

Ignition Resistant Construction for High Hazard Areas

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Rodwin Architecture
www.rodwinarch.com

Introduction

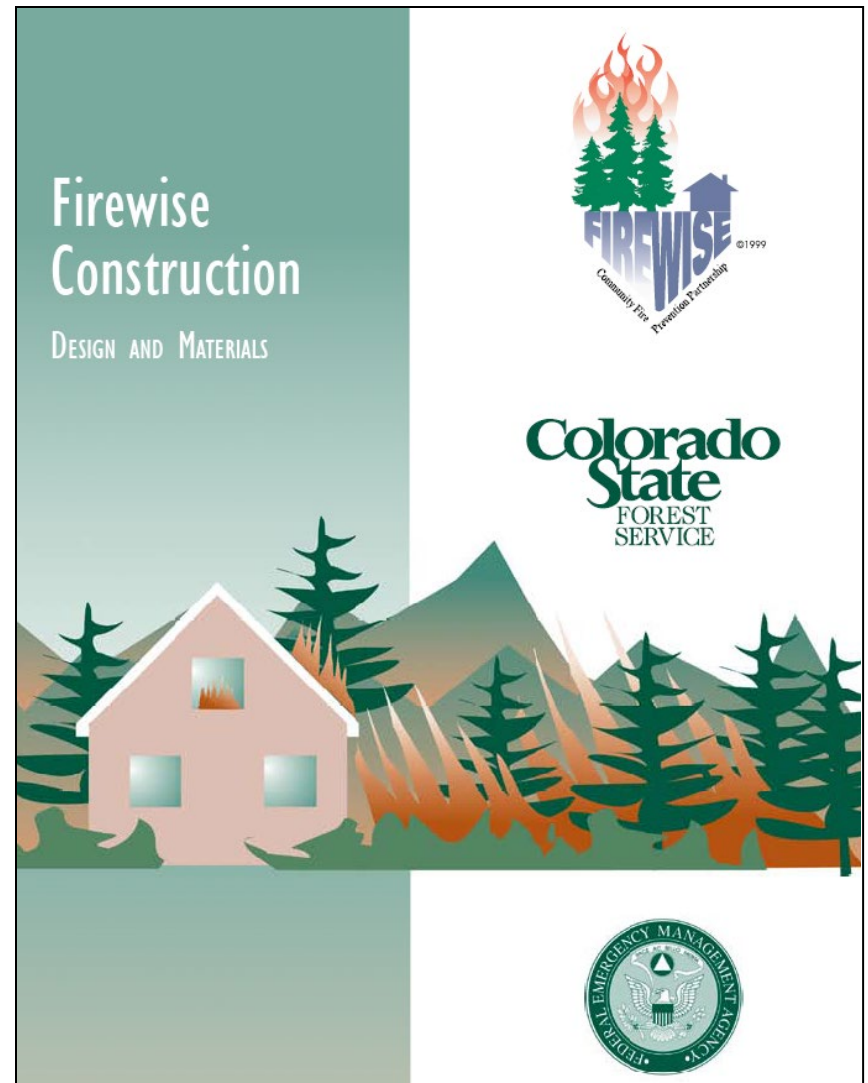


View from the top of Lee Hill. Photo by John Hutson



What are the Primary Threats

- Direct flame contact
- Wind Blown Flaming Debris (Fire Brands)
- Ember intrusion
- Radiant heat
- Accessory Structures
- Exterior Combustibles





