Building for the Future: Integrating Fire Resilience with Energy Efficiency in High-Performance Design

Webinar – May 14, 2025

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Integrating Fire Resilience with Energy Efficiency

In today's webinar we'll discuss:

How fire-resistant materials can align with energy-efficient design to create resilient, sustainable buildings in wildfire-prone regions

- Wildfire resistant building enclosure design and construction and lessons learned from past disasters
- Natural and healthy materials for fire and climate resiliency
- Regulatory barriers and opportunities for earthen and bio-based materials

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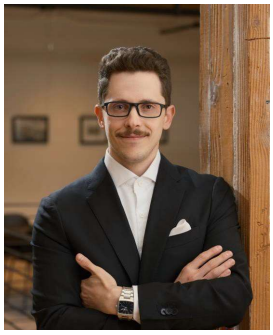
Today's Panelists



Cameron Chorney
RDH Architects

Ali Samantha Keenan
Ali Keenan Architecture

Ben Loescher
Loescher Meachem Architects

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Quiz time!

What physical elements in the city contributed the most to the **spread** of the January 2025 Eaton Fire?

- Trees and landscaping
- Homes and cars
- Lighting, communications, and energy infrastructure

Source: https://dirt.asla.org/2025/04/01/with-a-landscape-approach-we-can-reduce-the-risk-of-the-next-wildfire-disaster-by-ronnie-swire-siegel/

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MAY 14, 2025

Wildfire Resistant Construction - Lessons Learned and Rebuilding

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Outline

- Why Wildfire Resistant Construction?
- What is Wildfire Resistant Construction (WFRC) ?
- Wildfire Resistant Construction Details
- Climate Change Mitigation
- Additional Resources

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Why Wildfire Resistant Construction?

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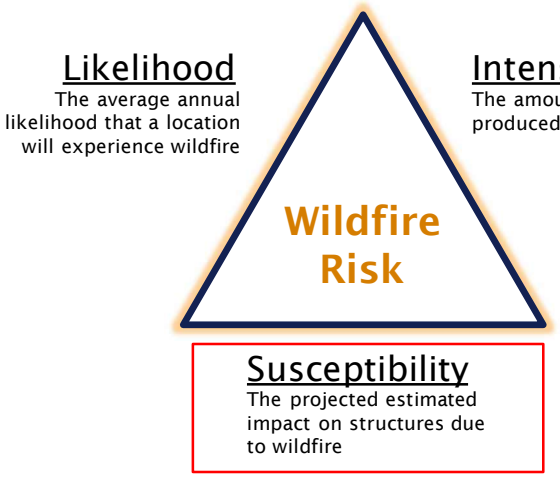
Why Build Wildfire Resistant Homes?



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Wildland-Urban Interface (WUI): A geographical area identified as a "Fire Hazard Severity Zone" or other areas designated by the enforcing agency to be at a significant risk from wildfires.

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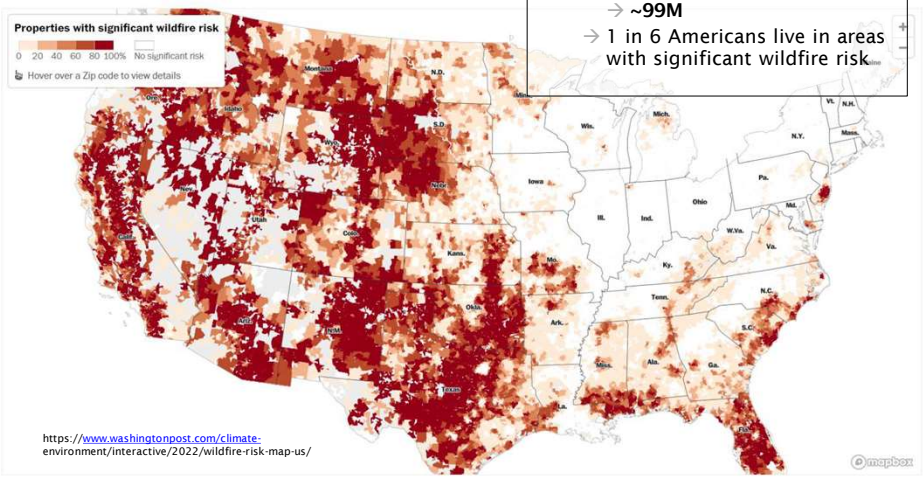
Impact

- **United States**
  - ~30% of US Pop lives in WUI zone (Radeloff et al. 2018)
    - **~99M**
  - 1 in 6 Americans live in areas with significant wildfire risk



https://www.washingtonpost.com/climate-environment/interactive/2022/wildfire-risk-map-us/

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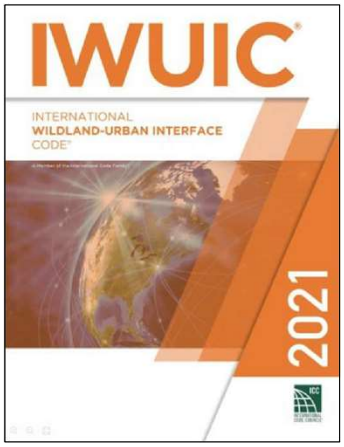

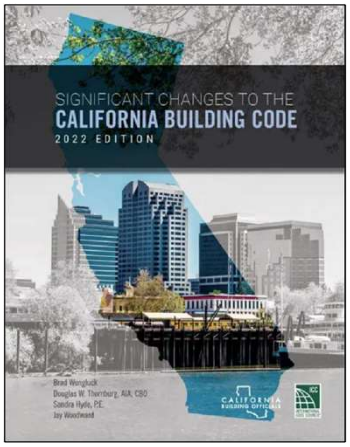

Chapter 7A *[SFM] Materials and Construction Methods for Exterior Wildfire Exposure*

- 701A *Scope, Purpose and Application*
- 702A *Definitions*
- 703A *Standards of Quality*
- 704A *Ignition-Resistant Construction*
- 705A *Roofing*
- 706A *Vents*
- 707A *Exterior Covering*
- 708A *Exterior Windows, Skylights and Doors*
- 709A *Decking*
- 710A *Accessory Buildings and Miscellaneous Structures*

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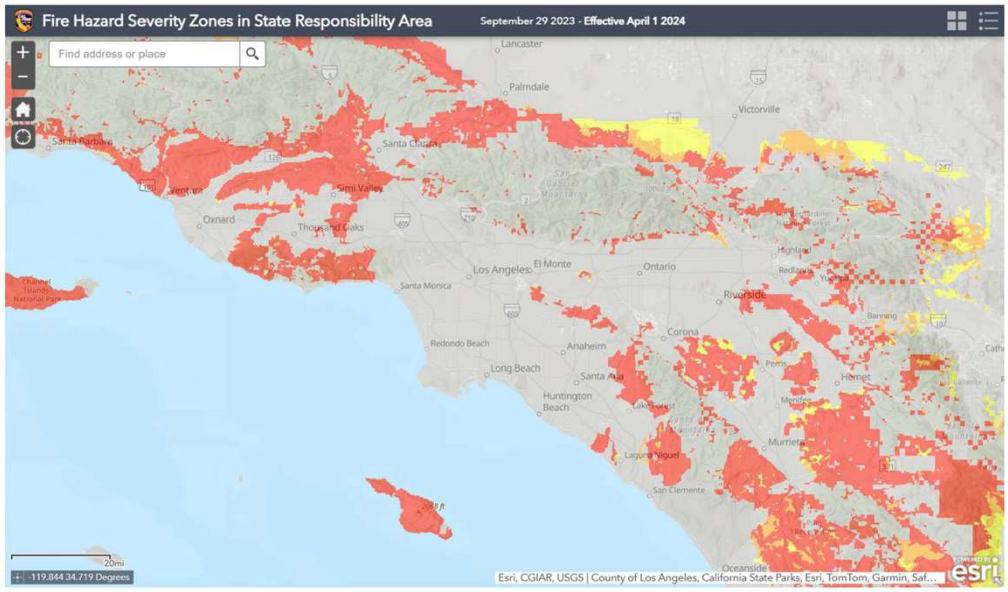

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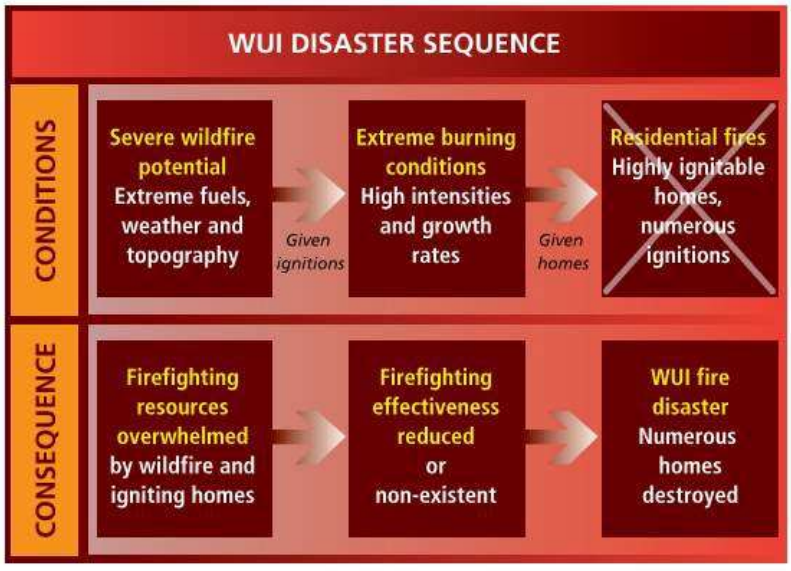

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Why some homes survived: Learning from the Fort McMurray wildland/urban interface fire disaster. Westhaver 2017

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Why Build Wildfire Resistant Homes?

