The collapse of the Ponte Morandi in Genoa has shocked the world. People rightly expect that bridges do not fall down. But there are no absolutes — engineering science is not perfect, and there is much we don't yet know.
Worse, without structural health monitoring of aged structures, we have little opportunity to learn from failures and make better predictions about future collapses.

Finally, bridge owners are always under pressure to increase the loads allowed and reduce the costs involved in inspection and maintenance, all while keeping open critical transport routes.

But first let's put the Genoa tragedy in context: bridges are the safest of all major structures — more so than buildings and dams.

The risk of fatality from a bridge collapse is about one in 100 million per year, which is roughly 100 times less likely than being struck by lightning.

And given that there are about 1 trillion bridges crossings annually, the risk in terms of exposure is remarkably low.

Nevertheless, these statistics originate from a time when the vast majority of bridges constructed are within their intended design working lives.

Many bridges are beyond their design life
Many of the bridges of the developed nations are at the end of their design lives. More than half of Europe's 1 million bridges are beyond their 50 years design life. Some 30 per cent of bridges in the US are listed as functionally obsolete or structurally deficient.

What caused the Genoa bridge collapse?

About 70 per cent of Australia's bridges are more than 50 years old. Against the backdrop of this ageing profile, there is pressure to allow heavier and heavier vehicles on the road network, and traffic
volumes are such that densely-packed trucks in traffic jams are more and more frequent.

And as if that wasn't enough, there is a dash to have automated truck platoons featuring closely spaced trucks moving at full highway speed across our network. Natural hazards, overloading, deterioration and foundation problems are the leading causes of bridge collapse. But most failures can be thought of as early-life failures and end-of-life failures, a phenomenon known as the bathtub curve. The collapse of the West Gate Bridge in 1970, or the collapse of the FIU Pedestrian Bridge in Florida in March, are examples of early-life collapses. Increasingly though, because of the increasing age profile of our bridge stock, we are likely to see more end-of-life failures, such as that in Genoa this week.

Indeed, Italy has been struck in recent years by a number of bridge collapses of this type, but anywhere with older bridges is susceptible.
PHOTO: On October 15, 1970, while it was under construction, the West Gate Bridge collapsed, killing 35 workers. It was Victoria’s worst ever workplace accident. (Supplied: Old Treasury Building)

Rush to blame clouds real issue

A real concern is that this trend will be obscured by the specific circumstances that unfolded in Genoa.

The rush to attribute blame that is evident now in Italy, and that occurs each time such a tragedy occurs, is certainly natural, but can cloud the real issue. Finding one person or agency at fault in Italy might falsely lead us to think that it cannot happen here in Australia.

Certainly in each instance there are specific circumstances that lead to a collapse, but these events cannot be seen as one-offs.

They are, sadly, part of a trend of increasing failures, and this trend is likely to worsen as deterioration and increasing freight and traffic loads take their toll.
PHOTO: It's surely time that smart sensing solutions are mandated for use across all our aged infrastructure to protect people from events like the Genoa bridge collapse. (AP: Luca Zennaro/ANSA)

No-one cuts a ribbon when a bridge is repaired

The problem is compounded by decision-makers cutting inspection and maintenance budgets on the basis of collapses being historically unlikely, just as their likelihood is increasing.
Bridge management, inspection and maintenance is somewhat costly, and the indications from Victoria and NSW are not ideal. But the costs of a calamity — human, social, economic and reputational — far outweigh the costs of proper care. At present, bridge managers prioritise inspection and maintenance on the basis of the budget made available to them. This should be reversed — the budget allocated should be that required to maintain an acceptable and quantifiable level of public safety.

Of course, compared to large-scale new pieces of infrastructure, though, these maintenance costs are not as attractive to decisionmakers or the public; no-one cuts a ribbon when an old bridge is repaired.

**SHM is good technology, sparsely used**

Happily, the technology to allow us keep our existing bridges operational, and load them to full utilisation, does exist.

* Tales of survival from bridge collapse
Structural health monitoring (SHM) systems use sensors to measure both the response of a structure and the loads acting on it. This gives bridge engineers invaluable information on how bridges behave in the field, rather than just in a laboratory. Unfortunately, SHM is quite sparsely implemented, even though it's not particularly costly.

Victoria and NSW, for example, have just a handful of real-time SHM systems in operation, and (to the author's knowledge) none are stipulated for use in the mega-projects currently being constructed. This severely limits the opportunity for bridge engineers to learn from past failures, predict future failures, and improve our future designs.

Contrast this with the aerospace industry in which almost every failure has a full data stream to facilitate accurate diagnosis and protection against similar failures in the future.

It's surely time that smart sensing solutions are mandated for use across all our aged infrastructure to protect people from events like the Genoa bridge collapse, while making best economic use of the assets we already have.
 est. on the public's behalf. (891 ABC Adelaide: Brett Williamson)

PHOTO: We must facilitate and resource our engineers to be proactively vigilant on the public's behalf. (891 ABC Adelaide: Brett Williamson)

Non-engineers shouldn't be the decisionmakers

Australians are not to worry about their bridges for now — the risk of fatality is very low.

However, we share in the problems of the developed nations with ageing bridge stocks.

We cannot look to past trends or specific explained-away failures to give some sense of reassurance and safety; we must facilitate and resource our engineers to be proactively vigilant on the public’s behalf.

Non-engineers should not be involved in decision-making — professional autonomy of those responsible for public safety ought to be ensured.
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