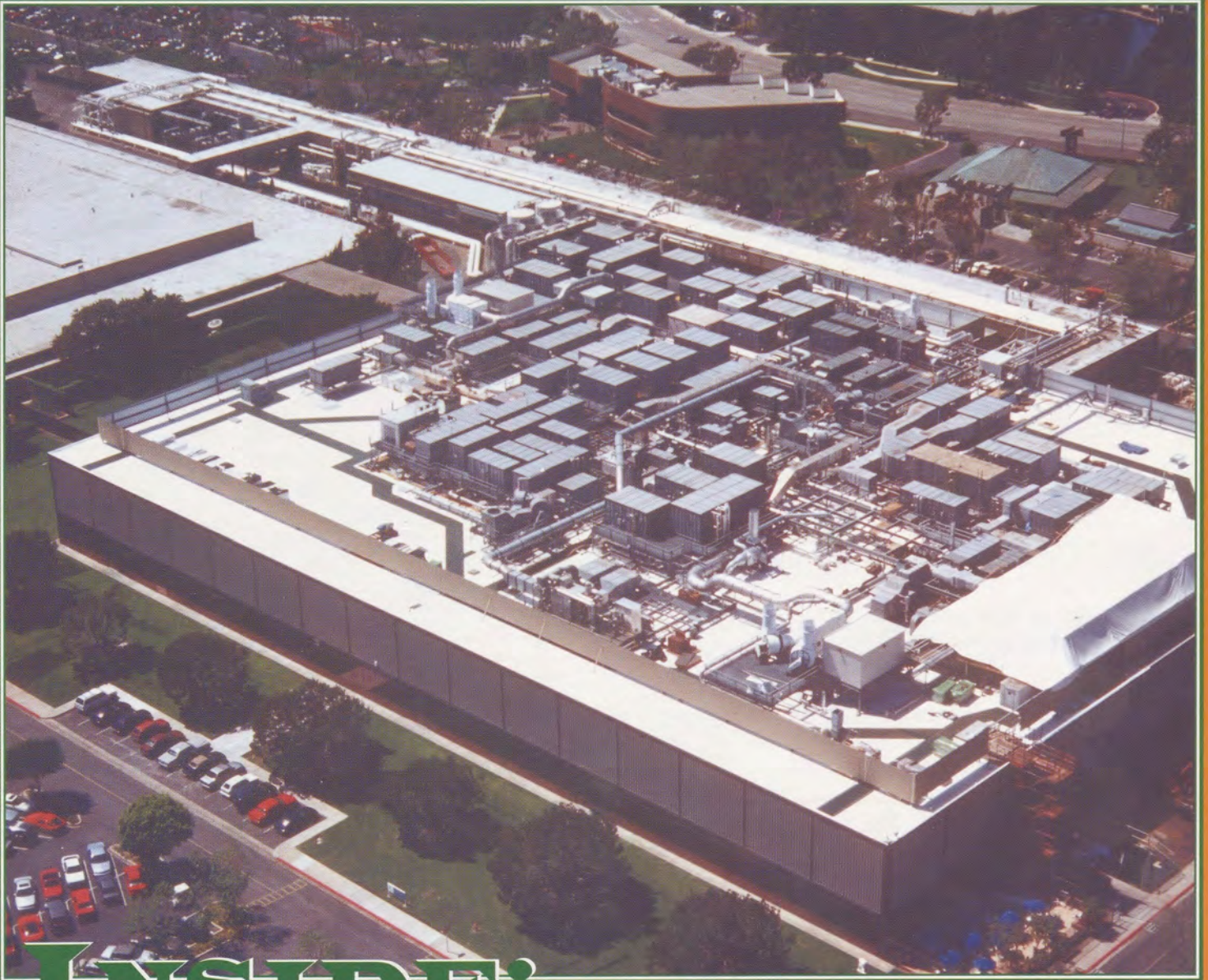




Journal of The Roof Consultants Institute

# Interface

October 1997  
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## INSIDE:

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**With Non-Foam Insulation • Page 5**

**Polyolefines .....**

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RCI was chartered, in part, to bridge the gap between the seemingly disparate elements of the roofing profession. It is the intent of *Interface* to connect with these elements, educate and inform about roofing-related topics, establish a common ground for discussion, promote Institute programs, and branch out toward even more people. *Interface* is circulated monthly to over 3,000 people (nationwide and overseas) including RCI members, specifiers, facility managers, owners, industry contacts, and a growing number of highly placed

professionals. *Interface* is frequently distributed at various trade shows, as well as educational and institutional functions.

The articles contained in this publication are intended to provide information that *may* be useful to members of the Roof Consultants Institute. RCI does not necessarily endorse this information. The reader must evaluate the information in light of the unique circumstances of any particular situation and independently determine its applicability. Entire contents, © RCI.

**On The Cover:** *Rockwell International's semi-conductor plant in Newport Beach, CA, couldn't afford disruption of cleanroom/laboratory operations during replacement of its roof. The roof on the 130,000 square foot facility was extremely wet and blistered and contained five or six existing roofing systems up to six inches thick and loaded with so much rooftop equipment it looked like a small city from the air. Following removal of existing material, a Sarnafil mechanically-attached Sarnafast system was successfully installed by Southern California Roofing Co. without disruption to interior operations.*

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# PRESIDENT'S MESSAGE

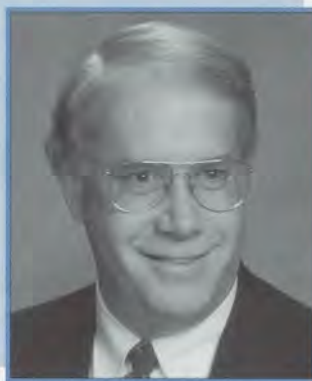
## Candor, Honesty, Insight, Vision!

These expressions are seldom heard publicly from the mouths of senior company management in today's competitive business world. So when I was recently told by a senior manager of a major manufacturer that "we learned that selling our roofing products at a low profit margin to anyone who would ask for them, just to achieve high sales volume, was not good for our business long term," I knew our meeting was going to be engrossing. The speaker then underscored his point by adding that "warranty costs are a clear indicator of a company's focus on delivering a quality product to quality contractors."

Frankly, I couldn't believe my ears, but WOW, was it refreshing! He went on to say that their new goal was to team up with those customers who recognize quality and are willing to pay a fair price for it. While the concept of "teaming" is not revolutionary to American business, I believe it is in our industry. When a national roofing manufacturer concentrates on building relationships for delivery of a quality product (yes, a roof can and should last for 20 years or more), as opposed to simply building quality relationships, it is a significant sign of maturity. This message was one I had never heard before from someone at this level, and it obviously made me think about sharing the news with my clients.

In this new era, certainly everyone who has a pickup truck is not going to be able to buy quality products. Naturally, the quality manufacturers' contractor base will be shrinking, as determined by past installation performance of the contractors' roofs.

Of course, someone has to sell products to those low-dollar buyers, both contractors and owners. However, with major roofing manufacturers growing and broaden-



**Robb G. Smith, RRC, RRO**

ing their product line by purchasing smaller manufacturers, the total number of manufacturers will also be diminishing. I believe we will see an even fewer number of those manufacturers make this statement of quality by setting themselves apart from the commodity, high-volume, low-profit marketeers.

Simply put, manufacturing with the goal of trying to meet the bare minimum ASTM standards is always going to be the focus of some. Fortunately, I predict we will begin to see a few more quality manufacturers distancing them-

selves from the pack. They will be diligently developing relationships with quality consultants, leading the way into the next century by providing quality products to building owners who have had enough of that uncertain ASTM ride. **And isn't it about time?**

We all know of great contractors who have worked hard to improve their application techniques, attempting to deliver a pretty good roof while working under the constraints of some very average or minimum-standard materials. These contractors will now be able to provide even better, longer-term, watertight roofs on a more consistent basis, thanks to their teaming with those whose goal it is to become quality manufacturers.

I think I can speak for all RCI professional members when I say, **Congratulations, Mr. Quality Manufacturer.** We welcome the opportunity to be part of the quality-based industry team, and know our clients will profit from the mutual benefits for many years to come.

Do you have ideas, thoughts or suggestions for RCI's future? Contact me at [advrooftech@sprintmail.com](mailto:advrooftech@sprintmail.com) or fax me at **702-825-9256**.

A handwritten signature in blue ink that reads "Robb G. Smith".

President

# LETTERS TO THE EDITOR



Dear Editor:

In a recent press release (*Interface*, July 1997), the Polyisocyanurate Manufacturers' Association (PIMA) failed to state current or accurate facts about fire testing of extruded polystyrene insulation. This seems to be an attempt to confuse the specifiers of rigid foam roof insulation. This "smoke and mirrors" approach misrepresents the issue of fire testing and code approval of extruded polystyrene insulation.

The press release from PIMA states concern over U.L. test procedures which evaluate the use of polystyrene foam directly on a metal roof deck. PIMA has not based its press release on current U.L. fire testing results, even though PIMA has the latest documentation.

It is important that specifiers know that the Dow Chemical Company has successfully passed the large-scale "White House" test witnessed by UL. This is the very test developed after the Livonia, Michigan (General Motors) fire that was referred to in the PIMA press release. The UL 1256 and FM 4450 are small-scale tests developed after the White House test in order to reduce costs. The White House test is recognized in the industry as the oldest and most stringent test for rigid insulation products.

UL has developed an intermediate test which Dow also ran and passed; however, Dow also went on to pass the White House test. In fact, Styrofoam® Deckmate® performed much better than the control roof system (which is fiberboard and a built-up roof membrane). This B.U.R. system has been used for over 50 years. Styrofoam® Deckmate® direct to metal decks meets S.B.C.C.I. and B.O.C.A. criteria for use below ballasted or mechanically-fastened single plies, and metal roofing, or fully-adhered, modified bitumen, and shingles (with an overlayment).

PIMA questions the validity of a UL test that is over 30 years old, and the code bodies for approving products that pass this test.

To use a large-scale test by building a structure (10' high x 20' wide x 100' long) is much more representative of an actual fire than the small-scale test that PIMA currently endorses.

Rather than question the validity of an established fire test, PIMA should look within and start publishing accurate R-values for polyisocyanurate foams. PIMA and its member manufacturers should publish long term in-service R-values as opposed to those based on a 180-day "conditioning" procedure. What good are "conditioned" R-values on buildings designed to last 50 years or more? This test was developed by PIMA for exclusive evaluation of isocyanurate products. Why doesn't PIMA develop a test for long-term evaluation of properties such as thermal efficiency and core moisture absorption? How does PIMA explain the fact that NRCA, MRCA, and ASHRAE publish much lower R-values for polyisocyanurate? PIMA should recognize that there are other rigid foam insulation products on the market with physical properties that allow them to be reused when the membrane fails.

Polyisocyanurate may have its place, but there are other products that just might have superior performance. Come on, PIMA, acknowledge the facts about fire testing and R-values!

*Mike Watts, CDT, CSI  
President, Styro Systems — Carolinas, Inc.*

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# Corrosion Of Structural Steel Deck Under Roof Assemblies With Non-Foam Insulation

BY HITESH DOSHI, M. A. SC., P. ENG.

VLADIMIR STRITESKY, P. ENG.

PAT LANNI, B. ENG.

## ABSTRACT

**F**ield roofing experience has shown that moisture is the primary contributor to corrosion and that corrosion will occur in the presence of most types of moist insulation. This paper documents the observation of steel deck corrosion on roofs with perlite, fiberboard and glass fiber insulation materials. These observations complement the concerns raised regarding the corrosion of steel deck when exposed to certain types of phenolic foam insulation that have become wet—due to either exterior or interior moisture absorption. The paper

provides an opportunity to assess the impact of moisture conditions in the roof on the corrosion of steel deck. The cases documented in this paper are categorized by the type of moisture conditions as well as the nature of corrosion.

The cases show that the propensity for steel deck to corrode is a function of the presence of moisture in the roofing system and is not limited to specific types of insulation. With the protection of a vapor barrier<sup>1</sup>, which is required and used in many buildings in northern climatic regions, the deck is not expected to

corrode under normal conditions. The vapor barrier, however, is not always used, not always positioned directly in contact with the steel deck or is penetrated by fasteners.

We conclude that because of corrosion's impact on structural integrity, it is an issue that needs the roofing industry's attention. On new construction, steel deck is generally a separate trade item, but on existing buildings, roofing professionals are first to uncover this condition. Areas that need industry attention and development work are also identified.

## CORROSION UNDER INSULATION—A BACKGROUND

### Roof Insulation and Corrosion of Steel Deck

Corrosion of metal in a moisture-laden roofing system independent of the type of insulating material has been recognized as a problem by Baker (1972), RIEI (1983), and Baxter (1986). Baker indicated that “without water, metal will not corrode.” Baxter indicated that “painted steel deck is particularly susceptible to rust caused by continuous contact with wet roof insulation.”

Since the early 1990s the roofing industry's concern regarding corrosion of steel deck has been primarily with phenolic foam insulation. Canon (1991) appears to be the first to publicly document three specific cases of corrosion of steel deck when in direct contact with phenolic insulation. Moisture was present in all three cases discussed by Canon. In the chemical analysis of corrosion product,

Canon determined and reported chloride as high as 0.01% and sulfur as high as 0.24%.

