



Fire-Hardened Residential Construction:

Best Practices and Emerging
Technologies for Wildfire Resilience



Help **protect your home** from wildfires using fire-hardened residential construction technologies and techniques

As wildfires increase in frequency and severity,¹ the construction industry is turning to advanced, fire-resistant building techniques and materials to create “fire-hardened” homes that can better withstand extreme heat, direct flames, and wind-driven embers. California’s Wildland-Urban Interface (WUI) codes (CBC Chapter 7A) set minimum fire-resistance standards; however, advancements in materials, construction techniques, and technologies now allow builders and homeowners to exceed these requirements for superior protection.

What you'll find in this guide:

In collaboration with J.S. Held, we have developed this technical guide to provide advice and examples for those who are building a new home or remodeling an existing home in California. Please share it with your architect, builder, or contractor.

INCLUDED IN THE GUIDE:



Fire-Resistant and
Advanced Building Materials



Innovative Construction
Techniques



Emerging Technologies



Case Study: Malibu's
"Miracle Mansion"

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Wildfire **Risk** in Residential Construction

Ember storms, radiant heat, and direct flame exposure are the primary reasons a home could catch fire. Wind-driven embers can travel miles ahead of a fire and accumulate in vulnerable areas like roof valleys, vents, and under decks, where they can ignite flammable materials. Traditional construction materials — such as wood roofs, wood siding, and single-pane windows — offer little resistance to embers or flames, making homes highly susceptible to catching fire. In contrast, homes built with fire-resistant materials and systems have significantly higher survival rates. Noncombustible roofing, siding, and ember-resistant designs dramatically improve a home's ability to withstand wildfire exposure.

KEY CONSIDERATIONS

FOR FIRE-HARDENED HOMES

By combining fire-resistant construction, ember-proofing, and suppression technology, homes can be made significantly more resilient to wildfire threats.



IF YOU'RE BUILDING A NEW HOME:

- Consider using Class A fire-resistant materials for roofing, siding, and decking.
- Limit combustible materials in walls, insulation, and decks.
- Eliminate ember entry points, such as vents, eaves, and windows.
- Seal vents, fire-rated windows, and noncombustible soffits.
- Install fire suppression and early-detection technologies, such as automated sprinklers, ember-resistant vents, and AI-powered wildfire detection.
- Maintain a five-foot noncombustible perimeter and use fire-resistant landscaping.

IMPORTANT:

Residences or structures located in a Fire Hazard Severity Zone, per CalFire Fire Hazard Severity Zone Maps and the California Fire Code, must have 100 feet of defensible open space around all residences and 10 feet of defensible space along each side of driveways and roads. Additional driveway and fire hydrant requirements may apply to new or replacement structures, depending on the driveway length and dwelling size. Some county fire codes may impose further requirements.

IF YOU'RE REPLACING AN OLDER STRUCTURE:

Replacement structures must be reconstructed in compliance with the requirements for Moderate or Severe Fire Severity Zones (FHSZ or SFSZ) and adhere to the wildfire protection provisions outlined in the California Residential Code (CRC) R337 and the California Building Code (CBC), including:

- Section 704A: Ignition-Resistant Construction
- Section 705A: Roofing
- Section 706A: Vents
- Section 707A: Exterior Covering
- Section 708A: Exterior Windows and Doors
- Section 709A: Decking
- Section 710A: Accessory Structures



Fire-Resistant and Advanced Building Materials

The following sections outline the materials, techniques, and technologies required for new or updated home construction.

ROOFING (CLASS A REQUIRED) –

UL790 OR ASTM E108

Your home's roof is one of its most vulnerable surfaces. The Class A roofing materials listed below provide the highest level of fire resistance:

- Clay or concrete tile – hips and ridge caps must be mudded to prevent the intrusion of embers
- Metal roofing
- Slate roofing
- Fire-resistant composite roofing
- Gutters equipped with debris guards to prevent the accumulation of flammable materials

Best practices for fire-hardened roofing:

- Install fire-hardened underlayment to provide additional protection beneath the roof covering
- Use sealed edges and metal flashing to help prevent ember intrusion
- Use class A roofing underlayment if the roof decking is not fire-retardant treated wood

EXTERIOR WALLS AND SIDING

The following noncombustible or ignition-resistant siding materials should be used to reduce fire spread and radiant heat ignition, per ASTM E2707:

