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THE FORUM

A TECHNICAL PUBLICATION FOR THE SRWA

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Sustainable Roofing & Waterproofing Alliance

UPCOMING EVENTS

2016 SRWA FALL CONFERENCE

Hershey, Pennsylvania | October 25–28, 2016

Carlisle Construction Materials is hosting its annual Sustainable Roofing & Waterproofing Alliance (SRWA) Fall Conference in Hershey, Pennsylvania, USA from October 25th – 28th, 2016.

The annual conference will showcase the latest developments in building envelope technology and educate attendees on product development, testing, governing codes and design improvements. The event will feature various educational tracks led by top industry icons in roofing and waterproofing, live demonstrations, and product fair.

October 25th
Registration, Dinner, and Awards Ceremony

October 26th
General Session, Product Fair, and Hands-on Demonstrations

October 27th
General Session and Educational Tracks

October 28th
Optional Plant Tour and Departures

For more information, contact:
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(717) 245.7148
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Featured Speakers:

- **Larry Harmon**, Air Barrier Solutions, Inc., Crown Point, New York
- **Colin Murphy**, Trinity/ ERD, Seattle, Washington
- **Darbi Krumpos**, Trinity/ ERD, Seattle, Washington
- **Douglas Stieve**, Wiss, Janney, Elstner Associates, Inc., New York, New York
- **Keith Roberts**, Roberts Consulting, Abingdon, England
- **Marshall Strabala**, STRABALA+, Chicago, Illinois
- **Thomas W. Hutchinson**, Hutchinson Design Group, Ltd., Barrington, Illinois

CONTINUING EDUCATION AIA & RCI ACCREDITATION

FEATURED ARTICLE

MAKING A BALANCED CHOICE

10 FACTS TO BE CONSIDERED WHEN SELECTING ROOF COLOR

Because the USGBC grants 1 point under their LEED program for projects utilizing reflective roofing membranes, architects and designers are led to make an assumption that light-colored/reflective roofing is the solution regardless of geographic location. With years of experience and thousands of installations, the industry has begun to encounter unintended consequences due to the shift in roof color. Below are the top 10 unintended consequences that should be considered when designing a roofing system.

1 WHITE ROOFS INCREASE ENERGY COSTS, NATURAL RESOURCE CONSUMPTION, AND CO2 EMISSIONS IN HEATING-DOMINATED CLIMATES. ASHRAE Zones 4-8 are heating-dominated climates where heating demands are 2-11 times greater than cooling demands. There is a significant "heating penalty" associated with using a "cool" white roof in northern and central climates, as illustrated in the charts below.

If a primary goal of the LEED program is to reduce natural resource consumption and CO2 emissions caused by burning fossil fuels, it makes sense to focus on reducing the heating load of buildings in heating-dominated climates, rather than using roofs designed to make these buildings colder.

A **2011 experiment** conducted by Ashley-McGraw Architects, PC and CDH Energy Corp concluded that in northern climates, dark-colored roofing is more energy-efficient than white roofing. In addition, when heating and cooling costs are examined, dark-colored roofs are more cost-effective for buildings in northern climates. The study found that the thermal heat loss of white roofing is 30% higher than black EPDM during the heating season, and that the heating penalty of a white roof exceeded the cooling benefit.

Other manufacturers have conducted their own studies and share similar viewpoints. Soprema, a manufacturer of white, gray, and black modified bitumen roofs, conducted a study on their facility in Vancouver (ASHRAE Zone 5) that concluded black roofs were more energy-efficient than white or gray, regardless of what type of insulation was used.

