

# CATtales

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## Icy finish

It looked like Canada's natural catastrophe story for 2013 was just about told when the ice storm mere days before the year's close added the chapter, 'It ain't over till it's over.'

By Glenn McGillivray  
Managing Director, ICLR

In what may amount to a 'coming-of-age' year for Canada, a string of severe weather events - ending with a major ice storm - conspired to ensure that Canadian property and casualty insurers will pay out more in catastrophe losses for 2013 than for any other year - by far.

While preliminary insured losses for Ice Storm 2013 came in at more than \$200 million, claims totals for five earlier events had already pushed 2013 insured losses to somewhere around \$3 billion. The number put the country in a league with many other western industrialized nations that face multi-billion-dollar claims years on a regular basis.

Perhaps somewhat ironically, the late-year ice storm came on the 15th anniversary year of the massive ice storm that ravaged eastern Ontario, the Ottawa/Montreal corridor and parts of the Maritimes - it was not until the floods in southern Alberta last June that the January '98 ice storm fell from first to second in the ranking of

costliest insured Canadian natural catastrophes - and on the tenth anniversary year of the widespread northeastern blackout in August 2003. Once again, several hundred thousand Canadians found themselves without electricity, many for as long as five days or more.

The latest storm was exceptional, rare to be sure, but not unheard of. And while it had the potential to be on par with the '98 event had it continued a few days longer, by the end of it, Ice Storm 2013 was no fair analog to the Great Ice Storm, whether measured by ice accretion, customer without power, property damage or fatalities. Still, it was a significant event. ►

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Ice accretion in the author's backyard in northeast Oakville, Ontario.

The view from here

## Accepting responsibility

By Paul Kovacs

Executive Director, ICLR

“Those who knowingly choose to assume greater risk must accept an increased degree of responsibility for their choice.” This is one of the seven founding principles of the Institute for Catastrophic Loss Reduction. We believe that this view enjoys widespread societal support but recognize that it can be difficult to put into practice. For example, response to the remarkable flooding last year in southern Alberta, other recent extreme events, and the debate about introducing private flood insurance for homeowners have frequently been juxtaposed with arguments related to homeowners accepting responsibility.

Insurance companies use their underwriting practices to link responsibility for risk with knowledge about risk. Those with a higher risk of damage pay more for insurance than those with lower risk. The difference in price is based on an actuarial assessment of the difference in risk. Intense competition in the insurance industry and actuarial practices ensure that the difference in price is fair. The presence of private insurance, where possible, should be viewed as an important tool to build confidence for society that a risk is managed effectively and fairly.

In some circumstances an assessment of risk determines that insurance is not offered at any price. In particular, insurance coverage may be provided for risks that are seen to be “sudden and accidental” but risks that are certain to occur are not insurable. For natural hazards this may include buildings located in a flood zone, on soils subject to liquefaction, near zones with extreme wildfire risk, and some coastal flood risks.

Government legislation and regulations may also seek to reflect the view about responsibility for risk. The recent flooding in Alberta led to several policy decisions based on this principle. For example, homes in the floodway that were damaged qualified for financial support from the government, but are required to acknowledge that if they rebuild with the knowledge that they are in the floodway that any future loss and damage would not be covered by government assistance. In addition, flood and wildfire losses paid by the province of Ontario contributed to a recent revision to the provincial planning act to provide even stronger regulatory direction to local governments to prohibit new development in areas at high risk of loss from natural hazards.

Prohibition of new buildings and development in zones of high risk is widely identified in the research literature as an effective tool for policy makers to minimize the risk of preventable damage from floods, earthquakes, wildfire and a number of other natural hazards. When a political determination of risk tolerance identifies a risk to be unacceptable then local planning regulations can be used to implement this view. However, policy actions to enhance protection from existing homes and buildings have been more difficult for governments to implement.

