Pushing the Envelope Canada

Blending Vintage Wine with Building Science:

Does Your Cellar Have Legs?
Don’t let moisture haunt you.

Spooked by the mysteries of the dew point? Creeped out by condensation? Cast out those demons with everything you need to keep moisture in check. For access to world-class advice and a complete line of products for the entire building envelope...

Who you gonna call? Convoy, obviously.

Convoy Supply
Construction Materials

BRITISH COLUMBIA, ALBERTA, SASKATCHEWAN, MANITOBA, ONTARIO, QUEBEC

CONVOY-SUPPLY.COM
Design Brief Challenge:
Supply A True C.I. Compliant Wall Which Meets Energy Code, Is Simple & Quick To Install AND has NFPA 285 Approval.

Accepted:
Armatherm™ Z Girt Structural Thermal Break

Thermal bridging is recognized as a significant factor in building envelope heat loss. It has been determined that the total heat flow through typical wall assemblies is underestimated by as much as 70% due to thermal bridging, yet simply adding insulation to walls has been proven to not necessarily decrease the energy use of a building. Heat flow paths (thermal bridges) allow heat to by-pass the insulation, negating any benefit of installing more insulation in the wall.

Metal, cement and laminate wall claddings are supported by and attached to continuous girts or clips that penetrate the exterior insulation layer, creating thermal bridges. These fastening systems are normally made of highly conductive steel or aluminium, creating significant energy (heat) loss. It has been demonstrated that these thermal bridges in conventional steel stud wall assembly construction reduce insulation effectiveness (R value) by as much as 50%, resulting in wall assemblies and interface details that do not meet current energy code requirements for minimum U value.

Armatherm Z-Girt is NFPA 285 Approved.

Visit armatherm.com to see the full range of Armatherm Structural Thermal Break Solutions.

www.armatherm.com

We are a collaborative, design-build partner who can assist in determining the extent of thermal bridging heat loss on building envelope performance including thermal modeling and connection design calculations. We look forward to working with you.
PRECAST CONCRETE BUILDS ON...
ENERGY EFFICIENT BUILDING ENCLOSURES

Precast Concrete resilient enclosure walls outperform other enclosures in:
- Exceptional rain penetration control
- Air tightness
- Excellent thermal mass properties
- Superior thermal conductivity and resistance
- Low building maintenance
- Faster sequence of construction
- Durability & long life

Simons Vancouver Park Royal Store
Vancouver, British Columbia
By LEMAYMICHAUD Architecture Design

Visit www.cpci.ca/publications to download your free copies of the Meeting and Exceeding Building Code Thermal Performance Requirements and High Performing Precast Concrete Building Enclosures – Rain Control Technical Guides

For more information on the Canadian Precast Concrete Quality Assurance (CPCQA) Certification Program, please visit: www.precastcertification.ca
Blending Vintage Wine with Building Science: Reserve These Tannin-Techniques to Ensure Your Cellar’s Body Has Legs

Lessons Learned from Self-Building a Super-Insulated House

Does Your Roof Meet Code?

Net Zero Carbon Might be Easier Than You Think

Reconstruction of an Underground Parking Level Concrete Slab on Grade

Thin vs. Thick & When to PUMA in Underground Parking Structures

ON THE COVER:

Did this cover of your favourite building science publication have you craving your favourite glass of red? Industry expert Joe Lstiburek’s article details how to properly install a wine cellar—from the bigger envelope components, right down to the smaller, but equally important factors, like temperature—to make sure your wine is properly stored. Turn to page 13 to read and ensure your wine cellar has legs!
A SMART ROOF IS YOUR BEST DEFENSE!

Integrated into the roofing system
Simple and fast installation
Early warning and timely notification
Reduce roof maintenance costs by up to 70%

SMARTEX® DM provides immediate notification to the area of a breach.

Be prepared with an intelligent flat roof monitoring system that tracks the moisture ingress of roofing systems 24/7 and contacts you when there's a breach. Smartex® DM is the economical choice for building owners managing flat roof constructions, humidity sensitive rooms and pitched roof areas.

Three smart roof monitoring systems. One perfect for you.

Toll Free: 1.866.282.5325
info@leak-detection.com

TRUSTED BY THE BEST.
NEWS AND VIEWS

Upcoming Events ................................................................................................................ 31
BEC Roundup ....................................................................................................................... 33

INDEX TO ADVERTISERS ................................................................................................. 34

MEET OUR EXPERTS

JOE LSTIBUREK
Joe Lstiburek, B.A.Sc., M.Eng., Ph.D., P.Eng., is principal of Building Science Corporation. Turn to page 13 to read his article.

GRANT WALKIN
Grant Walkin, M.Sc., P.Eng., is a building envelope and structural glass engineer at Entuitive Corporation. Turn to page 17 to read his article.

MEAGAN KIKUTA
Meagan Kikuta, M.Eng., B.Arch.Sc., is an architectural representative at Tremco Roofing & Building Maintenance. Turn to page 21 to read her article.

STEFEN MURRAY
Steven Murray, P.Eng., is principal and senior building envelope engineer at Morrison Hershfield. He is also a BSS Instructor. Turn to page 24 to read his article.

EMMA RUIXIAN QIAN
Emma Ruixian Qian is an architectural technologist with WZMH Architects. Turn to page 26 to read her article.

MOHAMED HUSSEIN
Mohamed Hussein, P.Eng., BSS, is a building science engineer with Morrison Hershfield. Turn to page 29 to read his article.

© 2020 Matrix Group Publishing Inc. All rights reserved. Contents may not be reproduced by any means, in whole or in part, without the prior written permission of the publisher. The opinions expressed in this publication are not necessarily those of Matrix Group Publishing Inc. Printed in Canada.

OBEC does not specifically endorse the editorial, products or services contained within this magazine. These products and services are presented here as an indication of the various possibilities in the Marketplace. OBEC wishes to advise the reader that sound Building Science Practices should be applied to any and all product or service selections. OBEC does not make or imply any warranties as to the suitability of any of these products or services for any specific situation. Furthermore, the opinions expressed in this magazine’s editorial content may not necessarily reflect the opinions of OBEC.
REPAIR, RESTORE, REVITALIZE

with Blok-Lok Restoration Anchors!

TORQ-LOK®
SPIRA-LOK®

For over 55 years, Blok-Lok has been engineering innovative solutions to bring aging structures back to their original beauty.

Blok-Lok anchors will not only fix the damage, they will help historic structures meet and exceed the updated, more rigorous building codes of today’s industry.

For more info & products:

www.blok-lok.com • 1-800-561-3026
Message from the President

We are blessed in our great organization, the Ontario Building Envelope Council (OBEC), with a fabulous board of directors, amazing committees, and wonderful members who pose great characters, a wealth of knowledge, and enthusiasm—among many other talents and gifts. 

As it has been stated, OBEC has been bridging the gaps among the architectural, engineering, research, manufacturers, and construction communities. Finding and engaging these professionals to serve can be extremely difficult, especially in our currently busy construction epoch. It makes it inevitably essential to focus on necessary positive changes right now, otherwise, we could be missing out on a one-of-a-kind chance to improve on the largest number of buildings this country has ever seen in one province. In this issue of Pushing the Envelope Canada, we have some fantastic, educational articles for readers to enjoy.

Ever thought about building your own personal wine cellar? Joe Lstiburek takes the time to offer his insight on the particulars of storing wine and building your own wine cellar, in his article on page 13.

Grant Walkin discusses the lessons he learned as he attempted to super-insulate a 115-year-old, semi-detached home. On page 17, he goes in-depth about the products used to embrace a leading-edge approach to energy performance.

On page 21, Meagan Kikuta explores the myriad of problems one can have if your roof does not meet code, and why it is crucial to ensure it does.

Steven Murray discusses the impact of thermal bridging and how envelope transitions are amplified in low-energy buildings. His article on page 24 explains why these transitions are particularly challenging to resolve in retrofit conditions.

On page 26, Emma Ruixian Qian discusses the changes needed for an existing high-rise office building with moisture deterioration problems caused by weeping tiles.

Finally, on page 29, Mohamed Hussein reviews the variations and differences when it comes to concrete protection systems. He also focuses on the advantages of using the PUMA system.

