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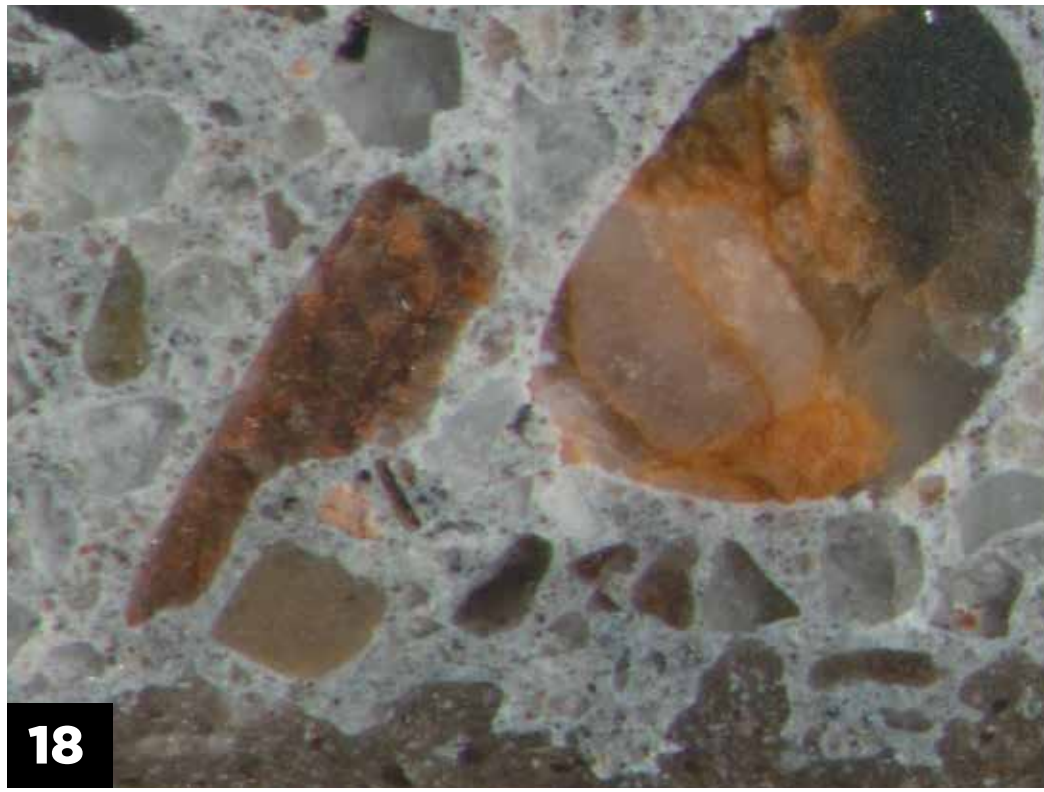
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LAYOUT & DESIGN: **GORD KLASSEN 24/7 CREATIVE**

PUBLISHED: JULY 2023/IIBEM0723/6609

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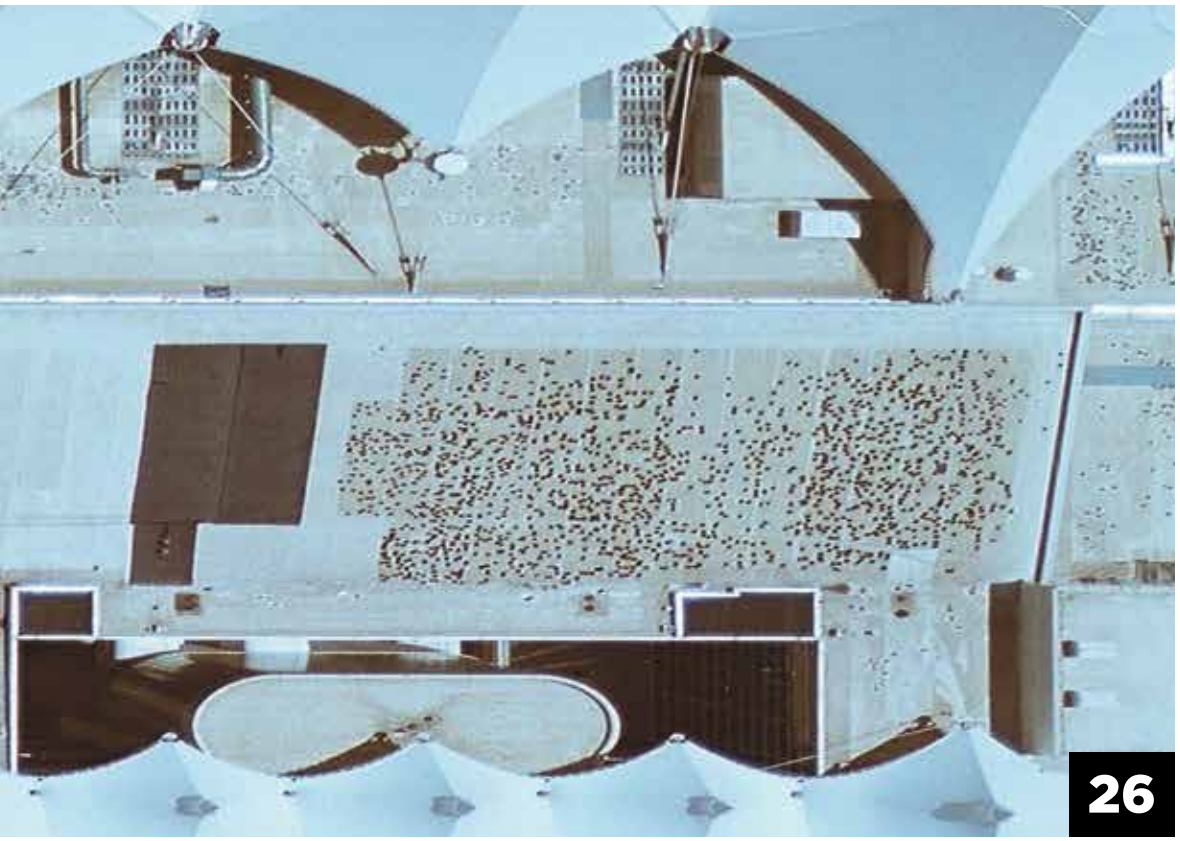
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The International Institute of Building Enclosure Consultants (IIBEC) was chartered in 1983 as the Roof Consultants Institute, in part, to bridge the gap between the seemingly disparate elements of the roofing profession. It later expanded to include issues of waterproofing and of the entire building enclosure and officially became IIBEC in 2019. The goal of ***IIBEC Interface*** is to connect those elements, educate and inform about related topics, establish a common ground for discussion, promote institute programs, and reach out to the industry at large. The publication acts as a moderator without approving, disapproving, or guaranteeing the validity or accuracy of any data, claim, or opinion appearing under a byline or obtained or quoted from an acknowledged source. The articles contained in this publication are derived from sources that we believe to be reliable. If you have reason to believe that any information contained in an article is false, factually incorrect, misleading, or otherwise erroneous, please contact us immediately, and we will promptly investigate your concerns. Except as expressly set forth in this paragraph above, to the fullest extent permitted by applicable law, IIBEC disclaims all warranties, express or implied, including, but not limited to implied warranties of merchantability, title, fitness for a particular purpose, noninfringement, comparability, security, and accuracy. Some jurisdictions do not permit the disclaimer of certain warranties, so the above disclaimers July not apply to you. The entire contents of this publication are copyrighted 2023 by IIBEC. All rights reserved. Featuring a paid circulation of 3700, it is commonly circulated intraoffice among multiple colleagues, creating a total estimated readership of 10,000 per issue. If you would like more information about advertising in *IIBEC Interface* or marketing to IIBEC members, contact manager of marketing & sales at info@iibec.org. ***IIBEC Interface*** (ISSN 2380-0240) Periodical Permit 22930 is published monthly except in June. Periodicals postage paid at 1 Floretta Pl., Raleigh, NC 27676. POSTMASTER: Send address changes to ***IIBEC Interface***, 434 Fayetteville St. Ste. 2400, Raleigh NC 27601.

Better Together



Amy Peevey, REWC, RRO, PE, CDT
President

CONGRATULATIONS TO THE first 15 recipients of the Certified Building Enclosure Commissioning Provider (CBECxP®) credential! I am so proud that these professionals successfully completed the rigorous application process and passed the CBECxP exam. I look forward to congratulating more credential holders in the future! As we celebrate this milestone, I want to acknowledge the IIBEC staff and volunteers who have developed and supported our credentialing program. Thanks to your hard work, IIBEC continues to meet our strategic goal of "lead[ing] the industry in building enclosure consulting credentials."

Speaking of IIBEC's strategic goals, staff and volunteers met at IIBEC's headquarters this past May to evaluate our strategic plan. Over the next year, the plan will be updated to ensure its continued alignment with the future of IIBEC and its members. I am grateful to those who took time away from their personal and professional commitments to support IIBEC.

As a part of IIBEC's strategic plan, the Diversity and Inclusion Committee published a diversity and inclusion plan (https://iibec.org/diversity-and-inclusion). Developed to ensure that each member has a place, value, and voice within our organization, the plan prioritizes the perspectives, experiences, backgrounds, and knowledge of every member, and it helps us—as an association, a profession, and a community—be better together than we can be as individuals.

In fact, IIBEC (formerly RCI) was founded upon the principle of "better together." Forty years ago, "building enclosure" was not a known area of practice within the construction industry. Individuals with specialized expertise in building enclosure materials, design, construction, and evaluation were underrepresented and underappreciated. They lacked an established community for networking, support, and growth, and they needed an amplified voice to speak up about their value in the construction industry. When IIBEC's founders realized that they could be better together, they took action and created this organization to help members network and support each other, succeed in advocacy efforts, and foster widespread recognition that building enclosure consultants are critical industry leaders.

IIBEC's founders were right: We are better together. Today, savvy owners, designers, and contractors want to work with IIBEC members because they recognize the value that building enclosure consultants provide. They know that IIBEC-credentialed professionals can ensure that qualified team members are engaged to achieve success for existing and new construction projects. Working together, IIBEC members have also researched and developed innovative industry solutions, and we have played an important role in improving building codes, standards, laws, and regulations. In these ways, we have had a powerful and positive impact on public safety, economic growth, and the future of sustainable and resilient construction.

In a nutshell, the 40-year history of IIBEC is the story of how building enclosure consultants have moved from underrepresentation to inclusion and empowerment in the construction industry, and how our success has benefited our professional community, the built world, and the public. I believe that incorporating diversity and inclusion into our best practices is necessary to continue forward on this journey. The society we live in is undeniably diverse. Therefore, we must be inclusive to grow and prosper.

Some may consider diversity and inclusion to be abstract goals, but they are actually quite practical matters, with practical goals and applications. As noted in IIBEC's diversity and inclusion plan, "substantial research shows that diversity brings many advantages to an organization: increased profitability and creativity, stronger governance, and better problem-solving abilities." For IIBEC and the building enclosure profession to continue to grow and sustain success, a key priority is recruiting talented, distinctive, and forward-thinking individuals to join our membership and the building enclosure industry. Additionally, our success in our individual careers and businesses is dependent on attracting and retaining employees who can develop innovative approaches based on sound expertise to resolve building enclosure problems and improve the building enclosure industry. And as human beings with an innate need for community, each of us has the responsibility to welcome, support, and include other members in our networks so that we continue to be better together.

Each day I hope to be a better version of myself than I was the day before. As a part of my personal initiative for growth, I pause and ask myself: "What steps can I take here and now to build an equitable future for our profession?" I hope you will share your thoughts and ideas with me regarding how IIBEC can better support you as a member and help everyone in our community as we each progress on the same journey of life.



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Correction

IN THE MAY/JUNE 2023 issue of *IIBEC Interface*, Figures 6 and 7 in "Best Practices for the Design and Installation of Thermoplastic Roofing Systems, Part 3 of 4: Roof Pipe Penetration Flashing Details" by Gary Gilmore were incorrect. The correct figures are shown here. We regret the error.

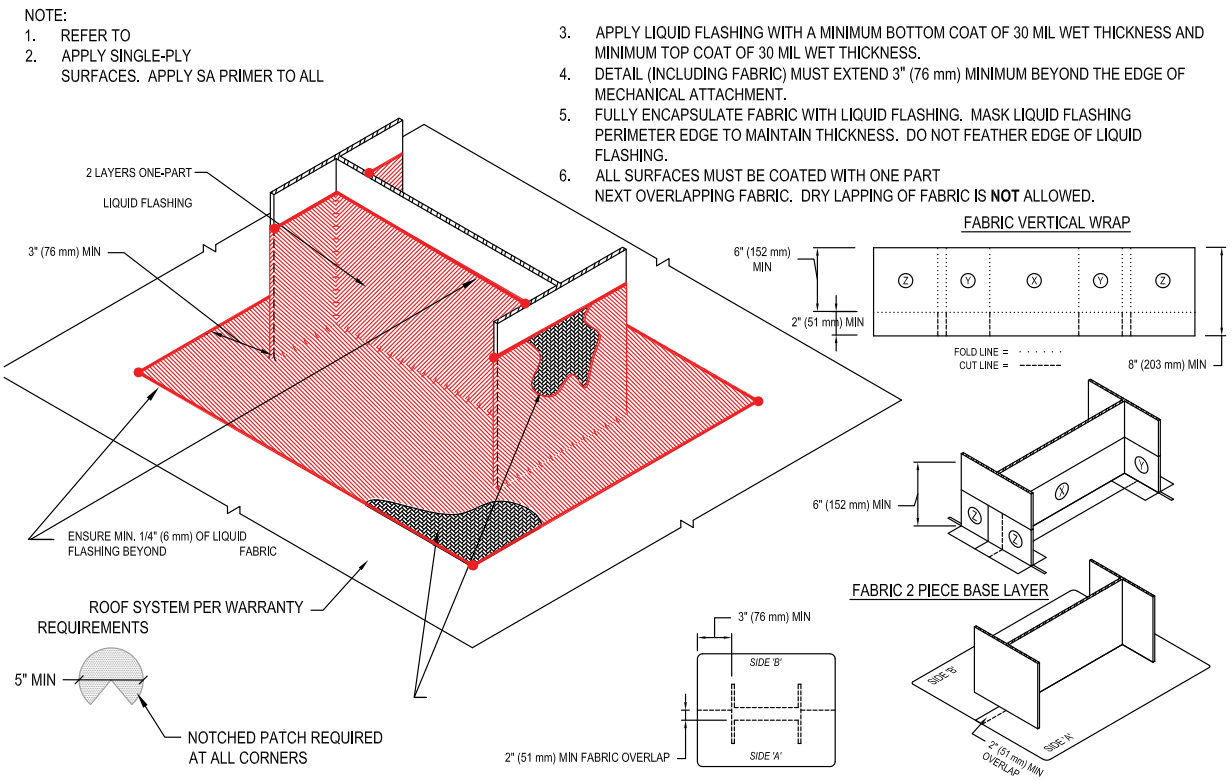
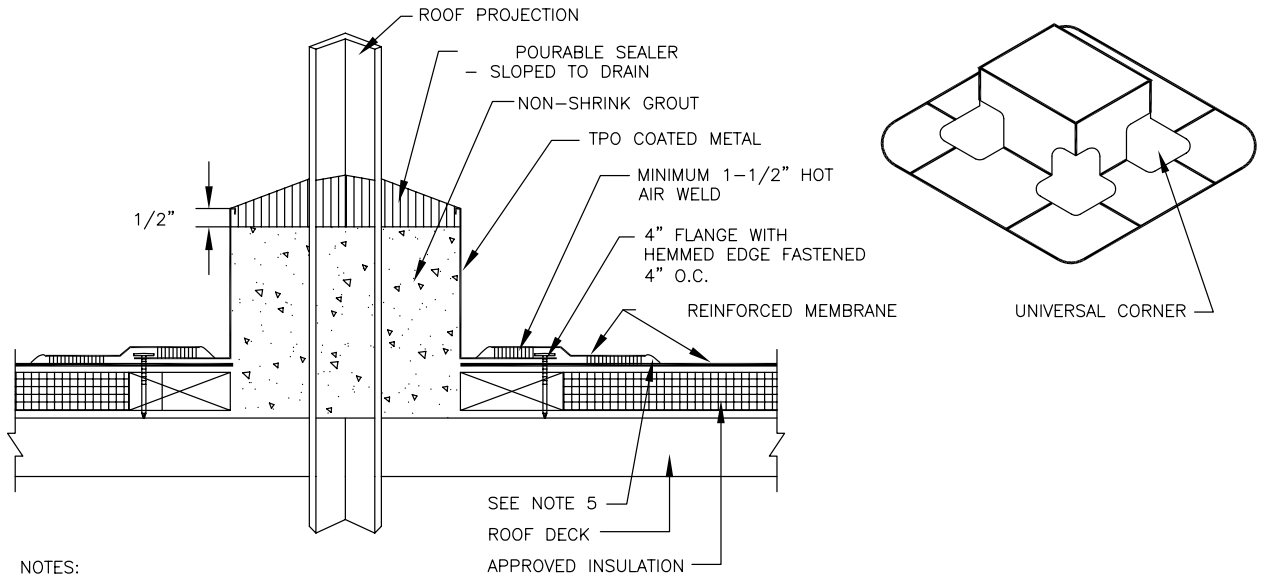


Figure 6. Standard detail for the installation of liquid-applied flashing on an I-beam.



NOTES:

1. BEND TPO COATED METAL TO FORM A PITCH PAN AS SHOWN.
2. ALLOW 2" CLEARANCE AROUND THE PROJECTION
3. ALLOW GROUT TO CURE AND DRY BEFORE APPLYING POURABLE SEALER.
4. INSIDE SURFACE OF TPO COATED METAL PITCH PAN (BARE METAL SIDE) AND OUTSIDE FACES OF PROJECTION MUST BE CLEAN AND PRIMED WITH
5. APPROXIMATELY ⅛" DIAMETER BEAD OF CUT–EDGE SEALANT IS REQUIRED ON CUT EDGES OF TPO REINFORCED MEMBRANE.
6. PRE–MOLDED PIPE BOOTS ARE NOT TO BE USED AS PITCH PANS.

Figure 7. Standard sealant-pocket flashing detail.

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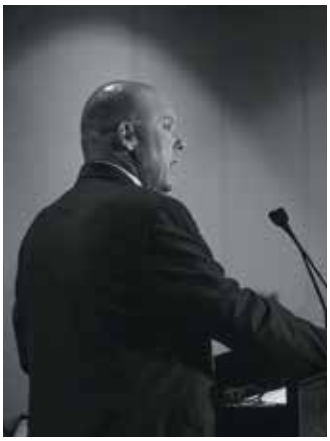
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Safeguarding the Role of the Design Professional in Public Procurement Projects

By Brian Pallasch, CAE

WITH THE RELEASE of the new RCI-IIBEC Foundation report, "An Analysis of Unit-Price Procurement," IIBEC has redoubled its efforts to protect the role of the design professional in public procurement.

The RCI-IIBEC Foundation study reveals shortcomings in construction project purchasing programs based on unit-price procurement (cooperative purchasing, job order contracting, and multiple award schedules). Specifically, using unit-price procurement to procure design and construction services often leads to wasted taxpayer dollars and risk to public safety. Recognizing these problems, some governmental entities have severely limited or banned unit-price procurement for design and construction services.

In our education and public policy activities, IIBEC is focused on the following policy changes:

Ensure the independence of the design professional. IIBEC advocates for the use of independent design consultants with no financial interest in products specified and installed on publicly funded projects.

Public health and safety are paramount. Independent design professionals have a responsibility to adhere to local building codes and design standards that protect public safety. For this reason alone, design and construction services should never be part of a unit-price procurement.

Avoid single-source product specifications. IIBEC recommends multiple material sources be specified in all publicly funded construction projects to promote competition and ensure best value. A specification focused on performance goals and life-cycle cost goals will allow for increased competition between material suppliers.

Require full and open competition in all public procurements. IIBEC encourages public entities to embrace competition in procurement to the maximum extent possible.

Utilize qualifications-based selection (QBS) for procurement of all design services. QBS is designed to ensure the public owner's primary concern is realized—to get the best available professional design services for the taxpayers' money and to conduct a fair and equitable selection process.