- Fiber-cement siding (e.g., HardiePlank®) – used for siding or trim
- Stucco – three-coat cement plaster
- Brick or stone veneer
- Metal siding
- Heavy timber – solid lumber or glue-laminated lumber with a minimum dimension of over 4" thick or deep
- Log wall construction
- 1-hour fire-rated exterior construction – must be tested in accordance with ASTM E119 or UL 263 by an independent testing laboratory
- Architectural features – all bump-outs, overhangs, and projections must utilize fire-resistant materials or construction techniques to reduce fire vulnerability

Use fire-rated sheathing (5/8" Type X gypsum) behind the siding for additional resistance, ensure tight joints, and use noncombustible backing to prevent embers from entering wall cavities.

GLAZING, DOORS, AND VENTS

Openings in a home's envelope, including windows, doors, and attic vents, represent critical weak points in wildfire defense. During wildfires, embers can easily enter these openings, igniting combustible materials within the home, while radiant or direct heat can compromise the integrity of standard windows and doors, making them more likely to break or warp.

The following materials should be used:

- Dual-pane windows or skylights – must have a tempered glass outer pane
- Fire-rated doors and glass – minimum 20-minute fire rating
- Glass block windows
- Metal-skinned doors and frames – includes garage doors





- Wildland flame and ember-resistant vents — must be approved by the CA State Fire Marshal or use noncombustible venting materials that comply with ASTM E2886
- Soffit and eave ventilation openings that are protected using approved metal mesh or ember-resistant vents to block fire entry points
- Soffits and walls that are stucco-wrapped or constructed from fire-retardant siding
- Metal corrosion-resistant mesh screens (1/16" or 1/8" mesh) should be installed to block embers and reduce the risk of ignition

In addition, limiting the number and size of windows on fire-exposed sides of the home helps minimize vulnerability.

INSULATION AND DECKING

Fire-resistant insulation and decking materials, like those listed below, reduce fuel sources and slow fire spread:

- Mineral wool insulation (Rock Wool)
- Dense pack cellulose
- Noncombustible concrete or metal decking
- Class A fire-rated hardwoods such as Ipe and Cumaru that comply with SFM Standard 12-7A-4A
- Fire-retardant treated wood decking
- Surface material for attached structures (e.g., entry canopies or decks) or any portion of such structures within 10 feet of a building must be ignition-resistant, fire-retardant, or noncombustible or comply with the performance requirements of SFM Standard 12-7A-4A

Accessory structures three to 50 feet from the principal dwelling and 120 square feet or larger must be built with noncombustible or ignition-resistant materials, and elevated decks and porches should be constructed using concrete or metal whenever possible. To reduce exposure to embers and direct flames, maintain a noncombustible five-foot perimeter around the structure.



Innovative Construction Techniques

INSULATED CONCRETE FORMS (ICFS)

One of the most effective strategies for constructing fire-resistant homes is replacing traditional wood framing with noncombustible, insulated mass walls, such as Insulated Concrete Forms (ICFs). ICFs utilize interlocking foam blocks filled with steel-reinforced concrete to create a monolithic, highly insulated structure. While ICF walls have demonstrated exceptional fire resistance, all exterior cladding must be ignition-resistant or noncombustible to ensure maximum protection.

PREFABRICATED AND MODULAR FIREPROOF CONSTRUCTION

Prefabricated fire-resistant panels not only offer noncombustible, high-performance materials, but also streamline construction. These panels, which include composite cores for walls and roofing, arrive pre-finished and fire-rated, reducing the need for extensive on-site labor. To ensure maximum protection, materials should comply with WUI fire-resistance standards, and fire-resistant adhesives and fasteners should be used to maintain durability and integrity under extreme heat exposure.

Landscaping and Defensible Space

While not part of actual home construction, defensible space around a home is crucial in limiting wildfire loss to your home, especially in the zone within 0-5 feet from the structure. This immediate zone is highly susceptible to ignition from embers and radiant heat, and when designed properly, can act as the first line of defense, helping to protect the structure from flames and increasing the likelihood that firefighters can safely defend the property. Homeowners should use noncombustible materials and remove flammable debris to reduce the chances of a wildfire spreading to the house.

Creating Defensible Space

ZONE 1

0' - 5' (Noncombustible Zone)

Overall: This is the area closest to your home. It should be a fire-free area without anything flammable.