Flames from Fuel directly reach the home

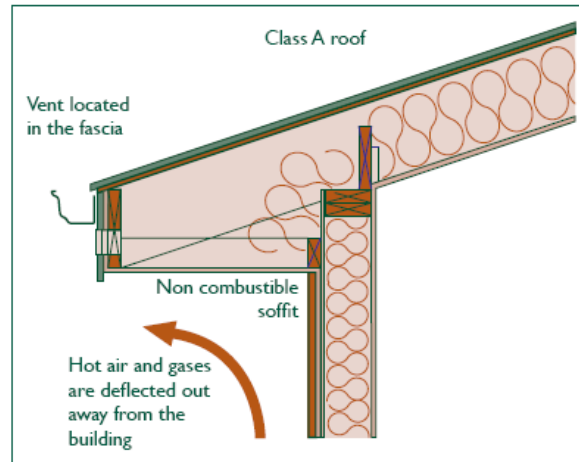
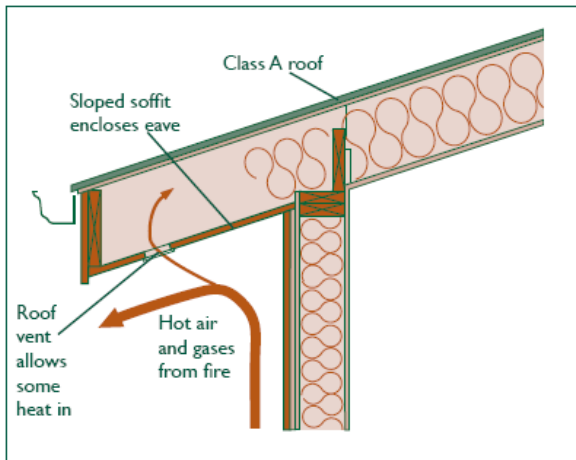
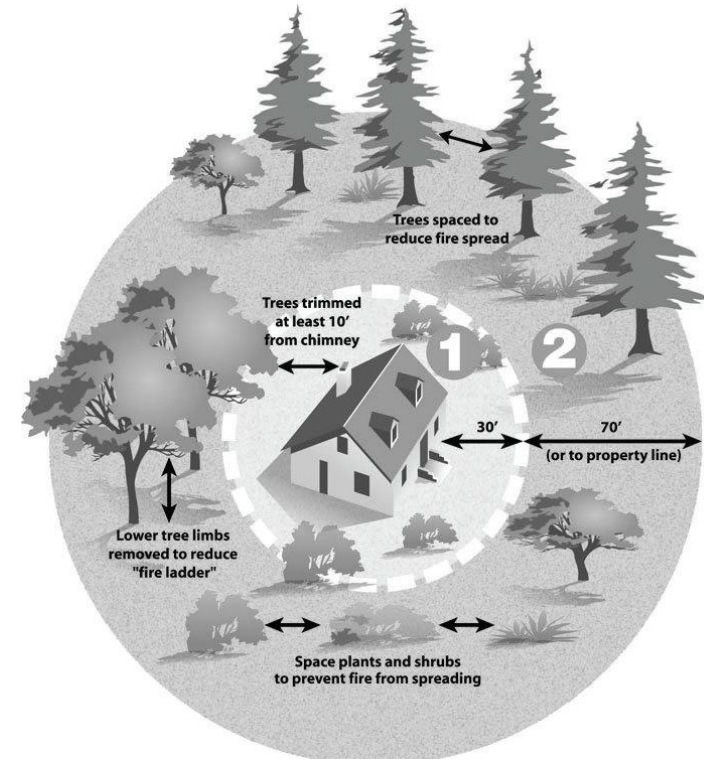
- Exposed Combustibles are ignited by direct flame contact

How Homes Burn – Direct Fire Contact



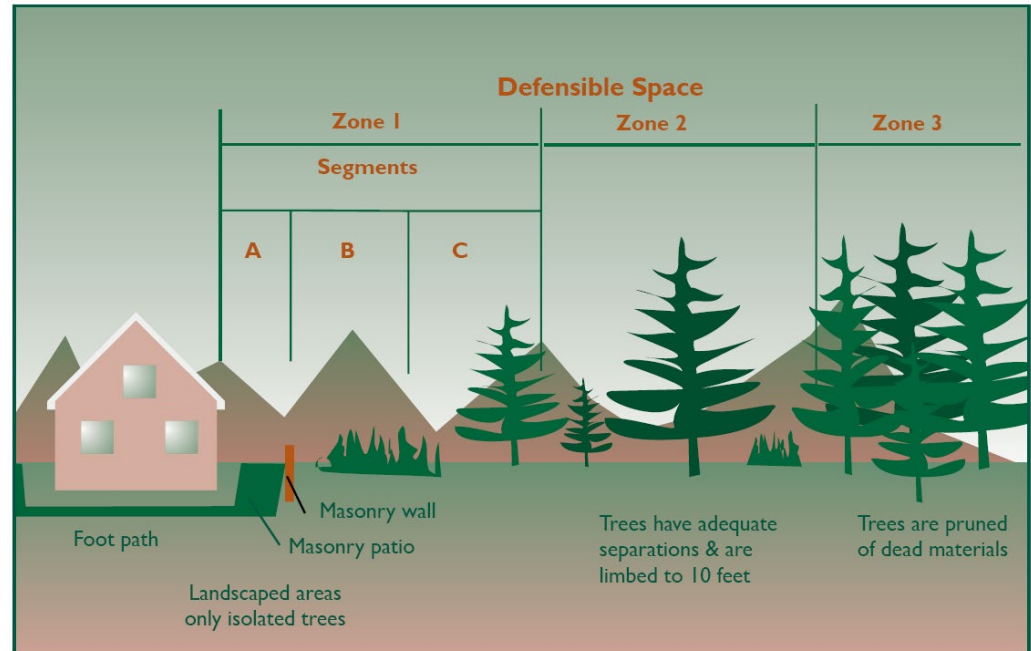
How to Protect:

- Reduce Fuel Sources near the home
- Build Exterior out of non-combustible materials
- Good Eave and Soffit details