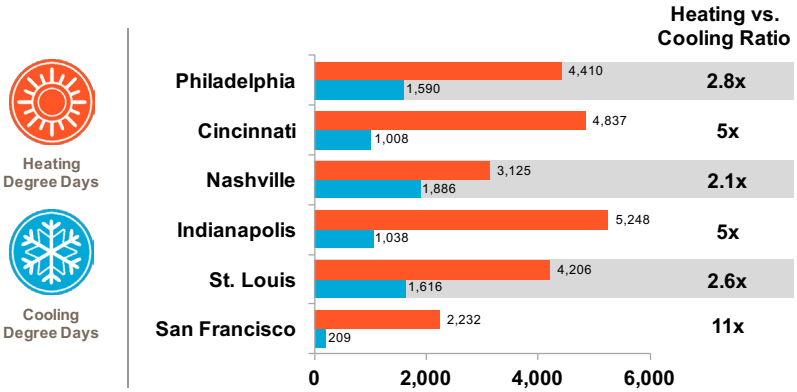
Joshua New, from Oak Ridge National Labs, published an article in the October 2013 issue of RCI Interface that stated, "…it is important to note that based on acceptable industry standard calculations in the current business environment, static reflective roofing does not provide an energy cost savings in cooler or temperate climates. In fact, it can be detrimental to overall energy costs to employ roofing with high SRI values."

The Department of Energy and Oak Ridge National Laboratory developed a Roof Savings Calculator, the use of which is recommended by ENERGY STAR®. This calculator indicates that white roofs are energy-efficient in warm, southern climates, but in cooler, central and northern climates, they can actually increase a building owner's total energy costs.

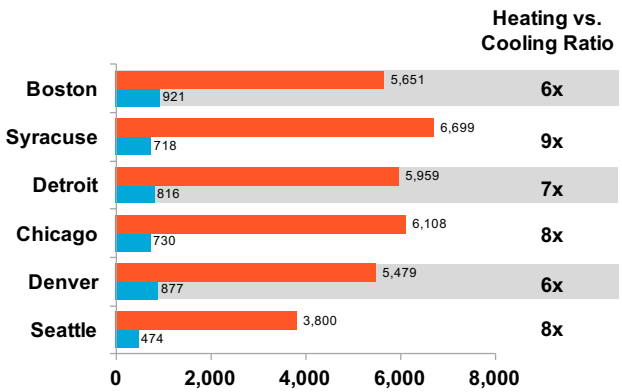
The **Advanced Energy Retrofit Guides**, published by the Pacific Northwest National Laboratory, do not include cool roof installation in the recommended package to improve energy efficiency when retrofitting a roof.

2 REFLECTED HEAT MAY INCREASE GLOBAL WARMING POTENTIAL. A 2011 **Stanford University study** concluded that white roofs may actually

Heating and Cooling Degree Days - Central



Heating and Cooling Degree Days - North



contribute to global warming. White roofs reflect heat back into the atmosphere where it mixes with black and brown soot particles, contributing to global warming and smog formation. "Cool" white roofs may make sense in warm, southern cities where the cooling benefit decreases energy consumption and CO2 emissions, but in heating-dominated climates like ASHRAE Zones 4 and above, they will increase natural resource consumption for heating purposes and therefore increase CO2 emissions which are thought to contribute to global warming.

3 CHANGES IN RAINFALL PATTERNS. A study by Arizona State University indicated that **widespread adoption of reflective white roofs can have an unintended effect on rainfall patterns**. White roofs reflect heat back up into the atmosphere and change the evapotranspiration rate, which results in less precipitation in some geographic areas, while increasing precipitation in others.

4 SUSTAINABILITY/WEATHERABILITY. Darker-colored EPDM rubber membranes typically perform better than cool plastic roofs in Xenon Arc accelerated weathering tests and real-world testing of 30-year-old weathered membrane. In general, black EPDM has 2-3 times greater UV resistance than alternative roofing membranes.

5 INCREASED RE-ROOFING FREQUENCY AND LANDFILL WASTE. Thermoplastic TPO and PVC membranes must be internally reinforced and only have 20-25 mils of weathering material over the reinforcing scrim. Comparatively, non-reinforced EPDM membranes have a full 60 mils of weathering material. Xenon Arc accelerated weathering tests indicate that Black EPDM (at 41,580 kJ/m^2) provides much greater UV resistance than most TPO and PVC membranes (approximately 12,000 to 20,000 kJ/m^2). Reinforced membranes must be replaced once the reinforcing scrim is showing through. The end result is white roof membranes wear out faster and have to be replaced more often, sending more construction-generated waste to landfills.

