Institute for Catastrophic Loss Reduction
Building resilient communities

CATtales

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Inside this issue

New ICLR report

Hail climatology for Canada: An update

On February 15, ICLR released *Hail climatology for Canada: An update*. The report was written by David Etkin, Associate Professor of Disaster Management at York University.

The paper serves as an update to Etkin's *Canada's Hail Climatology: 1977-1993*, prepared for ICLR in April 2001. The update is based on an objective analysis of hail observation station data from 1977 to 2007.

National hail climatologies (i.e. the number of hail days per year in Canada) serve as a foundation for hail risk analyses. Although national hail climatologies cannot be used to determine hailstorm severity or to infer damage, they are used to help identify vulnerable regions, and thus areas where mitigation efforts should be concentrated.

Hail days data for the analysis was obtained from the Digital Archive of Canadian Climatological Data, Environment Canada from all hail observing stations in the country. For each station, monthly days-with-hail were calculated where the number of missing observations were less than four days in any month. This represents 96.7% of the records. Monthly hail days were adjusted for missing data by multiplying the unadjusted hail-day observation by the factor [1+ (number of missing days) ÷ (number of days in the month)].

A trend analysis showed no change in hail frequency for Ontario, in contrast to other studies that have examined severe hail frequency and tornado frequency. Alberta, by contrast, showed a significant increase in hail frequency during the period 1977 to 2007. ►

Manitoba and Saskatchewan showed decreasing trends. Future research could examine in more detail which areas exhibit increasing or decreasing hail frequencies, and how those seasons correlate with larger scale climate drivers.

Etkin warns that further hail research would be constrained by the lack of ongoing hail observations by Environment Canada. Hail observations at Environment Canada weather and climate stations were not widespread until 1977, he notes. After 1993 the number of hail observing stations began to decline and after 2005 the number of stations reporting hail dropped precipitously. After 2007, he reports, the number of observation stations was trivial. Other datasets would have to be used, such as those created by radar and satellite imagery.

In the 1990s and early 2000s, ICLR conducted a number of studies focused on understanding the risk of hail damage in Canada. The hail research needs of insurance companies was acute before ICLR was established when Canada's most costly hailstorm struck Calgary in 1991. In particular, ICLR published an earlier hail climatology (1977-1993) and conducted several workshops where hail was considered as part of a broader discussion of convective storm-related losses.

Institute members also contributed to an industry discussion that lead to the creation of the Alberta Severe Weather Management Society.

Fortunately, there were few large hail damage events in Canada between 1991 and 2008. Indeed, there was a period of almost ten years when the Institute received virtually no requests from member companies to study the peril. The industry directed ICLR to focus its research on other hazards, including the alarming increase in water damage. Indeed, hail research was not included in the Institute's last five-year plan.

However, hail damage claims have ramped up in Canada in recent years. Just three wind/water/hail events in Alberta (2010, 2012 and 2014) totaled more than $1.66 billion in insured losses. As a result, in 2015 Canadian property and casualty insurers – through ICLR's Insurance Advisory Committee – formally asked the Institute to investigate the peril and suggest actions insurers can take to mitigate future hail losses in the country.

Conducting an updated climatology of hail is key to understanding the current state-of-play for the hazard before more in-depth research is pursued.

Prior to joining York University, David Etkin worked for 28 years with the Meteorological Service of Canada in a variety of fields, including operations and research. He has been an associate member of the School of Graduate Studies at the University of Toronto since 1994, doing research on natural hazards, teaching and supervising graduate students. In 2003 he was awarded the Environment Canada Award of Excellence. Prof. Etkin has participated in three international hazard projects and was one of only two non-Americans to assist with the U.S. *2nd national assessment of natural hazards*. He has been principal investigator for a NATO short term project on natural hazards and disasters and the Canadian Assessment of Natural Hazards Project that resulted in the book *An Assessment of Natural Hazards and Disasters in Canada*, which he edited. The summary report he wrote of this latter project has been widely distributed within Canada and was used by Public Safety Canada and Foreign Affairs Canada as the official Canadian contribution to the recent ISDR Kobe disaster conference. **CT**