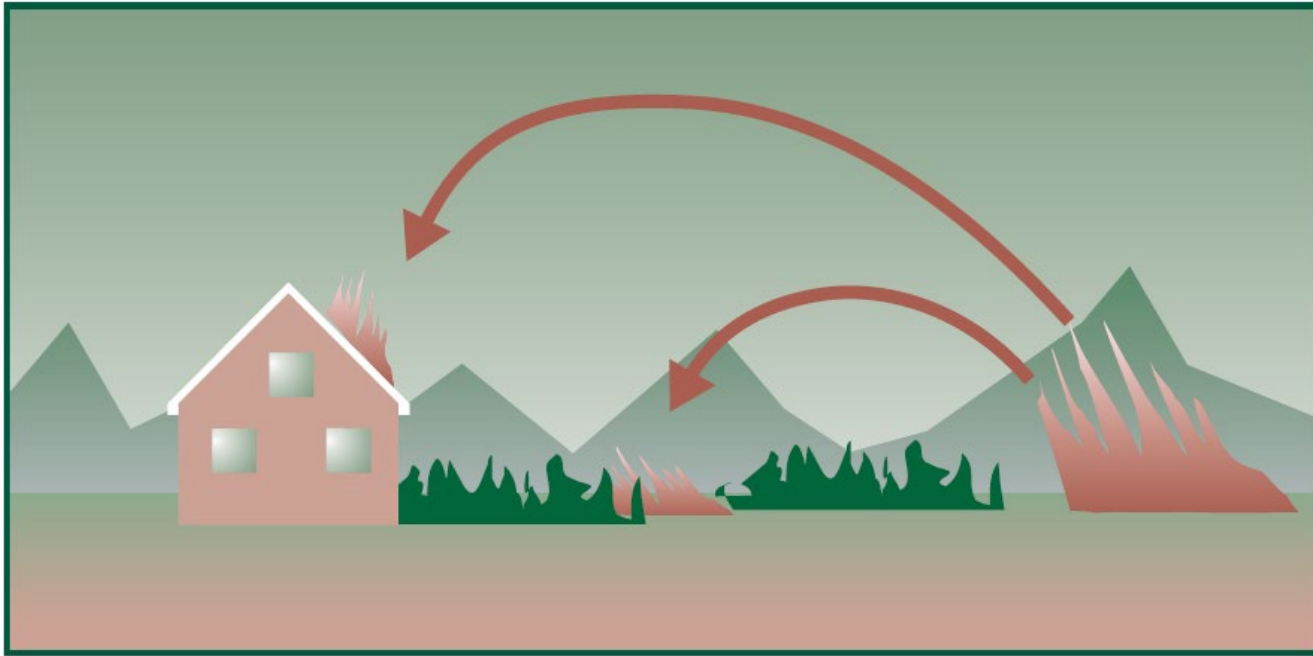


Wildfire Mitigation Plans (required for Permit)

- Site Location and Property Description
- Construction Design and Materials
- Defensible Space and Forest Management
 - Zone 1 – The Safety Zone
 - Zone 2 – The Transition Zone
 - Zone 3 – The Management Zone
- Driveway Access for Emergency Vehicles
- Emergency Water Supply for Fire Fighting
- Maintenance

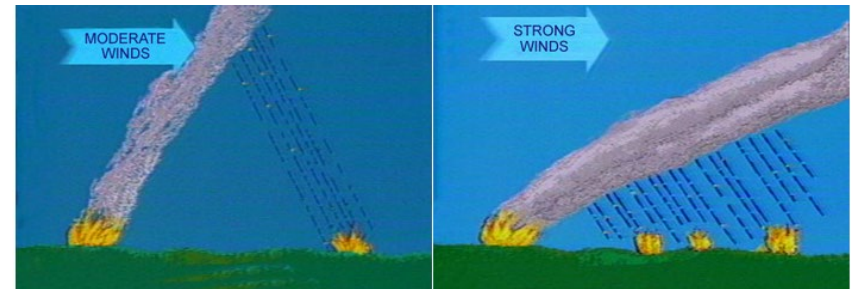


How Homes Burn – Wind Blown Debris (Fire Brands)

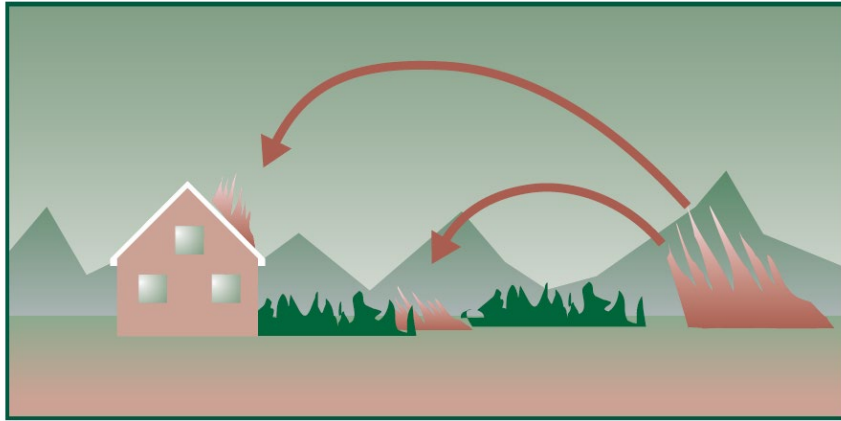


Wind Carries Flaming Debris (Fire Brands)

- Perhaps the most difficult to protect from
- Brands can be carried long distances
- Often will land and burn on roofs
- Wood decks particularly vulnerable

