SPECIAL REPORT

NATURAL CATASTROPHES

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Improving the odds

Risk managers and insurers are getting better at quantifying and evaluating earthquake risk

If ever a reminder that earthquakes can strike at any time was needed it was in October 2015 when a magnitude 7.5 quake hit the north-east corner of Afghanistan killing 339 people and destroying whole villages, mostly in Pakistan.

While relief efforts continue, risk and insurance professionals are still pointing to the need for better co-operation between governments, insurers, international relief agencies, and the World Bank, to improve natural catastrophe cover for people and enterprises in developing countries.

Risk mitigation, building standards, zoning, product innovation, and better access to, and distribution of, insurance, all have a part to play.

SwissRE estimates that total economic losses from natural catastrophes worldwide were $1.8 trillion over the past 10 years, of which 70% were uninsured.

After the magnitude 7.8 Nepal earthquake in May 2015, which killed more than 9,000 people and injured 23,000, the World Bank and International Monetary Fund called on the G8 to do more to help developing countries cope with natural catastrophe more effectively in the future.

As risk managers and insurers get better at understanding and quantifying earthquake risk, the risk community is learning more about the steps that can be taken to control and reduce risks.

An increase in data is changing what we know about earthquake exposures, how they are measured and quantified, and it's driving innovation in risk management and insurance

A corporate risk manager with an earthquake risk in today's markets is likely to have many more options for risk mitigation and for negotiating insurance cover than they had a few years ago. An increase in data is changing what we know about earthquake exposures, how they are measured and quantified, and it's driving innovation in risk management and insurance.

It has brought greater transparency into the insurance pricing process for earthquake risk, and from a risk manager's point of view, this is resulting in more flexibility and choice.

Combine all this with perhaps the longest-ever soft market cycle for natural catastrophe risk, and risk managers, wanting to buy earthquake cover, have a lot going in their favour.

One of the big developments of recent years has been a growing body of knowledge within the research communities of seismic scientists and structural engineers.

Understanding how specific building typologies, materials, and even construction methods perform when they are subject to seismic pressures of varying magnitudes has developed hugely.

This means that building owners – whether constructing a new site or retrofitting an existing structure as part of a risk mitigation strategy – can be much more intentional about how they want that site to perform in the event of an earthquake.

It also means that, when they have gathered an accurate picture of all the different data elements which go to making up their earthquake loss exposure, risk managers can start to take more control over the conversation they are having with insurers.

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By controlling the data and owning the risk evaluation themselves, they can reach their own conclusions about the value of their potential loss.

The question about the price of risk then changes, because the insurers' own accumulation of risk comes into play.

Making a decision on whether to mitigate, self-insure, or transfer the risk, has become much more data-led and scientific.

Smart data

Negotiating positions just got stronger

A quiet revolution is happening in decision-making surrounding earthquake risk, whereby quantitative methods are beginning to supersede the traditional probabilistic approach. As this happens, risk managers are finding themselves in a stronger negotiating position, because they have a much clearer idea of the value of their exposure.

John Kamnikar, director, insurance, global property Americas, at hotels group Marriott International, buys insurance for around 1,260 hotels, primarily in North America. "The primary driver of our total insured value is windstorm risk, whether in Florida, the Caribbean, or parts of South America, but our California earthquake exposure is nearly $2 billion," he says.

Kamnikar relies on his brokers to visit exposed hotels with a high value. "They gather all the characteristics of the building – the year of build, the number of floors, the construction, the foundation, the roof system, the walls, everything. And then we take that information and run catastrophic modelling, both on an individual hotel basis and on a portfolio-wide basis, to determine how much of earthquake insurance limits we are going to purchase."

The modelling looks at data such as proximity to fault lines, and the building's susceptibility to damage from earthquakes of different magnitudes. "Then they take historical earthquake information into play and say, okay, if a one in 250 years earthquake were to hit, here's the damage that you could expect on an individual basis and for all of your hotels."

The trend for quantitative risk assessment of this kind is leading risk managers, supported by brokers, to collect ever-more detailed and accurate data than before so that they can measure exposures accurately.

Caroline Woolley, EMEA property practice leader, Marsh, says, "We have a very clear view of best practice in relation to risk management and risk transfer for natural catastrophe risk.

"We begin by mapping natural hazard risk, not only the client's locations but suppliers, customers, ports and transportation hubs, looking at the whole value chain."

The next step is modelling, and this is where the need for complete and accurate data comes in. "It's amazing how certain data points can influence the result and cost of insurance. Missing roof information, for example, means that the model assumes the worst position, but it may be a strong roof with good materials.

