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FEATURES

DEPARTMENTS

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Samer Daibess,
President,
BCBEC

Thank you for supporting *BCBEC Elements* magazine

As this is my first term as a president of the British Columbia Building Envelope Council (BCBEC), I am honoured and privileged to be elected by my peers for this role. I would like to thank our roster of past volunteer board members for paving the way for the new board members and making BCBEC what it is today. As most of our readers know, BCBEC is a non-profit organization dedicated to providing a platform for stakeholders in the building envelope industry to discuss and exchange information on building envelope matters. BCBEC's membership is composed of all segments of the industry, including members of governments, consultants in the building envelope field, product manufacturers, manufacturing associations, contractors, developers and educators.

Secondly, I would like to thank our diverse membership for their contributions and support of BCBEC over the years. *BCBEC Elements* provides not only technical content through articles but also serves as a link between our readers and our advertisers. We would like to extend our sincere appreciation to our advertising partners for their essential financial support and endorsement of this initiative. The first two issues of *BCBEC Elements* magazine were very well received by both our readership and our advertising partners. These can be found on the BCBEC website.

In the spirit of BCBEC's mandate to promote education in the building envelope field, our team has put together this third edition of *BCBEC Elements*. We are very excited as this edition will feature a discussion of the new CSA/CAN Standard for asphalt roof shingles that highlights common application examples where the standard will apply, whether non-Canadian products meet Canadian standards and thresholds, safety with respect to consultants as outlined in WorkSafe BC requirements, a case study on the Hugh Bird rehabilitation project, and a personal profile of Mark Gauvin.

Our BCBEC directors and volunteers are now working on many initiatives to add value to our current membership. Our first premier event is the annual All-Day Conference and AGM. This year's event is scheduled for Wednesday, September 14 at the Fairmont Hotel Vancouver. We are also privileged to host the 15th Canadian Conference on Building Science and Technology (CCBST) in fall 2017. This is a three-day event that takes a considerable effort to plan so I urge you to help out and volunteer to be part of this great event. In addition to the *BCBEC Elements* publication, we will hold our regular luncheon presentations, half-day seminars in collaboration with the HPO and APEGBC, and will continue our support of local building research efforts through the Building Research Committee (BRC).

I would like to encourage our members and readers to get involved in BCBEC if you haven't done so in the past. Our volunteers are the backbone of the organization and nothing would be possible without their efforts.

Thank you for your continued support of *BCBEC Elements*. Please feel free to reach out with any comments, concerns or questions. ■

BCBEC Elements Magazine

BCBEC Elements is the official bi-annual publication of the British Columbia Building Envelope Council (BCBEC). *BCBEC Elements* magazine is designed to promote the exchange of ideas and information relating to the building envelope industry. *BCBEC Elements* is circulated to a large segment of the construction industry including architects, engineers, government agencies, product manufacturers, contractors, construction associations and educators.

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Hugh Bird Field Monitoring Study

An Overview

By Gary Parsons, Scott Croasdale and Les Yard[1]

High Performance walls in which most or all of the insulation is located exterior to the wall framing is becoming more common. With light gauge steel framed walls locating the insulation on the exterior is required to achieve necessary U values and address thermal bridging. It is common to use additional light gauge steel framing to support the cladding and insulation and most commonly this steel passes through the insulation. Increasingly, the industry has sought methods by which to minimize the thermal penalty caused by excessive conductive material support of cladding.

Continuous insulation (CI) is prescriptively required to be used with steel stud construction in order to comply with ASHRAE 90.1 and IECC standards. The effective use of insulation is also mandated by NECB 2011. Understanding both the hygrothermal benefits and structural impacts of meeting these prescriptive CI requirements using minimally thermally bridged attachment methods has been the focus of a number of industry sponsored studies by NYSERDA[2], The Foam Sheathing Coalition[3], Morrison Hershfield[4] and others.

An innovative wall design developed by JRS Engineering Ltd. for a Metro Vancouver Housing Corporation housing project in 2010 provided an opportunity to field monitor such a wall. With the support of the Dow Chemical Company and SMT Research Ltd., a five-year study has concluded and this article will summarize the background, construction methods, monitoring and results. A technical paper titled "Structural and Hygrothermal Field Monitoring of Thick Continuously Insulated Wall Assemblies Utilized in a Multi-Storey Residential Building"[5] delves into more definitive technical detail.

Images provided by JRS Engineering

FIGURE 1: NORTH ELEVATION BEFORE REPAIRS

1 The authors would like to acknowledge the collective efforts of JRS Engineering (Joel Schwartz), SMT Research (Jason Teetaert), the Dow Chemical Company (Jeff Hansbro and Craig Buck) and Metro Vancouver Housing Corporation.

2 New York State Energy Research Development Authority (NYSERDA) Fastening Systems for Continuous Insulation, Final Report 10-11, April 2010.

3 The Foam Sheathing Coalition published the following Tech Matters: Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, released 9/20/10 and updated 12/07/11.

4 Building Envelope Thermal Bridging Guide (A guide published by Morrison Hershfield Ltd. in co-operation with industry stakeholders including BC Hydro, Canadian Wood Council, the Homeowner Protection Office, FPInnovations, and Fortis BC).

5 "Structural and Hygrothermal Field Monitoring of Thick Continuously Insulated Wall Assemblies Utilized in a Multi-Storey Residential Building" authored for the 2012 BEST3 Building Enclosure Science and Technology Conference.

FIGURE 2: NORTH ELEVATION AFTER REPAIRS

BACKGROUND

As originally constructed, the wall assembly at the subject building had 1⅝ inch by 3½ inch steel studs, with R12 batt insulation infill and a semi-rigid fibreglass-insulated sheathing estimated at one-inch thickness. Therefore, the total nominal R-value of the insulation was approximately R15. However, actual effective R-value was calculated at less than R9, once thermal bridging of the steel studs and compression of the semi-rigid insulation against the steel studs and concrete floor slabs were considered.

INDUSTRY CONCERNS

The rapid increase in the thickness of CI on buildings due to more stringent energy codes, combined with increasing levels of enforcement and awareness, has raised many questions from the building community on the structural design when thicker layers of CI are included in a wall assembly. This article details the performance of this assembly design, which complies with modern code CI requirements.

INTRODUCTION AND HISTORY

The subject building is a 64-unit social housing complex in a seven-storey reinforced concrete structure, with steel stud infill walls and commercial space on the first floor. Ongoing moisture-related problems (mainly at windows and wall assemblies), aging roofs, and problematic integrations led to the need for comprehensive rehabilitation.

The original wall assembly consisted of 3 ½ inch steel studs at 16 inches on centre spanning the concrete floor slabs, interior gypsum with a polyethylene vapour barrier, and batt insulation in the steel stud cavities. On the exterior of the steel studs there was semi-rigid fibreglass covered by conventional three-coat stucco cladding. Water entering the stucco would drain down through the semi-rigid insulation, often appearing at suite floors, especially at the ground floor. Removal of the stucco cladding revealed extensively deteriorated steel studs and moisture-affected drywall (see Figure 4). The project team determined that it would be most cost effective to completely demolish large portions of the walls and install new tracks, studs and drywall.

Original Wall System

- Cement stucco with wire lath
- Semi-rigid fibreglass insulation (approximately one inch thick)
- 3 ½ inch steel studs with fibreglass batt insulation infill
- Polyethylene air/vapour barrier
- One-half inch interior drywall

The New Continuous Insulation Solution

An outcome of the ASHRAE 90.1 and IECC code committees was to increase the use of CI on both vertical and horizontal areas of the building envelope. ASHRAE 90.1 2007(2010), under the prescriptive path, requires continuous insulation on steel-framed buildings, defining continuous insulation as follows:

*"**continuous insulation (CI):** insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope."*

New (Rehabilitated Wall System)

- 7/8 inch acrylic stucco on paper-backed lath
- 7/8 inch Z-girts at 16 inches on centre, fastened with No. 10 self-tapping screw fasteners at six inches on centre
- Three inches Type 4 rigid insulation (R15), joints taped
- SA membrane (acting as the air, moisture and vapour control layers)
- One-half inch fibreglass faced exterior gypsum sheathing
- Existing 3½ inch steel studs
- Existing one-half inch interior drywall

The wall as described above and installed on the Hugh Bird Residence provides a robust wall in terms of thermal performance, resistance to exterior and interior moisture, air leakage resistance, and attachment and durability of the cladding while meeting the requirements of ASHRAE 90.1.

NBC 2015 PROVIDES ADDITIONAL CLARITY REGARDING THE USE OF FOAM PLASTIC IN NON-COMBUSTIBLE CONSTRUCTION (SEE NEW ARTICLE 3.1.5.6 TITLED "COMBUSTIBLE COMPONENTS IN EXTERIOR WALLS").

