Boulder County

Boulder County
Land Use Department
Publications

Building with Ignition Resistant Materials

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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 area 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 fire sprinkler system is required.

Roof Covering and Siding Materials

The roof is the most vulnerable area of a structure with regard to a wildfire. Falling embers and firebrands from a wildfire can land on a roof and ignite the structure, either by directly heating the roofing material, or by igniting light fuels (leaves, 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 a listed Class–A roof covering or be constructed as a Class–A assembly. 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, stone, or heavy timber construction (minimum 6" thickness material).

Exterior Windows, Glazing 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.

Exterior windows, window walls, glazed doors, windows within exterior doors, and skylights shall be tempered glass, multi-layered glazing, glass block, or have a fire protection rating of not less than 20 minutes. Window frames and sashes must be metal, vinyl covered metal, solid wood, vinyl-covered solid wood or fiberglass. *(Note: Vinyl windows may be used in high and moderate hazard wildfire sites.)* Exterior doors and garage doors shall be approved noncombustible construction, metal clad, solid core wood not less than 1-¾ inches thick, or have a fire protection rating of not less than 20 minutes. Moderate Hazard Wildfire Site doors and garage doors may be of any material permitted by the Code.

Decks, Balconies, Overhangs, and Exterior Stairs

Required in all Wildfire Zone 1:

Deck walking surface materials are to be approved noncombustible materials, ignition-resistant materials in accordance with Section R325.4.2 or any Class A roof assembly.

(continued on next page)

Requirements in Extreme Hazard Wildfire site:

Unenclosed accessory structures attached to buildings with habitable spaces and projections, such as decks, shall be a minimum of 1-hour fire resistance-rated construction, heavy timber construction or constructed of one of the following:

1. Approved noncombustible materials.

2. Fire-retardant-treated wood identified for exterior use and meeting the requirements of Section R802.1.3 of the International Residential Code, or

3. Ignition-resistant building materials in accordance with Section R325.3.

Requirements in High and Moderate Hazard Wildfire site: Deck framing may be of any material permitted by this code.

Soffits, Fascia, and Venting

Requirements in Extreme Hazard Wildfire site: Eaves, soffits, covered decks, and covered porch ceilings shall be protected on the exposed underside by ignition-resistant materials or by materials approved for a minimum of 1-hour fire-resistance-rated construction, 2-inch nominal dimension lumber, or 1-inch nominal fire-retardant-treated lumber, or ¾-inch nominal fire retardant-treated plywood, identified for exterior use and meeting the requirements of Sections R802.1.3 of the International Residential Code. Fascias are required and shall be protected on the backside by ignition-resistant materials or by materials approved for a minimum of 1-hour fire-resistance-rated construction, or 2-inch nominal dimensional lumber.

Requirements in High and Moderate Hazard Wildfire site: Eaves, fascias, and soffits, covered decks or covered porch ceilings shall be enclosed by using any materials permitted by this code.

Utilities

Bury new electric lines leading to the structure, at a minimum within the defensible space zone, and along or across access routes on the property leading to the structure. During a wildfire, power lines hanging over your driveway and/or access road represent a potential hazard. Downed power lines present a safety concern for firefighters and residents alike. Keep existing above ground lines, especially along driveways and access roads, free from overhanging tree limbs and remove ladder fuels (small trees, tree branches) from below the lines .

Propane tanks should be located outside of Defensible Space Zone 1 (at least 15' or more away from the house, depending upon tank size). See the Land Use publication *LPG Tank Locations* for more information. **Note: Propane tanks must be at least 50 feet or more from a firefighting cistern.**

Above ground tanks must not have anything combustible around them (such as firewood, or wooden fencing) or above them (such as overhanging tree limbs). Slash piles and firewood piles must be at least 30 feet from the tank. Maintain a 10-foot vegetation free zone around the propane tank. The tank must sit on a concrete pad surrounded by 2 feet of crushed rock or gravel. Consider purchasing a buried propane tank if possible.

Fire Alarms and Fire Sprinkler Systems

Because response times for emergency services in rural areas are much greater than in urban areas, and access conditions are generally less than ideal, structures are often fully involved in flames by the time that the fire department arrives. With the only available firefighting water supplies being those that are brought on the trucks, with perhaps some additional available from other sources (such as cisterns), bringing a fire under control in a structure in these areas is often difficult if not impossible. Fire spreading to forest or grassland areas or other homes is a real threat.

