



FORENSIC ENGINEERING NEWS AND VIEWS

At this time, our offices continue to operate as an essential service, conducting site visits while following health and safety guidelines including the use of PPE and physical distancing.

Fall 2020

Presidents Box



By Rene Caskanette

We want our clients to know we are all healthy and working safely from our home offices, just like we did before the pandemic. Our field work is done quickly and efficiently as it always was, but now we take extra precautions as recommended by public health doctors, to make sure our employees are safe.

We are seeing the normal types of assignments for fire investigation, structural repair design drawings, environmental assessments, mechanical failures, and personal injury investigations.

After a court shutdown over the spring and summer, it seems like lawyers have got back to work this fall, based on an increase we have seen in jobs from OTLA members. Seems like court backlogs are large and getting a jury trial is still a challenge, but nice to see the courts moving towards electronic communication measures to keep the process moving.

As fall is upon us, we expect the seasonal fires and accidents to increase.

Icy roads and sidewalks require maintenance for safe passage, and when the inspection and salt application measures are inadequate, the results will be property damage claims, motor vehicle claims, and personal injury claims. Snow removal is important, but more critical for safety is de-icing surfaces after the snow is removed. Property owners, property managers and municipalities must have systems in place to mitigate risk from weather effects.

Reduced daylight hours and colder temperatures naturally lead to more fire risk in homes as owners burn more candles and restart their fireplaces and seasonal heating appliances. Prestart inspections and annual maintenance of heating appliances and chimneys is critical. Creosote deposits in chimneys must be removed to avoid fires when using wood fired appliances. Unattended candles, and cooking remain common sources of ignition for fires.

When disaster strikes, know that we are here to help. Our office remains open through the holiday season and our phones are always answered promptly.

Wishing everyone a Merry Christmas and Happy New Year, hopefully the Covid surge will die down by then so people can gather with family and friends to enjoy the normally festive season.

Winter Perils



By Jeff Udall

We've had a long dry summer amid these Covid times, but as sure as night follows day, winter is coming. And as in all years before, we will surely have some crazy winter storms. The skies will open up and dump amazing amounts of snow with high winds and freezing cold temperatures. Such is life in this great country we live in.

But while most of us will hide inside with thick socks and the furnace blasting to keep us warm, there will be perils that come with the winter weather. Every year we investigate many winter related files giving us extensive experience with the root causes of these problems and how to fix them.

With winter comes snow. And sometimes a lot of it. Many buildings including agricultural barns and older buildings can be susceptible to damage with excessive amounts of snow on the roof. Roof collapses or trusses fracturing are common occurrences. The building codes do a pretty good job of designing for expected snow weight, but older buildings may have deteriorated or were not designed to a modern code. And sometimes the amount of snow is just above and beyond what could be predicted. We are able to figure out if a roof should have survived a heavy snowfall, or if mother nature just won the day.

With heavy snow build up on poorly insulated roofs comes another problem commonly referred to as ice damming. If a lot of heat escapes into an attic space, the underside of a snow pile on a roof can melt and the water runs down over the shingles towards the eaves. The eaves that overhang the side of the house do not have the same heat exposure from the attic, so the water can then re-freeze before it gets to the eavestrough and drains away. If enough water accumulates at the bottom of the roof slope, it can create a frozen dam that lets more and more water and ice build up. A roof is intended to shed water as it occurs. It is not intended to hold water. Retained water behind an ice dam can flow back under the shingles and leak into the attic, walls, and house space. Water damage from roof top ice damming can occur from a variety of factors. With experience we are able to determine the roof cause of ice damming and provide solutions to prevent reoccurrences.

Remember the 'frost quakes' that made the news a few years ago? Temperatures dropped so low that the ground froze to levels deeper and

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NFPA 921 Update (2021) for Fire and Explosion Investigations



By Bob Caskanette

The National Fire Protection Agency (NFPA) publishes the NFPA 921 Guide for Fire and Explosion Investigations, which is the standard of care for all fire investigators to follow. Revisions to 921 are generally made every 3-4 years, with the last revision coming in 2017. The new 2021 revision of NFPA 921 has been released, which came into effect April 25, 2020, and supersedes all

previous editions. It is not yet available electronically, but the paperbacks are available for order.

NFPA 921 is constantly being revised to stay current with the latest science on fire investigation. NFPA relies on the latest research, feedback and even scrutiny of the fire investigation community to ensure it stays up to date and as comprehensive as possible. As always, NFPA 921 relies on trained, certified investigators applying scientific principles and the scientific method to all fire and explosion investigations, and even goes as far as including an illustration of the scientific method on the front cover of the 2021 edition to emphasize the importance.