Research also shows that it is difficult to determine a consensus about risk tolerance. Strong views often emerge immediately after an extreme event, but with time society's concerns erode quickly and this frequently emerges in relaxed regulations. Most importantly this process is frequently managed

through ambiguous means, and the role of a science foundation for risk management is sometimes unclear. Frequently a sense of tolerance for loss and damage from natural hazards does not appear to be consistent with society's tolerance for loss from other hazards like crime, fire, safe drinking water, nuclear hazards, and a number of other perils.

Public officials, insurance companies and other stakeholders are frequently involved in communicating knowledge about the risk of loss. There is an extensive research literature documenting the difficulty in effectively communicating this information. The evidence shows that the greatest challenge involves low probability, high consequence events. For example, it is hard to convince homeowners to take action to protect their property from water damage, and even harder to get them to address the risk of damage from an earthquake.

The Institute's work is based on the principle that those that knowingly choose to accept the risk of loss from natural hazards should also assume greater responsibility for this risk, and those that take action to reduce the risk of loss should be recognized and rewarded. We welcome and support private sector and public policy actions that move in this direction. **CT**



**Takeaways**

Although essentially all hazard events offer a long list of lessons, two themes come out strong in the wake of Ice Storm 2013.

First, the ice storm again raised the issue of personal preparedness. The vast majority of people affected by this event simply were not ready for a severe weather event.

The lack of preparedness and overall awareness of what to do prior to, during and immediately following hazard events was evidenced by the many instances of carbon monoxide poisoning reported in the press, caused when people used unorthodox and dangerous means to heat their homes during the outages. Despite nagging warnings, few people take steps to prepare, and this must change.

Second, the event shone a glaring spotlight on the poor condition of the hydroelectric grid, particularly in the City of Toronto, where the system is old, trees tend to be older and larger, and streets are narrower. The ice storm, the July 8 flood event in the Greater Toronto Area (GTA), and the earlier urban flood event in southern Alberta warn of society's growing vulnerability due to aging infrastructure. This lends some credence to the idea that many natural catastrophes are, in effect, man-made.

Often, in the wake of severe weather events, the common mantra heard from politicians, public utilities and others is that the event was "just too big" and nothing could have been done to prevent it or lessen its impact. It would be difficult, however, for Toronto Hydro to use this strategy when the corporation has in the not-so-distant past taken the rare step of publicly criticizing the poor state of its own assets and has issued dire warnings about future reliability of its own service.

The Toronto Star reported on December 30, 2011

that unions for Toronto Hydro warned that "a yet-to-be released ruling by the Ontario Energy Board risks slashing Toronto Hydro's budget for renewing its aging system by two-thirds. And that, they say, will lead to an increasingly unreliable power system - a conclusion that Toronto Hydro doesn't disagree with."

Notes the article, "'We're seeing neighbourhoods that are getting 12, 18 outages a year,' Toronto Hydro vice-president Blair Peberdy said... The downtown core's system is also aging. Much of it is 50 years old, dating back to the start of the 1960s construction boom."

On January 5, 2012, The Star reported "the Ontario Energy Board has told Toronto Hydro it can see little evidence that the utility's state of repair is as bad as the utility claims." The board told Toronto Hydro "to manage its spending the same way other utilities in the province have done. As a result, it won't allow the utility to make a special case for radically higher spending on renewal and maintenance at a full-blown hearing before the board."

Two months later, on March 7, 2012, The Star reported that Toronto Hydro was being dropped by its insurer FM Global at contract renewal June 1.

"Toronto Hydro has been warning that a decision in January by the Ontario Energy Board curbing its equipment renewal program will prevent it from replacing aging equipment - leading to longer and more frequent blackouts. Peberdy said the prospect of insuring less reliable equipment seems to have triggered the decision by the insurer, Factory Mutual insurance, or FM Global," the article noted.

**Balance essential**

Toronto Hydro now finds itself in the unenviable position of being criticized after the July 8 GTA

flood for having too many underground assets and after the recent ice storm for not having enough.

It must now make some tough decisions. Investing in mitigation always involves the question of cost/benefit: How much should be invested to get major stakeholders to a certain risk comfort level? What is realistic and doable?

