Caskanette Udall
CONSULTING ENGINEERS

FORENSIC ENGINEERING NEWS AND VIEWS

Spring 2022

President's Box

By Rene Caskanette

A few personnel updates to share;

Alex Caskanette received his P. Eng. Designation and is now fully licensed with Professional Engineers of Ontario. Alex works from his home office in London, handling failure analysis, fire investigations, vehicle and personal injury accidents, and designated substance investigations.

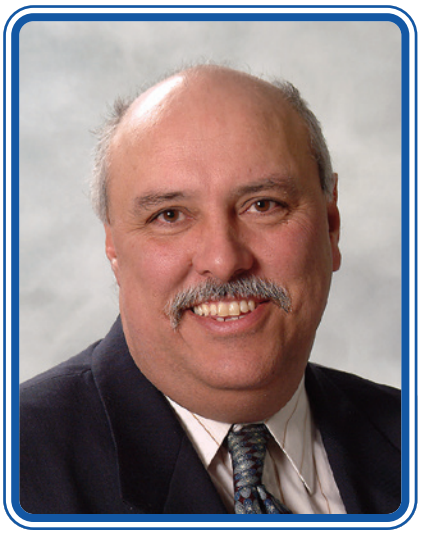
Samrand Abdi recently joined our Kitchener group. He is near completion of his architectural license and brings years of design experience in residential and commercial buildings to our firm. His expertise in building codes is helpful on many projects, especially new builds and developments.

Sadie Breg has decided not to return to work after her parental leave ends this summer, so she can stay home with her two young children. She and husband Justin plan a move to Barrie to get closer to family, and Justin will remain with the company working from their new home in Barrie. We are anticipating success in the Barrie area, with this new office putting us closer to the clients and work in the vicinity.

We are pleased to announce that Carolyn Winsborough has joined our company as an administrative assistant. She is re-entering the work force after raising her children into their school years. She will replace Barb Bezeau who joined us almost 9 years ago and has been a reliable and professional employee. We will miss Barb, but are confident that Carolyn will fill the role with the same friendly and reliable service skills. We wish Barb well with her retirement.

We continue to work from home offices in Kitchener, London, Niagara Falls (Jeff Udall), and now Barrie.

As I have entered my golden years, the plan to transition the ownership and management to the employee group is proceeding. Alex joined the shareholder group last fall, to join Jeff Udall, Micheka Kostyniuk and Bob Caskanette. My role is being reduced to management, mentoring and handling some larger files, and I will eventually turn most of that work over to the new owners and just work as a senior consultant when needed. So gratifying to see how the small company I started with my wife Kate back in 1998 has grown and flourished.



Farwell 4 Hire

Each May, for the past 9 years, Mike Farwell has raised funds within Waterloo Region for Cystic Fibrosis Research. His campaign – Farwell4Hire –finds him doing odd jobs for a donation. This year he helped us clean out our evidence storage unit and haul off some large items that were no longer required, to the landfill. Bob Caskanette presented him with a cheque for $1,000 to get him closer to his goal of raising $1 million total, over the past 9 years. https://farwell4hire.com/

Emergency Roadside and Residential/Agricultural Spill Remediation

By Bob Caskanette

It is estimated that more than 40% of all fuel oil spills reported annually in Ontario are from domestic fuel oil tanks at private homes. Fuel oil spills have a major impact to the surrounding environment. Contamination of soil, groundwater and surface water poses a major problem for surrounding ecosystems and habitats. Migration of fuel oil contamination through groundwater can lead to problems downstream such as groundwater well contamination, aquifer and drinking water contamination, and potential habitat destruction depending on the severity and volume of the spill. One cup of fuel oil can contaminate enough water to fill an Olympic-size swimming pool, and in many cases hundreds of litres of fuel oil can seep into the ground before a spill is even discovered. Fuel oil that has spilled into a residential basement can also pose a serious health hazard, threatening indoor air quality. Anyone who owns a fuel oil tank has a legal responsibility to properly maintain it and to clean up any spills or leaks that may occur.