The 2021 revision is more robust than the previous 2017 version with a lot of changes and additions made. NFPA was wise to make the text changes within the guideline shaded in grey for easier recognition and comparison to the previous 2017 version.

One change which was noticed immediately in “Chapter 18 – Origin Determination” was the following:

Previously, in the 2017 edition, this section outlined four key elements to determine the origin of a fire. Without establishing an accurate area of fire origin, you cannot establish a reliable cause of the fire. In general, the four sources of data for consideration when determining the area of fire origin were witnesses, fire patterns, arc mapping and fire dynamics (NFPA 921- 18.1.2).

The revised 2021 changes to now use going forward has reduced the number of key elements from the previous four down to three. The three sources of data for consideration when determining the area of fire origin now are (NFPA 921 – 18.1.2):

1. *Witness Information and/or Electronic Data.* The analysis of observations reported by persons who witnessed the fire or were aware of conditions present at the time of the fire as well as the analysis of electronic data **including but not limited to** security camera footage, alarm system activation, or other such data recorded in and around the time of the fire event
2. *Fire Patterns.* The analysis of effects and patterns left by the fire, **which may include patterns involving electrical conductors.**
3. *Fire Dynamics.* The analysis of the fire dynamics [i.e., the physics and chemistry of the fire initiation and growth and the interaction between the fire and the building’s systems].

Of note, the fourth previous key element outlined in the 2017 version was “Arc Mapping”, which was removed from the 2021 revision. Instead, “patterns involving electrical conductors” has now been included within “Fire Patterns” above. There has been a lot of debate and ongoing research involving the reliability of arc mapping when investigating fires, which has perhaps led NFPA to change the wordings within the 2021 guideline. This is something for fire investigators to be aware of. Arc mapping can still be a rather useful tool, if used appropriately, but also has certain limitations and misconceptions, which is beyond the scope of this article.

Many other revisions and additions are included in the new version of 921. Some interesting additions are found in “Chapter 11 – Fire Related Human Behaviour”, which added sections in “11.5 – Youth Fire-Setting Behaviour”; “11.5.1 – Developmental Stages” and “11.5.2 – Mental Health”. These sections outline children who may set fires, why they may set them, research on where fires may be set based on developmental stages of children and other pertinent factors including mental health disorders such as attention deficit disorders (ADD/ADHD), conduct disorder and adjustment disorder, which may contribute.

It is important to carefully select a well-qualified and experienced fire investigator who is up to date on the latest developments and research within the field of fire and explosion investigation. Our firm has many fire investigators who have been qualified as experts to give you the peace of mind you are receiving sound, scientific answers and if litigation becomes reality. We are a team of highly educated and experienced engineers and fire investigators. Whether it is 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.

Buried Pipe Leaks



By Sadie Breg

Incoming water, fire suppression, storm and sanitary drain lines often run through a building concealed behind wall and ceiling finishes. When a pipe leaks in a wall or ceiling, it inevitably causes water damage. This type of above-ground leak can be noticed quickly as it drips on building occupants and creates visible water stains on walls and ceilings.

Slow leaks can go undetected where water-carrying pipes are located underneath a building. There is no tell-tale dripping or water marks to indicate a problem. Unfortunately, the first evidence of a slow leak below a building can be structural cracking in the floor and walls.

Whether a below-ground leak is fast (in the case of a high pressure sprinkler main burst) or slow (perhaps from a pinhole leak in a drain), water below the building can cause major structural issues as water erodes fill beneath the slab and footings. As fill is replaced by void, the floor slab will eventually crack and settle. Footings, which support the structure above, can become undermined. These damages are not visible until they show up as structural cracks in the floor and walls.

Structural cracks in a foundation can be caused by other factors as well, such as vehicle loads, frost heave, wet soils, etc. A forensic investigation is required to determine the cause of cracking.

It is also important to determine if the damages observed are stable or continuing to worsen. Crack monitoring can help determine if damage is ongoing over time. We can set up the equipment necessary to measure crack growth.

Once the source of the problem is found, we can work with you to design an appropriate repair strategy.

We specialize in both structural and forensic engineering, keeping safety and building remediation in mind throughout our forensic investigation.

Renovations and Part 11 of the Ontario Building Code



By Micheka Kostyniuk

One of the most common questions we receive from contractors and adjusters alike is with respect to Part 11 of the OBC. More specifically, what is acceptable to remain under Part 11 and what needs to be upgraded following a loss and subsequent tear out (e.g. fire, water, tornado, etc). The majority of questions seem to revolve around houses, since there are a large number of homes

that are found to be non-Code compliant following a loss. Some of the more common questions will be addressed in this article.