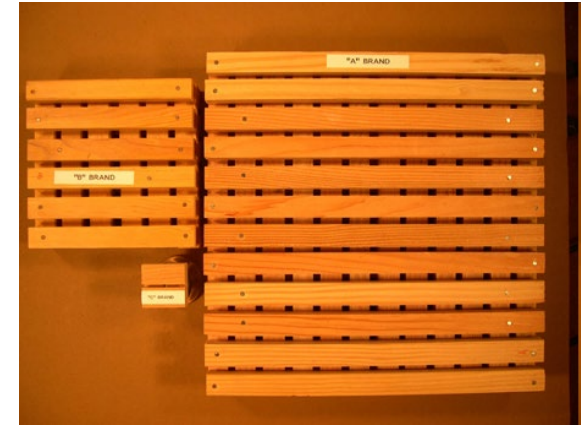


How Homes Burn – Wind Blown Debris (Fire Brands)



How to protect from Flaming Debris (Fire Brands)

- Increase Defensible Space (stack the odds in your favor)
- Listed class “A” roofing materials or assemblies (or better)
- Non-combustible decks
- Non-combustible exterior siding
- Reduce fuel sources adjacent to the home (such as firewood and fences)



ASTM E-108

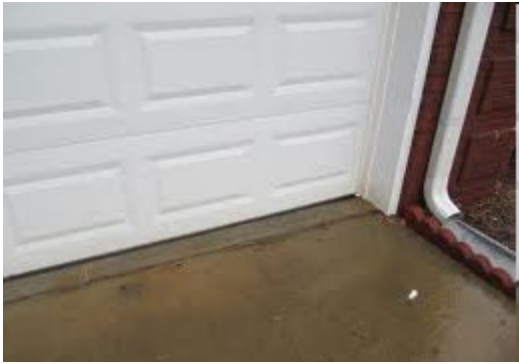




Ember Intrusion

- Sparks and embers from burning and exploding trees enter home
- Commonly enter through various roof vents
- Occasionally enter through crawlspace vents
- Very small sparks and embers can start fires (especially when home has been exposed to dry superheated air)

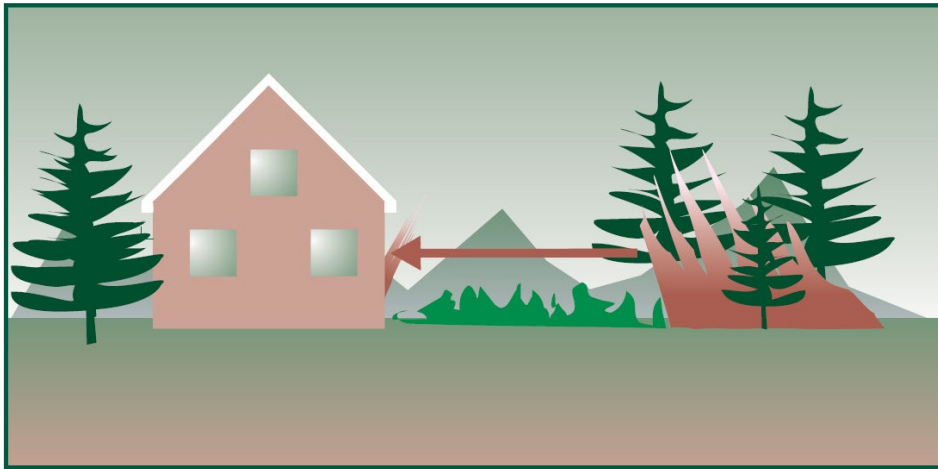
How Homes Burn – Ember Intrusion



How to protect from Ember Intrusion

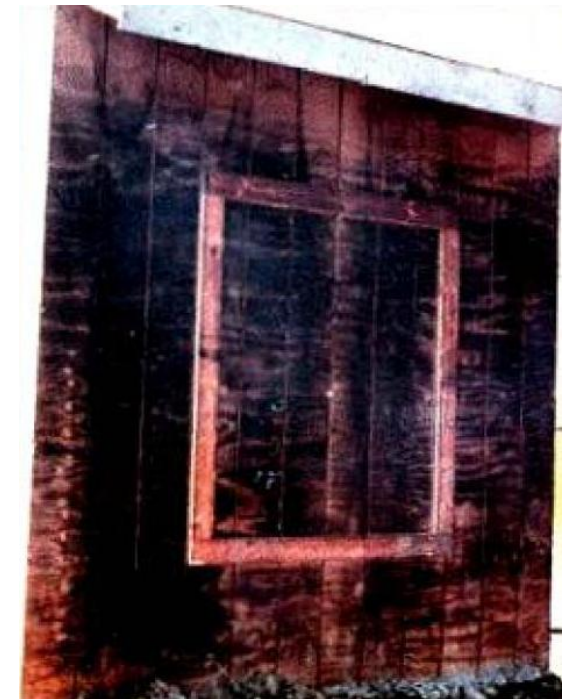
- Eliminate Roof and Soffit Vents
- Avoid operating skylights
- Avoid venting crawlspaces





Combustion from radiant heat

- Direct flame contact not needed
- Extreme temperatures can ignite interior while exterior remains intact
- Interiors that have been “pre-heated” will flashover rapidly
- Radiant heating can cause windows to fail

