# WOULD YOU LIKE THAT ROOF Supersized?

BY ROB REALE

American consumers are always looking for value, and we love to have options. Fast food restaurants with their medium, large, and supersize value meals are perfect examples of our desire for choices. Maybe that's one of the reasons that single-ply roofing now accounts for nearly 50% of the commercial roofing market, according to a 2007 market share study conducted by NRCA. The market share continues to grow, with a diverse selection of roofing options. Highly reflective TPO membrane is popular in warm southern climates, while EPDM continues to be favored in northern markets where winters are harsh and heating-degree days outnumber cooling-degree days. Single-ply membranes can be ballasted, mechanically fastened, or fully adhered, resulting in even more choices of fasteners and adhesives. Finally, regardless of membrane type, the thickness must also be chosen. Of all the choices along the way, thickness may be the most important, though its significance is often overlooked.

Selecting a thinner roofing membrane over its thicker counterparts can be a shortsighted decision, not to mention a costly one. Whether it's EPDM, TPO, or PVC, there are several reasons that a thicker membrane will deliver both greater performance and a more solid return on investment.

### An Issue of Dollars and Sense

In many instances, cost is the deciding factor in selecting membrane thickness for a given project. However, in most cases, the membrane cost is viewed in the wrong context, creating a misleading perception of its effect on the overall cost of the job. For instance, the increase in material cost from a 45-mil to a 60-mil single-ply membrane is slightly more than 20 percent, which might sound like a hefty increase but is minimal in relation to the overall installed cost of the entire roof system. When considering the additional cost, total installed cost vs. return on investment is the accurate barometer.

A typical project involves costs for design, insulation, labor, and materials. A membrane upgrade only affects material costs. Thicker TPO or PVC membrane can be welded without changing the welder speed or temperature settings. EPDM makes use of the same seam tapes, regardless of membrane thickness. Detail flashings do not change based on the membrane thickness. In either case – thermoplastic or elastomeric systems – labor and flashing costs should remain virtually unchanged.

Increasing from a 45- to a 60-mil membrane typically adds as little as 5 percent to the cost of the roofing installation. If the project involves the added expense of a tear-off, the percentages are even less: approximately 2-3 percent. However, the return on investment from making that switch is substantially improved, as the projected lifespan of the roof can be increased by as much as 33 percent.

In almost any situation, most individuals would pay a little extra for a yield of that magnitude. That's how the fast food chains continue to supersize the American population! However, unlike extra fries and soda, a beefed-up roof provides additional protection from its mortal enemies – careless tradesmen, chemicals, animal fats, and UV exposure. When the numbers are added up, the supersized roof is clearly the greater value.

### Return on Investment (ROI)

A basic math calculation can be used to determine ROI in roofing. Simply divide the cost per square foot by the projected length of service, and the results are a no-brainer. This equation shows that the increased installed cost of thicker membrane actually saves the building owner money over the projected life of the roof.

Sandra Gray, RRC, roof consultant and president of the Moriarty Corporation, with offices in Texas and Connecticut, is a leading proponent of using thicker roofing materials. "If I had my choice, I would specify the heavier 75-mil membrane every time," said Gray. "If the owner intends to keep the building for an extended period of time, we tend to specify a thicker material to minimize life cycle costs."

This same logic can easily be applied to the remainder of the assembly. *Figure 1* compares the average installed cost per square foot of a 30-, 20-, and 15-year fully adhered single-ply system. The 30-year system is based upon one manufacturer's[1] 30-year warranted EPDM specification that calls for 90-mil EPDM, cover board, and prefabricated, ES-1 certified metal edging, among other design enhancements. Even with the enhancements, the 30-year system more than pays for itself with additional service life. In the spirit of supersizing, this 30-year system also features increased warranty protection for higher wind uplift, hail up to two inches in diameter, and accidental puncture. That's even better than getting a free hot apple pie with your value meal!