FIGURE 3: SEMI-RIGID INSULATION WITH SLAB EDGE EXPOSED

FIGURE 4: EXTENSIVE STEEL STUD DAMAGE

FIGURE 5: GALVALUME Z-GIRTS ON 3" RIGID XPS

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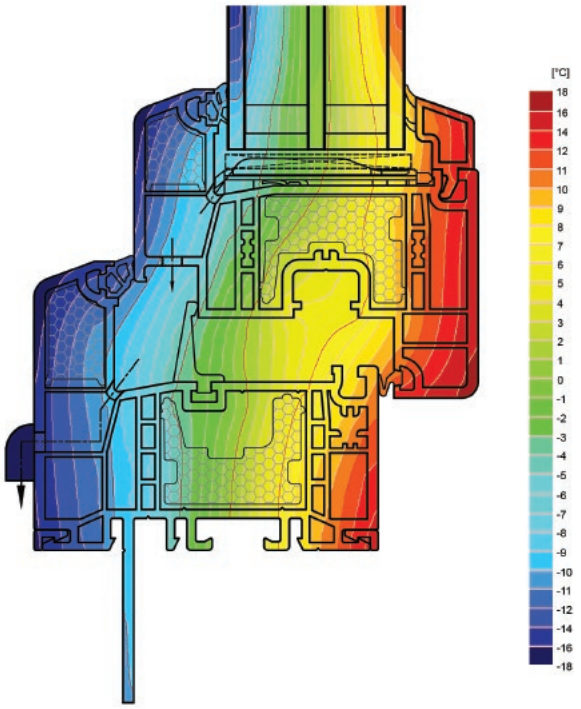
Picture window	0.75 (0.13)	72 (2 13/16)	0.033 (0.019)	0.63 (0.11)	0.55
Door	0.78 (0.14)	142 (5 9/16)	0.033 (0.019)	0.63 (0.11)	0.55

[1]Glass: 4mm Cardinal LoE180 - 16mm argon - 4mm clear - 16mm argon - 4mm Cardinal LoE180
[2]With TriSeal Super Spacer
[3]U_f tested according to EN 12412-2
[4]Centre of Glass (COG) U value and Solar Factor according to EN 673 and EN 410



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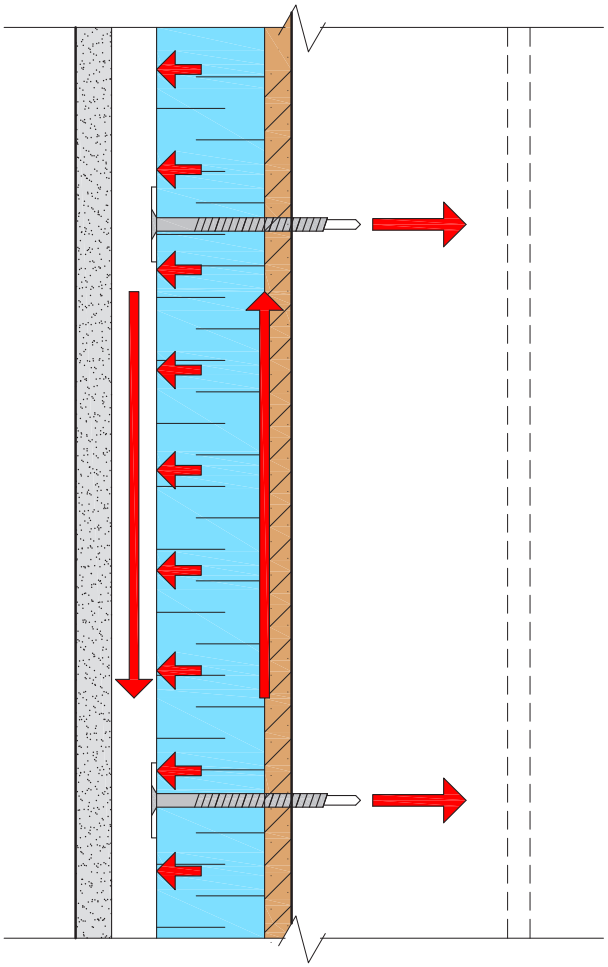
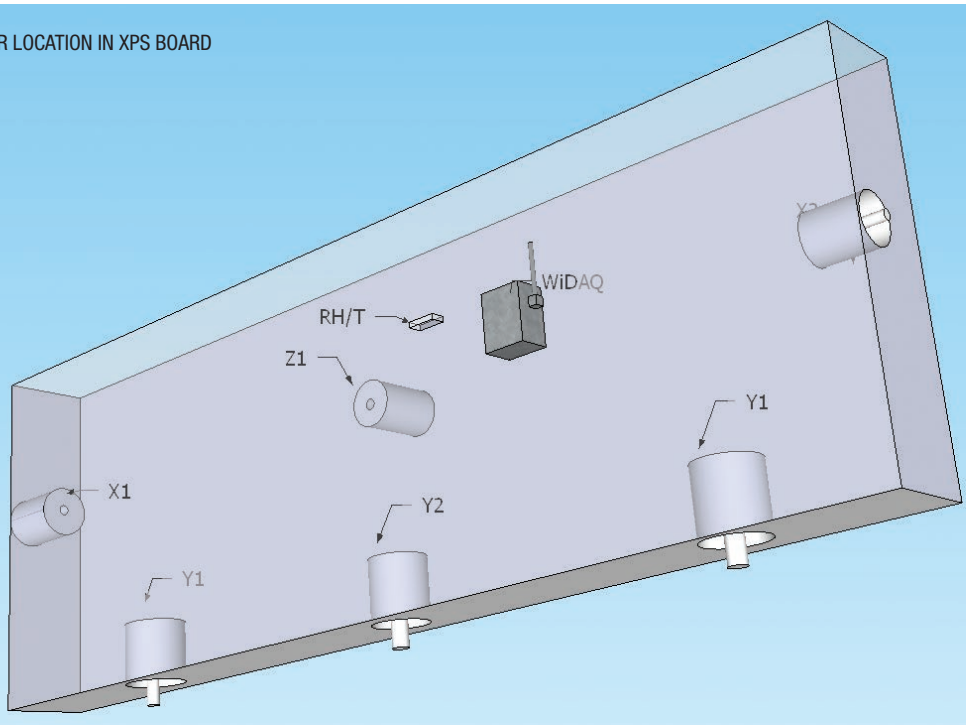


FIGURE 6: INSULATION CLADDING FORCE DIAGRAM

FIGURE 7: LOAD TESTING MOCK-UP PANEL

The new wall assembly includes three inches of CAN/ULC S701 Type 4 rigid insulation with a nominal R-value of R15. As a whole, the assembly has an effective R-value of approximately R17.8 – around twice that of the original assembly. Installing the insulation on the exterior also allows for the construction of a more durable and higher performing wall assembly and facilitates the use of continuous self-adhered membrane to make the assembly airtight and watertight. The rainscreen cavity is achieved by fastening the paperback lath on the outside face of the metal Z girt over

FIGURE 8: SENSOR LOCATION IN XPS BOARD



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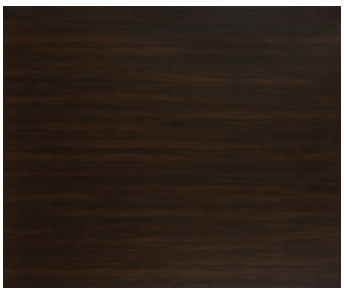

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NOTE: For more information about building with steel, please refer to the CSSBI publication on the structural integrity of steel building panels.

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which the sand cement three-coat stucco is traditionally applied. When installed properly, this method for providing CI reduces thermal bridging effects from the steel framing members and maintains the temperature and humidity of the inside stud cavity at levels similar to the building's interior conditions, thus reducing condensation potential in the cavity.

MONITORING STUDY HIGHLIGHTS

The gravity loads are designed to be resisted by the foam insulation. If the cladding moves downward, the fastener has to lengthen or insulation has to compress. If the insulation does not compress and the fastener does not stretch, then it braces the cladding (See Figure 6). With a 4320 psf (30 psi) rating, a significant load is required to compress the insulation. This size of load is not produced with common claddings, as demonstrated in Figure 7, where a 3,500-pound concrete block is being held up by proprietary metal furring strips that are installed over rigid foam insulation.

A common misconception exists that the fastener will bend and the cladding will deflect with increasing thicknesses of exterior continuous rigid insulation and cladding weights. While this may be true with some attachment methods, using a rigid exterior frame results in downward loads being transferred as compressive loads onto the insulation, resulting in a negligible downward deflection, a common concern of practitioners.

One of the goals of this monitoring program was to confirm the structural stability of this type of system, as demonstrated by the deflection readings. Figure 8 demonstrates the positioning on the Y1, Y2 and Y3 sensors that were installed in three building locations to investigate creep movement. Figure 9 summarizes the movement seen in the Y direction (mm). Analysis of the X and Z direction sensors indicates a similar lack of movement.