Thomas et al. (1993) appear to be the first to publicly document the issue of corrosion associated with phenolic insulation based on simulated field tests. Several different types of phenolic insulation were considered in the tests, along with polyisocyanurate insulation. Chemical analysis of different types of insulation was conducted and the pH and the type and amount of Cations and Anions in the leachate were reported. The pH in the different types of phenolic insulation was reported to be between 4.85 and 1.75. Those for perlite, polyisocyanurate, rigid glass fiber and wood fiberboard were reported to be 5.65, 6.25, 6.70, and 3.70 respectively.

Results of two separate National Roofing Contractor's Association (NRCA) contractor member surveys were

deck. The remaining eleven (11) had insulation on the steel deck. Although the reported cases with phenolic foam increased following the 1991 survey, the total number of cases was relatively low. Thomas et al. state that "...corrosion problem is a direct function of the gain within the roof system rather than the insulation system." Based on results of limited testing, Thomas et al. (1993) found one type of U.S.-manufactured phenolic foam insulation and its Canadian counterparts to be possible contributors to possible deck corrosion. The type of phenolic insulation manufactured in Canada was identified as resol foam as well as the open-cell type manufactured since the mid 1970s) "...did not show the interaction [superficial corrosion] with the steel deck, whereas the U.S.-produced phenolic insulation [Canadian counterpart [prior to incorporating a protective facing]] did show surface interaction."

Thomas and Thomas et al., the concern with corrosion has been evident in the general building industry from time to time by the NRCA, in 1994 by the Roofing Contractor's Association (CRCA) and the National Association of Insulation Contractors (NAIC), e.g., Domtar (1992). The reports are primarily advisory and make reference to the work done by Thomas et al. or appear to be based on their respective experiences. Fishwick reports some Canadian experience with corrosion of steel deck under phenolic foam. The information is generic and does not lend itself to application of analytical models. Nonetheless, most reports confirm the key role that moisture plays in corrosion and the need to minimize moisture in the insulation.

### Corrosion Under Wet Insulation In Other Applications

Problems under wet insulation have not been limited to the roofing industry. In the introduction to the proceedings of the National Association of Insulation Contractors' (NAIC) 1990 Symposium on "Corrosion Under Wet Thermal Insulation" [Process Piping] Under Wet Thermal Insulation, it was noted that the corrosion under wet insulation in the process and refining industry cost \$25 million in 1988. It was also noted that this problem has occurred in the past and affects pipes subjected to a wide range of temperatures. The problems have not been limited to process piping but to moisture in the process and refining industry has dealt with the problem by prescribing better coatings and

A case of wet fireproofing insulation causing building column corrosion was recently reported by Thompson et al. (1997). Corrosion due to wet fireproofing has been known to occur, and standards are in place to deal with the corrosiveness of sprayed-on fireproofing. What is interesting about the reported case is that "the steel column had corroded due to water ingress near the base of the column, which was wicked upward by fireproofing material on the column." It was determined that "the wet fireproofing material contributed to accelerated corrosion of the steel column."

### Objectives of This Paper

A review of the problem faced in insulated roofing systems, insulated piping in the process and refining industry, insulated wall assemblies with steel stud construction, and steel columns with fireproofing, indicates that moisture in insulation is the dominant driving force contributing to the corrosion of metals in contact with insulation. While published literature recognizes the contributory role of moisture, the current overwhelming focus on problems with phenolic insulation understates the important message of keeping moisture out of the roof. The evidence of steel deck corrosion in contact with other conventional types of roof insulation is known but very little has been documented. Most specification writers anticipate deck replacement in their reroof projects. Property owners have come to accept normal steel deck corrosion. Three cases have been previously reported by Doshi et al. (1996). This paper documents six cases with different mechanisms of moisture transfer into the roof system and the type of resulting failure. Two of these cases were previously reported by Doshi et al. (1996) and are repeated here in the context of the contribution of moisture and for comparative analysis. Photographs from four case studies are included in this paper. It is evident from the cases that the design of moisture control strategies should take into account the potential of steel deck corrosion in contact with insulation. This requires an understanding of the physics and the ranges of expected moisture-loading conditions.

### CASE STUDIES

All cases reported here are located in the general vicinity of the City of Toronto in the Province of Ontario, Canada. The weather in Toronto is characterized by the following average weather conditions: January 2.5% design temperature: -18°C, July 2.5% design Dry Bulb

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### Case 1: Prolonged Moisture Drive From Interior—Uniform Corrosion

This roof design included 38mm standard galvanized steel deck with 50mm wood fiberboard insulation applied using strips of adhesive and a four-ply built-up roofing membrane with floodcoat of bitumen and aggregate cover. The roof was approximately 15 years old at the time of investigation and the building had remained vacant for two years prior to the investigation. The surface of the roof was weathered but in a repairable condition at the time of the investigation. Four test cuts approximately 200mm by 200mm were made at randomly selected locations. Three of the four cuts showed evidence of corrosion, but the insulation was dry to touch. Four larger samples measuring 450mm by 900mm were taken to improve the reliability of the assessment. The large samples taken at different locations showed a similar pattern and distribution of corrosion. The building was undergoing major renovations with an anticipated change of occupancy requiring a vapor barrier in the roof assembly. It was decided to remove and replace the roof.

Observations made after the existing deck was exposed confirmed the presence of uniform corrosion. The insulation was noted to be dry and did not show any signs of noticeable moisture damage. There was a clear demarcation between the 75% area suffering from corrosion and the 25% area unaffected by corrosion (Photographs 1 to 3). The distribution of corrosion, its uniform presence, good roof drainage, condition of insulation, and absence of widespread membrane defects were the main reasons to eliminate water leakage from the exterior as the main cause of corrosion. Additionally, the clear straight line demarcation separating the corroded areas from the non-corroded areas was used to formulate the opinion that the corrosion was likely by moisture from the interior of the building condensing in the roofing system in the absence of a vapor barrier.

A close-up of the area of corrosion (Photograph 1) shows uniform corrosion to have occurred on the web, the flange and the flute of the deck. Corrosion was absent in areas where there was a ribbon of adhesive. Corrosion was also noted on the crimped joint where one steel deck connected to the next parallel to the direction of the flutes. The corrosion was not deep and had only marginally decreased the thickness of metal. Minor structural restoration was required to remedy the situation.

### Case 2: Water Leakage—Localized Corrosion, Pitting and Complete Loss of Metal

This roof consisted of a standard 38mm galvanized steel deck, with 50mm fiberboard insulation and a four ply built-up roofing membrane with floodcoat and aggregate



Photo 1 - Case 1: BUR with fiberboard. Corrosion on web, top flange and flute. Notice adhesive on back of insulation and no corrosion at adhesive location.

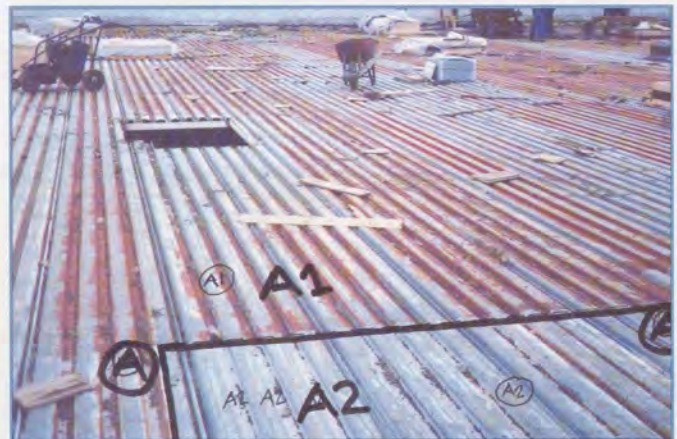


Photo 2 - Case 2: BUR with fiberboard. Clear demarcation shown by Line A-A between area with corrosion (A1) and without corrosion (A2).

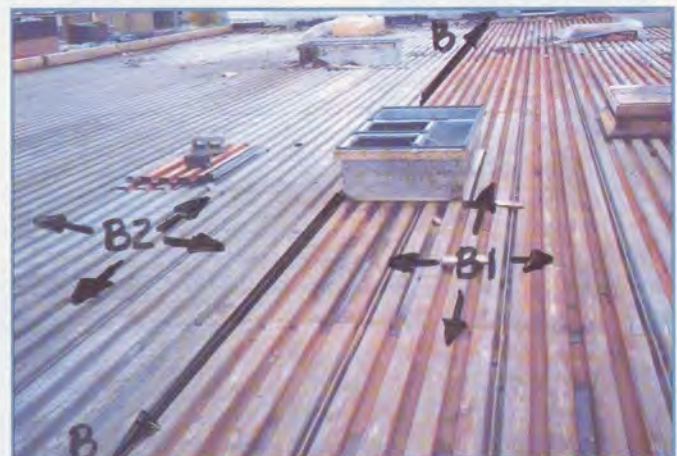


Photo 3 - Case 1: BUR with fiberboard. Clear demarcation shown by Line B-B between area with corrosion (B1) and without corrosion (B2).

gate cover. Asphalt was used to adhere the insulation to the deck, but the quantity and application of asphalt adhesive were inconsistent and inadequate. At the time of investigation, the building housed a light industrial

manufacturing facility and the roof was estimated to be 18 years old. Water leakage was experienced infrequently for the previous 1-2 years. A field survey of the roof surface revealed localized but deteriorating ridging of the membrane, and test cuts had indicated presence of wet insulation and corroded steel deck. Roof replacement was considered to be the most effective option.

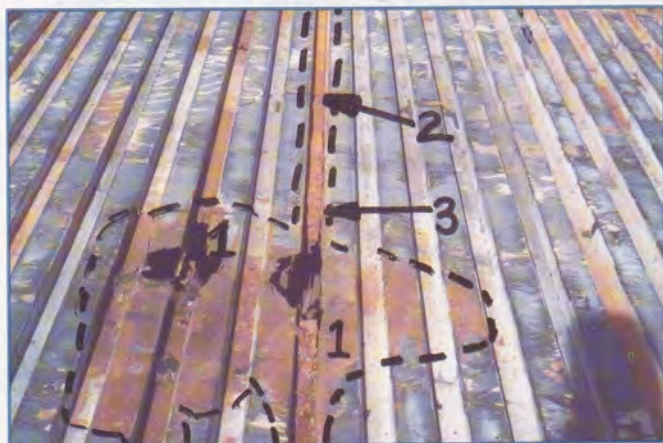
Observations made during the replacement revealed localized uniform corrosion. In some areas the pitting was severe and had caused complete loss of metal. The amount of corrosion appeared to be concentrated in areas of wet insulation and decreased away from the area of wet insulation (*Photograph 4*). This can best be described as localized uniform corrosion. The top flange appeared to be affected throughout the area of wet insulation. There were rust colored stains in the flutes of the deck throughout the area affected, which extended towards the low point on the roof. The web was affected in areas where the leak originated. Extensive pitting of the surface was noted in these areas with few areas exhibiting complete loss of metal (*Photographs 4 and 5*). Although the perforations were evident after removing the insulation, they

were not evident when the underside of the deck was viewed from the shop floor.

The extensive and deep corrosion had rendered the deck structurally unsound, requiring localized replacement. Where the deck was structurally sound, the surface was cleaned and treated with rust inhibiting paint. A vapor barrier was installed as part of the new roof on the building.

### Case 3: Water Leakage—Localized Corrosion and Pitting

This roof consisted of a wide-flange, 38mm-deep galvanized steel deck, with 50mm perlite insulation and a four-ply built-up roofing membrane with a floodcoat of bitumen and aggregate cover. There was no evidence of adhesive between the insulation and the steel deck. At the time of investigation, the building housed a light industrial manufacturing facility and the roof was estimated to be 18 years old. Water leakage was experienced infrequently for the previous 1-2 years. A field survey of



*Photograph 4 - Case 2: BUR with fiberboard. Complete loss of metal (1), corrosion localized as shown by dotted lines, rust stains on flute (2), web separated from flute (3).*



*Photograph 5 - Case 2: BUR with fiberboard. Pattern of localized corrosion concentrated around leak locations shown by dotted lines.*



*Photograph 6 - Case 3: BUR with Perlite. Pattern of localized corrosion concentrated around leak locations shown by dotted line. Notice ridge (1) in foreground in line with the center of maximum corrosion.*



Photograph 7 - Case 3: BUR with Perlite. Corrosion concentrated around leak shown by dotted line. Corrosion on web (1), flange (2) and flute (3).

the roof surface revealed deteriorating ridging of the membrane. Infrared thermography had confirmed the presence of wet insulation under several of the deteriorating ridges. Replacement of the areas of wet insulation and repair of areas of deteriorated membrane were considered as part of a maintenance program.

Observations made during the repair revealed severe corrosion of steel deck in areas with wet insulation. Photographs 6 and 7 show the concentration of corrosion. The amount of corrosion decreased in a leaf pattern around the area of leakage. This can best be described as localized uniform corrosion. The top flange appeared to be affected throughout the area of wet insulation. The flute and the web were affected in areas where the leak originated. Extensive pitting of the surface was noted in these areas and several of the pitted areas had perforated the steel deck. The largest perforation was measured to be approximately 5mm x 100mm on the top flange in contact with the insulation. Although the perforations were evident, after removing the insulation, they were not evident when the underside of the deck was viewed from the shop floor.