- Embers cause 50-90% of structure ignitions
- WFR construction reduces risk of structure ignition from embers and heat
- Camp Fire (2018) - California
  - Homes built **before 2008** - **18%** survived
  - Homes built **after 2008** - **51%** survived

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What is Wildfire Resistant Construction (WFRC) ?

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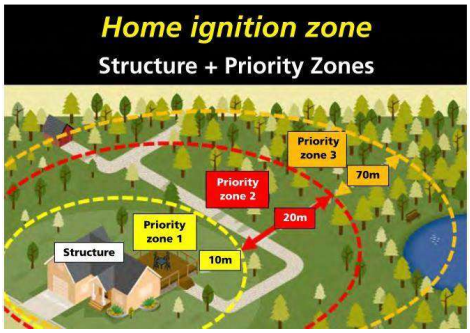
What is Wildfire Resistant Construction (WFRC) ?

- Reduces risk of **structure** ignition due to wildfire
- Slows the spread of fire in a community
- Should be used in tandem with other mitigation measures
  - Landscaping
  - Fuel management
  - Structure response (fire fighting)
- **Not fire-proof**



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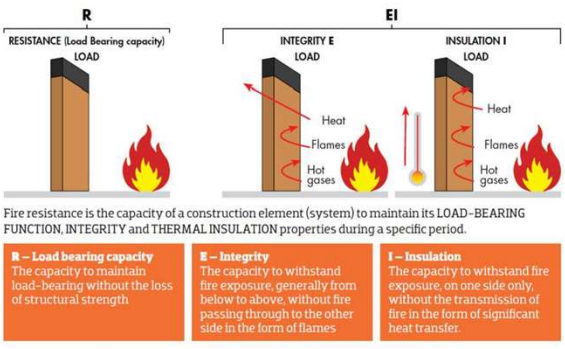
What is a Fire Resistance Rating (FRR)?

- **Fire Resistance Rating (FRR)** = duration of time that an assembly can withstand exposure to fire under standard testing conditions without collapsing or allowing fire to spread to the unexposed side.
- Stems from urban fires in the late 1800s and early 1900s and typically fires starting inside buildings
- In the IBC, all assembly fire resistance ratings are based on interior fires



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ASTM E119 - 2 Hour Listing for Unique Assemblies: e.g. 1" stucco over strawbale




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Wildfire Resistant Construction Measures

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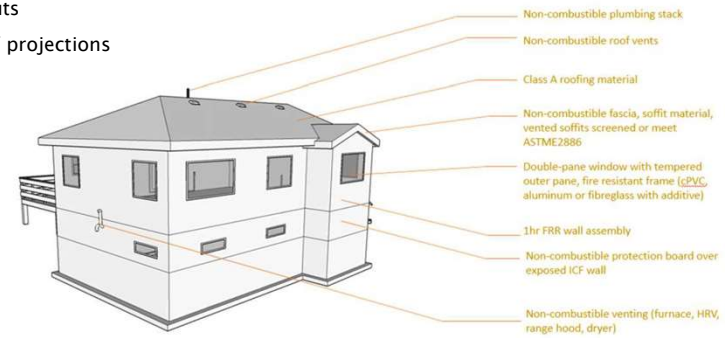
Fire Resilient Construction Measures

1. Roof
2. Gutters and downspouts
3. Eaves, soffits and roof projections
4. Exterior walls
5. Foundation walls
6. Windows and doors
7. Decks and balconies



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Roof

1. Class A roofing material (e.g. asphalt, tile, metal, composite)
2. Flashing is non-combustible
3. Pipes are non-combustible
4. Vents non-combustible with screen (<1/8")
5. Cants, curbs, nailing strips non-combustible
6. No gaps greater than 1/8"

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Gutters and Downspouts

1. Non-combustible (ie. aluminum) with screen or guard to prevent buildup of debris

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Eaves, Soffits and Roof Projections

1. Eaves, fascia, roof projections non-combustible
2. All roof vents non combustible with screen (<1/8")
3. Soffits, gable ends, and roof projections enclosed when not used for venting

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Solar Panels

- Install Class A rated panels for greatest protection
- Maintain panels free of damage and debris
- Install invertor and energy storage components within the building and not within 5' of exterior walls
- Fire classification requirements were updated in 2014 (UL 1703) with focus on fire performance considerations
- Installation very important

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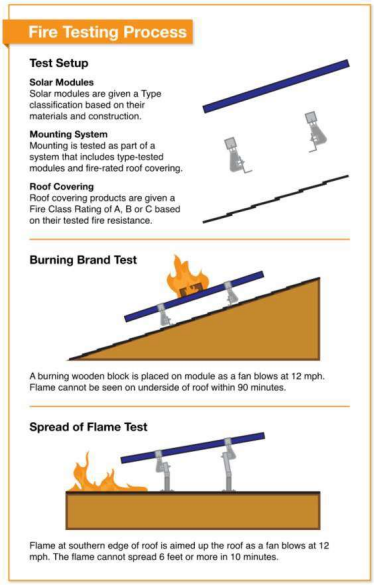

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Exterior Walls

1. Wall cladding extends from top of foundation to underside of roof structure
2. No gaps greater than 1/8"
3. Fire Resistance Rating ASTM E119 from the exterior
4. Non-combustible cladding (e.g. fiber cement, stucco, metal)
5. Rainscreen has non-combustible screen mesh

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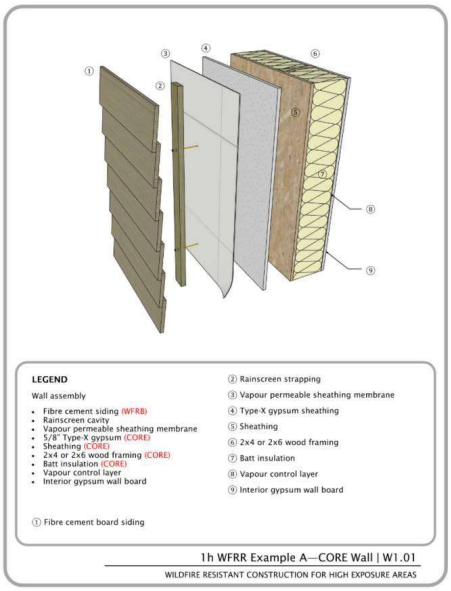
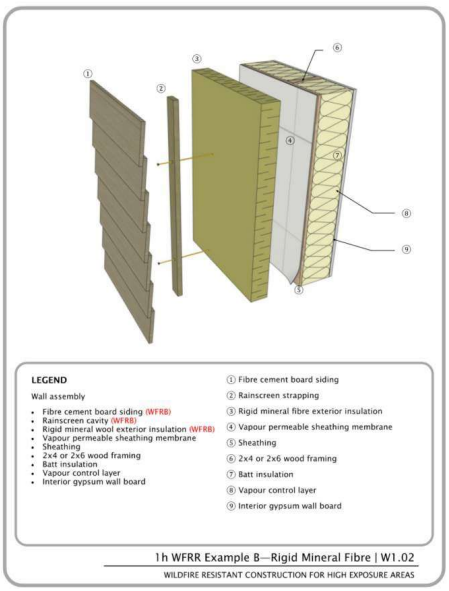
1h WFRR Wall Assemblies





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Window failure

- →Wildfire enters interior of building through failed windows
- →Glass can fail when:
  - → Exposed to extreme heat (radiant/flame)
  - → Wind blown debris
- →Frames can fail:
  - → Deformation caused by extreme heat
    - → Frame deformation
    - → Between glass unit and separators/interlocks
  - → Combustion caused by heat

Dual pane window in a fire. Radiant exposure resulted in the failure of this window, including both pieces of glass, and the vinyl clad screen. The length of exposure to the heat is an important factor to prevent the failure of the window.

