WOOD ROOFS ARE DANGEROUS

Summary

Roofs on many residential structures are installed using wood shakes or shingles as an architectural feature. Wood roofs are very susceptible to fire from various sources. Firebrands, or burning embers, from roofs themselves, can fly in high Santa Ana winds causing adjacent structures to burn. The resulting conflagration could then encompass entire blocks of structures. The most recent local fire of note is the Laguna Beach fire of 1993 that destroyed 366 homes.

The wood shingle industry developed wood roofing materials, which are labeled as fire retardant, to meet increased building code requirements. However, firestorms continued on non-treated roofs. As fire resistance of treated roofs came into question, some governmental agencies banned the use of wood roofs entirely. This was followed by lawsuits brought by the industry.

Building codes have been established to protect those homes within wildland areas from firestorms. Yet, fires have occurred in urban areas where flying firebrands have started additional fires. Insurance companies are now beginning to recognize the inherent dangers of wood roofs and may impose a premium for such a roof, or simply refuse coverage. The average number of fires involving wood roofs as the origin in Orange County is 40 fires per year for the period 1991 to 1999.

The choice of products for a new roof is varied, as is the cost. However, the expense may be equivalent between choices when upgrading to the more resistant Class A construction if considering the life of the roof material. But the choice of roofing materials is only one element in fire safety for protecting one's precious home filled with years of memories.

The debate continues as to the suitability of wood roofs, treated or not, in residential areas. The climate of Orange County becomes an even more critical factor. The high velocity and low humidity Santa Ana winds, which occur every fall, present a very unique condition that potentially supports a conflagration and requires the highest class of fire resistant roofing systems.

The thirty-five different jurisdictions within Orange County currently require three different classifications for roofs. A uniform building code for roof construction needs to be established throughout Orange County to protect public safety, and the lives and property of the individual homeowner based on the unique climatic conditions caused by topographical conditions.

Introduction

Orange County's eastern border is the Cleveland National Forest and has undeveloped areas of natural wildlands. Generally, residential developments in or near these areas have building requirements that include non-combustible or fire-retardant roofs. The perceived goal of these requirements has been to protect the structure itself. However, several fires have shown that burning firebrands from roofs travel great distances to other structures and ignite new fires. The adoption and implementation of new building codes is a slow and arduous process that often is only prompted by additional fire losses. Local governing bodies must be continually reminded of the potential for huge fire losses in the urban-wildland interface. What has been learned is that conflagrations in urban areas can be as disastrous as structure fires adjacent to wildlands. What needs to be considered is not just the combustibility of an individual roof, but the conflagration hazard in urban areas caused by several different fire sources.

Low annual rainfall, combined with dry Santa Ana winds, can contribute to a disastrous situation for any fire. History has shown that these wind conditions can take a seemingly innocuous fire, even under control, and spread firebrands to structures with wood roofs causing great real and personal property loss.

Although an argument can be made to ban all wood roofs, the current standard (California Building Code) only recognizes various classes of fire resistant roofs. The Grand Jury recommends that cities and Orange County consider adopting amendments to the California Building Code, or modifying their local building codes, adding the most stringent class of roofs for new construction, based on the unique climatic and topographical conditions of Orange County.

Method of Study

A study was conducted of the major residential structure fires in Orange County and California that involved wood roofs. A review was made of the California Building Code (Chapter 15, Section 1503 and Table 15-A) requirements for the use and replacement of residential roofs. The study and review were compared to the local building codes of the incorporated cities of Orange County and Orange County unincorporated area. The codes of the thirty-five jurisdictional entities have been tabulated to compare the uniformity throughout Orange County. Recommendations of the Orange County Fire Authority as well as all 35 governmental jurisdictions were solicited to arrive at a consistent building code requirement for roofs throughout Orange County. Local suppliers of roofing materials were contacted to obtain average material comparison costs.

Background

This study reviews the need for a change in the local building code for residential roof construction (Group R), the effect local environment has on these codes, and the impact on the industry. With these considered, an improved local building code can then be proposed.

The Problem

Several fires in Orange County have occurred in residential areas due to various sources. They then rapidly spread to adjacent homes by means of flying embers landing on the popular cedar wood shake or shingle roofs caused by high winds. Table 1 lists a partial summary of fires involving wood roofs, including urban-wildland interface fires.