The extensive and deep corrosion had rendered the deck structurally unsound, requiring replacement. The deck was non-standard, creating a problem for the roofing contractor who was proceeding to install a 0.46mm (26 gauge) flat stock loose laid over the affected area. It was coincidental that the roof engineer happened to be on site, and alerted the roofing contractor to potential problems with using an unattached, thin, flat stock.

#### Case 4: Wet Topping/Condensation—Localized Corrosion and Pitting on the Underside of Deck

This roof consisted of a four-ply built-up roof membrane with floodcoat of bitumen and aggregate cover on a composite deck of poured concrete and a 38mm galvanized steel deck. Extensive leakage was reported in the space below the roof at penetrations. A field survey indicated that there was water below the roof membrane, and



Photograph 8 - Case 4: BUR on concrete/steel deck composite. Corrosion on web (1), flange top (2) and bottom (3).

the concrete was wet. Corrosion was occurring on the underside of the steel deck (Photograph 8). There was evidence of localized pitting on the top flange, the web and the flute. In most locations the pitting was very localized and the loss of metal was limited to the zinc coating. However, there were several small areas where complete loss of metal had occurred. The space below the roof was a mechanical room in the building and was small. A high humidity condition existed in this area, a cause of which could not be ascertained. A combination of wet concrete and condensation from high humidity below the roof contributed to the corrosion of steel deck.

It was determined that the corrosion had affected the structural integrity of the deck. Due to the nature of the distribution of corrosion, it was possible to structurally strengthen the deck from the underside. The roofing was replaced with a new membrane, and the concrete topping was allowed to dry before roof replacement.

#### Case 5: Change of Use-related Moisture Drive—Uniform Corrosion


Complete failure of the roofing system, including the steel deck, occurred after a facility used for dry warehousing was occupied by a flower shop. The original roof system consisted of a four-ply built-up roofing membrane with a floodcoat of bitumen and aggregate cover on 50 mm fiberboard insulation on 38mm standard galvanized steel deck. An investigation of the roof revealed that the insulation had collapsed into the flutes of the steel deck. The membrane surface undulations corresponded to the flange and flutes of the steel deck. Test cuts revealed that the insulation was wet and had lost its rigidity to support the membrane. The steel deck was severely corroded.

The interior environment when the building was used as a warehouse was estimated to be 20°C and 30% relative humidity in winter and 24°C and 50% relative humidity in summer. The interior environment for the flower shop was estimated to be 22°C and 60% relative humidity in

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winter and 22°C and 70% relative humidity in summer. As shown in *Figure 4*, and explained later, under these conditions there is a net moisture drive *into* the roofing system through the annual cycle.

### Case 6: Temporary Roof Winter Construction—Uniform Corrosion

In order to facilitate winter construction, the construction schedule required the roof to be closed-in before the concrete slab on grade was poured. The design called for roof construction that consisted of standard 38mm galvanized roof deck, 25mm glass fiber insulation, a 2-ply asphalt and felt vapor barrier, 50 mm glass fiber insulation and a 4-ply gravel-surfaced built-up roofing membrane. To accommodate the winter construction schedule, the roof was only completed to the vapor barrier, which was then intended to serve as a temporary membrane. The remainder of the roof would be constructed in the spring.

The concrete deck was poured during the heating season in November. All interior construction continued and the remainder of the roof was slated to be finished in March of the following year. At the time the construction of the remainder of the roof was to start, it was determined that the temporary roofing did not have sufficient rigidity to support the balance of the roofing. Further investigation revealed that the glass fiber insulation on the temporary roof was saturated with water and there was uniform surface corrosion of the steel deck. The temporary roof had to be removed, the steel deck surface treated, and a new roof (complete with vapor barrier) installed.

### ANALYSIS OF CASE STUDIES

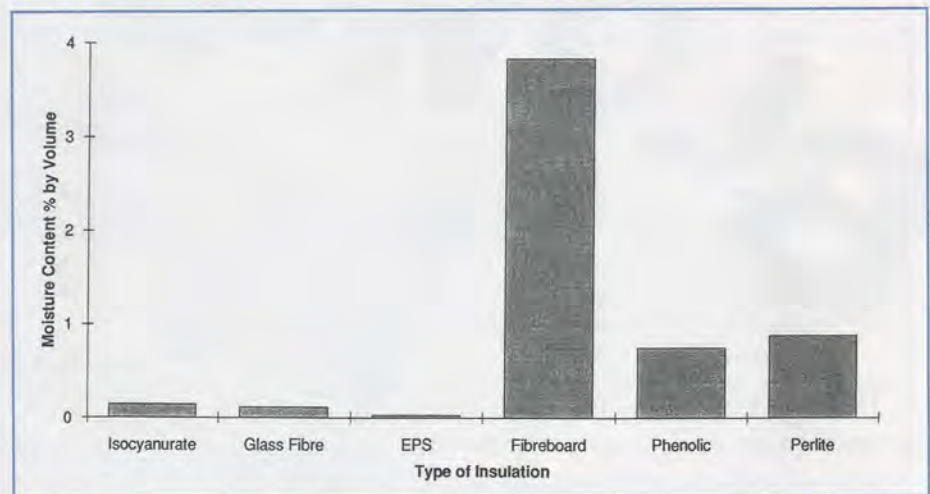
#### Impact of Type of Corrosion Protection and Type of Insulation

Significant corrosion can occur, even on steel decks with ZF075 coating of zinc (specification for minimum zinc coating required on steel deck), commonly used in Canada compared to the commonly used prime painted deck in the U.S. It is evident from the observations of the six roofs, that steel deck, even with minimum galvanized coating, is vulnerable to corrosion on roofs with wet insulation. Most types of insulation in the study continue to be commonly used in roof assemblies. The extent and severity of corrosion in these roofs seems comparable to

the reported cases of roofs with phenolic foam insulation. The conditions causing moisture migration are climate related and must be considered during design of the roof. As shown in Cases 5 and 6, the rate with which corrosion occurs can be high with traditional types of insulation. It appears that the amount of moisture in the insulation is one among many factors that dictates the speed with which corrosion occurs.

### Sources of Moisture Contributing to Corrosion

Water contributing to corrosion of steel deck can migrate into the insulation, either from the exterior, in the form of water leakage, or from the building interior, by moisture diffusion or air leakage. In some circumstances, water may already be present in the insulation during its installation. Cases 1, 5, and 6 demonstrate that



*Figure 1 - Equilibrium Moisture Content (EMC) for various insulating materials at 20°C and 90% relative humidity. Data taken from Cash (1985) as % of dry weight converted to % by volume based on dry density of insulation. This representation is a more appropriate indicator of moisture for given thickness in a given area than data representation as % dry weight.*

the most likely mechanism of moisture transfer inside the roofing system was by diffusion of water, perhaps aided by minor air leakage. Case 6 illustrates the significant amount of moisture that can enter, condense and saturate insulation under the high water vapor pressure gradient that frequently exists in cold climatic regions of the U.S. and Canada. All three cases clearly suggest that roofs will become vulnerable to corrosion unless their design considers inclusion of a properly positioned vapor barrier.

In Cases 2, 3 and 4, there is definite correlation between the location of roof membrane defects, the areas of wet insulation, and corresponding corrosion of steel deck. These cases show that roofs should be regularly maintained in order to correct deficiencies and prevent water penetration problems that contribute to corrosion of steel deck.

Current methods of measuring and reporting the mois-

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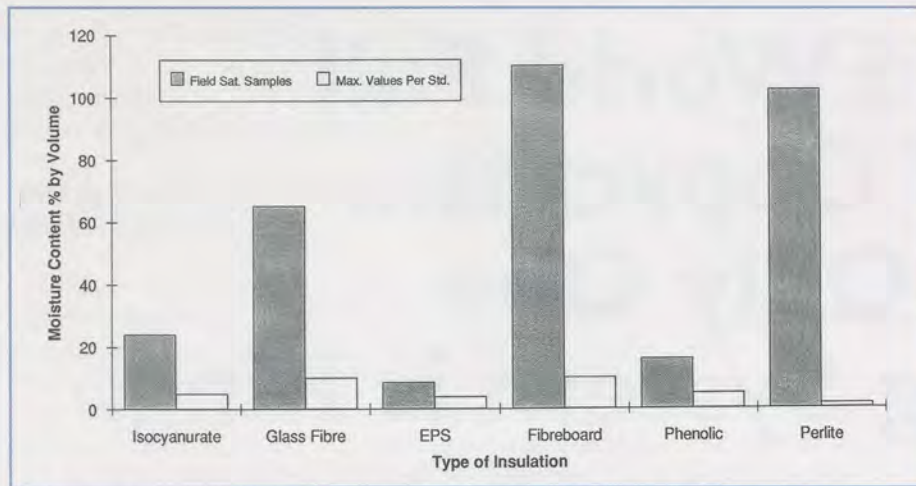


Figure 2 - Moisture content from field saturated samples, collected by Anderson (1985), compared to allowable values in insulation standards. Data as % of dry weight from Anderson (1985). Converted to % by volume based on dry density of insulation. (See explanation in caption of Figure 1).

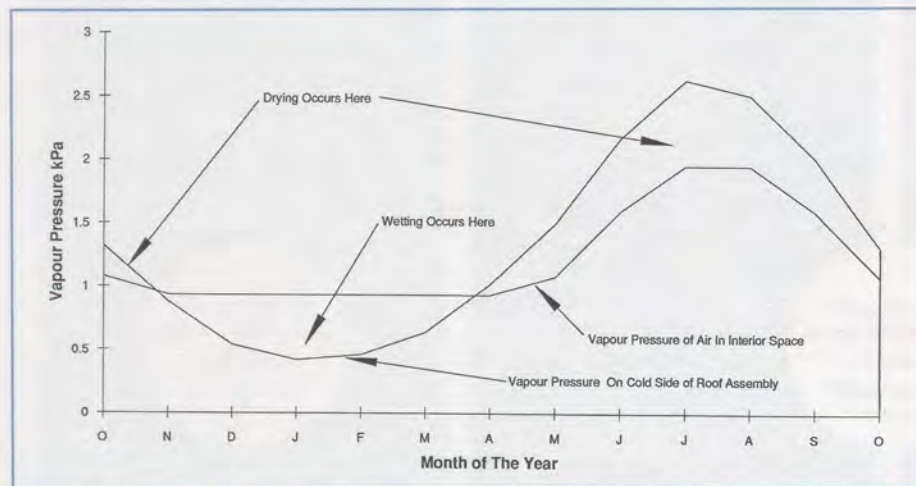


Figure 3 - Seasonal variation of vapor pressure drive across an insulated low-sloped roof in Toronto. Winter interior condition of 20°C and 40% relative humidity, no cooling in summer. Interior conditions follow exterior temperature and relative humidity.

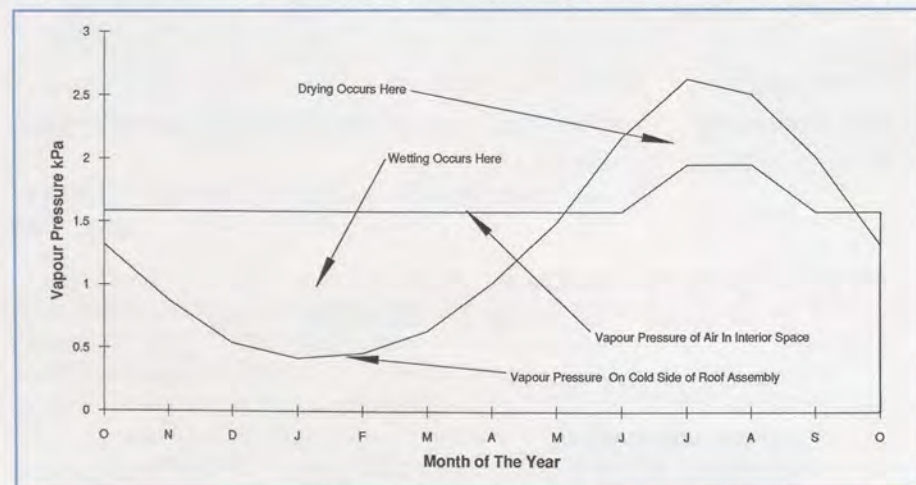


Figure 4 - Seasonal variation of vapor pressure drive across an insulated low-sloped roof in Toronto. Winter interior condition of 22°C and 60% relative humidity and summer interior condition of 22°C and 70% relative humidity.

ture-related properties of insulating material are inadequate to assess the role of insulation in the corrosion of steel deck. Presently, equilibrium moisture content (EMC) at a given temperature and relative humidity and moisture gain from a short term immersion test are quoted to identify the moisture related characteristics of roof insulation. The former gives an idea of the hygroscopic absorption of insulation but does not give any indication of the bulk water intake. The immersion test gives an indication of the short-term bulk water absorption of insulation but provides no long-term indication of bulk water absorption. Neither method gives an indication of the drying characteristics of the insulation or the effect of the insulation composition. The amount of moisture in the insulation and its wetting and drying characteristics will affect corrosion of metal in contact with the insulation. Current tests do not completely describe these properties and do not help in completely predicting the role of moisture-laden insulation on corrosion.