MONITORING STUDY CONCLUSIONS

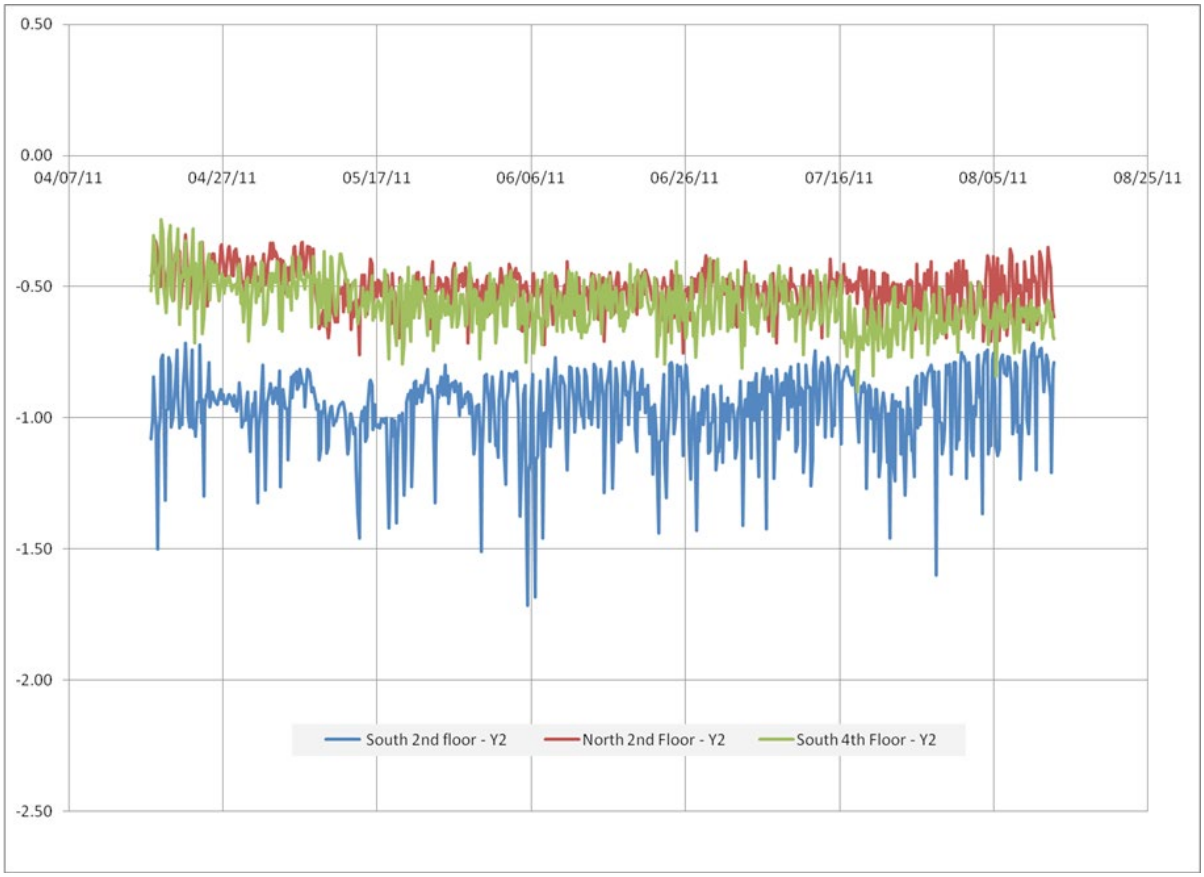
1. A continuously insulated rainscreen wall system constructed from three inches of extruded polystyrene insulation, with 7/8 inch Z-girts installed every 16 inches on centre on top of the insulation boards using 4.5" #10 self-tapping fasteners at six inches on centre, provides a structurally robust wall that complies with the prescriptive requirements of ASHRAE 90.1 and is dimensionally stable.

2. Range of displacement changes are similar in X, Y and Z directions, suggesting that gravity loads do not amplify movement in the Y, or gravity-loaded, direction.

3. The movement range in all directions does not appear to be related to the dimensions of the boards being measured. That is, movement in the Z direction, where the insulation board is three inches thick, is similar to measured movement in the X direction, where the board is eight feet long.

4. The correlation between temperature and displacement change is poor. While the total displacement being measured in the X and Y directions is what would be expected from thermal expansion of the foam, the statistical analysis of the data indicates that the displacement

FIGURE 9: VERTICAL DISPLACEMENT MEASUREMENTS OF NORTH AND SOUTH PANELS



is not driven by thermal expansion or contraction. Movement in the Z direction is greater than expected from thermal expansion.

5. The measured hygrothermal performance of this wall confirms the expected performance of this wall construction. Temperature measurements indicate that the interior face of the exterior sheathing is at or near room temperature. Humidity measurements show little or no potential for condensation.

6. No stucco performance problems have been reported to the date of submission of this paper. The goal was to attach stucco to girts and girts to wall very well in order to reduce the risk of movement and potential for cracking. Proper mixing and curing of stucco is also important to stucco performance. Due to the controlled construction conditions (protected from rain and direct sunlight), mixing and curing was done properly, with a higher level of quality control, minimizing the risk of cracking or other problems, such as efflorescence.

7. Results indicate that this is a high-performance, thermally efficient wall assembly with a low risk of condensation.

For more information and results on the Hugh Bird field monitoring project, please consult Reference #1 below: ■

REFERENCES AND FURTHER READING

1. "Structural and Hygrothermal Field Monitoring of Thick Continuously Insulated Wall Assemblies Utilized in a Multi-Storey Residential Building" authored for the 2012 BEST3 Building Enclosure Science and Technology Conference.

2. New York State Energy Research Development Authority (NYSERDA) Fastening Systems for Continuous Insulation, Final Report 10-11, April 2010.

3. The Foam Sheathing Coalition published the following Tech Matters: Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, released 9/20/10 and updated 12/07/11.

4. The Dow Chemical Company, Dow Building Solutions, Technical Evaluation Report No. 1105-01: Requirements for Attaching THERMAX™ ci Exterior Insulation & Three-Coat Stucco Cladding to Steel Stud Walls, Released 9/29/11 and updated 10/12/11.

5. *ANSI/SBCA FS 100–2012* Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies published October 2012 / Commentary Released January 2013.

6. Building Envelope Thermal Bridging Guide (A guide published by Morrison Hershfield Ltd. in co-operation with industry stakeholders including BC Hydro, Canadian Wood Council, the Homeowner Protection Office, FPInnovations, and Fortis BC).

7. Three-Coat Stucco Veneer Cladding Attachment Schemes for Thick Continuous Insulation (ci) foam Based on Experimentally Validated Finite Element (fe) Modeling. RCI 26th International Convention Proceedings, Reno NV April 2011 (Gary Parsons, Dow Chemical Company; Jeff Hansbro, Dow Chemical Company).

PEOPLE POWER:

Q&A With Mark Gauvin

By Matthew Bradford

Gauvin 2000 Construction Ltd. is closing up shop in 2016, capping over 43 years of success and stewardship within the Vancouver market. President Mark Gauvin has been with the family-owned company since he and his father founded it in 1973.

Building science professionals commented to *BCBEC Elements* on Gauvin's successful career and selfless contributions to the industry. Gary Parsons, building scientist and fellow at Dow Building Solutions R&D, said, "Mark Gauvin is truly a rare find in the industry. He generously gives both his resources and time to answer critical building durability performance questions. Mark unselfishly shares what he learns with other builders and product manufacturers across the industry so we all benefit from his work as we strive to make higher performance and longer lasting buildings."

Recently, Gauvin sat down with *BCBEC Elements* to share his thoughts on the company, its legacy, and his plans for retirement. This interview has been edited for clarity and brevity.

BCBEC Elements: Let's start from the beginning. How did Gauvin Construction come to be?

Mark Gauvin: I have always had an interest in technical matters, and as a high school student I worked over the summers on construction sites for my father and other subcontractors. After high school, I had two or three construction-related jobs going, so it was an easy path to stay in the industry.

During my early years, my father was self-employed as a home builder, but in the mid-1960s he joined a larger developer building resource communities in remote parts of B.C. Eventually, I joined the same company to work on projects in Stewart and Clearwater, B.C. By the early 1970s, the company was moving away from new construction and more towards land development in urban areas. My father and I saw an opportunity to carry on in the construction side of the industry, and in 1973 we incorporated our own company to begin new projects in northern B.C. and the Yukon.

BE: What do you recall of those early days?

MG: In the beginning, my father managed the jobsites and I worked in the office looking after the business side of things and pursuing new work. As markets changed and as the company grew, we started bidding on larger projects closer to home in the Greater Vancouver area. We did a fair number of social housing projects for the federal/provincial governments, all while building up relationships with local developers and institutional clients.

There are so many different aspects to running a construction business that there has never been a boring moment. Because of that, I have thoroughly enjoyed my time in the industry, especially being involved in the local construction associations. That has allowed so many opportunities to meet interesting people and be a part of the bigger picture within the industry.

BE: What are your proudest achievements throughout the years?

MG: The fact that we have carried on business in a professional manner all these years, always completed our projects, and always paid our bills has to invoke some pride. That, of course, is in no small way due to our people, who are long-time employees, experts in their field, and totally dedicated to client satisfaction. The result can be seen in our record of repeat business with our clients, and in the huge variety of projects that we have undertaken over the years.

At the same time, it gives me great satisfaction to say that we have always maintained an excellent safety record on our projects and that we have never had a serious jobsite accident or injury. Safety programs and training have been a priority all these years, and being able to retire with a good safety record is, I think, a wonderful achievement.