6 HAIL RESISTANCE. Several independent studies conducted by roof consultants show that **due to excellent elongation properties, EPDM membranes provide very good resistance to damage from the hail storms** that frequently occur in ASHRAE Zones 4 and above. TPO and PVC plastic-based sheets do not perform as well in severe hail storms, especially as they age.

7 CONDENSATION ISSUES. Because white roof assemblies remain cooler than dark-colored alternatives, white roofs in central and northern climates are more prone to condensation issues that can slowly erode the integrity of the roof insulation, especially in the absence of a vapor barrier. An **experiment conducted by Oak Ridge National Laboratory** showed that a white mechanically fastened roof will accumulate twice as much condensation than a black mechanically fastened roof. Condensation issues have led to premature failures in roofs, and roof failures caused by internal moisture accumulation within the roofing assembly are not covered under warranty.

8 WINTER SAFETY ISSUES. Central and northern climates are far more likely to experience frost, dew, and ice, which are difficult to see on white roofs and can create a slip hazard for maintenance people who work on rooftops. Roofers are well aware of this hazard but building owners or their facilities crews are not, which can lead to unnecessary accidents.

9 AESTHETICS OF LEED BUILDINGS. Aesthetics can become an issue on white roofs because they collect and show dirt, debris, and unwanted biological growth much quicker than dark-colored or ballasted roofs. Cleaning white roofs requires the use of fresh water and cleaning detergents that can add to the environmental impact of white roofs when used in climates better-suited for other options.

10 PUBLIC SAFETY ISSUES. Public buildings are often used as places of refuge during catastrophic weather events and as such they are typically designed to a higher performance standard. EPDM's historical long-term weathering/UV performance and excellent hail resistance (documented above) result in a higher level of resiliency than the typical thermoplastic options.

Protection from extremely cold weather is another public safety benefit of dark-colored EPDM. An article in **The Lancet** referenced a report stating that more deaths are caused by cold exposure than by heat exposure. They analyzed data for over 74 million deaths and found deaths related to cold exposure were 7 times greater than deaths related to heat exposure. The study collected data for 384 locations in Australia, Brazil, Canada, China, Italy, Japan, South Korea, Spain, Sweden, Taiwan, Thailand, the U.K., and the U.S.

Indur Goklany's study "**Death and Death Rates Due to Extreme Weather Events**" analyzed U.S. deaths caused by temperature extremes and came to a similar conclusion: that exposure to cold results in twice as many deaths than heat exposure. He also noted that death rates due to high temperature extremes are incredibly low in the U.S. People rely on public shelter during extreme weather events, and the resilient nature of fully adhered and ballasted EPDM would be a benefit to public safety.

POLYISOCYANURATE VS. MINERAL WOOL: LOOKING BEYOND NFPA 285

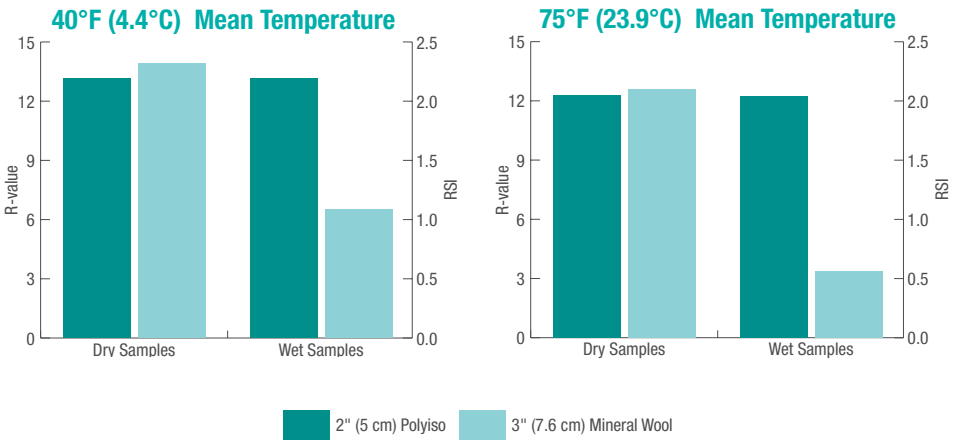
With the ever-increasing requirement for continuous insulation, architects and designers are faced with choosing a product that meets both commercial energy codes and commercial building and safety codes. The National Fire Protection Association's "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components," or NFPA 285, is one test that seems to have created tunnel vision for architects and designers. Obviously fire testing is important and, due to its inherent properties, mineral wool does quite well when tested against the NFPA 285 standard. However, it has been proven through extensive testing that polyiso insulation also meets the stringent code requirements for flame spread and smoke development in many different wall assemblies when tested according to NFPA 285.