### Moisture Migrating From Interior of Building Into The Roofing System

Most roofs in Canada and the Northern U.S. are exposed to freezing temperatures for several months a year. The interior environment of buildings which are sheltered by these roofs is often kept at temperatures and relative humidity fit for human occupation, around 20°C (68°F) and 40% respectively. This creates a significant water vapor pressure<sup>2</sup> drive across the roof assembly. The vapor pressure that exists across a roof provides an estimate of the wetting and drying potential and is often represented in a graph similar to the one shown in Figure 3 for Toronto, Ontario. The concept of wetting and drying potential was first developed by Baker (1980). Figure 4 shows a similar graph for

high humidity interior environment of the type encountered in Case 5. The relative magnitude of area under the wetting portion and the area under the drying portion gives the net potential of wetting or drying over the annual cycle.

Another situation occurs when buildings are constructed during the winter months. It is typical during these months to enclose the entire building before interior work starts to facilitate construction in a partly controlled environment, as in Case 6. Under these conditions, moisture is generated from sources such as curing of concrete, interior finishes, and temporary (combustion) heaters. The amount of construction moisture in this partly controlled environment during winter creates a water vapor drive across the roof which is considerably higher than the drive under normal operational conditions. Water condensing under these conditions takes several annual cycles of climate changes to dry as shown in Figure 5 for Toronto, Ontario.

The roofing system has to be designed to resist the moisture drive under normal operational and construction conditions. A vapor barrier is typically designed and located at a position in the roof assembly that is higher in temperature than the dew point of the interior air. When the vapor barrier is located at the interface of the insulation and the steel deck, it not only minimizes the entry of interior moisture in the roof assembly, but also prevents exterior water leakage to make direct contact with the steel deck, thereby providing corrosion protection. However, when mechanical fasteners are used in roofs with two-layered insulation systems, it may be prudent to install the vapor barrier in such a way that fasteners do not penetrate the vapor barrier. Positioning of a vapor barrier between two layers of insulation should only be done based on a detailed dew-point analysis.

### Impact of Vapor Barrier Design Approaches.

There are several design practices that determine the requirement of a vapor barrier in a roofing assembly, e.g., Baker (1980) and Tobiasson (1989). These methods are based on restricting the total amount of moisture from the point of view of preserving the thermal integrity of the insulation and the serviceability of the roofing membrane. A situation can exist where a design practice may not require a vapor barrier but there may still be a net moisture accumulation into the roofing system during part of the year (Figure 1). Typically, in heated buildings in cold climates, moisture may accumulate during

winter and dry during summer. Although this winter accumulation with summer drying may not result in water leakage, it can contribute to corrosion of steel deck during the winter months. The amount of corrosion will be highly dependent on the moisture wetting and drying characteristics of the insulation as well as the chemical composition of the insulation. Insulation that can absorb and retain more moisture than others (see Figure 1) and is chemically corrosive may not be advisable under these circumstances.

### Arguments Against Installing a Vapor Barrier.

An adequately designed and installed vapor barrier can provide effective corrosion protection by preventing moisture to come in contact with the steel deck. However, many in the industry, e.g., Griffin (1982) and RIEI (1983) feel that installation of a vapor barrier creates a sandwich whereby any moisture in the roofing system, regardless of its source, will remain trapped for a long time before its presence becomes apparent. Trapped moisture reduces the thermal effectiveness of the insulation and deteriorates the organic components in the roofing system, which often results in major roofing repairs. In the absence of a vapor barrier, it is argued, the water in the roofing system can dry to the interior during warmer weather, and as long as the net balance over the annual cycle keeps moisture from accumulating in the roofing system, no problem should be expected. In the absence of a vapor barrier, the argument continues, water that penetrates from the exterior would immediately travel into the occupied space below, forcing an investigation and repair of the problem before extensive damage to the roofing system can occur. The results of cases presented in this paper show that the reasons to exclude

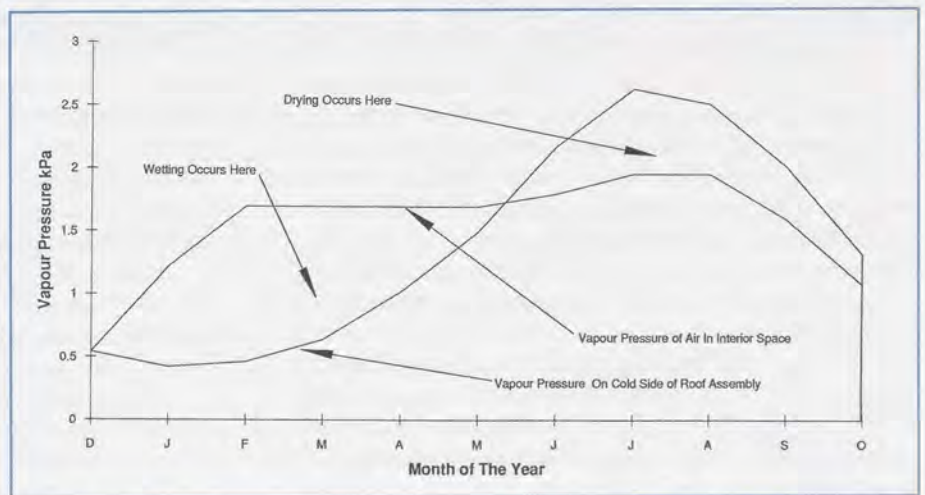


Figure 5 - Seasonal variation of vapor pressure drive across an insulated low-sloped roof in Toronto. Roof constructed in November, slab on grade construction in December, occupancy in spring. After occupancy, winter interior condition of 20°C and 40% relative humidity. No cooling in summer. Interior conditions follow exterior temperature and relative humidity.

the vapor barrier on grounds indicated above do not hold true, and need to be critically investigated.

### **Vapor Barrier Sandwiched Between Insulation Layers.**

In some roofing installations there is a trend to position the vapor barrier between two layers of insulation. This is primarily done to allow the first layer of the roofing insulation to be mechanically attached to the deck to prevent the vapor barrier from being penetrated by the fasteners and to provide a flat surface to install the vapor barrier. In this system, the first layer of insulation is mechanically attached to the deck, the vapor barrier is laid on top of the insulation and the fasteners, and another layer of insulation is then adhered on top of the vapor barrier. This system designed properly will provide a superior roofing performance compared to a system where only one layer of insulation is used. However, design calculations should be conducted to ensure that the roofing components in contact with the deck are not vulnerable to harmful amounts of condensation, particularly from construction moisture during winter construction.

### **Impact on Structural Integrity**

The most severe consequence of steel deck corrosion is its impact on the structural integrity of the roof. An area of deck with reduced ability to carry its load is a significant safety concern, even though it may be highly localized. Winter loading conditions due to snow are severe in the northern U.S. and Canadian provinces. The spot welded connections of the steel deck to the joists are highly susceptible to corrosion. In regions with high wind uplift, this poses a serious concern with respect to blow-off. There is also a concern with respect to the loss of diaphragm action of the deck that can affect the lateral load resistance of the structure.

The roof deck in Cases 1 and 6 had only its galvanizing sacrificed. It sufficed to treat the deck and provide it with additional corrosion protection to comply with code requirements. The roof decks in Cases 2, 3 and 4 were structurally impaired to the point where they required localized replacement. A major concern was observed in Case 3, where the repairs to the deck were being made without any consideration to its role as a structural element. This is inevitable, since the roofing trade is normally not responsible for installing the steel deck. However, during roof repairs or roof replacement, it is hardly expected that the steel deck installer will be at hand to deal with problems. This requires training the roofing trades to recognize problems and deal with them effectively or engaging a knowledgeable roofing consultant.

### **CONCLUSION** .....

Some recent literature can easily lead one to believe that the corrosion of steel deck in insulated roof assem-

blies is limited to the use of a specific type of insulating material. But as shown in this paper, steel deck can significantly corrode even when more traditional types of insulating materials are used. This indicates that the basic design principles must be followed to minimize or eliminate conditions contributing to wetting of insulation. The design for moisture balance within the low-slope roof assembly needs to be reviewed and possibly new standards need to be developed with respect to an insulation's response to moisture and corrosion potential.

Designers need to be cognizant of the several factors that contribute to the corrosion of steel deck. Significant net annual condensation of water in a roofing system due to vapor pressure differences remains a major issue. Extensive damage can also be caused by water penetration from the top of the roof in an improperly designed and maintained roof. Ongoing moisture penetration which goes unnoticed and does not alert the owner to a problem is seen to contribute to localized structural damage to the deck. On the other hand, moisture migration from the interior appears to affect a large area of deck, but with lesser severity. Use of non-destructive testing to determine the presence of moisture in a roofing system is advisable as a routine maintenance practice and when designers suspect wet insulation in a problem roof.

In many cases, the simple and logical solution to prevent these problems is to properly design, install and maintain the roof. With vapor barrier protection, the steel deck should not be expected to corrode.

Construction and maintenance practices have been traditionally slow to change. Concern also remains in situations where the vapor barrier is sandwiched between the two layers of insulation and not in direct contact with the steel deck, particularly during winter construction. Another concern is the situation where a design approach results in not requiring a vapor barrier based on the moisture allowed to accumulate in winter if it can completely dry out in summer. Even if a vapor barrier were installed, the contribution of the insulation to the corrosion process remains poorly understood and of concern with respect to corrosion of fasteners.

With the above in mind, there is a need to carry out further work in the following areas :

- ▼ Establishment of accepted test procedures or data to determine the contribution of roofing components such as insulation to corrosion. In particular there is a need to study the moisture absorption and drying characteristics of insulation along with its chemical composition. Designers need this type of information to make proper choices.
- ▼ Development of accepted procedures to non-destructively assess the extent of in-situ corrosion.
- ▼ Review of procedures to categorize corrosion and to reliably estimate its structural consequences.
- ▼ Development of repair strategies to remedy corrosion problems.

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<sup>1</sup> The term vapor barrier is used throughout this paper and taken to mean the same as vapor retarder.

<sup>2</sup> Moisture can be transported by air leakage that can occur in some roofing systems but is not considered in this paper.

## About The Authors



**Hitesh Doshi** teaches building performance related topics in the Dept. of Architectural Science and Landscape Architecture at Ryerson Polytechnic University in Toronto, Ontario. Prior to joining Ryerson he was with Trow Consulting Engineers Ltd., a multi-disciplinary engineering firm. As a contributing editor to *Plant Engineering* and

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**Pat Lanni**, P. Eng., is a project engineer in the Building Science & Structural Engineering Division of Trow Consulting Engineers

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**Vladimir Stritesky** assumed the presidency of Trow Consulting Engineers Ltd. in 1996 after serving as Vice-President of Operations of the Greater Toronto Region, Vice-President of 14 Ontario branches, and spending over 10 years as manager of the Building Science Division. Stritesky is a specialist engineer in building science, with expertise in building envelope analysis and design. He has handled projects with capital values exceeding \$50 million Canadian.



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# Factory Mutual Acceptance vs. Approval for Base Sheet Attachment to Existing Nailable Roof Decks

BY DARREN R. PERRY, PE

This article was written to help the reader understand the difference between base sheet attachment methods that are Factory Mutual (FM) "Approved" for *existing* nailable decks, and methods that can be considered "acceptable" per Factory Mutual standards and guidelines.

It is a common practice when re-roofing buildings with wood or other nailable decks to first attach a base sheet, then adhere roofing components above. Factory

Mutual has currently granted "approval" to a small number of roof cover systems installed in this manner over *existing*, sound, FM Approved nailable decks.

It should be noted, however, that there are several FM Approved *Construction* listings in the *FM Approval Guide* that include a nailed base sheet for *new* nailable roof decks.

Re-roofing refers to removing the above deck roof components down to the *existing* deck. Nailable decks refer to those decks that can employ nail-type fasteners (e.g. wood, cementitious wood fiber, lightweight insulating concrete, and gypsum).

## FACTORY MUTUAL APPROVED

Factory Mutual Approved roof assemblies are listed in the *FM Approval Guide* as specific *constructions*. The roof system must be installed per the listing in the *FM Approval Guide* and per applicable FM Loss Prevention Data Sheets in order to be considered "FM Approved." Factory Mutual advocates only those roof systems that have been tested and Approved as listed in the most current *FM Approval Guide*.



*Improper base sheet application resulted in wind gusts less than 70 mph removing this section of roofing. Note the smooth shank roofing nails protruding up through the base sheet.*

In some cases it may be desirable to install a re-roof system in a manner which has not been tested or listed in the *FM Approval Guide*. An example of this is the common method of nailing a base sheet to an *existing* non-FM Approved nailable deck, then adhering roofing materials above. This method may be done in a manner "acceptable" to FM, based on current FM standards and guidelines. If the roof system is not installed exactly per the *FM Approval Guide* and Data Sheets, the roof system is not "FM Approved."

## "ACCEPTABLE" FM INSTALLATIONS

Often re-roof specifications or proposals are written to include:

- 1) The re-roof system should be "FM Approved" (1-60 or 1-90), and...
- 2) A base ply should be nailed to the *existing* deck with subsequent layers of roofing materials adhered above (typically using asphalt).

Contractors, engineers, and even roof consultants often propose the above under the assumption that they can comply with FM Approval. However, in most cases, the two

items above are mutually exclusive! This is primarily due to there being only a limited number re-roof systems listed in the *FM Approval Guide* that utilize a nailed base sheet on existing decks. Many existing nailable decks are not FM Approved, and many base sheet fasteners used in this application are not FM Approved.

