

White vs. Black: does membrane color matter?

In the roofing game, everyone's looking for an edge, some advantage that makes their product the right choice for at least a segment of the roofing market.

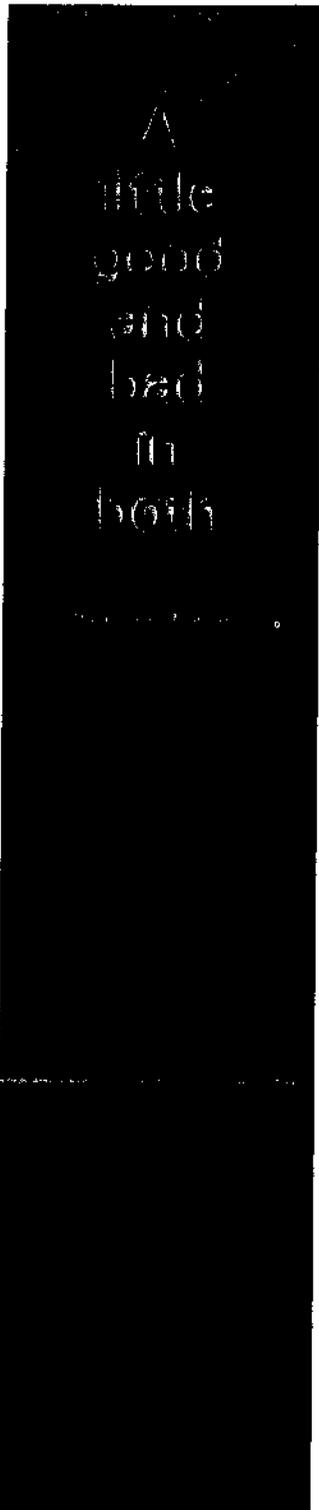
The manufacturers of white roofing membranes believe they've found their edge. They claim that their white roofs wear better, look better and save more energy than their black counterparts. As one manufacturer says in its literature, the white color "reflects sunlight, lowering internal building temperatures, reducing the load on air conditioners and prolonging membrane life." While no manufacturer is selling its product on the merits of color alone, most devote at least a paragraph in their brochures to the benefits of a white surface.

Despite these manufacturer's claims, the jury is still out on white roofing's superiority. Some industry experts are taking a hard look at the energy efficiency and weatherability of these products as well as the ability of traditional roofing to offer the same benefits.

Upon reflection

The manufacturers of white roofing base their claims on their products' ability to reflect the sun's rays. This keeps the roofing system and the building's interior cooler during the day, they say, reducing cooling costs.

The Du Pont Co., which manufactures Hypalon®, a white synthetic rubber that is used in some single-ply membranes, has studied the effects of white roofing on energy costs. According to Du Pont's computerized research, "Cumulative annual energy consumption for the combination of both heating and cooling is less for white roofing based on Hypalon than conventional black roofing materials, despite geographic location." Over a 10-year period, an owner of a commercial building in Phoenix would save \$1.16 per square foot (based on 1984 costs), while in Chicago an



owner would save 38 cents per square foot, the company claims.

Citing another computer study, DuPont reports that Hypalon's white surface can reduce air conditioning loads from 33 to 66 percent. "At the same time," according to the company, "the program indicates that the heat loss in winter is negligible."

Many manufacturers also state that their white membranes weather better than black materials. Because the system remains at a nearly constant temperature throughout the day, they reason, it is not subject to the life-shortening stresses experienced by roofs that must endure daily heating and cooling cycles.

Most of these claims are being made by plastomeric single-ply manufacturers. Their products are based on such chemicals as Hypalon (its generic name is chlorosulfanated polyethylene or CSPE), chlorinated polyethylene (CPE), polyisobutylene (PIB), or polyvinyl chloride (PVC). High reflectivity is only one of the benefits these products offer, according to the manufacturers. Some also resist the damaging effects of ultraviolet radiation, fire, oils or chemical contamination. In addition, these systems may be easier to install than traditional roofing, with seams that may be either heat welded or glued.

Some EPDM manufacturers have also experimented with white rubber roofing, but these membranes have not met with much success. Both Carlisle SynTec Systems and Firestone Building Products Co. have produced white roofs on a trial basis but have rejected the idea of full production because of dissatisfaction with the membranes' quality, according to persons at each company. They found that when they substituted titanium dioxide or other white chemicals for the carbon black that is used as a filler in rubber roofing, they lost some of the benefits, such as strength and ultraviolet radiation resistance, that the carbon black provided.

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Black roofs may be lightened

It may not be necessary to abandon the use of black bituminous or EPDM systems to gain the benefits of reflective roofing, however. Paints, coatings and surfacings as well as light-colored ballast may also add some degree of light and heat resistance to a dark-colored roof membrane. Don Backenstow, director of research and development for Carlisle, said that 60 percent to 70 percent of his company's business involves ballasted roofs "because it's a relatively inexpensive way of providing a reflective covering; it's very cost effective."

Coatings may need more maintenance than building owners can provide or afford, however. Some paints will need to be reapplied every few years. Dave Bailie, marketing services manager for Firestone, says the white Hypalon-based paint his company sells to coat its black EPDM roofs "has to be put down in the right thickness in the right way or problems can occur; it may chip off, flake or peel."