### Save Green While Building Green

The numbers are clearly favorable when projected over the life expectancy[2] of the roof. However, these estimates are based on

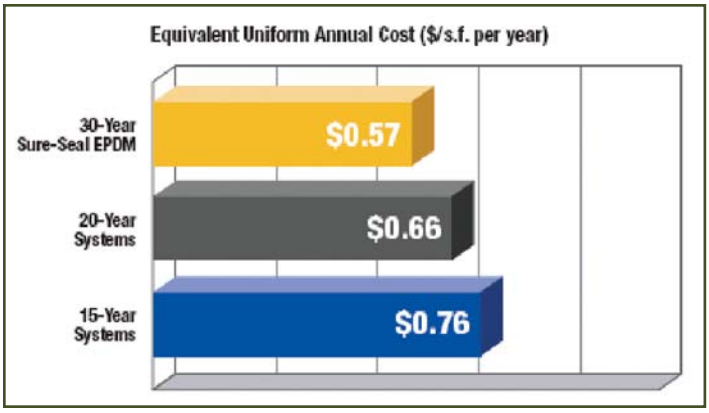


*Figure 1*

a typical roof installation using the ASHRAE 90.1 minimum standard for insulation: R-20 (in climate zones 2-8). If these equations were calculated using the PIMA recommendations of R-25 (zones 2-5) or higher, the percentage of the cost increase for thicker membrane relative to the total installed cost of the roof system would appear even less significant. In all climate zones, insulation can aid dramatically in reducing cooling and heating loads, lowering energy costs, and reducing pollution and carbon emissions.

In this day and age, it is hard to imagine specifying a roof that is destined for a landfill in approximately 15 years. Seldom do architects or specifiers design 15-year systems. The push for these systems typically rests with building owners and roofing contractors, who value-engineer their roof designs in order to generate a system with a low sticker price.

"Frankly, too many people are looking exclusively at installed cost," laments Steve Chaffee, principal of Chaffee Industrial Roofing in Rhode Island. "I can't tell you how often I hear superintendents asking, 'What do I care? I won't even be here in 20 years.' It can be frustrating."

This approach is no more responsible for the planet than it is for building owners' bottom lines. Those in the roofing community are often puzzled by this conventional wisdom, or lack thereof, which does not seem to happen at any other point throughout the building process. Imagine the impact and potential fallout of specifying a 15-year foundation or exterior wall. The rest of the building is intended to stay erect for a very long time; yet often, the roof is not. If the building is designed to last for decades or more, it should have a roof protecting its contents and inhabitants for that same duration. A 15-year roof – especially one that is minimally insulated – is a promissory note to the landfill: "See you soon!"

### Can the Membrane Be Recycled in 15 Years?

Though initiatives are under way for recycling membranes at the end of their service lives, the industry as a whole is still in its infancy. Currently, systems have to be torn off, packaged, and transported to a grinder. Postconsumer, recycled content can be reintroduced into the bottom ply of thermoplastics and into EPDM sheeting, but it is more often used in accessories such as walkway pads. The current reality is that recycled materials cost significantly more than virgin raw materials, and it will remain this way until additional uses for the recycled materials are identified and production volumes are increased. Rather than simply dispose of the material, roofing contractors are also finding it more expensive to tear off materials in accordance with grinder specifications and then ship them to the nearest recycling facility. Building owners are very rarely willing to absorb the additional cost associated with recycling the aged roofing membrane.

"We've already proven that EPDM is recyclable," states Scott Long, EPDM product manager for Carlisle SynTec and member of the EPDM Roofing Association's (ERA) technical committee. "It is a top priority of ERA and its entire membership to identify additional viable sources for the ground material that will provide a more desirable option than landfills."

## Life Cyle Analysis Programs Show Savings

A good life cycle analysis program such as Roof$ense or the U.S. Department of Energy's Cool Roof Calculator can project comparative life cycle costs for different membrane thicknesses, effectively demonstrate the potential energy savings realized with additional insulation, and calculate the carbon footprint benefit of reduced energy consumption. Such tools can help building owners understand the tremendous payback of a more sustainable roofing assembly.

