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New ICLR report

A benefit-cost analysis of impact-resistant asphalt shingle roofing

The Institute for Catastrophic Loss Reduction creates and disseminates disaster resilience knowledge for Canada. Among the catastrophes ICLR addresses are hailstorms, one of Canada’s most serious natural hazards. Hail costs $400 million annually.

A June 2020 hailstorm at the edge of Calgary damaged 77,000 homes and cost $1.4 billion. Much of that money paid for roof repairs.

A direct hit on Calgary could be 5 to 10 times worse. Though the hailstorm is inevitable, the catastrophe is not. A new study by the Institute considers one way that homeowners and insurers can prevent costly hail damage: by using impact-resistant asphalt shingle roofs instead of standard shingles.

Impact-resistant roof shingles look like ordinary shingles, but have material that makes them resistant to hail damage. When struck by large hailstones, they resist pits and fractures that would otherwise allow water to pool or penetrate beneath them. And they resist cosmetic damage like the loss of granules: the specks that cover the shingle surface.

Impact resistant shingles make financial sense across all of Hailstorm Alley

According to an analysis conducted by study author Dr. Keith Porter, ICLR’s chief engineer, the shingles are cost effective wherever it hails almost once a year or more, the yellow areas in Figure 1. Climate change will worsen future hailstorms, making impact-resistant shingles more valuable and the yellow area bigger. >
Impact-resistant shingles can save 8 times what they cost

In Calgary, impact-resistant shingles reduce the chance of damage by 15 times. If the roof is damaged, average repair cost drops by half. Considering how frequently hailstorms happen, that saves $3 for every $1 in added cost, or $10,000 over a life of a roof. The shingles pay for themselves in 5 years, on average. (That assumes one repairs the roof every time it gets damaged.) Figure 2 shows where the shingles are most cost effective: red means savings 8 times the cost.

The costs and benefits scale up or down with roof size. Equations in the technical report show a mathematically-inclined reader how to scale the costs and benefits for different sized roofs and different locations. Like all studies, this one has its assumptions, limitations, technical details, and suggestions for future research. See the technical report to learn more.

Both the full study and a separate executive summary document are available for download at www.iclr.org

A video summarizing study findings is available here.

Top findings of ICLR’s benefit-cost analysis of impact-resistant asphalt shingles

With performance-based engineering, we can do apples-to-apples comparison of costs and benefits of hail mitigation

Impact-resistant asphalt shingles make financial sense for insurers and homeowners

On an average-sized roof (170 m², 1,800 ft²), they add about $3,400 in cost, more for a bigger roof, less for smaller

Their rubber-like qualities reduce the chance of damage by 15 times

If damage does occur, impact-resistant asphalt shingles reduce the repair cost of damage by half: from $2,400 on average to $1,200 for the average-sized roof

They pay for themselves wherever it hails almost once a year or more

BCR = 3:1 In Calgary, they pay for themselves within about 5 years on average, and eventually 3 times over. The benefit-cost ratio is 3 to 1

BCR up to 8:1 In some places, they save 8 times their cost or more, assuming you repair the damage every time it occurs

Climate change will make them more valuable
Canada needs to design buildings that will shrink its disaster credit card balance

We can design new buildings to survive disasters. But we don’t.

In December, 2021, a tornado cut a 270-kilometre path through Kentucky, killing 58 people. It led University of Florida’s David Prevatt to write a Washington Post article reminding Americans that new buildings in tornado country are not tornado proof but could have been.

We could learn similar things from Canadian tornadoes, such as the twister that struck Barrie, Ont., in July, 2021, or the September, 2018, tornadoes in the National Capital Region. Or fires, such as in Fort McMurray, Alta., in May, 2016, or Lytton, B.C., in June, 2021. Or historic floods like in British Columbia last November.

Engineers know how to make new buildings resist tornadoes without making them resemble bunkers. The community of Moore, Okla., proved that. After three fatal tornadoes in 15 years, city officials decided that national building codes did not protect them so they opted to protect themselves. They enacted an ordinance making new buildings resist all but the most severe tornadoes. It added about 1 per cent to the construction cost of new houses. Despite dire warnings, researchers found no impact on home prices or development.

We could also design earthquake-resilient buildings but do not. Why? Because of a false choice between two extreme design philosophies: either build impossibly expensive earthquake-proof buildings, or accept inexpensive ones and damage short of collapse. The choice ignores the resilient middle road balancing upfront cost with long-term risk reduction.

Must we continue to accept this false dichotomy? In research for the U.S. Federal Emergency Management Agency and others, my colleagues and I found simple methods to design resilient buildings that cost 1 per cent more initially but avoid future losses many times greater.

Engineers could have used these ideas long ago. The buildings that now cost us so much in disasters could have been much more resilient and cost less in the long run.

Had it taken that middle road, the U.S. would not now be losing US$100-billion annually to disasters. That is 8 per cent of the US$1.3-trillion in annual new construction, or one month of construction cost a year of new building.

Those losses grow 6 per cent annually, 10 times faster than the population, like a credit card bill when you always buy more than you repay every month. The U.S. credit card balance of disaster liability now exceeds US$2-trillion. Canada’s buildings resemble those in the U.S., so our proportional balance probably surpasses $250-billion.