For these reasons, residential sprinkler systems are recommended. *Note: they are required for new structures over 3,600 square feet.* An approved National Fire Protection Association (NFPA) 13-D automatic indoor fire extinguishing system, preferably with a monitored fire alarm, will either put out these kinds of fires, or at least contain small fires until firefighters arrive, even if no one is home at the time that the fire occurs. Install a fire extinguishing system with an automatic refill capability if the water source is a cistern. Include a power backup for power failures, if not on a public water system.

A Class-A foam system for exterior protection may also be installed, especially for structures over 3,600 square feet with combustible siding material. Foam has insulating properties, which offer greater protection than water from the duration and intensity of a fire. This system allows the homeowner to literally coat the exterior of their house and surrounding landscape with a thick layer of foam, which prevents the penetration of burning embers and radiant heat to the structure.

Detached Accessory Structures

Detached accessory structures (such as storage sheds, garages), when located less than 50 feet from a building containing habitable space (the primary residence), should have exterior walls constructed with materials approved for one-hour-rated fire-resistive construction, heavy timber construction or be constructed with noncombustible materials on the exterior side. When the detached structure is located and constructed so that the structure or any portion thereof projects over a descending slope surface, the area below the structure should have all underfloor areas enclosed to within 6 inches of the ground, with exterior walls.

Fences

Minimize the amount of wooden fencing on your property. Keep wooden fencing away from structures and other improvements (such as propane tanks, cisterns, etc.).

Fences should be made with non-combustible materials (metal chain link, for example) when located within 12 feet of the perimeter of buildings containing habitable space.

Stone or concrete walls (which can help deflect the heat of flames on a steep slope below) may be considered in the design for those structures bound to be sitting near the edges of such slopes.

Gutters/Chimneys

Use metal gutters and downspouts. Keep gutters free of pine needles by utilizing a metal gutter cover or screen.

Install a screened spark arrestor within the chimney cap. Keep vegetation at a minimum distance of 20 feet from all chimneys.

Roofing Materials

General
No material is "fire proof;" however, proper use and assembly of fire-rated building materials can reduce a fire's spread and extend the amount of time it takes for a home to ignite and burn. (Structural assembly is the process of layering materials when building exterior walls and roof.)

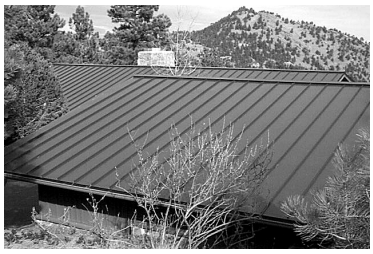
Your roof is vulnerable to wildfire because it is the largest surface area of your home. The exposed, uneven surface of a roof can easily trap hot, wind-blown embers. Simple roof forms are easier to protect than complex ones due to less surface area and intersections, which may create heat traps. Use class A or B roofing materials to reduce risk.

Wood shakes and shingles
The thin physical make-up and surface structure of wood shakes and shingles are readily combustible and conducive to fire spread.

Asphalt shingles
Asphalt shingles are the most economical in terms of cost and life expectancy. Mineral reinforced asphalt shingles have a Class C rating and are gradually being replaced by fiberglass reinforced asphalt shingles, which are Class A or B materials.

Metal: sheets and shingles
Metal roofing is sturdy, lightweight, and non-combustible. However, it requires a gypsum underlayment for a class A assembly rating.

Metal roofing comes in the form of galvanized steel with paint; aluminum with paint; stainless steel; and, copper. It is also manufactured in the form of imitation wood shingles.

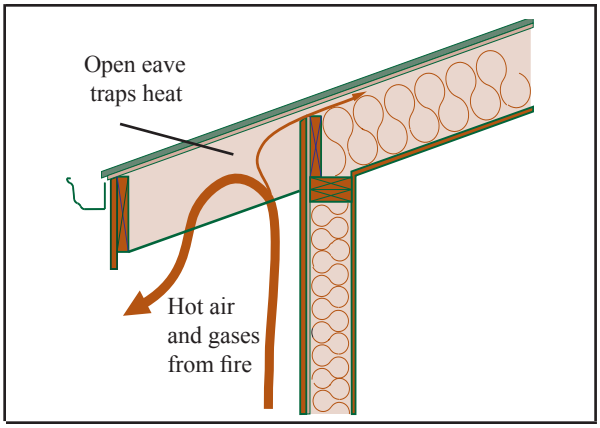


Fiber-cement shingles
These synthetic cement shingles are manufactured with either a fiberglass or wood mixture and are less brittle then solid cement shingles. They are a non-combustible material, but require an underlayment for a Class A assembly rating.