Vinyl frame. The vinyl deformed as a result of a radiant exposure from a neighboring home that had ignited and was ultimately destroyed. The glass did not break, or fall out as a result of the deformation in the vinyl frame.

Double pane annealed glass window. Photograph after a 2007 wildfire in the Lake Arrowhead area. The outer pane broke under radiant exposure from a neighbor's house that burned down. The window was dual pane with a vinyl frame. Both panes contained (regular) annealed glass.

Image Credit: University of California, Agriculture and Natural Resources

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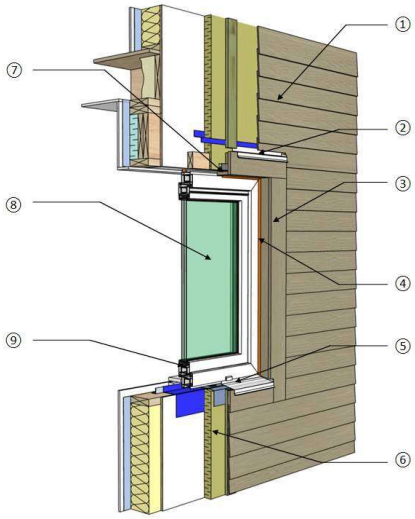
Windows

- Multi-pane (minimum double glazing); including,
- Minimum one pane of tempered glass (preferably the outer pane); AND
- Fire-resistant frame material, for example:
  - Metal (aluminum, steel), thermally broken; OR
  - Wood with non-combustible skin (ie. aluminum clad); OR
  - uPVC with steel reinforcement to prevent frame deformation; OR
  - Fiberglass with fire resistant resin.
- Skylights should meet the requirements listed above.



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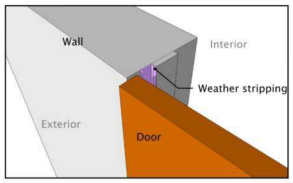
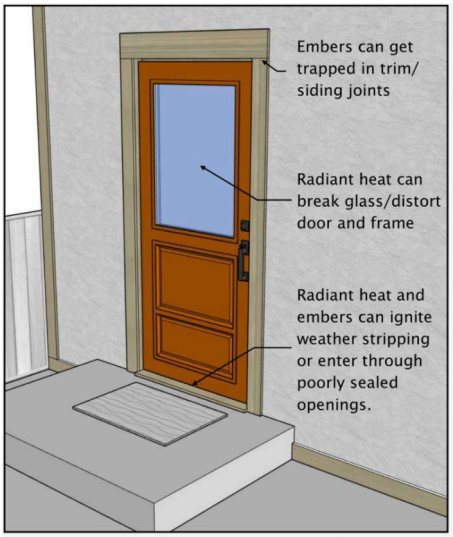
Doors

- Non-combustible door skin (for insulated doors), OR
- Solid wood core not less than 1 ¾ inches thick (44mm), AND;
  - Stiles and rails must be minimum 1 3/8 inches thick;
  - Raised panels must be minimum 1 ¼ inches thick except the perimeter of the panel, which can taper to a minimum 3/8" thick.



Graphic 1.2— Protected weather stripping



Graphic 1.1— Weak points in exterior door

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Wildfire Resistant Construction Details

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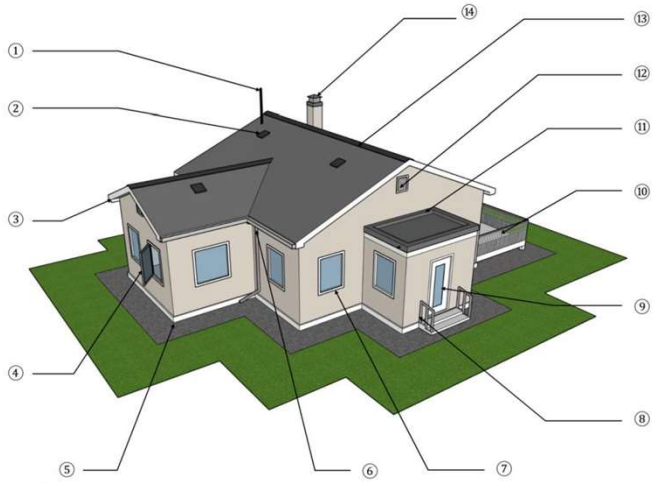
Enclosure Vulnerabilities



LEGEND

① Plumbing and HVAC penetrations
② Roof vents
③ Soffits and soffit vents
④ Operable windows
⑤ Base of wall
⑥ Gutters and downspouts
⑦ Windows and window trim
⑧ Structural connections (guardrails, etc.)
⑨ Doors, door trim and weather stripping
⑩ Decks, balconies and cantilevered floors
⑪ Roof/wall interface
⑫ Gable-end vents
⑬ Ridge vent
⑭ Chimneys

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+Importance of Details

- Once the wall assembly is designed and meets the 1h WFRR then develop the building enclosure details for fire protection
- Getting the details correct is just as critical as the assembly design - is a complete system
  - Non-combustible materials
  - Resistant to high temperatures from contact with brands/embers and from radiant heat
  - Block ember entry w/ screens
  - Protect temperature sensitive materials like wood, plastics etc.
- Consider resiliency and post-fire repairs

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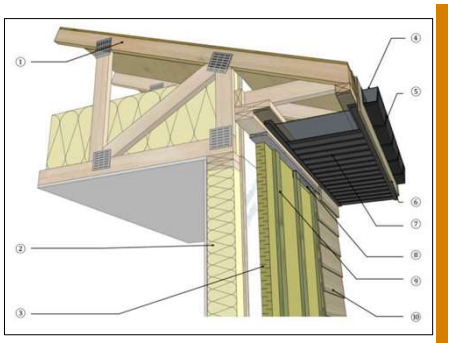

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Wildfire Resistant Barrier (WFRB)

- Same idea as air barrier, vapor barrier, water resistant barrier
- Must be continuous and encapsulate the combustible elements of the building
- Must be able to resist heat and embers

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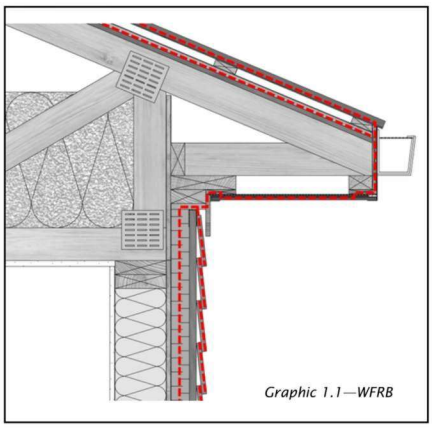

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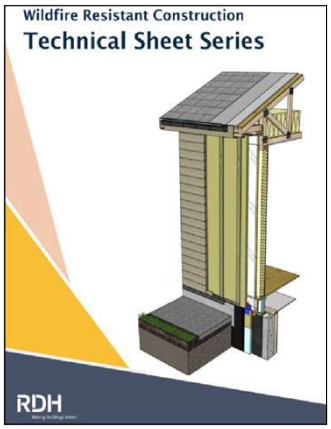
RDH WFRC Technical Sheets & Other Technical Guidelines



ROCKWOOL

Building with ROCKWOOL Stone Wool Insulation in Wildfire-Prone Areas
Technical Bulletin

Wood Frame Construction up to 4 Storeys: Lightweight Cladding.

Intended Use of this Document

This document provides example key assembly interface details showing the use of ROCKWOOL™ products within a split-insulated wall assembly for commercial buildings up to 4 stories.

