BUILDING SCIENCE perspective

FALL 2021

THE BIG CHILL

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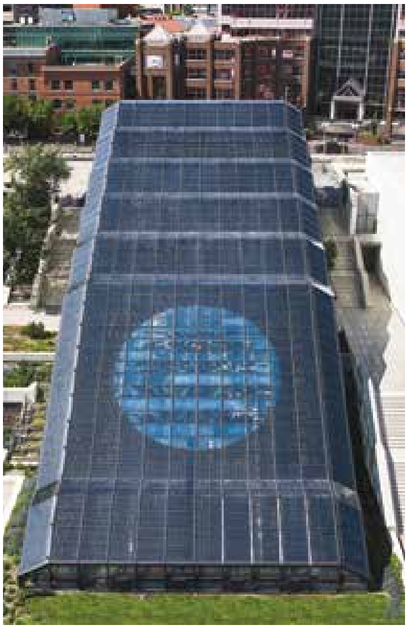

DEL Communications Inc. www.delcommunications.com

PRESIDENT / PUBLISHER
David Langstaff

MANAGING EDITORS
Cindy Chan cindy@delcommunications.com
Shayna Wiwierski shayna@delcommunications.com

SALES MANAGER
Dayna Oulion dayna@delcommunications.com

SALES REPRESENTATIVES
Brent Astrope | Corey Frazer | Colin James
Ross James | Mic Paterson

PRODUCTION SERVICES
S.G. Bennett Marketing Services

CREATIVE DIRECTOR / DESIGN
Kathleen Cable

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PUBLICATION COMMITTEE
Bob Passmore | Brian Shedden | Ed Bushnell
Fred Edwards | Kevin McCunn

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DEL Communications Inc.
Suite 300, 6 Roslyn Road, Winnipeg, Manitoba R3L 0G5
Email: david@delcommunications.com

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Amir Hassan
President, ABEC (North)

Message from the ABEC North President

I want to start by wishing our readers physical health and mental wellness during the difficult time of COVID-19 pandemic. Propelled with the positive feedback of the first issue, we enthusiastically present you the second issue of your magazine. This rich publication was made possible by the hard work and commitment of our passionate and knowledgeable technical committee from ABEC North and ABEC South.

If you have not heard, there is an ongoing discussion between Alberta Association of Architects (AAA) and Association of Professional Engineers and Geoscientists of Alberta (APEGA) over who can stamp building envelope work: architects or engineers? ABECN has members from both professions with doors open to all individuals with knowledge and experience in the field of building science regardless of their occupations. I personally believe that all new buildings should be led by architects, with the exception of some specialized buildings that require more engineering than architectural involvements, such as standalone parking garages where structural engineers can be the prime consultant with assistant from architects. As for repair and renovation of existing buildings, the professionals – whether architects or engineers – should be the judges of their abilities to design and monitor construction within their specific scopes of work. Needless to mention that architects should be engaged in all restoration projects involving any changes in the building aesthetics.

Should only an architect be required for all building envelope projects, investigation and studies? In my opinion, we practically need someone accredited by AAA or APEGA and who has related experience and high level of confidence to perform the work. Likewise, a landscape architect with experience in waterproofing or a chemical engineer with knowledge in glazing can be building envelope consultants and manage the entire repair work process. Similar discussion happened a few years ago between Architectural Institute of British Columbia (AIBC) and Engineers and Geoscientists British Columbia (EGBC), and they reached an agreement, followed by a publication titled *Professional Practice Guidelines for Building Enclosure*; a copy of the latest publication can be found on www.egbc.ca. We hope that all building science specialists would work together within their abilities and defined roles to maintain this growing field and have a prosperous economy.

ABECN is a non-profit society dedicated to encouraging the pursuit of excellence in the design, construction and performance of building enclosures and to advancing educational and technical standards within the building envelope industry. This council welcomes anyone interested in the evolving field of building envelope. To know more about us, visit our website at www.ABECNorth.org and follow us on ABECN LinkedIn page. Happy reading!

Amir Hassan, M.Sc., P.E., P.Eng.
President, Alberta Building Envelope Council (North)

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Fred Edwards
President, ABEC (South)

Message from the ABEC South President

Welcome readers to the second (Fall 2021) edition of the *Building Science Perspectives* magazine. Although the COVID-19 pandemic has had a negative impact on ABEC South's normal operations, your executive committee has continued to meet regularly and keep the ball rolling, so to speak. We intended to hold our luncheons through 2021, but the third and now fourth waves of this pandemic have caused many of the luncheon seminars to be postponed. Similarly, our golf tournament was postponed for the second year in a row. Optimism is abundant and we fully expect to resume luncheon presentations for the remainder of 2021 and through 2022 operating under the Government of Alberta's new Restrictions Exemption Program (REP). Stay tuned; the details will follow in the upcoming newsletters.

The ABEC South AGM was hosted in person at the Winston Club in Calgary on September 22, 2021. Attendance was a modest 22 members. The 2021-2022 board of directors was approved by the members in attendance and except for one resignation remains unchanged from previous years. ABEC South remains in a strong financial position and the executive is actively pursuing additional educational opportunities for our members.

One such opportunity is a potential partnership between RRC Polytechnic in Manitoba and the Southern Alberta Institute of Technology (SAIT). As some of our readers will know, RRC Polytechnic offers a whole building air leakage testing course at their Winnipeg campus. They have offered to bring their course equipment and expertise to Calgary and put on a series of courses for interested members. ABEC South is looking to provide seed funding for this opportunity and will also look into subsidizing a portion of the course tuition for members. Planning of this has been hampered by COVID-19 and we will keep members apprised of further details in upcoming newsletters.

Back in January 2021, the ABEC South executive was made aware of a situation in Edmonton which centres on the practice overlap between architects and engineers in building science. ABEC South responded and I am pleased to report that APEGA and the AAA are working together to arrive at an amicable resolution. We will keep our members apprised of developments on this front when details become available. You can refer to the ABEC North president's message for more details.

In the summer of 2021, one of the ABEC South's directors accepted an out-of-province work opportunity and thus resigned. Sathya Ramachandran was a member of the ABEC South executive from 2014 and notably the chief editor of this magazine. We thank Sathya for his contributions in bringing this publication into existence and wish him the best in his new role.

Thanks for reading and we welcome any feedback you have on the content of this magazine or suggested topics for inclusion at lunch seminars.

Fred Edwards, P. Eng.
President, Alberta Building Envelope Council (South)

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THE NEW CCDC 2

By Mary Ghobrial

In December 2020, the Canadian Construction Documents Committee (CCDC) published several exciting new documents, including the newest version of our flagship document, the CCDC 2 'Stipulated Price Contract', as well as the Master Specification for Division 01 'General Requirements, amongst other documents. This new CCDC 2 has brought some very important changes to the Canadian construction industry.

The CCDC 2 standard contract has seen significant modifications to many key sections, including updated insurance clauses, new language to account for provincial payment legislations, provisions addressing early takeover by the owner, and, most importantly, the new 'Ready-for-Takeover' project milestone which sets a new standard for construction projects here in Canada. This milestone is the new trigger for warranties and the handover of care, custody and control of the work. This recognizes that substantial performance does not always mean the project is ready for the owner's use, while still allowing the contractor to receive their holdback in a timely fashion, as that will still be tied to substantial performance as defined in the relevant legislations.