Hail Climatology for Canada: An Update

By David Etkin, York University

February 2018

Hail climatology for Canada: An update can be downloaded for free at www.iclr.org

The hurdle of Replacement Cost Value (RCV) to Building Back Better

By Emily Stock, Insurance litigation lawyer
Monaghan Reain Lui Taylor LLP

When we discuss the concept of building back better, we all agree that it is great. Who can oppose making our communities, infrastructure and people more resilient to catastrophes? We also recognize that there are a multitude of hurdles to consider, and that underlying many of those hurdles is an often inflexible legal regime.

Understanding property insurance coverages is significant to any policy for building back better. Typically property insurance policies provide for some combination of Actual Cash Value (ACV) and Replacement Cost Value (RCV), depending on a variety of criteria.

Actual Cash Value is also sometimes referred to as market value. It is intended to be the dollar amount you could expect to receive for the item if you sold it in the marketplace. It thus takes into account depreciation of the property. An insurance company determines the depreciation based on a combination of objective criteria (a formula considering the category and age) and a subjective assessment in the marketplace.

The result is that if a homeowner receives ACV they technically receive exactly what they lost (i.e. the value of an old house); however they cannot afford to replace their property (i.e. build a new house).

Replacement Cost Value (RCV) is the cost to replace the property. It insures the depreciation of the property, so that the homeowner receives the cost to build a new house similar to the house they lost. When we talk about building back better, the homeowner can typically only afford to rebuild if they are able to obtain RCV.

The difficulty in obtaining RCV is that it is typically only available where the rebuild is: a) At the same site or location; and, (b) Uses materials of "like kind and quality."

But what if being at the same location, or building with like kind and quality, is not building back better? Consider if the insured event is a flood in an area that is now prone to flooding. We don't want to encourage that homeowner to rebuild in the same location, despite there being significant financial incentive for them to do so.

Similarly if the event is a fire, we know that we don't want to require that the rebuild use the same non-fire resistant materials (i.e. siding, roofing materials), or even to rebuild the same type of structure which may have been inappropriate for the location recognizing the changing environment.

Although we recognize that the wording of the policy must define the rights of the homeowner, and the monetary obligation of the insurer, I expect we would also agree that it seems unfair to require the homeowner to rebuild at the same site, or use materials of like kind and quality, where such is contrary to the principles of building back better.

In considering this conundrum, it is helpful to consider the rationale for RCV, as recently articulated by the Ontario Court of Appeal in *Carter v. Intact.* After recognizing that replacement cost insurance is justifiable even though it provides the policyholder with greater value than what they lost, the Court explained the following as to why the limitations on RCV are reasonable and required:

… allowing insureds to replace old with new raises a concern for the insurance industry. The concern is moral hazard: the possibility that insureds will intentionally destroy their property in order to profit from their insurance; or the possibility that insureds will be careless about preventing insured losses because they will be better off financially after a loss.

To put a brake on moral hazard, insurers will typically only offer replacement cost coverage if insureds actually repair or replace their damaged or destroyed property. If they do not, they will receive only the actual cash value of their insured property.

It is clear from this reasoning that there is little to no risk of moral hazard in insured catastrophic events. There is similarly no risk of moral hazard where an insured homeowner does not want to comply with one or both of the criteria to receive RCV, same location and/or like kind and quality, because of a desire to build back better.

As a supporter for encouraging the insurance industry to build back better, we therefore advocate thoughtfully reducing the two criteria for building back better. This could be done proactively by deleting the same location requirement in policies in flood or other risk zones. The like kind and quality criteria should also be carefully examined for certain types of insured events (i.e. fires), so that more appropriate materials can be agreed upon before the event as acceptable under the policy.

An important step to reducing these types of hurdles is to continue and develop the conversation. **CT**

Why sump pumps fail

By Paul Okrutny, Senior Associate, Materials & Product Failure / Piping & HVAC, and Meaghen Gutelius, Project Coordinator, Materials & Product Failure, Materials & Product Failure / Piping & HVAC
30 Forensic Engineering

30 Forensic Engineering has been involved in numerous insurance claims where a sump pump failure led to basement flooding and property damage, and the majority of these failures were residential insurance claims made in Ontario.

