

**Blog Post**

# Construction expertise from Japan: earthquake proof buildings

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There is one country which is decades ahead of the rest of the world when it comes to making its buildings resilient. Japan is world-renowned for its earthquake-proof buildings. With feats of modern engineering, Japan's earthquake proof buildings have helped the country cope with numerous powerful quakes that would have been calamitous in other, less well-prepared countries.

Resilient construction is now firmly on the agenda right around the world. Whether it's [floods](#) in Europe, wildfires in Australia, hurricanes in the United States or rising sea levels in South Asia, architects, engineers and governments are accelerating efforts to protect infrastructure from natural and manmade disasters.

So, how can we make buildings earthquake-proof, Japanese-style, and what can other nations learn from the country's experience?



## Why is Japan a leader in earthquake proof buildings?

Japan's finesse at designing earthquake-proof buildings is born largely of necessity. The island nation sits on what is known as the Pacific Ring of Fire, a zone where the Eurasian, Pacific and Philippine tectonic plates are forced beneath one another. This enormous pressure periodically results in a huge release of energy – resulting in the archipelago's earthquakes.

Japan has suffered earthquakes throughout its history, with one of the worst being the [Great Kanto Earthquake](#) of 1923. The quake reached 7.9 on the Richter scale, devastated Tokyo and Yokohama and killed over 140,000 people.

After WWII, the Japanese government introduced a series of increasingly strict measures to force builders to make earthquake proof structures (this was especially important as buildings were growing taller). Japan's earthquake proof building standards are [as follows](#):

- **Taishin:** This is the minimum requirement for earthquake resistant buildings in Japan, and mandates that beams, pillars and walls be of a minimum thickness to cope with shaking.
- **Seishin:** The next level of earthquake-proof buildings in Japan, Seishin is recommended for high rise buildings. It uses dampers that absorb much the energy of an earthquake. Essentially, layers of thick rubber mats are placed on the ground below the foundations, thereby absorbing tremors.
- **Menshin:** This is the most advanced form of earthquake proof buildings in Japan, and also the most expensive. The building structure itself is isolated from the ground by layers of lead, steel and rubber which move independently with the earth below. This means the building itself moves very little – even during the most severe quakes.



## Common earthquake-proof features in Japanese buildings

Depending on the location and purpose of the building, Japanese architects may pick and choose between many other earthquake proof building features including:

- The use of a steel frame in the building's core – as opposed to the reinforced concrete core common in Western structures
- The use of diagonal dampers, steel beams and columns rather than concrete columns
- Pendulums in the core or on the roof of the building
- Dampers installed between the levels of the building
- Mesh structures to help to fortify the building
- Made-to-break T-joints
- Many new buildings are also connected to the country's early warning system, which alerts inhabitants of an oncoming quake
- Use of fall-away doors which provide more ways to escape
- Covered lights to protect people in case light bulbs explode

## 3 examples of Japan's earthquake-proof buildings

All buildings in Japan today must conform to the country's strict earthquake proof building codes. Here are three examples of innovative structures that meet the standards:

### 1. Tokyo Skytree

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As one of the tallest buildings in the world, the Tokyo Skytree tower is believed to be totally earthquake-proof. It uses seismic dampers on the structure's base which connect to a central pillar that can absorb an earthquake's shock.

## 2. **Shinjuku Mitsui Building**



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Absorbing the power of earthquakes is not only something to think about on new builds. In the example of the Shinjuku Mitsui Building, also in Tokyo, several 300-tonne pendulums were retrofitted on the skyscraper's roof. The pendulums rock back and forth during a quake which helps counteract the building's side-to-side movement.

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### 3. **Air Danshin's 'floating' homes**

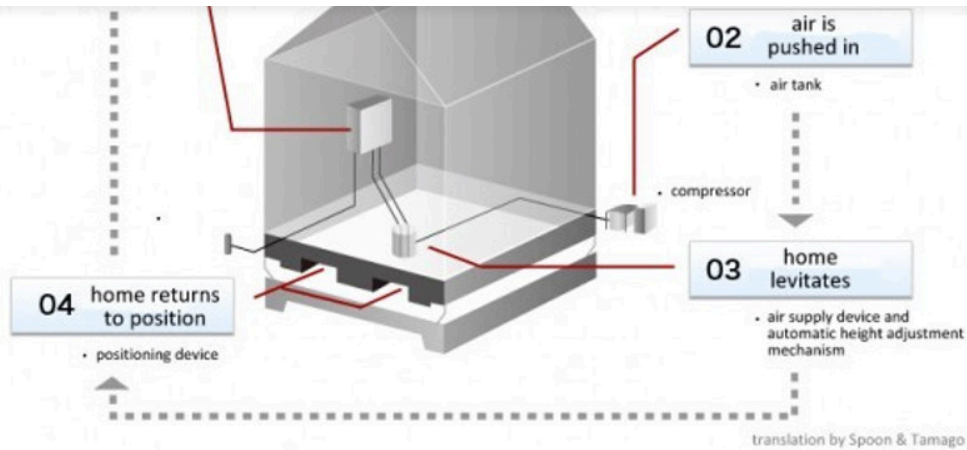


Image source: [New Atlas](#)

Japanese company Air Danshin has created a unique solution to the problem of earthquakes: levitation! The residential homes are fitted out with a quake detector. If it registers a tremor, a compressor pushes air into a space beneath the building, lifting it one to three centimetres from the building's foundation. This makes it impossible for the building to shake and therefore helps avoid damage.

## What can we learn from Japan's buildings?

Japan is admired around the world for its high-tech innovations in multiple fields, and when it comes to resilience in its infrastructure, it is certainly at the cutting edge. So, what can other countries facing natural and manmade disasters learn from Japan's approach to earthquake resilience?

- **Strong regulation is vital:** Clear laws about minimum standards for resilience mean that Japanese builders know what to deliver. This also gives customers more security and confidence.
- **Innovation is essential:** Japanese designers are continually innovating to make even more sophisticated earthquake proof buildings.
- **Investment is critical:** Building an earthquake-proof building costs [up to 20%](#) more than a standard structure. Yet, in the long run, this approach saves owners money since their buildings are safe from damage when earthquakes strike.

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or design elements to mitigate these hazards. Keeping these features maintained is vital – and this is where PlanRadar helps.

The cloud-based app, which is accessible on mobile and desktop, allows your [building facility managers](#) to view [BIM models](#) of the structure, identify any areas that have been damaged or that need upgrading, and monitor building improvement projects.

Every building owner today needs to ensure that their properties are resilient – and ready for a changing world where natural disasters are more common. Whether you’re facing earthquakes, flooding, sea-level rising or storms, PlanRadar can support your resilience strategy.

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