Fortunately, there is an "acceptable" method of "nailing" the first base ply, then adhering components above per FM standards and guidelines. This method is found in FM Loss Prevention Data Sheet 1-29, "Above-Deck Roof Components," June, 1996. The base sheet attachment guidelines may be used to comply with FM standards and guidelines for wood decks that are not FM Approved.

### Fire Resistance:

The FM Class 1 fire resistance classification of a roof system is dependent upon roof deck materials, roof composition and roof surfacing. Non-FM Approved nailable decks vary among the various materials (wood, cementitious wood fiber, lightweight insulating concrete, and gypsum). An existing unapproved deck's fire resistance and building fire protection needs require individual analysis by a qualified specialist.

It is recommended that roof systems using a nailed base sheet over a deck that is not FM Approved should have components listed together in a similar FM Approved manner under a "Construction" listing in the current Approval Guide. The roof cover components and surface should comply with Class A, B or C as applicable for the surface fire resistance needs.

### Hail Resistance:

In order to consider "acceptance" for the "non-FM Approved" deck, a roof assembly listed in the *FM Approval Guide* should be installed to ensure applicable hail resistance (SH-Severe Hail or MH-Moderate Hail). For example, the roof surface material, number of plies, interply asphalt application rate, insulation type and thickness should all follow an *FM Approval Guide* "Construction" listing for a similar FM Approved roof deck listing.

### Wind Resistance:

One of the most potentially detrimental aspects of using a "non-FM Approved" method of base sheet attachment is the roof cover's inability to resist wind uplift.

Factory Mutual Loss Prevention Data Sheet 1-29 outlines an "acceptable" method of nailing a base sheet to wood roof decks. Section 2.11, "Mechanically Fastened Assemblies Over Wood Decks," provides guidance for this application. Tables listing base sheet fastener coverage, fastener layout, and minimum fastener disk (or head) size are provided for "acceptable" fastener application. This procedure may provide guidance for other existing non-FM Approved nailable decks such as cementitious wood fiber, gypsum and lightweight insulating concrete. Base sheet fastener pull-out test

requirements, deck condition, and fastening are indicated in FM Data Sheet 1-29, and FM Loss Prevention Data Sheet 1-28 "Wind Loads to Roof Systems and Roof Deck Securement" (1996).

## THE IMPORTANCE OF FM APPROVED/ACCEPTABLE ROOF SYSTEM DESIGN

Over the past several years, roofing-related losses have accounted for an increasing portion of property insurance company loss costs. Fire resistance from above and below the roof, and a roof's ability to resist natural hazards (e.g. wind and hail) are all important in reducing the risk of property loss.

The Factory Mutual System, consisting of Allendale, Arkwright and Protection Mutual Insurance Companies, strongly recommends that its insureds comply with FM Approvals, standards and guidelines regarding roof system installations.

For FM insured locations and locations where FM Approval is desired, roof design criteria should be reviewed with the client to ensure they are aware of the difference between FM Approved, and "acceptable" roofing applications (based on FM standards and guidelines). If neither FM Approved nor "acceptable" methods are employed, statistics from FM indicate that roof systems are more likely to fail under extreme conditions.

It should be noted that for facilities "insured" with one of the Factory Mutual system insurance companies, FM recommends that roofing installation proposals should be submitted to the local Factory Mutual Engineering District Office for review.

To purchase a printed copy or CD-ROM of The 1997 FM Approval Guide (Building Materials), or to obtain printed Factory Mutual Loss Prevention Data Sheet 1-28, 1-29, or other related FM Data Sheets, call Factory Mutual Order Processing at 617-255-4682.



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# Working The Trade Show Booths: Become a Savvy Visitor

BY RICHARD G. ENSMAN, JR.

**E**nter the exhibit area at your next convention and look around. You'll see booth upon booth. It's easy to spend your time meandering through the exhibit hall, chatting with friends and colleagues, and only occasionally interjecting some purposeful business with an exhibitor when you happen upon a booth of particular interest to you.

But there's another alternative. You can parlay your limited time in the exhibit hall into a genuine learning and networking experience. With a little attention to planning, you can get a tremendous return on the time you spend there. Here's how:

**Plan your stops.** Pick up a map of the exhibit area before you begin browsing. Then identify a selection of booths that might offer especially useful information.

**Divvy up the work.** If you're attending the convention with a colleague and you have a lot of booths to visit, split the booths up between the two of you, either by interest area or physical location.

**Stay in shape.** Don't kid yourself: spending a few hours in an exhibit hall can be a grueling experience. Whenever possible, wear loose-fitting clothing and, above all, comfortable shoes. Or take a lesson from veteran exhibitors, who often wear padding inside their shoes. Before setting out, eat a light meal. Avoid sugary snacks, caffeine or soft drinks in the hall; water and easy-to-digest snacks, such as dried fruit, will help you keep your energy level up.

**Know when to browse.** Take the tempo of the trade show. When exhibit traffic is light, make your high-priority, business-oriented visits. You'll be able to spend more time with exhibitors this way. When traffic is heavier, you can browse through the lower priority booths more casually.

**Set goals.** Decide what you want out of each exhibit even before you start making the rounds. Do you want help with a thorny service problem? Want to learn about a new line of products? Want to save money? Keep these goals in mind as you visit each booth. You might even want to develop a list of stock questions to ask each exhibitor you visit.

**Understand the goals of exhibitors.** They vary. Some exhibitors want to foster an image or impart positioning statements. Others may want to build prospect lists. Others may want to gather qualified leads. And the list could go on and on. You can often discern an exhibitor's

purpose with a quick glance or a brief conversation. Ask yourself: is the exhibitor's goal compatible with mine? If not, don't spend excessive time there.

**Stick to your agenda.** Approach each booth with your agenda in mind. Stop, look around, introduce yourself, and then move directly to the business at hand.

**Look for the quick message.** When you approach a booth, look and listen for the "quick message"—the exhibitor's key points. The signs, posters or demonstrations around the booth often display this message at a glance.

**Overlook the clutter and hype.** Trade show exhibits are designed to whet your appetite for what's being offered there—and that's good. But don't spend so much time around the signs, the giveaways and the show-and-tell demonstrations that you neglect what you're really after.

**Bring your specs.** Bring along specifications for products you'll need in the months and years ahead. Refer to them when talking with exhibitors, and don't hesitate to pass copies along to exhibitors who may help fill your product needs later on.

**Ask for help.** Pose questions and problems—perhaps from a ready-made list—to exhibitors. Specifically, ask for help with problems you're having on the job. They frequently know what's happening in your industry, and can offer you valuable solutions, insights and recommendations.

**Ask for high-value materials.** What relevant brochures, magazine reprints and case studies can exhibitors give you? If an exhibitor doesn't have what you're looking for, ask him to place your name on a follow-up list.

**Ask about free seminars.** Many exhibitors offer seminars or demonstrations during the convention or throughout the year. Ask for a schedule of events and note topics, dates and times that are right for you.

**Learn about the competition.** Chat with the exhibitors about the competition. You might discover clues about their recent successes and problems.

**Let them sell you.** When you visit a busy trade show booth, you often have the opportunity to see the representatives of various firms in action—giving information, answering questions, attempting sales, managing the booth—in short, juggling a myriad of duties. It's a great time to test the capabilities of exhibitors, the qual-

ity of their products, and their ability to serve you.

**Kick the tires.** Participate in demonstrations. Try your hand at surveys, exercises or evaluations offered by exhibitors. Do you have a product or service suggestion for an exhibitor? Don't hesitate to throw in your two cents before you leave.

**Offer advice.** Have you used an exhibitor's products in the past? If so, can you offer examples of effective and ineffective performance? Offer your insights. Exhibitors take these suggestions very seriously, and often forward them to their home offices.

**Become a customer.** If you're pretty sure you're going to be doing business with an exhibitor, give her whatever information she needs to begin a successful sales relationship—right then and there. This information might include company background, credit references, products used now, quantity information and purchasing resources available.

**Evaluate.** Make a brief handwritten note after you leave each exhibit. Jot down the key points you've learned, product problems you've encountered, or issues you'd like to raise in a return conversation with the exhibitor.

**Develop company contacts.** Exhibitors often know the companies they represent inside and out. They may be able and willing to furnish you with the names and

telephone extensions of key training, accounting and technical people in the company. If you're conscientious in gathering this information, you can often leave the convention hall with a treasure trove of new contacts.

**Organize information.** Carry a portfolio or bag with pockets so that you can sort and file printed material as you receive it. If you indiscriminately dump everything handed to you in an oversized bag, chances are that most of the material will eventually land in a junk pile.

**Talk to other visitors.** You can often learn about their needs and problems, and pick up valuable tips from them. Better yet, you can build new professional acquaintances that can make your job easier over time.

**Boost your energy.** To revitalize yourself after walking around a busy exhibit hall, stand in a corner and tense and rotate your foot and leg muscles, one limb at a time. Then, standing erect and relaxed, take five to ten deep breaths before going along your way.

**Look for benefits.** Yes, you can get free promotional items and refreshments in the convention hall. But look, too, for benefits of lasting value: technical literature, case studies, product samples. Unlike the giveaways that bring momentary pleasure, items that influence your profitability offer lasting value—long after you return home.

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## Region V Explores Roof Asset Management



**Dan Neuhaus, RRC**

Region V held a luncheon meeting July 25 at the Coors Brewery in Golden, Colorado. Twenty-three were in attendance to hear about roof asset management.

Bob Summers Jr. of Coors, and a member of RCI, opened with a discussion on the evolution of Coors' roof asset management process. It all began

with Bob's attendance at a seminar where the benefits of proactive versus reactive roof management were discussed. He soon became a firm believer in the need to manage the roofs, and was designated as Coors' individual responsible for the company's 447 roofs. Summers established a roof committee consisting of various construction-related individuals and those responsible for different sections of the brewery.

It began with spreadsheets and simple visual inspections and analysis of the roofs. With over 3,000,000 square feet of roof to manage, and the tightening of funds at the

brewery, this process became too cumbersome and difficult for one person to manage. More and more work was required to get roofing budgets approved and Bob's department was considerably downsized, meaning his own work load was significantly increased. He began to research various computerized asset management programs and roof consulting firms that could assist him.

Rick Davis of TechniScan then demonstrated the computerized roof asset management program he developed for Coors and discussed life cycle cost analysis of roof systems. Rick spoke mainly about how consultants can assist their clients in selling the need to do proactive roof management from a financial point of view. The approach Rick used was based on life cycle analysis and maximizing the return on the company's investment at any proposed funding and being able to compare the return on funding for roofing projects to funding for other projects (e.g., marketing campaigns). He also reviewed the cost of "doing nothing," or deferral. Rick distributed a paper written for Coors to assist management in understanding the process of roof asset management life cycle cost analysis.

The presentation was well received. Some took the opportunity after the meeting to take the tour of the Coors Brewery and enjoy a cold one in the hospitality suite.

## Region III Meets in South Haven, MI

Twenty-one were in attendance at the Region III spring meeting Friday, July 18 at the Old Harbor Inn along the banks of the Black River harbor outlet to Lake Michigan in South Haven, MI.

### Life Cycle Costing

Luther Mock, RRC, from Martin Riley Mock Architects/Consultants, Fort Wayne, discussed "Roof Management and Life Cycle Costing."

Through roof asset management, the client can anticipate: 1) increased service life; 2) protection of the building contents and occupants; 3) conservation of energy; 4) uninterrupted building function; and 5) predictable and controllable operating costs.

In general, a roof asset management program begins with the acquisition of data, proceeds through its organization to the formulation of alternative courses of roof system treatment and budgeting. A continuing "organic" process, roof

asset management updates the program performance data by means of formal annual inspections.

Mock explained financial terms and introduced a program he uses, formatted in an Excel spreadsheet, allowing the user to subjectively input data and tailor the program to meet his or her needs. The existing ASTM E 917-93, "Standard Practice for Measuring Life-Cycle Costs of Buildings and Building Systems," is applicable to roofing.

Mock used three scenarios of treatment to show the varying effects on total present value life-cycle costing and the equivalent annual value. The first was a minimalist method with no formal maintenance, repairs only to leaks, no precautions to protect roof warranties, and roof replacement after ten years. The second was a moderate maintenance program of visual surveys every two years, an NDE moisture survey at 15 years, and a roof recover at 15 years. Approach three included aggressive maintenance programs with twice annual visual surveys (plus after severe storms), NDE moisture surveys every five years, and roof replacement after 20 years.



**Dennis McNeil, RRC, CCS, RRO**

The last method offered the lowest equivalent annual value.

### **Water Repellent Masonry Technology**

Jim Lucas, CSI, of J. N. Lucas Associates, Inc., Hammond, IN, then spoke on water repellent masonry technology. Water repellents

modify surface tension, resulting in repulsion of liquid. The application may be either as a coating or as a penetrant which lines the pores of the surface. If the coating completely fills the pores, covers the surface, and acts as a vapor retarder, it is classified as a waterproofing. The ideal water repellent would satisfy all the following characteristics: no color change; alkaline resistant; water repellent but vapor permeable; crack-bridging; long-lasting; inexpensive.