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Code Jurisdiction	Building Components			
	Common Requirements	01 - Roof Covering	02 - Walking Surfaces	03 - Protection of the Eaves
California	**R337.7.3. Coverings:** Noncombustible materials - OR - Ignition resistant materials - OR - Fire retardant treated wood. **R337.7.4 Assemblies:** 1-hour fire resistance rated construction - OR - One layer of 5/8" Type X Manual.	**R337.5.1.** ASTM E108 Class A Rating. Where covering has gap between covering and combustible deck, include mineral surfaced nonperforated cap sheet over combustible decking Add bird stops at eaves to prevent debris. Caps shall be mudded in to prevent fire ember intrusion. EXCEPTION: Cap sheet not required when no less than 1 inch of mineral wool board or other noncombustible materials is located between the roofing material and wood framing or deck. Can also use fire retardant deck material if no cap sheet is provided.	**R337.9** Walking surfaces of decks, porches, balconies and stairs within 10' of buildings	**R337.7.5 and 337.7.6** **Refer to Common Requirements.** EXCEPTION: Trim and fascia boards.

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Code Jurisdiction	Building Components			
	04 - Gutters and Downspouts	05 - Exterior Walls	06 - Foundation Walls	07 - Underfloor Enclosure
California	**R337.5.4** Roof gutters provided with means to prevent accumulation of leaves and debris.	**R337.7.3 and 337.7.4** Exterior coverings, wall assemblies, eave overhangs, soffits, porch ceilings, floor projections, and underfloor areas **Refer to Common Requirements.** Top of foundation to roof, terminated with 2" nominal solid wood blocking between rafters at all roof overhangs. Where enclosed eaves, terminate at the enclosure. Trim, fascias, embellishments, fascias, and gutters excluded.	-	**R337.7.9** **Refer to Common Requirements** - OR - Enclosed to grade. EXCEPTION: Structural columns and beams do not require protection where they are heavy timber 4" nominal or more.

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Code Jurisdiction	Building Components			
	08 - Appendages and Projections	09 - Exterior Glazing	10 - Exterior Doors	11 - Vents
California	**R337.7.10** Underside of Appendages: **Refer to Common Requirements.** EXCEPTION: Structural columns and beams do not require protection where they are heavy timber 4" nominal or more.	**R337.8.2** 1. Tempered, multi pane glass, 2. Glass blocks, 3. 20-min fire resistance rating per NFPA 257 4. Tested to SFM 12-7A-2 Openable skylights require non-combustible screen with mech apertures limited to 1/8" (3.2 mm).	**337.8.2. Exterior glazed doors:** Tempered, multi pane glass, -OR- Glass blocks, -OR- 20-min fire resistance rating per NFPA 252 -OR- Tested to SFM 12-7A-2 337.8.3. Exterior non-glazed doors Surface / Cladding is non-combustible / ignition resistance, -OR- Solid core wood with panels 1 1/4" thick, -OR- 20-min fire resistance rating -OR- Tested to ASTM E2707 or SFM 12-7a-1.	**337.6.2.** Vent openings to be wildfire flame and ember resistant approved by the fire marshal, -OR- Tested to ASTM E2886. Vents on sloped roofs shall be covered with a non-combustible, corrosion-resistant screen with a mesh aperture less than 1/8" (3.2mm).

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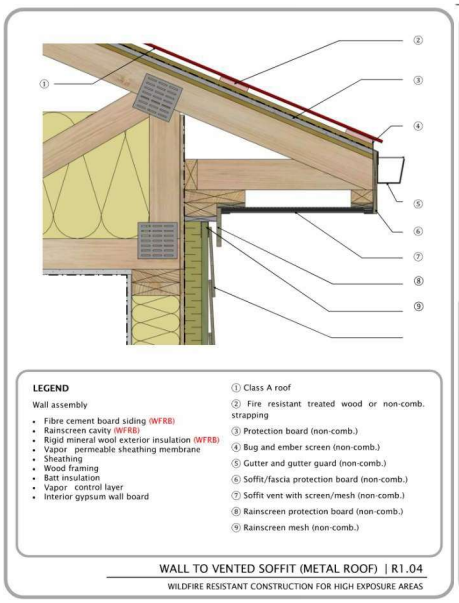


LEGEND

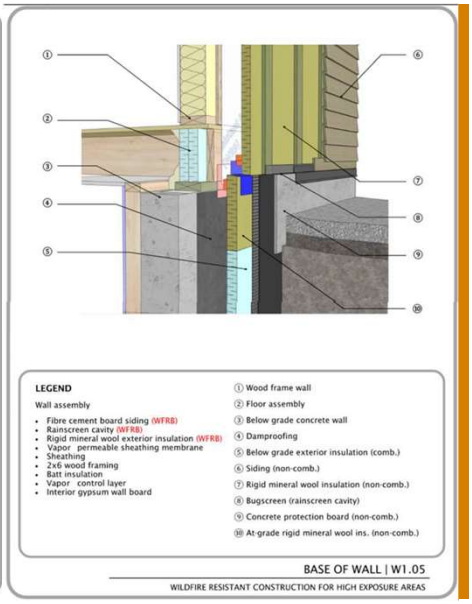
Wall assembly

- Fibre cement board siding (WFRB)
- Rainscreen cavity (WFRB)
- Rigid mineral wool exterior insulation (WFRB)
- Vapor permeable sheathing membrane
- Sheathing
- Wood framing
- Batt insulation
- Vapor control layer
- Interior gypsum wall board

① Class A roof
② Fire resistant treated wood or non-comb. strapping
③ Protection board (non-comb.)
④ Bug and ember screen (non-comb.)
⑤ Gutter and gutter guard (non-comb.)
⑥ Soffit/fascia protection board (non-comb.)
⑦ Soffit vent with screen/mesh (non-comb.)
⑧ Rainscreen protection board (non-comb.)
⑨ Rainscreen mesh (non-comb.)

WALL TO VENTED SOFFIT (METAL ROOF) | R1.04

WILDFIRE RESISTANT CONSTRUCTION FOR HIGH EXPOSURE AREAS



LEGEND

Wall assembly

- Fibre cement board siding (WFRB)
- Rainscreen cavity (WFRB)
- Rigid mineral wool exterior insulation (WFRB)
- Vapor permeable sheathing membrane
- Sheathing
- 2x6 wood framing
- Batt insulation
- Vapor control layer
- Interior gypsum wall board

① Wood frame wall
② Floor assembly
③ Below grade concrete wall
④ Damproofing
⑤ Below grade exterior insulation (comb.)
⑥ Siding (non-comb.)
⑦ Rigid mineral wool insulation (non-comb.)
⑧ Bugscreen (rainscreen cavity)
⑨ Concrete protection board (non-comb.)
⑩ At-grade rigid mineral wool ins. (non-comb.)

BASE OF WALL | W1.05

WILDFIRE RESISTANT CONSTRUCTION FOR HIGH EXPOSURE AREAS

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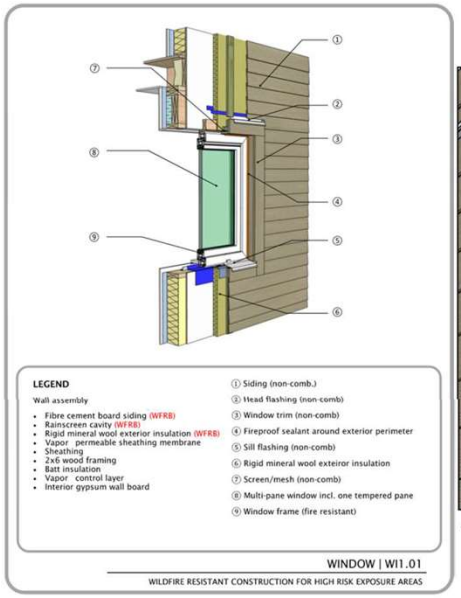


LEGEND

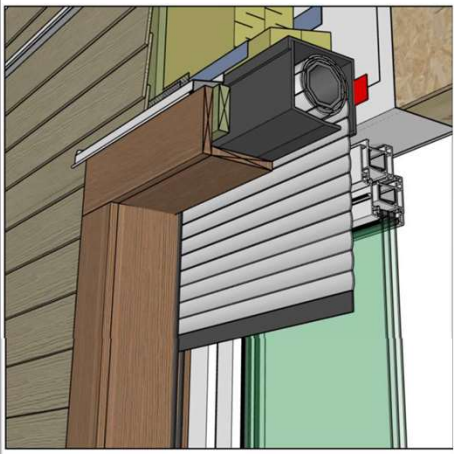
Wall assembly

- Fibre cement board siding (WFRB)
- Rainscreen cavity (WFRB)
- Rigid mineral wool exterior insulation (WFRB)
- Vapor permeable sheathing membrane
- Sheathing
- 2x6 wood framing
- Batt insulation
- Vapor control layer
- Interior gypsum wall board