Additionally, a select few clauses from the previous version of the CCDC 2 were relocated to the new Division 01, to ensure organizational clarity and cohesion. Since their release last year, the industry has adopted these new documents, particularly the new CCDC 2 with the Ready-for-Takeover milestone. ■

PHOTO COURTESY OF EXPLORE EDMONTON

THE BIG CHILL

By Brian Shedden, BSS®, Entuitive

As I sit down to write this article, it is a lovely late summer day here in Edmonton. 12°C feels a little cool now but when it hits -40°C this coming winter, as it always does, 12° C will just be a fond memory.

When I first moved to Calgary years ago, very few people had air-conditioning in their homes. A typical summer would see temperatures in the mid-20s and two to three days of plus-30 that you just suffered through. No big deal, you knew it would pass. But with each passing year the climate has continued to change such that this past summer saw Alberta with three weeks of plus-30 and even a few days that hit 40°C, making this the hottest summer on record. Air-conditioners were sold out across the province leaving many poor folks to suffer through extended periods of heat so intense that it became dangerous.

So why, in an article titled *The Big Chill*, am I talking about summer? Well, here it is: When I first got into this business, the bible of the industry was "Building Science for a Cold Climate" by N. B. Hutcheon, Gustav O. P. Handegord, published in 1983. Still a critical resource today, this book was the first to scientifically delve into how to construct building envelopes to separate the 20°C humid interior from the dry -20°C exterior that was a common feature of the Canadian environment at that time. We figured out the vapour drive and we designed for it. Life was wonderful.

But in the intervening 40 years, things have changed. It has become much warmer in the summer and I believe much colder in the winter, for longer periods of time, in some ways turning the science on its head. How do we design for what is now an 80°C delta? Do we need to? What might change?

I ask these questions now, while it is still fresh in our minds from the sweltering summer. While we are huddled inside this winter, waiting out the inevitable minus-40 days that will come we need to turn our attention to this 80° delta by first acknowledging that it exists here in Alberta where it may not exist anywhere else on the planet. Ours is a science experiment that must be undertaken all with a view to sustainability and effectiveness. Our buildings and our homes can only be as effective in separating the environment as we make them and they are under stress.

So, while we get ready for the Big Chill, give this some thought when you are sliding into your parka. It's a great coat for the winter, but not much use in the summer! ■


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YEG HARNESSES THE SUN

By Brad Watson, Program Manager, Facility Infrastructure Delivery, Integrated Infrastructure Services | Infrastructure Delivery Branch, City of Edmonton

The Edmonton Convention Centre is an iconic building in Edmonton's River Valley skyline. Its key visual feature is a south-facing glass atrium, an ideal palette for Canada's largest building-integrated solar photovoltaic (PV) glazing system.

The rehabilitation project began as a like-for-like replacement of the existing original insulated glazing units (IGU) with design options that incorporated solar electricity generation. Since the City of Edmonton and Explore Edmonton have an aligned commitment to sustainability and a goal of working toward becoming an energy sustainable and climate resilient partner and city, this project provided a great opportunity to contribute towards that goal.

With an average of 2,300 hours of bright sunshine each year, and as one of the sunniest cities in Canada, solar is the most viable form of renewable energy for widespread application in Edmonton. Combined with cooler temperatures, this creates ideal conditions for high levels of electricity generation. Our system is expected to generate about 200,000 kWh/year, making it the sixth largest solar PV system in Edmonton. As a comparison, the average household consumes about 7,200 kWh/year and the Convention Centre consumes some 7,000,000 kWh/year. As the Convention Centre consumes a significant amount of energy, this generation plant will only contribute to about three per cent of the building's electrical energy consumption and offers us an expected payback of about 22 years. The lifespan of the PV-IGUs, as with most traditional glazing units, is 25 years. It is worthy to note that the glazing units that were replaced were original to the 1983 building, making them 37 years old at time of replacement, so although efficacy drops over time, we may be able to keep them on longer than 25 years.

The system has only been in operation since July 2021, so our performance data is limited to the whole of August. Edmonton has also been constrained by excess smoke this year, which is not typically part of design calculations. For August, we can report 17,951 kWh of an August design average of about

20,800 kWh – about 14 per cent less generation, which is not of concern. As we're only using Class C monitoring, we can't answer why it was slightly lower other than making assumptions; we're simply able to just read the meters.

The PV scope of work was funded through the City's sustainability fund, a funding profile with the purpose of reducing greenhouse gases, utilizing low carbon energy and increasing energy efficiencies as part of our Connect(Ed)monton Climate Resilience goal for 2050. Solar PV technology has advanced so much in recent years that it made the timing just right to incorporate this array into the rehabilitation of the Convention Centre.

Aesthetically, the atrium maintains its clean look from afar with the exception of the Morse Code poem in the oculus (circular pattern in the middle) and actually lets in one to two per cent more light than the previous tinted glazing units. From the inside, patrons will see the solar PV cells within the glass and a patterned reflection on the floor. We're currently working toward enhancing the Centre's user experience by providing real-time generation data on its website and on the monitors in the atrium.

Next time you're in Edmonton's River Valley, be sure to stop by and check out the Edmonton Convention Centre's subtle new look! ■

"GLASS SHARDS KEEP FALLING ON MY HEAD..."

By Heather Elliot, P.Eng., LEED® Green Associate, Building Envelope Specialist, Entuitive

Impact damage (note: clear film applied post breakage), typical breakage pattern.

Thermal stress cracking, meandering cracking pattern.

When it happens, it often hits the news quickly. Sometimes the media will take pains to keep the exact location vague, and other times the articles blatantly state the address of the high-rise building where glass has just fallen into the street. In the most severe and heartbreaking of incidents, bystanders may have been hurt. Nearby sidewalks and streets may be closed immediately, and the building owner may be left scrambling to answer the question: what happened? Often, glass façade or building science specialists are called upon to help answer this question.

Glass falling out of, or breaking after being installed in, a high-rise building raises several, often panicked, questions at once: What type of glass product is it, in what orientation and with what layers included? Did the glass shatter into hundreds of pieces and fall out-of-frame, or crack and remain in place in-frame? Was the glass of a high quality of manufacture, and installed correctly? Did weather conditions or high winds play a role? Did something hit the building? Was the breakage a one-time event on one elevation, or has there been a repeating pattern of many similar breaks? And very importantly, is the breakage related to an underlying systemic issue that will continue to be a concern, with an increased risk of more breakage occurring in future?

The first question to be asked can be simplified to a forensic focus: Why did this specific piece of glass break?

Type of Glass

To begin, confirming the glass types used in the original assembly is important. If the breakage involved an insulating glass unit (IGU), we want to know whether the unit is double-glazed or triple-glazed, and which "lights" or layers broke. Next, identify the glass type used for each layer, from shop drawings or on-site visual review, knowing the typical breakage characteristics of each. Glass is a relatively stiff material with limited strength. Unlike more ductile materials, glass fails in a sudden, brittle manner. While we can apply various treatments to glass to increase its strength, if an external force applied to a piece of glass exceeds that strength, it will break – it's that simple! But depending on the types of treatment applied during original manufacture, the method in which the glass breaks will differ.

Annealed glass (also known as float glass) involves a specific cooling process during manufacture. Heat strengthened glass takes annealed glass one step further and further improves its strength by

Edge damage, cracking emanating from edge.

heating the glass and cooling it. Heat strengthened glass is approximately twice as strong as annealed glass. When broken, both annealed and heat strengthened glass break into large sharp-edged pieces.

Tempered glass (also known as toughened glass) is similar to heat strengthened glass, but with higher temperatures and accelerated cooling used to strengthen the base material annealed glass. Tempered glass is typically four to five times stronger than annealed glass, and more resistant to blunt impacts straight-on. Its weakness comes along its edges, where if a blunt force is applied breakage can more easily occur. When broken, tempered glass breaks into many small pieces. As these small pieces are less likely to inflict serious damage or injury, tempered glass is often used in applications where safety glass is desired.