With fire safety being a moot point in the comparison of polyiso and mineral wool insulation, it is necessary to compare other aspects of the two products. Firstly, insulation should insulate. The average R-value per inch for polyiso is 6.5 versus an average of 4.0 for mineral wool. In addition, for rain screen wall assemblies where the insulation will be exposed to moisture, it is important to compare the products' ability to resist water absorption. It has been known for years that mineral wool insulations do a great job at retaining moisture—so much so that mineral wool has been used for decades as water retention for green roof systems. Because water is conductive, water absorption is extremely detrimental to the performance of an insulation. As the moisture content of an insulation increases, it's insulating value decreases.

ASTM C209 "Standard Test Methods for Cellulosic Fiber Insulating Board" is a test procedure for examining the mechanical, physical and thermal properties as well as properties related to water absorption and water vapor exposure of insulation board. Section 14.3 of ASTM C209 specifically defines test procedures for water absorption testing of insulation boards and has been the test method of choice for above-grade exterior rain screen wall insulations. The test requires an insulation board to be submerged in a water bath for two hours, removed from the water, and then allowed to drain for 10 minutes. The insulation board is then placed in a plastic bag, where the air is removed and sealed before testing occurs. Before and after being submerged in water, polyiso and mineral wool insulation samples were tested using ASTM C518-10 "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus" to determine their initial R-value and any subsequent changes in R-value after water submersion. The test results below were taken at both 40°F (4.4°C) and 75°F (23.9°C) mean temperatures. Both materials were subjected to identical test procedures at an accredited independent testing agency. Due to the higher R-value per inch that polyiso possesses, the tests were performed using 3" (7.6 cm) dual-density mineral wool and 2" (5 cm) polyiso to yield around the same average initial R-value for both materials. The results of the testing are below:

In both the 40°F (4.4°C) and 75°F (23.9°C) mean temperature testing, the dry state R-values for both materials were in line with published R-values for the products. After the 10-minute drain period, the polyiso's R-value had almost completely returned, with the insulation retaining 99.9% of its original insulating value. The mineral wool product, on the other hand, did not fare so well. At 40°F (4.4°C) mean temperature, mineral wool retained, on average, only **46.9% of its original R-value**. When tested at 75°F (23.9°C) mean temperature, the mineral wool retained, on average, only **26.7% of its original R-value**. It can be concluded that while closed-cell foam insulation products such as polyiso have excellent moisture resistance, fibrous materials like mineral wool do not. Fibrous insulation manufacturers often state that when the product is wet, R-value will be reduced, but they do not typically reference how much reduction will occur. The above results show the R-value reduction to be substantial, even when drainage opportunity is provided.

It is important to take a holistic approach when choosing exterior continuous insulation for rain screen wall assemblies. One should not throw all their eggs in one basket and select a material on only one particular attribute. Of course, insulation is used to provide insulating value, so first a foremost an insulation should be a proficient insulator. For rain screen wall assemblies, when moisture is almost always present, it is imperative to choose an insulation that is unaffected by moisture.



CCM GLOBAL SPOTLIGHT

KIA MEXICO

With an initial investment of approximately $3 billion into the project by Kia Motors and suppliers, the state-of-the-art Kia Motors Mexico plant was constructed in a mere 13 months.