Responding to Questionable Procurements

At the state, provincial, and local levels, IIBEC has redoubled its efforts to ensure that procurement officials are following existing laws and regulations. The goal is to be alerted to questionable or improper procurements before the closing date. In those instances, IIBEC can quickly reach out to identify the issues with the procurement. This was the case in Alberta and British Columbia, where we sent a series of letters regarding specific procurements. In a number of instances, this resulted in the reissuing of the procurement to comply with the regulations. Due to our outreach, we started a dialogue with a number of local officials, resulting in a better understanding of their challenges with procuring design services while allowing them to understand the important role IIBEC members play in project delivery.

In May, IIBEC sent a letter to the Texas Region 4 Educational Services Committee (Houston area) that outlined problems with a job order contract solicitation that closed in June.

Even if we do not learn in advance of a questionable procurement, we still have the opportunity to educate local officials and start a dialogue. Also in May, IIBEC learned after the fact that Louisa County, Virginia, had used cooperative procurement on a number of projects. Virginia had years earlier passed a law outlawing cooperative procurement for public construction projects. After contacting the Louisa County procurement officials, we received a quick response saying that in the future the county would use a different process for procuring needed services.

Opposing Legislation to Expand Cooperative Procurement

Attempts are ongoing at the state level to expand the use of cooperative purchasing and similar procurement methods. IIBEC continues to oppose these attempts and to engage partner organizations to join the cause. So far this year, IIBEC has contacted legislatures in North Dakota and Missouri to oppose the expansion of cooperative purchasing, and in each case the outcome was favorable to our position.

Protecting QBS

Last year IIBEC successfully defended against efforts in Illinois and Alabama that threatened the use of QBS for the selection of design professionals. This spring, a controversial amendment was added to a Florida charter school funding bill that would have eliminated the state's QBS requirements and allowed the university system to design its own procurement system. Over the course of 72 hours IIBEC alerted allies and wrote and delivered testimony in opposition to the amendment to all members of the committee. At the end of the day, the amendment was stripped out of the final bill—protecting QBS and eradicating the new procurement system. Even though QBS recently celebrated its 50th anniversary of use at the federal level, those supporting a price-based approach to design services procurement threaten QBS every year.

How You Can Help Improve Procurement

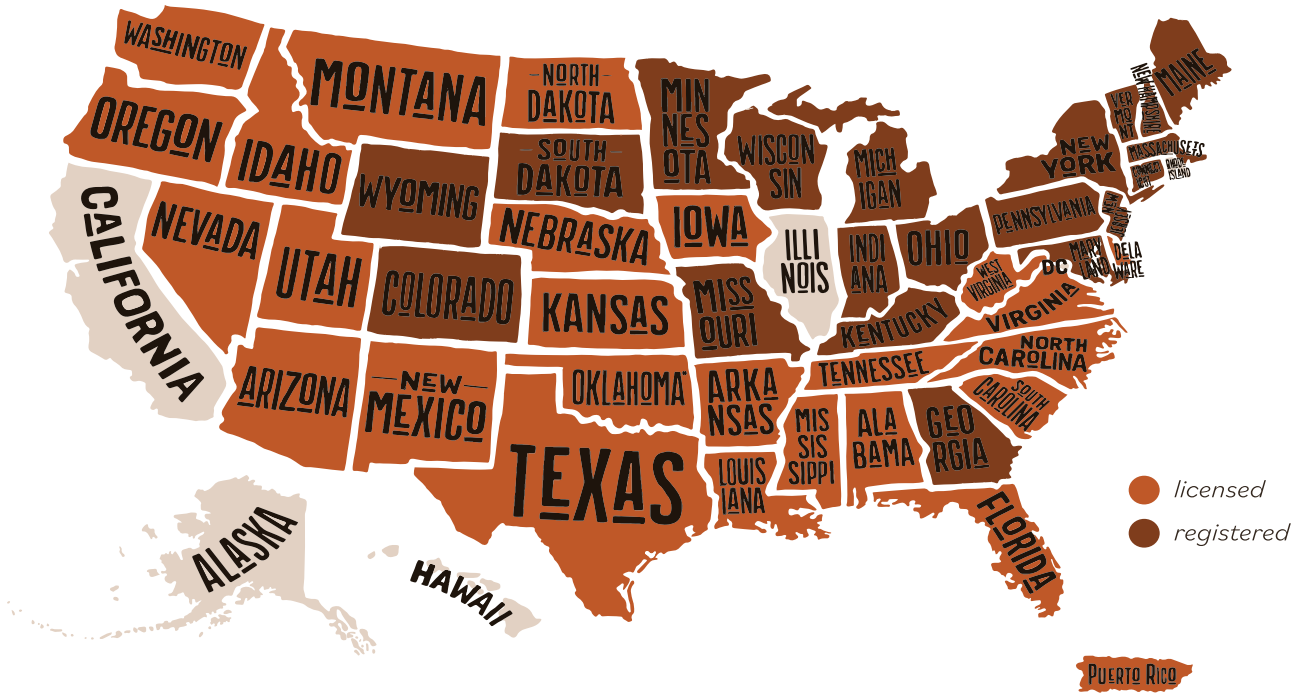
Let IIBEC know when you see a procurement that is not following the rules. We have a system that allows us to respond in these instances confidentially. Our experience is that local procurement officials are willing to engage in a dialogue to improve their procurement practices.

Independent building enclosure consultants safeguard taxpayer dollars by ensuring proper design, appropriate materials, and quality installation. IIBEC's goal is to ensure that public officials comply with the letter and the spirit of the law when procuring design services.



P.S. Watch your inbox this month for the IIBEC member survey. Your voice matters in shaping our future.

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Remediating Leaks in Below-Grade Structures and Plazas

By Paul Buccellato, AIA, RWC, REWC, FASTM, F-IIBEC

WATER INFILTRATION THROUGH a roofing or waterproofing membrane is problematic and can cause deterioration of structural building components that can adversely affect their performance. When water infiltrates a basement—whether through the foundation, the slab-on-grade, or the plaza above—the results can be catastrophic and render the basement space uninhabitable. Also, ascertaining the source or cause of these leaks can be difficult, and the repairs can be costly and disruptive to occupants.

For that reason, waterproofing membranes should ideally perform for the full life of the building. Durability is a principal consideration in selecting a waterproofing membrane. Notably, if waterproofing manufacturers offer warranties or guarantees, the usefulness of the warranty or guarantee tends to be severely limited for below-grade structures, for two reasons:

- Waterproofing for foundations and under slabs-on-ground are inaccessible.
- Replacing a waterproofing system under a plaza will require removal and replacement of the overburden, including vegetation, concrete slabs, pavers, and setting beds.

Relative to waterproofing, when roofs leak, the sources of water intrusion can usually be readily identified and repaired because most roof membranes are accessible. Even if those membranes are covered with aggregate, pavers, or protected membrane systems, it is not difficult to observe and expose the roofing membrane or flashing and then identify and repair the defect.

By comparison, remediating leaks in below-grade structures and plazas can be more challenging. This article addresses those challenges.

INVESTIGATION OF BELOW-GRADE OR PLAZA LEAKS

The methodology described in this section is intended to provide a systematic approach to evaluate leaks in below-grade structures or plazas. The investigation procedure of finding and stopping leaks in below-grade structures or plazas is similar to the process of resolving a roof leak.

Documentation Review

First, before a physical exploration is performed, the following should be acquired and reviewed:

- The geotechnical report (if one was issued)
- Construction documents to ascertain the type of waterproofing system installed, along with the thickness of the slabs and foundations
- The history of water infiltration, including locations
- A record of leak-related repairs
- Documentation showing whether sprinklers and lighting conduits were installed after application of the membrane
- Documentation regarding recent alterations of the structure to determine whether new below-grade penetrations were installed
- Reports from building personnel knowledgeable as to whether leaks are intermittent or continuous

Ascertaining the building area's flood zone, if applicable, can also provide invaluable information to the investigation.

Leak Survey and Observations of Existing Conditions

A basement plan of the premises should be obtained from the building owner. If they are not available, plans should be prepared to assist in recording all current leak sites and any inactive leak sites that have been repaired. The following items should be recorded:

- Areas where water is infiltrating from below (that is, through the slab/foundation joint)
- Locations of water infiltration through construction joints or cracks
- Flowing, dripping, or staining from water leaks at penetrations, plaza drains, piping, pipe hangers, or other penetrations in the suspended slab
- Leaking or staining near form-tie holes or rock pockets
- Staining under openings to window wells
- Volume of water infiltration or seepage
- Whether leaks appear only as damp spots
- Flood-level lines
- Whether stains on slab soffits and pipes are circular, indicating condensation

Additionally, not all damp spots on walls or puddles on floors are caused by water infiltration. These may be due to condensation or from overhead pipes that leak.

DETERMINING THE CAUSE OF A WATERPROOFING FAILURE

Leaks through below-grade concrete foundation walls and slabs-on-ground exhibit themselves at cracks, cold joints, expansion joints, and penetrations. On concrete masonry foundation walls leaking can extend over many mortar joints.

If leaking occurs after a period where the basement has been dry, it is usually caused by failure of either a structural element or one of the waterproofing components. These failures can be exacerbated by an unanticipated increase in hydrostatic pressure.

When structural failures occur, they exhibit as cracks or the opening of construction joints. These types of failures may be due to overloading, settlement, vibration, seismic

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Figure 1. Absence of gutters can cause additional recharging of soil from roof runoff.



Figure 2. Oil (petroleum) infiltration can be identified by color and odor.

events, creep, shrinkage, or adjacent construction activities. Structural failures can also happen if a nearby construction site utilizes controlled blasting to minimize the over breakage of rock beyond the excavation site. Dewatering in nearby excavation sites can cause differential settlement from groundwater level drawdown.

When a below-grade or plaza waterproofing failure occurs, it can generally be traced to one or several of the following:

- Membrane rupture over voids or holes in the foundation from rock pockets or formwork spreaders
- Splitting or seam failure of waterproofing membrane at plane changes
- Cracking or disintegration of inadequately compacted soil or gravel
- Concrete cants at the footing/wall joint
- Membrane deterioration from aggressive soils, petroleum products, and other deleterious chemicals
- Membrane damage from root intrusion when vegetation is replaced or backfill settlement
- Loss of bentonite from rapidly moving water
- Improper or inadequate penetration flashing
- Ruptured flashing at plaza drains caused by traffic or wearing course movement
- Displacement or construction joint separation of waterstops
- Rupture of plaza expansion joints or separation of flanges from the membrane

Leaking in below-grade walls and slabs is frequently caused by an unanticipated increase in hydrostatic pressure due to a rise in the water table or from an overload of water in the soil surrounding the foundation. The latter may be caused by the following:

- Nearby construction of new below-grade structures or utilities diverting underground water tables toward the site
- Runoff from recently paved adjacent areas

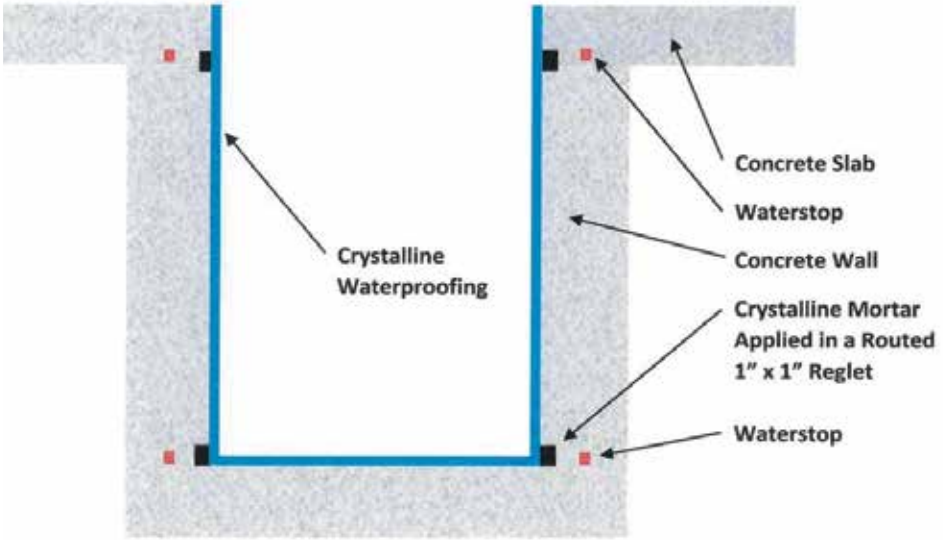


Figure 3. Diagram of crystalline waterproofing application.

- Regrading on neighboring lots that directs water toward the building
- Leaks from nearby area drains or sewers (storm or sanitary)
- Obstructed plaza drains
- Negative grading
- Dense shrubbery at the foundation preventing groundwater from evaporating
- Sprinkler heads that spray water under adjacent wall flashing
- Gutters that are undersized, absent (**Fig. 1**), too widely spaced, or clogged
- Lack of drainage or blocked drainage in areaways or window wells
- Relocation of underground water tables from their normal flow at nearby construction sites
- Abandoned or concealed catch basins

Leak sources from an increase in hydrostatic pressure can often be identified by observing the color or odor of the infiltrating water or from chemical tests. For example:

- Chlorine is indicative of a water line break.
- An unusually high level of bacteria is typically associated with a sewer line break; such breaks often go unreported because the leakage does not affect waste removal.
- Saltwater can be traced to a tidal flow from a nearby body of water.
- Bentonite or bitumen often indicates a failure of a bentonite or bituminous waterproofing system.
- Oil can originate from a ruptured fuel line or tank (**Fig. 2**).
- Rust stains on the interior of a concrete foundation can come from reinforcing bars attacked by aggressive soil chemicals.

REMEDIATION OPTIONS

After performing a leak survey, the consultant should complete a visual inspection of the building exterior. That inspection will help determine which remediation option is appropriate.



Figure 4. Crystalline waterproofing being applied by brush.

Depending on the specific variables associated with the repair project, a variety of remediation options may be pursued for leaks in below-grade structures and plazas. Each approach comes with its own advantages and limitations.

Crystalline Waterproofing and Hydraulic Cement

Crystalline waterproofing is a long-established method of remediating basement leaks. It is applied to moist surfaces. Construction joints and cracks are routed out, primed, and packed with a cementitious mortar (**Fig. 3**). Crystalline coatings are capable of limited self-healing of cracks that measure up to 0.012 in.(0.3 mm) wide. There are also many useful proprietary hydraulic cements marketed for emergency repairs of flowing water.

The application of negative-side waterproofing materials is a common remediation method. It is an efficacious approach in situations where water is infiltrating through many locations over a large or broad area.

Surfaces must be mechanically abraded to open the pores. Cracks and joints must be routed out at least 1 × 1 in. (25 × 25 mm) and a cementitious mortar forced into them. Surfaces to which the materials are to be applied must be kept moist for 36 to 48 hours after application, or as specified by the crystalline manufacturer. The material can be applied by brush or air spray (**Fig. 4**). Crystalline waterproofing is typically applied in two coats.

This approach is relatively inexpensive and easy to apply, and it is suitable for active leaks. A major disadvantage to crystalline coatings is that they are vapor permeable and should not be used in areas where high humidity must be controlled.

Some other disadvantages include:

- Vulnerability to substrate cracking
- Dependence on construction joint treatments
- Inability to protect against corrosive soils
- Impractical for structurally framed slabs and intersecting walls

Bentonite Grout

Sodium bentonite is a high-solids, clay-based remedial waterproofing material. When bentonite is injected at the foundation interface with the adjacent soil, it forms a dense, watertight material course. Bentonite grout is effective when injected behind heavy stone foundations or at least 6 in. (150 mm) thick reinforced concrete slabs.

Bentonite can be injected behind foundation walls from the interior, or it can be injected from the exterior of the building (**Fig. 5**). It can also be injected under basement slabs. Injecting from the interior requires the predrilling of holes through the foundation wall to pump grout through. Exterior injection does not require soil excavation and is accomplished by sinking a pipe into the soil adjacent to the foundation (**Fig. 6**). Pipes are spaced 2 ft (0.6 m) on center and used for shallow foundations that are less than 10 ft (3 m) deep. Maintaining proper pumping pressures is critical to ensure the structural integrity of walls and slabs, as high pressures can displace insufficiently reinforced concrete and masonry. It can fill large voids in the soil and is suitable for remediating failed foundation waterproofing.

Some installers state bentonite should not be used within 24 in. (600 mm) of the grade because of the difficulty of maintaining sufficient pressure and restraint. Without confinement, sodium bentonite cannot create sufficient pressure.

Bentonite is relatively inexpensive. It can fill large voids in the soil, and bentonite injection is suitable for remediating failed bentonite waterproofing. However, bentonite injections can be washed away by swiftly flowing water in well-drained soils.

Bentonite injections require the compression of the surrounding soil and construction components. Cracks wider than 0.125 in. (3 mm) must be sealed with mortar to maintain proper compression. Pumping must be monitored, as its force could displace insufficiently reinforced concrete or masonry walls.

When compared with urethane or acrylate esters, bentonite grout is less expensive and does not require the same level of application skills as other remediation methods.

Some of the advantages of sodium bentonite grout include the following:

- The product is a natural, inert mineral and contains no volatile organic compounds.
- It can fill both small and large voids around the foundation.
- It can be injected through the same drilled holes to provide greater coverage if the initial injection does not stop the leak.

Some disadvantages that should be considered:

- It may flow into footing drains and clog them.
- If the injection fails to stop the leaks, additional bentonite is the only option because it forms a bond breaker with alternative materials.

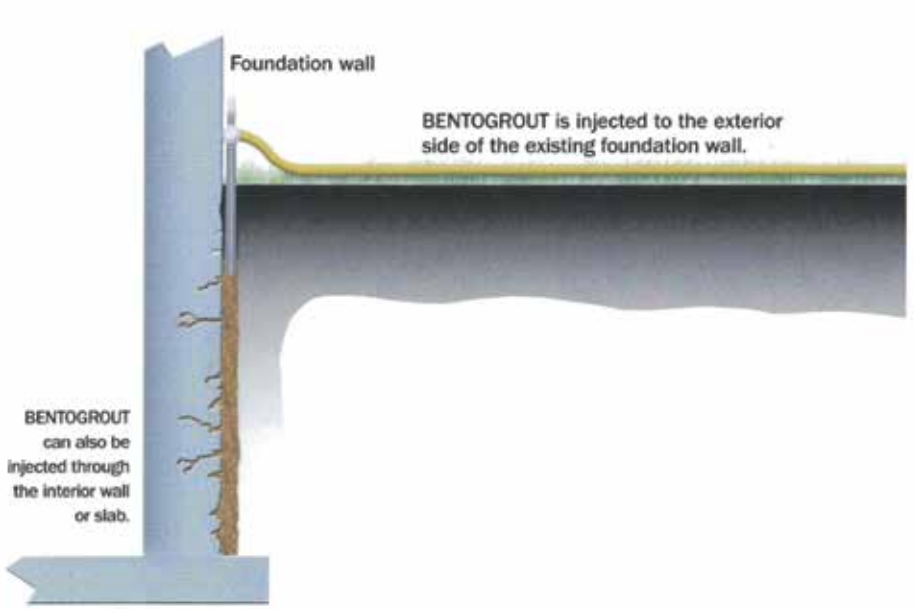


Figure 5. Diagram of bentonite injection on exterior of foundation (Diagram courtesy of CETCO.)


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Figure 6. Bentonite injection on exterior side of foundation.



Figure 7. Port installation for epoxy injection.

Epoxy-Resin Bonding Systems

Epoxy-resin bonding systems are the preferred material for repairing structural damage in cracks or cold joints that are not subjected to movement from thermal changes or vibration. Injected into concrete cracks as narrow as 0.002 in. (0.05 mm), they can stop leaks; however, they are not as effective as chemical gel products. Epoxy-resin systems are two-component, consisting of modified epoxy resins and a curing agent of amine hardeners and modified fillers. They are specified under ASTM C881, *Specification for Epoxy-Resin-Base Bonding Systems for Concrete*.[1] These systems are classified according to type, grade, class, and color.