Laminated glass is also a type of safety glass, but is in fact made up of multiple layers of glass, possibly a combination of annealed, heat-strengthened or tempered layers. A PVB (polyvinyl butyral) interlayer holds these layers of glass together. When broken, even if some layers within the laminated glass

Tempered glass inclusion, typical "cat's eye" or "butterfly" breakage pattern at origin.

are tempered glass, the glass is meant to stay intact with the interlayer bonded between the multiple plies of glass. A common use for laminated glass is in skylight glazing, where it is ideal for the glass to stay in-frame should it be subjected to an impact from above.

Breakage Origin

Once the type of glass unit involved is known, a glass breakage investigation should next attempt to identify the origin of the breakage by visually inspecting the broken glass. This is often possible if the broken glass was retained in-frame or can otherwise be reassembled into its original layout. Note that tempered glass which has completely shattered or glass that has fallen a large distance may not be able to utilize this method, as the pieces are often too small to perform reassembly. Other factors can also be highlighted during this visual inspection, such as scratches, rubs, or chips/shells that may indicate contact by a projectile or similar external forces.

Finding the breakage origin is like following a roadmap backwards, with cracking often leading back to the point where breakage has propagated from. If the origin is easily identified, the type of patterns visible help explain the story of why breakage has occurred.

Breakage Pattern

The most common causes for breakage are incidents due to impact, stress cracking, edge damages and spontaneous breakage due to defects in the glass itself. Each provides its own roadmap of typical breakage patterns to look out for.

1. IMPACT DAMAGE

Impact damage can occur when any object comes into contact with glass, from birds to BB gun pellets. The breakage pattern will vary depending on the speed and mass of the body, and the angle at which it hit the glass. A fast moving smaller hard body object may leave a puncture through the glass with a small circular impact zone and cracks emanating outward from point of impact. A slower moving larger soft body object may have a larger circular impact zone and more cracks emanating concentrically outward from point of impact with breakage pattern more indicative of a spiderweb.

2. STRESS CRACKING

Stress cracking is more likely to occur in annealed or heat strengthened glass and can be related to the application of excessive mechanical or thermal forces to a piece of glass.

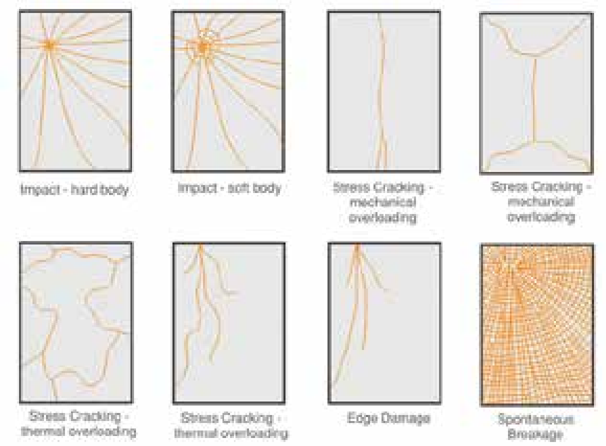
Mechanical forces include loads such as wind – there is an associated amount of bending and deflection that each particular piece of glass is designed to take depending on the loads expected for its application and location. If mechanical forces being applied outweigh the tensile and compressive strength of the glass, the glass will break. Breakage patterns indicative of stress cracking usually give a clue to how loads were applied, with cracking leading from corner to corner or top to bottom being indicative of failure under mechanical loading. In these cases, the glass may have been underspecified or of poor quality not meeting required performance characteristics.

Glass will also break to relieve the stress induced by excessive thermal changes, most commonly a large temperature difference between the edge and center of glass. The pattern of breakage often includes multiple meandering cracks over the glass surface. Where thermal stress cracking is suspected, it is important to note the distribution of any similar glass breakage on a building and any patterns that may invoke greater temperature swings in those areas. For example, do breakage locations coincide with the use of interior blinds that are only partly opened, or does an element shade only a portion of the glass in these areas?

3. EDGE DAMAGES

Glass is generally most vulnerable at its edges, with imperfections from manufacture, cutting and handling adding to a risk of failure in that area. Shells, digs, scratches or chips can form along weakened areas at the edge of glass or the surfaces near the edge. Stress cracking under the application of normally expected forces can occur at these damaged areas, with cracking patterns that generally emanate from the edge of the glass.

To tell the difference between stress cracking brought on by excessive mechanical or thermal forces and glass breakage due to edge damage, a breakage investigation should aim to review the edge of the glass unit for any damages, if enough of the glass remains in place to do so. The glass can be stabilized during removal from the frame with a self-adhesive film or scrim to keep glass pieces in place during removal, to allow for review of the edge condition.



Above: Breakage pattern of annealed or heat strengthened glass versus tempered glass.

Right: Summary of typical breakage patterns.

4. SPONTANEOUS BREAKAGE

Inclusions are tiny impurities in glass not visible to the naked eye. The most well-known are those comprised of nickel sulfide; however, ferrous, silica and gaseous inclusions also exist. Inclusions behave the same way that glass and other materials do, expanding and contracting as temperatures change. The issue becomes that, based on the size, location, and composition of the inclusion, spontaneous breakage can occur as the inclusion expands and contracts at a different rate than the glass material surrounding it. This type of breakage most often occurs in tempered glass, where once a pinpoint of weakness exists, the entire piece of glass breaks into small pieces. When broken tempered glass does not fall out of frame or stays in place as a layer in a piece of laminated glass, we can look for an important clue at the breakage origin: a pair of adjacent hexagons, also known as a “cat’s eye” or “butterfly” pattern, that typically borders an inclusion.

Unfortunately, spontaneous breakage cannot be easily forecast or tested for once units are in-place. There is no known technology that completely eliminates the possible formation of inclusions during the manufacture of glass. As such, inclusions within glass units are expected to occur in a small percentage of all glass supplied in industry. Heat soaking of glass can be undertaken during manufacture to eliminate flawed panels from being used but is not always specified for buildings due to its extra cost. During a breakage investigation, if original manufacturing information is available, confirming whether heat soaking was undertaken will provide some background on measures taken to minimize the chance of spontaneous breakage.

Although glass manufacturers continue to develop technologies to make their products resilient to breakage, perfection is not possible with an inherently brittle material. With flaws in the manufacturing process difficult to control, such as inclusions, and the range of environments in which glass must ultimately perform, breakage will always be an issue facing glass units in buildings. Sometimes, glass breakage is a true “one-off” due to a localized defect or impact, but it is important to highlight any signs that the building itself is experiencing larger scale issues such as excessive movement or potential under-design of the glass itself. Conducting thorough investigations of individual glass breakage incidents is one way that building science professionals can assist Owners and help to use that information to prevent future failures and breakage. ■

ARE YOU READY FOR A WHOLE NEW WORLD IN CONSTRUCTION LAW ?

By Brian Shedden, BSS®, Entuitive

As Alberta prepares to embark on the most substantive change to the Builder's Lien Act in a generation, the government of Alberta has been able to draw upon the relatively recent experience and practices of Ontario's Construction Act to develop its own law and regulations with respect to both the prompt payment of proper invoices in the construction industry and the timely and effective resolution of disputes arising from non-payment.

Adjudication will, for the first time in the history of Alberta, be available as a rapid, low-cost alternative to the traditional litigation route of dispute resolution, which has always favoured those with the deeper pockets, essentially mitigating the role of Natural Justice in dispute settlement.

