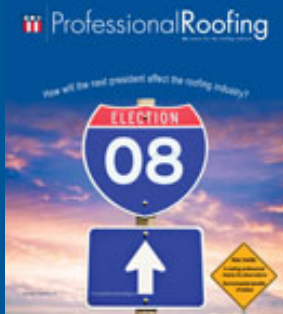


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A matter of opinion

A roofing industry professional shares his views about current issues facing the industry

by Thomas W. Hutchinson

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Editor's note: The following views are those of the author and not necessarily those of NRCA or Professional Roofing.

Paddy Chayefsky once said: "I'm mad as hell, and I'm not going to take it anymore."

This statement might best describe how I feel about the current state of the roofing industry. Never in my 25 years of involvement with the industry as a roof consultant, architect and former president of RCI Inc.—The Institute of Roofing, Waterproofing, and Building Envelope Professionals have I seen the profession and industry being so frequently challenged and changed by others who have no vested interest in the industry and, most devastating, no liability in the decisions they make. In my opinion, this is the roofing industry's No. 1 concern.

Federal agencies, such as the Environmental Protection Agency (EPA), and its single-component roof ENERGY STAR® program, which pays blind apostolic allegiance to Lawrence Berkeley National Laboratory (LBNL), Berkeley, Calif., have done more to contribute to poorly performing roof systems than the entire roofing industry.

It's about time the roofing industry's myriad associations band together to slap some sense into the agencies, research institutions and code bodies that affect the industry before the catastrophic results of their actions are realized.

Following are observations and opinions garnered from my experience with various issues during the past few years and how I believe these issues are affecting the roofing industry.

Cool roof catastrophe?

Because of its obvious years of roof system experience and what must be millions of square feet of roof system inspections, LBNL has influenced EPA to believe the world will end if we don't make all roof systems in the U.S. white. Unfortunately, computer modeling and research on small-sized samples without empirical roofing knowledge do not make for a good hypothesis or recommendations.

Anticipated results often are not as expected. Energy calculators based on unproven hypotheses can provide poor data. In fact, after more than four years, I still am waiting to see information about the algorithms used in EPA's ENERGY STAR Roofing Calculator.

As I previously predicted in *Professional Roofing*, the effect of single-component roof system mandates is rearing its ugly head. Even the average freshmen architectural student is astute enough to know roofs act as systems and are only as good as their weakest link. The impending litigations and resultant monetary awards will be enormous, and I would suggest they be underwritten by EPA and LBNL as their recommendations are a direct causation.

Condensation

Cool roof membranes with single-layer insulation mechanically fastened to metal roof decks are guaranteed (in conditioned buildings) to result in an energy loss of up to 15 percent through insulation joints and mechanical fasteners. Interestingly enough, most architects and code bodies believe this roof system type is an energy saver; however, this is a misconception.



Photos courtesy of Hutchinson Design Group Ltd., Barrington, Ill.

Photo 1: Movement of moisture-laden air through insulation joints to this membrane's underside resulted in condensation.

In the Midwest, for example, where the climate is conducive to condensation, the movement of moisture-laden air through insulation joints to a membrane's underside results in condensation (see [Photo 1](#)).

Although condensation can form on the underside of any loose-laid or mechanically fastened single-ply membrane, a white membrane tends to accelerate and accentuate moisture accumulation because of its cooler temperatures, which may never be much higher than ambient temperature during an entire winter.

Condensation often freezes on the underside of membrane areas and

results in crunchy walks across roofs.

Additionally, ice accumulation up to 1/2 of an inch thick has been observed in laps (see [Photo 2](#)). Make no mistake, the membrane shown in the photo is watertight and performing well, but the system is failing. This condensation is not just minor moisture accumulating in the roof system but enough to result in saturated insulation facers, leaks into the interior and ice formation below the membrane.

Such moisture is the first step toward mold manifesting on the facer; deterioration of the metal roof deck around the screw fasteners and resultant loss of wind-uplift protection; "wet" spots resulting on the surface; and increased potential for individuals to slip, not to mention damaged products.

Not only are condensation concerns real, but their correction is costly. Many buildings affected by condensation are large "box" types, totaling hundreds of thousands of square feet. Replacing a roof system often can cost three to four times the original roof system installation cost.



Photo 2: Ice accumulation up to 1/2 of an inch thick has been observed in laps.

Reflectivity—good or bad?

The jump onto the cool roofing bandwagon has been so fast and furious, it appears no one stopped to ask *where* we're deflecting the sun's rays. Let me answer: in part, onto adjacent masonry walls and parapets, exterior insulation and finish systems' (EIFS) walls, wall sealant joints, adjacent cool roof membranes, into rooftop equipment, through windows to buildings' interiors and on rooftop maintenance workers. And these magnified rays' effects on adjacent building elements have not been good.