I welcome your suggestions on attracting more envelope enthusiasts, starting the talk about positive initiatives, and building a better future for this vibrant, fast-growing construction world. Thank you to all those authors and contributors who took time to write for this issue of Pushing the Envelope Canada.

OBEC 2020 BOARD OF DIRECTORS

President
Ehab Naim Ibrahim, B.Arch., MRAIC, LEED® AP, BSS®, CPHD
Gamma North America

President-Elect & Chair, Education Committee
Mila Aleksic, B.Arch.Sc., M. A. Sc. Technologies, George Brown College

Past-President & Chair, Membership Committee
Ian Miller, P.Eng., LEED® AP
Pretium Engineering Inc.

Secretary/Treasurer
Negan Pakzadian, B.Eng., M.Arch., MB.Sc., BSS, CPHD
City of Pickering

Chair, Awards & Scholarships Committee
Gauss Wong, B.Eng., P.Eng., BSS
Sense Engineering

Chair, Codes & Standards Committee
Michael Rekker, C.E.T., BSS
Tacoma Engineers Inc.

Chair, Communications Committee
Meagan Kikuta, M.Eng., B.Arch.Sc.
Tremco Roofing

Chair, Events Committee
Rob Quattrochiochi
EllisDon

Chair, Building Science Specialist Certification
Exams Committee
Daniel Aleksow, P.Eng., BSS
Pretium Engineering

Chair, Technical Discussion Group Committee
Brian L. Abbey, OAA, M.A.A.T.O., BSS, A. Sc. T. CSC., BCQ.
ADTEK Building Consultants

OBEC STAFF
Operations Manager
Sherry Denesha
Are you knowledgeable enough to become a Building Science Specialist?

The BSS® (Building Science Specialist) designation provides members of the industry, including building designers, specifiers, developers, contractors, and owners, with the confidence that any designation holder has a high level of education and understanding in the field of Building Science.

These individuals have written and passed an extensive set of exams covering:

• Building Science Theory Exam
• Building Envelope Systems Exam
• Materials Exam
• Mechanical Systems Exam

In addition to obtaining a minimum 65% in each of the above four exams, the candidates must also have an engineering or architectural undergraduate or graduate degree and at least 2000 hours of practical experience directly related to the practice of building science.

OR

Have an engineering or architectural diploma from a recognized college or polytechnical institute and at least 5000 hours of practical experience directly related to the practice of building science.

On our website at https://bssb.ca/bss-exam/learning-objectives the BSSB provides a list of detailed learning objectives and reference material listing everything you need to know to self-study for the exams. The exams are closed book. It is the candidate's responsibility to ensure they are prepared to write each exam after reviewing the current Learning Objectives posted on this website.

We also provide a comprehensive list of courses that may help you prepare for the exams, but these are provided for reference only. They can be found on our website at https://bssb.ca/bss-exam/exam-courses. Many of these courses are part of a degree or certificate program only so you must contact the relevant institution to determine whether you are eligible to take the course. Note that the BSSB does not endorse any of these courses and does not certify that the content covered by the courses is the same as what is covered on the exam.

Do you want to think that you are knowledgeable enough to obtain the BSS destination?

90% of exam applicants got these questions wrong:

• Briefly explain the function of a "Stack Joint".
• Briefly explain why the exterior of a below-grade cast-in-place concrete foundation wall is often covered with bituminous coating.
• Suggest a chemical admixture which would be logical to consider for an industrial floor slab (which will be enclosed inside a building) being placed outdoors in July. Explain the purpose of the admixture and justify why it would likely be required in this particular application.

The BSS Designation is not a license to practice Building Science, it is a certification of a level of knowledge that those who obtain the designation are highly skilled in the practice of Building Science.
Building Science Specialist Exam Dates

Building Envelope Systems Exam

**DATE:** JUNE 26, 2020

**TIME:** 1:00 P.M. – 4:00 P.M.

**LOCATION:** TO BE CONFIRMED. CHECK WWW.BSSB.CA FOR CURRENT DETAILS.

Materials Exam & Mechanical Systems Exam

**DATE:** OCTOBER 16, 2020

**TIME:** 1:00 P.M. – 5:00 P.M.

**LOCATION:** TO BE CONFIRMED. CHECK WWW.BSSB.CA FOR CURRENT DETAILS.

---

**Rocco Liscio, M. ENG, P. ENG.**

Vice-President

CONSULTING ENGINEERS

Building Science and Materials Engineers

2051 Williams Parkway

Unit 21

Brampton, Ontario L6S 5T4

Tel: (905) 792-7792

Fax: (905) 792-7829

Cell: (416) 560-7700

E-mail: rocco@davroc.com

www.davroc.com

---

**DYCON ROOF CONSULTANTS INC.**

**BARRY O'BRIEN**

518 BRANT STREET, BURLINGTON, ONTARIO L7R 2G7

TEL: 905-639-4956 OR 1-800-749-8609 • FAX: 905-639-6162

CELL: 905-330-2480 • bobrien@dycon.ca • www.dycon.ca

---

**Brown & Beattie BUILDING SCIENCE ENGINEERING**

568 Edward Avenue, Unit 49, Richmond Hill, ON L4C 9Y6

P 905-737-0111 F 905-737-4046 (Guelph) P 519-827-1757

**PRACTICAL APPROACHES**

- Reserve Fund Studies
- Performance Audits
- Condition Assessments
- Specifications & Tendering
- Forensic Engineering
- Roof Consulting
- Construction Review
- Contract Administration

**SENSIBLE RESULTS**

www.brownbeattie.com

---

**Love where you work!**

RJC is currently hiring Building Science and Restoration Engineers and Technologists across the country.

We offer:
- Exciting and challenging projects
- Competitive benefits + exceptional bonus program
- Flexible work hours
- Training and development
- People-focused culture
- A fun and engaging work place

Creative Thinking Practical Results rjc.ca

---

Pushing the Envelope Canada 11
Vetropieno™ Glass Brick

100% solid glass brick offers design possibilities limited only by an architect’s imagination and vision.

SevesGlassBlock.com | inquiry@sevesglassblock.com | 877.738.3711
I love wine. People think I must know something about the stuff because I drink a lot of it. I don’t really know much, but I do know what I like: red, French, and with a cork. Most of the questions I get, I have no clue about, so I make up stuff—I am a consultant, after all. But I know how to store the stuff.

Here is the magic formula for storing wine: 55°F at 70 per cent relative humidity. Where does that come from? Old French guys.¹ That is not the temperature you should drink it at but the temperature and relative humidity you should store bottles at. Drinking temperatures are more difficult to pin down. There is no consensus; it varies by type of wine and which nation produces it.²

The colder you store wine, the longer it will last. So why not store it colder? We want it to age, which means we want chemical reactions to continue in the bottle for a long time. If it is too cold, these reactions don’t happen. There is a difference between “preserving” wine and “aging” wine.

How did the French pick 55°F? Tradition, mostly. Wine was stored in cellars—that is why we call them wine cellars. If you have a

---

**Blending Vintage Wine with Building Science:**

Reserve These Tannin-Techniques to Ensure Your Cellar’s Body Has Legs

By Joe Lstiburek, B.A.Sc., M.Eng., Ph.D., REng., ASHRAE Fellow, Building Science Corporation

A French Chateau’s cellar is the traditional place to store wine, as it remains at the accepted 55°F naturally.

A professional at work in the wine cellar.

Barrels need higher humidity conditions than bottles.
big, old-fashioned French Chateau handy, you will find the temperature in the cellar at about 55°F.

What about relative humidity? Notice, earlier I said “bottles.” Most wine in the Chateaus starts out in barrels. Drinking out of the barrel is complicated—you can’t move them easily to the dining room so you need a guy with a “thingy” (yes, that’s the technical term) that extracts wine directly from the barrel into a waiting glass. The French, the innovators they are, figured bottles made from glass—small enough to carry—would be more convenient.

Why not put wine into glass bottles straightaway? Not so fast. The barrels are made of wood, and the wine needs the wood to be able to taste like wine (read: good wine). The type of wood the barrel is made of is a big deal. Oak is optimum. French oak is magnifique for French wine, American oak is ideal for American wine, Slovenian oak is preferable for Italian wine, etc.