Epoxy-resin bonding systems cure chemically, are moisture tolerant, and are unaffected by cycles of freezing and thawing. They can cure under humid conditions and bond to damp surfaces. They adhere well, but they are relatively inflexible and do not tolerate movement. They are not recommended for high-volume leaks because it is difficult to keep the resin in position until it has cured. They are not as effective as urethanes for stopping leaks.

Since epoxy is inflexible and stronger than concrete, cracks may occur in the concrete near the site of the repair where stresses are transferred to adjacent areas. Additional injections at adjacent cracks with urethanes are often required to solve leak problems.

Epoxy injection requires workers who have the knowledge to select the most appropriate products with the correct viscosity and the skill to apply those products with the proper injection pressure and timing (**Fig. 7**). Cleaning cracks is crucial where epoxies are injected.

Epoxy-resin bonding systems are suitable for concrete, but not for masonry. Their use is inappropriate to repair dynamic joints or cracks that are actively leaking, as there is the possibility of re-cracking. Epoxy injections can be odorous. The use of an epoxy-resin bonding system does not preclude the subsequent application of other remediation materials such as gel foam or injection.



Figure 8. Urethane grout injection at a horizontal concrete slab.

Chemical Gels and Foams

Products in the category of chemical gels and foams are urethane, acrylate polymers, and similar hydrophobic and hydrophilic chemicals that are one- and two-component resins. The installed products can be flexible or rigid materials and/or open- or closed-cell foams, depending on the formulation and proportions. Chemical gels and foams function as a flexible gasket between surfaces. Chemical gels and foams generally stop leaks and permit limited joint movement, but they will not restore strength or structural integrity.

Hydrophilic urethane gels react with water and expand to form a flexible resin that maintains its watertight integrity even during limited concrete movement (**Fig. 8**).

Hydrophobic urethane foams react with small amounts of moisture and expand, forming a water-impermeable grout curtain. Their cured density is more predictable than that of hydrophilic foams. In their cured state, hydrophobic urethanes are not affected by changing moisture conditions.

Acrylate polymers have excellent adhesion and are very fluid, with viscosities approaching that of water. They do not expand upon reaction with water but exert less pressure than bentonite and most urethanes. As such, they are suitable for injection into thin cracks and joints in concrete and masonry, and for repairing deteriorated membranes in split-slab assemblies. They also form superior flexible grout curtains in moist environments.

Low-viscosity flexible urethane and acrylate polymer grouts are injected from the negative side into cracks or joints, and into soil behind leaking walls and slabs. The resins are installed by pumping them through holes drilled in the concrete from the interior. To create gel curtains, the holes are drilled through floor slabs spaced 12 to 24 in. (305 to 610 mm), and through foundations 12 to 24 in. (305 to 610 mm) each way. At cracks and joints, the holes are drilled at opposing angles on either side, generally spaced 12 to 24 in. (305 to 610 mm) apart. Packers are inserted in the hole and chemicals are injected under pressures ranging from 1 to 3000 psi (6.89 to 20,860 kPa) progressively from drill hole to drill hole. ASTM D8109, *Waterproofing Repair of Concrete by Chemical Grout Crack Injection*,[2] describes the selection of materials, installation methods, and inspection required for sealing leaks at cracks in concrete building walls and slabs.

Injected chemical gels and foams resist acids, alkalis, and organic solvents, but they are ineffective for structural repair and the strength of slabs and walls must be evaluated to ensure they can withstand the increase in hydrostatic pressure. Urethanes can be used to lift or stabilize floor slabs structurally by filling voids below the slabs. Other limitations with this technique include the fact that certain hydrophilic gels can shrink, and the application process can be messy and difficult to clean up.

Above-Ground Building Components

As noted earlier, the building enclosure consultant should complete a visual inspection of the building exterior before initiating

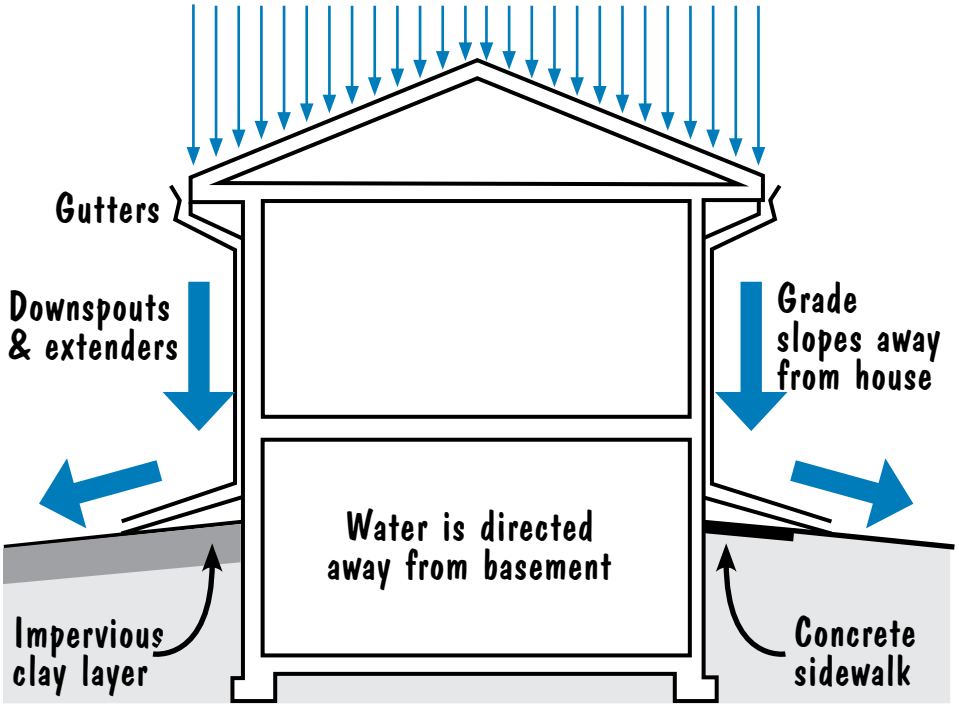


Figure 9. Leaks may be remediated by installing gutters and providing a positive slope away from the foundation.

remediation. In some situations, remediating a leak can be as simple as:

- installing gutters where they are absent and providing larger downspouts (**Fig. 9**);
- connecting downspouts to a storm water sewer or extending them to daylight at least 10 ft (3 m) from building:
- recontouring the grade to slope away from building;
- constructing swales to divert water around building;
- providing interceptor drains on uphill side of the site;
- installing a perforated pipe in gravel at the building perimeter and at the base of a metal and glass curtainwall to reduce hydrostatic pressure; or
- locating lawn sprinkler systems to avoid spraying water onto the building.

Other remediation methods may involve the following:

- Draining water within the basement by installing an interior perimeter gutter sloped to a sump so it can be pumped to a sewer
- Installing drainage panels on basement walls and floor slab and then covering them with watertight wall panels and 3 to 4 in. (75 mm to 100 mm) concrete slab; the water would be conducted to a sump and then removed by a pump

Repairing or replacing the waterproofing membrane on a concrete foundation can be costly but can be effective on shallow foundations where there is access.

CONCLUSION

The location and severity of the leaks will determine the appropriate method of remediation. Sometimes, more than one method is required. Factors that influence the selection process include the following:

- Access to the foundation and slab either from the interior or exterior
- The degree of disruption to the building occupants
- Budget limits imposed by the owner

In many cases, the best approach is to begin with the simplest and least expensive method and graduate to more complicated and costly remedies as required.

Causes of leaks in basements include the following:

- Failure or absence of a positive-side waterproofing system
- Movements that open cracks and joints
- Flashing failures of the waterproofing at penetrations
- Hydrostatic pressure absent at the time of construction

The building enclosure consultant should perform a thorough and systematic investigation to determine the source of water infiltration. The cause and building limitations should be determined before a remediation method is selected. Additionally, all options should be considered before a final decision is made as to which approach is best for the building.

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2. ASTM International. 2017. *Waterproofing Repair of Concrete by Chemical Grout Crack Injection.* ASTM D8109-17. West Conshohocken, PA: ASTM International.

ACKNOWLEDGEMENT

The author acknowledges Stacy Byrd of CETCO for reviewing and editing the Bentonite section and Thomas Planert of Substrate Testing Inc. for reviewing and editing the Epoxy and Chemical Gels & Foams sections.

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Below-Grade Waterproofing: A Closer Look into Fully Bonded Blindside Systems

By Nitharsan Kugadas, MSc Chem, MBS

All images courtesy of Nitharsan Kugadas

THIS ARTICLE REVIEWS the bonding mechanisms and test methods for fully bonded blindside waterproofing membranes that are permanently bonded to basement and below-grade concrete structures. The described systems are used to waterproof the positive side (the side facing the soil or backfill) of a concrete structure.

Leaks can occur in below-grade concrete structures exposed to groundwater in the surrounding environment. The leaks can originate from a vast variety of issues. Typically, untreated construction joints (cold joints) and penetrations within the concrete structure (such as pipes, pile heads, and so on) are the areas where water travels to the inside of the below-grade space. In addition, cracks in the concrete slabs or walls can pose a pathway for groundwater to cause leaks.

Different waterproofing solutions are used to protect below-grade concrete structures from leaks. The solutions range from waterproofing admixtures to waterproofing membrane systems. In general, waterproofing solutions can be classified as integral waterproofing systems and barrier waterproofing systems. Integral waterproofing systems add the waterproofing performance directly to the concrete mixture design, which is achieved with waterproofing admixtures.

Barrier waterproofing systems create a separation layer between groundwater in the surrounding environments and the inside of a building. Types of barrier waterproofing systems can be categorized as negative-side waterproofing and positive-side waterproofing. Negative-side waterproofing refers to a waterproofing layer that is applied on the inside of the below-grade concrete structure. It prevents leaks created by groundwater that has penetrated through the entire thickness of a concrete slab or wall. Typical products are cement-based coatings such as waterproofing grout, mortars, and similar materials. Negative-side waterproofing

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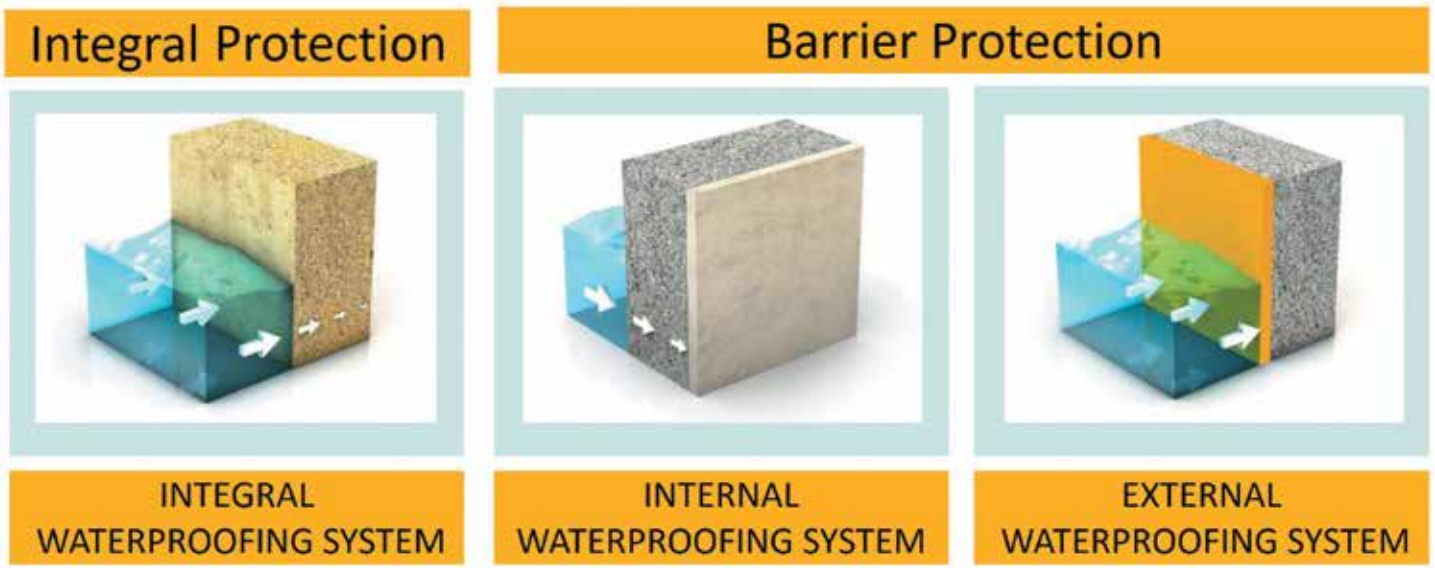


Figure 1. Waterproofing systems can provide integral or barrier protection. Note: Negative-side and positive-side waterproofing systems are shown in the middle and right sections of the figure, respectively.

is used for repairs of existing concrete structures and can be used in new construction as a last resort. However, negative-side waterproofing leaves the concrete structure exposed to its surrounding environment, whereas positive-side waterproofing creates a barrier between water and the concrete structure.

Products used for positive-side waterproofing include coatings, sheet membranes, liquid-applied membranes, and self-adhesive modified-bituminous sheets, among others. The choice of product depends on the project requirements such as resistance to chemical exposure, resistance to hydrostatic pressure, and material durability. The duration of the warranty may be another consideration when selecting a product. Positive-side waterproofing for new construction on areas where there is no access to the concrete structures once the concrete is poured is called blindside waterproofing. Historically, clay-based systems have been used as blindside waterproofing systems. However, newer polymer-based blindside products have emerged; these are also referred to as fully bonded systems. **Figure 1** shows illustrations for the addition of waterproofing performance to a concrete structure.

BLINDSIDE WATERPROOFING

With the introduction of fully bonded systems (blindside waterproofing systems), manufacturers intended to provide a solution to the lateral water migration that is a significant problem of a system under hydrostatic pressure that is not fully bonded.

All systems that are installed before reinforcement is placed are subjected to the risk of puncture during the process of reinforcement placement. If reinforcement is dropped or dragged on these systems, that can cause damage and potentially lead to leaks, especially in areas subjected to groundwater and hydrostatic pressure. On residential and commercial concrete structures, vapor barriers with a thickness of 10 mil (0.25 mm) to 15 mil (0.38 mm) are used when there is no hydrostatic pressure against the building. Occasionally, a drainage system is installed in addition to the vapor barrier to divert any potential buildup of hydrostatic pressure. These systems are referred to as loose-laid systems because they are not fully bonded to concrete. The risk of leakage with loose-laid systems arises in situations where the system is damaged and hydrostatic pressure builds up. High-risk scenarios include heavy rainstorms and situations in which the drainage system is blocked. In these types of events, the water level can reach the vapor barrier, bypass the damaged area, and freely move between concrete and the vapor barrier sheet. This effect can also occur with loose-laid systems that are partially fixed but not fully bonded to a vertical concrete substrate. Eventually, the water will be visible in the form of a leak through a crack in the concrete or improperly detailed penetrations. To prevent the described lateral water migration, fully bonded systems have been used for blindside waterproofing, especially for concrete structures in the water table.

Polymer-based fully bonded systems have a general buildup of two layers. The main layer is facing the water and is called the waterproofing layer. This layer resists hydrostatic pressure and general membrane punctures. The second layer, which is referred to as the bonding layer, creates a bond with fresh concrete during the curing process. Various chemistries and technologies are used within the class of fully bonded systems.

Waterproofing Layer

The most common types of polymers used for the waterproofing layer are high-density polyethylene (HDPE), thermoplastic polyolefin (TPO), and polyvinyl chloride (PVC). The main objective for using a specific polymer and sheet thickness is to achieve the desired physical properties of a fully bonded membrane such as puncture resistance and flexibility (elongation). Puncture resistance is a key factor regarding the waterproofing layer weight, due to the steel reinforcement weight placed on small spacers. When a high load is placed on the small surface of a spacer, a high puncture load is created. Therefore, a fully bonded system must have a high degree of puncture resistance.

Flexibility plays a significant role during the installation of a system. A flexible and pliable system facilitates the installation on site, especially if the geometry of a slab design contains elevation changes and unconventional angles.

Bonding Layer

Fully bonded waterproofing membranes form a bond with the fresh concrete over the entire surface of the bonding layer. The main advantage of this system compared with loose-laid membrane systems is that in the case of a potential damage to the membrane, intruding water will not migrate laterally between the

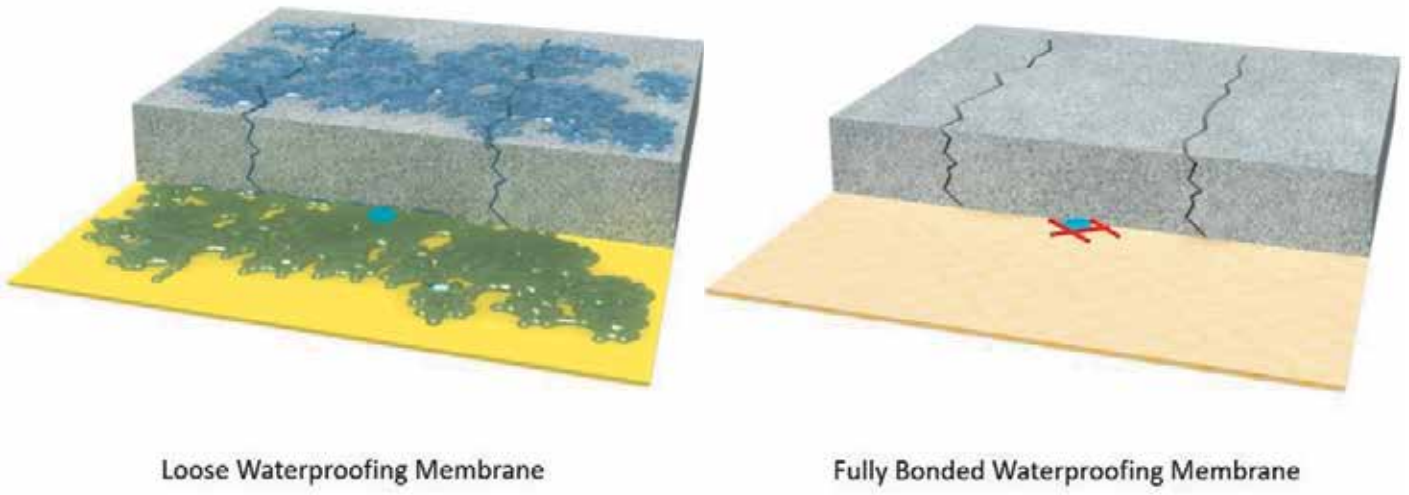


Figure 2. Water migration with loose-laid waterproofing membrane (left) and fully bonded waterproofing membrane (right).



Figure 3. Nonwoven fleece bonding layer.



Figure 4. Bonding layer with sand granules.

concrete and the waterproofing system. Instead, the water will remain contained locally on the damaged area. Thus, the fully bonded system reduces the risk of potential leaks through the concrete structure. In addition, fully bonded systems act as a form of damage control by decreasing how much injection repair is required if a leak occurs. **Figure 2** illustrates the lateral water migration for loose-laid waterproofing membranes and fully bonded waterproofing membranes.[1]

In fully bonded systems, the formation of the bond between the bonding layer and the fresh concrete is critical. There is a large variety of bonding layers on the market. However, the bonding mechanisms can be classified into three categories: mechanical, chemical/adhesive, and dual bond (mechanical and chemical/adhesive). In the following sections, the different bond mechanisms are described in more detail.

Mechanical Bond

Bonding layers with a mechanical bonding mechanism incorporate the effect of friction. Static friction occurs between two motionless objects. The surfaces of objects are generally uneven on an atomic scale. This unevenness results in surface roughness, which creates static friction that prevents sliding of the objects involved. If a shear force is introduced and becomes larger than the force of the static friction, the object will start to move. The resulting force acting against the shear force is called sliding friction. Generally, the force of sliding friction is less than that of static friction. To take advantage of the effect of friction, mechanical bonding layers contain either nonwoven fleece textile fibers or sand granules (see **Fig. 3** and **4**).