Photo 3: This masonry wall expanded so much the control joints squeezed shut and mortar debonded, resulting in moisture intrusion and deterioration.

Masonry expands when heated, and the highly concentrated sun's rays reflected onto adjacent masonry walls result in "excessively" heated masonry—beyond what can be expected in design and undertaken by construction tolerances.

The result is masonry walls expanding so much that the control joints squeeze shut and mortar debonds, resulting in moisture intrusion and even more deterioration (see [Photo 3](#)). I have observed coping stones that expanded so much they popped off the parapet. If a sealant joint

survives the excessive expansion, the excess ultraviolet radiation often

degrades the sealant prematurely.

Roof surface reflectivity affects not only masonry but also other cladding materials, such as EIFS. EIFS can gain so much heat from adjacent roof system reflectivity that certain insulations behind the cementitious coat, such as expanded polystyrene, have been reported to literally melt away.

Also well-documented and of concern is when a lower roof system has a cool roof membrane, the resultant reflectivity passing through windows in adjacent walls requires building owners to replace blinds and, in extreme cases, window glass. Rooftop equipment also is becoming super-heated, access panels are buckling and, in at least one instance, I have observed sheared-off screws.

Another little-known concern but one that will become more apparent as time passes is cool roof membranes' degradation at points where tall "cool roof" membrane base flashings are reflecting the sun's rays downward, concentrating the rays on a point on the membrane and resulting in the membrane's premature heat aging. As a child, did you ever start a fire with a magnifying glass? This is a similar phenomenon and, again, something those uninvolved with the roofing industry are not likely to consider.

All these concerns currently are manifesting themselves and will result in litigation to obtain funds for corrective actions.

Cool roofing redefined

Because Oak Ridge, Tenn.-based Oak Ridge National Laboratory's (ORNL's) researchers participate in the roofing industry and hear the industry's concerns and issues, ORNL is at the forefront of understanding the roofing industry.

ORNL's latest report, sponsored by SPRI, confirms what I long have believed to be true from empirical experiences on roofs: The shade of ballast and the heat sink ballast provides are good qualities.

An ORNL/SPRI report, *Evaluating the Energy Performance of Ballasted Roof Systems* (available at www.spri.org), documents the monitoring of various loads of stone-ballasted roof systems during a four-year period. The project shows ballast coverage of 17 pounds per square foot or greater and concrete pavers provide benefits greater than cool roof membranes (see Photo 4). This is not to suggest that everyone should now turn to ballasted roof systems, but with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Inc. and the California Energy Commission realizing ballast's benefits, designers have another roof system option.



Photo 4: Ballast coverage of 17 pounds per square foot or greater and concrete pavers provide greater benefits than cool roof membranes.

Greenwashing

You cannot read a construction trade magazine without being inundated by products claiming to be "green this" or "green that"—what I like to refer to as "greenwashing." But the issue of quality seems to be lost in all the rhetoric.

Although many so-called "green" products and/or buildings fail to resist water for various reasons, it appears green products are here to stay. The fallout of companies and products not associated with quality has begun and will affect the roofing industry for years to come.

I urge you to research new product claims and proceed with caution with regard to long-term promises of not only performance but also intended results.

Life-cycle assessment

If you are not familiar with life-cycle assessment, you likely will be within the next year. Life-cycle assessment—which has the potential to turn the roofing industry on its head—is a scientific approach to evaluating a product's environmental effects during its life cycle.

Life-cycle assessment often is referred to as a "cradle-to-grave" approach though with the addition of comprehensive recycling programs it also may be called a "cradle-to-cradle" approach. Life-cycle assessment tracks a product's environmental effects from the initial extraction of raw materials to the final recycling of these materials into new products.

Recently, the U.S. Green Building Council's board of directors voted to incorporate life-cycle assessment as a key component in its well-known Leadership in Energy and Environmental Design® (LEED) Green Building Rating System.™ With this endorsement, I assume the LEED system will be progressively modified to integrate life-cycle assessment principles and procedures into its traditional point structure.

Because life-cycle assessment measures a product's indirect environmental costs, it differs from traditional life-cycle cost analysis, which focuses almost exclusively on direct economic impact. As a consequence, life-cycle cost analysis may be more directly related to a product's durability as reflected in its service life.

