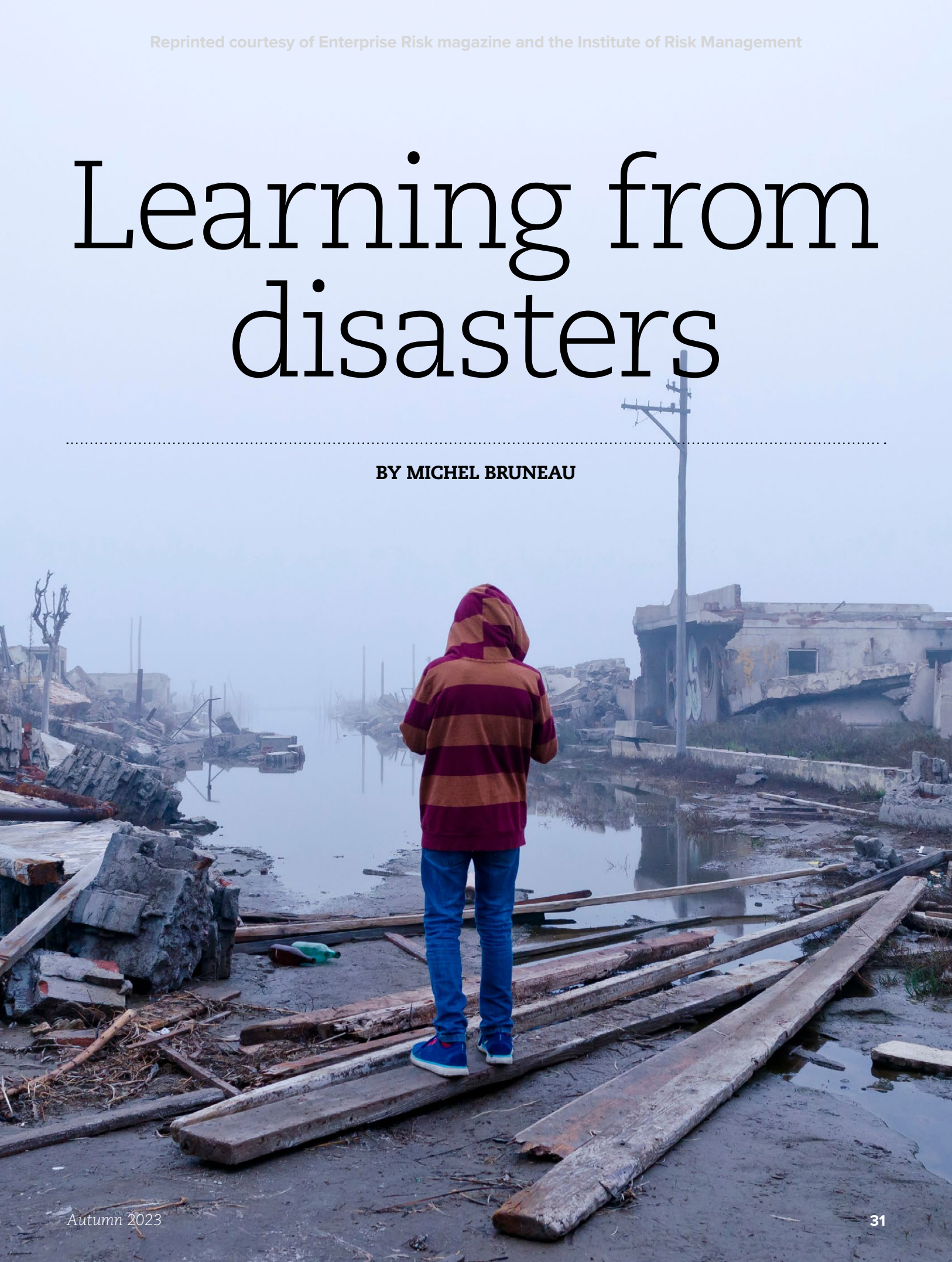
Learning from disasters

BY MICHEL BRUNEAU



Risk managers know that critical infrastructure must be protected for businesses to continue to operate after a disaster. But understanding building codes that underpin the resilience of physical assets are a case study in how detailed knowledge must inform strategic decision-making

Within seconds, your market share – or your entire business – can be lost, thanks to an earthquake, a hurricane, a tornado or other natural hazards. Insurers and risk managers may consider their exposure to various economic, societal or technological hazards, but some often underestimate their exposure to losses from natural hazards, for a number of different reasons that "fly under the radar". This typically happens when incorrect assumptions are made regarding the performance of the built infrastructure during extreme events.