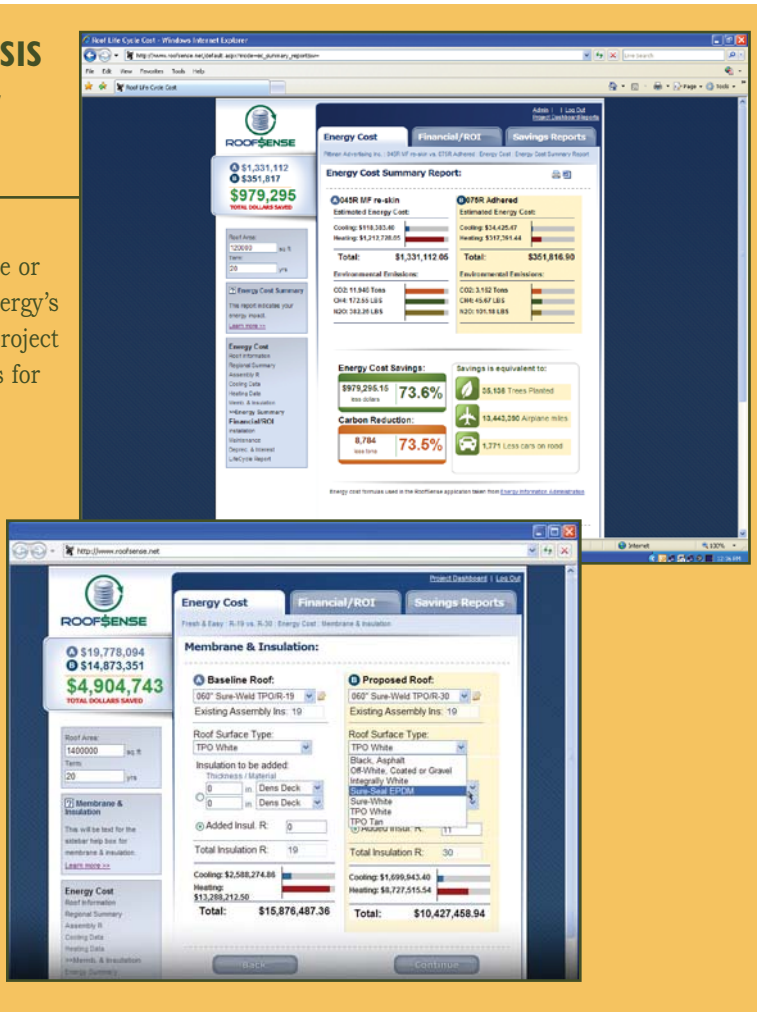

*Figure 2 – Debris left by maintenance crews for various rooftop mechanical equipment increase the risk of a puncture.*

Clearly, recycling is a high priority for most roofing manufacturers, but it is impossible to speculate where the industry will be in 15 years. From an environmental standpoint, manufacturing materials consumes energy, but the difference between manufacturing thinner versus thicker membranes is minuscule, and materials still have to be transported to the job site. The environmentally responsible choice is not to wait to do it all over again in 15 years in the hope that recycling technology will have advanced accordingly.

### Thicker Membrane Offers Increased Puncture Resistance

Unlike choosing the varying grades of gasoline at the pump, which offer the consumer similar performance at different prices, with the buyer returning a week later for another fill-up, regardless of grade, there are several benefits to choosing a premium or ultragrade roofing system. With a little common sense, it is easy to realize that thicker material will be more puncture resistant than thinner material.

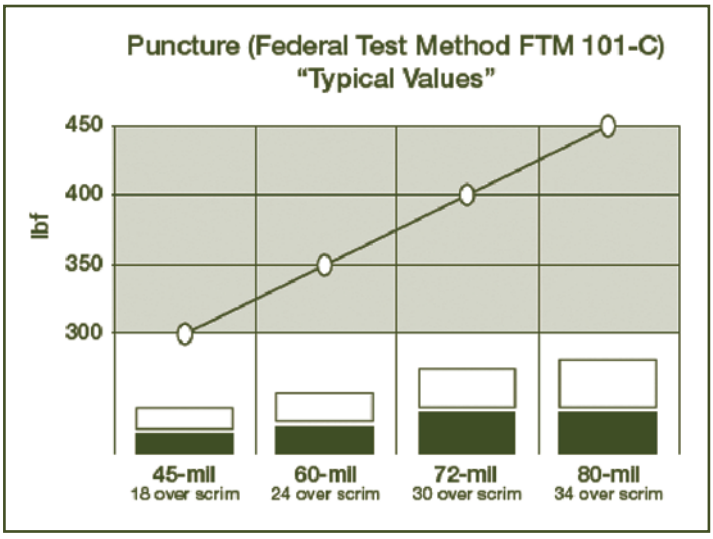


*Figure 3*

Sources of puncture on a roof can vary, but the most common are abuse by other construction trades and foreign objects being dropped by maintenance personnel (*Figure 2*). Thicker materials will not resist all of these inappropriate actions, but they can significantly minimize the potential damage. Laboratory testing shows a 50 percent increase in puncture resistance from a 45-mil-thick membrane to an 80-mil-thick TPO membrane (*Figure 3*).

"We've done a lot of roofs in Chicago-town, and usually when a leak occurs, it's because somebody dropped a tool and punctured the membrane," says Gray. "We specify a lot of 75-mil [reinforced EPDM], especially when there is a lot of mechanical equipment, because we believe that it offers much more puncture resistance."