However, if environmental effects are considered a superior measure of economic cost in the long run, life-cycle assessment may be viewed as a more accurate form of life-cycle cost analysis. And if a product's long-term environmental effects are indeed the best indicator of its true economic cost, life-cycle assessment may be as sensitive as life-cycle cost analysis to materials' comparative durability.

For example, if an "environmentally friendly" roof system with a useful service life of less than 20 years is compared with a more traditional roof system with a service life of more than 30 years, the traditional roof system's total environmental effects will be lessened because of its superior service life. As a result, the lowered environmental effects of a longer service life may make the traditional roof system a superior choice versus the supposed environmentally friendly roof system.

The cost for manufacturers to attain a life-cycle assessment value will be high and greatly affect the products specified. Life-cycle assessment may be a good or bad development for the roofing industry depending on who's in charge of defining service life.

Several recent papers and reports regarding service life are based on survey results and are poor evaluations of anticipated service lives. Additionally, there are researchers who espouse that cool membranes with lighter colors will have service lives greater than other roof systems. This is not necessarily true.

Hidden material facts

I once heard a story about how a phenolic foam insulation manufacturer quickly learned the potential of chemicals leaching out from moisture-contaminated material to deteriorate metal roof decks. Consequently, the manufacturer placed in its product information a valuable piece of information about how its product, if used on a metal roof deck, should be used in conjunction with a vapor retarder. This fact could have saved the roofing industry millions of dollars and years of frustration. The problem was this qualifier was on the last page of the product data in small print and most likely never was read. It should have been at the top of the first page in bold letters.

I believe we currently face similar issues. Consider, for example, material characteristics. They do not affect a material's performance per se, but they can affect roof system performance. Specifiers and contractors should be aware of this potential.

For example, consider the fact that per ASTM D2126, "Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging," polyisocyanurate has an allowable dimensional change. Polyisocyanurate tends to shrink under certain encapsulated and environmental conditions. This is not a problem except when it is used in single layers or when one is trying to level it off with a nailer.

Two layers of insulation are a mandate in my opinion, and those who are knowledgeable realize the insulation at gutter and gravel stops should be slightly greater in height than the nailer; however, it is disturbing that this information is not readily forthcoming in product data.

Another example concerns nail base and vented nail base insulation warranties. Read warranty information closely and you'll see oriented strand board or plywood may not be covered. This is interesting because one of the main reasons for specifying the material is for the nailing substrate.

Moral of the story: It is the responsibility of the designer, specifier and/or contractor to read all the product data material and understand all roofing material characteristics.

FM 1-90 fastening

Changes made by FM Global during the past few years have everyone—manufacturers, designers, contractors and consultants—scrambling. All of a sudden, I started hearing "don't overspecify" more frequently and that too many fasteners were being installed. I even went to an FM Global educational presentation about the changes and was informed there was no need for additional fasteners above what is specified by FM

Global for their various ratings and/or the code-required ratings.

I would have liked to ask the presenter how many roof systems he has designed or how much design liability insurance coverage he has because this simple guideline is wreaking havoc.

Designers are slimming down designs to meet budgets. In Chicago, on mechanically fastened roof systems that need to meet FM Approvals' 1-90 rating for wind-uplift resistance, designers, specifiers and contractors often are using only four or five fasteners per board with a mechanically fastened membrane over the top.

Although this fastening number may meet an uplift test requirement, it often does not meet a roof system's needs during its construction and service life.

Earlier, I mentioned my concerns regarding single-layer insulation and condensation; now imagine a layer of 2-, 2 1/2- or 3-inch-thick insulation board being installed on a metal deck with four fasteners and a mechanically fastened roof membrane being installed in late fall.

Next, imagine thousands of yards of concrete being placed in the building during winter. The interior moisture gain from the hydrating concrete would be enormous, likely with a moisture drive upward to the roof deck. The moisture would pass through the roof deck and insulation joints and condense on the membrane's underside. The amount of moisture likely would be substantial and result in the insulation deforming by cupping or bowing. The few fasteners used for wind-uplift resistance would not be enough to prevent the insulation boards from bowing and cupping.

Now imagine a new building is for sale and the potential purchaser hires you to perform a due diligence roof survey. You gain access to the roof and observe a sea of ponding water, mud, algae and debris in the valleys of all the cupping insulation. Is your recommendation to the potential purchaser going to be: "The roof is installed to FM standards and did not need additional fasteners, but, seeing as there is a problem, give FM Global a call—I'm sure it will pay for your new roof?"

Although FM Global can provide some valuable information, it does not employ designers and often lacks the experience many of us have gained through years of addressing such concerns.