Through our investigations, we have inspected, disassembled, and tested 60 sump pumps (collectively referred to as the 'set of failed pumps' in our discussion below).

Note that these investigations do not represent the entire failure space since we, as forensic engineers, typically become involved by the homeowner or insurer only if damage from the failure exceeds tens of thousands of dollars. Regardless, we can provide the following commentary from our investigations.

Number of manufacturers

The set of failed pumps contained 14 different pump brands and approximately 30 different models. There was no one brand that represented more then 16% of the total failures. Although 16% may seem high, calling that specific brand of pump problematic is difficult without knowing the total number of pumps that brand produces and the percentage of the pump marketplace represented by the brand. As such, it is possible that, within our set of failed pumps, that brand was a dominant brand within North America and its failure rate was simply inline with the brand's market share.

Age of pumps at the time of failure

The average age of a sump pump at the time of failure was three years. The oldest pump was ten years old at the time of failure, and the youngest was six months. Given the short average life span found, we further considered the impact of pump use on the life of the pumps within our set of failed pumps.

Lifetime of pumps

While reviewing the sump pump manuals for most of the pumps we investigated, we noted that sump pump manufacturers do not issue general time frames for how long their pumps will last. This may be because it is nearly impossible for them to predict the conditions in which their pumps will be used, and no pumps come with a 'cycle counter' that could be used by the homeowner to determine when a pump replacement is required (similar to how an odometer in a car can be used to determine when service is required).

Although official life expectancies are not published by pump manufacturers, we can make educated guesses based on some of the internal components common to most sump pumps and the published life cycles of these components. One such component is the pump float switch, which turns the pump on and off.

Sump pump float switch assemblies generally include a microswitch. The microswitch manufacturers, who are generally not the same company as the pump manufacturer, do not manufacture their switches specifically for sump pumps, and as such, these generic microswitches are used in many applications such as small appliances and large scale machinery. The microswitch manufacturers issue a general 'operating cycles' classification for their switches assuming a certain current draw and force to actuate the microswitch. The classifications vary from manufacturer to manufacturer and between the type of testing standard that was applied to achieve the cycle count.

While looking through our data, we noted that, most often, the float microswitches were rated for 50,000 cycles by the microswitch manufacturers. Using this number, we can estimate pump life based on float switch cycles.

If, on average, a sump pump turns on once per day and the float switch is rated at 50,000 cycles, the pump/float switch would theoretically work for 140 years. However, if a sump pump is installed where it turns on every 20 minutes, it will cycle 26,280 times in one year and exceed its float switch rating in just two years.

In some of our investigations, we were able to attend the residence where the sump pump was installed. While looking at the installation, we found that in several cases, the pump would cycle every few minutes. At the extreme, we found a pump installation where the pump was cycling every ►

45 seconds. At 45 seconds per cycle, the pump would cycle 525,600 times per year, more than 10 times the rated microswitch life. As such, we found several installations where the pump microswitch life would be exceeded in less than three years and at least one when the life time would be exceeded within a few months.

We found that the type of foundation drainage and the sump pit design/installation are the largest contributing factors to the number of cycles a sump pump will encounter.

Installation

We did not have the opportunity to inspect all the homes in which the sump pumps failed. However, in the homes were we found installation defects, we noted the following most common installation deficiencies:

1. Installation of the pump discharge done without a check valve. Such an installation would allow discharge water to flow back into the pit after the pump shut off;
2. Sump pit being used to drain washing machine discharge water, which can corrode the pump components and degrade floats;
3. Sump pump float installed too close to a sump pit wall, causing the float to become stuck against the wall of the pit;
4. Sump pit operated without a backup pump that would work if the primary pump failed or there was a power failure; and
5. Sump pump powered by an electrical socket that was not on a dedicated circuit.

