Caskanette Udall
CONSULTING ENGINEERS

FORENSIC ENGINEERING NEWS AND VIEWS

June 2023

President's Box

By Rene Caskanette

As anticipated our new environmental expert Dave Giles has proven to be a perfect fit for us, serving our existing and newer clients in a competent and professional manner.

Our new website is now active, so check it out.

We hired two new structural engineers in the Kitchener territory this spring, to upgrade and expand our expertise. Erik Mahon has prepared an article on the use of mass timber in damaged building restorations, and Jesse Hildebrand has authored an article on solar arrays, an expanding technology in response to new government initiatives. They both did work in these areas with previous employers and bring us new expertise to offer to our clients in these areas.

We always monitor trends and try to stay current with change. One of those trends often talked about is the move to a 4 day work week to achieve a better work-life balance. We have been piloting this in London with Micheka Kostyniuk working 4 day weeks for the last year, so she can spend more time with her young twin daughters. Happy to report this has been a great success, with revenue and production staying where it needs to be for corporate success. It may require more hours during the 4 work days but the longer weekend makes up for it. Our policy is now to allow each employee to decide what schedule works best for them to achieve an acceptable balance and still get the job done, so flexibility is provided.

Work from home gets a lot of attention now, we have been work from home for 25 years now so nice to see we were trend setters, and the world is catching up.

Next up is extended leave which we will call a sabbatical as our friends in the academic world do. Micheka will be the first to experiment with this as well, with leave planned to begin in June when the kids are out of school, with a trip to England and Europe, and a planned return date in the summer of 2024. Our new hires this spring will be trained and ready to pick up the workload in her absence.

In July we will celebrate our 25th anniversary, a milestone we have worked hard to reach, and a source of pride for me as the company founder. We have grown and expanded our personnel and services, to always ensure we can offer clients the quick and top quality service we have become known for.

We are in the early stages of a transfer of ownership from Jeff Udall and myself to a group of senior employees. When the process is complete you will hear more details on a rebranding program sometime early next year. As us old guys move closer to retirement it is important to ensure an orderly transfer to the next generation of employee owners who will continue to offer the same excellent services our customers have come to expect. Exciting times here at Caskanette Udall.

PRODUCT RECALLS

June 12: Mercedes-Benz EQS Class (2022, 2023)

On certain vehicles, a software problem could cause the electric drive system to shut down unexpectedly while driving. If this happens, there could be a loss of power to the wheels. A sudden loss of power to the wheels could increase the risk of a crash.

June 8: John Deere XUV590 Gator Utility Vehicles

Fuel can leak from under the fuel cap, posing a fire hazard.

June 8: Ashley Furniture Industries Party Time Power Loveseats, Sofas and Recliners

The power loveseats, sofas, and recliners' cupholder with LED lighting can overheat, posing a fire hazard.

June 8: Arctic Cat 8000 Snowmobiles

The fuel rail dampener snap ring can become loose and leak fuel, posing a fire hazard.

June 8: Navistar CE School Bus (2016, 2018-2024)

On certain school buses with hydraulic brakes, the brake pressure switch could leak. If this happens, the brake switch could short circuit. A short circuit can cause wiring to overheat and create the risk of a fire.

For more recalls visit: www.cpsc.gov/Recalls

Caskanette Udall congratulates Alex Caskanette and his wife Bronwyn on the arrival of their daughter, Elora, born on May 30, 2023.

Solenoid Valve Failures – Flooding Your Home

By Alex Caskanette

Solenoid valves are a fundamental and often overlooked component found in many of the devices that we use on a daily basis. Some examples of where solenoid valves can be found in our homes include: coffee makers, washing machines, dryers, ice makers, and plumbing systems. Solenoid valves are integral to ensuring the smooth operation of many modern systems.