Releases of contaminants can also occur at roadsides or other areas away from structures following vehicle or agricultural equipment accidents, fires or even train derailments. Safeguarding the health and safety of persons and the environment are imperative. Identifying the contaminants involved is also important, whether it is petroleum hydrocarbons (PHC's), volatile organic compounds (VOC's), SVOC's, metal/inorganics, manure/liquid waste, fertilizer, pesticides, or anything else that is potentially released. These types of spills can occur at any time of day or night and it is important to respond quickly, setup containment and establish an approach as quickly as possible to mitigate unnecessary costs and project scope due to the spread of the contaminant plume and identify pathways and conduits the plume may travel. Roadside spills can often involve culverts, drainage ditches and other pathways which can affect nearby wetlands or environmentally sensitive areas. We are able to respond quickly when emergency calls come in and have an extensive list of capable environmental remediation contractors we often work with who are ready to go on short notice when emergencies occur.

Persons are responsible under the Environmental Protection Act (EPA) for reporting any release or spill that could cause property damage or health, safety or environmental adverse effects to persons or the environment. The Environmental Protection Act states in Part II, Prohibition 6. (1), "No person shall discharge into the natural environment any contaminant, and no person responsible for a source of contaminant shall permit the discharge into the natural environment of any contaminant from the source of contaminant, in any amount, concentration or level in excess of that prescribed by the regulations."

When there is a discharge of a contaminant into the natural environment such as soil, groundwater or surface water, the person(s) responsible must report it to the Ministry of the Environment, Conservation and Parks (MOECP) and/or Technical Standards and Safety Authority (TSSA), via the Spills Action Center (SAC). The MOECP administers the Environmental Protection Act (EPA) and the Ontario Water Resources Act (OWRA). They respond to spills affecting more than one property owner, or spills on public lands or into drainage systems. The TSSA administer the Technical Standards and Safety Act (2000), Ontario Regulation 213/01 Fuel Oil, CSA B139-00 Installation Code for Oil Burning Equipment, and GA1/99 October 2001 Environmental Management Protocol for Operating Fuel Handling Facilities in Ontario. Section 16 was adopted for addition to the B139-00 Code. Other stakeholders or regulatory authorities may also become involved such as various Conservation Authorities, just as one example.

Brownfield legislation categorizes 4 classes of Petroleum Hydrocarbons (PHCs) pertinent to PHC's including fuel oil including: F1 (C6-C10), F2 (>C10-C16), F3 (>C16-C34), F4 (>C34), where C is the amount of Carbon atoms present in the molecular chain. Brownfield protocol uses 3 methods for cleanup criteria, generic, background and site specific, and criteria can differ depending on whether or not potable groundwater is affected. Generic involves conforming to prescribed standard criteria via reference tables for detection limits (ug/g, ug/L), and can either be classified as full depth cleanups or stratified cleanups (only 1.5 metres from surface is cleaned, more common for sites where groundwater quality is not impacted or changed from resulting contamination). Background as you might guess, simply involves getting hydrocarbon levels as close to previous background levels as possible (table parameters listed per contaminant), while site specific is more specialized and geared towards risk assessment. Other criteria are present for other contaminants such as VOC's, SVOC's, metals/inorganics, fertilizers, various pesticides, manure impacts, etc. Often times, identifying the specific compounds/contaminants present in each agricultural product released (such as a pesticide/fertilizer) will vary greatly from product to product and an experienced consulting professional is needed to navigate this task properly to ensure the project is handled in a safe and appropriate manner.

Both TSSA and MOECP officers can respond to spills and have the power to order property owners to perform delineation studies, prepare reports and cleanup the product by issuance of a delineation and/or cleanup order. If the spill remains on the property the TSSA normally takes control and orders delineation/cleanup and oversees the project. If the spill affects groundwater, migrates off-site or occurs away from building infrastructure (i.e. roadside spills) the MOECP typically takes authority and oversees the project. In either case, qualified persons (QPs) such as professional engineers, hydrogeologists and other environmental experts will be ordered to verify the cleanup is done in compliance with the prescribed standards.