Building codes sacrifice assets

There is generally lack of a ground-level understanding of the kind of protection provided by design codes and standards, and the extent of their enforcement. For example, in approximately 10 seconds, hundreds of reinforced concrete buildings – including new ones designed to the latest edition of the building code – were severely damaged by a magnitude 6.3 earthquake that struck Christchurch, New Zealand, in 2011 in one of the country's most tragic disasters. Considering the prohibitive cost to repair them, most were demolished. To the structural engineers in Christchurch, as far as their buildings had preserved life, this was a success story. They knew that the design objective in the modern building codes worldwide is to achieve life-safety, and not protection of the assets – meaning that a building can be damaged to the point of being a total write-off as long its occupants can escape safely.

This life-safety design philosophy is engrained in all building codes, but, with some rare exceptions, nearly everybody is unaware of this fact. To the non-engineer, the term designed to code implies an umbrella protection approaching invincibility – something far from the truth. This reality had either not been explicitly communicated to, or not understood by, the Christchurch public and building owners, who were figuratively crushed to see their downtown being similarly literally crushed by demolition crews, multiple buildings at a time. All of this in a country known to have some of the most stringent requirements when it comes to providing earthquake-resistant buildings.

Note that the fundamental philosophy of building codes has not changed since – in New Zealand or elsewhere for that matter – because building codes are only intended to provide minimum standards, and many believe this should not change, because this is what the market will bear, or for whatever other reasons. Case in point, in California, proposed legislation that would formalise the option of designing buildings to remain fully functional following an earthquake has been vetoed multiple times by the governor so far.

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To counter this, more and more engineers nowadays, in some parts of the world, make it a priority to inform their clients of this situation and to offer them options that could reduce or eliminate damage. Even when that happens, many developers still choose the less expensive life safety option. Not surprisingly, in Christchurch, some tenants for whom business continuity in the event of future earthquakes is important have asked to talk to the structural engineer who designed a building before renting

there, rather than trusting the interpretations of a developer. However, that is the exception, not the norm. Few are aware that their business enterprise could collapse overnight.

Codes do not always exist

Climbing a bunch of steps on the vulnerability scale, most of the existing infrastructure has been built at a time when knowledge did not exist on how to design infrastructure to resist the extreme forces from hurricanes, earthquake, tornadoes and others. For example, while the latest edition of a building code may require nowadays that the first occupied floor of a building at a specific coastline location be elevated 17 feet above sea level, that does nothing to prevent the buildings built on grade decades ago (per obsolete editions of the code) from being wiped away by a storm surge. Most jurisdictions do not have the leverage to legislate imposed upgrades to existing buildings, simply because that is not politically viable (even when this is known to be economically viable from a long-term perspective).

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Also, that is assuming that a building code has been enacted by a jurisdiction in the first place, which is – surprisingly – not always the case. Some cities and some states have been keen in adopting building codes, and some have ferociously resisted doing so, in the name of freedom – for lack of a better term. For example, by the end of 2010, a FEMA study reported, “The State of Missouri relies on the local jurisdictions to adopt and enforce their own building codes. The State only demands that projects for State-owned facilities must be designed in accordance with the latest edition of the International Building Code.”

In other words, a new 200-

seat state courthouse will be designed in compliance with a national model code, but for a 2,000-seat movie theatre, anything is possible; consult the local jurisdiction. In the same spirit, in Arkansas, waivers have been provided to allow developers to construct in flood zones because it created economic development. Similar code adoption tangles have been symptomatic across the board, irrespective of hazards. Like college students partying on Florida beaches in the middle of a pandemic, convinced of the invincibility of their immune system and not about to let all these fake-news stories disturb their drunken plans, some groups oppose any building code rules and restriction. As of 2018, states such as Texas, Mississippi, Kansas, Illinois and Alabama, for instance, still had no mandatory statewide codes. Earthquake design requirements are non-existent, as are hurricane and flood design requirements. Even basic requirements to resist gravity loads are absent.