Lucas traced the historical development of water repellent coatings from mid-century: boiled linseed oil and early silicones in the 1950s; acrylics in the 1960s; stearates in the 1970s; silanes and siloxanes in the 1980s; and, currently, water-based silanes, siloxanes or silicates or solvent-borne silicone elastomers. New VOC regulations will take effect May 1, 1998, which will impact the number of currently available materials.

Silanes and siloxanes are available with a 10-year warranty and offer advantages of application to damp surfaces (although resulting penetration will suffer somewhat), and compatibility with many sealants. Consultation with a products rep is suggested to discuss the specific project needs (type of substrate, existing surface conditions, ambient conditions) in order to determine the most suitable type of repellent coating.

### **Lightweight Insulating Concrete and Re-Roofing**

Leo Legatski, Elastizell Corporation of America, Ann Arbor, MI, who has experience in lightweight insulating concrete since the 1960s, next spoke on the subject. Although this material comprises only 10% of roof decking, its use is more predominant in the Southwest and Southeast than in the Midwest.

These materials incorporate rigid EPS insulation boards integrated into the fill to reduce the deadload and add insulation value, and can be formulated using lightweight aggregate, expanded aggregate, or preformed foam. The densities and compressive strengths vary accordingly, as do the venting requirements. Thickness is a minimum of two inches. When installed over galvanized steel decking, venting for lightweight aggregate and expanded aggregate is usually accomplished by using perforated decking (1-1/2% venting) or side-

lap venting (1/2% venting), and possibly perimeter venting. Foamed concrete does not require deck venting, but perimeter venting is recommended.

Lightweight insulating concretes are nailable (for attaching membrane base plies), provide good wind uplift resistance, can act as an air retarder, and may be FM and UL approved. Keystone wire mesh reinforcement provides additional fire resistance by supporting the concrete above the EPS insulation, in case the EPS melts due to an interior fire. Minimum compressive strength of 200 psi is required for a nailed membrane (with a 40# pullout per fastener), or 250-300 psi for fully adhered. A single ply with fleece backing is suggested if fully adhered.

In a re-roofing scenario, lightweight insulating concrete offers several advantages: ability to reconfigure the roof slope to accommodate irregular shapes and to work around existing units and penetrations; eliminate tear-off (assuming no wet insulation and no deadload limitation); and economically add insulation.

### **Project Profile**

Fred Helmen of Midland Engineering Co. Inc., South Bend, IN, presented a project profile on the re-roofing of the Amoco Building in Chicago. Fred, with Midland for over 20 years, was personally involved in the project. Midland came in on the project in late 1989, following completion of a five-year re-roofing project for Amoco's Naperville, IL facility.

Over a two-year period, the roof system treatment was reviewed and the situation discussed with a project team including representatives from Amoco, Midland, a Massachusetts-based consultant, the roofing membrane material manufacturer, the local engineer, and the construction manager. Planning for the inherent difficulties of re-roofing an 88-story high-rise in downtown Chicago were further complicated by the ongoing removal and replacement of the building exterior skin. The logistics of concurrently accommodating both operations posed as many problems as did the design for the roof assembly.

The system ultimately selected was an engineered, bar-attached, reinforced 72-mil PVC membrane over 25 psi tapered polyisocyanurate insulation mopped in asphalt to a smooth SBS underlayment (acting as an interim membrane after tearoff), also mopped to the concrete deck. Extensive re-design of flashings and sheet metal work accompanied the re-roofing, along with elevating and re-mounting many items of roof equipment.

The original coal tar and gravel built-up roof membrane, installed over thermo-setting asphalt/perlite insulation, had been "re-saturated" and weighed between 20 and 25 pounds per foot. This, together with antennae mounted 10' O.C. across the roof surface, extremely low equipment clearance, and access/scheduling conflicts with the exterior construction elevators, all posed numerous headaches in completing the

## REGIONAL NEWS

work.

Helmen showed numerous slides depicting phases of the work and the conditions encountered, with the start of the job in the summer of 1991 through its final completion over a year later.

### Roof Quality Observation and Reports

Dan LaFountain, RRO, with TSK Roof Consulting Inc., Marshall, MI, spoke on Roof Quality Observation and Reports. He spoke from his own experience as a roofer in the 1970s through his current duties as a roofing consultant. LaFountain has published in *Interface* on this topic.

Dan noted the frustrations experienced by an architect or consultant who, after spending time gathering field data, reviewing existing documents, codes, and manufacturers' requirements, performing calculations for "R" values and dew-points and then combining all these into a set of construction documents, then finds that the roofing crew on the job either doesn't have the necessary documents; has them but doesn't use them; or has no support from their office.

Often, when a crew is asked why they are not following the construction documents, the response is that that's not the way the manufacturer wants it done, or it's the way they've always done it. Part of the communication problem may be due to the separation between the contractor's project manager/estimator and the superintendent at the office and the foreman and crew in the field. Quite often, those who attend the prebid, precon and job progress meetings don't pass the word to the crew in the field who ultimately execute the work.

How might this be resolved? An obvious solution is the presence of a roof observer to assist in promoting communications, resolving conflicts, and administering contract documents. Technical competence of the observer is obviously important, but effective communication is no less critical. A positive attitude directed to helping all members of the team achieve the desired end result—a good installation applied in accordance with the contract documents—is more effective than a punitive demeanor and an attempt to find fault with small things.

One of the important tools utilized by the observer is the report form. The form may be one of several different types or a combination of them: 1) material description form to indicate compliance with specifications, note the packaging and any damage, document ASTM, FM or UL labels, and moisture content; 2) kettle logs to record bitumen temperatures at the kettle/tanker and on the roof, and record the quantity of bitumen used; and 3) daily report forms to describe areas worked, weather conditions, crew size, operations observed, variances, and other items of interest. Information entered on the forms should be objective and impartial. Dan concluded by showing slides of typical rooftop

conditions encountered, plus several specific report forms he has had experience with.

### Roundtable Discussions

Discussions were held on several questions posed by Region Director Dennis McNeil. The first concerned asphalt-adhered roof insulation to a concrete deck for a fully-adhered single-ply membrane. The consensus seemed to be to mop the insulation whenever possible rather than drilling and fastening, although, in some instances (high-rise work or windy locations), mechanical fasteners should also be used. Also recommended was the use of a base sheet or two-ply mopped to the concrete first to smooth out the deck surface somewhat, thus promoting adhesion of the mopping to the underside of the insulation.

The next question dealt with preferences for modified bitumen membrane base flashings. Popular opinion seemed to favor at least two plies, so the backer ply can dry-in the wall or curb prior to installation of the cap sheet. Hot asphalt application for SBS seemed of concern to some, due to the handling problems of large flashing sheets and rapid cooling of the moppings. Heat welding is the option there. Some noted that foil-faced flashing seems to adhere better than cap sheet, especially at corner details.

The final issue dealt with metal edge detailing for modified bitumen. The consensus seemed to stress use of raised edge curb or water-dam type flashings whenever possible, rather than flush-edge details. Another strong opinion was not to mop SBS strip-in plies; instead, torch (if torch-grade material) or use modified roof cement.

### Business Meeting

The afternoon concluded with a regional business meeting. Dennis McNeil noted the publication of a new ASTM D-6083 for acrylic roof coatings, and then read the names of the 12 new RCI members from Region III who have joined since January.

Immediate past president (and a former Region III director) Chris English, AIA, RRC, noted that state chapters of RCI for North Carolina and Illinois are in the formation stages. Several members expressed concern that the formation of a state chapter might detract from the region.

Jack Robinson, RRC, of the NRCA, noted that the former NRCA/RCI Liaison has phased out as a standing committee in favor of an ad hoc group to meet as the need arises. He noted that NRCA has opened a new membership category for sole practitioners (architects/engineers/consultants). Members will be able to participate in the "Project Pinpoint."

The next Region III meeting will be a joint session with Region IV at the Midwest Roofing Contractors Association (MRCA) convention in St. Louis Friday, Nov. 7.

## Richard C. Rinks, PE, AIA, RRC, RLS, CEIFSI, CMA

BY KRIS AMMERMAN, EXECUTIVE EDITOR, INTERFACE

**R**ichard C. Rinks has so many initials after his name and wears so many hats, he defies easy categorization. An early bloomer, at the age when most kids are trying to find ways to skip school, Richard was already building them. From construction he quickly moved into surveying. He earned his civil engineering degree from Tennessee Technological University (1966), did a stint in off-shore oil well construction with Chevron Oil, and obtained his master's degree in structural engineering in 1968.

Eventually, Richard moved into teaching what he had learned—courses in structural engineering, surveying, computer methods, and airport design at his alma mater. He also performed consulting work in related fields and eventually formed a consulting, engineering and architectural firm in the early '70s. The firm grew and prospered, working on airports, bridges, water and sewer projects, schools, hospitals, industrial facilities, and apartment complexes.

In 1978, Rinks bought out the firm and formed Richard C. Rinks & Associates, Inc., in Cookeville, Tennessee. The company began to specialize in roof consulting, moisture detection and building envelope problems in the early 1980s as Richard developed innovative techniques and systems to deal with building envelopes. Working throughout the country, Rinks is registered as an engineer in Tennessee, Kentucky, Alabama, Arkansas, Georgia,



*Richard Rinks, PE, AIA, RRC, RLS, CEIFSI, CMA*

Mississippi, Florida, and North and South Carolina. He is also registered as an architect in the state of Tennessee, as well as a land surveyor.

Another area of expertise is Rinks' development of computerized roof evaluation, cost estimation and economic analysis systems, as well as computerized techniques for developing roof plans and details. In the past year, he has evaluated over 10,000,000 square feet of roof.

Richard is certified as an EIFS inspector and moisture analyst by the Exterior Design Institute and belongs to that Institute, as well as several engineering and architectural associations.

In 1988, Rinks joined the Roof Consultants Institute, becoming certified as a Registered Roof Consultant in 1989. His sons, Patrick and Jason, both members of the Rinks firm, are also active members in RCI. Richard has taught at RCI educational courses and serves on an ad hoc committee for the Institute. While his wife, Shirley, is not a member of RCI, she is actively involved in the business.

"For fun," Richard is a licensed instrument pilot, and uses the company plane in the business. He is also an avid golfer who has (what else?) designed golf courses.

RCI is honored to have a man like Richard Rinks, with his considerable talents, energy and experience, as an active member of the Institute.

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# MEMBER NEWS

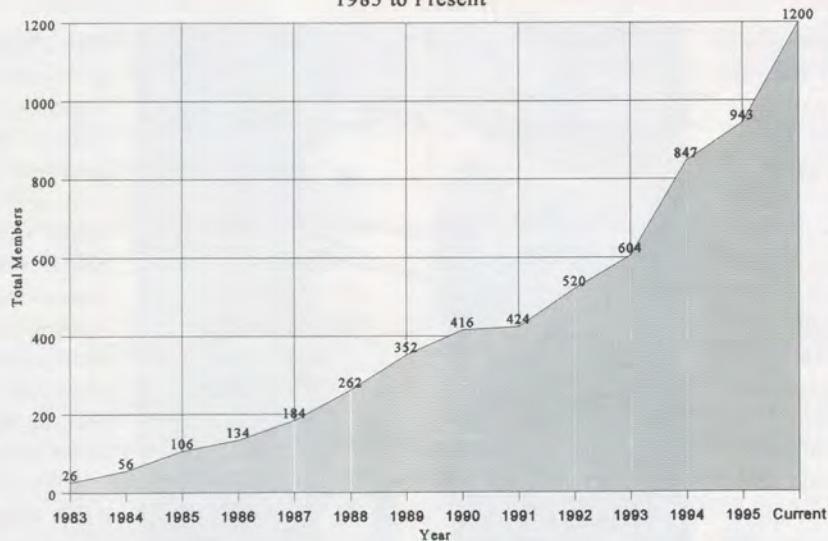
## Schauffele On Editorial Advisory Board For CSI

Roy Schauffele, CCPR, CASI, RCI, owner of Division 7 Solutions, Inc., has been appointed to the Editorial Advisory Board of *Construction Specifier* magazine, a publication

of the Construction Specifications Institute. Roy is an Industry member of RCI.

### Growth of RCI

1983 to Present



## R C I H I S T O R Y

### Five Years Ago at RCI

▼ The First Registered Roof Observer examinations in June 1992 at the Region VI meeting in Reno, NV, produced the first RROs: Brian T. Van Tiem, Types I, II; Robert D. Chandler, Type I; and Douglas S. O'Brien, Types I, II, III. James E. Magowan was the Quality Assurance Committee Chairman.

### Ten Years Ago at RCI

▼ Regional Directors were to serve as full voting members of the RCI Board of Directors. Directors were: Robert Martin, I; Joe Hale, II; Don Bush Sr., III; Chris Clarke, IV; Wells Jackson, V; Harold Larsen, VI; Harold Crooks, VII.

