




Re-roofing

Requirements Mean Radical Changes

It will cost more, perhaps a lot more, to do it right. But the cost of not doing it right could be even greater!

By Richard E. Norris PE RRC D. Eng.

"REPLACING THE ROOF" is not just replacing the roof anymore. If you comply with all code requirements, you may end up converting your building into a compost pile. This is the extreme, of course, but in reality, lack of knowledge on the part of the owner, designer and contractor during re-roofing has turned more than one re-roofed condominium complex into self-composting buildings. Correcting this requires another re-roofing project, frequently less than 10 years later. Only this time, the roof, deck and insulation are being replaced; and, many of the rafters are either replaced or reinforced due to advanced wood decay (dry rot).



Code changes require bringing the attic ventilation up to current standards as part of a re-roofing project. The alternative permitted by the California Residential Code is adding impermeable (closed-cell spray foam, for example) insulation in the most expensive place to install it – directly under the roof deck. In many cases, the roof will also need to meet “Cool Roof” requirements of the California Energy Code. These requirements can involve adding insulation and installing reflective roof covering materials, which is best done by removing the ceilings under the roof deck.

Changing attic ventilation, adding insulation or changing the reflectance of the roof covering materials changes the way the roof-attic-ceiling assembly handles heat and moisture. Moisture issues are much more complicated in more energy efficient construction. Less air leakage results from tighter building envelope construction. It is good for reducing heat movement, thereby improving thermal efficiency. But it also reduces the potential for moisture movement and the resulting drying.

If code-required energy efficiency “improvements” are not properly designed and constructed, the result may be the accumulation of condensed moisture in the roof-attic-ceiling assembly. Accumulated moisture allows the growth of mold and the decay fungus. It can change buildings that worked into self-composting buildings – buildings that decompose around us.

The responsibilities of those designing roof covering replacements are not as clear as they were for those involved in the initial design and construction of the roof. The building owner should hire a designer knowledgeable in building envelope science when planning a roof covering replacement. The only exception is the rare case where an existing roof covering (asphalt

composition shingles, for example) is being replaced by similar materials of the same color (same solar reflectance) and where no additional ventilation or insulation is installed. Changes to the codes in the last 10 years make these cases the exception.

Roofers are not designers. They do not typically have sufficient building science knowledge to design the roof covering replacement with the improvements required for energy efficient construction. Their education and experience is in the assembly of the roofing system according to the design. Similarly, good designers should not install roofs. Their expertise is in the design of the roof-attic-ceiling assembly.

Unfortunately, not all of the traditional roof designers – architects, engineers and roof consultants – have sufficient building science knowledge, either. This significant change in building envelope design toward energy efficient construction caught the industry off guard. Most designers are scrambling to catch up. Unfortunately for them, there are few opportunities for the continuing education they need, and what is available, as well as the new tools they need, is generally expensive. As a result, a re-roof design will cost far more than it would have 10 years ago.

Few of those writing reserve studies have any idea of this change, either. There will be a significant adjustment in their industry as the actual costs come in.

Building departments have been laying off staff during the recession that hit our economy about the time that these code changes were introduced. The remaining staff rarely had the budget or the time to get the training necessary to review the new code requirements. Again, even if they had the budget and time, the training needed to understand the changes is not readily available.

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The trial lawyers specializing in construction defect litigation are getting ready to fight the battles in the legal system. The only winners from those legal battles are attorneys and expert witnesses.

Paraphrasing the attorney for Lord Grantham in the popular BBC television program *Downton Abbey*: "If what I am saying does not scare you, I am not stating it properly."

Re-roofing can cost as much as two to three times more than anticipated. It will be more complex and may involve major reconstruction of attic ventilation and the addition of insulation, as well as the installation of a cool roof. The risk is not just that the re-roof design sent to the city building department may be rejected for not following code; ignoring the building physics in roofing assembly redesign could turn the structure into a self-composting building.

Some of the code requirements are unnecessary or even contradictory. It would be easy for a contractor to unknowingly convert an existing structure into a self-composting building, even if he follows (and perhaps because he follows) the requirements of the codes. Most contractors understand how to install the roofing system, but few understand the building science required to avoid these pitfalls. Building owners who rely on well-meaning contractors may wind up with extensive wood decay in the roof deck and framing and mold in the insulation and on the roof framing, roof deck and roofing.



Re-roofing may become necessary again in a few years, only this time they will also be replacing the roof deck and reinforcing or replacing the rafters.

Pictured is one example of what happened at an HOA when a dark-colored roof was replaced without adding ventilation (now required) on a non-air conditioned condominium unit in the Southern part of the San Francisco Peninsula. The computer model shows that it would have still accumulated condensation, even if it had been ventilated. The roof system was rebuilt with closed-cell foam (in this case polyisocyanurate) insulation boards on top of a new roof deck and no ventilation.

Shortly after the existing built-up ("tar" and gravel) roof on this condominium complex was replaced with a new cool roof, the unit owner complained of water dripping into the unit through the ceiling on cold days. Most of the fiberglass batt insulation was removed before this photograph was taken. It had a lot of mold in it. Some of the roof deck and the vertical faces of the rafters have decay fungus white fibers (mycelia mats) covering them, a sure sign that there is advanced decay within the wood. The plywood roof deck was severely deteriorated. In places, it was so badly decayed that it was easy to remove the plywood by the handful. ■

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