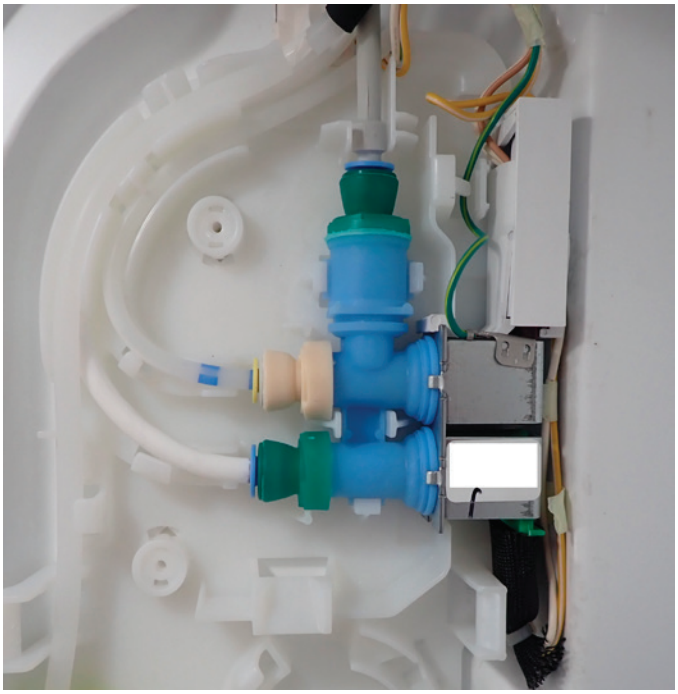
Solenoid valves are electromechanical devices that control the flow of fluids or gases by utilizing an electrical current. They consist of a coil, plunger, and valve body, and are commonly used to automate fluid handling processes. Outside your home, these valves find application in a wide range of industries, including manufacturing, automotive, medical, water treatment, and many more industries. A dual solenoid valve in a refrigerator that controls the flow of water to the ice maker and the water dispenser can be observed in **Photograph A**.

The functioning of solenoid valves revolves around the principles of electromagnetism. When an electric current passes through the coil wrapped around the ferromagnetic core, it generates a magnetic filed. This magnetic filed attracts or repels the plunger, which is connected to a valve mechanism. When the plunger moves, it either opens or closes the valve, allowing or blocking the flow of a fluid. A spring is often used to reset the plunger back to its original position once current ceases to flow through the coil. An X-ray photograph of a dual solenoid valve can be observed in **Photograph B**.

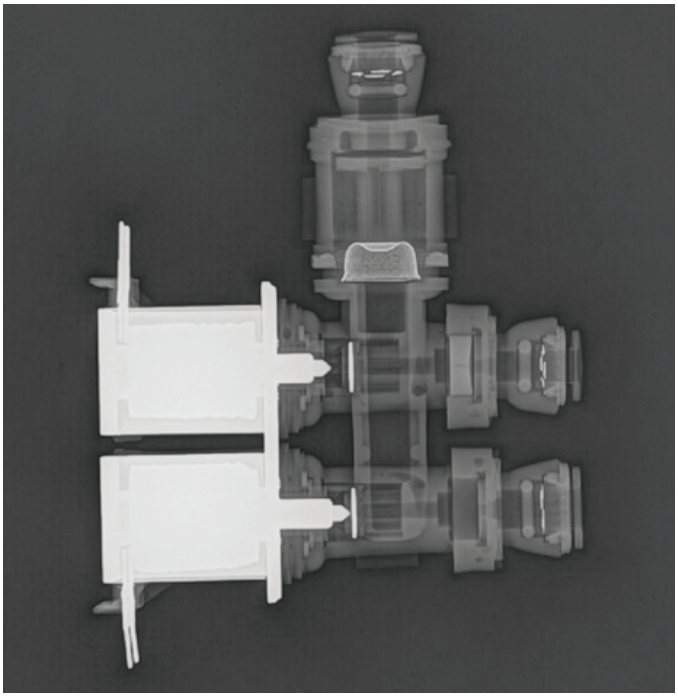
While solenoid valves are known for their reliability, like any other mechanical device, they can fail. We have investigated a number of solenoid valve failures where the valves have failed open, resulting in the flooding of homes and significant water damage. Some common failure modes for solenoid valves include:

1. Coil Burnout: Overheating of the coil due to excessive current, prolonged use, or poor ventilation.
2. Seal Degradation: The seal within the valve can deteriorate over time. This can be exacerbated by exposure to corrosive fluids or high temperatures.
3. Sticky Plunger or Failed Spring: Accumulation of dirt, debris, or inadequate lubrication can cause the plunger to become sticky. Also, the spring used to reset the plunger can fracture. Both scenarios hinder or prevent the valve from opening or closing. An example of a fractured spring from a solenoid valve that resulted in a water loss can be observed in **Photograph C**.
4. Degradation of the Plastic Valve Body: The valve's plastic body can degrade over time. This can be exacerbated by the exposure of the plastic to direct sunlight. An example of crazing to a plastic solenoid valve body which resulted in a water loss can be observed in **Photograph D**.
5. Clogging: Foreign material within the fluid can obstruct the path of flow within the valve.
6. Electrical Issues: Faulty wiring, loose connection, or power surges can disrupt the electrical supply to the valve leading to intermitted or complete failure of the solenoid valve.

We have investigated numerous solenoid valve failures that have resulted in damage to property. Let us help you determine if subrogation is a potential avenue of recovery for the solenoid valve failures that you will encounter. Our staff at Caskanette Udall Consulting Engineers specialize in all types of mechanical and material failures.

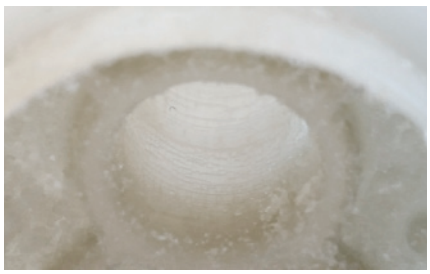


Photograph A



Photograph B

Photograph C



Photograph D

Pre-engineered Truss Damage

By Jason Richards

Frequently in newer modern homes we see pre-engineered wood truss roofs instead of more dated stick framed roof construction. These roofs can be simple gable style roofs or complicated roof systems consisting of any number of hips, valleys, and gables.

There are a number of advantages to using pre-engineered wood trusses. Pre-engineered wood trusses arrive on site prefabricated, allowing for quick and easy installation during construction. Pre-engineered roof truss roof systems are a more efficient engineering design than stick framed roof construction, allowing for greater spans with lighter materials. Pre-engineered wood trusses are typically only supported at exterior walls, or off larger girder trusses that are then in turn supported at exterior walls, allowing for significant freedom for appealing open concept living areas. They allow for a number of different aesthetically pleasing ceiling types including vaulted and tray ceilings, among others.

Pre-engineered wood trusses rely on chord members, web members, and steel connection plates working together to support roof loads, instead of heavier rafters and ceiling joists. Each member and connection point are integral to the strength and rigidity of the truss. Because of this, when pre-engineered wood trusses sustain structural damage as a result of a fire or wind loss, even a single member or connection being compromised can significantly weaken the entire roof truss.

When structural damage occurs to pre-engineered truss roofs after a loss, the options are to repair the damaged trusses or replace them. Generally, if several members of a truss are damaged, replacement is the only viable option for that truss. Likewise, replacement is the best option if more than a handful of roof trusses are damaged. In situations where over 50% of a roof's trusses are damaged, replacement of the entire roof is generally the best option. In situations where only a small number of trusses sustained localized damage, repair of those specific trusses is a viable and beneficial option.

Truss repairs can include sistering of damaged members, or replacement of damaged members and affected connections. Using measurements of the truss taken on site, and the design roof loading, analysis can be done to determine the loads in each truss member and at each connection point to allow for design of the required repairs. As the original steel connection plates are pressed on as part of truss fabrication, it is not possible to simply remove and replace steel connection plates on site as part of repairs. Instead, plywood gussets can be designed and associated nailing requirements that provide the same connection strength as the original steel plates. If warranted, new splice locations can be added as part of the truss repairs with properly designed new plywood splice connections.

There are advantages to repairing trusses rather than replacing. Depending on the time of year and the demand at that time, waiting for replacement trusses to be designed and fabricated can delay repairs, leaving homeowners with a structurally compromised roof for longer than otherwise necessary. Roof trusses can often be repaired without further compromising interior ceiling finishes, simplifying the repairs, and limiting the disturbance to homeowners.

