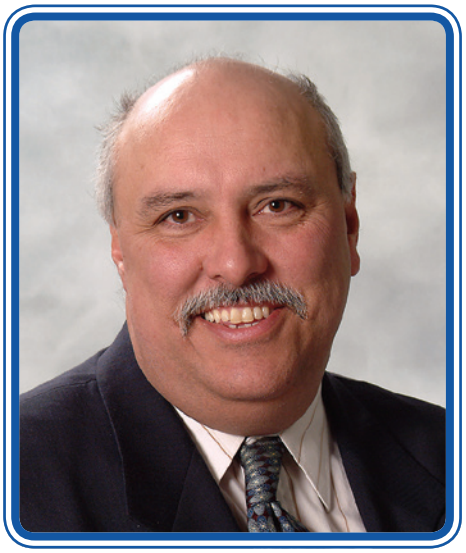
Caskanette Udall
CONSULTING ENGINEERS

FORENSIC ENGINEERING NEWS AND VIEWS

Spring 2019

Presidents Box



By Rene Caskanette

Our 2018 fiscal year end of Jan 31, 2019 has passed, and once again we have posted a new record sales total. Thank you to our repeat customers for your continued support. We strive to provide quick, accurate and reliable answers to your engineering questions and problems and judging by the continued support we receive, we are achieving our goals.

As part of our long term strategy for corporate success, the younger generation of professionals in the firm have made a move into the ownership structure. The senior partners sell off shares as the new generation buys them, ensuring a smooth transition to avoid any sudden changes to the business. Clients can be assured that the service levels will continue at the current high level, even as the ownership and management structure is slowly transformed and modernized.

To ensure we have the required manpower to continue to grow and still provide excellent service, we are currently interviewing new engineers to join our team of experts. We are excited to see the high quality of candidates, with two very smart young graduates with doctorate degrees looking to join our firm. The future looks bright indeed as the new workforce expands our capabilities in structural engineering, building science assessments and bring along new architectural skills. These new hires will add capacity to handle the busy times in property claims when catastrophes strike.

Our recent expansion into Niagara Region with Jeff Udall based in the area, has yielded some new business partners in that territory. Adding new services such as Radon Testing, and new equipment such as updated Vehicle Data Retrieval equipment has rounded out our range of services in the environmental, and accident reconstruction areas. We continue to provide our insurance clients with the full range of forensic engineering services required to adjust both property and casualty claims.

Reserve Fund Studies for condominium properties has introduced us to a new client base of property managers. Property managers also require help from forensic and civil/structural engineers for the properties they manage when problems emerge, so this is a natural growth area for our firm.

We look forward to another strong year, and continued growth and success for our firm and all of our partner firms. I hope 2019 is a good year for each of us.

De-Icing with Salt

By Micheka Kostyniuk

We are regularly asked to review and assess winter maintenance activities, and whether or not proper de-icing was applied. The most common method for de-icing is using salt, though other chemical de-icers are available. Salt is highly corrosive and can damage concrete structures by degrading rebar. It also has adverse environmental effects when overapplied, since the salt can kill vegetation and contaminate groundwater aquifers. The big advantage to salt is the low cost.

So how does de-icing with salt work? Solid rock salt mixes with water to form a brine. This water can come from snow, ice, rain or humid air. When the moisture is absorbed by the salt, it forms a brine solution. A brine is essentially salty water.

As moisture is absorbed into the salt and the brine forms, the ultimate concentration of 23.3% is reached. As additional moisture is absorbed into the brine from melting snow/ice, the concentration dilutes. Eventually it will dilute to the point where there is so little salt remaining that the brine is basically just water again, and it will re-freeze.

As the concentration of the brine is higher, it is more effective at lower temperatures. At a concentration of 23.3%, salt works at temperatures as low as -21°C. As it gets diluted, the effective temperature for the salt increases. For example, a 10% brine will work at temperatures of approximately -6°C or warmer

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Fire Investigation of Buildings, Vehicles and Equipment

By Bob Caskanette

I have had the pleasure of serving on the executive board of the Canadian Association of Fire Investigators (CAFI) Ontario Chapter 006, since 2015. I was recently elected to the position of 1st Vice President in 2018, which is the role I currently hold and am poised to become the next President.