The barrels themselves are not impermeable. Wood is not a vapour barrier, nor an alcohol barrier, nor an oxygen barrier. Water diffuses out, as does alcohol, while oxygen diffuses in this outward diffusion of water, and alcohol concentrates the flavours, whereas the diffusion inward of the oxygen governs the chemical reactions.

For the wine-making process, it’s important the vapour diffusion outward is controlled—slowed down, but not stopped. This is done by storing the barrels at a high relative humidity. How high? Back to the French, again. A cellar in France has about 80 to 90 per cent relative humidity.

You’re not going to find those conditions in a cellar in California unless you get help from an ASHRAE member. Even with help from an ASHRAE member, you’re not going to get conditions identical to France. You’ll get close, but it will not be the same. You’re going to get California conditions. Therefore, you’re going to get wine that tastes differently.

Now, let’s think about the consequences of temperature and relative humidity conditions relating to 55°F and 80 to 90 per cent relative humidity. Great for making wine and storing wine barrels—not so great for the space. Without fail, you’ll get all kinds of mould. Is this mould good or bad? The mould on the walls doesn’t seem to be a problem; it’s how the mould is cleaned that can be the problem. Cleaning with bleach leads to something called 2,4,6-trichloroanisole (TCA). If
TCA gets into wine, it becomes tainted. The French don’t worry about the mould on the walls in their wine cellars that store barrels. They also never use chlorine in their wineries for cleaning purposes—simply soap, water, and elbow grease. They tend to build these cellars out of rocks and wood rather than paper-faced gypsum board and engineered lumber. It’s harder to get mould on rocks and wood than what we use in North America.

In the U.S., particularly California, the zeal to eliminate mould with chlorine led to tens of millions of dollars’ worth of tainted wine. I love to watch the French in California, especially near food or a winery—their heads would explode.4 We also put chlorine in water. It’s not a good idea to have chlorinated water anywhere near a winery or a wine cellar.

What the French do worry about is mould in corks. This becomes more of a problem once we take the wine out of barrels and store them in bottles. Too much humidity, and we get mouldy corks. Too little humidity, and we get dry ones. With a dry cork, air can get into the bottle, and that will lead to spoilage and potential evaporation. That’s why wine is stored horizontally, so the wine keeps the cork wet on one side, maintaining the seal.

Why not get rid of the cork and use something that seals better for longer? The only reason we used cork in the first place is because it was the only technology available at the time. It’s like the designated hitter rule in baseball: there will never be peace between the American League and the National League. The folks who want to get rid of the cork are American League-types—why use poor technology (e.g., corks), and why watch a lousy hitter (e.g., pitchers)? The folks who want to retain the cork are National League-types—purists and traditionalists.

If we have cork-in wine bottles and want to store the wine, what do we do? Back to the answer at the beginning of this story: 55°F at 70 per cent relative humidity. The 70 per cent relative humidity is just about the maximum we can maintain without damaging corks. It’s also a good humidity to keep the cork from drying out. What’s the rate of moisture entry into the cork on the wine side versus the rate of evaporation on the outside-seal side? We have 100 per cent relative humidity on one side and 70 per cent on the other. Seems to work. How do we know? Watching lots of bottles for lots of years.

What do 55°F and 70 per cent relative humidity mean for wine cellars? Well, for the French and their Chateaus, it means they must install dehumidifiers in their cellars if they want to store their wine in bottles with corks and paper labels.

If you don’t happen to be French and have a Chateau with a cellar and a dehumidifier, what do you do? You construct a wine cellar using a psychometric chart and some building science (see Figure 1 on page 14). To make this work, I need an assembly that handles bi-directional vapour flow. I prefer materials that are semi-vapour impermeable and more-or-less homogenous. That way, flow is slow in both directions, but isn’t eliminated in either direction. Figure 2 on page 14 provides a pretty easy way to construct a wine cellar if you don’t happen to have one.

Cheers!

Joe Lstiburek, B.A.Sc., M.Eng., Ph.D., P.Eng., ASHRAE Fellow, is a principal of Building Science Corporation. He is a forensic engineer who is recognized as the authority on moisture-related building problems and indoor air quality.

AUTHOR’S MUSINGS

1. Yes, I know other folks also make good wine. However, it is much like asking Canadians about hockey, even though other folks play pretty good hockey. They are the “experts.”

2. For example, ASHRAE legend Ollie Fanger carried around a gold thermometer with him wherever he went to ensure the wine he drank was at precisely the correct temperature.

3. Some wine manufacturers do this part of the process in large stainless-steel vessels they spike with wood chips.

4. Memo to the French: the rest of us also think the folks in California are crazy.
Introducing a Unique Innovation:

**INSULSHEATHING panel**

**R5 XP**

**YOUR ONE-STEP SOLUTION FOR:**

- **CONTINUOUS INSULATION**
- **HOUSEWRAP**
- **WIND BRACING**

**Designed to meet**

**MMAH SUPPLEMENTARY STANDARD SB-12**
**ENERGY EFFICIENCY FOR HOUSING**

- PROVIDES A CONTINUOUS THERMAL RESISTANCE OF R-5; perfect for meeting the requirements of the Quebec & Ontario Building Code.
- DOES NOT REQUIRE ADDITIONAL BRACING; one-step installation saving time and cost.
- INTEGRATED AIR-BARRIER; no additional housewrap required saving material costs.
- LIGHTWEIGHT AND EASY TO INSTALL; allows for fast installation saving time and cost.

**BP**
**BUILDING PRODUCTS OF CANADA CORP.**
**FOR OVER 100 YEARS**

bpcan.com
Lessons Learned from Self-Building a Super-Insulated House

By Grant Walkin, M.Sc., P.Eng., Building Envelope Specialist, Entuitive Corp.

The journey in pursuing my own, hands-on approach to complete a deep energy retrofit began in 2014, when I purchased a 1904 semi-detached home in the east end of Toronto. My formal education is in civil engineering, but my real passion is building science; so, what better way to learn than to get my hands dirty with my own self-build?

Our first winter of 2014-2015 revealed the house’s major energy inefficiencies: the HVAC ducts were neither insulated nor air sealed, there was a large hole in the foundation wall for HVAC “fresh air,” and the walls were largely uninsulated—all aspects made the house perfect for a deep energy retrofit.

**PROJECT GOALS**

Like any high-performance build should aim to achieve, the goal was to improve the building’s durability, occupant comfort and health, and energy efficiencies. My goal was to improve the building with principals from the “pretty good house” movement. I followed the exterior insulation method outlined in the Mass Save Deep Energy Retrofit Builder Guide by Building Science Corp. (see Figure 1 on page 18) and the forum discussions at www.greenbuildingadvisor.com.

I also worked through smart efficient details to better understand the high-performance systems and materials, building an architecturally aspiring green home (what’s the point of a high-performance house if it’s an ugly box destined for the landfill within a few decades?), and maximizing passive heating and passive cooling systems. At the time, going off fossil fuels wasn’t a goal; today, however, it most certainly is.

**PERFORMANCE HIGHLIGHTS**

Super insulation was one of my main focuses. An overview of the project’s thermal insulative performance is shown in Figure 2 on page 19 and is compared against code-built project and the original project prior to the deep energy retrofit. The figure also highlights how windows de-rate the effective R-value of walls, even with high-performance windows and a 20 per cent window-to-wall ratio.

Continuous exterior insulation and batt insulation used within stud cavities helped achieve high performance. To provide an uninterrupted blanket of continuous insulation, the existing roof overhangs were cut off. Thereafter, new eave overhangs were installed for good water control and to maintain architectural intent. New, high-performing windows were installed to maximize the overall building performance. More on this, later.

**INSULATION SYSTEMS**

Four-inch-thick exterior insulation in two staggered lifts of expanded polystyrene (EPS) foam board and graphite-impregnated EPS (GPS) wrapped the exterior walls, and seven-inch-thick EPS and GPS insulation wrapped the warm roof. Pine strapping (one-by-three) on the walls and roof allowed the attachment of siding and roofing (see photo on page 19), and provided a vented rainscreen cavity. Long screws secured the strapping to the framing at the walls and roof. I chose EPS and GPS foam board insulations based on good insulative properties, lower costs, and lower global warming blowing agent potential (see Figure 3 on page 19) and mineral wool batt insulation to fill walls and ceilings due to its excellent fireproofing, soundproofing, and insulating properties.