Differences between the two Acts:

On the surface, the two Provincial Acts are substantially similar, as one would expect, but the primary differences appear to lay in the scope of those issues available for Adjudication.

In Ontario, Section 13.5 of the Act states:

AVAILABILITY OF ADJUDICATION

CONTRACT

13.5 (1) Subject to subsection (3), a party to a contract may refer to adjudication a dispute with the other party to the contract respecting any of the following matters:

1. The valuation of services or materials provided under the contract.
2. Payment under the contract, including in respect of a change order, whether approved or not, or a proposed change order.
3. Disputes that are the subject of a notice of non-payment under Part I.1.
4. Amounts retained under section 12 (set-off by trustee) or under subsection 17 (3) (lien set-off).
5. Payment of a holdback under section 26.1 or 26.2.
6. Non-payment of holdback under section 27.1.
7. Any other matter that the parties to the adjudication agree to, or that may be prescribed. 2017, c. 24, s. 11 (1).

Ontario's Construction Act is essentially designed to deal with matters arising from disputes between owners and contractor, contractors and subcontractors and suppliers of what could broadly be described as those labour and physical materials required to construct a building, structure or the like. It would appear that professional services, such as those provided by architects, engineers and the like, are excluded from access to Adjudication as their role in a construction project appears to be deemed as “intellectual property”, a class which is not defined within the Act.

In Alberta, the Act, as Amended at this time but yet to come into force, does not stipulate the matters related to construction that can or cannot be adjudicated. Additionally, the Act goes even further to include professional services within the scope of the construction industry. Both of these items appear to give the new Alberta legislation superior powers, in some areas, to expedite the dispute resolution process for a much broader scope.

(5) Section 25 is amended

(a) in clause (a)

(i) by renumbering the new section 70(a) as (a.01) and by adding the following before the new section 70(a.01):

(a) make regulations for the purposes of section 1.1

(i) prescribing a class of professionals acting in a consultative capacity referred to in section 1.1(1);

(ii) respecting the application of any part or all of this Act to one or more prescribed classes of professionals acting in a consultative capacity;

(iii) respecting an agreement, entity, undertaking or work or a class of agreements, entities, undertakings or works for the purposes of section 1.1(2) (c);

(iv) prescribing persons or entities, or classes of persons or entities, whether incorporated or not, for the purposes of section 1.1(3);

(v) prescribing a project agreement or a class of project agreements to finance and undertake an improvement for the purposes of section 1.1(3);

(vi) respecting the application of any part or all of this Act to a prescribed person, entity or project agreement or to a prescribed class of persons, entities or project agreements for the purposes of section 1.1(3)

One of the most significant differences between the two Acts deals with the exclusion of a significant aspect of the Alberta construction industry, specifically in its application.

APPLICATION

1.1(1) This Act or a provision of this Act may, in accordance with the regulations, apply to a prescribed class of professionals acting in a consultative capacity.

(2) This Act does not apply in respect of

(a) public works as defined in the Public Works Act,

(b) agreements to finance and undertake an improvement in which either of the following is a party:

(i) the Crown in right of Alberta;

(ii) a provincial corporation as defined in the Financial Administration Act that is an agent of the Crown in right of Alberta,

and

(c) any other agreement, entity, undertaking or work or class of agreements, entities, undertakings or works as may be prescribed for the purposes of this section.

This is very significant as public works projects are often large and complex with a predisposition for disputes. With the exclusion of these projects from the Adjudication process, a major sector of the construction industry is left with essentially no changes or improvements to the dispute resolution process. Litigation and delayed payments will continue to be a major concern. In Ontario, only nuclear facility projects are granted an exemption from the Adjudication process, placing the province government of Ontario on the same level playing field with the rest of the construction industry.

This substantive difference between the two provincial Acts would appear to be the result of the ability of Alberta to benefit from the Ontario experience to date both with an eye to improving upon the overall effectiveness of the Adjudication process in Alberta and minimizing the possible effects on public works projects. This would appear to be a self-serving exemption that acknowledges the need for Adjudication, while keeping the province out of its reach.

One area of the Alberta Act, which is as yet unclear, is that of the adjudication procedures, which have not been defined. The responsible Nominating Authority has yet to be determined in Alberta.

Adjudication procedures

33.5(1) An adjudication must be conducted in accordance with the adjudication procedures set out in the regulations or established by the responsible Nominating Authority.

(2) Adjudication procedures set out in a contract or subcontract apply only to the extent that they do not conflict with the procedures set out by the regulations or established by the responsible Nominating Authority.

(3) In the event of a conflict between the procedures set out by the regulations and those established by a Nominating Authority, the procedures set out by the regulations prevail.

As we await the final regulations, it would appear that Albertans participating in the construction industry, save for those involved with public works projects, will have broader access to rapid construction dispute resolution on matters concerning more than just the prompt payment of an invoice.

Adjudication of dispute

33.4 A party to a contract or subcontract may refer to adjudication a dispute with the other party to the contract or subcontract, as the case may be, respecting any prescribed matter in accordance with the regulations or the procedures established by the Nominating Authority responsible for that matter.

With respect to items such as a "Proper Invoice", "Notice of Non-Payment", the content of a Notice of Adjudication, the role of the Nominating Authority, the timing for payments and notices to be filed as well as the timing of the timing and process for the Adjudication, there appear to be very minor differences between the two Acts. Both Acts are designed to expedite payment relating to a disputed matter in a fair manner, consistent with the principle of Natural Justice.

The enforcement mechanisms of registering the determination with a court clerk, rendering the decision effectively an Order of the Court, are also similar in process and effect.

In both provinces, the application for Judicial Review is available should a party feel that an improper Adjudication has resulted in an unfair Determination by the Adjudicator.

Going Forward:

This is a promising and exciting time for those involved in the construction industry in Alberta. While we await the final form of the regulations that will apply to the Act, we have been fortunate to have been able to draw upon the experience and expertise of our colleagues from the U.K. at RICS, who have been at this since the late 1990s, as well as that of our colleagues in Ontario who have just two a few years of experience to date.

It is a promising time in that, at present, the opportunity exists to really get the regulations right, to really incorporate the best practices from the other jurisdictions and improve upon those that have proven to be problematic.

The final recognition that the Alberta Court of Queen's Bench is not an appropriate place to resolve a construction dispute and the intent to allow only those truly qualified and experienced in the construction industry to act as Adjudicators will be a welcome mechanism, never before available to Albertans. Natural Justice in Alberta, to date, has essentially been nothing more than a concept. The changes to the Act will, for the first time, allow affordable and speedy access to a Justice system specifically designed for the construction industry.

This is an exciting time because for the first time, the entire construction supply chain will be held to account for their financial dealings and obligations. The days of unscrupulous behaviour by owners and contractors who have withheld payments on duly executed contracts and invoices, simply because they could, are nearing an end.

While justice is the driving force behind the Acts in both Ontario and Alberta, it is rarely perfect. The eagerly awaited regulations for the Alberta Act have an opportunity to both increase access to justice and decrease the cost of that access for those who have typically been disadvantaged; those on the supply side of the construction industry.

While this author is unaware of the effectiveness or degree to which the Ontario Act has been utilized since its 1999 effective date, the opportunity for sub-contractors, material suppliers and professional services to benefit from Adjudication would seem to be enormous in Alberta. The initial driving intention to divert construction disputes from the court room to an Adjudication process should have the effect of not only freeing up the time of the Courts, but also allowing many more disputes to be determined than had ever been brought before the courts, primarily due to the extremely high costs and extremely long timelines associated with litigation.