The surface of the mechanical bonding layer is embedded by the cement paste of the fresh concrete during pouring. Once the concrete cures, a boundary layer is formed. The friction present in the boundary layer is called form closure. This kind of friction is achieved when at least two connecting materials (textile fibers/sand granules and concrete) intertwine, thus remaining connected even if the force transfer is lacking.[2, 3]

Chemical/Adhesive Bond

Adhesion generally describes the connection of two surfaces of different materials. Various types of forces are present between the attached particles. Adhesion can occur mechanically through the interlocking of the adhesive material and the surface on which it is applied. This process occurs at a microscopic scale where the adhesive fills in the pores of the surface area. This type of adhesion is a physical connection and does not change the chemical structure of the adhesive or the substrate surface.[4,5] **Figure 5** illustrates a scheme of a micromechanical adhesion.[5] **Figure 6** shows a sample of an adhesive bonding layer.

At the molecular level, micromechanical adhesion is created through forces acting between atoms or molecules to form a connection. These intermolecular bonds are influenced by the properties of the atoms or molecules. The types of forces that can form intermolecular bonds can be classified as ion-induced dipole forces, ion-dipole forces, and van-der-Waals forces.

Ion-dipole forces act between an ion and a polar molecule (see **Fig. 7**). The oppositely charged parts of the molecules locate themselves to generate maximum attraction. In an ion-induced dipole force interaction, the charged ion disrupts the arrangement of electrons in an atom or nonpolar molecule and induces a dipole. Hence, a weak bond between the ion and the induced-dipole occurs. The same effect occurs in van-der-Waals forces; however, in van-der-Waals forces, the interaction happens between

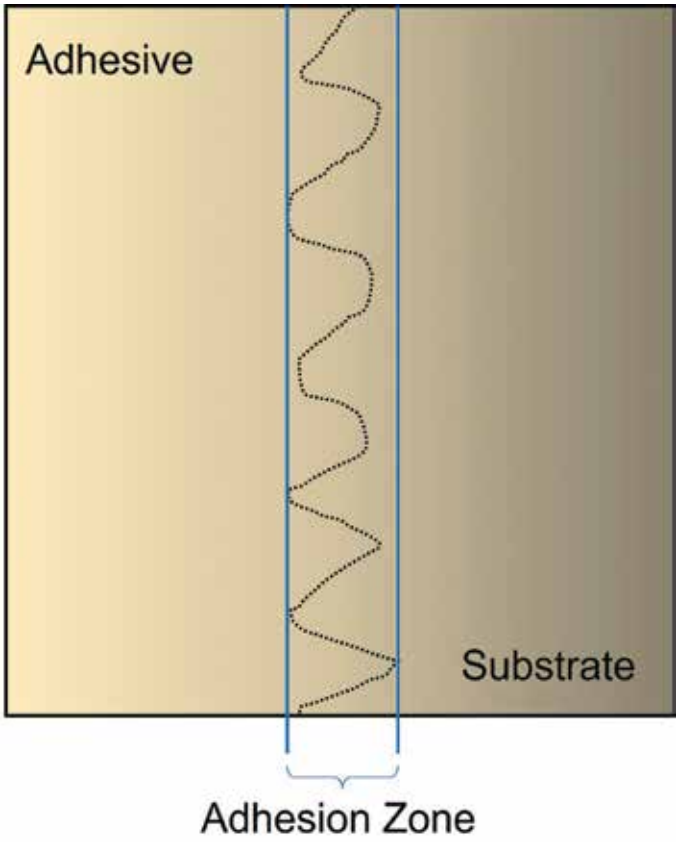


Figure 5. Scheme of micromechanical adhesion.



Figure 6. An adhesive bonding layer.

a polar molecule and either another polar molecule or a nonpolar molecule instead of an ion and another polar molecule or a nonpolar molecule. These interactions are called dipole-dipole and dipole-induced-dipole interactions.[4]

Dual Bond

A new generation of fully bonded systems have been developed to use both mechanical and chemical/adhesive bonding mechanisms. The bonding layer is designed to have a rough or coarse texture so that a mechanical bond is created when fresh concrete encapsulates the layer. In addition, adhesive polymers are added to the bonding layer matrix to provide a chemical/adhesive bond. **Figure 8** shows a cross section of a fully bonded membrane using the dual-bond mechanism. The rough/coarse structure keys into the concrete while an adhesive bond is simultaneously created between the bonding layer and concrete on the entire contact area.

PERFORMANCE TESTING

To test the resistance to lateral water migration between concrete and blindside waterproofing systems, a test method based on ASTM D5385,

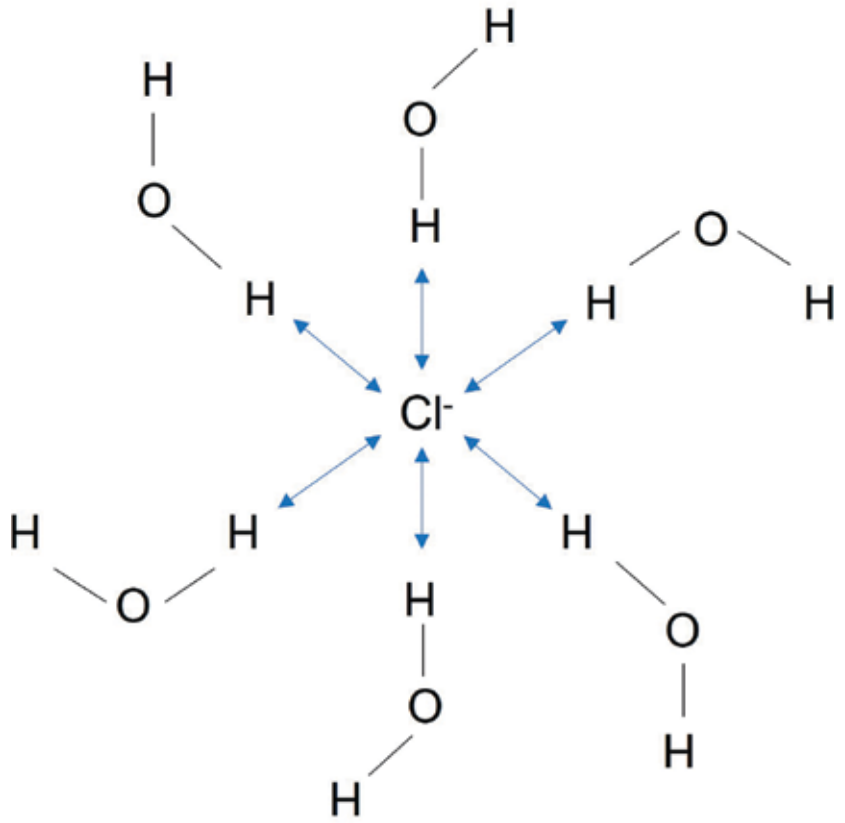


Figure 7. Example of ion-dipole interactions (blue arrows) between a chloride (ion) and water molecules.

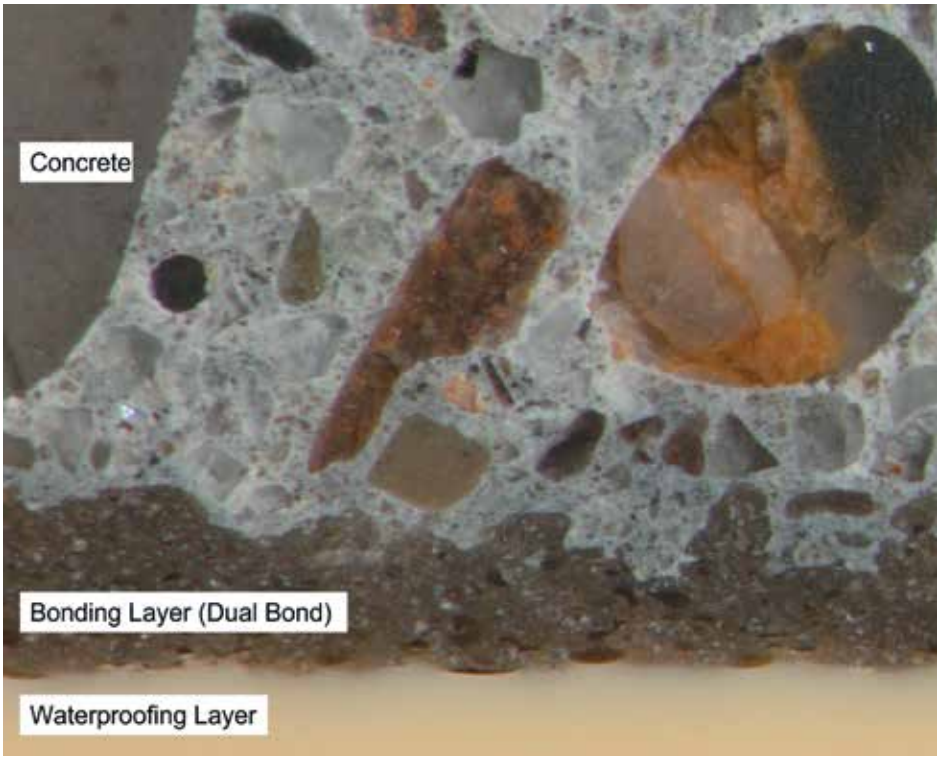


Figure 8. Microscopic image of dual-bond layer bonded with concrete.



Figure 9. Apparatus used for ASTM D5385[6] testing and the study test method.

Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes,[6] was introduced by manufacturers. Product data sheets of blindside waterproofing systems reference the test method as ASTM D5385 Modified (hereafter called "modified test method"). The modified test method uses the same testing device as ASTM D5385; however, the modified test method is significantly different from ASTM D5385 and thus results from the two methods are not comparable. The following describes both methods in detail for the purpose of understanding the procedural differences.

ASTM D5385

In waterproofing membrane systems, the susceptibility to failure at side laps increases if installation is poorly done and bonding is insufficient. To address this concern and ensure watertightness of the product, manufacturers can use the ASTM D5385[6] method to test the membranes in the waterproofing system. This test focuses on the crack-bridging capabilities and watertightness of the membrane joints. The testing apparatus has a chamber, gasket, and clamping bracket (see **Fig. 9**). During testing, the membrane sample and the substrate block are fixed between the gasket and the clamping bracket. The substrate block usually consists of concrete and includes a spacer lengthwise on the opposite side from the membrane. The spacer is triangularly shaped with a width of 125 mils (3.2 mm) and height of 173 mils (4.4 mm). The membrane joint is adhered to the substrate block, where the joint must be perpendicular to the spacer. Subsequently, the substrate block is placed onto the chamber, and the spacer is processed to a crack with a wedge and a hammer. The membrane side of the substrate block is put under water pressure, which is transferred from the chamber (**Fig. 10**). The pressure is increased by a rate of 15 psi (103 kPa) per hour up to 100 psi (689 kPa). Thus, the overall testing period lasts 7 hours. The watertightness is visually evaluated by the amount of water that has traveled through the crack.

MODIFIED TEST METHOD

In the modified test method, the fully bonded membrane is intentionally damaged to simulate lateral water migration between the concrete and the fully bonded membrane. As shown in **Fig. 11**, the fully bonded membrane is bonded to the concrete substrate. This sample is created by pouring fresh concrete onto the fully bonded membrane. During the concrete curing process, the bond between the membrane and the concrete is formed. Subsequently, the sample is positioned in the testing apparatus, and hydrostatic pressure is exerted on the membrane side. The sample contains two pipes that are located 4 in. away from the intentionally created damage, and the modified test method uses these pipes to evaluate whether water migrates through the damage between the membrane and the concrete. If the bonding layer fails, water will push through the pipes and make the failure visible as a leak. In contrast, successfully tested fully bonded sheet waterproofing systems do not show any leak (see Fig. 11).[6] **Table 1** summarizes the differences between ASTM D5385 and the modified test method.

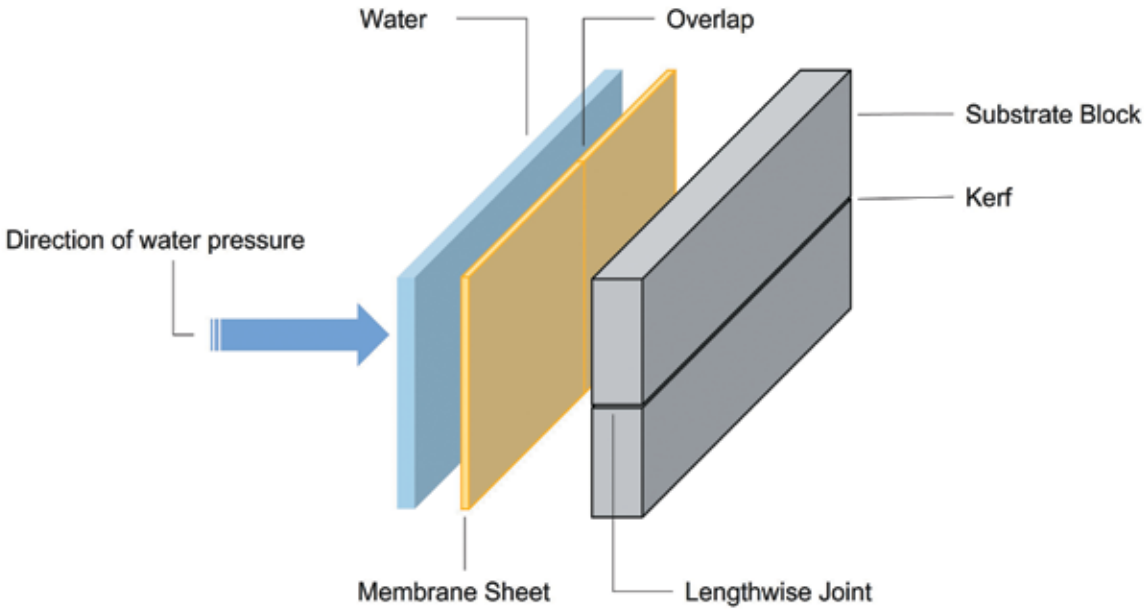


Figure 10. ASTM D5385[6] test setup.

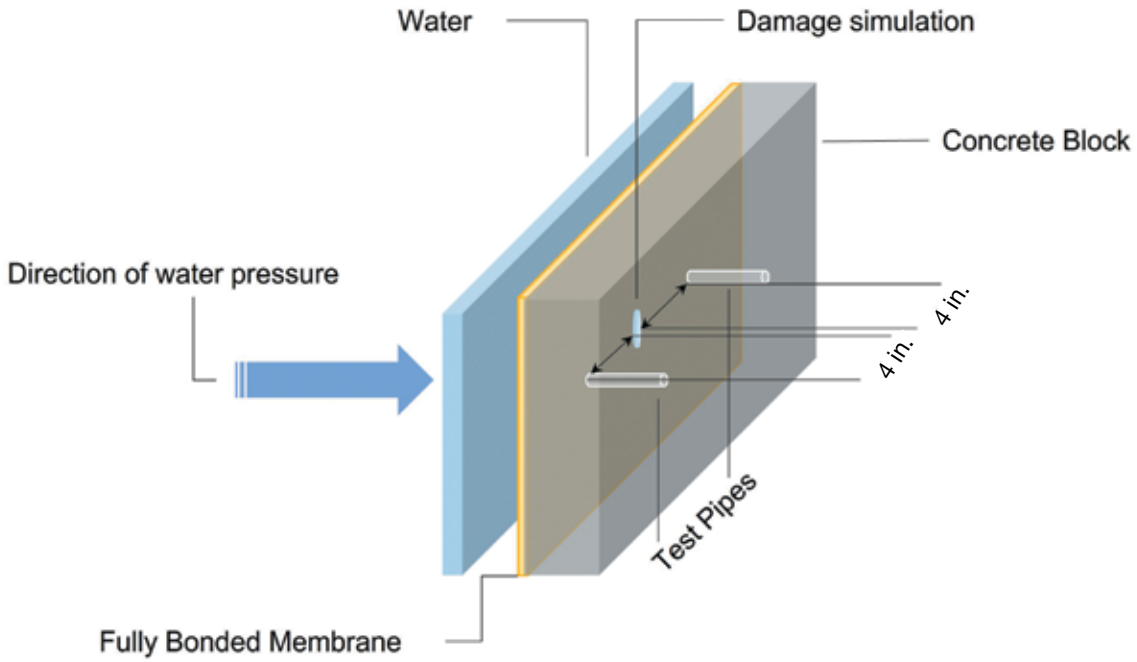


Figure 11. Setup for the modified test method.

CONCLUSION

Fully bonded blindside systems provide a barrier between groundwater and a below-grade concrete structure on its positive side. As reviewed in this article, there are three main methods on how the bond to concrete is achieved.

A mechanical bond is created by a nonwoven fleece/geotextile bonding layer. Alternatively, a bonding layer with sand granules also creates a mechanical bond.

TABLE 1. COMPARISON OF ASTM D5385[6] AND THE MODIFIED TEST METHOD

Testing criteria	ASTM D5385	Modified test method
Aim	Watertightness of joints/laps	Resistance to lateral water migration
Solution	Water	Water and control tubes
Block preparation	With spacer	Without spacer; with initial damage
Membrane application	Post-applied to substrate block	Pre-applied with fresh concrete
Pressure procedure and duration	15 psi (103 kPa) per hour until 100 psi (689 kPa); 7 hours total	15 psi (103 kPa) per hour until 100 psi (689 kPa); 7 hours total

Bonding layers consisting of an adhesive layer or containing adhesive polymers create an adhesive bond with concrete. A combination of mechanical and adhesive bond is provided by bonding layers that have a rough, textured surface in addition to containing adhesive polymers. This bond method is also referred to as dual bond. The main objective of fully bonded waterproofing systems is the resistance to lateral water migration. This property is tested by a modified test method that utilizes the device referenced in ASTM D5385. The modified test method exerts a hydrostatic pressure at a rate of 15 psi (103 kPa) per hour until 100 psi (689 kPa) resulting in a total test duration of 7 hours.

The fully bonded blindside waterproofing market has adopted the modified test method as the main test method for evaluating the resistance to lateral water migration. For this reason, most manufacturers list the result in the product data sheet of their systems. In the product data sheets, the modified test method is stated as ASTM D5385 Modified.

ABOUT THE AUTHOR



Nitharsan Kugadas

***Nitharsan Kugadas**, MSc Chem, CDT, is a product engineer who specializes in sheet waterproofing for below-grade concrete structures. He has vast experience in advising on below-grade waterproofing projects ranging from residential and commercial buildings to tunnel and infrastructure projects in the United States, Europe, and the Middle East. In his previous roles and his background as a chemist, he has been deeply involved in the research and development of below-grade waterproofing solutions.*

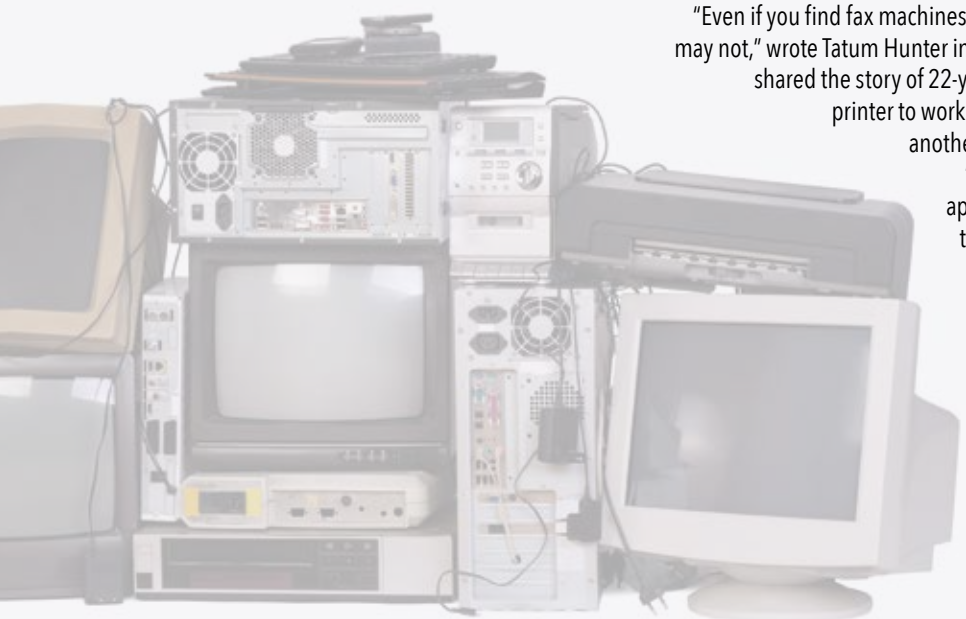
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Special interest

How to Defeat Workplace Tech-Shaming between Generations



Workplace tech can befuddle older workers—and younger ones.

