BY STEPHEN MEAD AND JIM WHEELER

Fire-Wise Construction

Building strategies that may save your house from a wildfire

Along with most people, we watched on television as devastating wildfires ripped through Southern California last fall. These fires moved faster than fleeing cars and leapt multilane highways, threatening even more homes while frustrating firefighters.

So much happened all at once that it was hard not to be overwhelmed by the magnitude of the event. And it was even harder knowing these losses, more than 3,400 homes, could have been reduced significantly. It is said that lightning doesn't strike the same place twice, but wildfires do. And if we are to live in these danger zones, the way we build our homes has to change.

Because it is nearly impossible to duplicate wildfire conditions in a laboratory, precise testing on materials and construction assemblies have not been done. But we still can make our houses safer by reducing things that burn with good landscaping techniques and noncombustible building materials.

A good site plan is your first defense against a wildfire

Consider fire defenses as a series of concentric spaces, or zones of managed landscape around your home (drawing p. 80). These zones act as natural breaks that can slow the spread of fire and don't have to look like a barren wasteland. Consult your local forest-service agency (www.fs.fed.us) for help with selecting plants that have natural fire resistance.

Long-term maintenance is also important. You should eliminate ladder fuels—vegetation that provides a path for fires to climb from the ground to the treetops—by removing tree branches that are within 12 ft. of the ground. Remove dried vines from the side of the house, keep gutters clean, prune shrubs, and remove dead leaves to eliminate potential fuel sources. Also, you should store firewood and flammable fuels at least 30 ft. from the house.

Noncombustible materials won't make a house fireproof

A noncombustible material like metal roofing or siding doesn't burn. But metal is an excellent heat conductor. During an intense fire, enough heat can be conducted through the metal to ignite the material behind it.

In conjunction with noncombustible materials, fire-rated assemblies can provide additional protection. A fire-rated assembly is a combination of materials forming a component of a building, such as a roof or wall, which resists ignition at the same time it is protecting the rest of the structure.

Photos: James Smalley (right); Corbis Royalty Free (above right).

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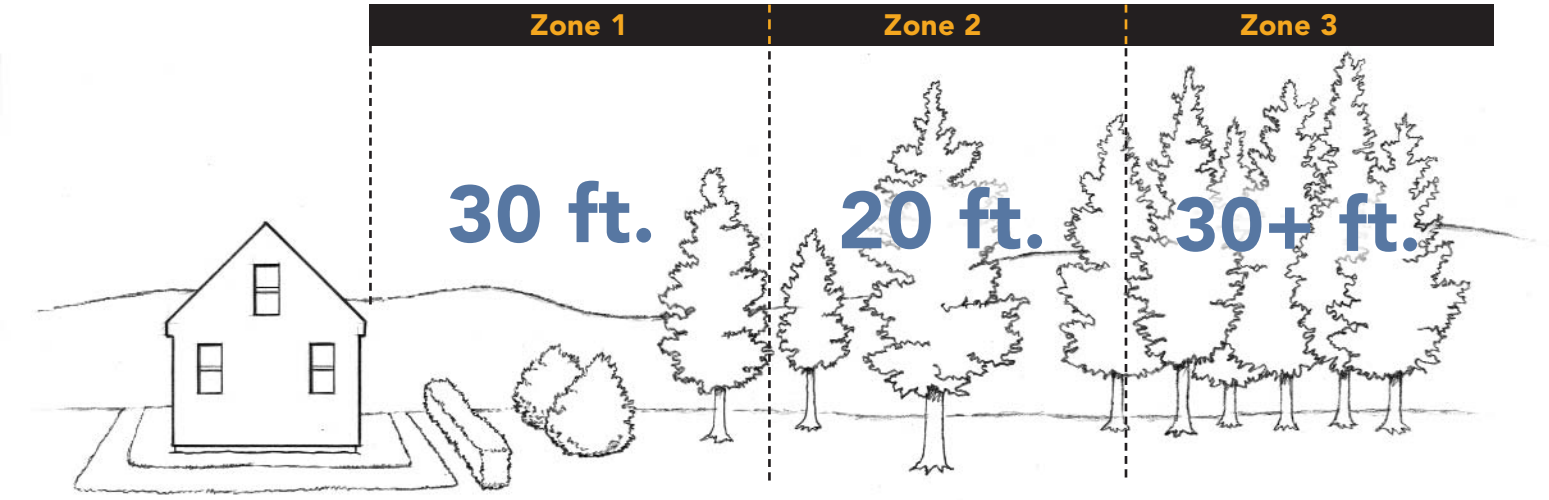
Hourly fire-resistance ratings are a function of the assembly and generally require the use of a noncombustible membrane (gypsum or masonry). The American Society for Testing and Materials (ASTM) has a test to determine the hourly rating of an assembly (E-119 Fire Tests of Building Construction Materials; www.astm.org). It exposes an assembly to heat and flame on one side and tests for heat transmission, burn-through, structural integrity, the ability to withstand water pressure from a fire hose, and the assembly's capability of carrying its own load.