The plant, with an annual capacity of 300,000 units, represents approximately 10% of Kia Motors' global manufacturing output.

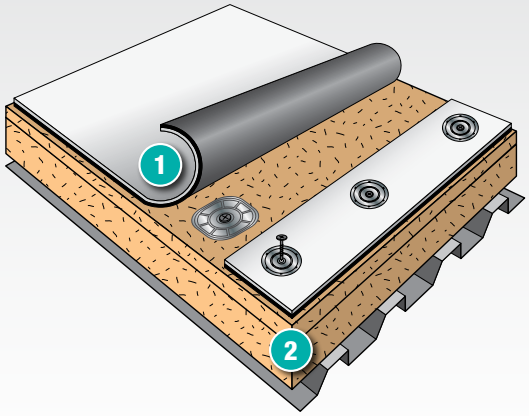
Located on land spanning around 500 hectares, the plant is composed of four main shops: stamping, body welding, paint, and assembly. During the construction period, approximately 27,000 tons of steel were used and nine local Mexican companies worked together to build the structures of the four main buildings and framework for surrounding buildings.

Kia's Mexico plant joins the 10 other manufacturing facilities in Korea, China, Slovakia, Russia, and the U.S., where Kia vehicles are assembled. 60% of the plant's output will be exported to North America, 20% will supply the Mexican domestic market, and the remaining 20% will be exported to neighboring countries in Latin America.

The manufacturing complex features sophisticated production equipment such as a $75 million stamping press that measures 18 meters high and weighs 3,862 tons, making it the largest press owned and operated by Kia.

In line with Kia Motors' commitment to developing green production technologies to minimize its environmental impact in all of the regions in which it manufactures vehicles, Kia's Mexico plant utilizes an advanced monitoring system that promotes continual improvement in energy saving and environmental conservation.

"Kia's Mexico plant joins the 10 other manufacturing facilities in Korea, China, Slovakia, Russia, and the U.S., where Kia vehicles are assembled."



PROJECT PROFILE

PROJECT LOCATIONS:
Pesqueria, Nuevo Leon, Mexico

CARLISLE APPLICATOR:
- Grupo Dipicsa
- Total Solutions Group Mexico
- Abinco
- Universal Roofing

ROOFING SYSTEM:

1. Mechanically fastened TPO 60mil
2. Polyiso 1½ + ½" SECUROCK Glass-Mat Roof Board

PROJECT PROFILE

WILLARD HIGH – A SCHOOL WITH A MODERN PROFILE

In August 2013, the Willard City School District began to raze its current middle school and high school buildings and built a new, state-of-the-art facility that would house classrooms, administrative offices, and athletic facilities for its Kindergarten through 12th grade students. Willard High is the only high school in the Willard City School District and this new facility would provide much-needed expansion and modernization for its 590 enrolled students. The new 200,675-square-foot (18,643 square-meter) building, which contains separate wings for Elementary, Middle, and High School, was completed in phases; the project began in the fall of 2013 and was set for completion in the spring of 2015.

M. Smith Roofing was tasked with finding a high-performance roof system that would not only provide long-term durability, but would also enhance the school's modern aesthetic appeal. The team at M. Smith knew they wanted to use a roofing system manufactured by Carlisle. With ten years of experience installing Carlisle roofing systems, M. Smith knew that Carlisle would be able to meet the school's criteria and even exceed their expectations.

Carlisle's gray 115-mil FleeceBACK® KEE HP (High Performance) PVC membrane was chosen for this project due to its exceptional performance characteristics. FleeceBACK membranes offer excellent resistance to hail, punctures, and tears, while PVC membranes provide increased resistance to chemicals, pollution, oils, and acid rain. KEE HP PVC membranes go one step further with the incorporation of DuPont® Elvaloy® KEE HP; a solid, high-molecular-weight plasticizer that will not migrate out of the membrane over time. The incorporation of KEE HP into PVC compounds increases the window of weldability, minimizes smoke during the welding process, and increases the low-temperature flexibility of the membrane.