The stringent environmental regulations present in Ontario helps reduce the damage to the natural environment caused annually by spills and releases. Having the right consultants and contractors in place will go a long way to help reduce the amount of contamination escaping into soil, groundwater and surface water throughout sites in Ontario, as well as minimize environmental impacts, project costs/scope and future liability. We are here when you need us most.

A Future with Plastic Parts

By Alex Caskanette

A polymer is a compound consisting of long-chain molecules with each molecule made up of repeating units connected together. Polymers can be separated into plastics and rubbers. The accelerating transition from traditional metal and ceramic parts to plastic parts has been on the rise.

The first synthetic plastic was developed in the early 1900s by the Belgian born American chemist L.H. Baekeland. This plastic involved the reaction and polymerization of phenol and formaldehyde to form what is called bakelite. It was not until the 1920s and 30s that polyvinylchloride (1912), polystyrene (1927), and polyethylene (1932) were developed. These are the plastics that many of us are the most familiar with.

Fast forward almost a century and plastics are everywhere. Currently the annual usage of polymers exceeds that of metal. Some of the main reasons for the rise of plastic includes:

- Plastic can be formed into intricate part geometries with no further processing required.
- Plastic is low density relative to metal and ceramics.
- Plastic has good strength-to-weight ratios (certain polymers).
- Plastic is highly resistant to corrosion.
- Plastic has low electrical and thermal conductivity.
- Plastic requires less energy to produce than metals and is cost competitive.
- Certain plastics are transparent.

Although plastic parts have all of these great benefits, they also suffer from a number of distinct drawbacks when compared to metals and ceramics. Some of these drawbacks include: plastic has relatively low strength, plastic has a low service temperature, some plastics degrade when exposed to sunlight, and plastic exhibits viscoelastic properties. These drawbacks have manifested in significantly shorter service life for plastic parts and have resulted in significant losses in both residential and commercial settings. With the production of plastic parts on the continual rise and the introduction of 3D printing, plastic failures are our imminent future. Some common failure modes of plastic include:

Plastic Creep –One of the most common failure modes of plastic is creep. One way to conceptualize creep is to think of solid plastic on a molecular level as long strands of spaghetti all tangled together. When a load below the yield strength is applied to plastic for a prolonged period of time, the spaghetti strands have a tendency to untangle. This can result in either excessive deformation of the part or cracking of the part in the area where disentanglement occurred. Proper part design and proper installation are necessary to mitigate creep failures.

Contamination – Occasionally contaminants enter the plastic formulation and can have a negative impact on the properties of the part. This is a manufacturing deficiency. Fourier Transform Infrared Spectroscopy (FTIR) can be used to determine if a contaminant is in the plastic formulation.

Degradation – Plastic parts can be susceptible to degradation when exposed to sunlight or radiation, they can degrade due to oxidation or hydrolysis, and ultimately will degrade over time. This is one of the many reasons why plastic parts typically have a shorter service life than traditional metal or ceramic parts.

Chemical Incompatibility – Some plastics are susceptible to degradation from exposure to various chemicals such as certain cleaning chemicals that can be found around your home. These chemicals react with plastics and damage it's molecular structure. One reason this can happen is due to human error.

Part Design – Poor part design can result in plastic parts being manufactured with molded-in stress or expected regions of stress concentration. This is commonly observed in plastic parts with sharp transition geometries and is a design deficiency. One example of this can be observed in Figure 1 which shows a plastic water filter manifold that has failed at an abrupt transition.

With plastic part failures expected to dramatically increase, let us help you determine if subrogation is a potential avenue of recovery for the plastic part failures that you will encounter. Our staff at Caskanette Udall Consulting Engineers specialize in all types of material failures.