"Even if you find fax machines or zip files self-explanatory, your younger colleagues may not," wrote Tatum Hunter in the *Washington Post*. To illustrate this point, Hunter shared the story of 22-year-old Erica Lock, an "IT whiz" who couldn't get her printer to work, ruling out one possible problem with the printer after another—until she realized the device was out of paper.

"Age bias affects both sides, as boomers try not to appear out of touch and Gen Z contends with stereotypes that young people are naturally skilled with all forms of tech."

To overcome this communication breakdown, Hunter recommended talking with colleagues about what's not working, then picking one tool to address any breakdowns—for example, use Slack for brainstorming or Google Docs to collaborate in real time. "Then schedule no-shame, question-and-answer sessions to get everyone up to speed. Encourage questions and provide written directions whenever possible."

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Fifty Years of Roof Consulting

By Jim D. Koontz, PE, RRC

This paper was originally presented at the 2023 IIBEC International Convention and Trade Show.

EARLY HISTORY

In the early 1970s there were only a few active roof consultants within the United States. At the time I was unaware there were any firms exclusively offering roof consultant services. My father and I, in the late 1960s and early 1970s, would assist/consult with architects in the design of reroofing projects. Consulting would also involve assisting representatives of insurance companies with hail and wind claims.

I became aware of three roof consultants in a small advertisement in the back of a *Sweets Architectural Trade Catalog*,[1] which looked like a set of green encyclopedias. This was obviously pre-internet. The three consultants were Werner Gumpertz/Carl Cash of Simpson, Gumpertz and Heger in Boston, Massachusetts; Frank Moore of Armm Consultants in Gloucester City, New Jersey; and Edward Schreiber of Construction Consultants in Detroit, Michigan.

After reviewing background data on these consultants, I knew I was on the right track to becoming a roof consultant. I met some of these consultants and roofing manufacturers' top technical people at an American Society for Testing and Materials (ASTM) meeting in 1974 in Houston, Texas. This was a revelation to me of the technical aspects of the roofing industry.

The roof consulting business grew to include quality control inspection during construction, laboratory analysis of roofing samples, assistance on large insurance claims, and cost estimating and expert testimony in roof litigation. Most of the initial clients had serious roof problems. One of the biggest obstacles was trying to explain, "What is a roof consultant?"

Things were pretty basic in the beginning of the roof consulting business, particularly compared to today's technology. In this era before cellphones and AutoCAD, all drafting was done by hand. All reports were typed by hand on a manual typewriter. Copy machines were a luxury. We did not have a word processor. The first infrared surveys were performed with equipment that weighed over 70 lb. The infrared equipment required the use of liquid nitrogen poured into the camera on the job site. The most important equipment was a 200-ft cloth tape and a notepad on a clipboard.

FIRST ROOF CONSULTANT ORGANIZATIONS

In the late 1970s the National Roofing Contractors Association (NRCA) asked for a meeting with the major roofing consultants in the United States. The meeting was held in Chicago. The NRCA was represented by its technical director, its president, and a few board members. Fewer than ten roof consulting firms attended the meeting. Three major roof consulting firms, which were invited to the meeting, chose not to participate with the NRCA.

The NRCA took the position that there were several unqualified firms in the United States providing improper and unprofessional roof consulting services. The NRCA asked the consultants present to form an association and set quality control standards for roof consultants. The initial participants in the meeting were from throughout the United States. The roof consultants who were present, less than ten, agreed to move forward. As a result, the Institute of Roofing and Waterproofing Consultants (IRWC) was formed.

Founding members of the newly formed association met several times and established some fairly high standards for membership, which included education, background verification, and long-term experience in various areas of roofing. After the group was formed, the IRWC asked for a meeting with the NRCA to propose a working relationship with the NRCA. For whatever reason, the NRCA had a change of heart and refused to meet with or recognize the IRWC.

Unfortunately, this was a time period where there was a great deal of animosity from the NRCA towards roof consultants. Some of this may have been well deserved. For a while the NRCA would not allow roof consultants to attend the NRCA annual conventions. Fortunately, this changed.

Although the IRWC set very high standards for membership, it floundered. In 1982 Robert "Bob" Lyons founded the Roof Consultants Institute (RCI). Membership in the RCI exploded to Bob Lyons's credit. The roof consultant industry changed dramatically. An excellent book titled *The First Five Years* by William C. Correll,[2] AIA, 1989, documents the early history and key players involved in the start of RCI.

ROOF ENGINEERING INC. AND JIM D. KOONTZ & ASSOCIATES INC.

After working as a roof consultant in the early 1970s, I obtained my Professional Engineer

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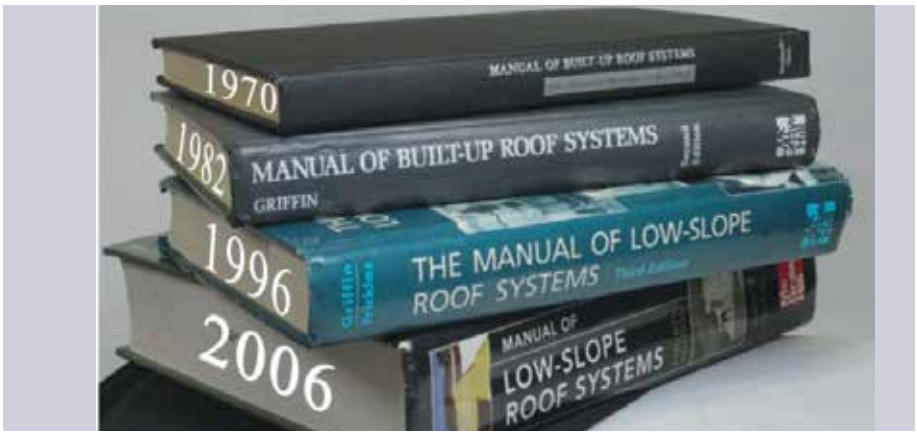


Figure 1. Roofing manuals: Manual of Built-Up Roof Systems, *C. W. Griffin, First Edition 1970;* Manual of Built-Up Roof Systems, *C. W. Griffin, Second Edition 1982;* The Manual of Low-Slope Roof Systems, *C. W. Griffin and Richard Fricklas, Third Edition 1996;* Manual of Low-Slope Roof Systems, *C. W. Griffin and Richard Fricklas, Fourth Edition 2006.*

license and formed Roof Engineering Inc. (REI) in 1976. The business grew rapidly. In 1987 Professional Services Inc. (PSI) acquired REI, and I worked as a vice president with Bob Lyons and PSI for about a year and a half. In 1990 I started Jim D. Koontz & Associates Inc. (JDKA), and I continued to work until 2022.

EDUCATION: TECHNICAL ADVANCES

As a roof consultant, one of the first books I relied upon was the American Institute of Architects (AIA) *Manual of Built-Up Roof Systems* by C. W. Griffin, PE,[3] published in 1970 (**Fig. 1**).

The book was very informative and, at the time, one of the best references in the roofing industry. I read it from cover to cover, multiple times. The book was extraordinary, with no agenda, just letting the reader know where we were in the roofing industry. One of the original reviewers was William C. Cullen of the National Bureau of Standards, now known as the National Institute of Standards and Technology (NIST). As the roofing industry changed, Griffin, with Dick Fricklas, updated the future publications.

In 1996 the name of the Third Edition changed from *Manual of Built-Up Roof Systems* to *The Manual of Low-Slope Roof Systems*.[4] This reflected the increased use of non-built-up roof systems, such as single plies**.** The Fourth Edition[5] in 2006 has approximately three times as many pages as the First Edition. This is an indication of the increase in technical knowledge in the roofing industry from 1970 to 2006.

Paul A. Tente of Colorado Springs was one of the first roof consultants in the United States. In 1977, Tente authored a book, *Roofing Concepts/ Principles*,[6] which was relied upon and referred to by many early roof consultants.

Another early quality reference book includes *Roofs* by Maxwell Baker[7] in 1980 by the National Research Council of Canada.

ROOFING ORGANIZATIONS

Emphasis on technical knowledge within the roofing industry grew exponentially. In 1972 Johns Manville (JM) introduced a four-day seminar on roofing, BURSI (Built Up Roofing Systems Institute). BURSI was directed by Dick Fricklas. The classes, held in Denver, Colorado, were highly successful. Within the roofing industry, contractors, architects, and a few future roof consultants clamored to obtain invitations to attend these technical meetings. During the course of over 50 years, the original BURSI morphed into the Better Understanding of Roof Systems Institute.

The NRCA worked with JM and formed the Roofing Industry Educational Institute (RIEI) in 1979. RIEI was headed by Dick Fricklas. The RIEI seminar, which was also a multiday class on roofing, was held at different locations throughout the United States.

The first RIEI roofing seminar in 1980 was held in Atlanta. The seminar was a huge success. RIEI had more applicants for attendance than could be accommodated. I attended this seminar.

Several other organizations promoted the technical aspects of roofing and would publish articles generated by professionals within the roofing industry. These organizations would also hold technical seminars and symposia on roofing. A few of these organizations included ASTM, Department of Energy, International Union of Testing and Research, National Bureau of Standards, National Research Council of Canada, and Single Ply Roofing Institute.

Simultaneously over the years, the various roof contractors' associations would hold technical seminars. This would include the NRCA, the Midwestern Roofing Contractors Association, RCI, and several others. There was basically an explosion of technical knowledge within the roofing industry.

GOVERNMENT INVOLVEMENT IN ROOF CONSULTING

In the late 1970s and early 1980s, several government agencies began to use roof consultants. This included the General Services Administration (GSA), Air Force (USAF), US Navy, and US Army. As a roofing contractor I had a great deal of prior experience working on government contracts.

REI was awarded a GSA contract for five states: Texas, New Mexico, Oklahoma, Arkansas, and Louisiana. Services included design of new and reroof projects, full-time quality control inspection, laboratory testing, evaluation of existing roof systems, and cost estimating. This first GSA contract generated a substantial amount of business. The GSA expanded the contract to include six additional states from Colorado to North Dakota. REI was very busy.

Other contracts followed with the USAF, US Post Office, US Army, and US Navy. The government contracts injected a great deal of work into the roof consulting industry. Several other roof consulting firms benefited from this work.

In 1980 the USAF adopted a technical manual, AFM 91-36,[8] authored by a roof consultant from Detroit. Overall, the document was a good quality control manual on the application of built-up roofing. The document had some strict quality control requirements that in some cases were objectionable to the NRCA.

Interply bitumen tolerances of 15% plus or minus was required. One of its recommendations was the removal of roof samples and testing of newly installed built-up roofing on a daily basis. At the time the USAF had approved one laboratory to perform testing on samples per ASTM D2829 requirements. Over a period, REI was able to obtain contracts for laboratory testing with five Air Force bases.

The NRCA was very opposed to this testing. At least two articles published were critical of the AFM 91-36: "Quality Assurance for Built-Up Roof Construction"[9] by William C. Cullen, NRCA 1985, Proceedings of the 1985 International Symposium on Roofing Technology, and "The Air Force Goes under the Knife"[10] from *Roof Spec/ Professional Roofing* in 1987.

The US Army developed a program in 1989 called "Roofer: An Engineered Management Systems for Bituminous Built-Up Roofs."[11] The document was developed by David Bailey, Donald Brotherson, Wayne Tobiasson, and Al Knehans, all well-known technologists in the roofing industry. The document was designed to assist army personnel in how to make the best use of maintenance and repair funds for built-up roofs.

ROOF FAILURES

Roof failures have played a key role in advancing roof consulting (see sidebar "Roof Failure Articles," p. 32) New, unproven, untested roofing material systems came on the market just as roof consulting was getting started. Roofs would fail! The bigger the roof failure, the greater amount of money would be in dispute. Roof failures were the result of:

- Material failure
- Quality-of-work errors on the part of the roofer
- Improper design on the part of the architect/designer

In numerous cases, roof failures were a combination of all three factors. In some situations when new products were introduced it took time or somewhat of a learning curve to understand the failure mode.

As some built-up roofing systems failed, there became an increased market and demand for roofing experts. These initial roof failures, along with the introduction of a variety of new, unproven roof systems, created a market for the roof consulting industry. In the late 1970s and early 1980s an emphasis on technical research on both conventional and newly introduced roofing systems, (e.g., single-ply and modified bitumen membrane) fueled the roof consulting industry.

Many newly introduced roofing systems were problematic and added to the roof failure portion of roof consulting. Early on the NRCA had concerns about problematic "unqualified" roof consultants with unsupportable opinions.

Two-Ply Built-Up Roofs

In the late 1960s and early 1970s, the two-ply built-up roof was introduced to the market. Instead of the traditional four-ply, 15-lb built-up roof, the new roofing system only required two plies of 40-lb organic felts. These 40-lb felts were 15-lb felts with extra asphalt. The manufacturers marketed two 40s equal to four 15s. Perhaps they were numerically similar, but they were not the same in tensile strength. The extra asphalt coating also made it more difficult to properly adhere the two membranes with hot asphalt. The two plies failed, split, and delaminated. This created a lot of lawsuits, thus the need for the "expert witness" on roofing.

The roof expert would determine the cause of the failure, assign blame, generate reports, and eventually become an expert witness. This generated large fees for the roof consultant. In many roof failure cases, regardless of the facts, the initial blame was placed on the roofer.

In 1974, The National Bureau of Standards published *Preliminary Performance Criteria for Bituminous Membrane Roofing*, by Robert Mathey and Bill Cullen.[12] They tested the physical properties of various four-ply built-up roofing systems. The tests included:

- Tensile strength
- Thermal expansion
- Flexural strength
- Tensile fatigue strength
- Flexural fatigue strength
- Shear strength
- Impact resistance

This groundbreaking research changed the roofing industry. The two-ply roofing systems were discontinued. The two-ply systems could not meet these recommended performance standards. The cause of some roof failures could be attributed to the roofing system and not the roofer or architect. In some cases, the qualifications and knowledge of the new roofing expert were called into question. Unqualified experts created a lot of animosity with roofers and thus roofing associations.

PVC Roofing Systems

New, unproven, untested roofing systems came on the market just as roof consulting was beginning to develop. This included single-ply roofs. When polyvinyl chloride (PVC) single plies were first introduced they were marketed as easy to install, free of blisters, lightweight, and clean. The PVC roofs were marketed as superior to built-up roofing, based on advanced German technology.

Unreinforced PVC roof systems, using unstable plasticizers, in some cases would shatter like a pane of glass after a few years of service. The chemical mix of the PVC could not stand up to UV exposure over a period of time. The PVC shatter failures were in some cases cataclysmic. Entire buildings would be flooded, resulting in the loss of all equipment, inventory, and items within the building. Whatever businesses were in these buildings would be completely shut down for months. The insurance claims were staggering.

Thus the need for a "roof expert" to take samples, perform lab testing, evaluate the roofing system, and offer expert advice to the insurance carrier, its attorneys, and the building owner.

Asphalt Shingles

Roof failures also occurred with asphalt shingles. After just a few years of service, many fiberglass asphalt shingles would split. Several shingle manufacturers were required to issue "recall notices" for their products. The subject of splitting shingles was discussed by several parties. I myself wrote articles on the topic: "Fiberglass Shingles: Shingle Splitting Problem Observed in a Number of Western Applications" from the May/June 1990 issue of *Western Roofing*,[13] and "Performance Attributes of Fiberglass Shingles" from the July 2007 issue of *RCI Interface*.[14]

Foam Insulations

In the late 1970s, following the Arab oil embargo, there was a growing concern about energy conservation. Gas prices at the time increased from 0.30 to 1 USD per gallon.

Increasing the *R*-value of roofing systems was seen as a way to save on fuel for heating and cooling. Roof insulation at the time, fiberglass, wood fiber, or perlite had a minimal *R*-value of approximately 2.7 to 3.7 per inch. Additional insulation with higher *R*-value was installed in roofing systems. This was primarily driven by changes in the building code. Polyurethane and polyisocyanurate board stock roof insulations with higher *R*-values were manufactured and marketed by the roofing manufacturers. The insulations, however, had not been subject to long-term "field evaluation."

The increase in thickness of roof insulations complicated roof designs. As these products were used, various problems began to develop. This included facer sheet delamination, which obviously exacerbated uplift problems resulting in roof blow-offs. Many times, the facer sheet problems were accompanied by the presence of "knit-lines" that were formed in the roof insulation at the time of manufacture.

Problems reported included dimensional stability issues, cupping, and bowing, particularly shrinkage, and edge cavitation, and crushing or powdering. The NRCA issued a technical bulletin 2000-3 recommending a cover board over polyisocyanurate roof insulation.[15] This provided some temporary relief. Many of the problems were not solved until manufacturers researched and implemented changes to the chemistry of the foam formulations. The NRCA also recommended changes in compressive strength, dimensional stability, and *R*-value determination.

Phenolic Foam

One roof insulation introduced by the Koppers Co. was phenolic foam. The new insulation had somewhat of an orange color. The insulation was marketed with an *R*-value of 8.2 per inch. The insulation, however, had a serious issue. When exposed to any moisture from roof leakage to humidity within the building, the chemicals within the phenolic foam would become acidic and leach out. The net result was corrosion or rusting of the steel deck. The failure of the steel deck in some cases would occur in as short as five years.

Koppers sold its phenolic foam manufacturing business to JM in 1989. JM manufactured and sold phenolic foam until 1992, at which time serious corrosion problems of the phenolic foam over steel decking were well known. JM and Koppers were the subject of a class action lawsuit in 1996. The US District Court granted a final approval settlement involving Koppers and JM in December of 2000. At the time this was the largest class action settlement in the roofing industry.

Articles concerning the corrosion problems of phenolic foam appeared in 1991 and 1993. This included "Metal Deck Corrosion: Three Case Studies" by R. P. Cannon[16] and "Steel Deck Corrosion Associated with Phenolic Roof Insulation" by Thomas L. Smith and James D. Carlson (NRCA).[17] An excellent follow-up article was published in *Professional Roofing* by the NRCA in 2005, entitled "The Aftermath of Phenolic Foam" by Rex Greenwald.[18]

Coal Tar Type III

Historically, a four-ply coal tar pitch membrane with gravel was one of the best-performing systems in the roofing industry. A life span of 30 to 40 years was not uncommon. Working with coal tar pitch fumes, however, was very problematic. The roofs had to be installed on low-slope or no-slope structures. The fumes would cause eye and skin irritation, and it was later learned that prolonged exposure to these fumes could cause cancer.

In response to the fume problem, the manufacturers of coal tar pitch changed the formulation and provided an additive that cut down on the fuming. Roofing contractors jokingly referred to the new coal tar as "perfumed pitch." The installation of the coal tar bitumen minimized eye and or skin irritation. Safety was touted as an advantage. The low-fuming "coal tar bitumen" was given its own ASTM designation in 1978: ASTM D450, Type III.[19]

After a few years of use of the coal tar bitumen, problems began to develop. The flood coat surface would begin to harden, crack, and split, unlike a typical coal tar pitch. An oily brownish residue would also develop on the surface of the roof. When questioned, the manufacturers denied asphalt had been added to their product. It turned out the additive being used was some type of paraffin or candle wax material.

The bitumen also had a higher softening point. As the roofs aged, cracks would develop in the surface of the roofing system. Overall, the roofs did not appear to be defective other than the oily surface. The cracking occurring in the bitumen, however, would go completely through the system. This would allow water to flow through the roof and into the interior of the building. I tested a number of these roofs which had prematurely failed.