① Siding (non-comb.)
② Head flashing (non-comb)
③ Window trim (non-comb)
④ Fireproof sealant around exterior perimeter
⑤ Sill flashing (non-comb)
⑥ Rigid mineral wool exteiror insulation
⑦ Screen/mesh (non-comb)
⑧ Multi-pane window incl. one tempered pane
⑨ Window frame (fire resistant)

WINDOW | WI1.01

WILDFIRE RESISTANT CONSTRUCTION FOR HIGH RISK EXPOSURE AREAS



Graphic 1.1— Integrated exterior fire shutter

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Climate Change Mitigation

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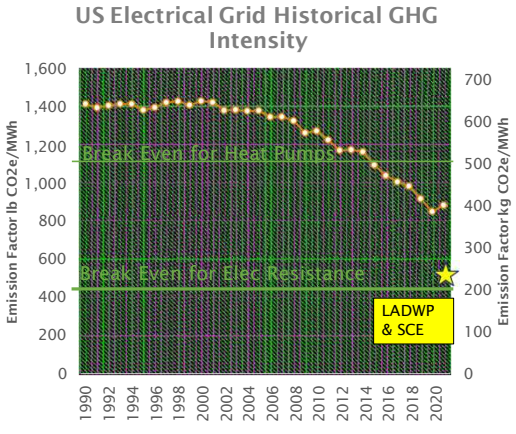
Emissions Intensity by Source

Generation Source	lbs CO_2e/kWh	kg CO_2e/kWh
Coal	2.26	1.03
Natural Gas	0.97	0.441
Petroleum	2.44	1.11
Hydro	0	0
Nuclear	0	0
Solar PV	0	0
Wind	0	0



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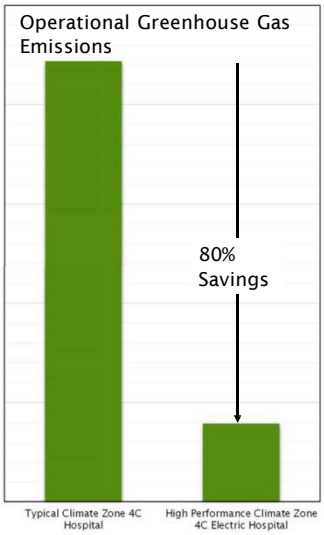
Energy efficiency and electrification

- Electrifying heating can have a significant impact on operational greenhouse gas emissions (depending on energy grid)
- Seek opportunities to electrify
  - Appliances
  - Heating and Cooling
  - Vehicles



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Additional Resources

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Additional Resources

- Rockwool/RDH Technical Bulletin: https://www.rockwool.com/syssiteassets/o2-rockwool/documentation/technical-bulletins/residential/rockwool—building-with-stone-wool-in-wildfire-prone-areas.pdf?f=20250311140839
- SFPE WUI Handbook: https://www.sfpe.org/wuihandbook/home
- NFPA Wildfire Resources: https://www.nfpa.org/education-and-research/wildfire
- 2022 CBC – Chapter 7A: https://up.codes/viewer/california/ca-building-code-2022/chapter/7A/sfm-materials-and-construction-methods-for-exterior-wildfire-exposure#7A
- Calfire WUI Listed Products: https://osfm.fire.ca.gov/what-we-do/fire-engineering-and-investigations/building-materials-listing
- IBHS Wildfire Research: https://ibhs.org/risk-research/wildfire/
- AIACA Hardening for Wildfire Resilience: https://aiacalifornia.org/news/hardening-for-wildfire-resilience/
- Continuing Education: Wildfire-Adapted Design: https://www.architecturalrecord.com/articles/14853-continuing-education-wildfire-adapted-design#continuing-education
- Sustainable Defensible Space - www.defensiblespace.org

nbi

49

Materials

For Fire [**& Climate**] Resiliency

A fire poppy only blooms after a wildfire.

50


L.A. fire contaminant levels could sicken the marine food chain, new tests show
L.A. County soil testing near Eaton, Palisades fires shows significant contamination
The L.A. wildfires left lead and other toxic material in the soil of burn zones. Here are their health risks
After Wildfires, L.A.'s Clear Skies Conceal a 'Toxic Soup'
Scientists urge caution after a carcinogen is detected in water in fire-stricken areas
More fire-torn Altadena homes test positive for asbestos than Palisades – affecting cleanup times, Sen. Schiff says
Health impact of California wildfires to be felt for years to come
A 'calamity waiting to unfold': Altadena residents with standing homes fear long-term health effects
Image: LA Times 2025-01-08

51


Image: Jae C. Hong

52

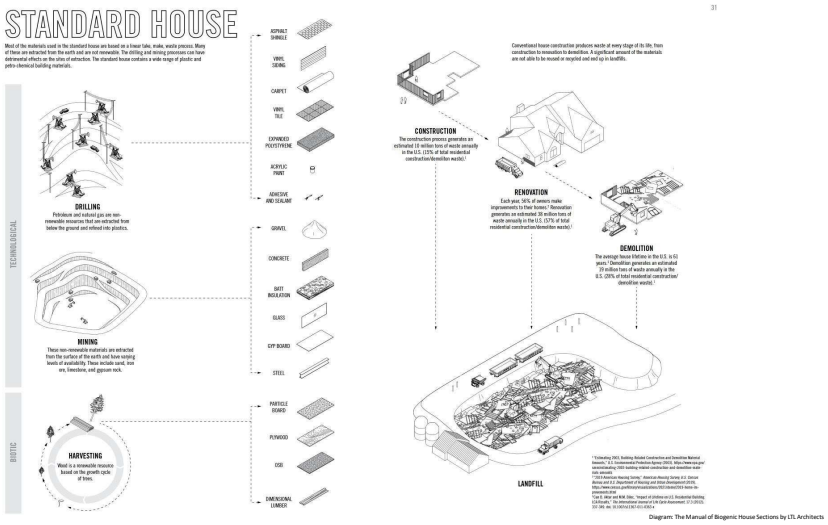
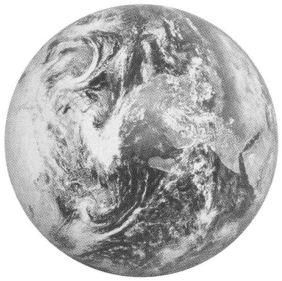


Diagram: The Manual of Biogenic House Sections by LTL Architects

53

Can we put our planet forward…***finally***?

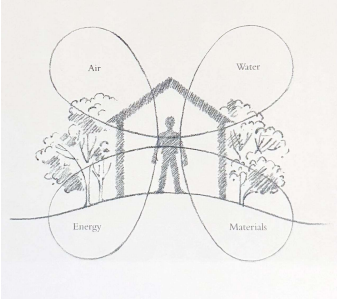


Climate change is happening all around us

Image: climatescience2030.com

54

What is a ***healthy home***?



Healthy for the home's *occupants*.

Healthy for the home's *builders*.

Healthy for the *material manufacturers & surrounding communities*.

Healthy for the *planet*.

Image: The New Natural House Book by David Pearson

55

Diagram: USGBC Better Building Materials Guide

56


1 – PFAS
Although useful, PFAS remain in the environment indefinitely and may cause serious health problems.
2 – Antimicrobials
Antimicrobials have limited benefit, if any, and are associated with developmental, hormonal, and reproductive problems.
3 – Flame Retardants
Flame retardants are added to products to meet flammability standards. They often don't improve fire safety and can harm our health.
4 – Bisphenols + Phthalates
These hormone disrupting chemicals are so widely used that we are constantly exposed. They can harm our health, even at very low levels.
5 – Some Solvents
Some solvents used in consumer products are linked to neurological problems and increased cancer risk.
6 – Certain Metals
Metals are essential for many uses, but some, such as mercury, arsenic, cadmium, and lead, can cause health harm. Fetuses and young children are particularly susceptible.
Diagram: sixclasses.org