Resources:

Builders' Lien Act, RSA 2000, c B-7, <https://canlii.ca/t/51v9j> retrieved on 2021-08-23

Builders' Lien (Prompt Payment) Amendment Act, 2020, SA 2020, c 30, https://canlii.ca/t/54vrz retrieved on 2021-08-31

Chapter 30 (Bill 37, Assented to December 9, 2020, in force on Proclamation)

Amends Builders' Lien Act, RSA 2000 cB-7

Red Tape Reduction Implementation Act, 2021, SA 2021, c 16, https://canlii.ca/t/553ms retrieved on 2021-08-29

Chapter 16 (Bill 62, Assented to June 17, 2021, in force on Proclamation)

Amends Builders' Lien (Prompt Payment) Amendment Act, 2020, SA 2020 c30. ■

INDUSTRY EXPERT Q&A: BOB PASSMORE

Bob Passmore is principal of Building Science + Architecture Ltd., where he provides expert opinions with respect to building envelop, oversees building inspections carried out by his staff on a daily basis, and more. He has been in the industry for 30 years, and he has a wealth of experience to show for it. Read on to know Bob a little more below.

You are a professional architect, and building envelope is a relatively new discipline. How did you come to specialize in building envelope?

BP: What brought me to architecture was working my way through my undergrad degree as a framer's helper. After graduation, I worked in the residential construction industry, where my interest in good construction practices grew. When my boss died unexpectedly, I was at a crossroads. I applied to the faculty of Environmental Design at University of Calgary and was accepted largely based on my construction background. My master's thesis was on air leakage in townhouses, as air leakage and the R2000 program were just coming into focus. After graduation I worked in architectural offices where I became a project architect and contracts administrator. I enjoyed being on site and making decisions to help resolve difficult details. Once I attained my professional status, I was offered the opportunity to specialize in the area of building science as a partner in Building Science Specialists, the predecessor to my own firm.

How long have you been principal of Building Science + Architecture Ltd., and what does your firm offer that differs from a typical building science consultant?

BP: Our firm was formed in 2003 when we purchased the predecessor, so I have been principal for 18 years. Everyone at BS+A has a background in construction. We have hands-on experience in carpentry and masonry, for example. That background affects how we approach building envelope design and construction. We take a very practical approach to design, always thinking of buildability. We also take a much more "hands-on" approach during construction, meaning we work closely with builders and specialty trades to work through details. We have found that this approach leads to success on projects.

In the past it was possible to construct a high-rise building with 10 or fewer architectural drawings. That is generally viewed as incomprehensible today. Is there a direct correlation between bigger drawing packages/more

detailed design and quality of the building envelope?

BP: That is a loaded question, and there are several parts to this answer. I think, in the past, the materials and methods were simpler. There was not a lot of concern or focus on the building envelope. Buildings were reasonably simple enclosures: sometimes heated, sometimes drafty, sometimes leaky. As occupant expectations changed, all aspects of the building changed to suit, including improved lighting, ventilation, temperature control, insulation and better details to accommodate these improvements. As a result, the drawings became more complex. The quality of the drawing package is far more important than its size. Good drawing packages often end up being larger, simply by virtue of the fact that more information is contained; however, we have also seen a great many large drawing packages with poorly designed assemblies and details. Drawings also almost never provide information for the most complicated and failure prone details – three-dimensional interfaces. It's also important to remember that the drawing package is also only one piece to the overall puzzle of a well-constructed building envelope.

What advancement in technology has had the largest positive impact on the building envelope? Largest negative impact?

BP: There has not been one technology that has had a seminal impact on the building envelope. I'd argue that new materials and assemblies have had both a large positive and negative impact on building envelope construction. There has been an explosion in the available materials and assemblies for building envelopes. If the materials deliver as promised, and are utilized appropriately, there are opportunities to achieve improvements in the affordability, constructability, performance and durability of building envelope systems. On the flip side, new materials and assemblies are often poorly understood, and not designed or constructed properly. Some new materials also simply don't deliver as promised. Consequently, failures have abounded.

Do you see (other) changes coming in the way we construct buildings and the building envelope?

BP: Continually improving thermal performance will be the trend. This will result in increasing airtightness and insulation levels. I expect to see more prefabrication in the future. I also expect (and hope) to see a push for materials and assemblies that can withstand extreme weather, such as flooding and hail events.

How do you see the building envelope discipline developing or changing in the future?

BP: Since I've been involved in the industry, there has been a significant learning curve throughout the industry. I expect that to continue. I also expect the trend to have more involvement of building envelope experts in design and construction to continue as well.

If you could go back to that point in your career when you began to specialize in this field, would you do it differently?

BP: No, but if I knew then what I know now, I probably would avoid a few mistakes. ■







BUILDING FOR THE FUTURE

Sustainability a huge feature in new Red Deer Polytechnic residence building

By Shayna Wiwierski

Red Deer Polytechnic (RDP) is offering a home away from home for students completing their studies.

The college has built a new residence building on the northwest sector of its main campus. RDC previously had 575 beds on campus, and this new Residence building increases the capacity up to 720 with its 145 rooms.

"This building has been carefully designed to meet the needs of our students, which is always at the heart of all of our planning," says Trent Rix, director, ancillary and sport services. "It provides us with an important component for future growth and development."

The five-storey building features 145 suites that are approximately 245 square feet in size. There are 113 standard studio suites, 19 barrier-free studio suites, and 13 premium studio suites. Each unit has a self-contained kitchen and bathroom complete with shower.

"We have some superior rooms for short-term visits, such as people staying for conferences, visiting faculty members, and when new staff move to our region as well," says Rix.

In addition to the suites, the residence also offers emergency suites for when students have to stay on-site due to bad weather, as well as low-rate rooms for students to stay if they have nowhere else to go.

"Demand for the self-contained, full-featured suites in the new building has been high compared to our other unit styles," says Rix. "Given all of the challenges that the pandemic has placed on our students, it has proven to be excellent timing to have a building that offers only bachelor suites to meet their safety and comfort needs."

Construction for the building started in October 2017 and was completed

in early 2019. From February 15 to March 3, 2019, the building housed athletes who were in central Alberta for the 2019 Canada Winter Games. Since then, throughout its yearly cycle, the residence has been utilized by students, as well as adult and youth learners attending RDC's Series Summer Arts School and Summer Camps, and individuals and groups on campus for training and other purposes.

The building itself is a glulam structure with exposed wood and defining features. According to Jason Mudry, director of campus management at Red Deer Polytechnic, only the main floor is made of steel, while the rest of the structure is glulam right down to the slabs in the building.

The project was planned and constructed utilizing an integrated project delivery (IPD) team who incorporated sustainable and energy-efficient technologies through the use of vertically installed, electricity-generating solar panels that cover the south, east, and west elevations of the building.

Although the Red Deer Polytechnic Student Residence did not have a mandate to meet any green building certification, it was designed to LEED Gold standard, says Vedran Škopac, project architect with Reimagine Architects Ltd. (formerly Manasc Isaac Architects). With its R27 walls, R35 roof, R6 windows, and Passive-House-certified fibreglass curtain wall, it exceeds the prescriptive requirement of the NECB [Energy Code] at the time of design. Special attention was given to maximizing walkability and minimizing use of the elevator, maximizing solar heat gain in the winter, operable windows for natural ventilation, and natural daylight and views. It also features indoor plants, 100 per cent LED lighting, façade integrated PVs on three sides, a locally controlled 90 per cent efficient HVAC system,

Read Jones Christoffersen, Smith + Anderson, Canem Systems, World Class Contracting Ltd., All Weather Windows, Collins Steel, Goodmen Roofing Ltd., Mytec Contracting, Western Archrib and Essence Cabinets.

low-flow plumbing fixtures, low-VOC materials, no-PVC policy (as much as possible), waste management control, and a reduced parking stall count, which encourages biking and bus transport.