Spray foam insulation was decided against based on its very high global warming blowing agent potential, toxicity, and flammability. There are also concerns with its long-term airtightness (one of its primary benefits). In considering other insulation materials, high material costs and proper airtightness also played a part. Do your research to find the best fit for your project.

**AIR BARRIER AND VAPOUR RETARDER**

The traditional poly vapour barrier was designed out to prevent the risks associated with a vapour sandwich caused by the vapour impermeable poly sheet on the interior and foil-faced EPS on the exterior. These two impermeable surfaces could trap moisture within the wall. If not allowed to dry, trapped
moisture could lead to building failure. Moisture could enter from the interior in the form of water vapour through an electrical receptacle or from liquid water penetration around a window. It’s a factor of *when*, not *if* there will be moisture penetration.

The building’s vapour retarder was provided by latex paint on drywall using the air-tight drywall approach, a method approved by the *Ontario Building Code*. Disclaimer: this method is incredibly tricky to do correctly and should only be completed by experienced professionals. A smart vapour retarder was used in the bathrooms. Although a robust design, an even more resilient design would have been to drop the foil facer on the exterior and provide a smart vapour retarder on the interior behind a service cavity; out of harm’s reach, from electrical, plumbing, and other service penetrations. At the building’s rear extension and over the roof structure, the air barrier was oriented strand board (OSB) sheathing with taped seams. Elsewhere, the air barrier (and water control layer), was provided by the foil-faced taped insulation seams. It’s best to provide the air barrier toward the building interior, which I did for the rear extension. The air barrier could also double as your vapour retarder if installed correctly. I used red tuck tape to tape the foil-faced insulation, which was an effective, low-cost solution at the time. However, it was later found to de-bond indiscriminately on the roof and walls to the foil facer, so I replaced the tape with a high-quality, acrylic adhesive tape with outstanding results. I guess you get what you pay for.

**WINDOWS**

The windows were high-performance, triple glazed, double low-e coated, fiberglass-framed windows. To deal with the thicker walls, factory installed interior jamb extensions were fitted to allow the windows to align with the exterior insulation plane, which maximizes thermal performance. The low-e coating and glazing surface were customized on each window elevation to maximize solar heat gain in the winter and minimize it in the summer.

**MECHANICAL HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) SYSTEMS**

High-performance heat recovery ventilators (HRVs) are critical for high-performance, air-tight buildings. The HVAC systems, or as I call them, the comfort

### Flannery, Inc.

*Manufacturer of Specialty Aluminum Trims*

---

Flannery is the only manufacturer of aluminum trims with a full line of products for application in each of the following wall systems:

- stucco
- drywall
- fiber cement panels
- millwork panels
- composite siding

**NOW OFFERING TRIMS FOR LEDS and Suspended Ceilings**

---

info@flannerytrim.com | www.flannerytrim.com | 300 Parkside Dr. San Fernando, CA 91340 | T: 818-837-7585 | F: 818-837-1155
systems, are comprised of a combined HRV and heat pump system. This specialized, all-in-one unit provides fresh air with HEPA filtration, heating, cooling, and dehumidification, operating based on sensors of temperature and humidity. The unit, with a coefficient of performance (COP) of four, lives in the conditioned knee wall to optimize space. For future builds, I would prefer a standalone HRV and heat pump, as each system has its own job. These combined systems could be reserved for very small buildings, such as multi-unit residential buildings.

A mid-efficiency (67 per cent) gas fireplace was selected for supplemental heat and ambience. It provides a resilient heat source that operates without electricity during power outage and is sized to heat the entire house in winter, if needed. The fireplace incorporates a direct, coaxial vent to draw and preheat combustion air from the exterior. This provides three benefits:

1. Sustains an air-tight building assembly;
2. Maintains a pressure-equalized space, so not to draw in uncontrolled and unconditioned exterior air; and
3. Improves efficiency.

I installed a high efficiency (95 per cent) direct vent condensing tankless gas water heater. While these gas units are very efficient, there have been large leaps in electric-driven hot water technologies over the past decade. Heat pump water heaters have extremely high COP levels, with one manufacturer having a published COP of six!

**CLOSING**

While this build did not pursue any high-performance certifications, it certainly entailed a lot of high-performance systems and is leaps ahead of the standard code minimum build. The hands-on experience taught me many lessons. For me, the project was a success, both in performance and architectural aesthetics. For others pursuing a high-performance project, the team’s experience and collaboration will be most critical for the success and cost of the build.

Grant Walkin, M.Sc., P.Eng., is a building envelope and structural glass engineer at Entuitive Corp. in Toronto. He specializes in commercial, institutional, and residential high-performance buildings.
Making Buildings Better™

At RDH, we have a passion for Making Buildings Better. Whether it’s as part of a design team for new construction projects or working with a condominium owner group to plan for the renewal of building systems after 30 years of service, our focus is on helping clients make informed decisions that lead to durable and effective buildings.

Learn more at rdh.com

Contact Us
26 Soho Street #350 Toronto, ON
T: 416 314 2328 E: tor@rdh.com

167 Lexington Court #6, Waterloo, ON
T: 519 342 4731 E: wat@rdh.com
It is important to understand that, in addition to designing a roof for thermal and waterproofing performance, a roof covering is responsible for providing external fire protection for both the roof deck and building below. A roof can be exposed to several potential fire risks, including fire spreading from an adjacent building or hot works activities at the roof level, such as welding or torching.

Not all roof membranes and assemblies provide the same degree of fire protection, though. It’s critical to understand how fire retardant a roof is when designing a building with combustible construction, if the roof membrane is being exposed to high temperatures, and if the type and occupancy of the building is of a sensitive nature.

Our current Ontario Building Code (OBC) requires that a roof covering be tested to achieve a rating of either Class A, Class B, Class C, or unrated (ranging from the highest level of fire protection to the least). This information provides a basis to compare how different roof systems perform when exposed to simulated fire exposure tests. This article will focus on roofs for buildings that fall under Part 3 of the OBC, and will address only the external fire performance of roofing assemblies. The classification and fire rating of a roof is based on pre-tested assemblies and not the performance of individual components. If alternate roofing components are submitted or installed, the roof assembly may not classify for a rating.

WHAT IS THE CURRENT OBC REQUIREMENT?

The scope of this article will address only the large and complex buildings that fall under Part 3 of the OBC. Buildings that fall under this classification can include schools, hospitals, office buildings, large apartments, condos, shopping malls, theatres, and industrial buildings. Under Part 3, there are two articles included in Subsection 3.1.15., Roof Covering (see Figure 1 on page 22).

When we interpret these two articles, we can conclude that if your roof assembly (all components including membrane, surfaced, insulation, vapour barrier, and cover board) has not been tested, does not have a Class A, B, or C rating and is not exempt under the provisions in Article 3.1.15.2, then it does not meet the minimum intention of the OBC and, therefore, is not compliant. These requirements apply to either new construction roofs, roof restoration, roof recovery, or roof replacement projects.

DEFINING A CLASS A, B, OR C FIRE RATING

There are three classifications a tested roof assembly can achieve (and a fourth of “unrated” if it has not been tested or if it has not met the minimum test requirements and failed). See Table 1 on page 23.

The classification of each roof assembly indicates how well the roof system performed against exposure to different fire tests. Although the test and classification do not necessarily illustrate the exact performance of a roof system under real-world fire conditions, they do provide a basis for comparing roof covering materials under simulated fire exposure.
Since the first edition was published in 1987, there have been relatively few changes to the CAN/ULC-S107 Standard (which is also equivalent to the American standards ASTM E-108 and UL-790). The intention of the standard is to demonstrate how easily a roof covering can be ignited by direct flame or by burning brands landing on the roof, the extent of the flame spread over the roof surface, and the tendency for flaming or glowing pieces of the roof covering to break loose and be carried from the roof to other portions of the roof or onto other structures.

Roofing systems are tested on the roof covering assembly, deck type, and deck incline. Roof covering assemblies are selected by the designer or client, or are recommendations provided by the manufacturer.