- Remove dead or dry leaves and pine needles from your yard, roof, and rain gutters. Ensure wood, mulch, bark, and plants are removed near crawl space vents. Select noncombustible mulch material such as gravel or rock.
- Remove branches that hang over your roof line and chimney within 10 feet of the home.
- Choose low-growing and widely spaced firewise plants, or plants with a high moisture content, if your siding is noncombustible. If you have wood siding, this should be a plant-free zone.
- Remove or prune flammable plants and shrubs near windows.
- Remove vegetation and items that could catch fire from around and under decks.
- Remember to mow and water lawn regularly.

ZONE 3

30' - 100' (Reduction Zone)

Overall: This area should be open and park-like.

- Prune tree branches up 8 feet off the ground with no ladder fuels.
- Cut or mow annual grass down to a maximum height of 4 inches.
- Create horizontal and vertical spacing between shrubs and trees. Slope and terrain may increase appropriate distances for both.
- Remove fallen leaves, needles, twigs, bark, cones, and small branches. However, they may be permitted for erosion control to a depth of 3 inches.

ZONE 2

5' - 30' (Lean, Clean, and Green Zone)

Overall: This is the area slightly removed from your home. Pay close attention to plant spacing and landscaping in this area.

- Remove all dead plants, grass, weeds, and other vegetation.
- Space plants carefully, and choose plants that are low growing and free from resins and oils that burn easily.
- Mow and water lawns regularly, or xeriscape.
- Relocate wood piles into Zone 3 and keep them 30 feet away from your home.
- Create a separation between trees, shrubs, and items that could catch fire, such as patio furniture, fences, sheds, or play structures, etc.
- Prune tree branches up 8 feet off the ground with no ladder fuels.
- Maintain adequate spacing between trees with no crowns touching. Additional spacing is recommended for conifer trees.
- Avoid placing propane tanks in this area. However, local building code may dictate a required specific distance.

ZONE 4

100'+ (Extended Zone)

Overall: This is the farthest zone from your home. The goal in this area is to improve the health of the property and interrupt the wildfire path. Shaping the terrain surrounding your home can influence the fire's spread and intensity.

- Remove any dead vegetation piles in this area. Thinning and pruning in Zone 4 can be more limited. However, it is recommended to manage vegetation the same way as Zone 3 in this area.

Emerging Technologies

AUTOMATED WILDFIRE

SUPPRESSION SYSTEMS

Smart fire suppression technologies can enhance home protection efforts by automating fire defense measures. For example, smart sprinkler systems will activate when heat sensors detect nearby wildfires, soaking the home and surrounding vegetation to prevent ignition. Ember-resistant vents block airborne embers from entering attics and crawlspaces, while AI-controlled fire shutters automatically seal windows and doors when high temperatures are detected. Together, these systems provide an advanced, proactive defense against wildfires, reducing the risk of a structural fire.

Contact Chubb

Help protect your new home from wildfire. By integrating noncombustible materials, ember-proofing, and smart suppression systems, your new or renovated home in a fire-prone area can be designed to withstand extreme fire events and enhance long-term resilience.

FOR QUESTIONS, CONTACT:

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FOR ADDITIONAL RESOURCES:

Please visit [Chubb's Understanding Wildfire and Home Resiliency](#)



Case Study

MALIBU'S "MIRACLE MANSION"

In January 2025, a massive wildfire tore through Malibu, California, destroying thousands of homes in its path. Among the devastation, one property stood unscathed – dubbed Malibu's "Miracle Mansion" – a testament to the effectiveness of fire-resistant architecture, advanced materials, and strategic wildfire mitigation techniques. While many neighboring structures succumbed to the fire, this mansion remained intact, demonstrating how modern fire-hardening strategies can significantly improve a home's survivability in extreme wildfire events.

Key design features of this home included the following:

- Reinforced concrete walls
- Metal roofing
- Dual-pane tempered glass windows and fire-rated doors
- Five-foot noncombustible perimeter
- Ember-resistant vents
- Smart exterior sprinkler system
- AI-powered fire detection
- Fireproof materials and coatings

References/Resources

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- Fire-Resistant Decking: Exploring the Best Material – Lumber Plus
- How Malibu's "Miracle Mansion" survived the LA wildfires – thanks to architecture and a little luck
- **Increasing Frequency and Intensity of the Most Extreme Wildfires on Earth**

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Count on Chubb to provide a path forward for comprehensive fire protection and resilience.

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