"Integrating a solar panels as the exterior cladding of the building allows RDC to showcase solar panel technology, and also further supports RDC's Alternative Energy Initiatives and our forward-looking Green Campus Master Plan," says Mudry. "In addition to reducing RDC's carbon footprint and decreasing utility costs, the vertical application of these panels creates a teaching and research opportunity for RDC faculty and staff. The electrical production data generated from these panels can then be used by students and researchers in our Alternative Energy Lab."

According to Škopac, the building orientation was optimized for solar exposure, with a 153 kW of building envelope integrated photovoltaic (PV) array on east, south, and west elevations.

On the opposite side of the high-tech, Reimagine Architects drew most of the building envelope and interior details of Red Deer Polytechnic Student Residence by hand, and contractors used them to build the entire building.

"Energy conservation occurs throughout the building with a high-quality building envelope," Mudry says. "The energy-efficient walls maximize occupant comfort." Mudry adds the building's photovoltaic panels not only produce electricity, but also act like a rain screen system.

Along with RDC, the partners on the project included Clark Builders (general contractors), Reimagine Architects (formerly Manasc Isaac Architects),

This was the first IPD project for Clark Builders, who spent months researching this particular method of building. Through their partnership with the Turner Construction Company, they went to California to learn about the IPD process and had weekly training sessions with their Turner IPD coach.

"It turns how you think upside down; it's very different," says Andrew Clews, project manager, Clark Builders. "It puts all of the key trades and designers on the same team and incentivizes everyone to work together for the best results, which is great. It's a different relationship than you would normally have."

Clews adds that there aren't many buildings out there with that level of solar cladding and that's a new thing they were working through and learning a lot about.

The $19-million building not only provides new housing options for RDC students, but the building itself is a pioneer for sustainability.

"Students are able to learn in and from the building as they enjoy life at RDC," says Mudry. "The beautiful and functional new residence helps position our institution as one of the leaders across Canada when it comes to integrating solar panels into the design and cladding of a residence facility." ■

OFFICE TO RESIDENTIAL CONVERSIONS

By David Leonard, P.L.Eng., Eng.L., BECxP, CxA+BE Associate - Building Envelope Specialist

With the rise in and the stagnant climate of commercial vacancies in Alberta, the industry as a whole needs to consider all options for adaptive reuse of this vacant building stock. Boom and busts have been cyclical over the decades and while economists have varying degrees of optimism, the reality is that there is a substantial amount of vacant commercial space in downtown Calgary and Edmonton. Naturally a commercial heavy district does not promote vibrancy and life in the area, as businesses generally operate between 9 to 5 and therefore surrounding restaurants and amenities are limited in their operation. This in turn reduces the amount of retail, restaurants and other amenities which maintain the pulse of the community over a longer period of the day. There has historically been a large need for housing, more so affordable/attainable housing. The housing continuum establishes the segments in which housing is provided, as shown below.

It is recognized that not all office spaces can be easily, or actually, converted from their current use to a residential use. Factors include geometry and sizing of the floor plate, existing services in the building, condition of the envelope and structure, as well as floor-to-floor dimensions. Where a building is suited for a conversion project to any of the segments across the housing continuum, therein lies an opportunity to revitalize the building and extend its useful service life to the community.

When Entuitive was approached to provide prime engineering consulting services for the proposed Sierra Place Office to Residential conversion project, we jumped in with both feet. The existing Sierra Place Office building located at 6th Street and 7th Avenue Southwest in Calgary was almost entirely vacant and had been for years.

> "Sierra Place is a great opportunity for HomeSpace to continue to do our work in providing much needed affordable and supportive housing to those in need in Calgary. As a developer, we were very involved in the acquisition of existing buildings and retrofitting in the past; in recent years we have focused primarily on new construction. Sierra Place takes up us back to our days of retrofitting but at a grander scale. This is an exciting project for us and we look very forward to producing another beautiful development, contributing to the revitalization of Calgary's downtown core and most importantly helping find a home for some of Calgary's most vulnerable citizens."
>
> *– Matt Vermunt, HomeSpace Society.*

The property sits directly adjacent to the LRT line providing exceptional transit access compared to most other sites in Calgary. HomeSpace and Inn From The Cold were able to procure the property and are undertaking the conversion.

The project was initiated by an accelerated schedule to complete a full building condition assessment, which evaluated the condition of the structure, building envelope, mechanical and electrical systems. We needed to establish a benchmark for the building to determine what needed to be repaired or replaced before a scope for the conversion could be determined. Immediately following the assessment, the team undertook a feasibility study which informed the scope of the project on what would need to be done to the building considering the current condition and the change in use. The team worked collaboratively with Gibbs Gage Architects, M3 Development Management Ltd., PCL and the client stakeholders to develop a design that was constructible and cost-effective to bring the project forward. Ultimately, we were able to retain a portion of the existing building envelope on the north elevation and the entirety of the west elevation with minor repairs to limit costs associated with the conversion. The building layout provided some challenges as it related to suite layout as the entire west elevation is almost completely void of any windows which limited suite exposure to the outside through the windows to the north, south and east elevations.

The feasibility study and project further include an on going monitoring of the structure and modifications required to the structure to suit new or reconfigured M&E systems; to identify any stresses or degradation in the structure; repair and strengthening of structural members, and strengthening of the roof structure for changes in snow accumulation and environmental loads from changes in the mechanical equipment located on the roof. Additional makeup air, replacement of the existing sanitary sewer service, smoke exhaust system, fire and domestic water boosters and all new distribution of the mechanical systems is included in the project. Upgrades to the incoming electrical service, new life safety systems including a back-up life safety generator, common and unit lighting and power, security access controls and communications system replacements were included also.

Systems that were being replaced or heavily modified and with the change in use the building is being brought up to current code (NBC 2019 AE) in all respects. Limited grandfathering of existing systems such as the existing stucco and masonry were retained in their existing condition with minor repairs to prolong the service life of the systems. The incoming services were determined to be undersized to suit the requirements for the new use of the building so priority was made on systems that needed to be replaced with budget evaluated for systems that would not require replacement. Factors that drove decisions included budget, expected service life, durability and maintenance requirements as well as meeting the requirements for the client's standards for operation of the building post-occupancy.

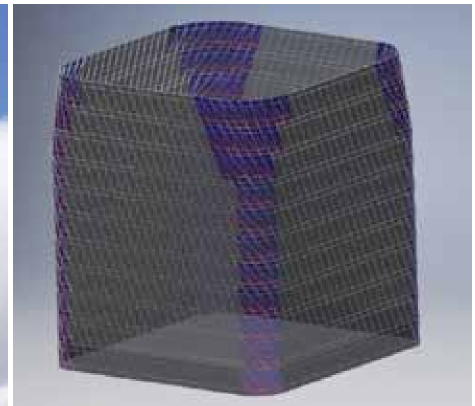
The project is slated to be completed in spring 2022.

To be continued…

Building Science Perspective will follow the progress and process of this project. ■

A STORY OF INNOVATION IN ALBERTA

By Mark Botkin



Left: The MacKimmie Complex at the U of C is a double-skin, net zero energy project that features a very complex panel mounting framework.
Above: A test model built over three days with the AutoCladding Method using Graham Architectural panel technology, just to demonstrate the possibilities.