For the sake of discussion, consider storm water management. While it is technically feasible to put a storm sewer system into Toronto that could handle heavy rain events such as the August 19, 2005 and July 8, 2013 storms, the cost would be beyond prohibitive (some estimate it would require the entire annual GDP of Canada) and the disruption due to construction would be unlike anything ever experienced in the country.

One news report posited it would cost about \$2 billion to underground all remaining overhead lines in Toronto, not including other associated costs like installing stand-alone traffic signals. (An even more recent article has suggested the total is more in line with \$15 billion.) ►

**Ice Storm 2013**

(Ice accretion in millimetres: December 21-22)

Trenton	30
Toronto Pearson Airport	24.8
Vaughan	25
Grimsby	27.7
Orillia	3-4
Niagara	27.7
Downsview	20
Niagara Escarpment	7-8
Hamilton	20
Barrie	20
Brampton	20-30
Cornwall	15
Kingston	20
Kitchener	15-20

# From temporary structures to resilient housing

By Sophie Guilbault, M.Arch, MS  
Research Coordinator, ICLR

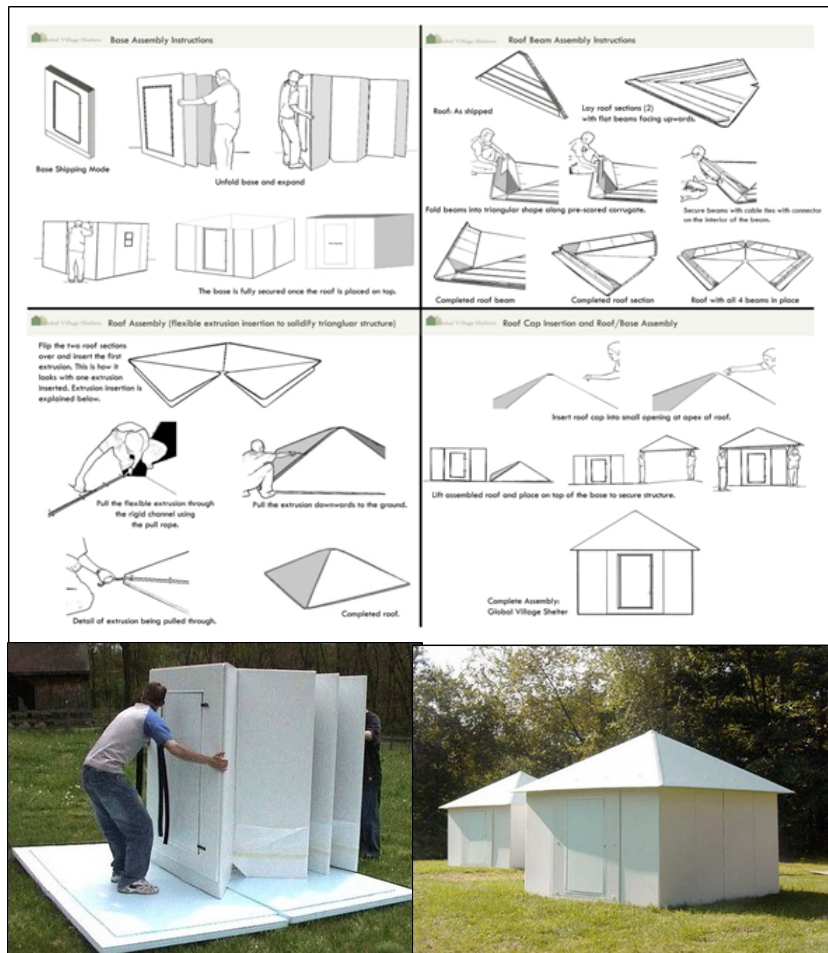
The housing sector is greatly impacted following a natural disaster given that it often represents up to 70% of the built environment of a city. In order to successfully rebuild the housing stock of an affected area, a quick response from government is necessary to allow individuals to resume their daily activities and ultimately accelerate the recovery process of a population. However, after a catastrophe, most effort is concentrated on rebuilding structures the way they were before the disaster. This is rarely a positive outcome seeing that natural hazards can strike more than once and can reproduce the same consequences, if not worse.