The most vulnerable component is the roof

During a fire, wind-driven embers can stick to the rough surfaces or valleys of a roof. If roof materials are flammable, the structure can catch fire long before a wildfire arrives. Consider using steel, clay tile, concrete tile, or asphalt shingles with the maximum class-A fire rating based on the ASTM/Underwriters Laboratories (UL) fire test for roofing materials. The open ends of clay tiles should be sealed along the bottom course for optimal protection.

In some fire-prone areas, wood-shake roofs are outlawed, and for good reason. Although some of these roofs may get surface treatment, which has been known to wear off, most have no fire resistance whatsoever. One company, Chemco (www.chemco.org) of Ferndale, Wash., pressure-impregnates cedar shingles with an effective fire-retardant formula. The fire retardant reacts in high heat to neutralize combustible tars and gases that normally feed a fire. Although fire resistant, the shingles can be installed over gypsum sheathing for even better fire resistance.

Luck favors the prepared. *Building with fire-resistant materials, in this case stucco and clay roofing tiles, and properly managing the landscaping turned this potential sitting duck into the sole survivor.*



Creating a defensible space

Zone 1 should be a well-irrigated and regularly trimmed area that encircles the house. Use generously spaced deciduous plants; they don't ignite as easily as evergreens. Walkways, patios, masonry walls, and driveways can function as fuel breaks. In Zone 2, keep trees at least 10 ft. apart and remove low branches. Zone 3 resembles a natural area. Lower tree branches and highly flammable vegetation (including dead plants) should be removed.

A roof sprinkler system is, at best, a backup to a fire-resistant roof assembly (National Fire Sprinkler Association; www.nfsa.org). Although a wet roof can reduce the chances of radiant and direct-flame combustion, roof sprinkler systems aren't foolproof. Water pressure tends to be low during a fire, and if sprinklers are pump-driven, the electricity that powers the pump can fail. Also, fire-generated winds can redirect the spray from the roof.

The problem with soffits

Exposed soffits and eaves are potential heat traps and are at risk of catching fire. But this problem isn't the only threat. Soffit vents, designed to allow a roof to breathe, also provide a freeway for flames and heat to enter an attic (drawing below). To minimize exposure, enclose all eaves and soffits with a mold-resistant gypsum underlayment and cover it with a fiber-cement sheathing. To vent attic spaces, it's safer to use ridge or gable vents and to be sure all exposed vents and chimneys are covered with ⅛-in. corrosion-resistant steel screens to keep out convection-driven embers.

Enclose your house with firewalls

Exterior walls are vulnerable to both radiant and convective heat from a wildfire. During an intense fire, vinyl and aluminum siding melts, exposing the wall's vulnerable interior. A layer of ⅝-in. gypsum sheathing under either vinyl or aluminum siding can increase the level of protection significantly. However, noncombustible siding is the preferred choice of material.

Siding materials like cement stucco, stone, or other masonry materials are better choices if you live in a fire-hazard zone. But stucco and other masonry assemblies are prone to cracking and need to be maintained to be effective. Some fiber-cement products, such as Hardiplank (www.jameshardie.com), actually look like wood and provide inherent fire resistance. Fiber-cement panels cost less than wood products.

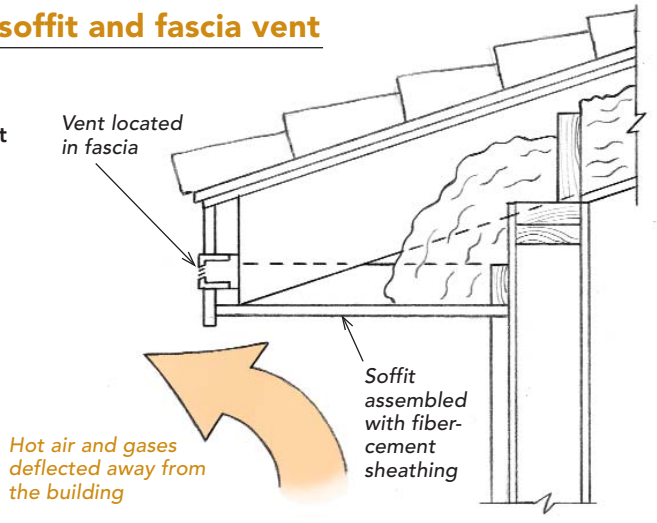
Logs, timber, and high-risk regions

After a wildfire rips through a forest, all that's left is blackened tree trunks rising from scorched earth. The thick trunks don't turn to ash because they have a low surface-to-mass ratio. They burn, but slowly, which is why heavy-timber and log homes are considered appropriate for medium- and high-risk regions.

The timbers must be at least 6 in. thick for framing members and exterior siding, and at least 3 in. thick for decking and stairs.

A noncombustible soffit and fascia vent

A flat soffit will allow the building to deflect a fire's heat better. But a soffit vent is a perfect path for fire to enter the structure. If it's the only place for the vent, then make sure it's placed as close as possible to the fascia. By relocating the vent from the soffit to the fascia, the amount of heat that enters the structure is reduced significantly.