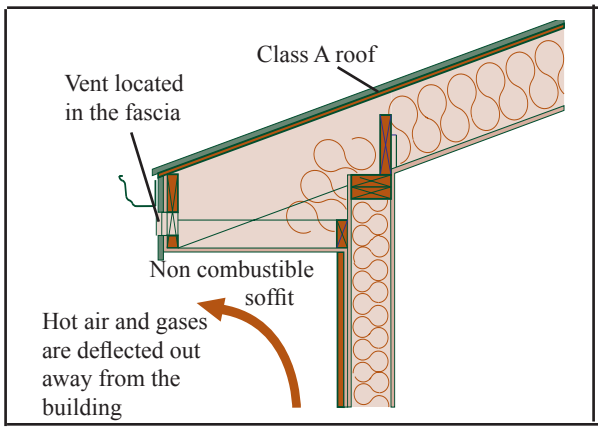
Membrane roofs
These hard or semi-solid materials (i.e. hot tar and rubber) are applied to flat roofs and are slightly combustible. However, they are often used in conjunction with other materials, such as cement, and can be applied over a gypsum underlayment for a Class A assembly rating.

Tile, clay tile, concrete and slate shingles
These thick noncombustible materials can be manufactured to look like wood shingles. They have a Class A rating and provide the best protection against fire.

Eaves and soffits
Enclose open eaves with a flat soffit to deflect burning embers and gasses.



Open eave with no soffit



Fully enclosed soffit with isolated vent

The combined use of fire-rated building materials, assembly, and design will give your home a chance of surviving a wildfire.

Ratings are based on assembly and layering of building materials and the burn time before ignition. Ratings are divided into classes:
A (the best –2 to 4 hrs)
B (1 hr)
C (20 min)

Material Classification

Class A

Brick	Concrete
Tile	Slate
Clay	Asphalt
Metal	Fiber-cement

Class B
Pressure-treated shakes and shingles

Class C
Wood shakes and shingles
Plywood
Particleboard

Material **Class** is categorized by composition or resistance to fire (combustible or noncombustible). Class A has the highest resistance, Class C has the least resistance.

However, Class A materials generally need an underlayment of additional materials to give it an A *rating*. This is because Class A materials conduct heat beyond the exterior.

References
For additional information on protecting your homesite, see:
6.302, *Creating Wildfire-Defensible Zones*
6.303, *Fire-Resistant Landscaping*
6.304, *Forest Home Fire Safety*
6.305, *FireWise Plant Materials*
6.306, *Grass seed Mixes to Reduce Wildfire Hazard*

For more information or assistance contact your local fire department, or the Colorado State Forest Service.

Siding

General
No material is "fire proof." However, the proper use and assembly of fire-rated building materials can reduce a fire's spread and lengthen the amount of time it takes for a home to ignite and burn. Structural assembly is the process of layering materials when building exterior walls and roof.

Your home's exterior walls and siding are most susceptible to radiant heat and open flame. Typically, the corners of your home are the weakest part of the structure. This is due to high surface to volume ratios. It is recommended that Class A or B *rated* siding materials be used.

Wood panels and boards
Wood panels and boards are readily combustible, and conducive to fire spread. A fire can burn through these materials to the underlying structure in less than 10 minutes. A gypsum underlayment can increase burn time to a one-hour rating.

"Real" Stucco
This noncombustible, one-hour rated material is a cement and gypsum mixture. It is applied in two or three coats and reinforced with metal mesh.

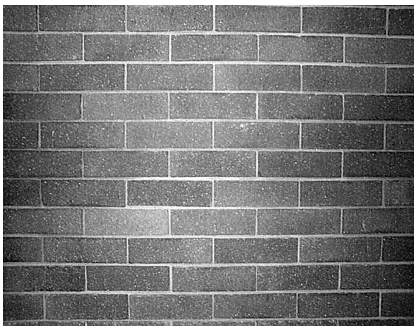
Synthetic stucco, exterior insulating finish system (EIFS)
Synthetic stucco is an acrylic cement finish on fiberglass mesh. This material is noncombustible and has no rating by itself.