Sample decks are constructed in UL-approved test facilities and mounted on a calibrated test apparatus.

Any of the following items would constitute a failure during testing:
- Any portion of the roof covering blowing off, exposure of the roof deck for combustible roof decks only, or breaking apart and continuing to flame or grow after it has reached the floor;
- Sustained flaming of the underside of the test deck; and
- Flame spreads exceeding the maximum distance for Class A, B, or C ratings, or if the lateral spread of flame reaches the edges of the test deck.

SELECTING A FIRE RATING

Now that you understand how a rating is achieved and what each rating represents, the next question to answer is “how do you know which rating to select for your building?” In an ideal society, all roofs would be constructed with a Class A fire rating; however, sometimes project factors—such as value engineering structural limitations—can reduce the level of fire protection provided.

Other than the exceptions detailed in Article 3.1.15.2, there are currently no guidelines provided in the OBC to assist with the selection of a Class A, B, or C roof. It is the responsibility of the designer, the building owner, or the facility management team to select the most suitable fire rating. The Code sets a minimum design requirement; however, certain municipalities and institutions have mandated higher standards in their own regulations and by-laws.

As a designer, it is important to verify with local authorities if a more stringent fire rating is required. It is equally important to also consider the sensitivity of the occupants within the buildings and the type of activity the roof will be exposed to. As a building owner or facilities manager, it may be prudent to review current design standards and establish a minimum fire rating requirement for future new construction or re-roofing projects. At a minimum, the roof should have a Class C rating—but you should always strive to design and install a Class A fire rated roof system.

HOW TO VERIFY YOUR ROOF HAS A RATING

All tested roofing assemblies and ratings can be found online in a database hosted by UL/ULC at http://productspec.ul.com/details.php?ccn=TGFU. The database provides some generic assembly options, as well as tested assemblies from a list of different roofing manufacturers. The first, and most efficient, way to determine the fire rating would be to consult your basis-of-design manufacturer and request a letter indicating the roof assembly classification and listing. Substitutions, including type of component or thickness, can only be granted by UL and may require additional testing.

FUTURE THOUGHTS

Roof systems contain relatively few components; however, the confusion arises with the sheer number of different manufacturers and different products available in the market. Because the classifications are based on test results of specific products, any type of substitution can alter whether the roof...
system meets Code and whether it has a fire rating. Through my research, I have identified some opportunities for stakeholders to simplify and streamline the Code compliance process.

For the OBC, there is an opportunity to provide generalized guidelines that would set the minimum fire rating requirements based on the type of building and occupancy. For UL/ULC, there is an opportunity to increase the ease of searchability in their TGFU database by assigning a unique reference number for tested and rated systems. This would allow designers and manufacturers an easier way of quickly identifying or searching for an approved system. And finally, for manufacturers who are investing heavily into the testing and approval of various systems, there is an opportunity to create a standardized form, letter, or specification verbiage indicating the classification and approved fire rating.

Meagan Kikuta is a design professional representative for Tremco with 10 years’ experience in the Building Science and Roofing industries. Meagan is currently serving her second term as the director of communications for the Ontario Building Envelope Council.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Fire Exposure Rating</th>
<th>Max. Flame Spread</th>
</tr>
</thead>
</table>
| Class A        | • Effective against severe fire exposure  
• High degree of fire protection to the roof deck | 1,830 mm or 6 feet |
| Class B        | • Effective against moderate fire exposure  
• Moderate degree of fire protection to the roof deck | 2,440 mm or 8 feet |
| Class C        | • Effective against light fire exposure  
• Measurable degree of fire protection to the roof deck | 3,960 mm or 13 feet |

Table 1: A description of classification ratings.

REFERENCES
Achieving certification to the Canada Green Building Council’s (CAGBC) Zero Carbon Building (ZCB) Standard can seem like a daunting task, particularly on a retrofit project. The relative impact of thermal bridging and envelope transitions are amplified in low-energy buildings and can be particularly challenging to resolve in a retrofit scenario.

As an example, the Thermal Energy Demand Intensity (TEDI) requirement for Passive House Institute (PHI) is so low compared to the actual usage of many existing buildings that the heating loads must be reduced by 95 per cent or more to meet the requirements. The good news is that Zero Carbon buildings aren’t quite that demanding.

The TEDI requirement in the Toronto area for Zero Carbon buildings is 30 kWh/m² compared to just 15 kWh/m² for PHI. Even so, how do you go about reducing heating demand by a factor of five, or even 10, from an average building? The key issue is important for us in the Ontario Building Envelope Council (OBEC) community, since it all hinges on envelope performance.

Significant heating demand reduction was exactly the challenge faced by Humber College’s Deep Energy Retrofit Project for the NX Building. We started with the envelope design targets:

- Really, really good glass and window frames;
- R-40-effective cladding and R-50-effective roofing; and
- An almost fanatical devotion to controlling thermal bridging (this is where PHI is very demanding).

How do we achieve these in reality? The easy part is defining excellent glazing and a well-thermally broken cladding system. The hard part comes with controlling thermal bridging, so the critical details don’t allow much heat flow to reduce the overall performance. When you improve the main field performance, the previous thermal bridges, which may have only represented 20 per cent to 30 per cent of the total heat flow, may now be responsible for more than the entire main field heat losses. For example, a one-metre length of poorly insulated grade slab and foundation wall may be equivalent to two-square-metres of cladding losses in an existing building. When the new cladding reduces the main field heat flow by 80 per cent, this same grade slab now represents 10-square-metres of cladding, or nearly three full storey heights of wall above.

It becomes clear how important it is for the envelope designer to develop high-performance details at slab edges, parapets, and window transitions. Just a handful of poorly performing details can derail the overall performance of the whole building. On the bright side, we now have many tools at our disposal to guide us in achieving the necessary performance such as the BC Hydro Building Envelope Thermal Bridging Guide, which now has a library of around 400 modelled details, and Passive House Institute certification details related to window transitions.

Borrowing from the PHI approach and wrapping the insulation over the window frames is one example of virtually eliminating thermal bridging at window transitions, which can be a large quantity of linear transmittance losses (see Figure 1 on page 25). However, the real challenge is constructing transitions like this to stay true to the assumptions of the modeling and not introduce miscellaneous clips and fastening elements. These may seem like minor components,
and may even be ignored by unsophisticated modelling, but minimizing or eliminating these elements may determine whether the detail actually performs as intended.

Even architectural details such as sun-shade elements, which are often an important feature of high-performance buildings, can be designed into the cladding to take advantage of thermally broken cladding supports. This can prevent the introduction of heat losses that undermine the other value of these elements, like solar heat gain control. This integration may create challenges, so a robust shop drawing and mock-up process involving multiple trades is essential to achieve the required performance. These are not unique challenges, but the impact can be amplified in low-energy buildings, so their importance is also amplified.

The wonderful benefit of achieving a truly high-performance envelope is it allows the mechanical designers to do things that used to seem impossible, like designing a building where the biggest energy loads are directly related to the actual use of the building—lighting and plug loads. At Humber College Building NX, the design team reached a counter-intuitive “a-ha” moment, where they realized that slightly more high-performance glass was an energy benefit since the daylighting benefit could reduce lighting loads and, therefore, the overall building energy use. Starting with a great envelope provided the design team and building owner with benefits we hadn’t anticipated.

I fully expect there are more of these pleasant surprises waiting for us as the industry keeps advancing and that low carbon retrofits will become the norm, as owners recognize the major financial benefits of operating low-energy buildings.

---

Steven Murray, P.Eng., is a principal and senior building envelope engineer at Morrison Hershfield and a BSSO instructor from program founding to 2016. He has experience in the rehabilitation and retrofit of existing buildings and has also developed expertise with six-storey timber framed and mass timber buildings, and the unique envelope challenges they entail.
A great deal of research has been done to analyze the age-old problem of deterioration of underground parking garage concrete slabs on grade. The symptoms of a weeping tile drainage problem can often be elusive and difficult to uncover, as they are located underneath the concrete slab and buried in soil. Many issues go undetected for years, only becoming obvious when the concrete slab develops efflorescence or when mould and other microbial contamination problems appear. By knowing and understanding the source of water and its movement mechanism, effective solutions can be developed to eliminate or slow down moisture movement.