The Willard High School rooftop is complicated, with 18 different levels that contain more than 40 different sections. The M. Smith team began by covering the entire metal deck with a reinforced polyethylene vapor barrier. The next step was to mechanically attach 2" (5.08 cm) of SecurShield™ polyiso insulation, using eight fasteners per board. Utilizing Carlisle's FAST™ Adhesive, the team then installed 2½" (6.35 cm) SecurShield HD Composite board, which combines a ½" (1.27 cm) high-density polyiso cover board with 2" (5.08 cm) of rigid polyiso insulation for optimal compressive strength. Combined, this system boasts 4" (10.16 cm) of polyiso insulation with a ½" (1.27 cm) cover board, which will improve the building's energy-efficiency, particularly during Ohio's cold winter months.

Once the insulation and cover board were secured in place, the 10' x 80' (3.05 x 24.38m) rolls of FleeceBACK membrane were adhered with FAST Adhesive; then 150-pound rollers were utilized to maximize adhesion. To flash around the numerous HVAC penetrations and pipes, the team used Carlisle's prefabricated gray PVC accessories, which were crucial for saving time and labor on the rooftop. To finish off the project, Sure-Flex PVC Contour Rib Profiles were used to give the appearance of a standing seam metal roof.

Contoured Rib Profiles

FleeceBACK KEE HP with Contoured Rib Profiles

INDUSTRY UPDATE

HOT TOPIC: 2016 ICC COMMITTEE ACTION HEARINGS

Recent Spring Code Hearing: 2016 ICC Committee Action Hearings
Group-B Codes (Admin, IBC-S, IECC-C, IECC/IRC-R, IFC, IRC-B, IWUIC)
April 17–27th | Louisville, KY

New proposal highlights:

- Adopting ASCE-7-2016 wind maps and calculation procedures
- Adding requirement for roof insulation marking requirement (for non-observable insulation)
- Adding requirement for using two layers of roof insulation in systems over R-17
- Adding Air Barrier Commissioning requirement
- Removing Test Method CCSB 37 GP 52M for impact resistance testing of low-slope roofing
- Adding ASTM D7425 standard for SPF used in roofing applications
- Adding Solar Ready Zone (pre-prepped area of a roof for photovoltaics) in appendices
- Definition changes for reroofing and recover

Arguments for and against will continue to be heard at the final action hearings and changes will update after final voting by all ICC members at the end of the year.

Next hearing:

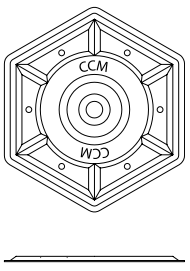
2016 ICC Final Action Hearings
October 19-25th
Kansas City, KS

WHAT'S NEW WITH CCM

FM APPROVALS FOR REDUCED FASTENING PATTERNS

Carlisle Construction Materials, in conjunction with USG Roofing Solutions, has obtained FM approvals for reduced fastening requirements for cover boards in fully adhered assemblies. These approvals are exclusive to Carlisle Construction Materials roof systems that utilize USG SECUROCK® Gypsum-Fiber Roof Board underneath fully adhered, single-ply membranes. The reduced fastening requirements are outlined in the table below:

Product Thickness	FM Rating	Typical Fastener Rate	Reduced Fastening Rate	Square Feet per Fastener (updated)
¼" (6.35 mm)	FM 1-90	16	10	3.20 (.975 m)
⅜" (9.52 mm)	FM 1-90	16	8	4.00 (1.2 m)
½" (12.7 mm)	FM 1-90	10	8	4.00 (1.2 m)
½" (12.7 mm)	FM 1-75	N/A	6	5.33 (1.6 m)
⅝" (15.875 mm)	FM 1-90	8	6	5.33 (1.6 m)



The use of Carlisle's InsulFast™ fasteners and SecurFast™ Plates is required in assemblies utilizing the reduced fastening requirements. Contact Carlisle for enhanced fastening requirements for projects requiring extended warranty durations and/or increased wind speed coverage.

CARLISLE CONSTRUCTION MATERIALS

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