"We are encouraging our clients to take control of this, and to ensure that all the information provided is correct."

Risk managers are then in a better position to compare between insurers, whose different accumulations of risk will affect pricing. "By getting into the position where, as a risk manager, you have the full data, you can then see that the difference in price is not your data but actually the insurers' position in relation to their accumulation," says Woolley. "This really starts to put the risk manager in a much stronger position for insurance purposes, and it helps to focus attention for risk management and loss prevention work."

Having a clear understanding of the value of earthquake exposure means risk managers are better able to negotiate, particularly in the current soft market.

Kamnikar says: "Limits are pretty readily available and pretty cheap these days. Any time we can transfer the risk of a loss to a third-party instead of self-insuring, we like to do that.

"We are trying to buy as much as possible, knowing that if an earthquake were to hit in a populous area, whether the US or Mexico or where-have-you, the price of insurance will go up significantly."

Kamnikar is taking advantage of soft market conditions to negotiate lower deductibles, which can be 5% to 10% for major earthquakes in California or Mexico. "We are always trying to lower those so that our out-of-pocket costs in the event of a loss are as low as possible."

By taking control of their own data, risk managers can start to negotiate harder in other areas

By taking control of their own data and putting themselves in the driving seat, risk managers can start to negotiate harder in other areas too.

As part of a company-wide commitment to sustainability, Marsh's property practice is introducing green building clauses and resilient repairs clauses to some policies.

"The principal of insurance is like-for-like, but that's a bit old fashioned nowadays. If a building has been devastated by an earthquake, you want to reinstate it in more robust way," explains Woolley. "It's all part of trying to make cities and buildings more resilient for the future. Insurers are willing to include these clauses, as long as we get the costing right."

Seismic shifts in design

More accurate loss assessments

As the practice of designing new buildings develops, many clever new ideas on how to improve earthquake resilience are emerging. Whether performance-based design, whereby building owners can set specific criteria for what they want from a structure in the event of an earthquake, or contemporary engineering solutions like displacement or deformation, or an emerging fashion for prefabrication, there are plenty of options for risk managers to consider. Increasingly, these factors are used in assessing earthquake risk and pricing earthquake insurance.

Swedish white goods manufacturer AB Electrolux took a strategic decision to invest in fast-growing South American markets, acquiring Compañia Tecno Industrial, in 2011, at which point Lennart Edström, vice president, group risk management, began to look at the seismic risk. Chile is in the Pacific Ring of Fire, one of the most active seismic zones on earth. In 2010, it was hit by a magnitude 8.8 quake, among the most powerful in recorded history, affecting two million people and damaging several hundred thousand buildings.

Edström says: "If you want to be in the market, you have to be there. You can't say, 'because there are earthquakes every now and again, we're not going to sell to you guys'. It was a business decision, and we have to handle the risk. We have one big factory in Chile. I send our loss prevention guys to do Electrolux Blue Risk assessment, where we measure 25 parameters annually. Nat cat is one of these. We then take that information and decide whether to bring the risk into the captive, or to take it outside because of the risk level."

"We mitigate and transfer risk. We want to transfer the risk because, if it's a really big earthquake, with its epicentre near our factory, it could be wiped out."

Edström is now preparing to fly to the Chilean capital, Santiago, following a magnitude 8.3 earthquake which hit just off the coast near Tongoy in September. "We are assessing if there has been any damage to the structure of the building, or to water, or electricity supplies. Did everything work, despite the earthquake? This will tell me what level of resilience we have against this kind of event."

Looking at the effect of earthquakes on different structures is the best way to understand the damage that can happen. Soil liquefaction caused by a magnitude 6.3 earthquake in Christchurch, New Zealand, in 2011, gave engineers the chance to study how building structures coped, while the magnitude 5.9 L'Aquila earthquake in central Italy in 2009, prompted AXA Matrix Risk Consultants and University of Naples Federico II to develop a new approach to seismic risk assessment which takes account of how different structures cope.

Michael Gustafson, industry

If we build a new factory in an earthquake zone, we build it to be seismically safe'

Lennart Edström, AB Electrolux

strategy manager, structural engineering, at Autodesk, a 3D design software house, studied the effects of a magnitude 6.7 earthquake at North Ridge, California in 1994, for his masters degree in civil engineering. "It was a significant event in terms of infrastructure damage, and there was a lot of research on the performance of the damaged structures," Gustafson says.