Our bill will inevitably come due in episodes of multibillion-dollar catastrophes, as in B.C. last fall.

How do we fix the problem? We could add sewer backflow valves, replace vinyl with non-combustible siding in the wildland-urban interface, and use impact-resistant asphalt shingle roofs in hail country. Catastrophe risk professionals offer long lists of sometimes-cheap, sometimes-costly solutions to problems in the buildings we already have.

Building codes created those problems, partly through their performance objectives – that is, their goals for what...
they will or will not require. Codes aim for safe and maximally affordable buildings, ignoring long-term ownership cost. We build cheaply but not efficiently, like building cars with the lowest sticker price but much higher maintenance costs. Or like selling coffee in single-use paper cups instead of metal travel mugs.

We could do better. Moore, Okla., did. So did Florida after Hurricane Andrew in 1992. The state leaped ahead of U.S. building codes with its own stricter code. The Insurance Institute for Business and Home Safety developed a voluntary standard called Fortified that avoids future losses and may more than pay for itself in higher resale value. Some institutional owners build new structures 50-per-cent stronger and stiffer than required because it makes good business sense.

The climate crisis is forcing major changes to Canadian codes. It offers a rare opportunity to fix our growing disaster liability at the same time, in something like three steps:

- Enact a building code objective to minimize society’s total ownership cost of new buildings. The Canadian Commission on Building and Fire Codes could formalize such a principle in the National Building Code of Canada.
- Require that at least some code-change requests be accompanied by estimates of added construction cost and benefits in terms of reduced energy use, future repair costs, improved health and life safety outcomes, and other economic effects whose monetary value can be reasonably estimated.
- Limit code committees’ freedom to reject cost-effective code-change requests.

Such changes will eventually shrink Canada’s disaster credit card balance. While it rethinks energy efficiency, Canada can rethink the false economy of “least-first-cost” construction. We can make buildings more sustainable and cost less in the long run.

With a wiser code, we can have better buildings for ourselves, our neighbours, our children and all future Canadians.

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Swiss Re: Extreme flood events once again drive high losses in 2021

According to Swiss Re March 30, natural catastrophes in 2021 resulted in a total global economic loss of USD 270 billion and insured losses of USD 111 billion, the fourth highest on sigma records. This continues the long-term trend of insured losses increasing by an average of 5-7% annually worldwide. While Hurricane Ida was the costliest single natural disaster in 2021, secondary peril events once again accounted for the majority of insured losses from natural catastrophes over the year. The flooding in Europe in July, for example, was the costliest natural disaster on record in the region. Despite record-level insured losses from floods, the associated global protection gap remains large.

“Floods affect nearly a third of the world population, more than any other peril. In 2021 alone, we witnessed more than 50 severe flood events across the world,” said Martin Bertogg, Head of Catastrophe Perils at Swiss Re. “Given the scale of devastation, flood risk deserves the same attention and risk assessment rigour as primary perils such as hurricanes.”

Climate change is anticipated to cause more frequent and more extreme weather events. Growing populations, rapid urban development and the accumulation of economic wealth in disaster-prone areas are contributing to the ever-growing catastrophe losses. 2021 was another year of intense natural catastrophe activity, including devastating floods in Europe, China, the US, and other parts of the world. Already in the first quarter of 2022, major flooding in eastern Australia has caused widespread devastation and substantial insured losses.

Sigma records show that flooding is by far the most frequently occurring natural peril. In the past decade, there were approximately three times as many major flood events as tropical cyclones. Floods were also causing more than a third of all fatalities related to natural catastrophes. Economic losses from floods amounted to 23%, the second highest after tropical cyclones.

Yet Swiss Re Institute finds that over the past decade, only 5% of severe flood losses were insured in emerging markets and 34% in advanced economies, indicating a large global protection gap. The largest gap in flood protection is in Asia, with only 7% of economic losses being covered by insurance. By contrast, in Europe 34% of flood losses are insured.
ICLR extending its reach into commercial risk loss reduction

Over the years, ICLR's work has largely focused on natural hazard damage reduction for single family detached homes, non-engineered structures that fall under Part 9 of the building code (i.e. Housing and Small Buildings). These often experience damage due to severe events. The Institute has done little work with structures built under Part 3 of the code, as these tend to be engineered and have been built with more rigor.

But many businesses, particularly smaller operations, fall under the Part 9 umbrella. Increasingly, many are experiencing damage and disruption in operations from severe weather, wildfires and earthquakes.

As a result of this increased loss experience, ICLR was asked by several of its member insurers about commercial risk loss control, so the Institute has decided to extend the reach of its research and outreach into loss control for smaller, non-engineered, non-complex risks. This is with the view of possibly extending that work into larger, more complex risks in the years ahead.

This work and ICLR priorities will be informed by a Commercial Risk Working Group, a sub-committee of the Institute's Insurance Advisory Committee. This working group is currently being co-chaired by representatives from Zurich Canada and Aviva Canada.

Under this new initiative, ICLR has issued three loss control bulletins under the “Mind your business” title. These include:

**Questions every condo owner should ask**

**Protection of vehicle floorplans and fleets against hail**

**Make your business wildfire ready**

More titles will be added in time.

These bulletins can be found [here](#).