The staff at Caskanette Udall Consulting Engineers specialize in assessing damages to pre-engineered wood truss roofs and we are always happy to assist with these claims. We provide fast emergency support, a structural scope of repair, and drawings for building permit to repair the damage.

Rooftop Solar Arrays

By Jesse Hildebrand

At Caskanette Udall Consulting Engineers, we are always committed to staying at the forefront of sustainable engineering practices. In this article, we delve into the design and inspection of rooftop solar arrays. As the demand for renewable energy continues to rise, harnessing the power of the sun through solar photovoltaic (PV) systems has emerged as a viable and environmentally friendly solution.

Ontario's commitment to clean energy and the Feed-In Tariff program have paved the way for a significant increase in rooftop solar installations across the province. With abundant sunlight and favorable incentives, many residential, commercial, and industrial property owners are embracing solar energy to reduce their carbon footprint and achieve long-term energy savings.

Designing an efficient and reliable rooftop solar array requires careful consideration of various factors, including site assessment, system sizing, structural integrity, electrical compatibility, and compliance with local regulations. As structural engineers, we play a crucial role in ensuring the safe and effective integration of solar PV systems into existing building structures.

During the design phase, our team conducts a comprehensive structural assessment to evaluate the roof's load-bearing capacity and determine if any modifications or reinforcements are necessary to support the added weight of the solar array. We also consider the orientation, tilt angle, and shading analysis to optimize energy production. By collaborating with solar experts and utilizing advanced software tools, we develop customized designs that maximize efficiency and minimize the impact on the building's aesthetics.

Once the design is finalized and construction begins, our inspection services come into play. Our experienced engineers conduct thorough on-site inspections to verify the adherence to design specifications, code compliance, and safety standards. We ensure proper installation of the mounting system, electrical connections, and grounding components, as well as the integration of inverters and monitoring systems. Our meticulous inspections aim to identify any potential issues or deficiencies early on, promoting the longevity and reliability of the solar PV system.

Fixing Old Barns with New Technology

Erik Mahon

Earlier this year British Columbia introduced a Mass Timber Action Plan with the intent to construct a bunch of new projects out of Mass Timber; prefabricated wood beams made by epoxying sawn lumber members together. Kitchener has adopted a similar plan in the past, if less far reaching in scope. These are only a couple of the many initiatives that have been coming forth in the past few years to introduce Mass Timber into the construction market as an aesthetic, faster, and more sustainable replacement for steel and concrete. Ontario has invested heavily in a large fabrication plant in St. Thomas to meet this demand.

But while Mass Timber is gaining popularity in new projects, that does not mean that it's use is limited only to that area. There is great potential for Mass Timber to be used in the repair of existing structures as well.

Let us look at barn failures. Broadly speaking there are three types of barn failures. The first can be called superficial; that is where a windstorm comes through and rips the siding or roofing off the barn. This type of damage often looks bad but is rarely structural and easy to fix. The second is construction failures. Everyone involved with buildings knows that the most dangerous time for a building is during construction because all the bracing components that would make a structurally sound package are not in place yet. If adequate bracing is not present, a gust of wind can topple the whole thing like a house of cards.

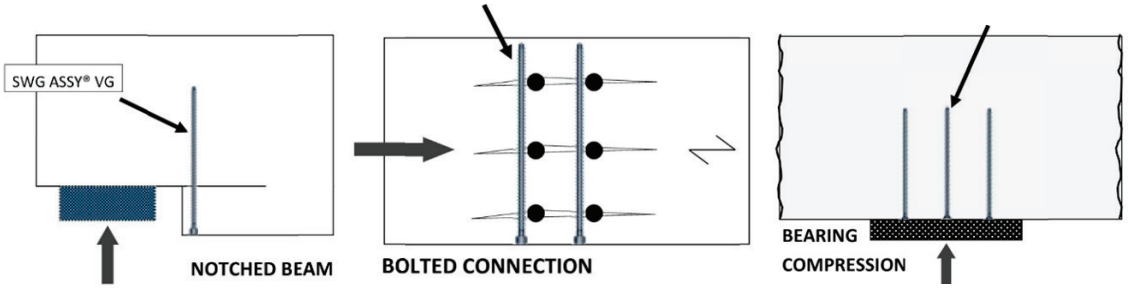
Then there is the third type, which is structural damage. This is where a beam or post or roof rafter has been damaged and needs to be repaired or replaced. If a tree hits your roof and breaks a few 2 x 6 rafters, that is an easy fix. But what do you do if someone backs a tractor into an 80 year old 12" x 12" column that is 30 feet tall? Or a windstorm finally topples that 150 year old tree on top of the 100 year old barn and breaks a bunch of the 12" x 12" true cut supporting beams? In cases like that you would need to hope that there are existing reclaimed wooden posts to use because it is going to be very hard or expensive to replace them as they were.

