



Fire-Resistive Strawbale Walls Survive North Bay Wildfires

While architects and builders have known for years that the strawbale walls of their buildings have superior fire-resistance, several examples of homes surviving recent wildfires bear further evidence of this quality.

This newsletter describes and illustrates a number of case studies. All of these examples were within the perimeter of the wildfires, and in some instances these structures survived when all else around them burned. A combination of factors aided in their survival; all have metal or tile roofs, other fire-resistant materials and details, and most had defensible space. In certain firestorms no structure will survive, so some amount of good fortune must be credited as well.

Case Study #1: Sonoma



fig.1. Norrbom Road Strawbale Home - fires burned to the foundation on but not up the walls.

This strawbale home that survived is located near the end of Norrbom Road, north of the City of Sonoma. The [residence](#) features strawbale walls coated in Natural Hydraulic Lime plaster, rusted metal roofs and a concrete terrace adjacent the wood frame walls. While the fires burned up to the plastered bale walls, and charred a sliding wood door, the home did not catch fire. The owner stated,

"I think it pretty much survived on its own, with some patrols for hotspots. [It] looks like once power is restored all our systems are go. We are SO LUCKY! Go Strawbale construction!"



fig. 2. Norrbom Road - Mineral oxides in Natural Hydraulic Lime turn pink when heated.

Michel Couvreur of TransMineral, purveyors of the Natural Hydraulic Lime used to plaster the walls of the home, noted that the pink hue is the result of the heat of the fires drawing out iron oxides from the mineral impurities in the lime mix, and that they use heat to create some of the colors. He added that the walls suffered no permanent damage and should be serviceable well into the future. Michel provided CASBA with these photos of the home after the fire.

Case Study #2: Lovall Valley



fig.3. Strawbale home on Lovall Valley Loop Road withstood fire against its walls.

Engineer Gary Black of Integrated Structures Inc. provided this account of a strawbale home their firm designed and built in the Lovall Valley, which survived the Partrick Fire between Sonoma and Napa:

"I am very happy to report that I spoke with the owner of the Napa house as the fire was approaching, (he got out in time and called me back a few days later). Apparently half of [the] landscaping was destroyed and the fire burned for quite some time with the flames hitting the walls and eave of the house. He had several oak trees that were in direct contact with the walls, resulting in NO defensible space. He reports no damage to the house, not even a broken window where the flames clearly burned for some time. Ray Cole believes that the 14" inset protected the glass as the flames tend to go vertically once they hit a wall. His two nearest neighbor's houses burned to the ground."

Case Study #3: Redwood Valley



fig. 4. Redwood Valley Residence - trees, outbuildings and two neighboring homes burned.

CASBA Director David Arkin received this harrowing tale of survival from Edward Doody, homeowner of one of Arkin Tilt Architects' strawbale designs:

"Spike and I were up in Redwood Valley over the weekend and had gone to bed Sunday night about 10 o'clock. Around 2:30 am for some unknown reason I awoke to find a strange glow outside my bedroom windows. I got up and put on my glasses and saw that the house was literally surrounded by fire. Fire was everywhere, near and far. The grasses around the house were glowing as a line of flame was traveling across the landscape. The sky was red and live sparks were flying everywhere. The trees just down the hill from the house were ablaze, fueled by the raging conflagration of the open, metal storage container that housed my solar power system, storage and most of my tools. Trees and brush at all points of the compass were ablaze. The fires illuminated isolated patches of the near distance. The light was eerie glow and all of this was against a larger background of darkness.

After running through the house, checking out the windows and fighting waves of panic, I kind of just settled into survival mode and started to move with purpose. The house itself did not appear to be on fire, although it seemed like it was only a matter of time. The trees next to the container were now ablaze and the flames from them were awfully close and seemed to be licking at the end of the house. I quickly dressed and found my phone, but there was no service. Flight mode settled in and I decided to make a run for it, down the road a mile to the valley floor. I had to coax Spike out the door and into the firestorm. He was not anxious to leave the relative calm and safety of the house to run a hundred feet across the burning and burnt lawn area to the truck. We jumped in only to find that the keys were back inside. I dashed back inside, found them and ran back to the truck. The windows had been left open and sparks were in the cab, but it fired right up and away we went. Reaching the top of my driveway, I stopped to

try 911 again. This time I got a signal and spoke with dispatch, only to learn that they were overwhelmed with calls from all over the county and already in full out response. There would not be anyone available to come to my immediate assistance. I tried to call my uphill neighbor, but got no answer.