Material costs

You would have to live in a cave on an uninhabited island to be unaware of the escalating costs of roofing materials and, in some cases, availability shortage. Copper and stainless steel have experienced large price increases; aluminum's price is up 20 percent; the prices of polymer-modified bitumen and membranes are rising; and the price of asphalt seems to rise daily. This is putting pressure on contractors who are bidding projects or trying to be profitable on projects bid months or even years ago.

Design professionals have not figured out how to bid a project with known material costs and then accept appropriate cost increases. The main impediment seems to be trust. How can a building owner be sure the price at bidding was at a certain level and is now greater at the time of project commencement? What type of escalation language did the contractor use?

In times of stable pricing, obtaining fixed pricing is possible; however, this is not the current state of affairs. Design professionals need to understand this predicament and educate building owners about the challenges contractors can face in trying to predict material costs.

For example, I just released for bid a complex asphalt shingle project, and shingle material was discovered to be a concern. I explained the predicament to the building owner who agreed to purchase the material during the bidding process and be assured of costs and availability.

Besides rising oil prices, what is causing the increase in material costs? It appears "binge" purchasing is occurring, driving up false demand and creating shortages in the U.S. The value of the dollar versus the Euro and other currency has resulted in unprecedented construction around the world with Dubai and China being the best examples. They are demanding materials from the U.S. that are now cost-effective.

Construction schedules

Although roofing contractors always are pushed by general contractors to "get the roof on" so interior materials can be installed, an increase in required productivity is reaching an unprecedented scale. For instance, the \$9.2 billion City Center project in Las Vegas is on a shorter schedule than the \$2.1 billion Bellagio Hotel built just a few years ago. Construction-generated moisture is resulting in a multitude of concerns, the least of which is mold growth on interior materials.

Additionally, new roof systems often are used as work surfaces and resultant physical damage to the roof systems often is not repaired. Designers need to understand the great benefits of a "temporary roof," or one that can be put into place, keep the building dry and allow all the trades to "beat on it" for the time being. When construction is complete, a new roof system can be installed. With a little coordination, this is an effective way to achieve a quality roof system at a relatively low cost.

Roof system removal projects also seem to have been placed on hurried schedules. Contractors in previous years may have had 10 to 12 weeks to complete a school project, but they now may have nine to 10 weeks.

These types of construction schedules affect a quality roof system's constructability and long-term performance.

Poor design and specification

A subject near and dear to me is roof system design, and it pains me that educational institutions do nothing to address an architect's greatest liability concern—moisture intrusion.

The plethora of poor and just plain incorrect roof system designs that have come out for bid by architects and some roof consultants is astounding.

Fundamentals such as getting water to a drain, designing all building elements into a roof system and coordination between disciplines are not occurring, and when they do, they appear haphazard. Old boiler plate specifications list material manufacturers that

are no longer around—and not just gone for a year or two but sometimes for many years. Too many specifications and drawings are unprofessional, forcing contractors to guess way too much to win jobs.

Design professionals give the impression they have little respect for roof systems. I have observed specifications and drawings on buildings with construction costs in the hundreds of millions of dollars, and what do they ask for? A manufacturer's standard 10-year warranty. The building owner is paying \$300 million, \$400 million or \$500 million for a building, and the architect is asking for the absolute market-driven minimum roof warranty on a roof system that is to be installed by the lowest bidder. Sounds like future work for me.

Environmental pressure

The cool roofing movement is not the only environmental issue affecting the roofing industry. A well-organized effort is afoot in the Northeast to eliminate the use of solvent-based adhesives by lowering the allowable volatile organic compound level to a level only water-based adhesives can attain.

The last time I checked, roofing is a year-round activity and often takes place during winter. In the Midwest and Northeast, this means roof systems are installed in below-freezing temperatures, and—if my memory of chemistry is correct—water freezes at these temperatures. You can imagine the result of this legislation, I am sure. And whom should we contact when a roof system fails because of the requirement to use water-based adhesives during winter?

If you're a contractor whose bread and butter is installing fully adhered membrane roof systems, get ready for more mechanically fastened roof systems. More and more building owners do not want to "smell" a roof. Primers, asphalt, adhesives and foam adhesives all have odors, and some people claim they are offensive. Be sure to educate your customers about the materials you will use and whether they have odors.

Contractors tell me more architects are designing for LEED points, not quality or appropriateness. The result is the specification of materials that may gain a LEED point but are inappropriate for the building in question, which will only lead to future concerns.

Economy

Most commercial roofing in the Midwest is still going strong; it appears this is being fueled by 2006 and 2007 dollars. The future, though, will not be as strong.