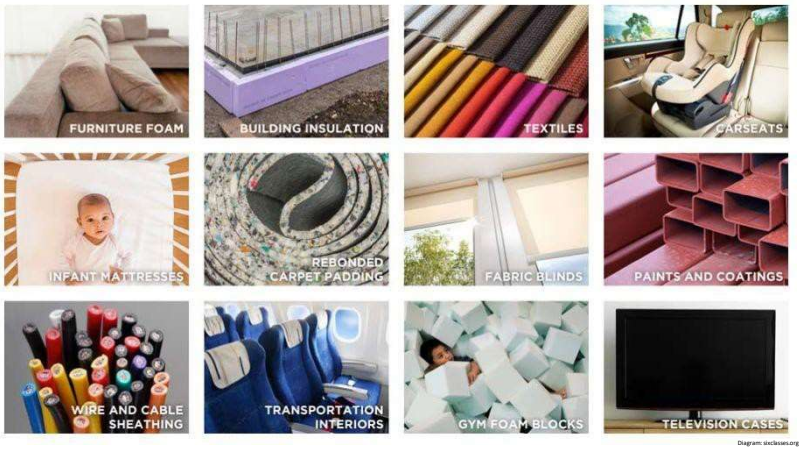
57

PFAS


CARPETS
CARPET CLEANING PRODUCTS
FOOD PACKAGING
FURNISHINGS
COSMETICS
OUTDOOR GEAR
CLOTHING
ADHESIVES AND SEALANTS
PROTECTIVE COATINGS
NON-STICK COOKWARE
CARSEATS
FIREFIGHTING FOAM
Diagram: sixclasses.org

58

Flame Retardants



59

How to be high performance ***and*** fire resilient at the exterior envelope of a ***healthy home***:

- Use fewer construction materials in fire resilient assemblies and ensure that the materials used have low embodied energy to significantly reduce short-term emissions.
- Choose bio-based and/or recyclable fire resistant materials.
- Lock as much carbon storage into the structure as possible.
- Protect workers, occupants and the planet by choosing products that have lower toxicity in manufacturing, construction and disposal. Fewer plastics, fewer chemicals, less plastic foam.

60

Earthen & Bio-Based Wall Assemblies

- Adobe
- Earth Block
- Rammed Earth
- Strawbale
- Light Straw Clay
- Cob
- Hemp Lime / Hempcrete
- Bamboo
- Rice Husk

Image: Adobe Stock

61

Comparison Table of Embodied Carbon of Building Wall Systems

EMBODIED CARBON (KGCO² PER KG)	BRICK RAINSCREEN	WOOD CLAPBOARD (LAP SIDING)	HEMP + LIME
Wood Framing¹			
Flame Retardant			*
Interior Paint (Single Coat)			
Gypsum Wall Board			
Hemp			
Polystyrene Foam Insulation* (General Purpose Polystyrene)			
Plywood Sheathing			
Air/Moisture Barrier (General Polyethylene)			
Brick (single)			
Mortar (cement, sand mix)			
Mortar (Hemp-Lime)			
Wood Lap Siding			
Starter Strip (Plywood)			
Brick Ties (Electrogalvanized Steel)			
Drainage Mat (Nylon Plastic) Filament			
Lime			
Sealant (Epoxide Resin)			
Aluminum Flashing (North American)			
Weep Hole Cover (Steel, hot-dip galvanized steel)			
Water			
TOTAL EMBODIED CARBON =	34.7 KG CO² PER KG	28.9 KG CO² PER KG	4.6 KG CO² PER KG

Hemp + Lime : a guide

Notes:

1. Wood structure falls under Timber category with no carbon storage
2. Report shows it is difficult to estimate the embodied carbon of lime
3. Gypsum Wall Board: Problems selecting good value, inconsistent figures. West et al believe this is because of past aggregation of EE with cement
4. The Hemp + Lime category is reduced to three main materials that create paint, stucco and plaster and mortar
5. Value for Foam Insulation is for General Purpose Poly-styrene
6. Embodied carbon of concrete excluded from table due to its use in all three assemblies

* Hemp is naturally flame retardant and it does not require additional chemicals.

LEGEND
- Absorbs CO²
- Releases CO²
- Neutral

Table 7.4 Embodied Carbon of Building Wall Systems

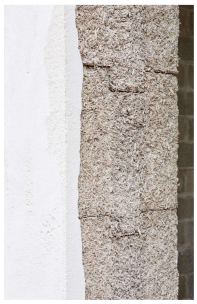


Diagram & Images: Healthy Materials Lab "Hemp +Lime: A Guide"

62

Re-thinking
Unvented Roofs

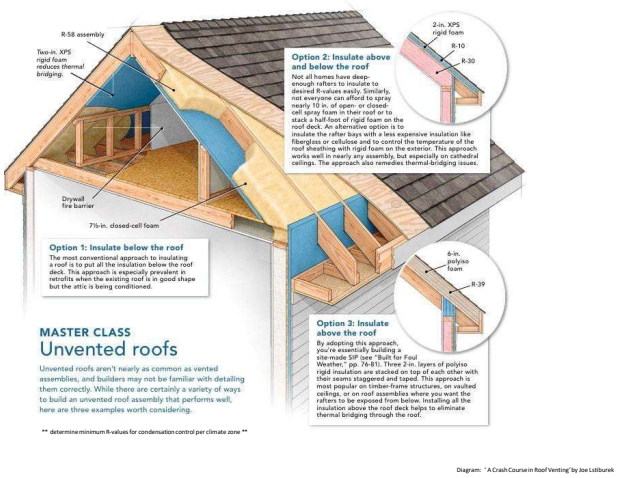


Diagram: "A Crash Course in Roof Venting" by Joe Lstiburek

63

Insulation

INFORMED

Diagram: informed.habitablefuture.org

64

THINK ABOUT TRANSPORT

THINK ABOUT AMOUNTS

REMEMBER SERVICE LIFE

REUSE OR WASTE?

THE DETAIL IS CRUCIAL

www.materialepyramiden.dk/

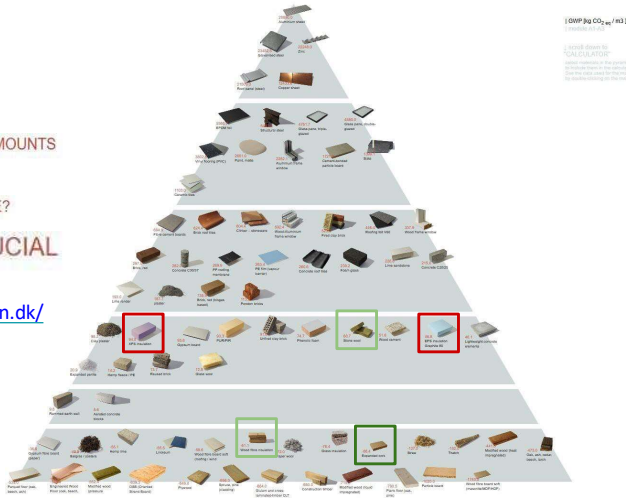


Image: https://www.materialepyramiden.dk/

65

The healthier choices:

Image: thermacork.com

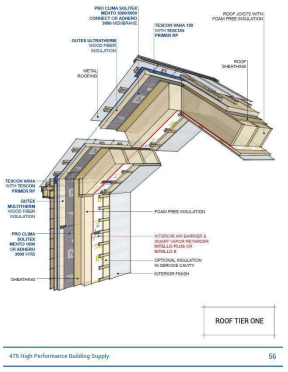
GUTEX
raw material sustainably harvested from the Black Forest

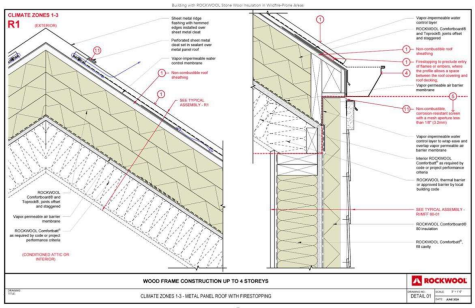
GUTEX
woodfiber insulation

Image: ' 2x Framing Smart Enclosure System' by 475 High Performance Building Supply

Image: rockwool.com

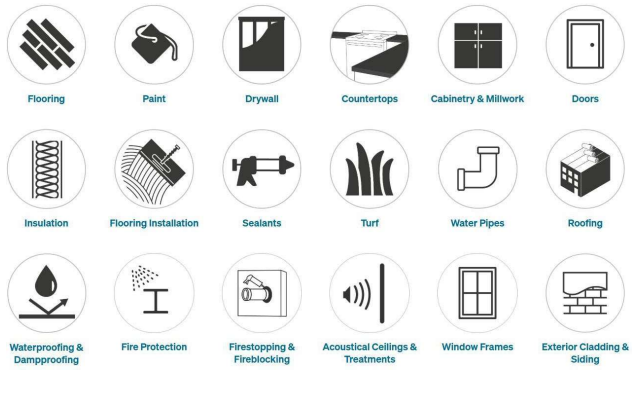
66


ROOF TIER ONE
475 High Performance Building Supply
56


CLIMATE ZONES 1-3
R1
WOOD FRAME CONSTRUCTION UP TO 4 STOREYS
ROCKWOOL
CLIMATE ZONES 1-3 - METAL PANEL ROOF WITH FIRESTOPPING
DETAIL 01