Several questions arise in the aftermath of disasters and vary from whether a community should be rebuilt to how the rebuilding should take place. This depends on the local context and is often influenced by the government and other decision making bodies. As an example, it would have been challenging not to invest in the reconstruction of major cities such as Toronto (Hurricane Hazel), Port-au-Prince (2010 earthquake) or New York City (Hurricane Sandy).

The damage generated by a natural disaster is certainly caused by the hazard itself but it is mostly influenced by where and how people choose to build their homes. Post-disaster environments need to be seen as an opportunity to clearly identify and map the risks of a community to ultimately generate a change and build back better.

The process of building back better is strongly influenced by the entire reconstruction process, which is divided into four separate (but interrelated) steps: emergency sheltering, temporary sheltering, temporary housing and permanent housing.

## Emergency sheltering



Figures 1, 2 & 3. Source: Cameron & Kate Stohr, 2006. *Design Like You Give A Damn: Architectural Response to Humanitarian Crisis*. New York: Architecture for Humanity, 336 pages.

refers to a short period of time, typically extending from a few hours to one day. It is the step that allows the least amount of time for planning and often uses public infrastructure to house individuals while shipping and edification of temporary shelters takes place.

Following this step, the **temporary sheltering** stage usually lasts from a few days to a few weeks. During this period (and climate and context permitting) tents are the most common choice for sheltering because of their quick and simple edification and easy storage. Over the years, several prototypes of temporary shelters have been designed and used in the aftermath of disasters. As an

example, Ferrara Design Inc. has developed a prototype made out of undulated cardboard that can be easily unfolded and assembled by two people during disaster recovery situations (see Figures 1, 2 & 3). The main challenges associated with these units and with temporary sheltering in general are related to material access, overall construction and shipping costs.

Temporary shelter designs have evolved over time and some high performance units have been developed with materials that could be used in extreme conditions. Although these units open new possibilities in terms of temporary sheltering, they also bring a level of comfort that is ►

not necessarily desired in the immediate aftermath of a disaster since it could potentially postpone the permanent rebuilding of the housing stock.

As the immediate post-disaster period is brought under control, the population slowly moves out of temporary shelters to **temporary houses**. This is certainly one of the most critical stages of the rebuilding process because of the consequences it can have on individuals' recovery and on the permanent rebuilding. It represents both a social recovery step and a physical representation of a particular type of habitat, which can be used from a few weeks to a few months, depending on the context and the amount of work necessary to rebuild the housing stock. While integrating these housing units, individuals normally have the opportunity to regain what constituted their former routine. Temporary housing units should not harm the permanent rebuilding and therefore, there are four factors to consider while setting them up: a rapid delivery of the units, choosing the right approach of construction (top-down or bottom-up) appropriate to the context, avoiding expensive costs for the units (in relation *with* their period of use) and finally, choosing the right land to erect the units upon

so they can be close to goods and services.

There are two main types of temporary housing units: existing structures and new construction. In the first type, displaced households will generally choose to temporarily rent an apartment or other type of housing while the permanent rebuilding takes place. The second type can either be built on site (bottom-up approach) or sent as a fully furnished unit (top-down approach). I-Beam Design developed a model of built on site units in 1999 that uses shipping pallets, generally easily accessible on site after a disaster, in order to build temporary structures that can act as temporary homes (see Figure 4). Using wooden pallets allows the population to become involved in both the design and construction of the unit because the material is easy to assemble and can generate several unit designs. The wooden pallets can also be filled with different



Figure 4. Source: I-beam Architecture and Design, transitional housing unit. <http://www.i-beamdesign.com/projects/refugee/refugee.html>

In many cases, governments decide to ship fully furnished units into the affected areas. This was the case in New Orleans in the aftermath of Hurricane Katrina when the Federal Emergency Management Agency (FEMA) decided to send thousands of trailers into the city. Both the significant financial investment required and the high level of comfort of each of the units may have contributed to the slow-down of permanent rebuilding efforts.