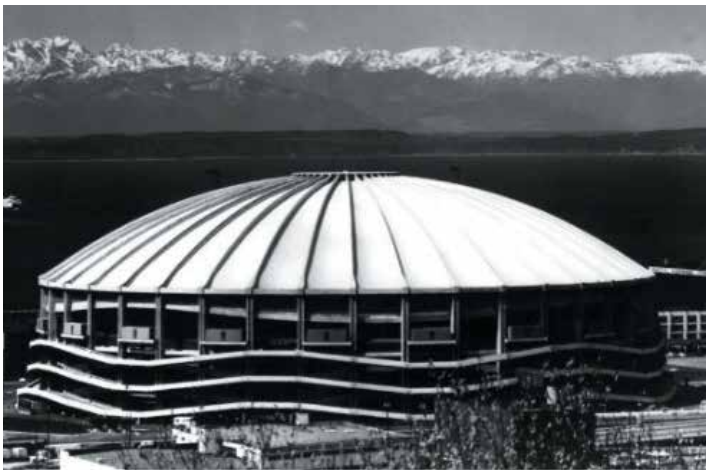


Figure 2. The Kingdome, Seattle, Washington.

FAILURE SUMMARY

Roof failures from workmanship, materials, or design have historically accounted for a considerable portion of business for the roof consulting industry. A big part of roof consulting over the last 50 years has been the introduction of new, unproven roofing systems. One of the problems is the new systems have to be in place a number of years in different geographic locations to see if they will perform. Some of these new systems have difficulty surviving the test of time. I am confident this trend will continue.

A FEW NOTABLE PROJECTS

The Kingdome, Seattle, Washington

REI was retained by the insurance carrier for King County on two different occasions. The first inspection involved a problem with a solvent-based coating applied over a polyurethane foam (PUF) roof also known as spray polyurethane foam (SPF) roof. The roof on the Kingdome consisted of a Tectum panel covered with reinforced concrete deck that was overlaid with SPF roofing, which was covered with an elastomeric coating (**Fig. 2**).

Two passes of solvent-based elastomeric coating had been applied over an existing SPF roof in 1993. The first pass of coating had not fully cured prior to the application of the second coating; the cool, cloudy, rainy weather in Seattle may have exacerbated this problem. The second coating did cure.

After the two coatings were applied, birds began to peck at the foam roof. One theory was the birds were getting high on the underlying uncured solvent, like sniffing glue. The peck holes were about an inch in diameter and extended into the polyurethane foam.

A meeting was held with King County, their architects, engineers, contractors, and the coating manufacturer. I represented the insurance carrier. The consultants to King County tried to put forth a claim on the roof indicating the holes were not related to pecking but were caused by hail or some other singular weather event phenomenon. When I tried to explain the bird pecking issue, the management representative with King County responded loudly, "Oh [expletive], you really don't expect us to believe the holes in the roof are caused by birds."

After some back-and-forth discussion, particularly with the coating manufacturer, the consensus of the various parties in the meeting was that the holes in the roof were in fact caused by birds. King County took the position that the bird peck holes were a covered peril under their insurance policy. The insurance carrier said yes, but each bird peck at a different time period has a "separate deductible." The fight was on! Eventually a resolution was reached.

A tragic event occurred at the Kingdome in 1994, resulting in the deaths of two workmen. The King County decided in 2000 to implode or

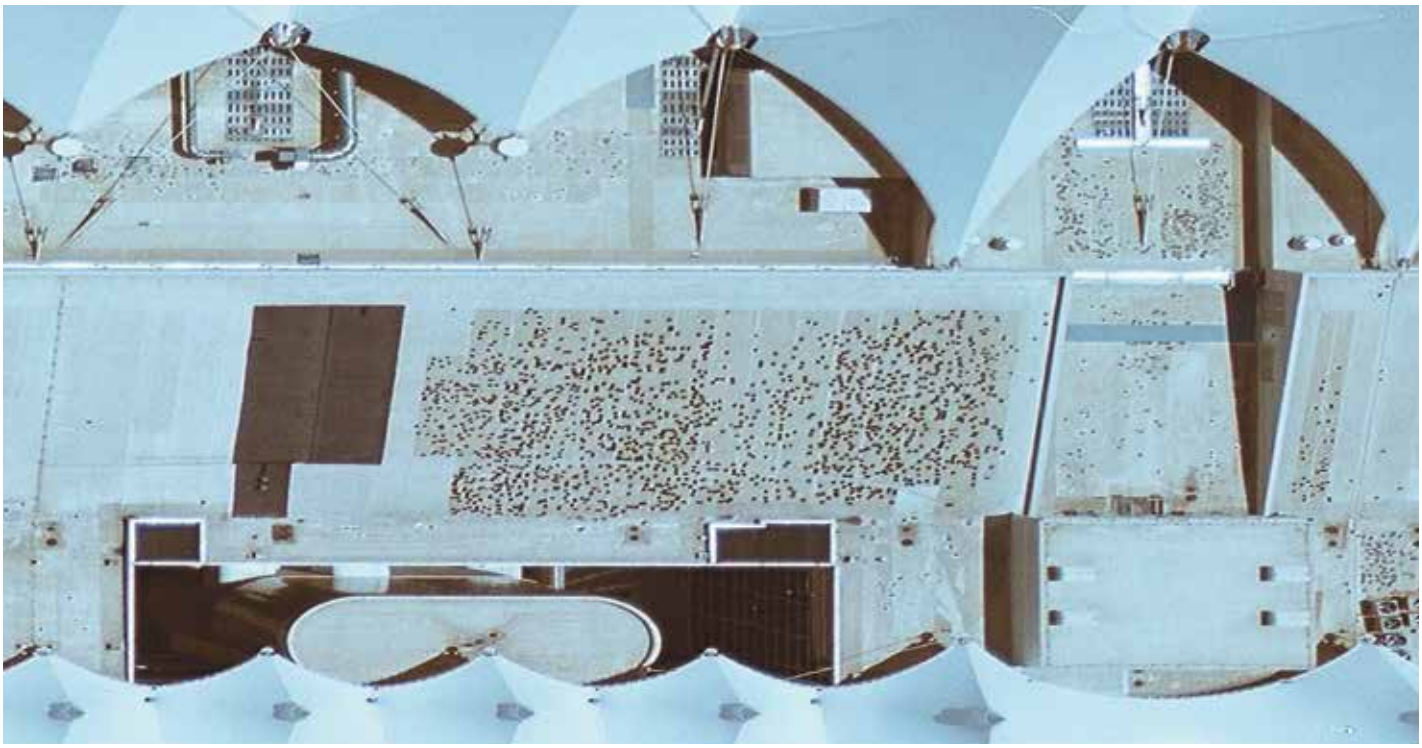


Figure 3. Denver International Airport roofs.

destroy the Kingdome. The two deaths and the eventual destruction of the Kingdome had all started with a coating and bird pecking problem on the SPF roof.

Stapleton International Airport, Denver, Colorado

I was retained to examine the PVC roof on the old Stapleton International Airport in 1997. The City of Denver had closed Stapleton International Airport and in turn opened the new Denver International Airport (DIA) in 1995. The roof consisted of a mechanically attached, non-reinforced PVC membrane. The PVC roof had shattered and completely failed, causing the unoccupied airport to flood. If the airport had still been in operation, it would have been a complete disaster.

While walking Stapleton International Airport's roof with the management for the City of Denver, the facilities director about halfway through the inspection stopped and exclaimed, "We have the same roofing system on the new Denver International Airport. Will the new DIA roof fail in the same manner?"

Denver International Airport, Denver, Colorado

The new DIA was constructed in phases. The south main terminal was initially constructed, followed by concourses A, B, and C. The roofs on all four areas consisted of PVC nonreinforced membrane. I was retained by the city of Denver to examine and test all four roof areas at DIA (**Fig. 3**).

The examination involved removal of 76 samples, each 2 × 2 ft. in size, from the main terminal and the three concourses. All of the samples were impacted with ice spheres per National Bureau of Standards 55 procedure. It was determinted that all of the PVC roofs were vulnerable to hail. Because of slight variations in the type of plasticizer used in the PVC membrane and age from the terminal to concourses A, B, and C, it was determined the main terminal was vulnerable to hail 1 inch in diameter.

Concourses A, B, and C were also vulnerable to damage from hail slightly larger than 1 inch. After a report was completed for DIA, a hail event did occur there.

The main terminal roof failed exactly as I had predicted. Fortunately, there was a relatively minor amount of rain following the hail event. The main terminal roof was temporarily repaired with 6- x 6-in. black membrane peel-and-stick patches. The PVC roof was replaced.

MURRAH FEDERAL BUILDING, OKLAHOMA CITY, OKLAHOMA

The Alfred P. Murrah Federal Building opened on March 2, 1977, and was named for an Oklahoma native who was one of the youngest federal judges in US history. I had worked on the building for the GSA. The roof was a ballasted EPDM (**Fig. 4**).

Former US Army soldier Timothy McVeigh parked a truck in front of the Alfred P. Murrah Federal Building on April 19, 1995. Within the truck was a homemade bomb built by McVeigh.

At 9:02 a.m. the homemade bomb exploded. Once the explosion occurred the surrounding area looked like a war zone. The Murrah building was reduced to rubble.

After the bombing of the Murrah Federal Building, JDKA was retained by several insurance companies to examine and evaluate damage to various buildings in the immediate area of the blast zone adjacent to the Murrah Federal Building.

The blast or shock wave from the explosion blew out windows and doors, resulting in the pressurization of the inside of the buildings. Consequently, roofs and structural decks were uplifted and damaged.

One of JDKA's clients was Zurich Insurance. A meeting was held in Oklahoma City with the president of Zurich Insurance, several building consultants, and senior property adjusters. The president of Zurich instructed the consultants that the primary goal was to restore the insureds to the pre-explosion conditions just as quickly as possible.

The president of Zurich stressed that the building consultants had a free hand to spend whatever was necessary to accomplish this goal, although they should not let it get out of control. Competitive bids for building repairs were not



Figure 4. The Alfred P. Murrah Federal Building in Oklahoma City, Oklahoma, after it was bombed.

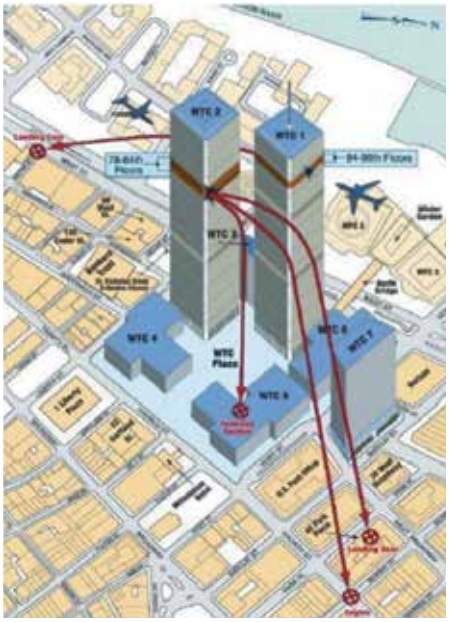


Figure 5. United States Post Office, 90 Church Street, New York, New York.

required. This was accomplished with several of the insureds in downtown Oklahoma City. Other JDKA insurance company clients took the same position. Often, insurance companies are criticized for not authorizing sufficient funds to repair damage to buildings. That did not happen in this case.

MedStar Washington Hospital Center, Washington, DC

On the morning of September 11, 2001, I was inspecting the roof on MedStar Washington Hospital Center in downtown Washington, DC. A roofer and several hospital representatives were on the roof with me. The hospital is approximately five miles northeast of the Pentagon.

I was walking the roof with my head down and taking photographs. During the roof inspection, one of the roofers yelled, "Look at that!" Smoke could be seen rising from the Pentagon, which had just been impacted by a hijacked airplane.

The roof inspection was obviously over. The clients and all of the people at the inspection left to return home. I stayed at the hospital for a few hours and helped move patients from one floor to another in order to have one floor open for incoming casualties from the Pentagon.

Initially, all flights out of Washington, DC, were canceled, and there was a long waiting list for the first available flights. I spent the next week at a hotel, along with at least a hundred other stranded people from all over the United States. I would see the same people every day for breakfast, lunch, and dinner, and by the end of the week, I had become friends with quite a few of them.

Finally, I was able to take the first American Airlines flight from Washington, DC, to Dallas. I sent a brief report to my client, specifying that the roof leakage was a flashing problem. I never heard back from my client about the hospital job.

United States Post Office, New York, New York

Following the September 11, 2001, attack by terrorists on New York, I examined the roof of the United States Post Office (USPO) located at 90 Church Street, New York.

United Flight 175, flying at 446 mph, had hit the World Trade Center Tower 2. A jet engine from Flight 175 penetrated through the building, exited, and hit the roof of the Church Street USPO (**Fig. 5**). The engine bounced off the roof and landed at the intersection of Murray Street and Church Street. The impact knocked a hole in the structural concrete deck of the USPO about the size of a small car.

Other falling debris hit the roof, resulting in impact damage. At the time of my inspection, temporary repairs had been performed to the roof. Some of the debris from the towers also partially obstructed the internal roof drains.

Special interest

Conventions Are Back! Will the Economy Cooperate?

The numbers don't lie: In-person conventions have come roaring back as concerns about COVID-19 have receded.

"Convention halls … across the country are filling up again, restoring a vital source of economic fuel that had been cut off during the pandemic and was slow to recover in many cities," wrote Austen Hufford in the *Wall Street Journal*. The Events Industry Council reported that its indexes show that conference and hotel demand in the fourth quarter exceeded the same in 2019.

What does that mean for you? More opportunities to travel and network. But for how long? Hufford noted that one Dallas, Texas, visitors bureau "is preparing for a short-term slowdown in tourism because of the possibility of a US recession." He also pointed to travel-budget cuts at Microsoft and 3M as further evidence of a possible downturn.

Source: Wall Street Journal



Mike Flippo/shutterstock.com

Roof Failure Articles

The subject of roof failures became a popular topic discussed by several roof consultants. A few articles on the subject appear in the following table.

Year	Author(s)	Title	Publication
1961	Donald E. Brotherson	An Investigation into the Causes of Built-Up Roof Failures	Research Report 61-2 University of Illinois Small Homes Council
1980	Max Baker	Roofs: Design, Application, and Maintenance	National Research Council of Canada Pages 307, 343
1982	C. W. Griffin	Premature Membrane Failures	*Manual of Built-Up Roof Systems*, 2nd edition
1990	Dr. Rene M. Dupuis	Different Roof Systems Have Different Failure Modes	NRCA Professional Roofing
1993	Tom Smith, James Carlson, and Tim Walzak	Steel Deck Corrosion Associated with Phenolic Roof Insulation	10th Conference on Roofing Technology "Problems: Issues & Answers"
1993	Ralph Paroli, Tom Smith	Shattering of Unreinforced PVC Membranes	10th Conference on Roofing Technology "Problems: Issues & Answers"
2003	Carl Cash	Roofing Failures	Amazon, Routledge
2005	Rex Greenwald	The Aftermath of Phenolic Foam	NRCA Professional Roofing
2007	Jim Koontz	Performance Attributes of Fiberglass Shingles	*RCI Interface*

In 1982, C. W. Griffin included roof failures in the second edition of *Manual of Built-Up Roof Systems*. The subject took up one complete section: chapter 12, "Premature Membrane Failures."

Publish in



IIBEC Interface is seeking submissions for the following issues. Optimum article size is 2000 to 3000 words, containing five to ten high-resolution graphics. Articles may serve commercial interests but should not promote specific products. Articles on subjects that do not fit any given theme may be submitted at any time.

40 YEARS IIBEC interface

ISSUE	SUBJECT	SUBMISSION DEADLINE
November 2023	The Building Enclosure	July 15, 2023
December 2023	Wind	August 16, 2023

One of the biggest differences is that we now have hundreds, if not thousands, of roof consultants. When I started there were less than a dozen.

The USPO had an overall roof area of approximately 75,000 sq ft. The building was divided into two separate areas. The 7th and 15th floors were covered with a gravel-surfaced built-up roof installed over a structural concrete deck.

The 7th floor has approximately 33,000 sq ft and the 15th floor has approximately 42,000 sq ft. During my inspection, roof samples were removed, and a capacitance meter was used to perform a moisture survey. Moisture was detected within the roof assemblies, and I recommended the entire roof be removed and replaced. During the inspection of the roof, work across the street at ground zero was in progress.

ROOF CONSULTING TODAY

Roof consulting has changed significantly over the last 50 years. From a technological standpoint, a few of the several advantages today include cellphones, access to word processors, Google Earth, Near Maps, drones, AutoCAD, miniaturized infrared equipment, hygrothermal computer analysis, and extensive peer-reviewed technical publications.

One of the biggest differences is that we now have hundreds, if not thousands, of roof consultants. When I started there were less than a dozen. Obviously, the market for roof consulting services has become much more accepted. Some of this industry acceptance is due to the marketing, technical work, and training provided by RCI/IIBEC.

There are also numerous new roofing systems on the market. Hopefully, many of these new systems will perform well; however, there will be failures in new systems which will create business for roof consultants. In addition to failure analysis, a significant amount of work by many consultants is to provide building owners and architects with guidance on complex or unusual projects.

There is also a much wider acceptance of roof consultants by owners, architects, contractors, and manufacturers. It is difficult for owners and most architects to be aware of options that are appropriate for a particular project.

I have been fortunate to be in this business over the last 50 years, and feel I made many good friends along the way. My family and friends have been very supportive over the years, and I feel I was blessed to have had their encouragement and assistance.

ABOUT THE AUTHOR



Jim Koontz

***Jim D. Koontz**, RRC, PE, has been involved in the roofing industry since 1960. His career includes experience as a roofer, estimator, manager of a roofing company, consultant, lecturer, and researcher. As a roof consultant, Koontz has worked in over 40 states, Canada, Mexico, the Caribbean, and Australia. Clients include numerous agencies of the city, state, and federal governments, large insurance companies, universities, developers, material manufacturers, contractors, and architects.*

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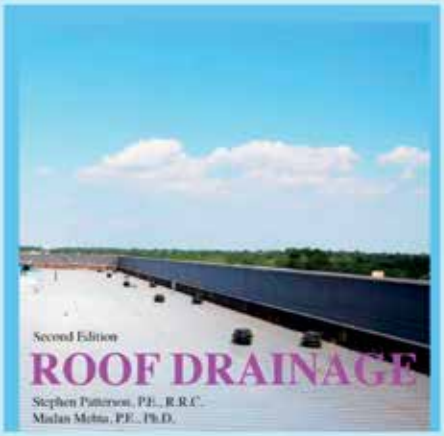
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2nd Edition

ROOF DRAINAGE

ROOF, WATERPROOFING, AND EXTERIOR WALL CONSULTING QUALITY ASSURANCE



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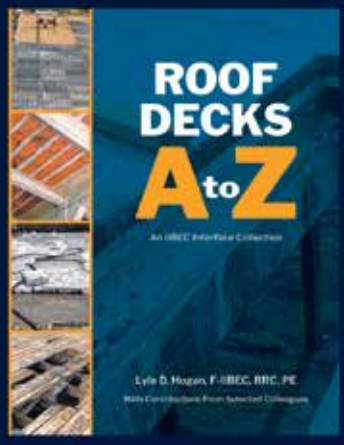
According to Patterson and Dr. Mehta, "In this edition, we are responding to an unprecedented change in roof drainage design from what has been used for more than a half century. Until recently, the plumbing codes assumed that the flow through a roof drain is the same as the flow through a vertical leader of the same diameter. Several investigations and roof-collapse forensics have shown that our assumption has been incorrect."

"This monograph has been written as a textbook to serve all three disciplines—architecture, plumbing engineering, and structural engineering," said Dr. Mehta. "We have learned a great deal since the 2003 publication and have incorporated it into this book."

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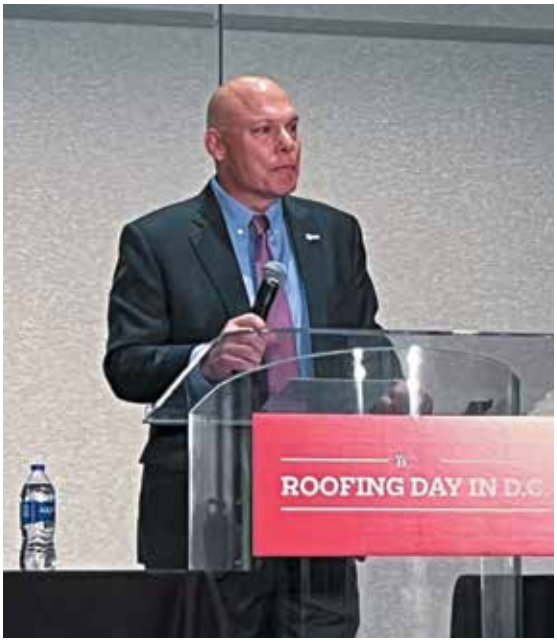
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IIBEC

Roofing Day in DC 2023—IIBEC Was There!

