

CATtales

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Basement flooding and backwater valves Are insurers giving bad advice?

By Glenn McGillivray, Managing Director, ICLR

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As a centre of excellence for basement flood risk reduction, ICLR never advises that just a backwater valve will reduce the risk (indeed, we have 20 tips to reduce basement flooding). Yet Canadian insurers have taken to advising insureds to install a backwater valve or risk having their sewer backup coverage severely sublimited or even cancelled. This has become particularly acute since the Alberta and GTA floods of 2013.

But do insurers really understand what it is they are advising their insureds to do? Do they realize they may actually cause their insured's basement to flood when it otherwise may not?

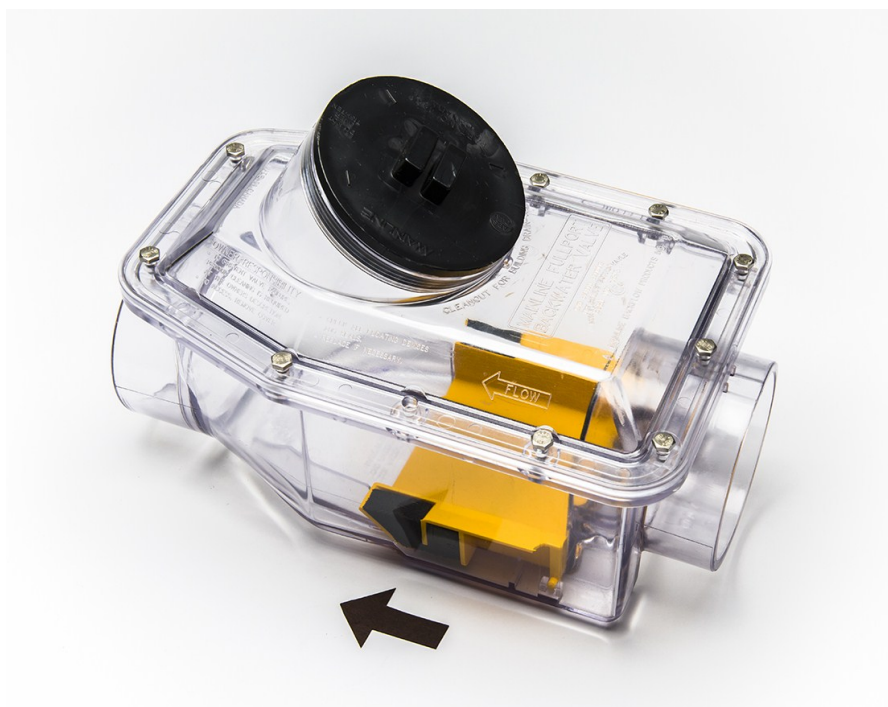
Basement flooding is one case where a little knowledge can be dangerous.

A backwater valve is not a silver bullet or panacea, and must be considered in combination with a number of other mitigation measures. Suggesting an insured install a backwater valve but take no other action may give him/her (and the insurer) a false sense of security.

More importantly, where a home's foundation drain (aka perimeter drain or weeping tiles) is connected to the building's sanitary sewer connection (as opposed to the storm sewer connection), the installation of a backwater valve ►

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valve on a sanitary lateral without severing the foundation drain and connecting it to a sump or storm connection could cause a basement to flood during a severe rain event. This 'self flooding' is caused when the flap of the backwater valve closes during a rain event, trapping water from the foundation drain behind – or 'upstream' – of the valve (keep in mind that while the flap in the valve is closed, the floor drains and weeping tiles in behind the backwater valve are being filled with water from connected downspouts and from showers, dishwashers, etc). This trapped water will have no place to go and, if there is enough of it, it will enter the home's basement via floor drains or below grade fixtures like sinks, toilets, showers, washing machines and the like.

Though there is no absolute rule of thumb (every municipality, subdivision and home is different), homes built up to and about the mid-1970s that have foundation drainage may have a higher likelihood of having weeping tiles connecting into the sanitary sewer system. It is also possible that homes built after that time have their weeping tiles connected to the sanitary system depending on municipal policies and potential construction errors. Indeed, some municipalities outlawed connection of foundation drainage into sanitary systems in the 1960s, while others allowed this practice to continue into the 1990s.

Currently, there are thousands of homes across Canada that have their weeping tiles connected to the sanitary sewer system, including several that flooded in Burlington, Ontario on May 13 and August 4 of this year.