"MARK GETS PLENTY OF RESPECT BECAUSE OF HIS LONG HISTORY IN THE CONSTRUCTION BUSINESS, BUT NOT ENOUGH PEOPLE KNOW ABOUT HIS FORAY INTO RESEARCH. HE PUT HIS OWN MONEY, TIME AND ENERGY INTO HELPING UNDERSTAND THE 'CONDO CRISIS' BY ORGANIZING AND SUPPORTING THE COQUITLAM TEST HUT STUDIES. GETTING SWEPT UP INTO THIS PROJECT REALLY TAUGHT ME THE EXTENT OF MARK'S HONESTY, INTEGRITY, AND GENEROSITY. RARE AND VALUABLE TRAITS INDEED."

JOHN STRAUBE, PRINCIPAL AT RDH BUILDING SCIENCE AND RDH BUILDING SCIENCE LABS

BE: Gauvin's invested a lot into building science research. What's been your motivation?

MG: Although the term "building science" wasn't widely recognized back in the 1970s, I suppose that our early involvement in northern B.C. and the Yukon sparked some interest as I sat with the architects and consultants to work out solutions to the problems of an extreme cold environment. In 1982, I started construction of my own home in Burnaby when the R-2000 program was just being introduced by Natural Resources Canada. With the promise of lower heating bills, improved ventilation and comfort, I decided to do this for myself and was quite pleased with the result. Building an R-2000 house was a great learning experience.

However, the field of building science really came into focus when Vancouver's housing industry was hit by the "leaky condo disaster," which started in the late 1980s. This was an unprecedented failure of building technology that involved almost all builders, and had terrible consequences for homebuyers – that is, our clients. During this time, I did my own investigations of leaking buildings both old and new, and had started to develop some idea of what was happening within the walls. Conversations with leaders in the field, Dr. Joseph Lstiburek (Building Science Corporation) and Dr. John Straube (University of Waterloo) confirmed the need for additional research. There was a suggestion that building a test hut to measure and compare performance of different wall assemblies was one way to accomplish this.

Continued on Page 22

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BE: Which led to the Coquitlam Test Hut?

MG: Yes. The University of Waterloo, under the direction of Dr. Eric Burnett and Dr. Straube, built the BEGhut, probably the first full-scale natural exposure test facility in Canada back in 1990. Dr. Lstiburek was involved in a couple of test facilities on the East Coast, so with all of the building enclosure problems showing up in Vancouver, we decided there should be a similar facility in our rainy West Coast marine environment. Our company volunteered to build the test hut, and Dr. Straube's grad students installed the instrumentation and data loggers. Essentially a small house, we built the facility on the roof of our office building. Power, water and Internet were readily available, but it was the free rent that clinched the rooftop location.

The hut itself has seven different wall assemblies on each of four elevations, which allows us to do side-by-side comparisons. For example, we have compared a wall with a rainscreen cavity to an identical wall without. Likewise, we have side-by-side comparisons with and without a polyethylene vapour barrier, and with and without continuous exterior insulation, etc. Even the indoor climate is controlled at a fixed temperature and relative humidity for the duration of a test run. And we can compare an identical wall on each of the north, south, east and west-facing walls to see how wind-driven rain or solar exposure affects performance.

Each of the 28 walls has a built-in wetting apparatus, which lets us inject a measured amount of water to the inside or outside of the sheathing. At predetermined intervals, every wall is wetted at the same time with the same amount of water, giving us in effect a "precision leak." The moisture pins, temperature, and humidity sensors located within the assembly can then give us a graphical picture of the drying response of each wall type for analysis and comparison.

To me, the genius of the test hut is in the side-by-side comparisons with all factors being equal except for the one part of the assembly that is changed in each wall. Typically, there has been so much heat and air movement through the walls of our older buildings that it's been difficult to understand what was really happening within the assembly. Blowing warm air through the walls, as we used to do, masks a lot of construction and design defects. But as we strive to improve airtightness and reduce heat loss, a better understanding of building science becomes crucial to every new wall design. We need to deliver durability along with comfort and energy efficiency to our clients.

BE: What have been the results?

MG: We built the hut in 2005 and we are now in Phase 5 of testing and on our fourth set of walls. From the beginning, we saw the effectiveness of rainscreen wall assemblies in promoting drying of the wall cladding. By providing a capillary break, a drainage space, and ventilation drying, the rainscreen is a huge advance in wall technology and Vancouver was the first to mandate this requirement.

The walls that consistently performed the best were those with a layer of continuous insulation to the exterior side of the sheathing. Aside from the obvious improved wall R-value and reduction in thermal bridging, the exterior insulation keeps the wood components warmer and thus dryer. This reduces the risk of condensation, especially due to accidental air leakage, and I think will be the next major advance in wall construction.

BE: Outside of its research contributions, how has Gauvin been involved in its community?

MG: It has been most gratifying when clients have accepted our advice on improving their building enclosures based on what we have learned with the test hut, and come back later to tell us they now occupy the best building they have ever lived in.

In the broader community, we've been long-time members of pretty well all of the local construction associations, and our people have participated on many committees and in various charitable projects over the years. We are continuously involved with a local food bank, food and toy drives every Christmas, and various charity fundraisers throughout the year. Occasionally our employees will get together and get involved in building assessments or renovations for non-profit groups. All this is on top of their own personal charities, which is amazing to see.

BE: Gauvin has also been a member of BCBEC for some time. What is the biggest benefit for you?

MG: I think their monthly luncheon meetings are a great idea. They're an important networking opportunity, and it's great to stay in touch with guys that are tops in their fields. Those events always have a good attendance and great speakers, so I know I will have the latest news on problems to avoid, and new technologies coming to the industry.

BE: What's next for you?

MG: It's been a very busy career, so I'm happily looking forward to spending more time catching up on my own projects. The shoemaker's children come to mind when I think about finally finishing my own house. I've been married 35 years, have four great kids with three grandchildren now. So maybe a little more travelling too, but simply spending more time with family – especially grandchildren – is high on my priority list. ■

"MARK IS A GOOD MAN. FORGET ALL THE ACCOMPLISHMENTS – AND THERE HAVE BEEN COUNTLESS ONES. AT THE END OF THE DAY MARK IS A GOOD FATHER, A GOOD HUSBAND, AND GOOD FRIEND. HE INSPIRES THE REST OF US TO BE BETTER. NOT A LOT OF GOOD MEN LEFT ANYMORE. MARK IS ONE OF THEM. THANK YOU, MARK."

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KNOWING THE HAZARDS

WorkSafeBC Regulations for Consultants and Inspectors

By Kelly Parker

Most building envelope remedial projects start with a condition assessment of the property, comprising a visual review and may consist of destructive testing and sampling. Whether it happens during these activities, or simply as part of the visual assessment, sites can be rife with hazards for the explorer, including circumstances where they may have to work at height, in confined spaces, or in proximity to or contact with hazardous material or fumes.

Under B.C's *Workers' Compensation Act*, employers are responsible for worker health and safety. As part of its prevention strategy, WorkSafeBC provides employers and workers with information, resources, and if required consultation with officers to support employers in their compliance efforts.

WorkSafeBC, of course, has regulations and guidelines in place that all too often are set aside as a result of complacency or other factors, and when that happens, the consequences can be fatal. As with any critical task with such serious consequences attached to non-compliance, periodic review is essential.

WorkSafeBC has provided *BCBEC Elements* with the following guidelines in the three areas:

WORKING FROM HEIGHT:

- Regulation concerning working at a height dictates that a fall protection system must be used when work is being done at a place where a fall of more than 3 metres or 10 feet may occur. There are, however, site-specific caveats outlined in the regulation that should be reviewed.

- Employers are required to have a written fall protection plan for a workplace if work is being done at a site where permanent guardrails do not protect workers, and from which a fall of 7.5 metres or 25 feet or more can occur. The fall protection plan must also be available on site before work begins.

- The regulation outlines the requirements to take into account when selecting a fall arrest harness, anchors and other safety equipment. There are also provisions for the continued inspection and maintenance of equipment.

Working from heights can include several variations such as Rope Access/Bosun's chair, swing stage, scaffolding, ladders, elevated platforms, and leading edges of floors on high-rise construction and roofs. Staff must be trained to work in these situations using fall restraint and fall arrest techniques.

Tim Stubbins, building technologist with WSP Canada, points out that because Rope Access/Bosun's chair work is a high-risk "trade," specialized training is required. "We require a specific Fall Protection Plan for each job. There are always two staff members who have been trained," he says, "and will review equipment, ensure that the safety anchor points have been certified and provide safety checks prior to and during the actual task."

CONFINED SPACES:

- WorkSafeBC defines a "confined space" as an area that is enclosed or partially enclosed, not designed for continuous human occupancy, has limited or restricted means for entry or exit that may complicate the provision of first aid, evacuation, rescue or other emergency response and is large enough that a worker could enter to perform work.

- The employer is required to ensure that each and every confined space in the workplace is identified and determine whether any space will ever require entry by a worker as a result of system failures, scheduled maintenance, or other emergencies. The employer must also ensure that all confined space hazards are eliminated or minimized, and before any worker is allowed to enter a confined space, the employer is required to prepare and implement a written confined space entry program.