By John Boling



Brian Pallasch introduces guest speaker Bruce Mehlman.



Chris Giffin (second from left) and other Roofing Day participants met with Rep. Chris Collins (second from right).

IIBEC AND INDUSTRY leaders gathered April 18—19, 2023, in the nation's capital for Roofing Day in DC to brief Congress on the issues important to building enclosure professionals, and to network with our roofing industry colleagues.

IIBEC President Amy Peevey joined me and IIBEC Executive Vice President and Chief Executive Officer Brian Pallasch; Immediate Past President Chris Giffin; and IIBEC Advocacy Committee Chair Melissa Barrows-Lieb. This year, the 225 attendees focused on three issues: mitigating workforce shortage, supporting tax fairness, and support for the Department of Energy's Building Technologies Office, which helps commercialize products and techniques in the building sector.

"Roofing Day in DC provides the industry an opportunity to educate our legislators about the importance of roofing and what policies need to be changed to ensure our industry can meet the needs of the nation," Pallasch said. "As a member of the committee that organizes the event, IIBEC appreciates the opportunity to both lead and support our industry colleagues as we lobby for smart policies and helpful programs."

Attendees heard from US Rep. David Kustoff (R—TN) about how attendees might work with Congress; from Bruce Mehlman, founder of Mehlman Consulting, on key



Melissa Barrows-Lieb (second from right) with Rep. Danny Davis (fourth from right) and other Roofing Day participants.

policy and political trends; and from a bipartisan panel of congressional chiefs of staff who provided guidance on how to effectively present issues during our meetings.

"It was an exhausting, jam-packed two days, but worth it," Peevey said. "What an empowering experience and testament to the idea of 'better together.' Thanks to NRCA and all the partner associations that made this event such a success!"

Barrows-Lieb, who attended Roofing Day for the first time, said she found it rewarding to participate in lobbying Congress, especially to support funding for the Department of Energy's Building Technologies Office. "IIBEC's advocacy is a critical function to ensure a more informed legislature while claiming our seat at the table to be part of the decision-making process," she said. "This continued endeavor is vital to protect the interests of IIBEC, its members, and the construction industry."

Early Success on 529 Accounts

In late March I participated in the ASAE American Associations Day fly-in and set up a full day of meetings on Capitol Hill to urge support for a bill that would positively affect those seeking an IIBEC credential. The Freedom to Invest in Tomorrow's Workforce Act (H.R. 1477/ S. 722) would allow a person to use their 529 educational account to cover expenses associated with obtaining and maintaining legitimate professional certification programs. Each one of IIBEC's seven credential programs, as an example, would qualify. I'm pleased to report that our advocacy worked, and new cosponsors were gained—the first step on the long road for a bill to become a law. If this bill advances, I will alert you here.



Left to right, Amy Peevey, Brian Pallasch, Chris Giffin, Melissa Barrows-Lieb, and John Boling.

Special interest

Is Brainstorming a Bust?

Are you a brainstorming booster? Or do your best ideas come to you when you're alone?

Columbia Business School professor Sheena Iyengar, author of *Think Bigger*, is strongly anti-brainstorming. "You do not get your best ideas out of these freewheeling brainstorming sessions," she told Callum Borchers of the *Wall Street Journal*. Save the brainstorming ethos for dinner parties, and keep it out of the conference room, Iyengar said.

But brainstorming has its fans. One brainstorming advocate interviewed by Borchers is Lukas Kaiser, senior vice president of content at Los Angeles–based Westbrook Media. According to Kaiser, even if brainstorming sessions are 70% bad ideas and only 30% good ideas, they're worthwhile. When it comes to ideas generated during brainstorming sessions, Kaiser believes that "duds tend to come first." Therefore, he schedules two-hour brainstorming sessions—enough time for the "good stuff" to surface.

However, that structured approach doesn't work for everyone. Erika Hall, cofounder of Mule Design Studio in San Francisco, told Borchers that she is often inspired when she is running alone. "It's freaky," said Hall. "I will go run on a problem, and things will happen in my head that do not happen under any other circumstance."

Borchers concluded, "Leaving breakthroughs to private serendipity can feel, to bosses, like losing control, but it might be more effective than trying to schedule magic in a conference room."

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Market Index Survey for Reroofing Finds Expansion in All Markets

THE LATEST QUARTERLY Market Index Survey for Reroofing results suggest that businesses in all three marketing segments (low-slope, steep-slope, and combined low-slope/steep-slope reroofing) are in a period of expansion and optimism.

The most recent Market Index Survey for Reroofing—sponsored by IIBEC and other trade associations in the roofing industry (Asphalt Roofing Manufacturers Association, Canadian Roofing Contractors Association, Chemical Fabrics and Film Association, EPDM Roofing Association, Metal Construction Association, Metal Roofing Alliance, National Roofing Contractors Association, National Women in Roofing, Polyisocyanurate Insulation Manufacturers Association, Roof Coatings Manufacturers Association, and Single Ply Roofing Industry)—shows trends among reroofing contractors and consultants from the first quarter of 2023.

SURVEY DEMOGRAPHICS

The Market Index Survey for Reroofing invites participation from roofing contractors and roofing consultants whose businesses are in the

Respondents working primarily in the steep-slope market segment comprised **18%** of the participant pool, whereas **43%** of participants came from the low-slope segment and **39%** worked in both segments.

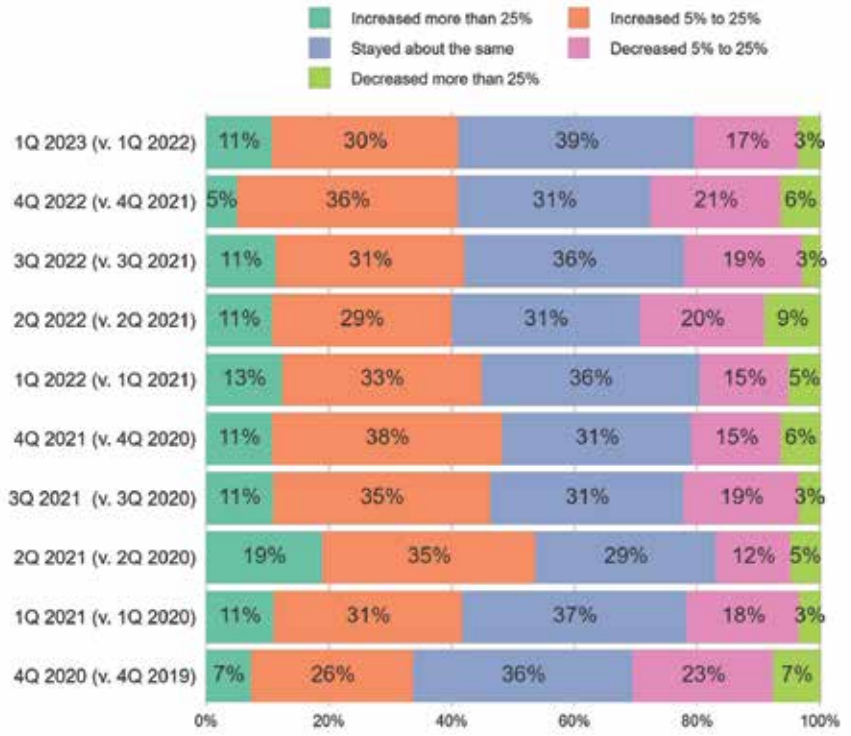


Figure 1. Customer inquiries vs. same quarter previous year: trended comparison.



Figure 2. Project contracts vs. same quarter previous year: trended comparison.



Figure 3. Customer inquiries index.

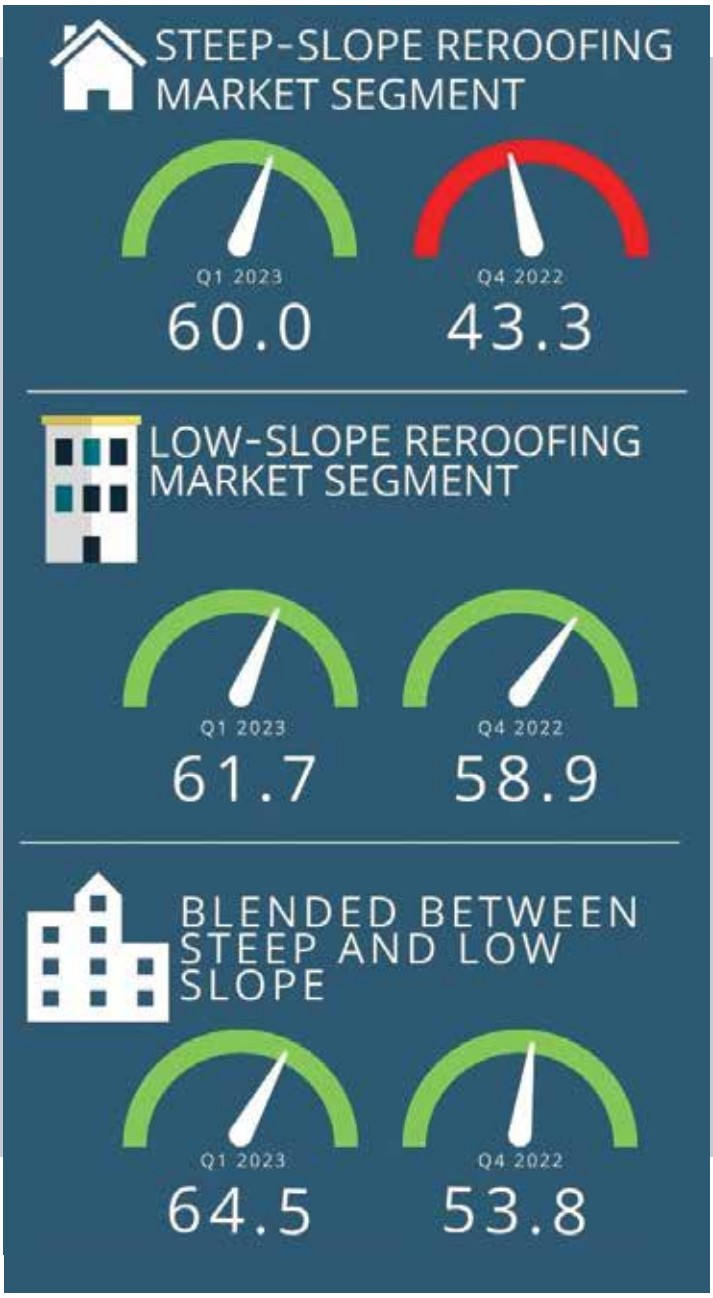


Figure 4. Project contracts index.

The index is equal to the percentage indicating that customer inquires and project contracts have increased when compared to the same quarter of the previous year, plus one half of the percentage reporting no change. The total is multiplied by 100 to create the index. A score of 50 or higher suggests expansion or optimism, while a value below 50 indicates contraction or pessimism.

steep-slope, low-slope, or blended low-slope/steep-slope market segments. In this quarter, 16% of respondents were consultants and the rest were contractors. Respondents working primarily in the steep-slope market segment comprised 18% of the participant pool, whereas 43% of participants came from the low-slope segment and 39% worked in both segments.

The survey asked respondents to estimate their company's annual gross revenues. They reported revenues ranging from less than US$1 million (15% of answers), US$1 million to US$5 million (26%), US$5 million to US$10 million (18%), US$10 million to US$25 million (20%), US$25 million to US$50 million (9%), US$50 million to US$100 million (4%), and more than US$100 million (3%). Four percent of respondents declined to answer this question.

The regions reporting the most significant revenue in the latest survey were the South Atlantic region (Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, and the District of Columbia) and the East North Central region (Illinois, Indiana, Michigan, Ohio, and Wisconsin). These two regions represented 22% and 20%, respectively, of the total revenue reported in the survey.

CUSTOMER INQUIRY AND PROJECT CONTRACT TRENDS

Each quarter, the Market Index Survey for Reroofing includes two questions related to business expansion/contraction:

- How does the number of customer inquiries at the participant's company for the most recent three months (Q1 2023 in this survey) compare with the number from the same quarter of the previous year?

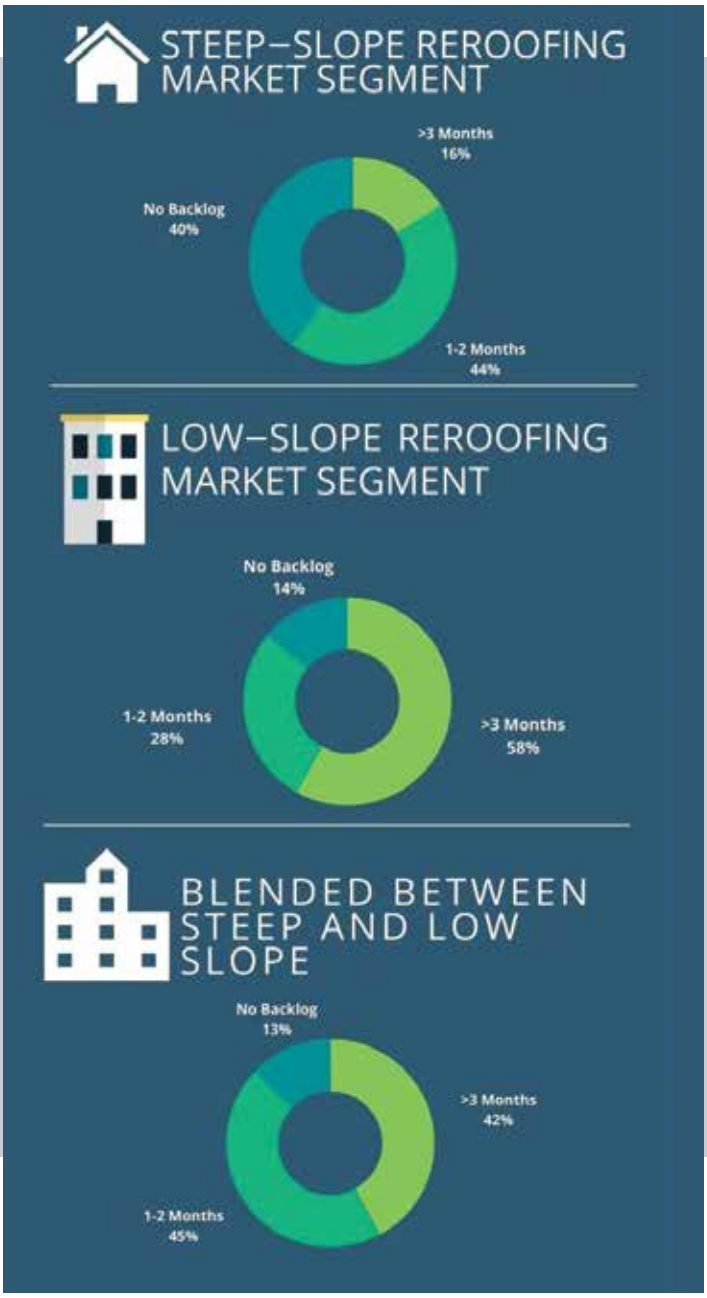


Figure 5. Project backlogs index.

Join the Participant Pool!

IIBEC encourages its members to participate in future Market Index Surveys for Reroofing. By participating, you can help ensure that the data are robust and fully reflect industry trends. Keep an eye on IIBEC's weekly newsletter for announcements about survey participation and results.

- How does the number of project contracts for the most recent three months compare with the number from the same quarter of the previous year?

Potential answers for these questions are a decrease of 5% to 25%, a decrease of more than 25%, no change, an increase of 5% to 25%, or an increase of more than 25%.

In this survey, 41% of participants reported an increased volume of customer inquiries, and 48% reported that they had more project contracts in Q1 2023 than in Q1 2022. For customer inquiry and project contract trends since the fourth quarter of 2020, refer to **Fig. 1** and **2**.

Survey data are indexed to indicate whether the data indicate market expansion or contraction. An index score equals the percentage of respondents who reported increased business plus one-half the percentage of respondents who reported no change, with the total multiplied by 100. A score equal to or greater than 50 suggests expansion (optimism).

Figures 3 and **4** present the customer inquiry and project contract indexes for the low-slope, steep-slope, and blended market segments. The indexes show expansion in all three market segments in Q1 2023. The indexes for the three segments combined were 60.5 for customer inquiries (up from 56.9 in Q4 2022) and 62.5 for project contracts (compared with 55.2 in Q4 2022).

The Q1 indexes for the reroofing industry as a whole, the low-slope segment, and the combined low-slope/steep-slope segment continue trends of optimism seen in 2021 and 2022. The index scores of 53.8 in customer inquiries and 60.0 in project contracts for the steep-slope market are welcome indicators of optimism in this market segment after periods of pessimism at the close of 2022.

PROJECT BACKLOGS

In April 2023, 82% of respondents reported that their companies had project backlogs. **Figure 5** illustrates the project backlog trends by market segment.

Industry news



Chadwick Collins

SPRI HIRES COLLINS AS TECHNICAL DIRECTOR

SPRI Inc. in May named Chadwick Collins as its new technical director. In his new role, Collins will be responsible for SPRI's technical agenda and will be involved in the development of action plans in response to actions by regulatory and governmental agencies that affect SPRI and other roofing-industry groups.

Collins comes to SPRI after five years at Kellen Co. Earlier he worked for Wiss, Janney, Elstner Associates and with Johns Manville.



Keith Kesner

KESNER JOINS SGH

Simpson Gumpertz & Heger (SGH) said on May 16, 2023, that Keith Kesner, a concrete repair and rehabilitation expert, had joined SGH's Structural Engineering division in New York City. Kesner has more than three decades of industry and academic experience as a specialist in the design, investigation, strengthening, and rehabilitation of existing structures and in assessing material performance.

SGH said Kesner also has contributed to the development of several codes and standards for existing concrete repair and new structural design.



Kirstin Beck

HOLCIM PROMOTES BECK

Holcim Building Envelope in April promoted Kristin Beck to president of its Americas Commercial Roofing Systems & Lining unit, which includes the Elevate and GenFlex roofing-system lines. Beck assumed the role from Jamie Gentoso, who had held the position since June 2022, which was when Holcim Building Envelope was formed.

Beck previously served as U.S. Cement's senior vice president of supply chain and distribution and as global chief supply chain officer for Holcim Solutions and Products.



Amy Becker

BECKER MOVES TO FGIA

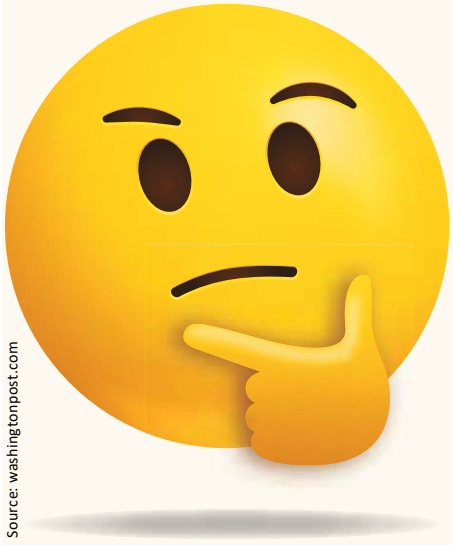
The Fenestration & Glazing Industry Alliance (FGIA) hired Amy Becker as its glass products specialist effective May 8, 2023. In her new role, Becker will oversee IGCC/IGMA and IGMAC insulating glass certification programs. She'll also be the internal auditor for FGIA fenestration certification programs.

Becker previously spent 23 years with the National Certified Testing Laboratories, and she has been an active FGIA member since 2010.

Special interest

Emojis, Slang, and Punctuation:

How Multigenerational Workers Miscommunicate



Source: washingtonpost.com

As members of Gen Z—those born between 1997 and 2012, also known as zoomers—move further into the workforce, they're bringing their own form of messaging with them. Unfortunately, generational differences in communication styles sometimes lead to unintended interpretations of messages that the sender considers to be perfectly clear.