In this case study, we were called to address the issues in an old underground parking garage. The old, clay weeping tile drainage system had stopped working and caused water problems. The blocked drainage system was a major concern that had to be addressed immediately. Once weeping pipes were blocked, the water table rose; the sand layer beneath the concrete slab became a reservoir for water, which created hydrostatic pressure. As a result, there was no way for the water to drain or evaporate properly. It is well-known that moisture will always move from a high relative humidity environment to a space of low relative humidity. So, the only direction the moisture could move from below the concrete slab was up onto the surface, which inevitably led to water damage and deterioration of the slab.

**ISSUES AND PROBLEMS**

Water moisture can cause a variety of problems, like efflorescence, the white, crystalline substance that can occur on the surfaces of unsealed concrete. These deposits often contain compounds such as calcium, sodium, and potassium hydroxides or carbonates, bicarbonates, chlorides, and sulfates of calcium and magnesium. These substances typically originate as soluble compounds within the concrete that are transported and deposited on the surface by upward moisture migration and evaporation. Water is the solvent and vehicle for transporting the soluble salts to the surface. Efflorescence can form a thick layer on the surface that can completely hide the concrete’s colour, create unsightly white patches, and degrade the slab strength.

Deterioration can be found anywhere on the concrete slab, especially around cracks. Cracks at concrete joints are easily caused by higher water pressure, sealant, and vapour barrier damaging. Once cracked, the concrete can be separated at the joints and water or moisture may enter. A hairline crack can grow into a bigger problem, resulting in floor slab failures, mould growth, efflorescence, and other microbial contamination problems.

Due to concrete’s porosity and permeability, water can migrate through the material as a result of hydrostatic pressure, capillary action, and the water vapour pressure gradient. The penetration or water can be accompanied by the leaching of chemicals from the underside footing soil or the...
materials used in the concrete mix. As the water and chemicals permeate the concrete, it can begin to disintegrate, and the rebar within the slab or steel core column within concrete cladding can start to corrode. As this happens, the steel expands and creates tensile stresses that can cause internal cracking, spalling, or delamination of concrete. One problem may be caused by numerous factors.

**RECONSTRUCTING CONCRETE SLAB AND WEEPING TILES**

After a site inspection, it became clear the existing clay weeping tile drainage system was unsuitable for the existing building system. We selected a polyvinyl chloride (PVC) tile to replace the existing clay weeping tile, and kept as many of the existing weeping holes as possible within the concrete foundation wall to maintain the structure’s strength and reduce reconstruction labour. We used high-performance, galvanized steel in the trench system to allow for easy draining, should the system become clogged, and we installed drains throughout the slab to allow water to drain more easily.

**NEW PVC WEEPING TILE**

Many of the earliest plumbing systems were comprised of clay sewer pipes, which still hold up against the test of time—if they remain unplugged and uncracked. While they are made of green materials, these pipes can have serious drawbacks that make them inappropriate for many applications. Modern PVC pipe, on the other hand, has many advantages, including the following:

- It is much easier to make holes in and is also quite malleable. The pipes also connect easily and securely to one another;
- It is lightweight, making it easy to transport; and
- It has high tensile strength and high compressive strength, allowing the pipes to endure abuse from extreme environments.

**CONCRETE SLABS**

Concrete slabs can crack due to many factors, including construction movement, shrinkage before and / or after hardening, excessive loading, settlement, freeze / thaw cycles, structural defects, fluctuations in temperature, earthquakes, and more. Some cracks are preventable; others aren’t. But
all cracks can become problems. To prevent initial cracks, the concrete itself must be mixed properly. If the water-to-cement ratio is too high, the slab will be too porous, leading to issues with bleed water, plastic shrinkage cracking, and primary efflorescence, increasing the chance cracks may occur. Once a slab has cracked, moisture may enter and cause corrosion along the concrete reinforcement, so, in this case, we used an epoxy-coated rebar to protect against corroding. Additionally, if a concrete slab is properly waterproofed, it will better maintain its integrity.

**HIGH-PERFORMANCE VAPOUR BARRIER**

If a concrete slab is properly waterproofed, it will reduce the occurrence of water-related problems. The longer it remains properly waterproofed, the longer the slab will maintain its integrity, and the longer you will go without water damage, which is why installing proper vapour barriers is essential.

Once a good vapour barrier is installed beneath the concrete slab, it will help stop water from rising and will prevent any other volatile organic compound contaminated gas from rising into the building. This will then contribute to an energy-efficient build; it will mean less work for your ventilation system and a better moisture-protected and thermal-protected building overall—a reason most green building codes include high-performance vapour barriers in their specifications. Presently, there is no cost-effective way to protect the building from encroaching moisture; however, over time, if you do the job properly the first time, it will save you money over the long-term.

The installation detail at the joint is also very important for proper protection, as these gaps allow moisture to seep in more readily than the solid slab. The vapour barrier must be looped at the joint to allow for the movement of concrete, while still sealing the gap at the bottom of the joint, ensuring no moisture gets into it. This typical detail also is applied around the re-finishing concrete-steel column and at other construction joints.

**SAND MAT AND CRUSHED STONE**

A sand mat layer must be installed below the vapour barrier to prevent the sand from becoming a water reservoir. This also provides a smooth surface, upon which the concrete slab and vapour barrier can be installed. Water drains faster through gravel than it does through most types of soil, so if you have a layer of gravel atop the earth, with the weeping tile installed within this layer, it will provide a pathway for water to flow easily away from underneath the slab.

With this new drainage system and slab assembly, the risk of creating a water reservoir was eliminated, even if the groundwater table rises at any time during reconstruction. If any problems do occur, like cracks in the slab, or tears in the vapour barrier, there won’t be a water reservoir present to cause water damage. Even so, don’t ignore these issues if they arise!

The new, dependable drainage system will provide long-lasting control of the ground water and water table, relief on the hydrostatic pressure, and retarding water moisture transmission, which will go a long way toward preventing moisture problems in the parking garage.

Emma Ruixian Qian is an architectural technologist at WZMH Architects in Toronto. She specializes in the building envelope.
The terminology “waterproofing membranes” is common in our industry. There are several types of waterproofing membranes with different physical properties and applications. Today, we’re focusing on waterproofing membranes in underground parking garages, specifically on intermediate slabs between floors of a parking garage. Most of these structures are composed of cast-in-place concrete slabs. In these intermediate garage slabs, the waterproofing membrane is exposed to vehicular traffic, hence the term “traffic topping.”

PROTECTING THE CONCRETE

The basic function of a waterproofing traffic topping system is to protect the underlying structure from water penetration, which can cause the embedded steel to corrode. Protecting intermediate garage slabs from water ingress is required in order to comply with the relevant standard CSA S413-14 Parking Structures. In Canada’s cold climate, the traffic topping system serves to protect against water ingress and migration of deicing products. These chemicals typically contain chlorides that are prone to corroding materials. Once this chloride contamination reaches a certain concentration, corrosion can continue to form, even in areas without active water ingress. This ongoing corrosion and subsequent delamination lead to frequent repair programs and reduced structural capacity.

VEHICULAR TRAFFIC TOPPING SYSTEMS

Traffic toppings must withstand physical damage caused by vehicle traffic. It’s essential the system has performance characteristics to resist dead loading, shearing forces, and abrasion from vehicles. Vehicular topping systems for suspended concrete slabs found in parking garages come in two basic types:

• **Thin systems:** These are typically elastomeric, cold-applied systems. They are commonly, but not always, made with polyurethanes. They consist of a base layer, which adheres to the concrete surface, and one or more “wear” coats. In these systems, the base coat layer has a minimum thickness, typically between 0.65 millimetres to 1.0 millimetres (25 to 40 mils), and the topcoats are each between 0.3 and 0.4 millimetres (12 to 15 mils) thick, depending on the manufacturer’s requirements. Fine aggregates are broadcast into both the wear and top coats to add durability to the membrane and provide a slip-resistant surface. This is applied in 90 per cent of parking garages.