This is where Mass Timber can be used. The beauty of a prefabricated Glued-Laminated (Glulam) beam is that you can dimension it to whatever size you need. 12 x 12 post? That is just a bunch of 2 x 12s glued together. If you need it wider, they can go wider by laying boards side by side (such as a 2 x 8 and a 2 x 6) and offsetting them in each layer. The finished look is smooth and can be painted or coated to match the existing timber if desired. Fire resistance is also very good as there are no gaps between the wood members like in a typical built-up beam. This article is about barns but there are also many old buildings in urban settings with wooden beams inside them that would see a lot of use from glulam beams during a repair. In those cases, aesthetics would be very important.

That is on the replacement side, but what about repair? What if the existing beam has a split down the middle or at a bearing support? A beam like this could be shored up with steel and epoxy if it had a fixable crack, but some barns have high humidity levels that can damage steel over time, others have unique dovetail connections that would require custom cut steel connections, and some are heritage structures that follow a whole different set of rules.

The second advantage of Mass Timber is the custom connections that have been developed to deal with their beams. Screws are king in Mass Timber because they are easily hidden and keep the aesthetic appeal of the wood. As designs get more demanding there is a higher chance that the natural weakness of wood, splitting, will occur and as such simple self-drilling screws have been developed to mitigate these issues. These screws are structurally engineered and intended for high loads and long-term use making them ideal for reinforcement of existing beams.

To summarize; a lot of insurance work can boil down to repairing or replacing. The development of Mass Timber has made both requirements much easier when it comes to older wooden structures. Instead of replacing a true cut 12 x 12 beam with a built-up beam, steel beam, or reinforcing it with steel plates you can get a glulam member cut to the exact size from as close as St. Thomas, Ontario. Instead of using steel plates and pre-drilled lag screws to hold together a cracking beam you can send one person with a clamp, a cordless drill, and a handful of specialized mass timber screws to reinforce the beam in under 10 minutes. As old barns (and buildings) get older and the original wooden beams start to degrade the advancement of Mass Timber will become a much needed windfall to return these structures back to their original condition.



NEW STAFF

Jesse Hildebrand

Jesse graduated from McMaster University with a Civil Engineering degree, and a specialization in structural engineering. He is a registered Engineer-in-Training with the Professional Engineers of Ontario (PEO) association.

Through his two years of experience at Steenhof Building Services Group, he has obtained a wide range of practical engineering experience including the structural design and analysis of conventional wood framing, reinforced concrete, timber, steel, and masonry.

We are delighted to add yet another qualified and capable professional to our firm.

Erik Mahon

Erik Graduated in 2017 from the University of Western Ontario with a Structural Engineering degree. His application for membership with the Professional Engineers of Ontario (PEO) is under final review so his P.Eng. license is expected soon.

Upon leaving Western University he compiled a broad range of experience including Engineering Consulting, Mass Timber Structural Design, Manufacturing, and Structural Condition Inspections.

He has worked high and low, with inspections in culverts hundreds of feet below ground and on towers hundreds of feet above. He has worked in both the consulting and contracting industries for a well- rounded perspective.

Since 2017 he has been growing his knowledge and expertise in Structural Engineering theories, principles, practices, and standards and is always eager to learn.

We are fortunate to add such a bright and eager young professional to our firm.

Please visit our new website at **www.caskanette.on.ca**

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