The construction or reconstruction of **permanent housing** units represents the last step of the rebuilding process. Among the reconstruction process, communities often have a tendency to rebuild identically to pre-disaster conditions. This is in part driven by a strong desire to return things 'back to normal' and reintegrate the same pre-disaster living conditions. The main challenge associated with this step is to rebuild high-quality affordable houses that will prove to be resilient if another hazard hits the affected area in the future.

Resilient houses can take several forms, depending on the local context and the type ►



Figure 5: Tulane URBANbuild housing prototype. Source: [www.tulaneurbanbuild.com](http://www.tulaneurbanbuild.com)

materials to insulate the temporary house when necessary. The use of shipping pallets to build temporary housing units can be a positive solution, but can be hard to apply to large scale

disasters because of limited material availability.

Whatever the total, a 2013 feasibility study entitled *Underground overhead wires: Town of Markham: Yonge and Davis Corridors* - by Lehman & Associates, DPM Energy and George Todd Consulting with the Town of Newmarket - notes that "the cost of converting an existing overhead distribution system to an underground system is relatively high - typically five to six times more expensive than the relocation of an above-ground system."

While even the \$15

billion is considerably more realistic than the storm sewer upgrade example noted previously, it is substantial nonetheless. So the question remains: How much should be spent to bolster the grid for what amounts to be fairly rare damaging wind and ice storm events? And what about an underground system that can withstand flood, which likely is not factored into the \$15 billion?

As of late, there have been many calls for senior governments in Canada to invest

in the country's infrastructure, including storm water systems. While a similar call must go out for upgrades to the grid, it is necessary to be smart about any decisions and choices made.

As with the August 2005 Toronto flood, once an extreme event happens, it is clear it can happen again. Witness July 8, 2013.

One day, there will be another major ice storm in the GTA. Let the discussion begin. **CT**

***From temporary structures to resilient housing cont...***

of hazard it is designed for. As an example, a house designed to resist the impacts of strong winds would ideally be implemented in parallel planning within its settlement to create no obstructions to wind-flow. Lower height structures are also more likely to resist strong winds. The shape of the building will also influence the way it will withstand extreme winds. T-shape, L-shape and U-shape plans are more likely to be damaged than linear shapes.

Resilient houses do not only take into consideration the structural needs of a house, but ideally integrates elements related to traditional ways of living in the affected areas. When houses are designed in a way that responds to its owners daily needs, the homeowners are more likely to quickly reestablish their daily routine.

After the passage of Hurricane Katrina in 2005, teams of professors, students and staff from Tulane University School of Architecture became actively

involved in the reconstruction of New Orleans and developed a program called URBANbuild to design and build seven types of resilient housing prototypes for a highly vulnerable neighbourhood of New Orleans. These houses were built with strong structural features such as the use of hurricane plates to reinforce the structure and use of additional screws to fix the metal sheeting on the roof. The structures were also raised from the standard elevation of the neighbourhood. In addition, special attention was paid to New Orleans traditional housing typologies during the design process. This way, residents would move into houses that offered traditional features such as a wide front porches, high ceilings and openings that allow for good transversal ventilation. Traditional materials were also used and painted in bright colours typical to the City of New Orleans (see illustration 5). The seven houses built by Tulane's URBANbuild program have been well received

by residents of affected neighbourhoods and have so far stood up well to such hazards as Hurricane Isaac, in the following years.

Rebuilding after disasters presents several challenges because of the short timeframe available to rebuild and the extent of damages that can be generated. Every step of the rebuilding process comes with very specific challenges but most mistakes are made when each step is viewed in a vacuum rather than as part of a process to build back better.

The distinction that some make between 'immediate relief' and 'long term recovery' can be useful but also somewhat misleading.

There are seldom clear-cut phases or demarcation lines between steps and, therefore, the idea of what the permanent rebuilding will look like should be set out early on in the process so that steps towards rebuilding are all taken in the same direction. **CT**

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*Mission*  
To reduce the loss of life and property caused by severe weather and earthquakes through the identification and support of sustained actions that improve society's capacity to adapt to, anticipate, mitigate, withstand and recover from natural disasters.

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