That said, some exemptions apply. For example, Randy Urbanowski, industrial hygienist with WSP Canada, says that with crawl spaces, "WorkSafeBC has an exemption if there is natural ventilation, and if that exists, it would not be considered a confined space, but rather an enclosed space. There still could be some hazards there that need to be managed, but they could still be managed outside of the confined space regulations."

"Crawl spaces and attic spaces are on WorkSafeBC's list of possible exemptions," explains Urbanowski, if they meet the criteria below. "Most times with crawl spaces or attic spaces, the determination comes down to the presence of natural ventilation as the determining factor."

1. The design, construction, location, and intended use of these spaces will ensure these spaces are characterized by clean respirable air at all times.

2. The space must have an interior volume of not less than 64 cubic feet per occupant.

3. The space must have openings to the atmosphere that are known to provide natural ventilation.

4. There must be no potential for a high or moderate hazard atmosphere, as defined in section 9.1 of the *Regulation,* to exist or develop immediately prior to any worker entering the space or during any work within the space.

5. There must not be a need to mechanically ventilate, clean, purge or inert the space prior to entry for any reason.

6. There must be no potential for a hazardous substance to migrate through any media (e.g., air, soil, conveyance, piping or structure) to infiltrate the space.

7. The space must be free of residual material (e.g., waste, sludge, debris) that if disturbed could generate air contaminants that could immediately and acutely affect a worker's health.

8. There must not be any risk of entrapment or engulfment to workers entering the space.

9. The space must not contain, have introduced, or be adjacent to tools, equipment, or involve processes that could generate air contaminants that could immediately and acutely affect a worker's health.

Initial investigation can also indicate a seemingly benign space that can suddenly become very dangerous. "One example that I'm aware of," notes Urbanowski, "was just an underground concrete pit – no connections, and no chemical contaminants whatsoever – that most people would look at and conclude that there was no risk. The only thing this pit contained was a few leaves that had dropped in there and some water, and what had happened was the leaves had started to rot, and that biological activity had consumed the oxygen in the space. In situations where there appears to be no risk, might in fact, when you dig a little deeper, reveal a significant risk."

"In one [crawl] space, they had a carbon monoxide gauge, and we got only about five feet from the access point into the space and the gauge went off like crazy and we had to evacuate. If we had been further in, it could have been very risky, so there is a plan before we go in," says Stubbins, adding that he has been in crawl spaces for up to four hours before.

Stubbins says that when working in confined spaces, you should always be in contact with someone outside of the crawl space for check-ins at pre-determined intervals, so that they know you're safe. Sometimes communication is disrupted and the person on the outside must make a judgment call on whether to call 911. However, each job is different and a specific Safety Plan should be developed for each project.

Urbanowski emphasizes that a rescue plan is one of the most critical components of working in confined spaces, citing statistics that say that about 60 per cent of the fatalities that happen in a confined space occur to the would-be rescuer. "Part of mitigating that problem," he says, "is having a good rescue plan in advance. It should be more than just setting up a tripod; it should be an understanding of exactly

Changes to WorkSafeBC Regulations on Investigation of Hazardous Materials

Early in 2015, WorkSafeBC BC changed their approach to the review of hazardous materials during investigation or renovation work in existing buildings. WorkSafeBC had previously required identification of hazardous materials (such as lead or asbestos) prior to any cutting or disturbing of materials (such as drywall) in pre-1990 buildings. WorkSafe is observing as a result of free trade agreements, that materials are being installed in new construction from offshore sources, which contain hazardous materials above locally acceptable levels, which in some instances are lower than in other North American jurisdictions. Thus WorkSafe regulations on hazardous materials now no longer stipulate anything about the age of buildings, and their regulations now apply to all buildings, even those that are recently completed.

Hazardous materials consultants have numerous stories to share about new construction materials with hazardous material contents above regulation levels, ending up in buildings after slipping through regulatory cracks. They have observed that new metal cladding is regularly being installed in B.C., after being sourced offshore, with lead content in paint coatings that exceed locally acceptable levels. An example about acoustical ceiling tiles outlines the problems with hazardous content in building materials, as an unintended consequence of neighbouring jurisdictions' differing regulatory limits. Although asbestos levels are regulated in components manufactured or imported into Canada and the U.S., the levels are different between the two countries, and even differ by province (ironically with the strictest limitations in Quebec, where asbestos is still mined and then shipped to other countries for use in manufacturing). Retailers bring the ceiling tiles sourced from Asia into the U.S., which meet U.S. regulations. But then those tiles can be shipped here through free trade agreements, even though B.C.'s asbestos content regulations are stricter, resulting in ceiling tiles ending up in new installations that exceed local levels.

The February 2015 changes to WorkSafeBC requirements mean that before proceeding with any investigation or renovation work, architects and engineers must obtain a report identifying any hazardous materials in the work area, from the owner of the building, regardless of the building age. The professional will likely want to request that the building owner arrange for this, as most professional liability insurers will assert that the owner should be the one contracting to have this investigation done. The professional may want to avoid taking on liability regarding existing building conditions, so while they will need an investigation to be completed before their work commences, they may not want to be the ones contracting directly for the hazardous materials investigation. It will likely fall to a professional instigating the work, though, to educate their clients and building owners who may not yet be aware of this change in regulation from WorkSafe, or its implications for their building.

Below are directions to find the regulation and guidelines, updated February 1, 2015 on WorkSafeBC's website: http://www.worksafebc.com/publications/

Under the OHS Regulations tab, in Regulation Part 20, "Construction, Excavation and Demolition," is requirement 20.112 Hazardous materials.

Similarly under the OHS Guidelines tab, in Guidelines Part 20, "Construction, Excavation and Demolition," is guideline G20.112 Hazardous materials – Asbestos.

As always, you'll want to consult with a hazardous materials specialist on issues such as these, as there will always be different interpretations on how to deal with these regulations, depending on the conditions at your building.

what you're going to do if something goes wrong, so that people don't just sort of rush in without giving it enough thought and find themselves in a problem as well. Things can go wrong very quickly, and they can go very, very wrong."

HAZARDOUS MATERIALS:

Occupational disease is the leading cause of work-related death. The leading cause of occupational disease is historic exposure to asbestos fibres. In fact, statistics reveal that asbestos-related illness and death make up almost the same degree of illness and death related to all other substances combined.

Most buildings constructed prior to the late 1980s contained construction materials with asbestos – materials such as insulation, floor tiles, cement pipes, drywall, linoleum and spray-applied fireproofing. Today, the number one way to be exposed to asbestos is by unsafe practices during demolitions and renovations.

To that end, WorkSafeBC regulation also dictates that every employer, owner/builder, agent or property manager *must*:

- Plan and supervise all activities on the worksite to prevent exposure to asbestos fibres.
- Have a qualified person inspect the site to identify any asbestos that may be handled, disturbed or removed.
- Submit a notice of project for asbestos to WorkSafeBC at least 24 hours before asbestos removal, demolition, renovation or salvage work begins.
- Ensure all asbestos-containing material is properly removed and disposed of by trained and qualified asbestos removal workers before demolition, renovation or salvage work begins.
- After removing the asbestos, retain written confirmation by a qualified person that the asbestos specified on the notice of project has been properly removed.
- If asbestos-containing materials not previously identified are found during work activities, work is required to be stopped immediately, and remain that way until trained and qualified workers have removed those materials.

While the dangers of asbestos are commonly known, that is not the case for some of the contaminants found in old buildings. "We've been putting lead in paint applied to all surfaces in buildings," says Jim Bagley, former senior environmental scientist for WSP Canada, "and up until the 1980s that lead content was potentially so high that if you cut into it, or sanded it down or abraded it, you could be exposing workers to high levels of airborne lead that is highly toxic, carcinogenic and very hard for the body to get rid of."

"When you're doing these assessments," concludes Bagley, "a real thorough knowledge of materials in buildings is really important. WorkSafeBC actually has really stringent requirements now; it used to be a bit of a free-for-all in the industry, and almost anyone could hang out a shingle and say that they were capable of assessing a building, but WorkSafeBC has been clamping down on this and now you have to have someone with the specific qualifications to do these assessments before the renovation work."

WorkSafeBC encourages any employer who is unsure about how to interpret the regulations or has any other related question to contact a WorkSafeBC prevention officer. It also stresses that how regulations apply on any individual worksite is dependent on an innumerable number of variables. Therefore, it is important that workers adhere to the safe work procedures established by their employer for each worksite, and the employer take into account that procedures may need to be changed, depending on the hazards present. ■

For more information, visit www.WorkSafeBC.com.