Walson Tai of the Calgary Climbing Centre (CCC) had heard I was researching the application of software methods to the manufacture of building envelope components and wanted to know if my work could be adapted to his problem. He was building his business around the technology of climbing walls and had an idea that would push his company to the forefront of this growing industry. Artificial climbing walls use complexity as their chief selling point to clients, attempting to mimic the real world climbing experience. The problem is that manufacturing these structures with a lot of complexity is expensive and the outcomes to this point in time were somewhat disappointing. Unfortunately, what he wanted to do was for practical purposes impossible with existing methods.

The design Walson wanted to implement was grounded in the idea of using large numbers of panels that would intersect each other at varying angles to form arbitrarily complex surfaces. Strength would come in part with the tightly mitered intersection of each edge with its neighbour. Strength is an important property as people would be hanging from them. This was an ambitious and creative upgrade to the then available climbing wall technology. The parallels embodied in this design method with panel-based building envelope components were not lost on me, so I agreed to look into it. If nothing else, the climbing wall project was potentially a convincing proof of concept that could validate the assumptions I was making about the use of software in dealing with the construction of complex cladding in a cost-effective manner.

The software in question, which I dubbed 'AutoCladding', was designed to run on top of Autodesk® Inventor®. The choice of Inventor was driven in no small part by the effort I had put into learning this application and by a desire to not reinvent the wheel with features like project management, sketching, and part and assembly management. From the start it was clear that the user interface had to be simple enough to accommodate someone who was more artist than engineer, and Walson proposed using another Autodesk product, 3ds Max® to create sketch dwg files that would form the primary geometry specification for each wall. It was evident to me that this would be a large, complex project and would require close collaboration, but it was also intrinsically interesting and had the potential to advance the fortunes of more general panel manufacturing.

On the input side, the AutoCladding application had to be able to import and interpret a dwg formatted sketch file for each wall, parsing out panel profiles and creating data structures to represent them. This would be expanded to accommodate any application that could produce a sketch dwg file, including Inventor. Also important was the digital prototype assembly the AutoCladding application created from this data. Each wall model had to represent many, possibly thousands, of panels, each one unique in its form, dimensions, edge mitering and mounting details. This meant that the model had to record specific information on every single panel that could be referenced at any time in the modeling process. The AutoCladding application, as it then existed, already had the ability to create dxf formatted production files suitable for driving CNC tools, and this proved to be important, as the CCC intended to produce the panels and components in-house, without the use of drawings.

The first major installation created this way was the so-called Hanger site near the Calgary airport.

This project revealed a few issues, not surprising for software of this level of complexity, but the project was deemed a success. The problems encountered were addressed and another even more ambitious project was undertaken, the so-called Rocky Mountain site in Calgary's Canada Olympic Park.

This 35,000-square-foot facility is unique. The interior is a stunning array of climbing surfaces of previously unimagined complexity. It also features one of the largest and most detailed outdoor artificial climbing surfaces in the world. The CCC website has a must-see video tour. So far, the reaction locally to this series of projects has been undetectable outside the climbing community. I submitted this work to CanBIM for their 2020 Innovation Spotlight Awards and was nominated in the Digital Products category. This work has received a lot of attention because of this, especially in Eastern Canada, but it seems as if the implications of the AutoCladding technology for the wider envelope manufacturing industry are still being missed. In summary, this is a story of the tension between vision and risk, and the way two unrelated threads in the technology world can combine and make something that was previously impossible not only possible, but cost-effective. This project has lessons for the wider envelope manufacturing industry, if they decide to take notice.

The next step

I continued the development and extension of the AutoCladding method with the help of data provided by Aluminum Curtainwall Systems of Kamloops and the online frame profile catalog of Graham Architectural. I decided to focus on unitized curtain wall implementations where the infill can be a range of materials including glazing. In its current form, the AutoCladding application can be used to read and interpret shop drawings showing frame profile details, from which it separates individual profiles into libraries.

Detailing such as mounting holes and slots can also be captured in this way. Structural geometry is supplied via 2D and 3D sketching and panels generated using a set of design rules specified for each panel technology and workflow.

The AutoCladding application will automatically populate panel frames. From the master assembly created in this fashion production data in the form of dxf formatted files for CNC tools can be generated. In addition, fully formatted production drawings can be created at the rate of about one per second. Other types of documentation can also be sourced from the model.

Conclusions

Automation built around the digital prototype has proven its worth in the climbing wall project. Models constructed using these automated processes tend to have a smaller memory footprint, in part because they do not depend on the knowledge and ability of individual modellers, but also because there is reduced need for many of the construction features that are required to model via the user interface. This means larger models can be accommodated. In addition, the master assembly created by the AutoCladding method is rarely edited directly, so the performance of the user interface is less of an issue. This is important because many commercial projects can be dauntingly large. In the 3D printing world this process is called generative design.

The advancement of envelope manufacturing automation may be further enhanced with Artificial Intelligence. I have initiated communication with the Alberta Machine Intelligence Institute with a view to exploring these techniques applied to a wide array of design and implementation challenges related to the problems facing the envelope manufacturing sector.

The future could eventually see these methods adopted by architects to evaluate technology choices and perform cost projections. Point cloud data collected by laser scanning could be evaluated with the AutoCladding method to facilitate panel remediation projects. Roofing and below grade structures are also candidates for automation.

Current development is focused on automating the generation of manufacturing data for house designs where most of the work is focused on sketching the desired geometry. The CMHC has recently announced a $300-million initiative to address the affordable housing crisis, and the AutoCladding app is poised to play a significant role in addressing both cost and sustainability issues.

What does all this mean?

There are two important points arising from this experiment.

1. The construction industry is being compelled to accept the fact that software is the technology that will advance their fortunes for the foreseeable future. The construction industry must acknowledge the disconnect between what they pay for software and the actual value it creates in efficiency and reduced ECOs. They need to understand that software development in the area of manufacturing is extremely difficult and expensive, and while there are all too frequent foul ups, when software is done right, the results can be spectacular.
2. The software industry has to face up to the fact that there is a crippling lack of trust caused by aggressive marketing on the part of resellers that seek to meet quotas, rather than address the real problems manufacturers have. Software vendors have to start taking up common cause with manufacturers, and in particular, they must assume some of the risk manufacturers take when they adopt new methods and tools based on software. The construction industry is built on a culture of what amounts to gambling. Fundamental processes like bidding on contracts even use gambling terminology and the outcome of a given project is never completely known until the final tally. This means that any kind of change comes with risk, and the software industry has to acknowledge their role in this. The close collaboration between Alberta Data Systems and the Calgary Climbing Centre represent one model for enhancing the flow of technology to create outcomes that would not have been possible otherwise.

The construction industry is at a crossroads as climate change and population pressure push us to improve and innovate to meet the existential challenges arising from the role the shelters we build play in the human story. This is a time to embrace experimental culture and the change it portends. New paneling technology, new materials, new methods and the encroachment of automation on long standing workflows are unavoidable, and we ignore the pioneering work being done outside of the mainstream at our peril. The labour shortage and the lack of a skilled workforce alone are trends that cry out for innovative change. The fringe has a way of becoming the norm in the evolution of technology, and the digital prototyping process driving automation is a direction that deserves critical consideration.