• **Thick systems:** These are the legacy systems initially used for waterproofing. The bottom waterproofing layer is a hot-applied, rubberized asphalt installed in two layers, utilizing a reinforcing polyester fabric or “fleece.” The membrane is applied in two lifts, with a total thickness of approximately three millimetres (120 mils). The top traffic layer in this system is typically a hot-applied, mastic asphalt pavement. While hot, it resembles what you could call a “black milkshake.” While cold, it resembles typical asphalt pavement without the coarse stone aggregate. It’s usually applied in a thickness that ranges between 10 millimetres and 20 millimetres (400 to 800 mils). When finished, this system is up to 20 times thicker than a thin system.

COMPARING THE TWO SYSTEMS

How do these two systems compare when it comes to issues such as bridging cracks, traffic forces, chemical fluid leaks, and cost and maintenance? There are many things to watch for and take into consideration, including:

• Bridging cracks: The loss of moisture from fresh concrete results in a reduction in volume, which leads to drying shrinkage cracks. Water contaminated with salt reaches the reinforcing steel through cracks in the concrete. The waterproofing membrane must be able to bridge the...
FEATURE

ic membranes can be more expensive to install than elastomeric systems. It has also become more difficult to find qualified tradespeople to install these products. Both systems require regular maintenance. Thin systems are easy to inspect to identify defective areas. Localized repair is as simple as removing and re-applying a new membrane with minimal tools and equipment. Thick systems also need to be regularly inspected for tire shears and damage from vehicle chemical leaks. The waterproofing membrane is concealed, making it difficult to identify defects or water entry points.

Comprehensive repairs are required for both systems at some point over their lifetime. This is often a good time to switch from thick to thin systems for simplified future maintenance.

CHOOSING THE BETTER SYSTEM

Both systems have pros and cons; however, the industry is moving toward thin systems. Is thin the better choice? Maybe—but this system still has its drawbacks, like durability and curing time. Repairs tend to be required every five years, particularly with high traffic volumes, and it takes the full system three to four days to cure in each area.

HISTORY OF PUMA

Over 30 years ago, methyl methacrylate (MMA) waterproofing was developed in Europe. The rapid curing system wasn’t temperature-sensitive and featured extreme durability, tenacious adhesion, and superior abrasion resistance. However, it was too hard and brittle. It lacked the flexibility and elasticity required in parking garage waterproofing applications. From here, the idea of adding polyurethane into the synthetic MMA resin was tested, and the Polyurethane Methacrylate (PUMA) formula was produced. PUMA technology allows the flexibility of polyurethanes in the base layer, while the top-wearing surface boasts the toughness of the MMA resins.

BENEFITS OF PUMA

Thanks to the fast-cure resin, it needs only 45 minutes to an hour to cure between coats. This minimizes disruption and closure times, so building owners and property managers can quickly repair and reopen their parking garages. The combination of polyurethane flexibility with methacrylate toughness means manufacturers can offer up to 20-year warranties, while standard urethanes are typically warranted at five years.

Primarily, PUMA systems are chemically cured, meaning they are cold-weather-tolerant and can be applied in temperatures as low as -7°C. Additionally, it has high chemical resistance when exposed to petroleum products.

These systems are currently a significant cost premium to standard polyurethane. In some applications, the shorter disruption and reduced labour costs may offset the higher costs. PUMA can be applied at the garage entrance, sharp turns, and high-volume traffic aisles, where a standard polyurethane system would be sufficient at the parking stalls and in low-traffic areas. This way, we get the high-performing system where we need it at a reduced cost.

The inherent qualities of PUMA chemistry make it ideal for projects with tight timeframes and stringent performance requirements.

Mohamed Hussein, P.Eng., BSS, is a building science engineer at Morrison Hershfield. He is a licensed engineer in the province of Ontario and a certified Building Science Specialist.
Upcoming Events

CANADIAN EVENTS

THE CANADIAN FEDERATION OF CONSTRUCTION SAFETY ASSOCIATIONS’ ANNUAL GENERAL MEETING
June 15 to 16, 2020
Regina, Saskatchewan
The CFCSA works as an umbrella organization for provincial and territorial Construction Safety Associations with a shared interest in promoting awareness of construction health and safety, improving information sharing, and collaboratively producing workplace health and safety training standards/information resources. Attend the AGM for the latest news and updates.
https://cfcsa.ca/meetings.php

THE 4TH ANNUAL FIRST NATIONS HOUSING & INFRASTRUCTURE WEST FORUM
June 24 to 26, 2020
Vancouver, British Columbia
The 4th Annual First Nations Housing & Infrastructure West Forum will highlight the latest funding announcements and financing opportunities for both housing and infrastructure needs. The forum will discuss how communities are bridging the gap between on- and off-reserve housing and offer networking with industry leaders in energy, construction, and design to identify the latest technologies that will support communities for generations to come.
https://www.canadianinstitute.com/first-nations-housing-infrastructure-west

BOMEX CONFERENCE
September 22 to 24, 2020
Vancouver, British Columbia
BOMEX 2020 is the 30th Annual Building Excellence Summit, where attendees can learn from highly engaging speakers, attend leading-edge educational sessions, network with industry professionals, and celebrate at the National Awards Gala.
http://bomamanitoba.ca

BUILDEX ALBERTA
November 4 to 5, 2020
Calgary, Alberta
BUILDEX Alberta is the forum connecting the province’s holistic building industry. The largest event of its kind in Alberta, BUILDEX brings together an ecosystem of professional communities to learn, network, and be inspired by the latest trends, innovations, and challenges from an industry in transformation.

BUILDEX VANCOUVER
February 10 to 11, 2021
Vancouver, British Columbia
BUILDEX Vancouver is western Canada’s largest forum connecting the holistic building industry, uniting tradition and innovation to shape the spaces of tomorrow. It brings together talent from across the industry to interact, learn, and discover the newest innovations of a market in constant transformation.
http://www.thesafetyconference.ca

MANITOBAN BUILDING EXPO
October 27, 2020
Winnipeg, Manitoba
Over 100 companies exhibited at the 2019 Trade Show, and this year promises to be bigger and better! This is the premier showcase for all the latest products and technologies for commercial and institutional buildings and is a terrific learning and networking opportunity for industry professionals. You will not want to miss it! Attend the Expo trade show free-of-charge to network with industry experts and get all the latest product news and trends.
http://bomamanitoba.ca

PASSIVE HOUSE CANADA CONFERENCE
November 18 to 20, 2020
Victoria, British Columbia
The Passive House Canada Conference brings together building professionals, manufacturers, and suppliers, who, today, deliver the buildings to be mandated by future building codes. Participants can take part in engaging and interactive sessions that will further enhance their knowledge of the standard and how it supports the local city’s mandate to reduce emissions. Those new to the standard will find opportunities to network and learn from other Passive House enthusiasts.
https://conference.passivehousecanada.com

THE BUILDINGS SHOW
December 2 to 4, 2020
Toronto, Ontario
The Buildings Show provides an unforgettable experience as North America’s largest event for products, services, educational programming, and professional networking.

**All events are up-to-date as of printing but may be changed without warning due to the ongoing COVID-19 pandemic. Please check each event’s website for the latest details available.**
BUILD YOUR REACH

The Fall 2020 issue of Pushing the Envelope Canada will be at

THE BUILDINGS SHOW
December 2 to 4, 2020 | Toronto, Ontario

WITH OVER 30,000 ATTENDEES, THE BUILDINGS SHOW PROVIDES AN UNFORGETTABLE EXPERIENCE AS NORTH AMERICA’S LARGEST EVENT FOR PRODUCTS, SERVICES, EDUCATIONAL PROGRAMMING, AND PROFESSIONAL NETWORKING.

DON’T MISS YOUR CHANCE TO ADVERTISE IN THE NEXT ISSUE AND BE SEEN BY THE KEY DECISION-MAKERS IN YOUR INDUSTRY.

CONTACT SALES@MATRIXGROUPINC.NET OR CALL (866) 999-1299 TO SECURE YOUR SPOT TODAY.
BCBEC PRESENTS BUILDING SMART USING AN INTEGRATED DESIGN PROCESS

On April 8, BCBEC and BC Housing presented a seminar that discussed the new Integrated Design Process (IDP), which is a collaborative design approach that is intended to optimize performance, cost, occupant comfort, and resilience of a residential building. It involves engaging the builder and their team of designers, mechanical contractor, and energy advisor at the conceptual design stage.