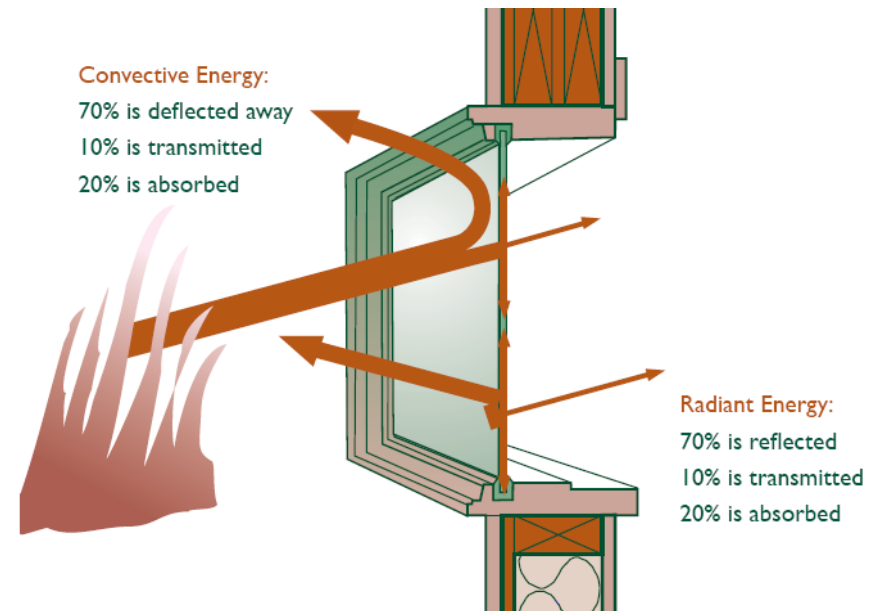
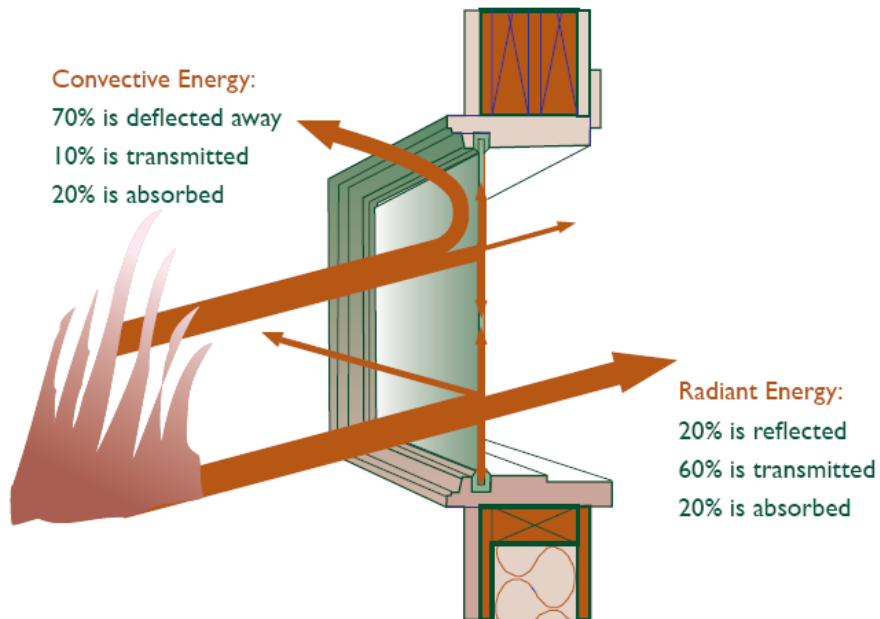


How Homes Burn – Radiant Heat

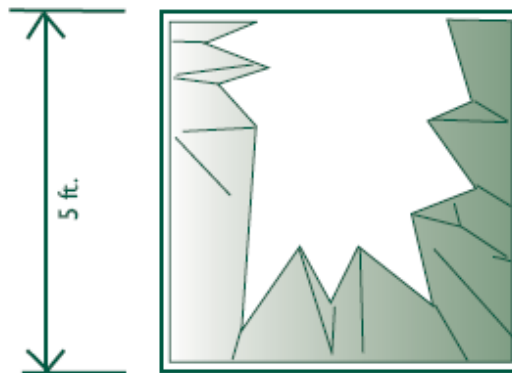
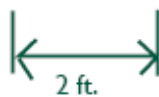
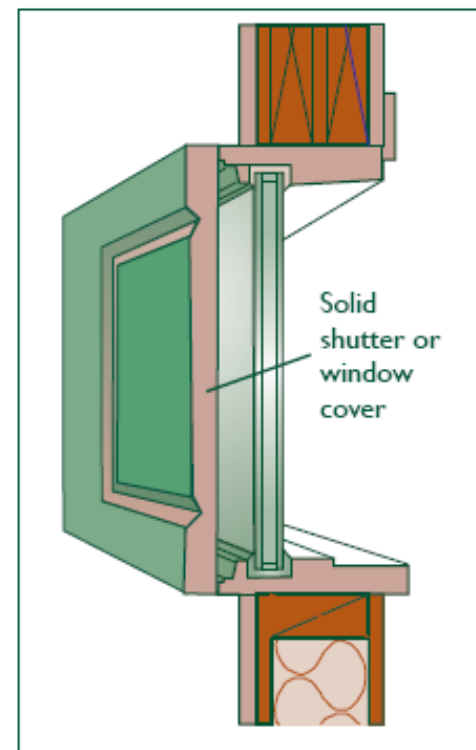
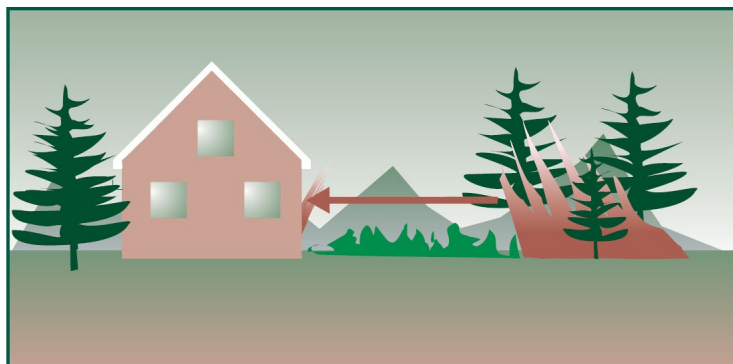