Through CAFI, our executive is responsible for a great number of things, including hosting training seminars and events for other fire investigators and engineers in the private sector and the public sector. In 2016 we constructed a burn building on the grounds of the Fire and Emergency Services Training Institute (FESTI) attached to Pearson Airport in Toronto, ON. This is the location we host many of our multi-day training seminars. It gives investigators and other stakeholders the opportunity to see and investigate a building following a fire(s) and can better evaluate things such as ventilation effects of fires, fire patterns and fire dynamics, fuel loads and fuel packages within a building, arc mapping, electronic and electrical failures, incendiary fire indicators, accelerant sampling and laboratory analysis and much more with the assistance and guidance of our executive.

We put a lot of time and effort into setting up the test cells to maximize the learning opportunity for seminar participants and video record the live burns to show the attendees after they have had the opportunity to investigate the potential cause(s) of the fires for themselves towards the end of the seminar. We use thermocouples and other instrumentation to gather data during the live burn so we can record when flashover within the compartment(s) occurs and to time how long after flashover the fires are allowed to continue before onsite FESTI firefighters suppress the fire. This shows the difference between fuel controlled fires and ventilation controlled post-flashover fires and the key differences that ventilation effects and patterns add to the complexity of fire investigation.

Participants also have in class training and lectures on a variety of topics in addition to the hands on learning offered outside. Our next seminar will be at FESTI on May 28 and 29, 2019. I will be one of the presenters during this two day seminar. The seminar is titled “Solving the Unsolvable” and will address topics such as Spontaneous Heating, Chemical Fires, Farm Buildings, Garages and Equipment and Electrical Faults. I hope to see you there.

I often get asked how I ended up in the field of fire investigation. I had the very unique benefit of learning from my father, Rene, who is an engineer and one of the most experienced fire investigation experts in Canada and still heads our engineering firm today. I don’t know anyone personally who has investigated more fires than Rene. My sister Micheka, who also works as an engineer and fire investigator in our London, ON office, and myself spent much of our childhood and teen years learning from our Dad, going to job sites as an extra set of hands, talking about fire investigation daily, helping in the office and writing reports since as long as I can remember.
It really did start as a family business and remains so to this day. I now have well over 700 fire and explosion investigations under my belt and enjoy what I do everyday. I have been involved in many high profile investigations such as the Sunrise Propane explosion, St. Jacob’s Farmers Market Fire, Sprucedale house explosion fatality, Mississauga restaurant explosion, and many others. Some of the most rewarding cases I’ve worked on involve working for public defenders representing persons wrongfully charged with arson and giving them an opportunity to start living their lives again.

It is important to carefully select a good, qualified and experienced fire investigator when a fire loss occurs. Certifications are available through the National Association of Fire Investigators (NAFI). I am currently a Certified Fire and Explosion Investigator (CFEI) and Certified Vehicle Fire Investigator (CVFI) through NAFI. CAFI also certifies Canadian fire investigators. I currently hold the designation of Canadian Certified Fire Investigator (CCFI-C) through CAFI. I also have an engineering background, which is of great use to having the technical knowledge needed and applying scientific principles and the scientific method to investigations, which is a requirement of all investigators as outlined in the National Fire Protection Agency (NFPA) 921, which is the standard of care for all fire investigators in addition to other supporting publications and available literature.

NFPA 1033 outlines 16 topics which fire investigators must be trained and competent in. Simply being educated or becoming initially certified is simply not enough. You must continue to gain experience through investigations and training to stay as current and competent as possible. This is critical when litigation occurs and a fire investigator needs to be qualified in order to testify and give evidence following an investigation or critique. Cross examinations of experts can be a very grueling and difficult experience for those not meeting the threshold. Many fire investigators do not get qualified as an expert when they get to this stage, which results in their evidence not being heard, which often leads to poor results during litigation for the party they represent. I often think back to the first time I was qualified as an expert in 2012 and how stressful that experience was.