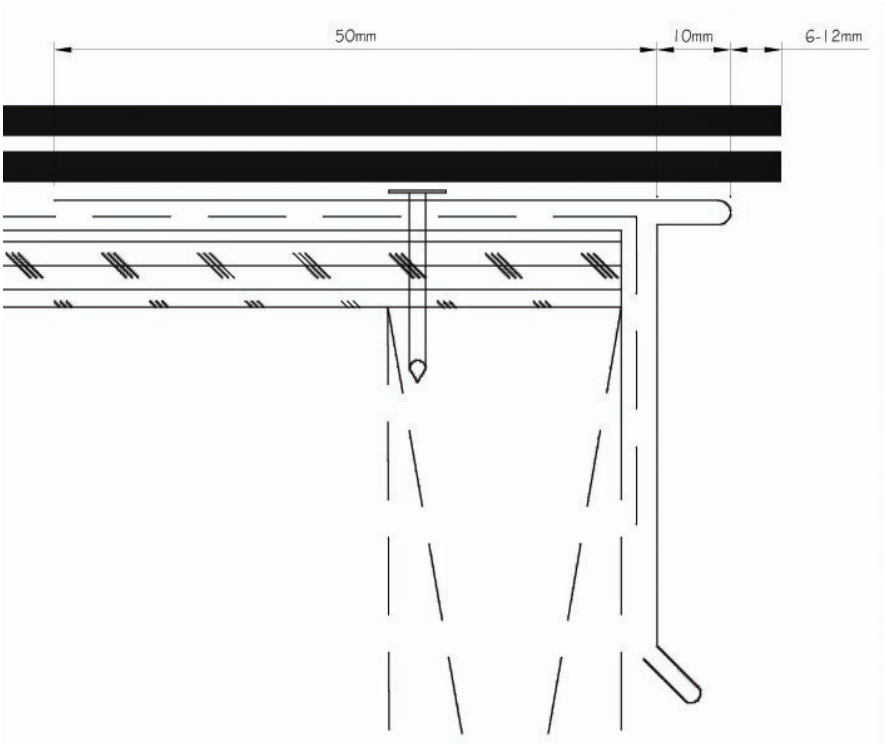
A NEW STANDARD, FOR A NEW AGE IN ASPHALT SHINGLE INSTALLATIONS

By Josh Jensen

In recent years we have seen many new and updated standards with respect to roofing; unfortunately these have predominantly been within the realm of low slope roofing. That is, until now. Two of the key reference standards for the installation of asphalt shingles have been amalgamated and revised. CSA CAN3-A123.51-M and CSA CAN-A123.52-M have been amalgamated into CSA A123.51-14, a new reference standard for asphalt shingle installations. The two original standards were first written in 1985 and have been reaffirmed with only minor revisions ever since. Within that timeframe substantial changes have come to the asphalt shingle marketplace in the forms of new technology as well as changes to best practices.

The two original standards were differentiated by the slope of the roof; however, the new standard combines these to provide a standard for roof slopes of 2:12 and greater. This makes it easier to read especially when you have roofs that have the main field at 4:12 and smaller crickets or valleys lower than 4:12. The new standard pulls in the requirements outlined in Section 9.26 of the Building Code to make the standard easier to read and have all the information in one place.

Figure 1 - Rake Model



Below we will build our roofing system based on the application instructions outlined in the standard, beginning with eave protection and ending with the various flashing required. There is a lot of information within the standard; therefore, the below information is just an overview of the changes. When designing an asphalt shingle roof the standard should be consulted for more in-depth information.

EAVE PROTECTION

Major changes came to the eave protection requirements. Within the new standard the only products that can be considered eave protection are:

a) Self-adhesive modified bituminous membranes in accordance with CSA A123.22;

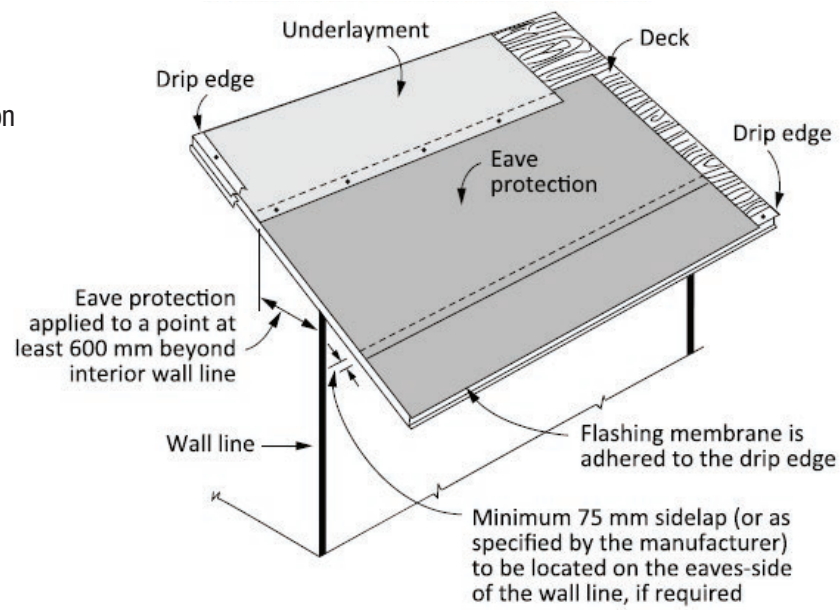
b) Roll roofing, mineral or smooth, conforming to the requirements of CAN / CSA A-123.2; or

c) Styrene-butadiene-styrene (SBS) polymer modified base sheets.

No longer can roofing felts be used as eave protection within an asphalt shingle roof assembly. Also not mentioned within the standard are any references to synthetic underlayments being used as eave protection; they are, however, mentioned under underlayments. This may have been an oversight or this may have been intentional. There are no testing standards for eave protection with respect to synthetic underlayments and many of the standards referenced on manufacturers' technical data sheets are for asphalt saturated felts. Therefore if designing a roof in an area that requires eave protection, make sure to review product submittals – especially in regards to what the standards referenced are for.

Figure 3 - Eave Protection Installation (See Clauses 5.2.2, 5.2.4, and 5.2.5)

All images except figure 1 credited to CSA A123.54



The eave protection area has also increased to 600mm (24") inside the inside face of the exterior wall, or 900mm (36") up the roof line. With the current requirements (12" inside the inside face of the exterior wall) many of the manufacturers developed products that would meet the requirements but only need one layer without joints. Given the change, these products will not satisfy the size requirements anymore and therefore a joint will be present in the eave protection. As the purpose of the eave protection is to resist water ingress due to ice damming, simple lap joints of the eave protection are not appropriate and the joints/seams will be required to be sealed. The standard goes onto require these seams to be located outside of the exterior wall (see Figure 3), meaning the first row of eave protection may only be allowed to be 2', requiring thought and planning to be undertaken prior to installation of the products.

DRIP EDGE METAL

A significant change within this standard is the change of the wording under drip edge metal. Drip edge metal is now a requirement of the standard rather than a recommendation. Furthermore, the drip edge metal is to be what is commonly referred to as a "T" style drip edge where the metal is to extend 10mm (3/8") past the edge of the roof. The drip edge metal is required not only at the eave locations but also at rake / gable locations (see Figure 1).

VALLEY PREPARATION

Only minor updates are presented within this section of the standard; however, terminology within this section can be difficult to understand. First they require self-adhesive membrane or underlayment to be installed into the valley, and this is referred to as "flashing" (see Figure 4). Once the "flashing" is installed, four options are presented:

a) Open Valley – Metal

b) Open Valley – Roll Roofing

c) Closed (cut) Valley

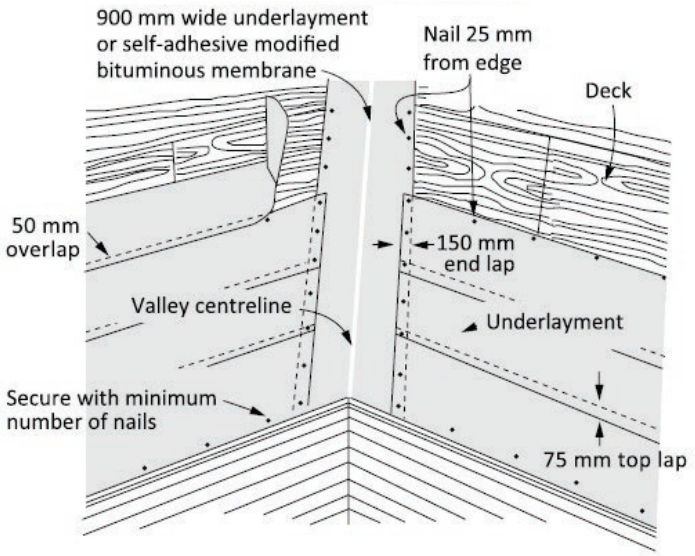
d) Woven Valley

Each of these valley types are installed on top of the already installed "flashing." So in the case of Open Valley – Roll Roofing (see Figure 5) for instance, after the flashing is installed, you apply the asphalt cement strips and the granulated roll roofing in the manner mentioned within the standard.