There I was, poised at the mouth of my driveway with the fire advancing up the hillside behind me, the ravines on either side of the property alight with the underbrush and trees on fire and the woods at the top of the property starting to go. To the right was the road down to the valley floor. For most of what I could see, the way was open with only what appeared to be small blazes, along the roadside. To the left was the drive up to my neighbor's house, a winding road that went through the woods that was now starting to catch on fire. I was faced with the decision of fleeing downhill or going uphill to see if my neighbor was home, awake and able to get out. I have never been so scared in my life.



fig. 5. Redwood columns salvaged from a prior fire frame the conflagration; charred but did not ignite.

As I sought the strength to go uphill, headlights pierced the smoke and Ronnie's car came around the bend. I have never been so relieved in my life.

While we conferred and were deciding on what to do, the well house, down the road about an eighth of a mile erupted into flames, blocking our passage through for immediate future. For those of you that have not yet visited, my house sits in a clearing on the side of a hill. The clearing is approximately three to four acres with only grasses and low vegetation, a few large oaks and away from most of the overhanging trees, which line the perimeter. The ground fires were being driven uphill by a gale-like wind and were well past the house and through most of the clearing by now, so we were relatively secure out there in the open. The air was full of lighted embers, pelting us like raindrops. Smoke and ash were swirling through the sky and breathing was a bit difficult. As the container fire burned through the contents, the trees next to it were mostly burnt out. The house appeared to no longer be in imminent danger, so we retreated there and settled in to wait out the remainder of the storm."

The owner, who has kindly agreed to make the plans of his home available to other fire victims, provided the photos. Arkin Tilt is providing this and eight other strawbale plan sets free of charge, including engineering courtesy of ATA's office partners [Verdant Structural Engineers](#).

Case Study #4: Napa



fig. 6. Napa Studio burned in the Atlas Fire; strawbale walls burned after the roof above was breached.

A remote one-room studio with strawbale walls on three of its four sides burned in the Atlas Fire on the east side of Napa the first night of the wildfires, when winds were out of the northeast and gusting to over 70 mph. The east end of the structure featured wood framing to the ground, with a trellis above; once these ignited the rest of the structure was consumed.

The owner reported the following:

“It looks to me that the plaster coated straw bale survived well until the wood part of the structure burned down. I wonder if the walls would still be intact if the plaster coating had covered the top of the wall as well. I think the straw burned after the top cap of the wall burned away and coal/embers dropped into the straw bales. To me the straw bale encapsulated in the plaster/concrete stood up well until the top was gone.”

David Arkin visited the walls on December 2, 2017, just prior to demolition, and observed that the PISE (pneumatically impacted stabilized earth) walls were still standing, and had been well bonded to the straw prior to the fire.

Two specific assemblies of strawbale walls have been tested, and one with a lime-cement plaster over bales placed on-edge achieved a two hour fire rating in an ASTM E119 test. Additionally, bales as insulation have are within code limits for the flame spread index and smoke developed index, confirmed in an ASTM-E84 test. Links to the test reports are provided below. In addition to fire-resistive qualities, strawbale walls sequester carbon in their construction, and throughout their life—along with thoughtful passive design and other details—help to keep structures cooler in summer and warm through the winter.

Learn more at www.strawbuilding.org For further inquiries contact CASBA Director David Arkin, AIA, LEED AP at info@strawbuilding.org

Links that may be of further interest:

Free Download of the 2015 IRC Strawbale Code with Commentary from the CASBA website:
<http://www.strawbuilding.org/news/3587353>

Straw Bale Fire Test Video: <https://www.youtube.com/watch?v=PjM0yXF7sy8>

Straw Bale Testing (fire tests and many others): <http://www.strawbuilding.org/testing>
<http://www.ecobuildnetwork.org/projects/straw-bale-construction-supporting-documents>