a government agency shall be at least 35% of that required by the current AS 1170.4-2007 Structural design actions (Part 4: Earthquake actions in Australia).

It is accepted that buildings constructed in South Australia during or after 1985 will meet this requirement. Buildings constructed prior to 1985 may however not have been designed and constructed to resist earthquake forces. Buildings of multistorey loadbearing masonry construction are of particular concern as they have been shown to present a hazard to life in numerous earthquake events around the world.

Engineering Risk Assessment

For buildings completed prior to 1985, a engineering risk assessment is required when the lease term is 5 years or greater. Buildings completed during or after 1985 do not require a engineering risk assessment of their capacity to resist earthquake loads except where they are to contain a function critical to post disaster recovery or where the client wishes to know the capacity of a building against the star rating criteria given in the business continuity recommendations in this guide note.

Functions critical to post disaster recovery include the following:

- hospitals and GP Plus Centres
- State control centres of emergency services
- State control centres of support agencies to emergency services
- stores containing essential supplies, e.g. medicines, rescue equipment
- buildings housing emergency services response equipment, e.g. ambulance stations, State Emergency Services depots, Country Fire Services depots.

An engineering risk assessment shall comprise a report from a professional structural engineer prequalified with Building Management. A list of prequalified structural engineers can be found at http://www.bpims.sa.gov.au/bpims/login/cc_search_start.jsp.

The report shall include:

- a review of drawings and other documents to determine the vertical and lateral load resisting structural systems of the building;
- comments on any evidence of design for earthquake loads;
- checks for any changes that have been made to the original building design and notes as to the effects such changes will have made to the buildings structural strength;
- comments on the general building condition and quality of construction;

- comments on any particular vulnerabilities, e.g. soft floor, irregular shapes, discontinuous shear walls, unrestrained parapets, cantilever canopies, certain types of facades. In a destructive earthquake, the occupants must be able to escape the building safely. This includes the area immediately in front of the building and any emergency exit paths;
- calculations undertaken and a report of the earthquake resistance of the building as a percentage of current code requirements (related to AS 3826-1998 Strengthening existing buildings for earthquake thresholds).

For information on more detailed engineering assessments, refer to the policy Strengthening Existing Buildings for Earthquakes (PO45) which can be downloaded from the Building Project Information Management System (BPIMS) Project Library.

Business Continuity Recommendations

Individual agencies should assess their own business continuity requirements. The following table is provided as a guide.

For the purpose of this table, a moderate earthquake is described as causing most people to be frightened with many finding it difficult to stand, especially on upper floors of buildings. Furniture is shifted and top heavy furniture is overturned. Objects fall from shelves in large numbers. This description is as per the Modified Mercalli (MM) Earthquake Intensity Scale of VII.

Building Description	Earthquake Star Rating (All buildings with a star rating meet minimum life safety requirement)	Business Continuity Impacts for a moderate earthquake
Buildings designed and constructed in compliance with AS 1170.4-2007 where a 'special study' has been undertaken for immediate post disaster occupation.	* * * * *	Building expected to be available for immediate use.
Buildings designed and constructed in compliance with AS 1170.4-2007.	* * * * *	Building expected to perform very well. Negligible interruption expected to business.
Buildings with a structural system and non-structural components which have been determined by an approved engineering assessment to have a capacity of approximately 75% of that required by AS 1170.4-2007.	* * * *	Building expected to perform well, may suffer minor non-structural damage. Minor interruption to business may occur.
Buildings with a structural system and non-structural components which have been determined by an approved engineering assessment to have a capacity of approximately 50% of that required by AS 1170.4-2007.	* * *	Building may suffer moderate non-structural damage, minor structural damage. Moderate interruption to business may occur.
Buildings with a structural system and non-structural components which have been determined by an approved engineering assessment to have a capacity of at least 35% of that required by AS 1170.4-2007.	* *	Building may suffer moderate non-structural and structural damage. Moderate to major interruption to business may occur.

Building Description	Earthquake Star Rating (All buildings with a star rating meet minimum life safety requirement)	Business Continuity Impacts for a moderate earthquake
Buildings designed and constructed after 1985 where an approved engineering assessment has not been undertaken.	*	Building may suffer moderate to heavy non-structural and structural damage. Major interruption expected to business.
Buildings designed and constructed before 1985 where an approved engineering assessment has not been undertaken.	—	Damage to building structure and interruption to business is unknown.

Contact

For further information contact:

John Callea

Manager, Professional & Advisory Services

Phone: 08 8343 2415

Email: john.callea@sa.gov.au