Our firm has many fire investigators who have been qualified as experts to give you the peace of mind if litigation becomes reality. We are a team of highly educated and experienced fire investigators. There’s not much we have not seen over the years, whether it’s a fire in a building, vehicle, piece of equipment, appliance or electronic device. We are trained to investigate and handle the most complex of fire investigations and pride ourselves on our prompt service, report turnaround time and unmatched cost effectiveness for our clients. We hope to see you on your next fire and appreciate the opportunity to serve you.

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Will Your Glass Bulb Sprinkler Freeze If the Window is Left Open?

By Alex Caskanette

Sprinkler systems have been around since the 1800s and automatic fire sprinklers were used in the U.S. as early as 1874. Fires have always been forces of destruction and manufacturing plants pioneered the implementation of sprinkler systems to protect their property. The first sprinkler systems began as uncharged pipes with perforations. In the event of a fire the fire department would connect a water supply to the system standpipe and pump water through the pipes to supress the fire. There were many drawbacks with these early sprinkler systems such as the valuable time it took to connect and charge the systems, and the susceptibility to clogging which would render them useless.

The first U.S. patent for a heat-actuated sprinkler head was issued to Philip W. Pratt. Since the early days, heat-actuated sprinkler heads have evolved with many significant improvements. Today there are two common types of heat-actuated sprinkler heads. There is the type that is activated by soldered fusible links and the type that is activated by glass filaments. On occasion both types of sprinkler heads have been documented to fail and release without a source of heat, causing significant damage.

When fusible linked sprinkler heads fail the cause of failure can often be determined by examining the fusible links which are often recovered. Determining the cause of a glass filament sprinkler head failure is much more challenging. The glass bulbs in these sprinkler heads contain an explosive liquid which expands and ensures short triggering times when they are exposed to temperatures over a certain threshold. When these sprinkler heads actuate the glass bulbs shatter. Unfortunately, when these glass bulbs burst there is little physical evidence remaining to recover.

The liquids contained inside the glass bulbs vary depending on the manufacturer. The most common types of expanding liquids used can be based on alcohols, aliphatic hydrocarbons, lower cycloaliphatic hydrocarbons, esters of ketocarboxylic acids, and lower ketones.

The question is, “Are the average residential glass bulb sprinkler heads susceptible to freezing if exposed to below zero temperatures”. An experiment was conducted where five TYCO TY2234 glass bulb sprinkler heads were left outside for four consecutive cold winter days. The maximum temperature recorded over this four-day period was -13°C and the minimum temperature recorded was -25°C. It was noted that the liquid contained inside all five of the bulbs remained unfrozen over the duration of the test. Although this study is limited in scope, the results support the hypothesis that a glass bulb sprinkler should not fail due to freezing if a nearby window is left open on a reasonably cold winter night.

De-Icing with Salt

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and a 3.5% brine will work at temperatures of approximately -1.8°C or warmer.

Salt is not effective at temperatures below -21°C. Realistically, salt has minimal effectiveness between temperatures of approximately -9°C and – 21°C. It can still be effective if used properly in this temperature range, but does require more regular monitoring/maintaining. Salt is most effective at temperatures above -9°C.

There are many factors that affect the ability of salt to act as a de-icer; temperature is the most important factor. Spreader rates are important (making sure the right amount of salt is used. Too much is wasteful, too little is ineffective). Also the weather (is it sunny or cloudy? Day or night?), the type of pavement surface (is it asphalt or concrete), the topography (is the area in shade where it is cooler?), traffic volume (to spread around the salt, apply some heat to the solution, etc), and a few other factors.

How is salt used for proper de-icing? Can you just throw salt on the surface and everything will be safe? No, not usually. Salt needs to be re-applied regularly to remain effective, as it is diluting during deicing, and becoming less effective. It shouldn’t be thrown down on top of an unplowed surface with hopes that it will help rid the surface of snow/ice.

Salt helps to break up the bond between the snow/ice and the pavement surface improving traction and making the surface safer. During snowy periods, you should always plow and then salt at regular intervals. The plowing removes a large volume of snow, so that the salt can be more effective. Once the salt has had time to work and break the surface bond, the plow should be back to do another pass and then additional salt applied again. This should be repeated as necessary to get the pavement to a safe and serviceable condition.