UNDERLAYMENT

There haven't been many changes to underlayments within the standard aside from adding additional products that can be used as underlayments such as self-adhering membranes, synthetic underlayments, and inorganic underlayments. Additional commentary has also been provided with respect to temporary protection, exposure, and securement of the underlayment. Similar to the previous standards, above slopes of 1:3 only standard underlayments are required. However, on slopes between 1:6 and

Figure 4 - Valley Preparation (See Clauses 5.3.2, and 5.4.1)



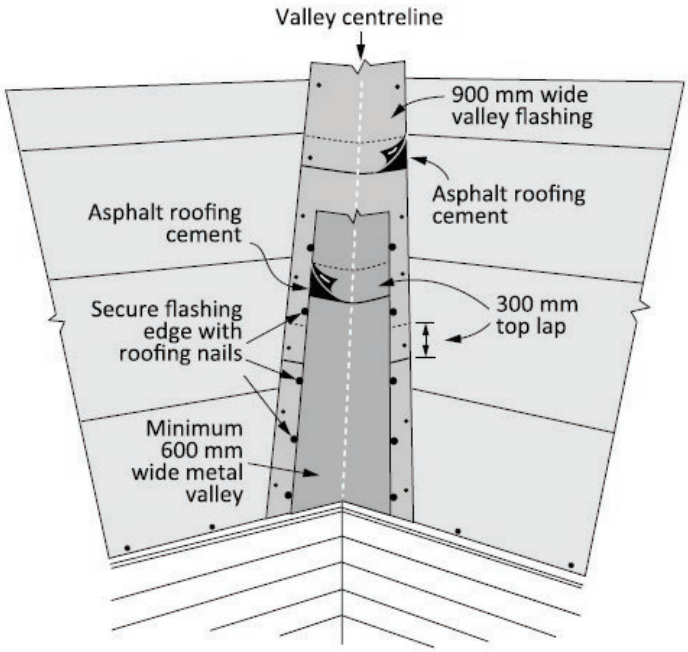


Figure 5 (a) - Open Valley Installation (See Clauses 5.5.1.1, and 5.5.1.3)

1:3, this standard requires one of the following three options for underlayments on these low slope roofs:

a) Cover the entire low-sloped roof area with self-adhesive modified bituminous membrane;

b) Cover the entire low-sloped roof area not already covered by ice dam / eave protection with two layers of underlayment – [i.e., laid such that each course overlaps the preceding course by half the sheet plus 25mm {1")]; or

c) Cover the entire low-sloped roof area with SBS membrane cemented at the vertical laps

It goes on to require that end laps be staggered by 1.8m (6'). In addition, it provides commentary regarding the fact that with low-sloped roof areas the entire area may be covered by vapour barriers and as such ventilation must be reviewed to mitigate the risk of condensation.

SHINGLE INSTALLATION

The shingling installation hasn't really changed, other than to reflect changes in the industry with commentary on new products such as pre-manufactured starter strips (see Figure 8). Minimum offsets in shingle joints have increased to 4" as well.

Figure 8 - Starter Strip Installation (See Clause 6.2)

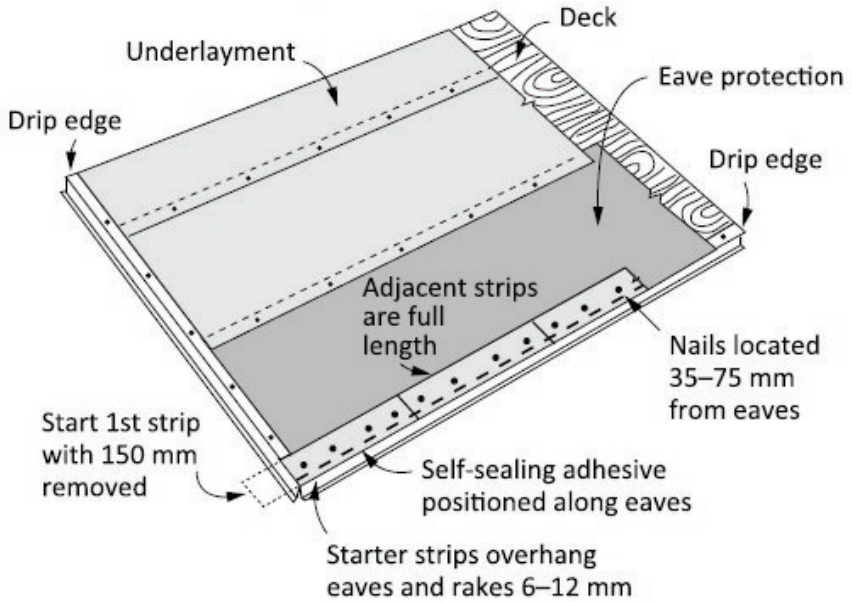


Figure 9 - Hip and Ridge Installation
(See Clause 6.5)

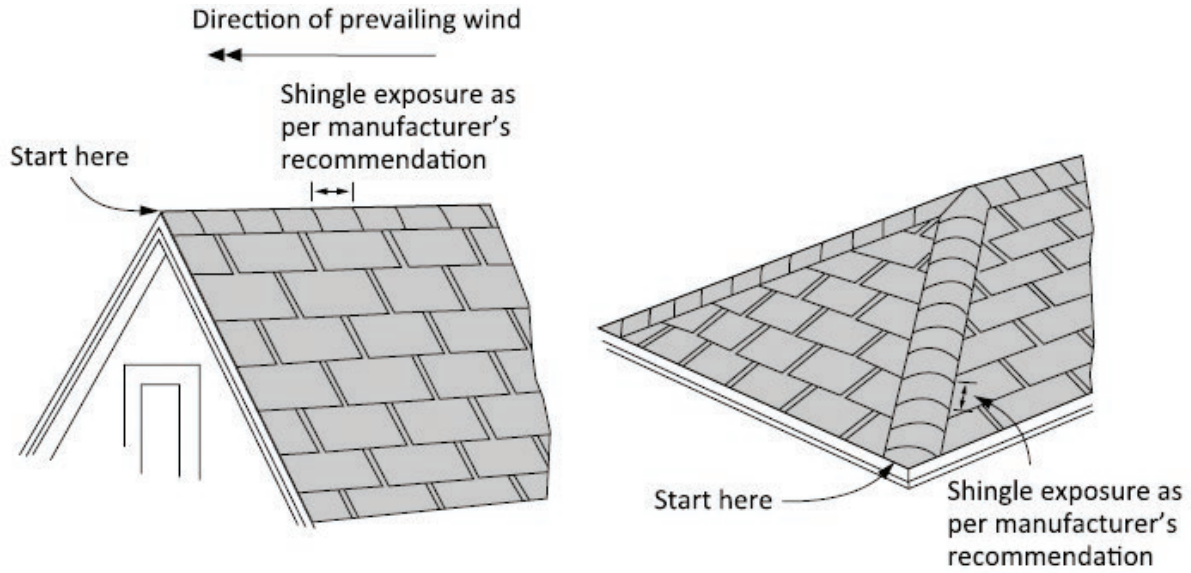


Figure 10 - Hip and Ridge Detail
(See Clause 6.5)

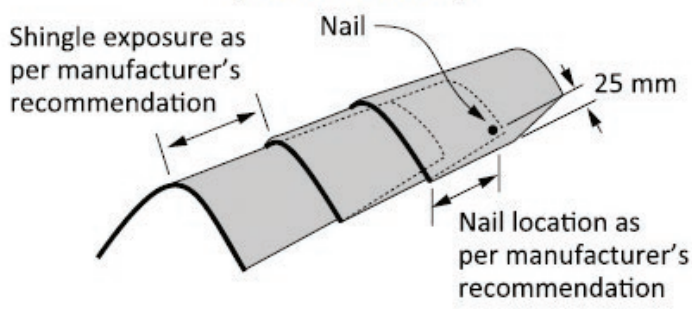


Figure 15 - Down Slope Wall-to-Shingle Flashing
(See Clause 7.1.1)

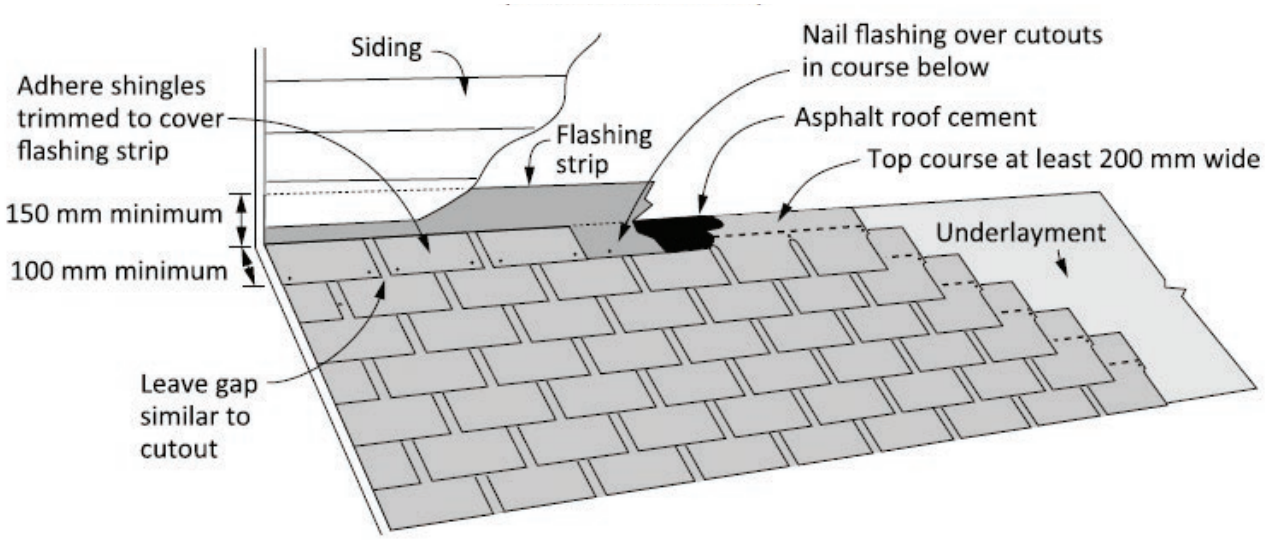
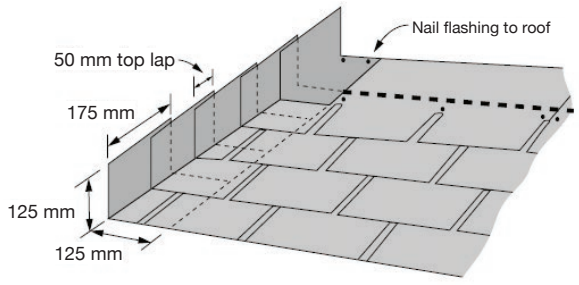
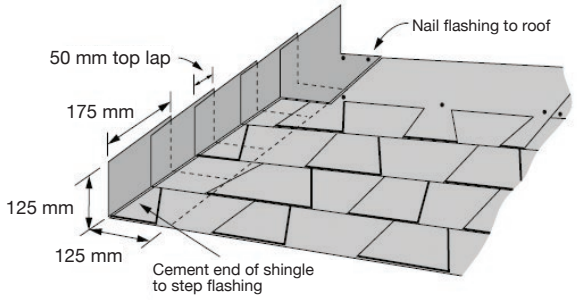