How to protect homes from radiant heat

- Distance is your friend
- Good windows (double pane, low SHGC, tempered glass)
- Exterior Shutters



How Homes Burn – Radiant Heat



SYNERGISTIC
BUILDING TECHNOLOGIES



How Homes Burn – Accessory Structures



Wood Decks and Fences

- Proximity to home problematic
- Often made from easily combustible materials
- Exposure from below is common



How Homes Burn – Exterior Housekeeping



Homeowner maintenance

- Materials on roof or adjacent to structure provides fuel for windborne debris
- Proper placement of firewood



Extreme heat -- with or without direct flame -- compromised the envelopes of houses and ignited material inside by entering houses through vents; poorly sealed doors or windows; and cracks in walls, subfloors or attics.

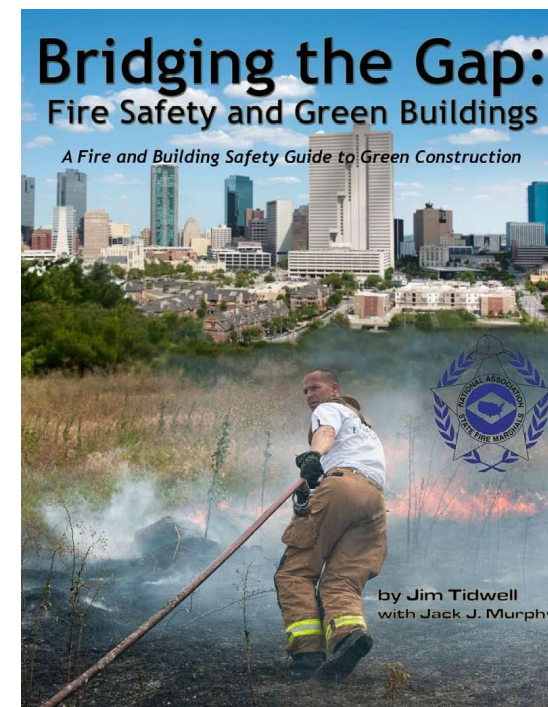
- Analysis of the 1993 Laguna Beach fire



366 homes destroyed
17,000 acres

Fire Resistant Construction is “Green”

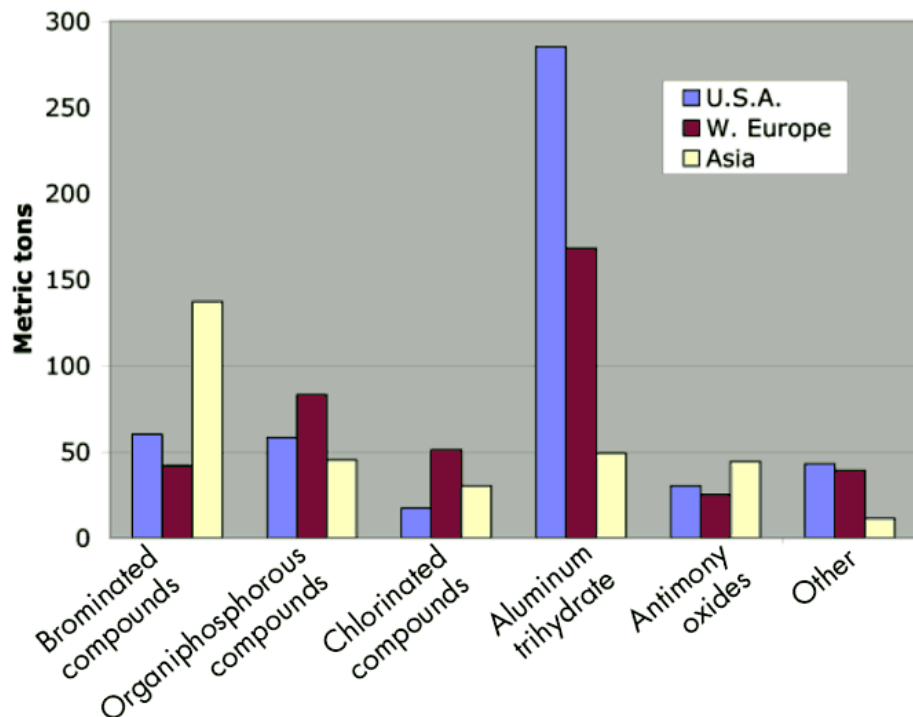
Fire Resistant Feature	“Green” Benefit
Houses that are fire resistant	House lasts longer
High performance windows are essential to reduce the risks from wildfires	Good windows save energy
Airtight construction can prevent superheated air from entering the home	Low natural air infiltration rates can dramatically reduce energy consumption
Cement, Stone, or Brick exteriors are naturally non-combustible	These exterior materials are long-lasting and require little ongoing maintenance
Unvented Attics and Crawlspace do not allow for embers or hot air to enter the home	This can help achieve extremely tight building envelopes and places insulation where it is needed most.
Diligent maintenance of roof gutters, and downspouts reduce fuel sources	Roof water drains better and is less likely to result in leaks