Windows and skylights are vulnerable

Windows and skylights are weak points because they can fail before a building ignites, allowing fire to enter a house (which is why an interior sprinkler system is a good idea). During a wildfire, single-pane windows last a couple of minutes before they break. Thermopane and double-glazed windows last twice as long.

During a fire, the window's sash causes a differential in the heating and stressing of the glass, causing it to crack. On smaller windows (less than 2 ft. wide), cracked glass usually stays in place and continues to offer some pro-

Photos facing page: The Tileman Inc.; photo lower left: Metal Roofing Association. Drawings: Chuck Lockhart.

tection. But on bigger windows, glass falls out because it's too heavy for the sash to hold.

Your best bet, especially on the windward side of the house, is to use noncombustible shutters that latch to protect your windows. Another good practice is to use low-e (low-emissivity) tempered glass. The ultrathin metallic coating on the glass dramatically reduces the fire's radiant energy from entering the house and possibly igniting drapes or other flammable material. The tempered glass, although expensive, resists high heat that weakens most glass and resists impact from wind-thrown objects.

But low-e tempered glass needs to stay in place. Vinyl frames warp, then melt until the window fails. All-aluminum frames seem like the best choice because there are no combustible components; however, they melt at 1200°F. Wood sashes, while combustible, will hold the glass in place best.

If replacing your existing windows isn't an option, you can use full-cover metal screens or noncombustible storm panels (AGI Group; 800-823-6677; www.shuttertime.com) to protect windows from heat and flying embers. These galvanized-steel storm panels aren't rated for fire but are used to protect windows from hurricane-force winds and blown debris.

Wooden decks and fences are fire bridges

An attached trellis, deck, or fence should get the same fire consideration as a roof. A deck over a sloping site is the ultimate firetrap (drawing below). Fast-moving ground fires can ignite a deck, turning it into an unwanted barbecue.

If a wood deck is your only solution, enclose the perimeter below the deck with ⅛-in. metal screening or noncombustible siding. The screening will stop burning embers and combustible materials from blowing under the deck.

Choosing decking material is also important. A recent study conducted by fire marshals in Arizona showed that many of the new synthetic materials are more prone to fire than traditional cedar or redwood decks. Although more rigorous testing needs to be completed, you should choose these materials carefully. Trex (www.trex.com) and Boardwalk (www.certainteed.com) offer a class-C fire rating and were the best synthetics tested.

But even the best materials won't make a house fireproof. Peter Slack, an architect and firefighter, likens building a fire-resistant house to a watertight roof. If one little hole in the roof lets some water leak in, it doesn't matter how well the rest of the roof was built. The roof failed, the water got in, and the damage occurred. □

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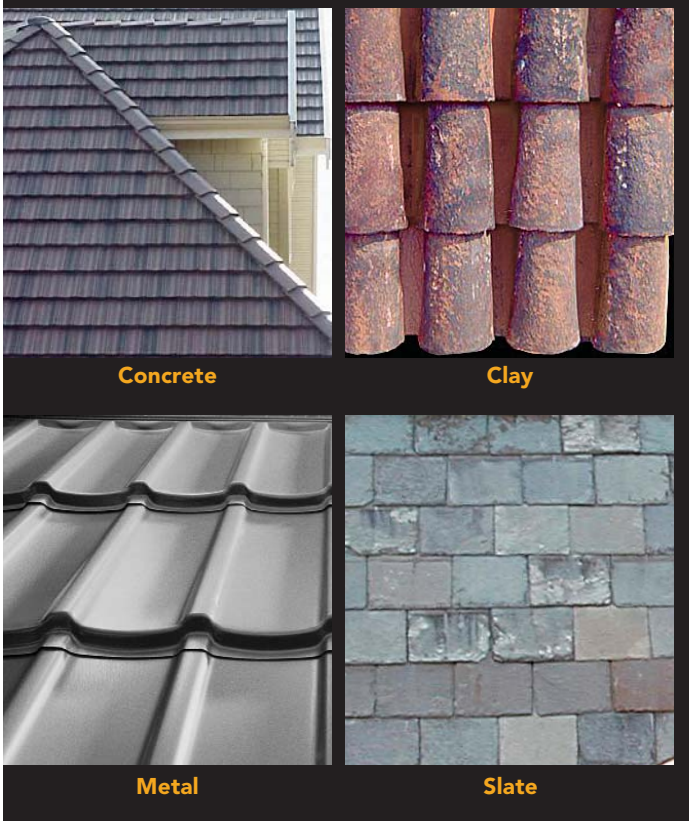
Roofs that won't burn



A roof catches fire when a firebrand or ember becomes embedded under the shingle from a wildfire's forceful winds. The wind blows on the ember, increasing its heat. These types of roofs (left) will not ignite. It is less likely that an ember can become embedded and ignite the subroof.

The danger from decks

Typically, decks are made from 2x materials. While perfect for load-bearing structures, 2x materials have a high surface-to-mass ratio and catch fire quickly. Encasing the exposed deck with fire-resistant materials and sealing the underside of the deck will deflect the fire's heat and reduce the fire hazard.