Figure 18 - Sloped Sidewall Flashing
(see Clause 7.2)



a) Three tab shingles



b) Laminated shingles

HIPS AND RIDGES

The only change within the hips and ridges section is to update the requirements for pre-manufactured products and their installation (see Figures 9 and 10).

PROTECTION AGAINST WIND

Similar to the previous standards, this standard includes a requirement to not rely on the pre-manufactured self-sealing strips in cold climate, inclement weather, or when job conditions make the self-sealing strips not immediately effective (dust for instance), and instead apply 25mm (1") dabs of asphalt roofing cement under the shingles during the installation.

SHEET METAL WALL FLASHINGS

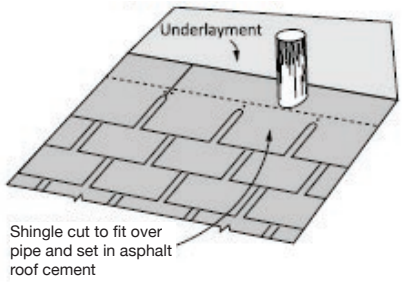
The standard has been written with emphasis on flashing against masonry walls; however, a note is provided stating that the standard still applies in a similar fashion to all other wall cladding types.

Substantial updates are provided within the metal flashing sections.

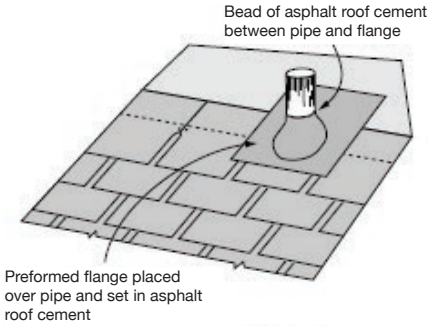
When the step flashings are also the counter flashings at masonry it specifically states that a compatible exterior sealant must be used at these locations. However, if a counter flashing is used, the counter flashing may be embedded into the mortar as long as a water stop is provided.

Step flashings are only allowed to be nailed to the roof surface with one nail; this is to allow the step flashings to be replaced when the roof is replaced in the future and to allow for movement between the roof and the walls (see Figure 18).

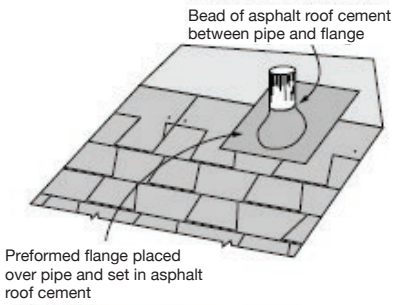
Figure 19 - Vent Pipe Flashing Installation
(see Clause 7.3)



a) Step 1 - Preparation



b) Step 2 - Three-tab shingles



c) Step 2 - Laminated shingles

Where flashings are to extend up the wall the wording has slightly changed to require a 100mm (4") overlap of claddings and sheathing paper over top of the flashing. Since wall claddings are typically required to be 50mm (2") above the roof surface (per BCBC 9.27.2.4.2), the standard has changed the size of the metal extending up the wall to be 150mm (6") (see Figure 15).

With respect to penetration flashings, the flange size has been reduced to 150mm (6") to 100mm (4"). This is to reflect the products that are currently being installed as many of them don't meet the 6" flange size requirement (see Figure 19).

CONCLUSION

Overall the new amalgamated and updated standard is a big step forward in the minimum requirements of shingle installation. However, given that many of the requirements have changed, disseminating the information into the design specifications and to the roofers on the ground will take time and may be difficult. Therefore, it is important that all designers and reviewers of installations read the standard in its entirety to ensure that previous installation methods are abandoned for these new requirements. ■

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BCBEC FOUNDATION AWARDS PROFILE:

James Higgins

By Holli Moncrieff

The BCBEC Foundation began in 2006 to offer scholarships and bursaries to British Columbia post-secondary students and apprentices who excel in building envelope design, construction and technology. The amount awarded each year is determined by the Board of Directors, and ranges from around $500 to $2,000, depending on applicant competitiveness and availability of funds.

In 2012, British Columbia Institute of Technology (BCIT) student James Higgins was awarded $2,000 for his success in Architectural and Building Engineering Technology.

Now a building science technologist, Higgins helps RDH Building Science design green buildings that are energy efficient and use sustainable materials. Higgins' areas of expertise include forensic investigations, building monitoring, thermal modelling, building enclosure design and graphics work, and field review and testing services for new construction and existing buildings. *BCBEC Elements* caught up with Higgins to see how he's doing four years after winning the award.

BCBEC Elements: When you were still a student at BCIT, you received a significant award and financial support from BCBEC. What impact did that award have on you?

James Higgins: It was a pretty big accomplishment for my last year at BCIT, and the culmination of all my hard work in the program. It felt really good.

BE: What type of research work are you doing at RDH?

JH: A lot of the work I do is researching new building sciences and materials. I find it so interesting – I'm able to use all the stuff I learned at BCIT in my current position. Our main focus is the energy efficiency of buildings; there's a really big push to make Vancouver a green city.

BE: How has your role in the industry grown or changed over the four years since your graduation from BCIT?

JH: I'm now project manager for a few projects. I'm still doing a lot of the technical work, but I'm also involved in quite a bit of the management as well, which is exciting.

BE: Have the education sessions presented by BCBEC played any role in your success?

JH: Yes, it's been a great experience to meet with clients and partners in the building science industry and make connections. The sessions provide an opportunity to learn about new things, while being able to promote the work I'm doing. I made the connection with RDH while I was still in school.

BE: What makes these education sessions unique in the building science industry?

JH: It's a really nice community to share and discuss building science knowledge in an open, relaxed atmosphere that is unique to BCBEC. The sessions make it easy for us to talk and make connections, and it's a great opportunity to see where other people in the industry are at.

BE: What does it mean to you to be able to give back by helping organize and participate in some of BCBEC's education sessions?

JH: It's very exciting. At RDH, we're often on the cutting edge, and the education sessions through BCBEC provide us with an opportunity to prompt other research work.

BE: What makes the research work you do important and relevant to the general public?

JH: Our main focus is in the energy efficiency of a building – that's a big thing we're seeing right now in design, and there's a really big push for it, especially in Vancouver. The buildings we're building now are going to last and the materials we use will be sustainable.

BE: Is the work you're doing now what you envisioned when you were still a student at BCIT?

JH: This is exactly the type of work I was expecting. A lot of the work I do is partnering with government and individual groups to research new building sciences and materials. I get to do all kinds of really cool building science research, and a lot of it leads to educational opportunities for my industry. ■

BCIT AWARDS CEREMONY

THE TOM MORSTEAD EDUCATION FOUNDATION AWARD OF $1,000 WAS PRESENTED TO SEPIDEH DANESHPANAH AND THE BCBEC EDUCATION FOUNDATION AWARD OF $2,000 WAS PRESENTED TO COLIN COULTER ON NOVEMBER 4, 2015.

BCBEC PRESIDENT SAMER DAIBESS AND BCBEC DIRECTOR CAROLINA MALONEY PRESENT THE TOM MORSTEAD EDUCATION FOUNDATION AWARD OF $1,000 TO SEPIDEH DANESHPANAH.

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Speaker: Alan J Whitehead,
President & CEO,
Radon Environmental Management Corp

- Radon gas – What it is, how it enters a building structure, health risks
- Radon mapping – where it is prevalent in Canada and in B.C. (national and B.C. maps)
- Radon detection and measurement options
- Latest B.C. building code requirements for radon prevention in new construction
- Radon mitigation methodologies/options
- New performance vs. prescriptive mitigation technologies, for new and existing builds (homes and commercial buildings)

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