About

I was born on a farm in Saskatchewan and graduated from the University of Saskatchewan with a degree in biochemistry (advanced). I subsequently moved to Edmonton, Alberta, and worked for a cadre of prestigious research groups at the University of Alberta, including the J.S. McEachern Canadian Cancer Society lab, the Mike James X-ray crystallography group and Chembiomed Ltd., an innovative biotechnology company formed in the chemistry department by Dr. Raymond Lemieux, a prominent researcher at the time. From there, my interest in computer systems led to invitations to join a series of technology start-ups, doing everything from computer design to heavy equipment fly-by-wire controls and high-speed telecommunications. The later years have given me the opportunity to develop an expertise in 3D modelling, which when combined with my innate talent for mechanical design, gave me fresh perspectives on the building envelope manufacturing industry and their efforts to solve some of their more pressing productivity issues. I am also an inventor, and have patented a revolutionary bicycle seat design. ■

LESSON LEARNED: AIR LEAKAGE

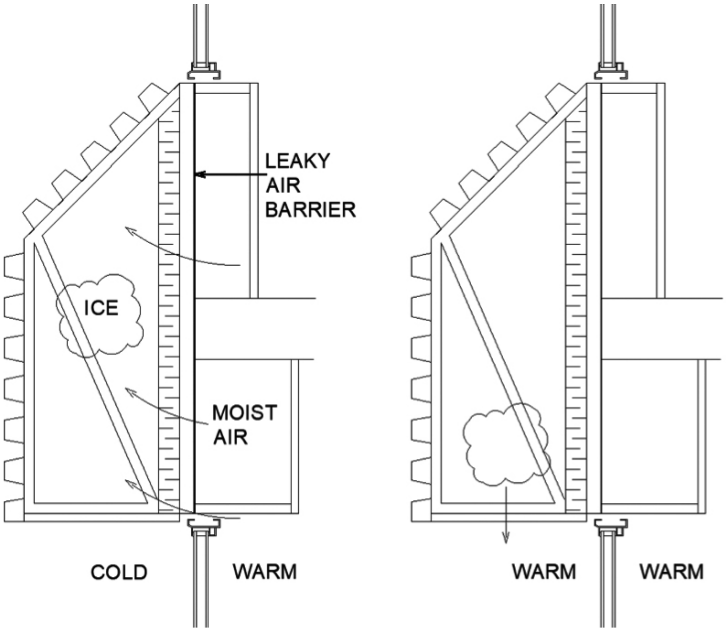
Most readers of a building science magazine will understand that uncontrolled air leakage is not a good thing; air leakage wastes energy and drafts make occupants uncomfortable. The Alberta Building Code requires an air barrier. Less understood is the damage that air leakage can do, how air transports moisture to cause damage and shorten the service life of building elements and ultimately the buildings themselves.

This is not a Halloween issue, but it is the season. Here are a couple of the horrors of air leakage:

Looking down from a rooftop of a high humidity facility, we see the outer layer of a custom stucco finish coat intended to mimic terrazzo or a stone-like finish. The problem is that the wall construction is our standard batt-filled steel stud wall with poly vapour barrier, and no reliable air barrier. Because the air barrier is not intact continuously, the HVAC system was adjusted to pressurize the building and avoid infiltration. This creates a constant drive of moist air out through the wall assembly and into the stucco. When the weather is cold, which it is much of our year, the moisture cools and condenses in the stucco. The less permeable outer stucco layer does not allow drainage or drying, so the water freezes faster than it can dry out, the finish coat separates, and boom!

Looking up, we see a damaged soffit. Behind the metal siding is a deep cavity, with exterior insulation over an innovative assembly of interlocking sheet metal sheathing and caulking, intended to act as both an air and vapour barrier and structure. It leaks air, as metal and sealant assemblies normally do. When you add stack effect to HVAC pressure, it leaks a lot. When the weather is cold, which is much of our year, the moisture cools outside of the insulation and freezes, sometimes into a mass behind the cladding. When the sun comes out or the weather warms, the ice is dislodged. The big chunks come crashing through the soffit, deflect off the sloped sill, and land on the roof below, and kaboom!

Luckily, no one was injured, and the envelope has been fixed! Stay tuned for our spring issue, where we will offer the story of repair and renewal. ■



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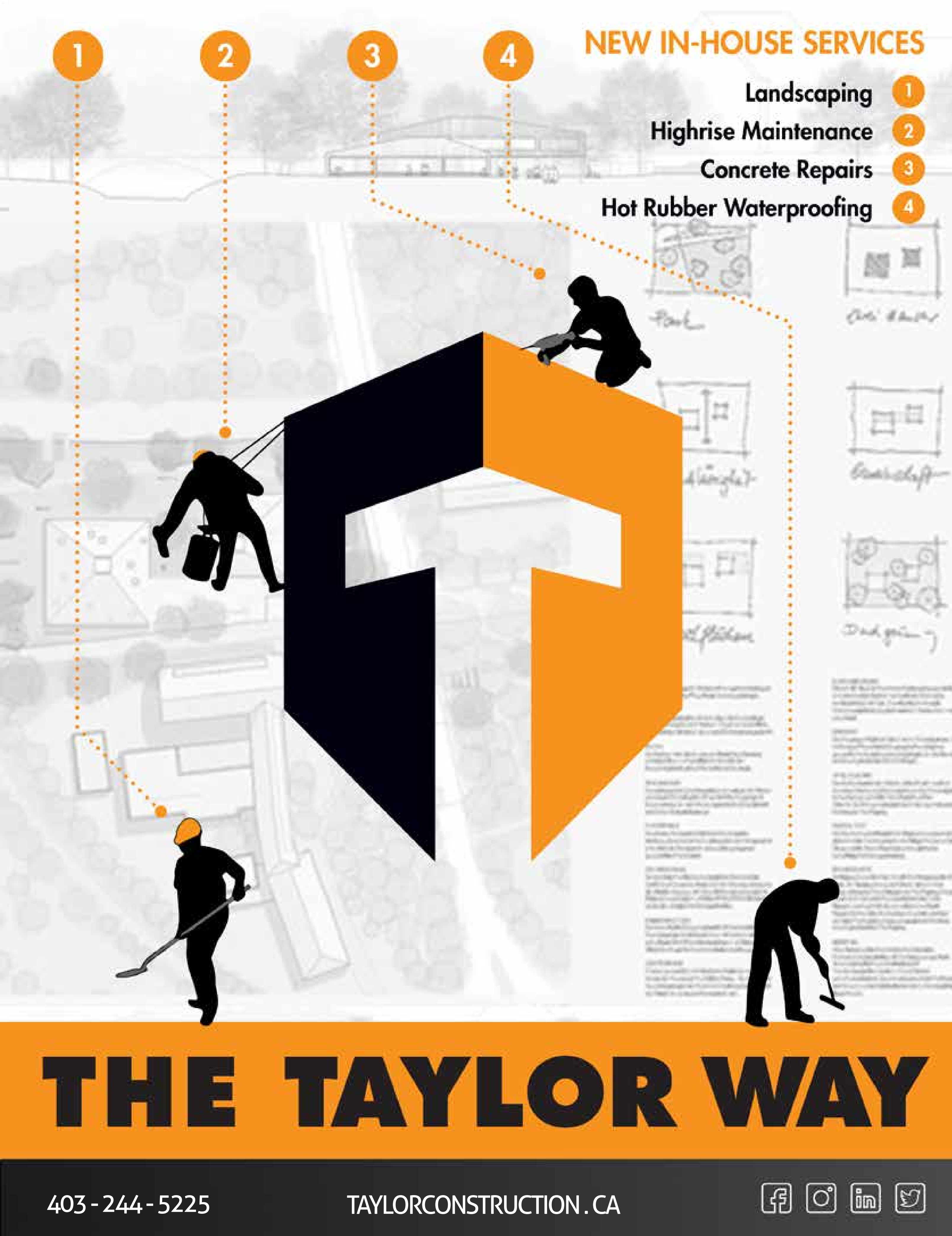
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