ASTM E-119 2-hour fire and hose stream test

Ecological Building Network Straw Bale Fire Test Program, July 2006





Source: European Flame Retardants Association, from SRI Consulting



European Chemical Industry Council
 Avenue E. Van Nieuwenhuyse, 4. Bte 2
 B-1160 Bruxelles, Belgium



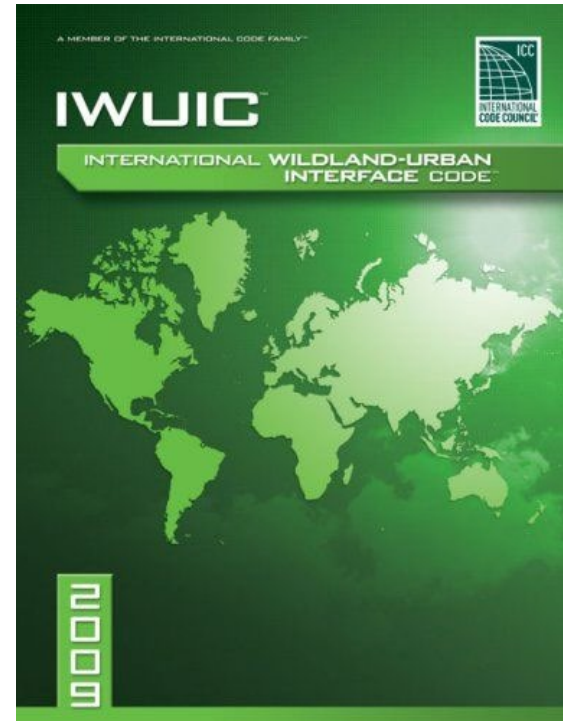
European Flame Retardants Association
 A sector group of Cefic

E-mail efra@cefic.be
www.cefic-efra.org

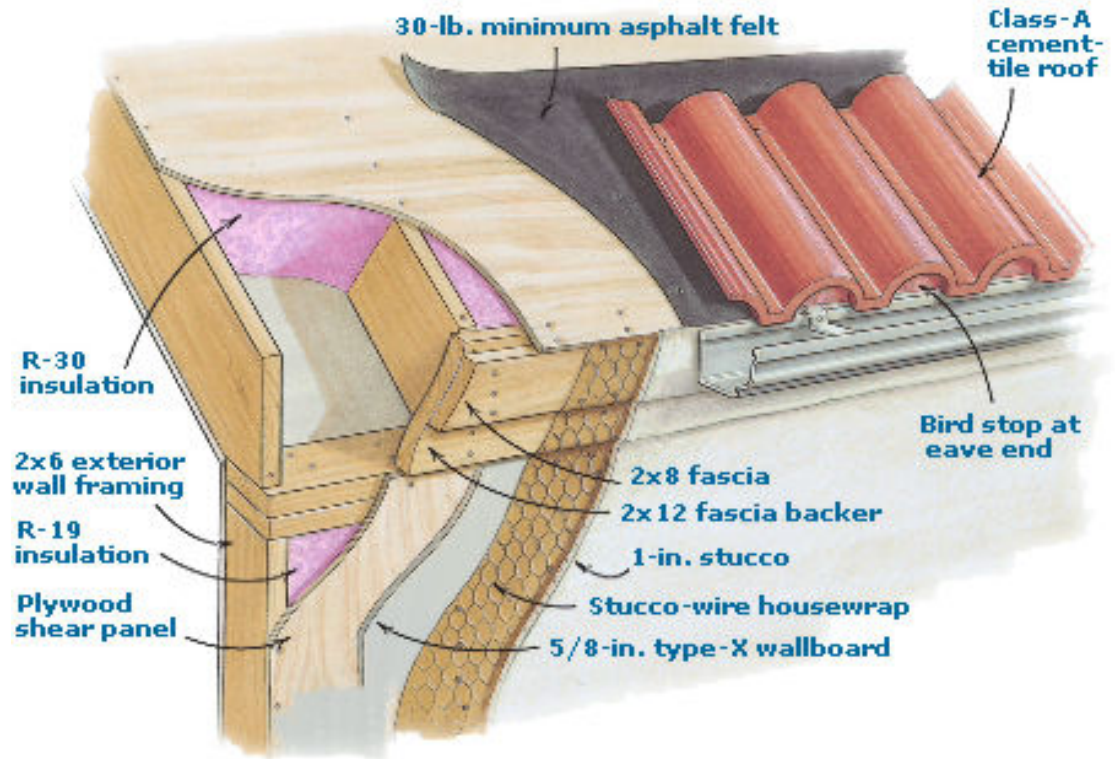




www.fire.ca.gov



www.iccsafe.org



John Underwood - Fine Homebuilding – Taunton Press

Stay Tuned... More to come!