The seminar discussed in depth the structure of IDP, the applications to various building types, and also had case studies and experiences from across BC and beyond. The guest speakers included Andrew Oding, Vice President of Building Science of Building Knowledge Canada Inc.; Gilles Lesage, President of Total Home Solutions; Mark Bernhardt, President of Bernhardt Contracting Ltd.; and Einar Halbig, Principal of E3 Eco Group.

ABEC DISCUSSES THE MACKIMMIE TOWER RETROFIT CASE STUDY

At their February Luncheon, on February 26, the two presenters, John Souleles and Adam Stoker, discussed the various developments and project drivers along with the unique design and construction processes employed in this low carbon deep retrofit project.

Both presenters shared a technical review of the active double-skin façade system that provides an exemplary interior environment, and a 90 per cent reduction in energy consumption. John Souleles is a project manager and design architect with DIALOG and is currently working with the University of Calgary on the MacKimmie Complex project. Adam Stoker has more than 15 years of experience working with energy efficiency and sustainable buildings.

The MacKimmie Complex project is a new standalone facility and existing building retrofit, which is set to accommodate academic excellence while striving for Net Zero Carbon. This project is one of 16 projects participating in the CaGBC Zero Carbon Building Pilot Program.

MBEC EXPLORES THE FACTORS OF CLADDING REQUIREMENTS

On March 26, the Manitoba Building Envelope Council hosted a presentation on Cladding and the Manitoba Building Code. Geoff Mikolayenko, Eng. L., C.E.T., and Dr. John Frye lead the conversation on how spatial separation, building height and non-combustible construction, and related standards address the issue of fire spreading from building to building.

Geoff Mikolayenko is currently the City of Winnipeg’s Administrator of Commercial Inspections. He is responsible for the overall direction and leadership of the Commercial Building Inspection services, encompassing construction methods, bylaw compliance, and correction of dangerous conditions involving electrical, mechanical, plumbing, building, fire, and life safety systems. Dr. John Frye has spent the last 26 years with the City of Winnipeg Building Inspections Department before he retired in 2000. He has held several senior positions in the Building Inspection Department.

QBEC EXPECTS A GREAT GROUP OF CONFERENCES

Are you ready to be launched into the heat of the future? Join QBEC at their conferences on April 29 and May 14 where they, in collaboration with FORMES Magazine and the School of Advanced Technology (l’École de technologie supérieure, ÉTS), will be discussing the latest scientific and technological developments in building science.

Topics planned include optimizing the building envelope for Quebec’s new energy efficiency regulations and the requirements of the National Building Code concerning fire safety of exterior walls and combustible insulation.

Practitioners, researchers, and experts will have the opportunity to discuss issues related to the design, construction, and operation of buildings, with an emphasis on building envelopes. Architects, technologists serving in architectural offices, as well as other stakeholders in the construction industry are invited to attend this two-day conference.
<table>
<thead>
<tr>
<th>Section</th>
<th>Company Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architectural Aluminum Building Products</td>
<td>Alumicor</td>
<td>20</td>
</tr>
<tr>
<td>Building Enclosure Consultants</td>
<td>RDH Building Science Inc.</td>
<td>20</td>
</tr>
<tr>
<td>Building Envelope</td>
<td>Convoy Supply</td>
<td>IFC</td>
</tr>
<tr>
<td>Building Products Supplier</td>
<td>Building Products Canada</td>
<td>16</td>
</tr>
<tr>
<td>Consulting</td>
<td>EXP</td>
<td>30</td>
</tr>
<tr>
<td>Consulting Engineers</td>
<td>Brown &amp; Beattie Ltd.</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Davroc &amp; Associates</td>
<td>11,23</td>
</tr>
<tr>
<td>Contractors</td>
<td>Corner Point EIFS, Ltd.</td>
<td>34</td>
</tr>
<tr>
<td>Curtain Wall Manufacturer</td>
<td>Gamma North America</td>
<td>15</td>
</tr>
<tr>
<td>EIFS &amp; Restoration Products</td>
<td>Durabond Products Ltd.</td>
<td>OBC</td>
</tr>
<tr>
<td>Engineers</td>
<td>RJC Engineers</td>
<td>11</td>
</tr>
<tr>
<td>Exteriar Wall Systems &amp; Trim Products</td>
<td>Flannery Trim</td>
<td>18</td>
</tr>
<tr>
<td>Fenestration &amp; Thermal Barriers</td>
<td>Azon</td>
<td>34</td>
</tr>
<tr>
<td>Fire-Rated Glazing Solutions</td>
<td>Vetrotech Saint-Gobain</td>
<td>25</td>
</tr>
<tr>
<td>Insulated Concrete Forms</td>
<td>NuDura Integrated Building Technologies</td>
<td>28</td>
</tr>
<tr>
<td>Leak Detection</td>
<td>International Leak Detection</td>
<td>6</td>
</tr>
<tr>
<td>Manufacturer of Glass Blocks</td>
<td>Seves Glass Block</td>
<td>12</td>
</tr>
<tr>
<td>Masonry Anchors, Tiles &amp; Accessories</td>
<td>Blok-Lok Ltd.</td>
<td>8</td>
</tr>
<tr>
<td>Precast Concrete Wall Assembly Supplier</td>
<td>CPCQA</td>
<td>4</td>
</tr>
<tr>
<td>Restoration &amp; Building Envelope Specialist</td>
<td>Brook Restoration Ltd.</td>
<td>IBC</td>
</tr>
<tr>
<td>Roofing &amp; Building Consultants</td>
<td>Infrared Thermographic Analysis Inc.</td>
<td>20</td>
</tr>
<tr>
<td>Roofing Consultants</td>
<td>Dycon Roof Consultants Inc.</td>
<td>11</td>
</tr>
<tr>
<td>Roofing Solutions</td>
<td>Tremco Canada</td>
<td>20</td>
</tr>
<tr>
<td>Stucco</td>
<td>Schut Plastering &amp; Stucco</td>
<td>20</td>
</tr>
<tr>
<td>Thermal Bridging Solutions</td>
<td>Armatherm Thermal Bridging Solutions</td>
<td>3</td>
</tr>
<tr>
<td>Testing Equipment</td>
<td>The R.M. Group</td>
<td>27</td>
</tr>
<tr>
<td>Testing Laboratory</td>
<td>Can-Best</td>
<td>31</td>
</tr>
</tbody>
</table>

Advertise in the next issue of *Pushing the Envelope Canada*  
Contact sales@matrixgroupinc.net or (866) 999-1299 for more information!
Welcome to the family.
Brook Restoration Ltd. acquires Wall-Tech Restoration Inc. to accelerate growth of its Building Restoration Portfolio.

Learn more at Brookrestoration.ca

HEAD OFFICE
11 Kelfield Street
Toronto, ON
M9W 5A1
T: 416-663-7976
F: 416-663-3650

OTTAWA
1520 Lagan Way
Ottawa, ON
K1B 3S9
T: 613-248-8887
F: 613-248-8881

AJAX
80 Fuller Rd.
Ajax, ON
L1S 3R2
T: 905-686-3640
Superior, Non-Combustible Cladding

Durex Equalite Select Non-Combustible Cladding System

ULC Tested, CCMC Evaluated
Mineral Fibre based EIFS System

- CCMC Evaluation: Thorough and Extensive Technical Evaluation by the National Research Council of Canada
- Self-Adhered, Modified Bituminous Waterproofing Membrane or Liquid Water Resistive Barrier with Proven Nail Sealability
- Non-Combustible Fastening Solution
- Non-Combustible Insulation
- PATENT PENDING

- Non-Combustible Cladding
- 10mm Geometrically Defined Drainage Cavity
- Meets Requirements of NBC & OBC Table 3.2.3.7 (Permitted Unprotected Opening <10%)
- Meets Requirements of NBC & OBC Table 9.10.15.5 (for limiting distance)
- 2 Hour Fire Resistance Rating (ULC W425)
- Compliant to:
  - CAN/ULC - S716.1 and S716.3
  - CAN/ULC - S114

To explore our full product catalogue call toll free at 1.877.387.2266, contact any of our convenient locations, or visit us online at www.durabond.com