Insulation

The most common question we get is with respect to insulation in existing homes. Typically, this would revolve around 2x4 framed exterior walls that had R14 insulation in them prior to a loss or a cathedral ceiling section of roof, particularly in old 1.5 storey homes that often only had 2x4 rafters. Unless you strap out the 2x4 rafters, it is not physically possible to get an R31 insulation in these roof cavities, and sometimes it is just not possible to strap out the rafters without significant and expensive design changes to the home.

The answer to the insulation question is, unfortunately, not a straightforward one. There is a compliance alternative, C199, which refers to insulation and allows for existing acceptable. However, this clause refers to 12.2.1.1.(3). This subsection deals with energy efficiency requirements before January 1, 2017. There is a separate subsection (12.2.1.2) that deals with energy efficiency requirements after December 31, 2016. And this one is not currently referenced at all in Part 11 of the Code, which leaves this area open to interpretation by individual building departments.

We have reached out to the Ministry of Municipal Affairs and Housing in the past to seek clarification on this issue from one of their Building Code Consultants. They have confirmed with us that the intent of the Code has not changed and that it is appropriate to consider insulation to still fall under Part 11 of the Code. However, they admit that it is not clearly defined in the current Code. They have provided us with various suggestions for Code wordings to use that help support the intent of the Code for negotiating with municipalities to adopt a Part 11 view when it comes to insulation. However, at the end of the day, they state that it is up to each municipality to interpret the Code as they deem appropriate.

We have found that in our experience, most municipalities still allow insulation to go back per existing in accordance with Part 11. However, some municipalities have taken the stance that insulation is not covered under Part 11 and insist that it be brought up to current Code requirements. When this happens, the building department unfortunately is the ultimate authority on the matter. We have occasionally been able to successfully negotiate with building departments, but not always. We are hopeful that future versions of the OBC more clearly define insulation requirements in Part 11.

Framing

Framing for houses is deemed “Existing is acceptable” under compliance alternative C187. If the framing does not meet current Code requirements, it is suitable to remain. Likewise, framing that is undersized can be replaced in kind if it is charred, cut by the fire department, etc during a repair.

There are some notable exceptions to this. Anything deemed to be a life safety issue is not governed by Part 11 and must be upgraded. For example, if framing is showing signs of cracking, sagging, twisting, etc that indicate it cannot safely support the intended loads, this is a life safety concern and the framing needs to be upgraded.

What is considered a “life safety issue” is rather subjective, which leaves framing somewhat open to interpretation by various parties (e.g. Engineers, Building Inspectors, etc). Like insulation, the building inspectors are the ultimate authority. However, we rarely encounter disagreement related to recommended framing upgrades with Building Departments. When we do, typically a site meeting to discuss with the inspector and/or others, complete with a follow up letter stamped by an engineer at our firm is enough to satisfy issues.

The other exception depends on the scale of the repairs. Let’s say your roof is stick framed and the rafters are too small to meet Code requirements. Replacing a small section of rafters is fine. But if half your roof framing is damaged and needs to be repaired, then it is unlikely that you will be able to repair this as per existing framing conditions. You’ll likely need to replace the entire roof with a new Code compliant roof. Typically, when you encounter these large scale repairs, it makes more economic sense to replace the entire component anyways, so this is rarely an area that is in dispute between any of the parties.

Guards and Handrails

Often fires are inside houses and there’s no damage at the exterior of the house. But then the municipality is requesting new guards and handrails at the exterior of the house, which had nothing to do with the fire. We are regularly asked why this should be an issue and why insurance should need to upgrade these items. Part 11 deems existing handrails (C113) and guards (C114) “acceptable, unless considered unsafe by chief building official”. So unfortunately, if the municipality asks for these upgrades, even if they were completely unaffected by the fire, they are required upgrades and not protected by Part 11.

Fire Separations

The number of times we have been to a house that was converted to a duplex, triplex, or some other multi-dwelling unit but no fire separations were ever installed during this conversion is too high to count. This seems to be one area that most people know is not protected by Part 11, but we do get enough questions about this that warranted a brief discussion. Fire Separations are classified as a life safety concern, and as such they must be installed or upgraded during restoration/renovation work following a loss. However, typically only the actual areas that are touched need to be upgraded. If the ceiling finishes in the back half of the main level are not affected and are remaining in place, but the front half of the main level ceiling is gutted and needs to be a fire separation, typically only this front half that’s been gutted needs to be upgraded.