SMALL PLANET SUPPLY
PLAN IT WITH THE PLANET IN MIND

67


Flooring
Paint
Drywall
Countertops
Cabinetry & Millwork
Doors
Insulation
Flooring Installation
Sealants
Turf
Water Pipes
Roofing
Waterproofing & Dampproofing
Fire Protection
Firestopping & Fireblocking
Acoustical Ceilings & Treatments
Window Frames
Exterior Cladding & Siding
INFORMED
Diagram: informed.habitablefuture.org

68

Window Frames

INFORMED

Diagram: informed.habitablefuture.org

69

Paint

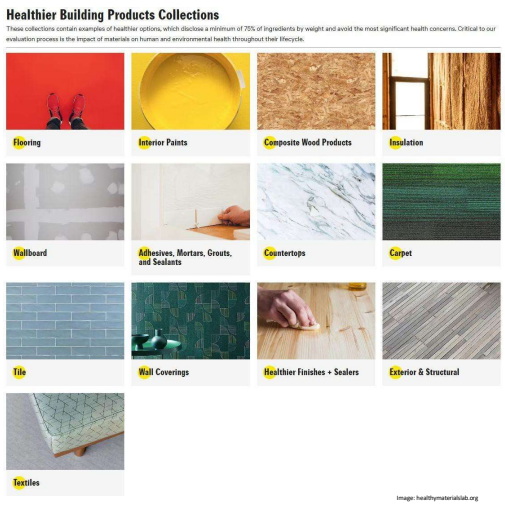
INFORMED

Diagram: informed.habitablefuture.org

70

Healthy Materials Lab

https://healthymaterialslab.org



71

We get what we give.

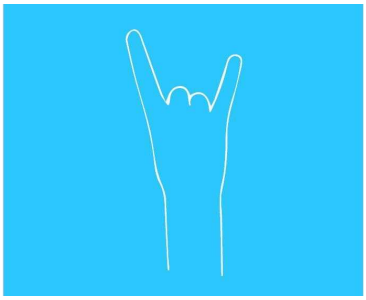


Image: Healthy Materials Method Cards

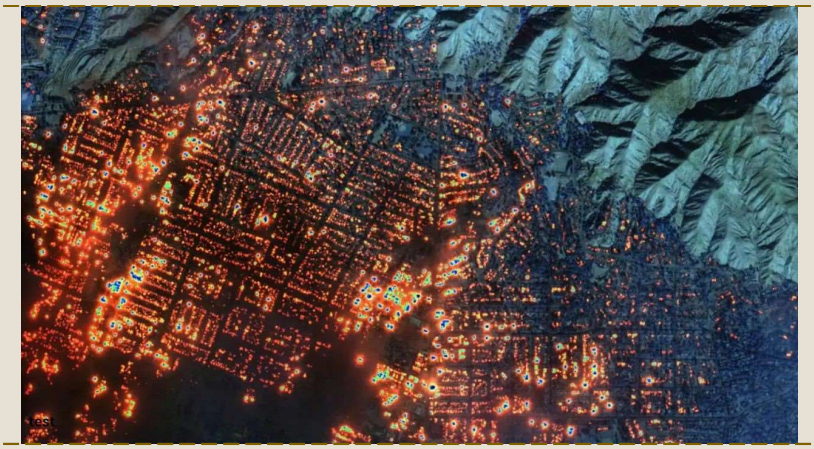
72

LOESCHER
MEACHEM
ARCHITECTS

73

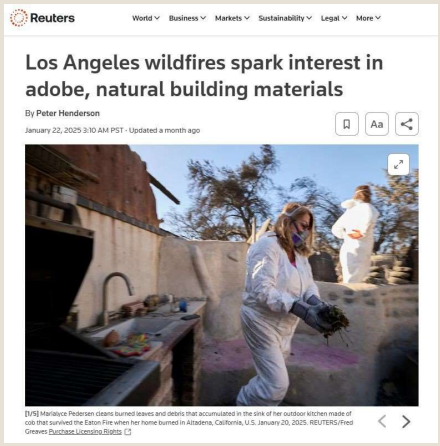
adobe
is not software

74



75

The Issue:



Reuters

World Business Markets Sustainability Legal More

Los Angeles wildfires spark interest in adobe, natural building materials

By Peter Henderson

January 22, 2025 3:10 AM PST · Updated a month ago

Aa

[1/5] Marialyce Pedersen cleans burned leaves and debris that accumulated in the sink of her outdoor kitchen made of cob that survived the Eaton Fire when her home burned in Altadena, California, U.S. January 20, 2025. REUTERS/Fred Greaves Purchase Licensing Rights

76

The Issue:

- California is under various mandates to reduce carbon emissions and embodied carbon from building materials.

77

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- Fires are becoming worse because of climate change

78

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- The building code mandates the use of specific materials in fire-prone areas

79

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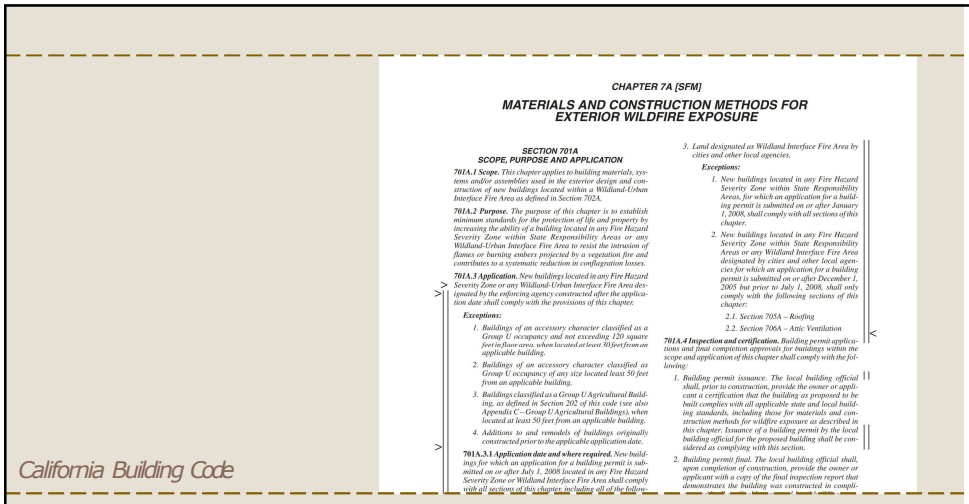
80

The Issue:

- California is under various mandates to reduce carbon emissions and embodied carbon from building materials.
- Fires are becoming worse because of climate change
- The building code mandates the use of specific materials in fire-prone areas
- Those materials are almost entirely imported and carbon intensive building materials
- Codes to allow locally sourced, carbon beneficial fire-resistant building materials are not recognized in California

81



CHAPTER 7A [SFM]

MATERIALS AND CONSTRUCTION METHODS FOR EXTERIOR WILDFIRE EXPOSURE

SECTION 701A
SCOPE, PURPOSE AND APPLICATION

701A.1 Scope. This chapter applies to building materials, systems and/or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface Fire Area as defined in Section 702A.

701A.2 Purpose. The purpose of this chapter is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface Fire Area to resist the intrusion of flames or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.

701A.3 Application. New buildings located in any Fire Hazard Severity Zone or any Wildland-Urban Interface Fire Area designated by the enforcing agency constructed after the application date shall comply with the provisions of this chapter.

Exceptions:

1. Buildings of an accessory character classified as a Group U occupancy and not exceeding 120 square feet in floor area, when located at least 50 feet from an applicable building.
2. Buildings of an accessory character classified as Group U occupancy of any size located least 50 feet from an applicable building.
3. Buildings classified as a Group U Agricultural Building, as defined in Section 202 of this code (see also Appendix C – Group U Agricultural Buildings), when located at least 50 feet from an applicable building.
4. Additions to and remodels of buildings originally constructed prior to the applicable application date.