"Gen Z's form of messaging is creating a quirky challenge for multigenerational workplaces: the potential for confusing, anxiety-inducing and sometimes comical miscommunication," wrote Danielle Abril in the *Washington Post*.

Abril shared the story of 24-year-old Mary Clare Wall, who giggled after reading a message from a colleague saying they would be "out of pocket." The colleague meant they would be unavailable, but Wall interpreted the phrase to mean engaging in something wild or inappropriate. Notably, the miscommunication went both ways, as Wall's use of the word "slay"—meaning "good job" or "killing it"—was misinterpreted by older colleagues. Wall told Abril that once she explained how she defined "slay," her colleagues adopted the term in their text messages. "They're excited they know how to use it," Wall said.

Alyssa Velez, a 23-year-old media relations specialist, told Abril that she wasn't used to seeing periods at the end of a sentence in Slack and in emails. "Once she received a comment from a colleague saying 'good job.' But the period made her second guess whether she was actually being praised," Abril wrote. Velez eventually realized, "Oh, I'm overthinking it."

Coda, a startup based in San Francisco, devotes a Slack channel to explaining emojis used by Gen Z workers. Coda software engineer Janvi Kalra told Abril about some of the emojis that might be misinterpreted. For example, the emoji with open eyes and puckered lips (😗) expresses judgment, not sending a kiss. And then there's the "generic" smiley face (🙂). While the sender might use this emoji to express a spirit of friendliness, it might not be received that way by a Gen Z reader. "It looks dead in the eyes," Kalra told Abril. "It doesn't seem warm."

Arissa Cooper

WHAT YOU DO IN YOUR JOB?

As IIBEC's manager of marketing and sales, I execute the marketing plans and strategies of the organization, including, but not limited to, membership, credentials, education, regions, chapters, and events. I also help generate revenue for the organization through trade show exhibition sales, advertising, sponsorships, and partnerships.

TELL US ABOUT YOUR FAMILY/ BACKGROUND.

I grew up in Asheboro, North Carolina, home of the North Carolina Zoo. My partner Scott and I live in in Raleigh, My partner Scott and I have been together for 13 years, live in Raleigh, and have a 10-year-old pit bull mix named Lucy and our recent addition of Ethel, a calico kitty, who was rescued from a dumpster.

WHAT IS YOUR FAVORITE THING ABOUT WORKING AT IIBEC?

When I came to IIBEC, I had been at my previous job for over a decade. I was used to knowing how to do every detail of the job, so it was a bit intimidating at first coming into a new organization and not knowing how to do it all. However, the staff at IIBEC have been nothing but welcoming and supportive. They showed me the ropes, and I know I can depend on them to teach me their ways and give great guidance and advice.



Arissa with self-portrait in Lisbon.

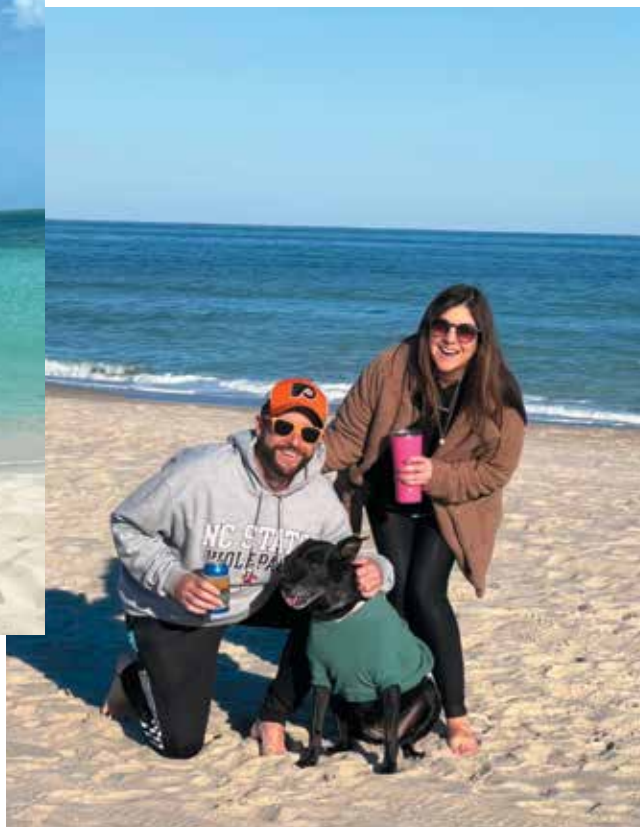


Arissa with mom in Prague.

The staff at IIBEC have been nothing but welcoming and supportive. They showed me the ropes, and I know I can depend on them to teach me their ways and give great guidance and advice.



Scott and Arissa in Aruba.



Arissa with Scott and Lucy at Carolina Beach.

NEVER EVER eat movie theater hot dogs.

TELL US ABOUT YOUR PREVIOUS JOB HISTORY.

Growing up I had a plethora of jobs—coaching gymnastics, working at a call center, and even outside sales selling ads on glassware for bars and restaurants! Before coming to IIBEC, I worked for the American Society of Echocardiography, starting as the digital marketing specialist and working my way to director of digital marketing and exhibits.

WHERE ARE YOU FROM? WHERE HAVE YOU LIVED?

I was born and raised in North Carolina, and I have happily called Raleigh home for the past 18 years! We've got the mountains and the beach all within a three-hour trip—can't beat it.

AT WHAT AGE DID YOU BECOME AN ADULT, AND WHAT PROMPTED IT?

I'll let you know when I figure that out!

WHAT WOULD YOU DO FOR A CAREER IF YOU WEREN'T DOING THIS?

TV critic. I already binge-watch TV shows and give my opinions to anyone who will listen, so it would be nice to get paid for it.

IF YOU COULD MEET ANYONE (LIVING OR DEAD), WHO WOULD IT BE?

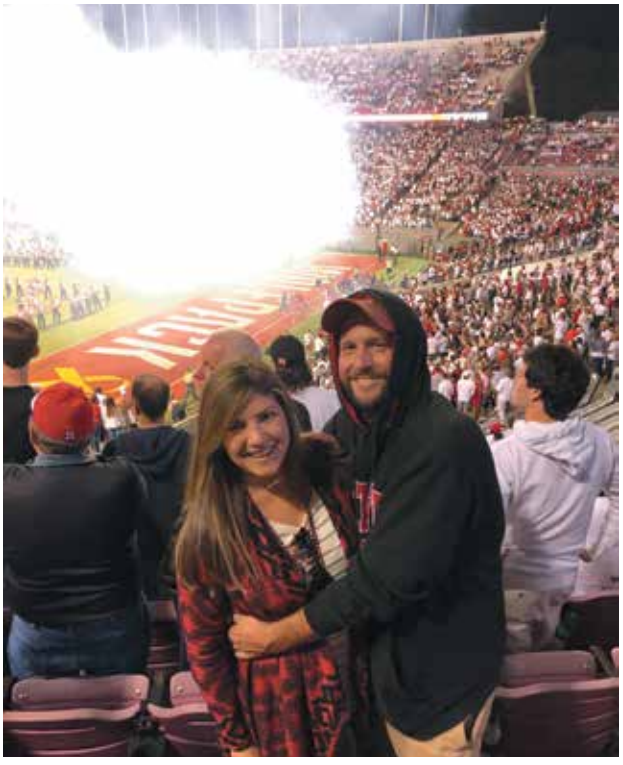
Lucille Ball. Growing up, *I Love Lucy* was my favorite show. I even own all 180 episodes on VHS (Special Collector's Edition—haha)! It's still my go-to comfort show, and the comedy still holds up today. So it would be nice to sit down with the legend herself.

WHAT WOULD YOUR LAST MEAL REQUEST BE?

I strangely think about this a lot, so here is what my last day of meals would be: for breakfast—southern biscuits and gravy with hash browns and grits; for lunch—all the oysters, raw, steamed, fried, Rockefeller, any way!; and for dinner—hibachi steak and scallops.

WHAT IS THE WEIRDEST OR MOST INTERESTING JOB YOU'VE EVER HAD?

It's not the weirdest job, but I worked at a movie theater in high school and early college. Take it from a former employee, NEVER EVER eat movie theater hot dogs. For fear of health code violations, I will not elaborate further, but just don't do it.



Scott and Arissa at an NC State football game.

WHAT WOULD PEOPLE BE SURPRISED TO LEARN ABOUT YOU?

Although I've stuck around North Carolina, I absolutely love to travel to new places and learn about other cultures. To date I've been to 45 states, 16 countries, and 3 continents. My dream is to visit all 7 continents—especially Antarctica!

For IIBEC, Every Month Is Building Safety Month

By John Boling

ON APRIL 28, 2023, US President Joe Biden signed a White House proclamation declaring May as National Building Safety Month.

"Modern building codes help to ensure that our homes, schools, workplaces, and gathering spots are safely constructed and secure, keeping the power on, our country strong, and our lives moving forward. During National Building Safety Month, we recommit to helping every community in America make all of its structures safer, more sustainable, and more resilient for the future."

However, for IIBEC and building enclosure consultants across North America, every month is building safety month. As IIBEC Executive Vice President and Chief Executive Officer Brian Pallasch has said, "When it comes to the role of the building enclosure consultant, safety or mitigating risk is a critical component of everything they do."

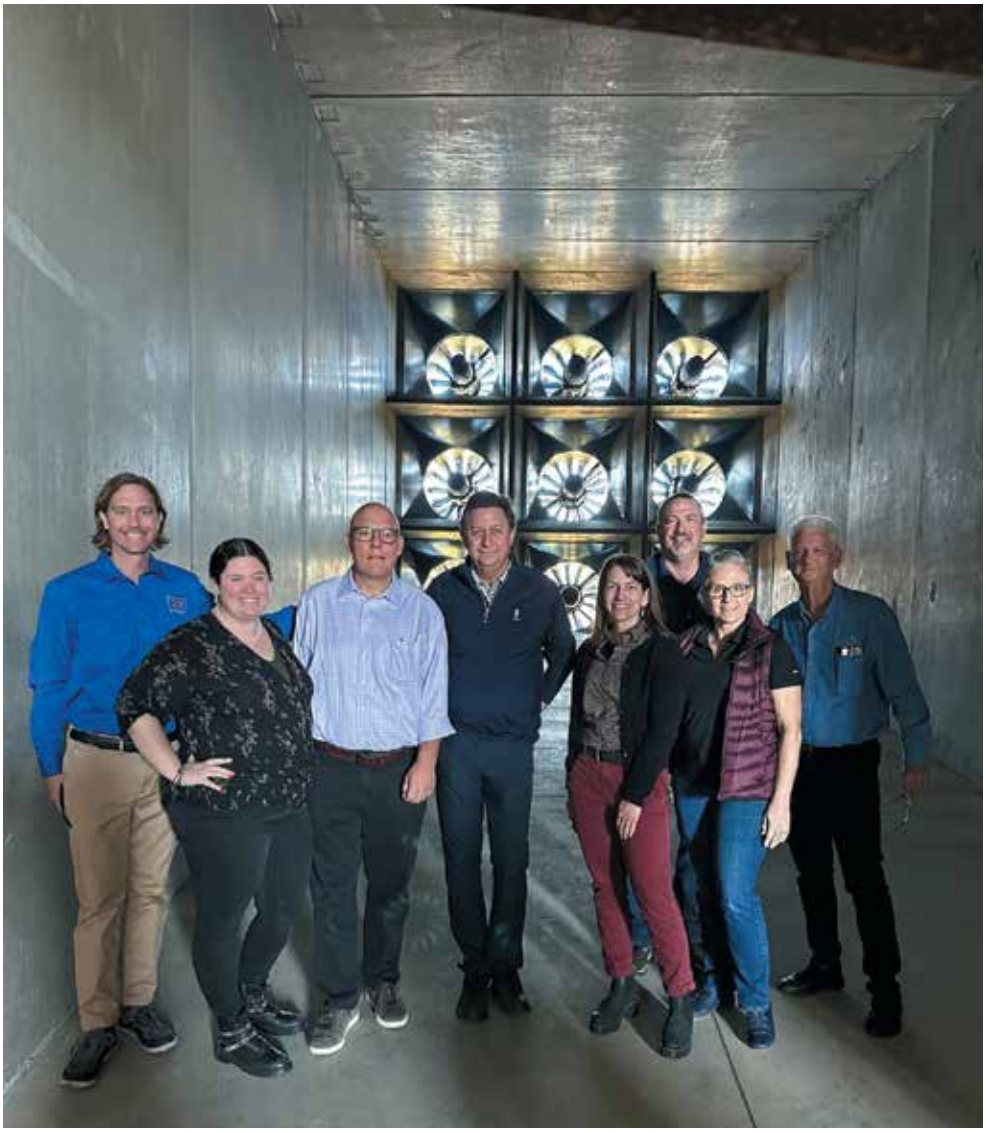


Figure 1. The IIBEC group in the wind chamber at the IBHS research facility. From left to right, Keith Parker, Jennifer Hogan, Brian Pallasch, Chris Dawkins, Emily Lorenz, Chris Giffin, Amy Peevey, and David Hawn.

RESILIENCE ON DISPLAY

Just a few weeks prior to the presidential declaration, an IIBEC delegation accepted an invitation from 2022 Building Enclosure Symposium keynote speaker Roy Wright, president and chief executive officer of the Insurance Institute for Business & Home Safety (IBHS), to tour its South Carolina research facility (see **Figure 1**).

IBHS's lab is the only one in the world that can test full-scale, one- and two-story residential and commercial buildings in a controlled, repeatable fashion for highly realistic windstorms, wind-driven rain, hailstorms, and wildfire ember storms. "Ultimately," according to IIBEC Past President Chris Giffin, "understanding how a building performs and identifying its weaknesses will lead to safer, more durable, better performing buildings."

After the tour, the group discussed ways the two organizations can work together to improve building performance. This included discussions on educating IIBEC members about the research conducted by IBHS, providing more information about the benefits of the FORTIFIED Commercial[1] program, and common goals to advance the resilience of codes and standards provisions. The FORTIFIED program is based on a voluntary "code-plus" construction standard backed by decades of research. Designers and contractors can use the program to make the building enclosure more resilient.

Safety was on the agenda again during a May 23, 2023, IIBEC delegation visit to the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. Meeting in the Engineering Laboratory, where



Figure 2. IIBEC delegation in front of the NIST Net-Zero House. From left to right, Anthony Dukes, Chris Giffin, Robért Hinojosa, Amy Peevey, Emily Lorenz, John Boling, Brian Pallasch, Chris Dawkins, and Walt Rossiter.

most of the research is related to building performance or manufacturing activities, the group engaged in a high-level overview of activities to learn of each other's capabilities and activities and to discuss in broad terms how the two organizations could mutually benefit each other.

Responsible for maintaining the US measurement system and enhancing the competitiveness of US industry through scientific and technical support, NIST also conducts an impressive amount of research on a wide range of topics of interest to the profession. As an example, NIST constructed the Net-Zero Energy Residential Test Facility to demonstrate that a typical home for a family of four can generate as much energy as it uses in a year. (**Fig. 2**).

Building performance and safety were the underlying themes of the research activities discussed during IIBEC's visit. For example, IIBEC looks forward to reviewing NIST's "Champlain Towers South Collapse" report when it is complete to learn the reasons behind that terrible event and what the industry can do to prevent future tragedies. Additionally, the National Windstorm Impact Reduction Program (NWIRP), a federal interagency science-based program focused on achieving major measurable reductions in the losses of life and property from windstorms, is producing some interesting data. Finally, Dr. Marc Levitan's presentation on the new tornado load provisions in the ASCE/SEI 7-22 *Standard on Minimum Design Loads and Associated Criteria for Buildings and Other Structures* generated discussion about how to bring his valuable research, and this new section of ASCE 7-22, to a larger group of people.

At the conclusion of the tour, Amy Peevey said, "It was an honor to meet with NIST leadership and tour their SPHERE laboratory, which puts materials through the wringer, mimicking years of exposure to the elements in a matter of days. There are many opportunities for IIBEC and NIST to collaborate in the future, especially related to wind and flood research and design that would benefit IIBEC members.

National Building Safety Month drew to a close in May, but Safety remains a priority for IIBEC and our members wherever they work. If you still need more, look for safety-related education sessions at the 2023 Building Enclosure Symposium, September 29–30, 2023, in Orlando, Florida!

REFERENCE

1. *Fortified Commercial. https://fortifiedhome.org/fortified-commercial/.*

Special interest

Having Trouble Concentrating during Meetings? Try Knitting

If you're having trouble focusing during meetings, there may be a surprising solution to your problem: knitting.

Knitting requires fine motor skills that help the brain focus, wrote April Rubin in the *New York Times*. You can also exercise those skills by doodling, crocheting, or using a fidget spinner. But the list of such activities isn't endless; reading social media and playing games on a phone may be distractions that contribute to a lack of productivity.

Despite the potential of knitting to improve focus, knitters-at-work have faced scrutiny from colleagues. Hotel worker Justin Harris told Rubin that people have viewed his knitting on the job as rude—and as an odd activity for a man. His employer, too, was skeptical of his knitting—at first. But once Harris explained that knitting lowered his stress and increased his focus, the boss backed off.

"It's a big thing for me," Harris said. "It's helped me honestly advance in my career."

Lisa Ben-Haim, an educational technologist, shared that a man once told her she was rude for knitting during a speech given at a conference they both attended. She responded by telling him that he had been typing on his phone throughout the speech, which she considered a real distraction.

Source: nytimes.com

Africa Studio/shutterstock.com

Calendar of events

JULY

17	3rd Annual OVC-IIBEC Golf Outing *Delivered by the Ohio Valley Chapter*	Westfield Center, OH
18	Annual Atlanta Braves Day at the Ballpark *Delivered by the Georgia Chapter*	Atlanta, GA
19	Lunch and Learn *Delivered by the Gulf Coast Chapter*	TBD
27	Masonry Seminar *Delivered by the Mid-South Chapter*	TBD

AUGUST

11	Moisture Scans Using Impedance, Infrared, and Nuclear Equipment *Delivered by the Georgia Chapter*	Dunwoody, GA
23	Lunch and Learn *Delivered by the Gulf Coast Chapter*	TBD
24	Curtain Wall, Storefront Lunch and Learn *Delivered by the Mid-South Chapter*	TBD

SEPTEMBER

6	Golf Tournament *Delivered by the Mid-South Chapter*	TBD
7	Late Summer" Golf Outing *Delivered by the Colorado Chapter*	Morrison, CO
14	Annual Golf Outing *Delivered by the Chicago Area Chapter*	TBD
19	Annual Sporting Clay Shotgun Blast *Delivered by the Georgia Chapter*	Waleska, GA
20	Lobster Bake *Delivered by the New England Chapter*	Andover, MA
28	Insulation Types Seminar *Delivered by the Mid-South Chapter*	TBD
28	IIBEC Board Meeting	Orlando, FL
29–30	2023 IIBEC Building Enclosure Symposium	Orlando, FL

OCTOBER

13	Wind Vented Roof System Design *Delivered by the Georgia Chapter*	Dunwoody, GA

NOVEMBER

3	Annual Fall Program and Social *Delivered by the Chicago Chapter*	Chicago, IL
8	Fall Session *Delivered by the Western Canada Chapter*	Langley, BC

DECEMBER

7	IIBEC 40th Anniversary Celebration & Christmas Happy Hour *Delivered by the Quebec Ontario Chapter*	Ottawa, ON
8	Educational Meeting *Delivered by the Georgia Chapter*	Dunwoody, GA

JANUARY

26	AGM, Seminar, and Webinar *Delivered by the Western Canada Chapter*	Vancouver, BC

Red print: IIBEC Education Opportunity
Blue print: IIBEC Leadership Event
Purple print: IIBEC Premiere Event
Green print: IIBEC Social Event
Black print: Industry Event

Calendar subject to change without prior notice.
Visit **www.iibec.org** for schedule updates.

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Room for *a couple more?*

Interesting use of an insulated wall panel aside, I don't think I've seen this many penetrations on a single curb in a non industrial setting before. Thank goodness for liquid-applied flashings!





Submitted by Dave Neal, RRO
Project Principal
Pretium Engineering Inc.
Burlington, ON



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