The importance of monitoring site conditions is paramount. Local site conditions can have hazards that aren’t noticeable by monitoring weather conditions from an office. Having an onsite presence to see firsthand what is going on and planning accordingly is critical. Inspections can be done by trained equipment operators who are out plowing/de-icing, or by patrollers who are touring around to monitor site conditions and dispatch crews as needed.

In addition to de-icing, there is also anti-icing. De-icing is trying to act after the snow/ice has accumulated. Anti-icing is a more proactive approach where a liquid brine is applied to the roads before a storm. When applied properly, this liquid brine helps to prevent snow from sticking to the ground so that the first pass with the snow plow is more effective at clearing away snow.

Property owners normally contract snow removal and deicing work to contractors who specialize in this work. If they do the proper inspections, plowing and deicing work needed, surfaces such as parking lots and walkways can be kept safe for vehicles and pedestrians, if they fail to do the job properly, ice forms, slip hazards develop and accidents will happen. We help to assess any failures in maintenance that allow these accidents to happen.

Spray Foam Insulation: Miracle or Mess?

By Sadie Breg

With the belt tightening around carbon emissions targets, buildings are one of the best places to cut back on energy usage. Buildings produce more CO_2 emissions than industry or transportation[1]. The Ontario Building Code plays a huge role in turning these targets into reality, by requiring newly constructed buildings to be more and more energy efficient.

But what about old buildings? When existing buildings need to be repaired or renovated, the Ontario Building Code can assert its power, requiring an old building to be upgraded to meet recent Code requirements. Code requirements for new buildings require a lot of insulation on walls, ceilings/roofs, and below grade. How do we get this kind of performance out of an old building built with little or no insulation?

Upgrading the insulation may be easy enough in an attic – just blow in some more cellulose. But it can become particularly onerous and expensive to meet Code requirements where the existing frame walls are only 2x4 construction. Options are limited: do we strap the wall inwards and reduce the living area? Do we exterior insulate and change the look of the building?

Part 11 gives some relief to older buildings, allowing them to be exempt from certain Code requirements. Up until the end of 2016, Part 11 has allowed us to "replace to match existing" levels of insulation wherever framing systems would need to be altered in order to accommodate this upgrade. However, new energy efficiency requirements in the Ontario Building Code, which came into effect in 2017 (Section 12.2.1.2), do not have any Part 11 grandfathering provisions. Municipalities are beginning to enforce these new requirements to varying degrees.

So where does this leave us? One miracle go-to solution presented at times like these is spray foam. Spray foam salespeople will tell you that closed cell spray foam is 2-3 times as effective as fiberglass batt insulation. In reality, it's more like 1.7 times as effective[2] when doing a fair comparison of R-value/inch. Still, 1.7 times is nothing to sneeze at if it can save us from more costly interventions.

Spray foam can be a great solution to upgrading an old building. In addition to adding thermal insulation, closed cell spray foam functions as an air and vapour barrier, which can help to achieve air tightness around tricky intersections. However, spray foam is not always the most appropriate solution.

Sometimes, spray foam can cause building science nightmares. From a forensic perspective, I have seen the role spray foam can play in catastrophic failure: a spray foam-covered roof collapse from trapped moisture rotting the structure, a fire caused by hot surface ignition of unprotected flammable spray foam, rapid degradation of a rubble stone foundation wall after installing spray foam in a basement.

Spray foam is essentially permanent: once it's installed, it's very hard to undo. That's why it's especially important to only use it in appropriate locations, and to get it right the first time.

1 USGBC. (n.d.). Buildings and Climate Change. Retrieved from https://www.eesi.org/files/climate.pdf

2 Straube, J. (2012). High Performance Enclosures. Somerville: Building Science Press.

New Staff

We would like to welcome our newest employee, **Farhad Habibi**. Farhad is a structural specialist who obtained his undergraduate engineering degree from McMaster University and will be defending his doctoral thesis at University of Toronto, this spring. You can expect to see him on sites requiring structural assessments.

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