But regardless of when a home was built, insurers should not blindly advise an insured to install a backwater valve without a plumbing inspection being conducted or without formal

communication from the insured outlining with certainty how the home's weeping tiles are set up. Further, and equally important, an insurer should not advise an insured to install a backwater valve unless it has a good understanding of the specific property and municipal policies related to protection of homes from storm and sanitary sewer backup. Indeed, depending on local wording and interpretation, the National Plumbing Code prohibits the installation of backwater valves in main sewer connections when the sanitary connection serves more than one dwelling unit, as would be the case in a duplex or buildings with basement apartments. (However, in these cases, property owners may be able to install in-line backwater valves.)

Not only is every home different, but a home on one side of a street in a given city may have a completely different foundation drain setup than a home located right across the street or down the road. No two homes are the same and, thus, a blanket policy of installing a backwater valve in order to get sewer backup coverage is not only untenable, it can be downright dangerous. A basement may flood when it otherwise may not, an insured may then have his sewer backup coverage severely sublimited or cancelled because of this bad advice, and the insurer could open itself up to substantial liability and reputation risk.

Along with the advice above, insurers should do two things. They should read the handbook they essentially paid us to write (see our 'Handbook for reducing basement flooding' at www.iclr.org) and they should take a page from doctors' Hippocratic Oath and 'Do no harm.' **CT**

Twenty tips to reduce basement flooding

Option 1: Talk to your municipal government about basement flooding

Option 2: Inform your municipal government about basement flooding that you've experienced

Option 3: Hire a licensed plumber to conduct a detailed plumbing investigation on your home

Option 4: Check your insurance policy, or talk to your insurance broker or insurance provider about basement flood coverage

Option 5: Avoid pouring fats, oils and grease down household drains

Option 6: Keep storm sewer grates clear

Option 7: Seal cracks in foundation walls and basement floor

Option 8: Considerations for overland flood entry-points

Option 9: Reduce home water use during heavy rainfall events

Option 10: Maintain eavestroughs and downspouts

Option 11: Avoid storing items directly on the basement floor

Option 12: Downspout disconnection, extension and splash pads

Option 13: Lot grading, backfilling and swales

Option 14: Weeping tiles, sump-pits and sump-pumps

Option 15: Mainline, normally open backwater valve

Option 16: Maintain sewer laterals

Option 17: Severance of storm sewer lateral

Option 18: Considerations for reverse sloped driveways

Option 19: Window wells and window well covers

Option 20: Avoid remodelling or finishing basements

ICLR's Slobodan Simonovic guest of Academia Sinica, Taipei, Taiwan

In April, Dr. Slobodan P. Simonovic, Professor of Civil and Environmental Engineering at Western University and Director of Engineering Studies at ICLR, was an invited guest at Taiwan's Academia Sinica in Taipei.

During his stay, Dr. Simonovic visited a number of institutions, sharing his experience on climate change risk analysis and water resources management under a broad scale project entitled 'Taiwan Integrated research Program on Climate Change Adaptation technology – TaiCCAT.

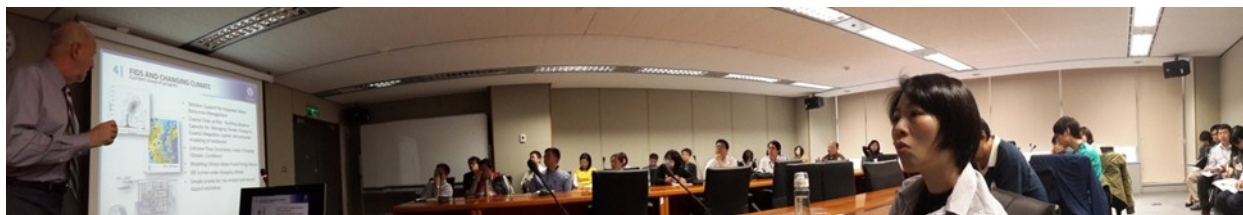
His stay included visits, discussions and lectures at Academia Sinica (Taipei), National Taiwan University (Taipei), National Science and Technology Center for Disaster

involvement with the Taiwan Integrated Research Program on Climate Change Adaptation Technology (TaiCATT). The project includes a very interesting approach to climate change including national adaptation policy development. Three main project focus areas include: (a) environmental systems analysis (EA); (b) vulnerability assessment (VA); and (c) adaptation governance (AG).

Professor Tung's group and NTU are the leaders of the TaiCCAT VA working group. The major tasks of the VA working group include: (i) establishment of key sectors to be included in climate change vulnerability assessment (preliminary choices include environmental disasters, public health, food security,

based on the Saaty's AHP approach.