## NEW MEMBERS FOR JULY

Name	Region	Classification
Ron Walters	Region 2	Quality Assurance Observer
Steve Taynton	Region 2	Government Liaison
Shan Oliver	Region 2	Government Liaison
Claude C. Malone	Region 4	Quality Assurance Observer
Tim Benzie	Region 3	Professional Associate
P. David Wills	Region 8	Professional Associate
Barry R. Huber	Region 2	Industry Associate

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# POLYOLEFINES

## The New Roofing Technology

By R.K. FOLEY AND WILLIAM RUBEL

As the environment is becoming a greater concern to more and more people, it is gratifying to see an increased awareness of the environment in the construction industry. Both in new construction and in the rapidly-growing retrofit market, concern for the long-term impact on the environment with products and practices has become evident.

This not only applies to building owners and developers who award construction contracts, but also includes architects and construction workers, as well as occupants and users of buildings. They are all demanding that environmentally friendly products be used. They are considering factors such as the long-term performance of the product and its life cycle cost rather than its initial cost; the ability of the product to be recycled<sup>1</sup>; the ease of future disposal; and the potential health hazards for construction workers and occupants coming in contact with the product. Forward thinking product development thus demands that the ecological composition of the product be seriously considered.

Fortunately, the same concerns are now being explored in the roofing industry. In part due to these developments, a new

series of synthetic roofing membranes started appearing in Europe in 1991.

The raw material base of these membranes is flexible polyolefines.

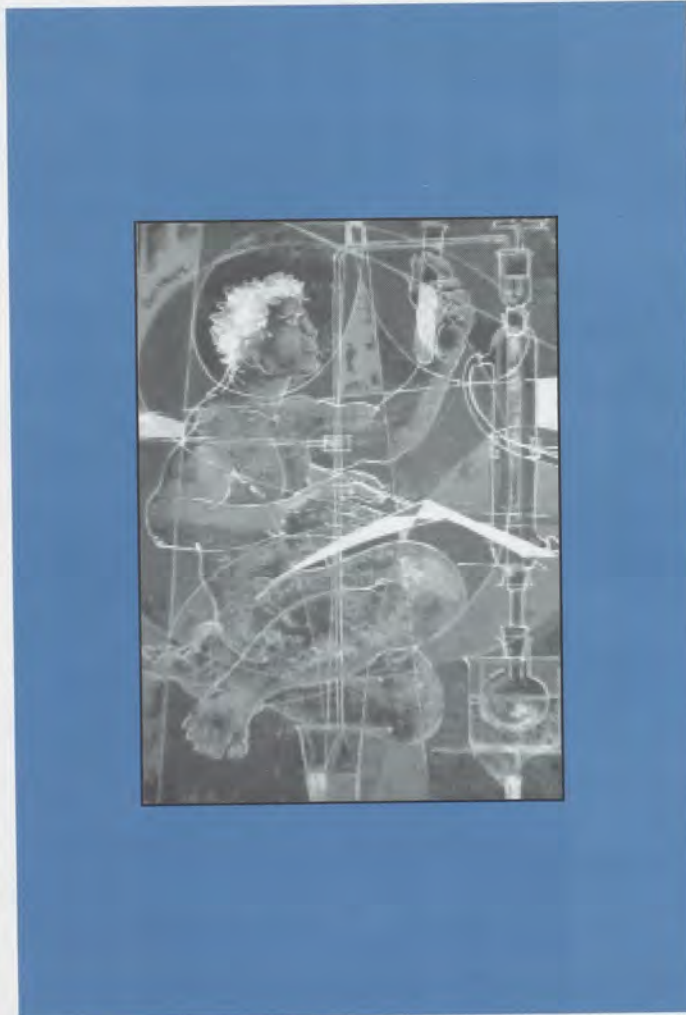
Polypropylene or polyethylene is combined with flexibilizing co-monomers in the reactor during the synthesis of

polymers (reactor blends). Hence, the designation of these materials is flexible polyolefine alloys (FPO-A). In order to achieve the desired end properties, such as UV resistance, thermal stability, mechanical strength, and low flammability, stabilizers and reinforcing

materials are added during the production of the membranes. With the proper use of these ingredients and the proper manufacturing method, these new roofing membranes can enjoy outstanding properties, including excellent weatherability.

As noted above, there are two basic types of these new products. One is based on polypropylene, the other on polyethylene, both of which are inherently stiff materials. Improvement in the flexibility of these products is achieved through internal plastification in the reactor process with other polymers. This is different from the plastification of the more commonly-used thermoplastic roofing and waterproofing material, called PVC, which has external plasticizers added to the PVC resin at the time of manufacture.

It is important to recognize, however, that thermoplastic PVC membranes have dominated the European roofing and waterproofing market for over thirty years, and have grown substantially and consistently in the North



*Development of roofing materials which produce complete, benign incineration of their by-products causes a closed circuit from raw material production to complete recycling for a safe environment.*

American marketplace over the past twenty years. The key to the success of PVC products was the knowledge of the plasticizer volatilization process, coupled with the correct manufacturing process and the understanding of compatible substrates.

Polyolefines have been used in various waterproofing applications for many years. Although they have generally performed well, some of the material's properties (such as stiffness) made it unsuitable for use on roofs. Advances in polymer technology over the past few years, however, have led to the development of suitable membranes for roofs. Although stiffer than conventional single-ply sheets, there are advantages associated with using products based on these raw materials in the rooftop environment.<sup>2</sup>

In Europe, these products are known as Flexible Polyolefines (FPOs). In the U.S. they are known as TPOs (Thermoplastic Olefines). Advantages include bitumen and polystyrene compatibility, very good low temperature flexibility, excellent puncture resistance, and increased welding rates. One of the most important features is that FPOs are "internally plasticized" during the raw material production. Therefore, they do not lose their plasticizing agents, a key factor in the aging of some thermoplastics. Well-formulated PVC membranes have life expectancies greater than 30 years, and these "internally plasticized" FPO products have the potential to match or exceed that performance.

Polyolefine membranes are currently being marketed in both the reinforced and unreinforced form. History has proven that reinforcement is critical for improving dimensional stability and mechanical properties in roofing membranes.

Long life expectancies mean longer periods between reroofing, an obvious economical benefit. From an environmental perspective, this can reduce the burden on our already overflowing landfill sites. In fact, a properly formulated FPO need never go to the landfill. These products are ideally suited for numerous types of recycling, and ultimately they can be incinerated.



*Typical stone-ballasted roof. These gain fire rating where some other roof types will not.*

During incineration, the combustion by-products are simply water and carbon dioxide. This makes a closed circuit from raw material production to complete recycling, and incineration at the ultimate end of service life. This is only true if the components which are added to the polymer (pigments, stabilizers, etc.) during the formulation of the membrane complement the base plastic's ecological profile. It is especially critical with regard to the flame retardants used to meet the demanding requirements of the various fire tests presently in use. This can be a challenging problem for roofs intended for mechanically attached or adhered application which do not have the fire protection of a gravel ballast layer, or the inherent property of a PVC membrane which has low flammability.<sup>3</sup>

A leading European producer of thermoplastic membranes pioneered the research many years ago into the technology of FPO-A membranes, including the technology for fire resistance and ecology. Other companies have also helped the research over the past two years. A higher technology FPO-A roof membrane used in Europe today (primarily in Switzerland, Germany, and Austria) meets these requirements and is produced by Sarnafil.

Since 1991, Sarnafil has been supplying FPO membranes for both bal-

lasted and mechanically attached applications in these markets. There are test roofs dating back to 1988, and approximately 100 million square feet of membrane have been installed since products were introduced to the market.

Adapting the European technology to meet the severe American fire tests carried out by Factory Mutual Research Corporation and United Laboratories is no easy task. Today, there are six suppliers of TPO roofing membranes domestically. As with everything, there are, of course, short cuts. Some of these suppliers of polyolefine-based materials have achieved passing results in these tests by adding bromine compounds and antimony trioxide to the base polymers. Although this achieves the desired effect in the fire tests, such additives dramatically reduce the potential for recycling these materials. It also makes incinerating them at the end of their service life much more complicated. Even more importantly, the fire retardants have been found to have significant negative effects on the UV resistance and the thermal stability of the end-use products. In the final analysis, the life expectancy of these products is reduced to the point where it is projected to be less than that of PVCs or other quality single-ply membranes.

Based on the present experience with FPO membranes which have

been formulated with the proper fire retardants for exposed applications, there is solid evidence of the long-term viability of these products. In ballasted applications, these membranes will perform at a level second to none. However, experience also suggests that quite a bit remains to be done to formulate membranes for unballasted applications that will meet American fire testing regulations and provide the life expectancies that these products are capable of achieving.

## SOURCES

1. For more complete literature and understanding of the recycle possibilities of PVC, contact the Vinyl Institute at 65 Madison Ave., Morristown, New Jersey 07960 (201-898-6699).

2. Beer, H.R., "Flexible Polyolefine Roofing Membranes. Properties and Ecological Assessment," *IX International Congress of Waterproofing Technology and The Environment*, International Waterproofing

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19, 1997.

3. Balser & Hofmann, "An Ecological Assessment," *Ingenieure und Planer AG, Mitglied SIA/ASIC*, Forchstrasse 395, CH-8029 Zurich, 1992.

## About The Authors



**Richard K. Foley**

**Richard K. Foley** is President and Chief Executive Officer of Sarnafil Inc. He is also a member of the executive committee of the parent Sarnafil Division in Switzerland and a past president of the Single Ply Roofing Institute (SPRI).

**William Rubel** is the Eastern Region Manager for Sarnafil Inc. Bill is a Registered Roof Consultant, a faculty member of RIEI, and a member of ASTM and RCI. He has also been a member of the Peer Review group for *Interface* for more than five years.



**William Rubel, RRC**

# ASTM Consensus Documents Condemned

The American Society of Civil Engineers' (ASCE's) Educational Activities Committee (EdAC) has endorsed a resolution opposing the American Society for Testing Materials' (ASTM's) "promulgation of consensus documents that are labeled as Standard Practices or Standard Guides." The endorsement originated at the Midwest Regional Meeting of the Department Heads Council (DHC). DHA's membership comprises the chairs or heads of the nation's 226 civil and environmental engineering programs accredited by the Accreditation Board for

Engineering and Technologies (ABET).

EdAC and DHC reportedly acted from fear that ASTM's issuance of prescriptive professional practice standards "could force ABET-accredited curricula to run afoul of ABET requirements for the teaching of design."

According to a spokesperson for ASFE (Professional Firms Practicing in the Geosciences), "ASTM's standard practices and standard guides presuppose a standard client with standard risk management objective for a standard project at a standard site. These

conditions will be almost impossible to match in 'the real world,' making attainment of optimal results almost impossible. Nonetheless, engineers and environment professionals could be required to follow such ASTM standards, if only to avoid the huge liability exposures that could otherwise accrue."

Both ASFE and the Geo Institute have argued that the problem can be solved easily, simply by calling the materials involved something other than "standards" and by including a user advisory in each.

# RCI PRODUCTS AND PUBLICATIONS ORDER FORM

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ITEM	MEMBER	NONMEMBER	QTY.*	COST**
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Mailing list labels (one-time use)	\$300.00	\$400.00		
<b>PUBLICATIONS</b>				
RCI International Directory	NC (1st)	\$15.00		
Basics of Roofing Text	\$75.00	\$90.00		
Basic Roof Consulting Text	\$125.00	\$140.00		
Advanced Roof Consulting Text	\$125.00	\$140.00		
Rooftop Quality Observation Text	\$75.00	\$90.00		
Glossary of Terms*	\$40.00	\$50.00		
Standard Symbols (hard copy)	\$10.00	\$15.00		
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Interface Subscription (to U.S.)	NC	\$50.00		
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Building Codes & Standards Ref. Guide	\$75.00	\$100.00		
Videotapes from previous RCI symposia	Phone for prices.			
<p>* Quantity discounts available.</p> <p>**Prices include handling and domestic shipping of individual copies. Shipping charges will be invoiced on multiple copies and international orders.</p> <p style="text-align: right;">NC residents add 6% tax:           \$ _____</p> <p style="text-align: right;">Total:                                       \$ _____</p>				
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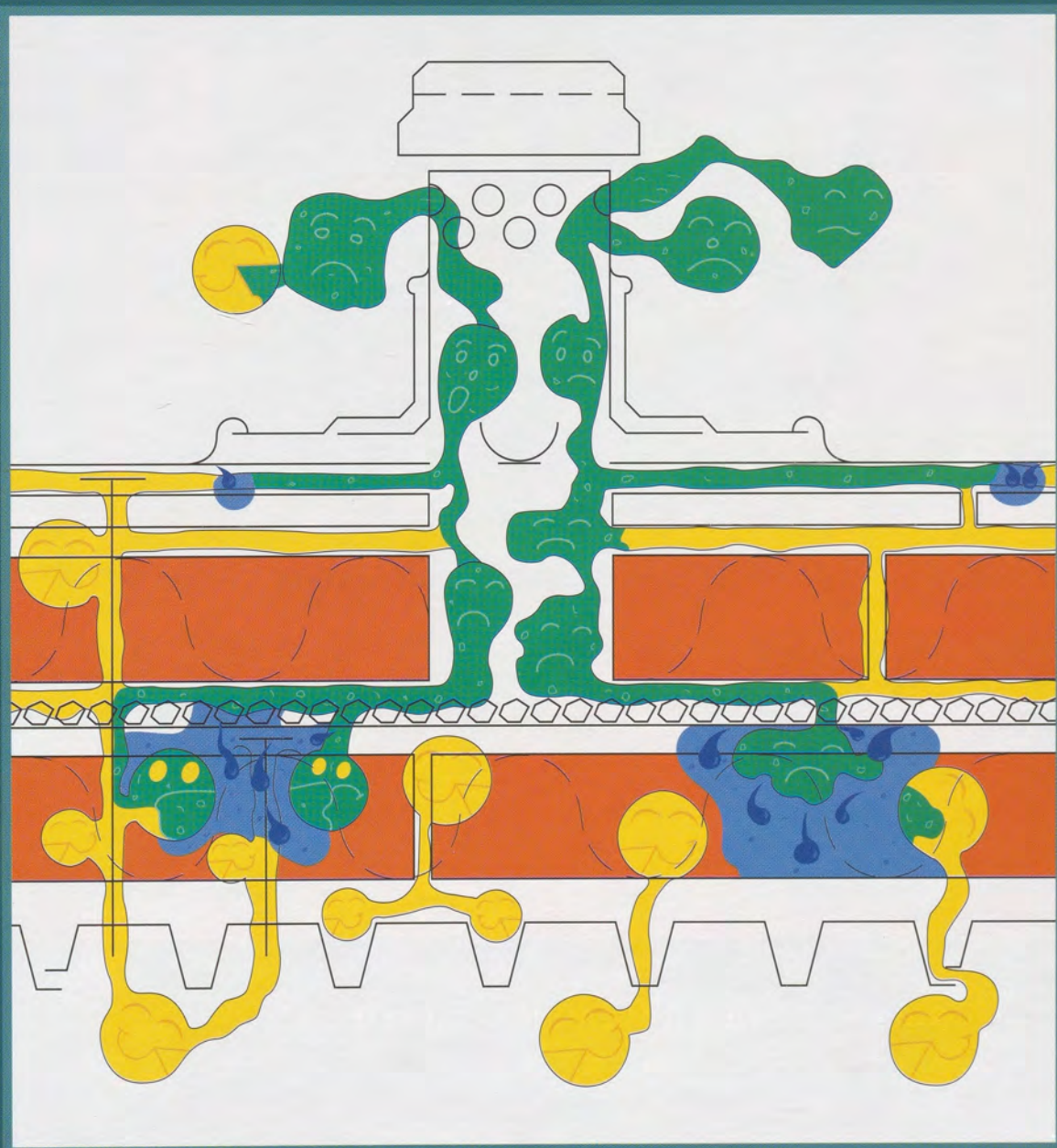
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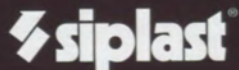
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*Thanksgiving Square (festival)*