This product is interesting because it significantly delays fire due to the insulation quality of the rigid foam and the fact that the system does not ignite; it actually fails and falls away. In moderate to high fire hazard situations this product works well.

Heavy timber or log construction
The low surface-to-volume ratio of heavy timber takes longer to burn; this makes it a practical choice in medium to high fire risk areas. The minimum thickness for log construction is six inches for the frame and exterior siding, and three inches for steps and decking.

Concrete synthetic stone
This noncombustible synthetic stone is reinforced with fiberglass and metal mesh, and has a one-hour rating.

Brick, stone and block
These permanent, noncombustible materials usually have a two-hour rating, and are the best to use in regard to fire.



Material **Class** is categorized by composition, or resistance to fire (combustible or noncombustible). Class A has the highest resistance; class C has the least resistance.

Ratings are based on the assembly and layering of building materials and the burn time before ignition. Ratings are divided into classes:
A (the best – 2 to 4 hrs)
B (1hr)
C (20 min)

Material Classification
Class A/B
- Brick
- Stone
- Block
- Concrete synthetic stone
- Metal
- Stucco
- Synthetic stucco
- Fiber cement panels, boards, shingles
- Heavy timber log (minimum of six-inch diameter)

Class C
- Wood panels and boards

However, Class A materials generally need an underlayment of additional materials to give it a class A *rating*. This is because Class A materials conduct heat beyond the exterior**.**

The combined use of fire-rated building materials, design, and assembly gives your home a better chance of surviving a wildfire.

References
For additional information on protecting your homesite, see Colorado State University Cooperative Extension Fact Sheets:
- 6.302, *Creating Wildfire-Defensible Zones*
- 6.303, *Fire-Resistant Landscaping*
- 6.304, *Forest Home Fire Safety*
- 6.305, *FireWise Plant Materials*
- 6.306, *Grass seed Mixes to Reduce Wildfire Hazards*

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Colorado State Forest Service

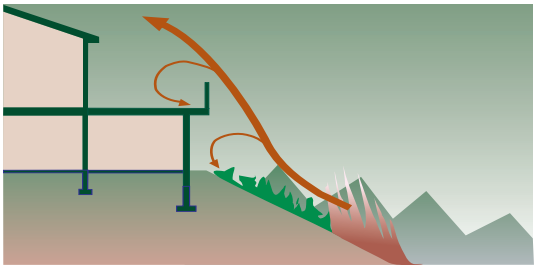
August 2005

Windows and Glass

General
No material is "fire proof." However, the proper use and assembly of fire-rated building materials can reduce a fire's spread, and extend the amount of time it takes for a home to ignite and burn.

Windows are the weakest component of your home in relation to wildfire. Glass can fracture within five minutes in direct heat. If the glass breaks and dislodges, your home's interior is vulnerable to fire. Keep the following in mind when building or remodeling your home:

Large vs. small windows
If fractured glass stays in place during a fire it can continue to shield hot gasses and open flame from entering your home. However, radiant energy can eventually ignite materials behind the window even with glass is place. Windows smaller than 2'x 2' will hold fractured glass in place better than larger windows.

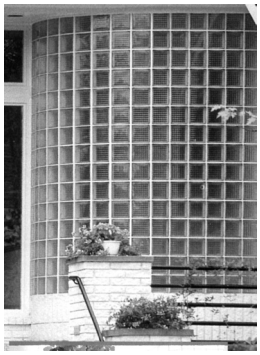


Small and large windows

Thermopane or double glazed windows
Thermopane or double-glazed glass will last twice as long as conventional glass windows (ten minutes). The same effect of convective and radiant energy apply, but, because there are two layers, the second pane is protected until the glass on the first has completely failed and fallen away.

Low E and tempered glass
Tempered glass is resistant to high impact and high heat, while Low E (low emissivity) glass stops the transfer of radiant heat beyond its exterior. The combination of the two provides the best protection in a wildland fire.

Glass block
Glass block is also a good alternative. Though not as visually appealing, this fire resistive glass has the highest rating (90 minutes).



Other:
- Solid in-pane shutters can offer an additional 10-20 minutes of protection
- Solid aluminum frames are best. Upgrade frames when windows are upgraded to better insure glass stability and hold during a wildfire.

Windows and glass do not have *"Material Classification"* labels that other building materials have, but the same concept applies. Understand the difference between material *Class* and *Rating*, and use this knowledge when upgrading around your home.