The second topic discussed during the visit focused on climate change education. An admirable effort is in progress in Taiwan that is looking into the possibilities for expanding post-secondary education by including climate change in curriculums. The three focus areas are: (i) academic curriculum planning and design, (ii) professional training on climate change adaptation for disaster reduction and management of water resources, and (iii) promotion of educational cooperation between academia and private industry. The future outcomes of this work will be of broader national and international interest.



Reduction (Taipei), National Central University (Jhongli City), and, National Chiao Tung University (Hsinchu City).

Over the course of the month, Dr. Simonovic conducted a number of presentations, providing the Taiwanese with information on the Canadian experience with climate change and natural disaster management.

National Taiwan University (NTU)

The visit to NTU was hosted by Prof. Tung from Bioenvironmental Systems Engineering. Presentations by NTU participants covered cross-sectoral climate change assessment and merging climate change into post secondary education. The five presentations dealt with NTU's

ecosystems and water resources); (ii) development of cross-sectoral information flow protocol; (iii) development of cross-sectoral system dynamics model; (iv) selection of vulnerability and resilience indicators; and (v) development of a demonstration case study.

The interesting part of the TaiCCAT work by NTU is TaiWAP – an integrated model for the assessment of the vulnerability of water resources systems. The model includes climate change scenarios obtained by GCMs, a weather generator for downscaling global climate information to a local scale, hydrologic models, irrigation water demand model, water resources system dynamics model, and a multi-objective decision making model

National Science and Technology Center for Disaster Reduction (NCDR)

The visit to NCDR was hosted by Dr. Liang-Chun Chen. The main focus of the discussion was related to disaster management and climate change. Through the NCDR presentations the role of NCDR was presented together with an introduction to a number of projects currently under way there. Taiwan is exposed to five major perils: earthquakes; typhoons; floods; landslides; and debris flow. The NCDR has a unique role in disaster management. It links research and emergency operations; government agencies and research communities; and provides coordination, collaboration and cooperation. It bridges the gap between ►

science and technology, and implementation and application. The main functions of NCDR are mission oriented and technology oriented.

The NCDR's early warning system and emergency response role were presented through the introduction of activities included in the early warning system: rainfall monitoring and forecasting (input into a probabilistic rainfall warning model); identification of high risk areas (input into a physical model); assessment of the impacted areas (input into a disaster scale estimation tool); and selection of scenarios (input for emergency operations). This complex process depends on extensive data support provided by different agencies and integrated by NCDR, as well as modelling work in various areas provided in-house and by collaborating research institutions.

The main climate change project under way in NCDR is the Taiwan Climate Change Projection and Information Platform (TCCIP). The TCCIP up to now produced a lot of output: digitized gridded meteorological data sets; climate change projections for Taiwan; high spatial-temporal resolution data sets using statistical and dynamic downscaling; and methodological approaches for the application of climate change data for disaster risk management.

A very significant component of TCCIP, so called project L4, includes climate change caused disaster risk mapping. The project links TCCIP and NCDR; climate change adaptation and disaster risk reduction; and climate science and adaptation policy.

National Central University (NCU)

The visit to NCU was organized

in three parts: a visit to the Center for Space and Remote Sensing Research, a discussion with the TaiCCAT research group; and a lecture at the Institute of Hydrological and Oceanic Sciences. During the visit to the Remote Sensing Center, a variety of research programs based on remotely sensed data were introduced.

The TaiCCAT project discussion involved a general presentation of the project, neither offering opportunity to get detailed information on the work being conducted, nor allowing an in-depth discussion of the project. Presentations and discussion of the TaiCCAT project work at NTU was much more informative and open for input. It was apparent that the work at NTU is much more advanced than the rest of the work being conducted at NCU and other partner institutions.

The lecture at the Institute of Hydrological and Oceanic Sciences was well attended and generated a lot of questions and comments. The role of the Institute in graduate education outlined very specific conditions for research collaboration with other institutions. Time was not provided for much more significant input into research areas of interest. Collaboration between the Institute's researchers and NTU was discussed during the visit to NTU.

The Institute offers graduate degrees in hydrologic cycles in the land-ocean-atmosphere system, hydro-environmental science and hydro informatics. The Institute is involved in interdisciplinary research in the areas of flood/drought prediction and water resources management, interactions of hydrologic cycles and biota, hydro-environmental monitoring and modelling, tsunami simulation, coastal observation, remote sensing applications in aquatic

environments, and multiphase flow in porous media.