*Southfork Ranch*

## Agenda

Technical Sessions  
Trade Show  
Auxiliary Business Seminars  
RRC and RRO Examinations  
Committee Meetings  
Annual Meeting and Election  
Document Competition  
Live Roofing Demonstrations  
Optional Sightseeing Tours  
Golf Tournament  
Roundtable Discussions  
Awards Banquet



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## PEOPLE & PLACES

### ■ Witkowski New CFI Tech Services Manager

Edward Witkowski has been promoted to Technical Service Manager of Construction Fasteners Inc.'s (CFI's) DEKFAST Product Group in Wyomissing, PA. He will coordinate the company's technical services and field training, its wind uplift test programs, and oversee its staff of roof fastener technicians.



Edward P. Witkowski

### ■ Mineart Promoted at Firestone



Paul R. Mineart

Paul R. Mineart has been appointed a corporate vice president of Bridge-stone/Firestone, Inc. President of Firestone Building Products since 1992, Mineart has been with Firestone for 30 years. The company is headquartered in Carmel, Indiana and owns 11 plants nationwide.

### ■ Greene Installed as FRSA President

Bill Greene, CPRC, Ferber Sheet Metal Works, Inc., Jacksonville, FL, was installed as president of the Florida Roofing, Sheet Metal and Air Conditioning Contractors Association (FRSA) at the organization's 75th annual convention recently in Orlando. Also installed were president-elect Bob Purdy; vice president Jody Cove, and secretary/treasurer Mike Gustafson.

### ■ Pate Appointed Product Engineer with GenFlex

Harold Pate has been appointed a thermoplastic product development engineer with GenFlex Roofing Systems. Previously, he was a senior development engineer for Goodyear Roofing Systems and a senior design analyst in the Technical Service Group for Versico, Inc.



Harold Pate

## PUBLICATIONS

### ■ RIEI Releases Seminar Directory

The Roofing Industry Educational Institute (RIEI) has announced the availability of its new Seminar Directory, covering course offerings from July 1997 through June 1998. To obtain a copy, contact Debbie Cangialosi, 303-790-7200 or fax 303-790-9006.

### ■ SMACNA Introduces Scaffold Compliance Manual

The Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) has developed a new manual covering the OSHA Standards for Scaffolds—Subpart L of the 1926 Standards for Construction. Copies are available by contacting the publications department, 4201 Lafayette Center Drive, Chantilly, VA 20151-1209.

## PRESENTATIONS

### ■ NRCA Convention Set for Las Vegas

The 11th Annual Convention and Exhibit of the National Roofing Contractors Association (NRCA) will be Feb. 8-11 in Las Vegas, NV. To register or for further information, phone 800-323-9545 or use the organization's fax-on-demand service at 888-455-6722.

### ■ NRLRC To Hold Seminar

The National Roofing Legal Roofing Center (NRLRC) will hold its annual educational seminar Nov. 13-15 in Cancun, Mexico. NRLRC is a separately funded organization of NRCA that provides roofing contractors with information about roofing-related legal trends and issues. For further information, phone Janice Berger at (847) 299-9092.

## PRODUCTS

### ■ Spec Software Developer Seeks Reviewers

Building Systems Design, Inc., developer of the BSD SpecLink automated specifications software, is recruiting highly qualified contributors and reviewers for a new specification service. Contributors will submit new specification sections for publication and provide an ongoing "industry review" for related sections. Reviewers

## INDUSTRY NEWS

must be users of BSD SpecLink in an active architectural, engineering, interiors, landscape, or specification consulting practice. For information, phone Susan McClendon at 800-266-SPEC.

## PROGRAMS

### ■ NRCA Training Program Launched

The Roofing Industry Alliance for Progress plans to spend \$750,000 on a program to help contractors recruit, train and retain roofing workers. The money, part of an endowment fund established by the National Roofing Foundation's (NRF's) Board of Trustees, will be allocated over a three-year period. NRF is an educational and research sector of the NRCA, which has also made a \$750,000 pledge toward the initiative.

The \$1.5 million contribution will cover the cost of producing 33 training modules. To date, 80 roofing contractors, 13 manufacturers, one insurance company, and NRCA have contributed a total of \$7.32 million to an educational endowment fund.

## PURCHASES

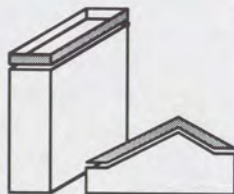
### ■ Johns Manville Purchases HPG Roofing Materials Business

HPG International Inc. has sold its North American thermoplastic roofing materials business to Johns Manville Corp. The sale will allow HPG to concentrate on its core competencies of PVC film and sheet production.

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# EXECUTIVE NOTES

## Mark Your Calendar!

I've just come from a meeting with several board and staff members, and the subject of the meeting was the activities and plans for RCI's 1998 Annual Conference and Trade Show, April 4-9, in Dallas. I'm excited about this conference and you should be, too!

The theme for this year's conference is, "Meeting the Needs of the Professional," and we're putting together an educational program designed to add significantly to the resources of the professional small business person. For the first time ever, the educational program is going to be divided into three tracks or components. One will contain programs on technical issues, so attendees can keep up with the latest information about commercial roofing techniques, materials or weather issues. The second will focus on current research designed to improve techniques and materials, or our ability to cope with environmental problems. The third track will focus on business support systems which can improve the work life of every roof consultant. Included will be presentations on moderately-priced CAD systems, small business computer systems, mobile communication systems to keep



**Francis A. Acquaviva**

you in touch when you're on the job or on the road, and marketing techniques for the small business. Additionally, this year we'll be offering a special seminar on roof photography techniques, and one on writing skills for the businessman—both essential elements of a roof consultant's daily life.

In addition, the conference will feature issue-focused round table discussions, artisan demonstrations, an expanded trade show, a golf tournament at Chase Oaks, one of Dallas's great courses, an exciting spouse program, and numerous social activities and opportunities for networking.

All in all, the conference is a wonderful opportunity for professionals to meet their responsibility to learn and to share information, and to do that in a great, congenial setting.

Dallas is sure to be fun, and it will be easy to get there. We are currently negotiating with several major airlines to offer RCI members discounted fares, and will report more on that later. For now, mark these dates on your calendar: April 4-9, 1998—RCI's Annual Conference in Dallas.

See you there!

## Foam Plastic Update

Following a July 10 hearing of the International Conference of Building Officials Evaluation Service (ICBO ES) Committee on proposed revisions to fire safety acceptance criteria for foam plastic roof insulation directly onto a deck, the issue was referred for further study.

Submission of "White House" testing criteria was to have been made in September, based on satisfaction of certain outstanding technical questions. The committee will then rule on the issue.

The Foamed Polystyrene Alliance (FPSA), a business unit of the Society of the Plastics Industry, Inc. (SPI), has been supportive of the proposal to add two new fire test methods to the existing criteria for evaluating foam polystyrene insulation applied directly to steel roof decks. The Polyisocyanurate Insulation Manufacturers Association (PIMA) has expressed concern with the new testing procedures and has urged ICBO to deny acceptance of the testing methods. The Building Officials and Code Adminis-

trators International (BOCA) and the Southern Building Code Congress International (SBCCI) have already accepted new tests as appropriate for evaluation fire testing purposes.

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# CALENDAR OF EVENTS

OCT 1997



- 11** RRO and RRC exams given to approved candidates   
 ■ Ft. Lauderdale, Florida
- 12-15** SMACNA Convention   
 ■ Las Vegas, Nevada
- 12-16** SBCCI Annual Conference   
 ■ Myrtle Beach, South Carolina   
 Info: (205) 591-1853
- 16-17** Building Envelope Symposium   
 ■ Dallas, Texas
- 16-17** Restoration '97   
 ■ Chicago, Illinois
- 17-18** Basic Roof Consulting Course   
 Region 7 Meeting   
 ■ Vancouver, British Columbia
- 28-30** Metalcon   
 ■ Atlanta, Georgia   
 Info: (617) 965-0055

NOV 1997



- 6-7** Rooftop Quality Observation Course   
 Region 5 Meeting   
 ■ Denver, Colorado   
 RRO exam given to approved candidates
- 7** Regions 3/4 Joint Meeting @ MRCA   
 ■ St. Louis, Missouri   
 RRC exam given to approved candidates
- 14** Region 2 Meeting   
 ■ Biloxi, Mississippi   
 RRO exam given to approved candidates
- 13-15** National Roofing Legal Roofing Center Seminar   
 ■ Cancun, Mexico   
 Info: (847) 299-9092
- 16-19** Brazilian Symposium on Waterproofing (Simpósio Brasileiro de Impermeabilização)   
 ■ Sao Paulo, Brazil   
 Info: 55-11-255-2506
- 19** Region 6 Meeting   
 ■ San Diego, California
- 20-21** Building Envelope Symposium   
 ■ San Diego, California

DEC 1997



- 4-5** Building Envelope Symposium   
 ■ Hartford, Connecticut
- 4-7** Advanced Roof Consulting Course   
 Region 7 Meeting   
 ■ TBA   
 RRC exam given to approved candidates
- 12-13** Rooftop Quality Observation Course   
 ■ Chicago, Illinois   
 RRO exam given to approved candidates
- 12** Region 1 Meeting
- 13-14** Basic Roof Consulting Course   
 ■ Boston, Massachusetts

FEB 1998



- 8-11** NRCA Convention   
 ■ Las Vegas, Nevada

MAR 1998



- 12-14** Restoration '98   
 ■ Boston, Massachusetts   
 Info: (508) 664-6455

APR 1998



- 4-9** 13th Annual RCI Convention & Trade Show   
 ■ Dallas, Texas

All events are presented by RCI unless otherwise noted. ALL RCI PLANNED EVENTS ARE SUBJECT TO CHANGE OR CANCELLATION. Call RCI for current dates, locations, and fees. Telephone 1-800-828-1902 or (919) 859-0742. RCI accepts payment in the form of cash, check, Visa or Mastercard.

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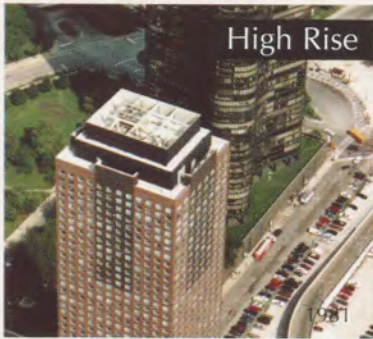
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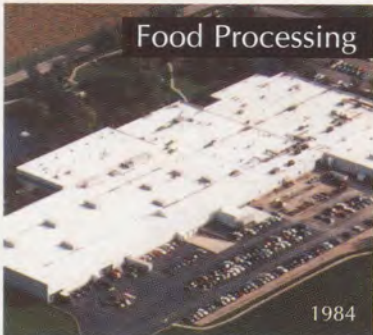
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