Mother Nature takes her shots at roofing materials, too. Reports of TPO and EPDM roofing systems surviving substantial hailstorms are common, and simulated hail testing over a variety of substrates and temperatures showed membranes 60-mil or greater displaying excellent resistance to damage. In fact, a recent laboratory study conducted by Jim D. Koontz and Associates Inc. (JDK), Hobbs, NM, shows that both new and aged nonreinforced EPDM roof assemblies offer a high


*Figure 4 – Three-inch hailstone impacting EPDM membrane, tested over OSB. To obtain a copy of the full report on Koontz's research, visit* ***www.epdmroofs.org****. (Photo courtesy of Jim D. Koontz and Associates Inc.)*

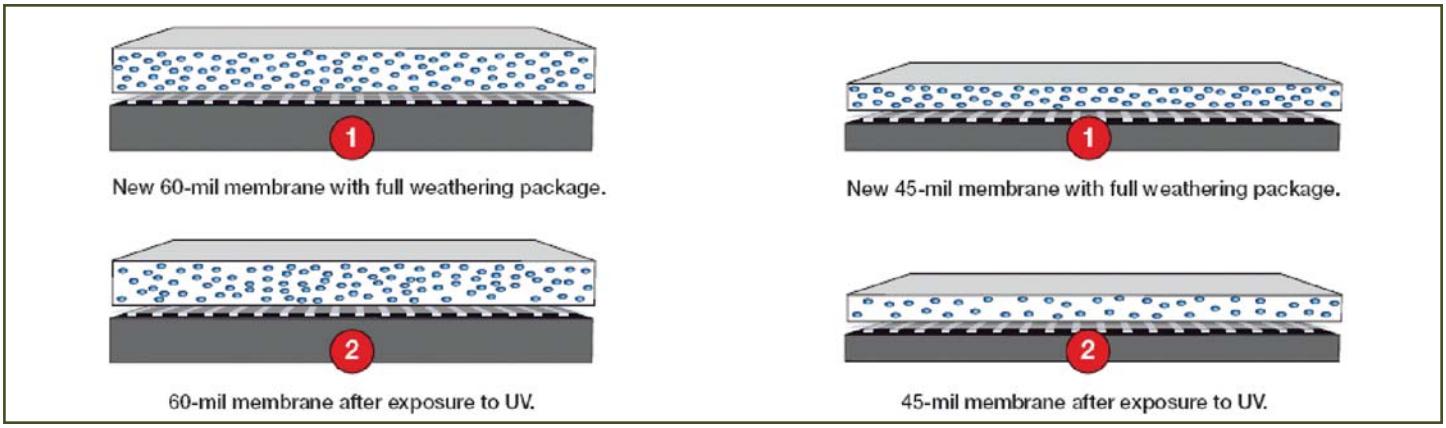


*Figure 5*

degree of hail resistance over a variety of roofing substrates. Of the 81 60-mil, nonreinforced EPDM targets installed over polyiso, wood fiber, plywood, and OSB board, 76 EPDM roof assemblies retained their waterproofing integrity when impacted by hail up to three inches in diameter.

### Thicker TPO Contains More Sunscreen

Popular in warm, southern climates due to its high reflectivity, TPO membrane is enhanced with a weathering package that protects the integrity of the sheet and prolongs its service life. As the sun beats down onto a rooftop that is waterproofed with TPO membrane, the weathering package contained in the TPO formulation will protect the surface from degradation caused by exposure to UV rays. As the weathering package on the surface of the membrane is depleted, reserves within the remainder of the membrane will continue migrating upward (*Figure 5*). The thicker the membrane, the greater the weathering package and the longer the surface will retain its smooth, glossy appearance. A common term for this phenomenon is "the reservoir effect."

To combat the negative effect of the UV rays associated with exposure to the sun – particularly for buildings in hot, southern climates – TPO manufacturers offer a variety of membrane thicknesses ranging from 45 mils up to 80 mils. Because it is thicker, the 80-mil membrane inherently features more weathering package than a 45-mil membrane, thus providing a potentially longer service life.

"The reservoir effect on a thermoplastic membrane can be compared to sunscreen, which features SPF values ranging from two to 50," comments Randy Ober, thermoplastic product manager for Carlisle SynTec. "Sunscreen with an SPF value of two is a

good sunscreen, but it will not protect your skin for the same duration as a sunscreen with an SPF value of 50. This is especially important in climates that experience high levels of radiation from the sun. For example, while an SPF value of 15 may be fine in Bangor, Maine, that same level of protection may not be adequate in Phoenix, Arizona."