Figure 1– A plastic water filter manifold that has failed at an abrubt transition in the part geometry.

Basement Foundation Wall Collapses

By Jason Richards

As we have entered Spring it seems appropriate to discuss basement foundation wall collapses. While these types of claims can occur throughout the year, we are most often retained to investigate these claims in early Spring.

With basement foundation walls it is first important to understand that these walls function as both a bearing support wall for the building superstructure above as well as an earth retaining wall separating the soil on the outside of the wall from the living/interior space on the inside of the wall. These two functions result in vastly different loading being applied to the foundation wall. The superstructure above applies gravity loads at the top of the wall while lateral soil pressure, soil vibration, and hydrostatic pressure from groundwater apply forces to the exterior below grade portion of the wall.

When a basement foundation wall collapses, we are often asked to investigate and report on the cause of the collapse, in addition to emergency handling support and repair design. Sometimes the cause of the collapse may be obvious, such as a vehicle impact event or improper original design or construction. Other times the cause of the collapse is less obvious, and a careful investigation is required. Often, multiple less obvious causes work in combination to cause the ultimate failure and collapse. Some examples of these causes are outlined below.

Lack of Lateral Support

In common residential foundation design, lateral support is provided for the basement foundation wall at the bottom, typically by a concrete slab, and at the top, typically by the main floor structural framing. Both elements are required to ensure the intended loading/support relationship. During construction or renovation, a floor framing or the basement slab may be temporarily removed or modified, compromising the lateral support for the wall. This can lead to a catastrophic collapse of the wall. Temporary bracing should be provided to support the foundation at these vulnerable times.

Through age-related deterioration or rot after improper treatment of water damage for example, floor framing can weaken, compromising the lateral support for the wall. When this happens, the wall may start to shift at the top as an early warning sign before ultimately collapsing.

Poured concrete with steel reinforcement is much stronger than concrete without steel, while concrete block is even weaker. Block walls are often seen to crack at mid height and start to move inwards, since there is no lateral support at that height on the foundation.

Surcharge Loading

Foundation walls built as per the requirements of the Ontario Building code are designed to resist lateral soil pressure, soil vibration, and hydrostatic pressure. When unforeseen loads are applied to a basement foundation wall, the wall can be weakened, crack, and/or collapse. One of the most common unforeseen loads would be surcharge loading caused by heavy equipment or vehicles operating immediately adjacent to the foundation wall. This is especially common during construction and renovation work. When heavy equipment or vehicles operate next to a basement foundation wall, the adjacent soil is compacted, amplifying the lateral soil pressure on the wall. As a rule of thumb, it is best to keep heavy equipment and vehicles away from foundation equal distance to the depth of the foundation below grade.

Hydrostatic Pressure

Hydrostatic pressure is water in the soil applying a lateral force to the exterior face of the foundation wall. Hydrostatic pressures peak during periods of heavy rain or snow melt in the spring, which is why we see the most claims for basement foundation wall collapses during that time. If a foundation wall is built as per the requirements of the Ontario Building Code, it should be adequate to withstand typical hydrostatic pressures.

When hydrostatic pressure is found to be the ultimate cause of a basement foundation wall collapse, other factors are usually in play as well, such as lack of lateral support, age-related deterioration or pre-existing damage. In these cases, hydrostatic pressure is sufficient to cause a collapse of an already structurally compromised wall.

Often in older homes, below slab sump pumps are installed to keep groundwater below foundation level, thus preventing or limiting hydrostatic forces on older foundation walls more susceptible to water penetration and/or a hydrostatic pressure failure. Sump pump failures allow an increase in the exterior pressure on the wall and can lead to leaks and collapses. Blocked foundation drains (weeping tile) can have the same impact.

These are just three possible causes of a foundation wall collapse, and they often combine to cause the ultimate collapse. Early warning signs such as foundation shifting, bowing, cracks, or water penetration should prompt an inspection of the foundation to hopefully prevent such a collapse from occurring.