National Chiao Tung University (NCTU)

The visit to NCTU was very well organized by Prof. Yang who leads the Disaster Prevention and Water Environment Research Center in the form of the 2014 Workshop for Sustainable Water Management. The two-day workshop involved members of Prof. Yang's Institute, consultants from GT International, and collaborators from the National Taipei University of Technology and National Applied Research Laboratories. The workshop included seven presentations (including Dr. Simonovic's) with a very informative overview of the Center's activities. A very strong emphasis of the workshop was on sustainable use of the Shihmen Reservoir, sedimentation problems and their resolution.

During the stay, instrumentation for monitoring sediment flow was introduced and a visit to the lab was conducted. The very advanced and innovative work involving development of the instrumentation by Prof. Lin and his group was impressive. ►

A demonstration concerning how the practical needs of reservoir sedimentation is addressed through mathematical modeling, development and implementation of monitoring equipment and the assessment of reservoir water supply reliability indicates the commitment and leadership that Dr. Yang's Center is offering.

Related topics covered during the second day included flood management, water supply and groundwater management.

The work conducted at NCTU is of high quality and relevance. A lot of discussion followed presentations focusing on reservoir management and risk assessment. The main questions raised during the discussion were around reservoir sediment load prediction and monitoring; reservoir sediment flushing; flood forecasting (with focus on hydrologic and hydraulic modeling); groundwater management for flood proofing; and reliability of water supply systems.

General observations

Taiwan is exposed to different natural hazards that in interaction with high population density, urbanization and existing infrastructure, can produce very significant impacts on the economy of the country and on social capital. The importance placed on research in support of natural disaster management and funding provided by national funding agencies is again putting Taiwan ahead of many developed countries of the world.

Existence of NCDR is just an example of the very significant role played by research in the real time management of natural disasters. This format provides for a desirable flow of research needs (from practice to research) and required solutions (from research to practice).

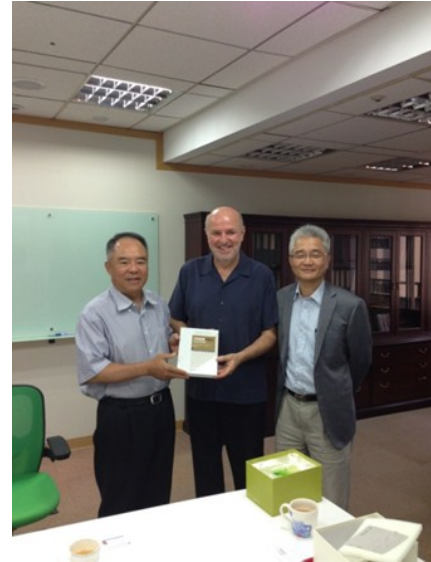
The visit and numerous

contacts with the research community provided for valuable exchange of the experience. The focus of Taiwan on climate change adaptation is commendable. Only a very small number of countries are so clearly focused on the development of active climate change adaptation plans and policies as is Taiwan. Investment in adaptation, and research to support it, will reduce the potential negative impacts of climate change.

The impact assessment of changing global and climatic conditions requires funding, interdisciplinary research, and input to policy and solutions for many practical problems. The only way to address the global and regional impacts of climate change is through large scale research investments. Projects like TaiCCAT are demonstrating the commitment of the Taiwanese government. It is expected that projects like these will soon generate results that can be directly implemented in order to support climate change adaptation activities on the national scale.

One key component in the process of management of natural disasters involves dissemination of information and risk communication. The Taiwan Climate Change Projection and Information Platform (TCCIP) of NCDR is already serving this purpose very well and its further improvement and maintenance will be generating benefits exceeding costs multiple times. Dissemination of information like the 'Climate Change in Taiwan – Scientific Report' (2011) is raising awareness, improving preparedness and generating incentives for active adaptation on all levels (from individuals, through organizations to all of society).

In addition to the admirable activities and results achieved in Taiwan to-date, there are some opportunities for future



consideration that may be able to further improve the country's preparedness for mitigating effects of future disasters:

- Improvement in coordination of climate change related research work.
- Broader sharing of various data (like remotely sensed data) among research institutions as well as among various agencies involved in the management of natural disasters.
- Further expansion of climate change-related work to better address various sources of uncertainty and their impact on the final assessment of future conditions.
- Strengthening risk communication related to climate change impacts.
- Much more serious consideration of sea level rise as one of the most significant climate change related impacts on the country (especially large coastal municipalities). **CT**

Tornado damage

The Angus, Ontario tornado showed some deficiencies in construction methods - some of which can be fixed cheaply.

By Dr. Greg Kopp, Western University

On June 17, 2014, an EF-2 tornado ripped through the small town of Angus, Ontario, about 100 km north of Toronto. It caused damage to more than 100 homes, tearing the roofs off of 11 of them, including seven in a row down one street. The worst of the damage was confined to two streets. In fact, the tornado appeared to travel down the backyards between the houses over a stretch where about 70% of the damage occurred. Events of this magnitude seem to happen every couple of years or so in Ontario.