Therefore, a thicker TPO membrane will offer longer protection against the dangers of solar UV rays. This is not to say that thinner TPO membranes are not a solid investment; however, predictably, their weathering package will dissipate more quickly than that of a thicker membrane if they are exposed to excessive solar UV rays.

### What a Roof Wants to Be When It Grows Up

In the past, a rooftop was intended to keep the building dry. Advancements in the green building movement have revealed that a roofing system can save significantly on energy costs with the addition of insulation and the use of reflective roofing in warm southern climates. The future of roofing now looks even more varied. Cities and municipalities are offering incentives for – and in some cases, mandating – the use of vegetative roof systems. Most vegetated roofing specifications require a minimum of 60-mil membrane and recommend even thicker membranes. Since roof garden system costs can soar to over $30 per square foot, the membrane cost on a garden roof is even less significant than the illustrations above.

While energy-saving roofs are the trend today, energy-producing roofs are inevitably where the industry is headed. As roof-mounted photovoltaic (PV) solar systems become more popular, the issues of puncture and traffic resistance become even more serious. PV systems will require regular maintenance and inspections, which will increase the chances of damage being caused by traffic and by tools dropped on the roof. Given that the cost of PV systems can reach $40-$50 per square foot, property owners should specify extra protection for their roofing investment to ensure that their PV systems are not prematurely or frequently taken out of service while the underlying roof is repaired. They will need to understand that the extra cost of a thicker membrane, whether a 90-mil EPDM or an 80-mil TPO, pales in comparison to the expense of prematurely replacing the roof membrane below a PV system.

Sandy Gray was quick to point out that the Moriarty Corporation has many rooftops throughout the country with aged 45-mil EPDM roofs. "We do like EPDM because it is not deteriorated by UV, and we can extend its service life by restriping the seams and flashings. Most of these roofs make it well past 15 years, some as long as 22 years, before needing major service." This is admirable performance by any measure, but Gray went on to state that she will continue to specify thicker materials. "I think it's reasonable to expect 30 years and beyond from a roof."

### Footnotes

1. Based on a Carlisle SynTec 30-year Sure-Seal® EPDM system. Other manufacturer specifications may vary.
2. Life expectancy refers to the warranted term for coverage of the roof system. In many cases, the roof will last beyond the warranty term.


Rob Reale

Rob Reale has over 15 years of experience in the construction industry, having started as a laborer framing houses in New England in the early 1990s. Having earned a bachelor's degree in visual communications from the Art Institute of Fort Lauderdale, he went on to become a partner in Brand Identity Group in Newton, MA, which specialized in both the commercial roofing and aerospace industries. Reale now serves as communications chair for the EPDM Roofing Association and is manager of Carlisle Creative Services.


## California Silica Dust Regulation Exempts the Rooftop

When the California Occupational Safety and Health Standards Board formally adopted Section 1530.1 of the Construction Safety Orders, it exempted rooftop operations from the "silica dust regulation." Breathing of silica dust, created when power tools or equipment are used to cut, grind, core, and drill concrete or masonry, has been linked with silicosis, lung cancer, chronic obstructive pulmonary disorder, and diminished lung function.

The new regulation generally requires the use of a dust reduction system, such as application of water or exhaust ventilation, when power tools are used with concrete or masonry materials.

The roofing industry argued that use of wet saws, vacuum systems, and other methods of reducing dust on the roof would only exacerbate the danger for roofers on sloped-roof surfaces. The California Professional Association of Specialty Contractors (CalPASC) and Roofers Local Union 81 convinced the standards board to include, "A dust reduction system is not required for rooftop operations with roofing tile, roofing pavers, or similar materials." If such activities take place on the ground, the regulation still applies, however.

At the same time that roofing contractors are permitted to dry-cut silica-containing materials on sloped-roof surfaces, they are required either to make sure that employee exposures to crystalline silica dust are below the permissible exposure limit (PEL) specified in 8 CCR 5155 or to otherwise supply respirators. Employers must also train their workers on the possible health hazards of breathing silica dust.

The exemption will disappear as soon as dust reduction systems are developed that can be safely used on sloped roofs.

California's law is believed to be the first safety regulation in the country to address construction worker health in regards to silica dust.

*— Western Roofing*