701A.3.1 Application date and where required. New buildings for which an application for a building permit is submitted on or after July 1, 2008 located in any Fire Hazard Severity Zone or Wildland Interface Fire Area shall comply with all sections of this chapter, including all of the follow-

3. Land designated as Wildland Interface Fire Area by cities and other local agencies.

Exceptions:

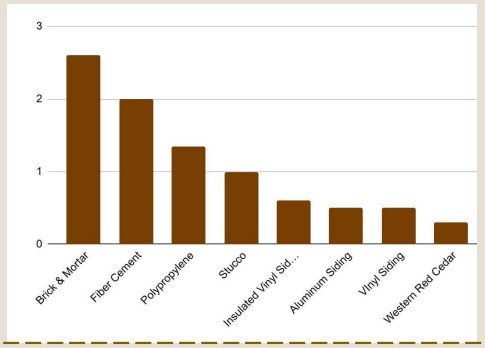
1. New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas, for which an application for a building permit is submitted on or after January 1, 2008, shall comply with all sections of this chapter.
2. New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland Interface Fire Area designated by cities and other local agencies for which an application for a building permit is submitted on or after December 1, 2005 but prior to July 1, 2008, shall only comply with the following sections of this chapter:
   - 2.1. Section 705A – Roofing
   - 2.2. Section 706A – Attic Ventilation

701A.4 Inspection and certification. Building permit applications and final completion approvals for buildings within the scope and application of this chapter shall comply with the following:

1. Building permit issuance. The local building official shall, prior to construction, provide the owner or applicant a certification that the building as proposed to be built complies with all applicable state and local building standards, including those for materials and construction methods for wildfire exposure as described in this chapter. Issuance of a building permit by the local building official for the proposed building shall be considered as complying with this section.
2. Building permit final. The local building official shall, upon completion of construction, provide the owner or applicant with a copy of the final inspection report that demonstrates the building was constructed in compli-

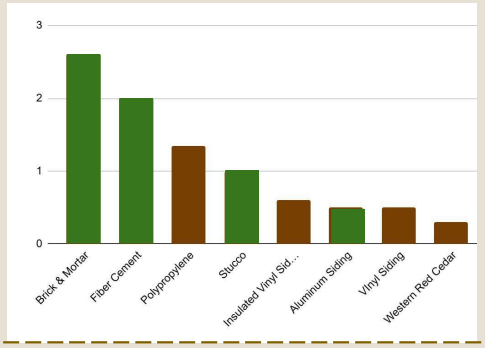
California Building Code

82



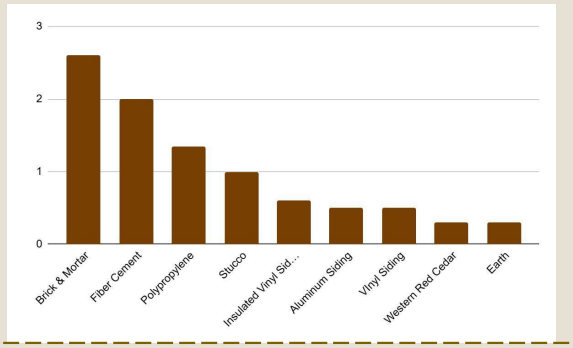
Global Warming Potential of Exterior Finishes (kg CO_2)

83



Global Warming Potential of Exterior Finishes (kg CO_2)

84



Global Warming Potential of Exterior Finishes (kg CO_2)

85

WHAT ARE CODES CONCERNED WITH?

1.1.2 Purpose

The purpose of this code is to establish minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, adequate lighting and ventilation and energy conservation, safety to life and property from fire and other hazards attributed to the built environment,and to provide safety to firefighters and emergency responders during emergency operations.

86

WHAT ARE CODES CONCERNED WITH?

Fire safety
Structural integrity
Means of egress
Light
Ventilation
Heat
Water & Wastewater
Electrical and Gas
Energy Efficiency

87

WHAT ARE CODES CONCERNED WITH?

Nope!	***Yup!***	***Nope!***
Externalized costs to society	*Fire safety*	*Risks to future generations*
Heat island effects	*Structural integrity*	*Resource depletion*
Nutrification of water	*Means of egress*	*Dependence on non-renewable energy*
Toxicity of materials	*Light*	*Loss of habitat*
Pollution	*Ventilation*	*Loss of biodiversity*
Embodied Energy	*Heat*	*Loss of agricultural land*
Climate Impact	*Water & Wastewater*	*Increased transportation*
	Electrical and Gas	
	Energy Efficiency	

After David Eisenberg, The Development Center for Appropriate Technology

88

What earthen and bio-based materials can be built in California(easily)?

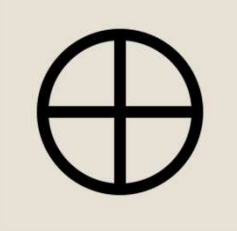
89

What can be built in California (easily)?

- Strawbale

90

What can be built in California(easily)?



- Strawbale
- Interior Earthen Plasters

91

What can be built in California (easily)?

- Strawbale
- Interior Earthen Plasters
- Exterior Lime Plasters

92

Can I build stuff that isn't in the adopted code?

CRC 1.2.3 Alternative materials, design and methods of construction and equipment
The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of this code, and that the material, method or work offer is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

93

Can I build stuff that isn't in the adopted code?

CRC 1.2.3 Alternative materials, design and methods of construction and equipment
The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of this code, and that the material, method or work offer is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

(Caveat: in the City and County of Los Angeles, these AMMR's are economically infeasible for alternative materials in Single Family Home construction

94

What isn’t specifically in the adopted code (but is still possible with some grit)?

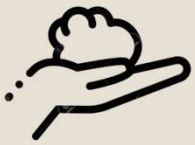
95

What isn’t specifically in the adopted code (but is still possible with some grit)?

- Light Straw-Clay

96

What isn't specifically in the adopted code (but is still possible with some grit)?



- Light Straw-Clay (but not in the City or County of Los Angeles)

97

What isn't specifically in the adopted code (but is still possible with some grit)?

- Light Straw-Clay
- Hemp-Lime (Hempcrete) (but not in the City or County of Los Angeles)

98

What isn't specifically in the adopted code (but is still possible with some grit)?

- Light Straw-Clay
- Hemp-Lime (Hempcrete)
- Cob (Monolithic Adobe) (but not in the City or County of Los Angeles)

99

What is in the code (but hard to use)?

100

What is in the code (but hard to use)?

- Adobe brick

101

What is in the code (but hard to use)?

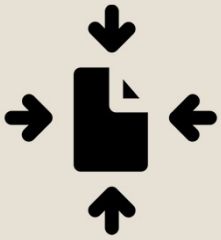
- Adobe brick (currently effectively impossible in the City and County of Los Angeles)

102

What is adjacent to the code (but even harder to use)?

103

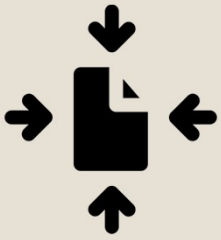
What is adjacent to the code (but even harder to use)?



- Compressed earth block

104

What is adjacent to the code (but even harder to use)?



- Compressed earth block (currently effectively impossible in the City and County of Los Angeles)

105

What is adjacent to the code (but even harder to use)?

- Compressed earth block
- "Superadobe"

106

What is adjacent to the code (but even harder to use)?

- Compressed earth block
- "Superadobe" (currently effectively impossible in the City and County of Los Angeles)

107

Code adoptions - State of California

2022 CRC	2025 CRC	Subject	State of California
Appendix AS	Appendix BJ	Strawbale	Yes
Appendix AQ	Appendix BB	Tiny House	No
-	Appendix BL	Hemp Lime	No
Appendix AU	Appendix BK	Cob	No
Appendix AR	Appendix BI	Light Straw-Clay	No
CBC 2109	CBC 2109	Adobe	Yes

108

Code adoptions - Local Jurisdictions

2022 CRC	2025 CRC	Subject	Los Angeles County	City of Los Angeles	Riverside County	San Bernardino County	City of Santa Monica
Appendix AS	Appendix BJ	Strawbale	Yes	No	No	No	No
Appendix AQ	Appendix BB	Tiny Homes	Yes	No	Yes	No	No
-	Appendix BL	Hemp Lime	No	No	No	No	No
Appendix AU	Appendix BK	Cob	No	No	No	No	No
Appendix AR	Appendix BI	Light Straw-Clay	No	No	No	No	No
CBC 2109	CBC 2109	Adobe	Yes	Yes	Yes	Yes	Yes

109

How do we gain better codes?

- It is often easier to change the building code for the entire United States than to obtain a permit for a single earthen building in California

110

How do we gain better codes?

- It is often easier to change the building code for the entire United States than to obtain a permit for a single earthen building in California
- For minor improvements, operating at a National scale may be the best approach

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How do we gain better codes?

- It is often easier to change the building code for the entire United States than to obtain a permit for a single earthen building in California
- For minor improvements, operating at a National scale may be the best approach
- For the significant work that we need to effect large scale change, there may be no substitute for legislative action

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