Most people would say there isn't much that we can do about these events, particularly when they look at the photographs of chaotic damage in the aftermath of the storm. However, when one digs into the details, patterns of damage emerge that suggest measures can be taken to reduce the number of people who lose their homes and have to re-build their lives. The most important mitigation measure is inexpensive - in the range of \$100 to \$200 per house.

In Angus, much of the observed damage was to the cladding (vinyl siding - 30% of the damaged houses), roof cover (asphalt shingles - 50%), and fascia, soffits and eavestroughs (40%). This is fairly typical of such storms, and while the damage can add up, our analysis suggests that these costs are not the main drivers of overall losses in severe tornadoes.

Of greater concern are structural failures, such as roof sheathing (10% of the houses) and complete roof failure (10% of the houses), which is both a life safety issue and a much more expensive type of failure. It has been shown that the loss of one sheet of plywood from the roof

can lead to substantial contents loss due to rain entry. Complete roof failure obviously leads to substantial re-building costs along with a high proportion of contents loss.

Roofs in wood-frame houses are fastened to the walls with toe-nails - a set of three nails connecting each roof truss to the top of the wall. In convective storms in particular, the wind creates pressure, which acts to lift roofs up. So, in a severe wind storm, we need to think about holding the roof down, rather than having walls that just hold it up. The toe-nailed connections have this job.

Engineers tend to dislike toe-nailed connections because it is difficult to control their quality and, even when properly installed, their capacity to withstand uplift is relatively small. Often, the lumber will crack when the nails are put in; and it is easy to miss nails. As a result, the toe-nailed connections are often the weak link in severe wind. In other words, how the roof is fastened to the walls tends to be the weakest structural component in wood-frame houses, even when they are installed correctly.

As a result, one usually finds complete roof trusses on the ground after the storm, with the toe-nails protruding out. In Angus, as part of the research we did after the storm, we found



Gregory Alan Kopp
@gregoryalankopp
Roof failure can destroy houses downwind which may have been otherwise safe. This one did. #Angus #tornado #onstorm
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many such toe-nailed connections during our survey. However, most of these were clearly faulty, often with only a single nail, instead of the three required by the building codes in Canada. Nailing problems were prevalent in Angus - we didn't find one failed toe-nail connection that was correct (although in the piles of lumber, we may have missed some).

Once a roof fails, it will fly through the air and could potentially impact adjacent houses that may have been otherwise undamaged. We saw several circumstances where roofs had landed on adjacent houses, and we also saw roof trusses that had penetrated adjacent walls like spears protruding through windows. About 40% of the houses in Angus were damaged by debris impacts. While shingles flying through the air have enough momentum to break common window glass, much of the damage due to debris impacts was caused by structural roofing material. Thus, if one can ►

Tornado damage cont...

keep the roof structure attached to the walls, there will be significantly reduced damage to surrounding houses.

So, how can we reduce the number of roof failures? We need two things. First, builders need to ensure that the building code is followed and the correct nails installed. Missing nails can be disastrous. It appears that improved inspection practices are needed in this regard.

Second, in order to significantly increase the strength of the weakest link, roof straps should be required instead of toe-nails. These are thin metal straps that replace the toe-nails. The simplest and cheapest of these are far stronger than toe-nailed connections, and they cost less than \$1 a piece. In an average house, like those in Angus, they would cost \$100 - \$150 per

house to install. Such straps would make inspection easier since they can easily be seen from the floor.

Severe tornadoes are relatively rare in Canada, at least compared to the numbers in the southern United States.

Nevertheless, for EF-2 tornadoes like that in Angus this year, or in Vaughan five years ago, much of the severe damage can be mitigated with roof clips holding the roofs onto the walls, and a few more nails holding the roof sheathing in place.

Our analysis, based on full-scale testing at the Insurance Research Lab for Better Homes, suggests that the use of roof straps would have eliminated the roof failures in Angus, substantially reducing the overall losses. Just because it is a tornado does not mean we have

to accept the damage - we can actually reduce the worst of it! **CT**



Dr. Gregory A. Kopp is a Professor in the Department of Civil & Environmental Engineering at the University of Western Ontario. Dr. Kopp is currently also a Research Director and a member of the Board of Directors of the Boundary Layer Wind Tunnel Laboratory. He can be reached at gakopp@uwo.ca; @gregoryalankopp; or 519-661-3338.



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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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