Hopefully this helps clarify a few of the more common questions. But if you ever have questions and need some answers, give us a call and we’re happy to chat with you and help you sort out your restoration Code Upgrade issues with you.

Agricultural Affairs



By Alex Caskanette

The leaves may already be falling this Autumn but subrogation potential does not need to fall through the cracks.

Spring and Fall are the seasons with typically the greatest number of agricultural fires and failure claims. The Office of the Fire Marshal and Emergency Management (OFMEM) tracks the fire incidents in Ontario and indicates that there are approximately 80 reported fires involving barns housing livestock with an estimated loss of 18.5 million each year. This is but a fraction of the yearly potential agricultural insurance losses incurred by Ontario farmers.

Caskanette Udall Consulting Engineers has extensive experience with agricultural structural fires and is well trained to investigate the origin and the cause of farm equipment fires. Farm equipment regularly involved in fires include: grain dryers, combines, and tractors. These fires not only destroy the expensive farm equipment but often spread and damage surrounding structures and equipment, and sometimes even result in costly environmental contamination. If a manufacturer deficiency, an installation defect, or if recent service work has contributed to the fire, subrogation is often a potential avenue that can be pursued to recover the associated damage costs.

Caskanette Udall also specializes in investigating the cause of agricultural equipment failures. Since all equipment failures are unique, our experience in combination with our attention to detail make us the ideal candidate to assist you with determining the root cause of a particular failure.

Some examples of recent equipment and system failures that we have investigated include: livestock feed systems, grain elevators, grain spouts, silo unloaders, and closed loop hot water heating systems.

Let our experienced experts assist you in determining the cause of agricultural fire or equipment failure claims to see if subrogation is an option for you. Contact us so that potential recovery does not fall through the cracks.



Alkali-Silica Reaction – Cause, Effects, Mitigation, and Repair



By Justin Breg

On October 21, 2020, Justin Breg and Farhad Habibi presented at the International Concrete Repair Institute on the topic “Alkali-Silica Reaction – Cause, Effects, Mitigation, and

Repair.”

Alkali-Silica Reaction (ASR) can occur in concrete structures when reactive aggregates are included in a mix. The presence of moisture initiates a reaction between the alkaline cement paste and reactive amorphous silica. The result is a gel that continues to dilate, which may cause cracks in the concrete mass.

First identified and researched in California in the 1930s, ASR has been observed in structure throughout Canada, the US, and various other nations worldwide. Famously, the pillars of the National Gallery of Canada suffered visible deterioration due to ASR after it was constructed in 1988. Many Canadian hydroelectric dams are affected by ASR on account the frost-susceptible chert aggregate that is widely available in Canada. ASR also causes significant damage to bridges, roadways, airport runways, and nuclear power plants.

The presentation reviewed findings from Farhad’s PhD research program, undertaken at the University of Toronto with the sponsorship of the Canadian Nuclear Safety Commission (CNSC). The project investigated the effects of ASR on large-scale concrete specimens. Several specimens were constructed using reactive (ASR) concrete and non-reactive (regular) concrete, and their short-term and long-term structural and mechanical behaviour were compared. To accelerate the deterioration of concrete, wall specimens were stored in an environmental chamber, specially constructed with the capacity to store large specimens in controlled high-temperature and high-humidity conditions.

Justin and Farhad discussed the implications of the research for concrete design and repair, provided a summary of best practices to minimize the risk of ASR in concrete during placement, and proposed several strategies for treating structures that have been degraded due to ASR.

For more information on concrete repair, please contact our office.

Winter Perils

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colder than in recent memory. Deep frost can cause havoc with foundations as moist soil freezes and expands and contracts. There is a phenomenon called adfreezing where an unprotected concrete foundation wall can actually lift off its footing by the forces of the freezing soil. This can result in significant structural damage to a building that relies on a stiff and stable base. Depending on the extent of damage, repairs could include simply repairing drywall cracks, or in worse case scenarios result in demolition of the building. Costs of repair can be substantial, so determining a practical cost effective approach is needed.

In addition to these problems, there are always frozen pipes that cause a lot of damage. Water damage from a broken pipe can be costly and requires a decisive analysis. Winter weather also brings car accidents that could have been prevented with proper tires, and slip and fall accidents where snow and ice clearing on sidewalks and parking lots is not done properly.

Our office is prepared to assist with property, motor vehicle, and personal injury claims that are sure to come in the coming months. Give us a call and one of our experts will be able to provide a solution.

Stay safe this winter. Keep warm and wear a mask.

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We are available to provide you with web based training that can be tailored to the needs of our clients, dealing with engineering and building science matters