"Mine was on steel construction and the way that steel structures perform, looking at things like welding procedures."

His findings were incorporated into future building codes.

Knowledge about the seismic vulnerability of buildings can help risk managers identify which of their properties are most at risk.

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Seismic Risk Gap Assessment, the first of three stages within AXA's new approach, prioritises the risks within a portfolio. It does this by comparing the country building codes in force at the time when the building was designed to a contemporary standard code.

"Comparing the seismic demand of today's codes with those which were in force at the time when the building was designed gives us a proxy for the seismic performance gap of a structure," says Fabio Petruzzelli, seismic risk specialist, AXA.

A growing body of knowledge about seismic design is also improving earthquake resilience, says Gustafson, who points to performance-based design (PBD), as a significant step forward. "PBD allows the owner to determine the appropriate level of performance for the building, rather that simply to follow building code requirements," says Gustafson. When designing a hospital for instance, the owner could set criteria that allows for damage to certain parts of the structure which are not critical to the functioning of the facility.

"You don't really know what type of seismic event will happen. It's just the weather, it's probabilistic. PBD enables owners to specify how they want that building to perform in the event of an earthquake," Gustafson says.

Engineers can then use a method like displacement; base isolation is an example of this—akin to mounting the building on roller skates, it minimises the amount of force from an earthquake by disconnecting the structure from the earth. Or they can use deformation, which takes the force of the earthquake and focuses it on very specific parts of the building where they want it to focus. Motor vehicles whose structures crumble easily even in a minor accident use deformation design, because it protects the driver and passengers by absorbing the impact of the crash into the vehicle structure.

Prefabrication is increasingly used in seismic design, because structures built in a controlled environment are more reliable than those put together in the field, whose construction is subject to variables such as materials, workmanship, and the weather. "Owners can use these engineering methods to make their buildings safer and more reliable," Gustafson says.

These kind of factors are taken into account in the second stage of AXA's risk evaluation, Frame@Risk, which enables a desktop loss assessment of a building. The third stage involves a site visit by seismic risk specialists and structural engineers, and computer-simulated modelling of seismic fragility.

Meanwhile for his trip to Santiago, Electrolux's Edström is preparing to keep a sharp eye out for any signs of seismic impact. "If we build a new factory in an earthquake zone, we build it to be seismically safe. It costs a lot more, but we do it anyway. So it should be able to resist an earthquake," he says. "But, if it's a really big one [earthquake], who knows?"

THOUGHT LEADERSHIP

MARCELLO FORTE, chief executive officer, AXA Matrix Risk Consultants, Italy

After the magnitude 6.3 earthquake in L'Aquila, central Italy, in 2009, we wanted a new approach. We saw that buildings which were rated the same way for insurance had responded very differently to the earthquake. The L'Aquila quake caused 309 deaths and 2,600 injuries and total losses of EUR 12 billion.

The traditional approach to earthquake risk gives an average of the exposure over a range of damage from past events. This type of analysis is not interesting or useful for risk managers – they want to know how their industrial plant is going to be affected.

At the same time, a major industrial client in Italy asked us to reengineer the process for assessing seismic risk. They wanted a focus on industrial occupancy, and asked for a framework which offered a comparison risk across a global property portfolio.

We created a tripartite relationship between one of our major industrial clients, the University of Naples Federico II, and ourselves which AXA Matrix coordinated. The first phase developed the conceptual framework. The second, with important input from the private sector partners, translated the research findings into tools and instruments for practical application.

AXA Matrix created a Centre of Expertise on Earthquake and Tsunami, which now has four engineers in Italy, and eight in our offices around the world.

We wanted to ensure that AXA Matrix is using state-of-the-art risk engineering approaches; to foster an ongoing culture of innovation – which is why our relationship with the University of Naples is continuing long term – and then disseminate our results, ensuring that they are understood and applied throughout AXA Matrix, and shared through client workshops, scientific conferences and papers.

The main outcome of the project has been the creation of a comprehensive quantitative framework for risk assessment of large industrial portfolios. We want to give risk managers all the information they need to make clear decisions. It is a flexible, multi-level approach that can be tailored to provide the right solution for clients and their portfolios. We optimise the investment required to assess the risk. We also break down the risk into its main elements, explaining where to invest in order to reduce and control risk, and why.

Compared to others on the market, we believe that our approach provides a rational and transparent basis for risk management decision-making. Nobody knows where an earthquake will occur, but it's important for risk managers to have a tool which proves that the process is logical, and that investment decisions are based on structured and clear approach.

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