In short, it would be unrealistic to set up headquarters in California expecting to survive the design earthquake without damage, or in Florida expecting to sail through a Category 5 hurricane, or in mid-America expecting that a tornado slicing through a building would leave it unscathed, if all those buildings were "designed to code" – or worse, to an obsolete code or to any other arbitrary design basis in lieu of code.

Team sport

One must also keep in mind that resilience is a team sport. Just like it is good but of limited benefit to be healthy in a pandemic when everybody else is sick, the same is true in a region devastated by any hazard – to be the only one standing is of little consolation. However, as many business and insurers know, the entire local economy of a region does not have to collapse for business operations to grind to a halt.

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A realistic risk assessment would require knowledge on how the infrastructure critical to operations will perform during an earthquake or similar hazard

When a critical link in the supply chain breaks, hell breaks loose.

In particular, much of today's operations critically depend on shipping, and shipping ports happen to be critical and vulnerable links in the transportation chain. For example, at 05.46 on January 17, 1995, the Kobe container port was the sixth largest in the world. Thirty seconds later, it was out of business, thanks to the 1995 Kobe earthquake. For the most part, the port had been built on reclaimed lands that liquefied (i.e. turned into quick-sand) during the strong shaking. Quay walls toppled, ground displaced, piers became submerged and cranes collapsed. Damage amounted to a trillion yen (roughly $10 billion). It took two years to repair it all and return to full operations, but in the meantime, container shippers had rerouted their ships to other ports, forged new lasting business relationships there, and the Kobe port never recovered its status, dropping to 17th largest in the world when fully reopened. In fact, even within Japan, it slipped from being the busiest shipping port before the earthquake to fourth place thereafter.

In 1995, the Japanese were already acutely aware of the threat of earthquakes, as they had suffered from many devastating such events before. However, in the belief that post-war Japan was a technologically advanced nation, everybody missed some important worldwide (and still applicable today) facts on how infrastructure is built to resist extreme events. In 1995, this collapse of shipping activities affected the entire Japanese economy, with some businesses never recovering. However, keep in mind that 1995 was before the globalisation frenzy had reached today's peaks.

Consider the Port of Long Beach today. Not only is it the largest port on the West Coast, where $10 billion of goods transit every year but also it is where all main pipelines to the oil refineries in California are located. Beyond the fact that it is situated in earthquake country, a simple terrorist attack with easy to fabricate shaped charges could create major economic losses to the nation by shutting it down for an extended period. Or likewise, could shut down the port of Boston, through which transits half of the liquid natural gas coming into the United States.

Keep in mind also that many industries are self-regulated when it comes to extreme events – meaning that they can typically write their own design codes, which can result in quite significant variations across industries and across a large country. In other words, a business may have an invincible building, but if its operations depend on a number of critically vulnerable lifelines designed with variable levels of resistance to extreme events (or never designed to resist any, if of an older vintage), then business survival is at risk.

Risk assessment options

If business continuity through extreme events is identified as a key objective, a realistic risk assessment would require knowledge on how the infrastructure critical to operations will perform during an earthquake, a hurricane, a tornado or other natural or man-made hazard. Some may indeed elect to investigate how the very infrastructure that their success depends upon will perform. Others may rely on redundancy to bypass the problem. For example, reputable North American banks used to keep duplicates of all their records on both coasts and now keep them on duplicate servers in this digital age, such that total destruction at one of these two places would locally mean lots of hardships and losses but would not impact survivability of the data – and of the business.

Others may be willing to forego the survival of their business, as long as everybody is in the same boat, which would make sense for example if the client base is local and the entire community would be wiped out by the same disaster anyhow. All options are possible and can be realistically considered, as long as misinformed, unrealistic assumptions are not made regarding the state of today's infrastructure. However, gambling that extreme events will never happen is a strategy adopted by those who feel lucky that only works until a disaster strikes – at which point, one then has to cope with the blessings of disaster.

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