Depending on ballast to protect a black membrane has its drawbacks, too. In addition to adding weight to the system, the ballast can increase costs and installation time. Also, the ballast can thin out or move, making the membrane in that spot more susceptible to heat and ultraviolet radiation, according to Steve Condren, technical

director for Cooley Roofing Systems, manufacturers of white CPE single-ply roofing. Another problem with systems, such as EPDM, that are ballasted with round washed river rock is that the ballast is really light tan, not white. Bailie explained that the pure white stone that would offer the greatest reflectivity has sharp edges that could damage the membrane.

Getting results

Before choosing any membrane or surfacing to achieve a white surface, the professionals involved in the decision should make sure the choice will produce the desired results. If a white roof is preferred for aesthetic reasons, the choice is simple. "Our research shows that white membranes have the most appeal in new construction," says Bailie. "If the building owner and the architect are interested in beauty, white is prettier than black."

But if a reduction in cooling costs is desired, a white roof may not be the better choice. A host of factors in addition to the membrane's reflectivity will determine a roof system's energy efficiency. In some instances, the installation of a reflective roof will reduce the owner's overall energy costs, while in others a white roof will make no difference at all.

"Every building is unique, depending on how they insulate the walls, how they insulate the roof, and whether it's a retrofit or new roof," says Cooley's Condren. "Each individual building has to be carefully evaluated before determining which roofing system is right for it."

One factor that must be considered is the roof assembly's overall insulation value. "If there's an R-value of at least 15 on the roof, it doesn't make any difference what color the roof is going to be because the effect on the cooling savings is going to be negligible," according to Charles N. "Rusty" Griffiths Jr., president of Binghamton Slag Roofing Co. in Binghamton, N.Y.

Backenstow agrees with Griffiths, but his view of white roofing's effectiveness is even more pessimistic. According to his estimates, a white surface will be most beneficial on roofs with an R-value of 10 or less. "Above that the extra cost of a white roof doesn't justify the savings," he said. "If it costs another 20 or 25 cents a square foot to put the white down, it takes a long time to get that back in air conditioning savings."



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Other white roofing products are also being used more frequently in the Southwest, according to Mullis. In recent years, the use of CSPE has increased in the Phoenix area. The material is applied either as a liquid coating or as a single-ply membrane. Mullis says that the use of a white Hypalon-based membrane can make an installation easier by eliminating the need for a coating or ballast. "That's one step you don't have to do," he said. "That certainly helps the product."

Mullis' own company, Universal Roofing, has been installing CSPE roofs for the last four years. "So far, so good," he commented. "But with longevity, I have no idea how it's going to do. It looks like it's going to be fine, but it's a little early to tell. In the 30 years I've been around this business, I've learned not to make predictions."

Durability a concern

As Mullis' remarks illustrate, the longevity and durability of the systems are major concerns for many who are considering installing a white membrane. They worry that expensive replacements or repairs will quickly eat up any savings in cooling costs a reflective roof might offer.

Even the amount of dirt and dust in the atmosphere will affect a white membrane's performance, some believe. As a roof gets dirty it becomes less reflective and it begins to absorb more sunlight and heat. Backenstow, observing that a white roof will darken and absorb more heat, said, "The cost calculations get a little funny over time." He recommends that a white roof should have a slope of $\frac{3}{16}$ inch per foot to allow dirt and water to drain off.

Referring to white roofs as a maintenance item, Backenstow says that a building owner should be aware that he'll have to invest some money to preserve the roof's original properties. "We've always felt it's difficult to provide long-term performance with a white roof," he commented.

This concern may not be justified in all cases, however. Some manufacturers claim their white plastomeric systems are actually more durable than black materials. Cooley, for instance, promotes its CPE membrane as having the highest ultraviolet radiation and ozone resistance of any single-ply product. These properties will help keep the membrane in service for more than 30 years, the company says.

Cooley also points to its product's tear and puncture resistance, which, it says, comes from the polyester fabric that is used to reinforce the CPE.

"Our oldest installation will be eight years old this year and it's still a viable membrane," said Condren. "It hasn't lost any millage. The tensile properties essentially are unchanged. That would indicate the roof is going to go longer than its warranty life of 10 years."

Some white membrane manufacturers also claim that their products will last longer than conventional or rubber roofing on rooftops that are exposed to harsh contaminants or oils. On the other hand, as Carlisle's Backenstow points out, "Every polymer has a hit list of chemicals that will disturb it. Those that are more resistant to oil are less resistant to water."

Griffiths agrees that there seems to be a trade off between properties. "You have to analyze what the possible contaminants are and pick the best system for the possible contamination," he recommends. "Most of our Hypalon jobs have been for contamination problems, and with the PVC roofs we've installed, the major reason seems to have been the fire rating."

Weighing the good and bad

The widely varying opinions presented in this article may leave some readers even more confused about white roofing's desirability or effectiveness. Unfortunately, it is impossible to make a blanket statement about the systems. Each system, whether white or black, coated or ballasted, has its good and bad points. "You have to sit down and scratch the numbers, knowing the climate that's involved, and find what's attainable," says Carlisle's Backenstow. "You must determine what you are shooting for and what's the most effective way of doing that. To get a white roof you give up something in performance and so you have to weigh the pluses and the minuses."