Ratings are based on the assembly and layering of building materials and the burn time before ignition. Ratings are divided into classes:
A (the best – 2 to 4 hrs)
B (1hr)
C (20 min).

Material Classification (in general)

Class A

- Inorganic materials (metal, brick, tile etc.)

Class B

- Whole wood materials (usually pressure treated, or thick diameter)

Class C

- Reconstituted wood (plywood, particle board, hardboard etc.)

Material **Class** is categorized by composition, or resistance to fire (combustible vs noncombustible). Class A has the highest resistance; Class C has the least resistance.

However, Class A materials generally need an underlayment of additional materials to obtain class A *ratings*. This is because Class A materials conduct heat beyond the exterior**.**

The combined use of fire-rated building materials, design, and technique will give your home a fighting chance to survive a wildfire.

References

For additional information on protection your homesite, see:

- 6.302, *Creating Wildfire-Defensible Zones*
- 6.303, *Fire-Resistant Landscaping*
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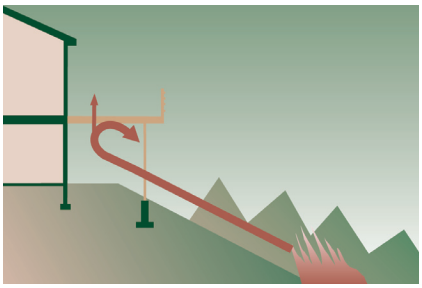
Decks

General
Though no material is "fire proof," the proper use and assembly of fire-rated building materials can reduce a fire's spread, and lengthen the amount of time it takes for a home to ignite and burn. Structural assembly is the layering of building materials.

Decks are a very popular, well-used feature of many homes. However, they often face downhill towards a fire's most likely approach – up a slope. Wood decks are also, highly combustible. Their constructional design makes them vulnerable to convective energy, wind blown embers, and trapped hot gasses. Decks are built perfectly to burn, almost as easily as wood stacked in a fireplace.

Conventional wood decks
All components of conventional wood decking are made of two inch thick wood with high surface to volume ratios – readily combustible and conducive to fire spread. Decks often ignite from radiant energy or wind-blown embers before approaching wildfire reaches the house. Use of Class A or B materials will reduce risk.

Isolate deck from fire with a patio and wall
If possible isolate the deck from fuels and fire by building a noncombustible patio and wall below it. A patio will ensure that no combustible materials are below the deck. The wall will act as a shield, deflecting both radiant heat and hot gasses from the fire.



Deck with a patio and a wall below

Heavy timber decks
The same rules for heavy timber siding applies to deck construction. A minimum thickness of six inches is required for structural members and posts, and three inches for decking and rails. The low surface-to-volume ratio of heavy timber takes longer to burn, making it a practical choice in moderate fire-hazard areas.

Composite decking
Composite decking is a mixture of recycled contents (generally wood and plastic). It's very durable and has a high resistance to environmental weathering. It requires no sealants and is noncombustible. However, even though this material will not ignite, it will fail and melt. No known tests have been done on the toxicity of fumes released by this melted material.

Fire-resistive materials
The same structural assembly rules apply here as with home construction. The combination of noncombustible and rated materials can offer longer protection than a single material by itself. However, keep in mind, additional layering of materials will require a reinforced structural support.

Other

- Enclose decks and balconies or use fire-resistive materials on surface and exposed underside to deflect flames and embers.

- Build a noncombustible patio and wall below to help deflect heat and energy from a fire.

Ratings are based on the assembly and layering of building materials and the burn time before ignition. Ratings are divided into classes:
A (the best – 2 to 4 hrs)
B (1hr)
C (20 min)

Material Classification

Class A/B

- Heavy timber log (minimum of 6 inch diameter)
- Brick
- Stone
- Concrete
- Concrete synthetic stone
- Composition decking
- Metal/steel
- Membrane
- Fiber cement

Class C

- Wood panels and boards

Material **Class** is categorized by composition, or resistance to fire (combustible or noncombustible). Class A has the highest resistance; class C has the least resistance.

However, Class A materials generally need an underlayment of additional materials for class A *rating*. This is because Class A materials conduct heat beyond the exterior**.**

The combined use of fire-rated building materials, design, and assembly will give your home a chance of surviving a wildfire.

References

For additional information on protection your homesite, see:

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