Boulder County
Land Use Department
Publications

Building with Ignition Resistant Materials

Land Use Department
Courthouse Annex Building
2045 13th Street
PO Box 471
Boulder, CO 80302

Wildfire Mitigation Services:
Phone: 720-564-2625
Fax: 303-441-4856
Email: ephilips@bouldercounty.org
<http://www.bouldercounty.org/lu/>

Office Hours:
Monday – Friday 8:00 AM to 4:30 PM

Building with Ignition Resistant Materials

When choosing the appropriate building materials for a structure located in the Wildland Urban Interface (WUI), one must consider a variety of factors, including form, function, aesthetics, cost and safety. In attempting to balance these factors, consider the following.

Building Design and Structure Size

The overall design of the structure greatly influences how it will withstand a wildfire. Simpler forms are generally easier to protect, in part because they have a lower surface area to volume of exposed to a wildfire. Complex building forms create heat traps, areas where the walls and roof members intersect one another where eddies form and hot air and embers from a fire can collect. As these forms cannot be completely avoided, the structure must be built with the appropriate level of Ignition Resistant (IR) construction in mind.

Ideally, the size of the structure should be no greater than that which can be protected with the amount of water and the resources that are available to the fire protection district. This is to protect not only the structure itself but also to protect neighboring structures and/or forests that may be threatened by a structure fire. This one of the reasons why an emergency water supply for firefighting and/or a sprinkler system is required.

Roof Covering and Siding Materials

The roof is the most vulnerable area of a structure with to a wildfire. Falling embers and firebrands from a wildfire can land on a roof and ignite the roof, either by directly heating the roofing material, or by igniting light fuels (pine needles) that have collected on the roof. In all major wildfires involving homes, those that had wood roofs have been observed burning thousands of feet away from the approaching fire front.

This is why all roof coverings in Wildfire Zone 1 (see Wildfire Zones Map) must be of an Underwriters Laboratories (UL) Class-A fire-resistant composition. Certain grades of fiberglass reinforced asphalt shingles meet this standard, as do metal or concrete tile roofs. Eave-end gaps in tile roofs should be fire-stopped with cement mortar or metal bird stops. Greater fire resistance can be achieved through the construction of a Class-A roof assembly as described in the Boulder County Building Code.

All exterior walls must be constructed with fire-resistant or non-combustible materials, such as cementitious siding, stucco (non-synthetic), brick or stone whenever possible. If a combustible material, such as wood or fiberboard siding is to be used, it must be applied directly over standard 3/4-inch, type-X gypsum sheathing to qualify as a one-hour-rated fire-resistive construction (Note: this is only allowed in moderate wildfire hazard areas). The exception is heavy timber construction (minimum 6" thickness material). In any case, a minimum three-foot high fire-resistant wainscot of rock, stucco or other noncombustible material must also be installed on the exterior walls along with crushed rock or stone spread within three feet of the base of the structure.

Exterior Windows and Doors

Windows are one the weakest parts of a structure with regards to wildfire. They often crack and fail before the structure itself ignites, providing a direct path for embers and radiant heat to reach the interior. It is best to minimize the number and size of windows, especially on the downhill side of the home.

Use thermopane or double-glazed (insulated) panels, low-e coated and/or tempered glass for exterior windows, window walls/doors, and skylights. Window frames should be aluminum-clad wood, not vinyl, as this material tends to melt in the heat of a fire and cause the windows to fail. All operable or openable windows must be provided with screening that is constructed of either aluminum, galvanized steel, stainless steel, copper, or of an approved material that, when exposed to flame for 15 seconds, will not burn through or melt, and remains intact.

Fire-resistant shutters (which can be closed in the event of a wildfire) can offer even greater protection for windows. Per the Boulder County Building Code, all glazed openings that face concentrations of vegetative fuels within 30 feet of the openings shall be provided with closeable, solid exterior shutters.

Exterior doors, other than vehicular access doors to garages should be noncombustible (steel or fiberglass) or solid core wood doors not less than 1-3/4 inches thick. Garage doors should be insulated metal or fiberglass.

Firewise Construction

DESIGN AND MATERIALS



Colorado
State
FOREST
SERVICE



www.bouldercounty.org/lu/publications/wildfire_mitigation



TOP 10 FIRE RESISTIVE CONSTRUCTION TIPS



1. Defensible Zones / Reduced Fuel
2. Ignition Resistant Construction Materials
3. Roof & Wall Intersections
4. Simple Geometry
5. Decks, Appendages & Projections
6. Air Tight Construction
7. Emergency Access
8. High Performance Windows
9. Unvented Attic and Crawlspace
10. Property & Building maintenance