The sump pumps were installed in a comparable manner in almost every home. The installations that were not deficient typically consisted of a single sump pump with a single discharge, a check valve, and no backup pump. The sump pump motor size varied between 1/3 horse power to 3/4 horse power, however, and there was no correlation between the pump size, property size, or ground water level. It appeared that in most installations the pump size was arbitrarily selected, and the installed pump was most likely sized based on what was available for convenient purchase at the time of installation.

Pump size

As mentioned, the set of failed pumps included pumps with motor size varying between 1/3 horse power to 3/4 horse power. At a typical basement height of 10 feet, these pumps would pump between 5,000 litres per hour and 16,000 litres per hour out of the sump pit. The total quantity of water pumped would vary significantly from manufacturer to manufacturer and model to model.

We found that two different manufacturers producing pumps of the same horse power rated the pumps as having very different capacities.

What was most interesting about pump size within our data was that most of the pumps investigated were 1/3 horse power, and their capacity was near the bottom end of the above-mentioned flow rating scale. Nevertheless, in all installations investigated, the installed pump capacity was not an issue where the basement was of average height (10 feet), and the discharge pipe was not excessively long or small in diameter. We found that the sump pumps, even at low capacity, were generally large enough to remove the water from the pit if they were installed correctly.

Summary of failure causes

The main contributing factor to sump pump failures was failure of the sump pump float. When the float failed in the off position, it prevented the pump from turning on. When the float failed in the on position, it caused the pump to overheat. Once overheated, the pump seals failed, water infiltrated the submersible motor, and the pump ceased to operate.

We noted some floats contained manufacturing defects, while others were simply operated well past their rated life cycle. A focus on adequate design/manufacturing and installation of the float and float microswitch would go a long way in preventing sump pump failures.

Other common contributing factors included:

- Deterioration of the shaft motor seal, causing water infiltration into the motor and electrical failure;
- Deterioration of the motor starter capacitor; and
- Debris caught in the pump impeller.

Commonality between failures – Conclusions

Our data was rather wide in terms of failure modes, pump sizes, installation deficiencies and manufacturing defects. Focusing on any one of those issues would prevent only one type of failure. We did, however, note that in 95% of the failures we investigated, there was only a single sump pump protecting the basement. Upon failure of the single sump pump, be it from inadequate installation, a float switch malfunction, a starter capacitor failure, or a motor seal failure, the basement would be at risk of flooding during the next rain event.

In the few cases where a backup pump was installed, the backup system was either not installed correctly, or its backup power was inadequate due to its battery being either under sized or not adequately maintained. Had a functioning backup pump been present in the systems where we found a failure of the sump pump, the loss would not have occurred.

The study of our data, somewhat obviously in retrospect, shows that had a back up pump been installed in the sump pit, the losses would not have occurred. Of course, as with all mechanical systems, even the backup pump needs to be maintained.

If it is not too much to ask drivers to change their engine oil ever three months, it ought not to be too much to ask homeowners to check their back up pump annually. **CT**

ICLR releases 'Protect your home from hail'

ICLR has published '*Protect your home from hail'*, the latest entry in the Institute's '*Protect your home from…*' series of natural hazard mitigation information booklets. Other titles include information on basement flooding, extreme wind, wildfire, earthquake and snow & ice storms. All titles are available in both English and French, though the French version of the hail booklet is pending.

This publication is designed to assist homeowners whose residences are at risk of damage from hail. It provides an overview of key areas in and around the house that may require attention in order to reduce the risk of hail damage.

The booklet covers information pertaining to roofs, roof covering and underlayment, discussing impact resistance standards set out by the ASTM and Underwriters' Laboratories (UL) for various roof coverings.

The publication also provides guidance on siding, windows, doors and skylights, thiough less is known about these than is known about hail impact on roofs.

Unlike the other publications in the series, this booklet also provides guidance on how to protect vehicles from hail impact, a major source of damage for owners and claims for insurers.

As with all booklets in the series, *Protect your home from hail* contains a hail damage quiz that can be taken by homeowners to gauge their level of risk to damage from hail. **CT**

Protect your home from hail can be downloaded in English for free at www.iclr.org. The French version will be made available soon.

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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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