The staff at Caskanette Udall Consulting Engineers specialize in foundation assessments and remedial measures to prevent foundation collapses. When collapses do occur we provide fast emergency support for shoring design, a structural scope of repair and drawings for building permits to repair the damage.

Introduction of Architectural Services

Caskanette Udall is pleased to have Samrand Abdi join our team. Samrand Abdi graduated in 1997 from Iran University of Science and Technology (IUST) in Tehran with a master's degree in architectural engineering.

He obtained his license to practice architecture in Tehran, Iran in 2000. His professional experience includes large scale industrial developments such as locomotive manufacturing (MAPNA-Siemens), automobile manufacturing (IKCO-Peugeot) as well as numerous commercial and multi-unit residential projects in Iran.

In addition to his expertise in forensic work, and his knowledge of fire separations and occupancy regulations, Samrand brings a new set of skills in providing architectural services to our clients. We have recently begun delivering design services for custom residential and commercial renovations, including additions as well as new build projects.

We also offer architectural services for subdivision planning and commercial plazas. This includes Site Plan Amendment, Minor Variance and Building Permit Application, in addition to construction management.

An important part of our services is building code and planning consultation, which includes building code and supplementary standards review as well as zoning bylaw review. We liaise with city officials, conservation authorities, and other authorities on behalf of our clients, providing timely communication and support.

Please don't hesitate to contact us with your next architectural project, be it a custom residential renovation, a multi-unit residential building, or a commercial development. We are always happy to discuss your needs and vision.

Proposed Planning Act changes

By Samrand Abdi▲ and Justin Breg▼

We are going to see some changes in the Ontario Planning Act by the end of the year. Bill 109, the **More Homes for Everyone Act**, 2022 was introduced on March 30, 2022 and received Royal Assent on April 14, 2022. Schedule 5 of Bill 109 made changes to the Planning Act related to zoning, site plan, plans of subdivision, official plans and official plan amendments among other changes that will impact the planning process for new developments.

The proposed amendments, among other matters, would extend site plan application review from 30 to 60 days. It also requires the establishment of a regulation-making authority to prescribe complete application requirements for site plan applications.

Typically, site plan approval is a time-consuming process, requiring numerous iterations and involving many municipal departments in decision-making on a given application. In recent years, I have worked on some applications that lasted several months. Applications take time due to constraints of the site conditions, and the need to maximize the sellable portion of a project. There is a significant pressure on the consultant to come up with solutions that address both developers' and authorities' concerns.

With the proposed extension of the review time, we can expect that a decision would more likely be made on applications within the legislated timeline. On the other hand, planning authorities can make more thorough reviews within the new timeline; hence more comments and revisions may come the consultants' way.

It is important for developers to receive proper consultation even before procurement of a property, to help ensure that their application will be processed in a timely manner and to avoid undue pressure to their resources. It is equally important for the consultants to properly study their proposals and understand the possible challenges of the kind before preparing their quotes.

Currently, each municipality has an exclusive set of requirements for site plan approvals. The majority of items are similar, but there are some differences. For example, while the City of Waterloo has a well-specified set of requirements for shadow impact acceptance, my experience with the Township of Grimsby revealed that such criteria were not well-established there, despite there being a requirement from the municipality for providing the analysis. An authority that prescribes requirements in a uniform manner for all municipalities will save consultants' time, as they won't need to review and modify requirements for applications to different legislatures. This measure can also help developers to have clearer understanding about the process and be better prepared for it.

It is anticipated that proposed changes to the Planning Act will impact the present housing crisis, and development in general positively, and will consequently introduce new opportunities for developers and consultants. To be prepared for the changing dynamics of the market in the near future, please do not hesitate to contact us for advice early on in your project. We are happy to assist in light of the legislations that are soon coming into effect.

More information about the approved changes to the act can be found in the Ontario's Regulatory Registry webpage.

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