Prices are continuing to rise that may not be supportable in the event a full-fledged recession hits, and funding for construction has tightened. Work in my office for future roof system removal and replacement projects is down, and 2009 will not be as active as this year.

Roofing professionals already should have modified their strategic plans and marketing efforts. I believe quality will become more of a concern and customers will be willing to pay for it. I also believe we should be working together to install roof systems with 30-year minimum service lives. The knowledge and materials to do so are there, and there are many contractors who are qualified to install such roof systems. Quality maintenance programs designed to ensure long-term performance also should be

viewed as an opportunity for contractors.

Landscaped roof systems

The installation of a landscaped roof system typically using sedum plantings has transformed from a futuristic concept to a fully accepted design option. (NRCA recently adopted the term "landscaped roof system" to define a roof system incorporating vegetation. Other names include garden roof system, green roof system, live roof system and planted roof system.)

Although landscaped roof systems have no wind-uplift resistance or fire-resistance ratings and could be considered non-code-compliant, a committee of industry professionals led by SPRI is addressing these concerns. There is a diverse selection of system types, including traditional fully planted, tray systems and pregrown systems, much like sod. I have concerns with all of them.

For example, I recently inspected a landscaped roof system using trays on a building in Chicago just off Lake Michigan. The trays had no erosion barrier, and, consequently, 2 inches of the soil medium eroded out, clogged roof drains and moved below the trays, which eventually will affect the roof membrane.

But my biggest concern lately is the desire by developers and building owners to walk onto their new landscaped roof systems and see the roofs completely covered with blooming plants. They want to be able to sell this new design element from day one. The plant type and density are driving specifications. This is always a challenge when landscaping is used as ballast and a roof is installed during winter.

There always has been a concern with landscaped roof system installations when deciding what trades perform which work, union versus open-shop contractors, potential damage to the installed roof system and future repair ability. The Chicago Roofers Union Local 11 has taken the proactive step of claiming landscaped roof systems qualify as roofing work and will deny union labor from subcontracting this work.

Landscaped roof system maintenance also is required. A 60,000-square-foot roof system I recently viewed had thousands of knee-high "weeds" that need pulling—sounds like a marketing opportunity for someone.

In my opinion, landscaped roof systems should be designed with the future in mind; in other words, with a fully adhered or mechanically fastened roof system in place before placement of an overburden so if the landscaped portion is removed, the building owner still has a functional roof.

Solar installation

Installation of solar-related components on roofs is increasing. Contractors already are concerned with the mechanics of installing solar components and the damage they inflict on roof systems. As the cost of solar appurtenances drops, tax incentives increase and familiarity grows, more roof systems will involve solar components.

Designers and contractors should learn from their initial failures with landscaped roof systems. They should gain an understanding of solar components by learning the

installation requirements and required maintenance so the roof systems can be designed with appropriate protection and accommodate the needs of roofing and solar components.

Be sure to consult with manufacturers regarding warranty options, concerns and exclusions and for recommendations for success.

Predictions

Based on my observations, I predict the following:

- Similar to all new and improved concepts, the industry's cool roof membrane sector will be hit hard by litigation resolution with regard to condensation, building components' deterioration, energy loss, performance below what was promised, and interior and exterior injury cases because of slippage.
- The government's control of the industry on various fronts will continue to grow.
- Life-cycle assessment will push the requirement for long-term performance to the forefront.
- Implementation of solar appurtenances will increase—chromatic (phase-changing) materials that change color as temperatures change will make their first appearance.
- Material costs will continue to increase for at least another year, contributing to the benefit of providing long-term performance.
- The number of building owners requesting long-term performance up to and beyond the 39-year tax depreciation schedule will increase.
- Roofing-related education of those affecting the industry will be undertaken by associations or a conglomerate of associations such as [NRCA](#), SPRI, RCI and the EPDM Roofing Association (ERA).
- Manufacturers and designers will look forward to the future when roofing asphalt either is no longer available or not cost-effective.
- Roof systems with built-in energy producers will be introduced (such as hot water piping embedded in roof insulation) in the initial push to take advantage of the sun's energy.
- Some things will never change. There still will be multiple codes; standards will continue to be introduced based on pressure from special interest groups; new, untested products with a multitude of promises will grow; and confusion will remain.
- Standards associations such as ASHRAE will begin to see the effects of their decisions, good and bad, and will seek input from the industry.
- Strategies for mitigating rising costs will include land banking roofs; carbon credit or carbon sinking; and the growth of income-producing biofuels, biomaterials and roof farms.

As always, the future holds promise for some and concern for others. You should continually educate yourself, provide quality documentation, plan ahead and be flexible.

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