Table 1

Residential Wood Roof Fires

Date	Place	Structures	Comments
November 20, 2002	Costa Mesa, CA	2	Winds carried embers to house next door
August 19, 2002	San Jose, CA	34	Construction fire 1/2 mile from apt. fire
October 16, 1997	Baker fire, East Orange County	1	130 mph Santa Ana winds
October 23, 1996	Oceanside, CA	9	One in the middle survived with a tile roof
October 21, 1996	Lemon Heights, CA	29	Down power line, 71 mph Santa Ana winds
October 21, 1996	Malibu, CA	20	3 deaths
October 27, 1993	Laguna Beach, CA	366	Started In wildland area
October 20, 1991	Oakland, CA	2,886	25 deaths; 150 injured
March 14, 1988	Davis, CA	29	Burning embers ignite adjacent structures
June 26, 1986	Santa Barbara, CA	1	Class B pressure treated roof
April 21, 1982	Anaheim, CA	550	118 fire companies responded

Often seen on televised newscasts or in newspapers during firestorms are residents with garden hoses watering their roof. This action demonstrates a very serious concern by residents about the flammability of wood roofs, especially in large housing development tracts. When some of these fires subsided, there have been homes which stood alone untouched by the fire due to, among other precautions, nonflammable roofs. These fires have included structures where firebrands have been known to travel up to a half mile and across interstate freeways.

The California Building Code sets roofs into three categories effective against fire test exposures:

- Class A - severe fire test exposure
- Class B - moderate fire test exposure
- Class C - light fire test exposure

These classes are specified depending on the fire hazard for the area. The local code can be changed based on findings by local jurisdictions that are affected by climatic, topographical, or geologic conditions unique to the local area. Topographical would include housing developments located in restricted access areas. Gate guarded and narrow streets that do not allow two-way traffic are included in this category. However, close spacing of homes (zero lot line) increases the risk of fires spreading from home to home. In Orange County, which includes national forests with wildlands, the hazard is higher.

Lemon Heights Fire – 1996

A problem closer to home also exists. Embers from chimneys without spark arresters, coupled with climatic conditions known as Santa Ana winds, may permit the blowing of sparks or cinders upon wood roofs of the originating home or to adjacent homes. This in turn may cause a conflagration of roof fires. Several cities in Orange County also allow the use of fireworks during the Fourth of July celebration. Bottle rockets or sparklers that land on a wood roof could be the beginning of a series of residential fires. Downed electrical lines, or lightning strikes, can also be origins of such fires. The State of California has tabulated the number of reported residential structural fires where wood roofs have been the origin of the fire during the period 1992 through 2002. The annual average number of such fires during this period was 118 and represents 2 percent of all residential fires reported.[1]

The Industry

In response to the fire sensitivity of wood roofs, the industry has provided a roofing system that has been rated for Class A. An expected question is how long will the pressure-treatment (fire resistance) on the shakes or shingles last? Tests conducted by the U.S.

Department of Agriculture's Forest Products Laboratory, independent testing laboratories, and manufacturers indicate that the treatment process renders the wood fire retardant for the life of the roof.[2] However, the City of Los Angeles has found that in their tests, the exposed edges created by cutting during installation will sustain combustion.

When wood shingles were first available with fire retardant coatings, they were rated as a Class C covering. Before that, they were non-rated. Pressure treated wood shakes and shingles receive a Class A rating when installed with a solid underlayment. Fire protection is provided by pressure impregnating fire retardant polymers into the innermost cells of shakes and shingles. However, there are no required inspections or tests after installation of roofs to determine the status of the fire retardant. It would also be difficult to tell when, or if, a roof was pressure treated or has lost its original treatment by inspection. There remains a debate among officials of the fire resistance of treated wood roofs and the longevity of the treatment. In place treatment of roofs has not proven successful.

The California Building Code specifies the testing wood shakes and shingles must pass for use in California. These tests include: Intermittent Flame Test; Spread of Flame Test; Burning Brand Test; Flying Brand Test; Rain Test; and Weathering Test. However, wood roofing materials have passed only six years of the required ten-year weathering test to date. In the burning brand test, the test exposes roofing materials to a 12-mph wind. In the flying brand test, the material is exposed to a wind of 18 mph.[3] These tests do not adequately simulate the conditions in Orange County during high Santa Ana wind conditions.

Table 2
Communities at Risk to Wildfires

City or Community	Federal Threat	Non Federal Threat
Aliso Viejo		X
Anaheim		X
Brea	X	
Coto de Caza	X	
Cowan Heights		X
Dana Point		X
El Toro Marine Corps Air Station	X	
Irvine	X	
Laguna Beach		X
Laguna Hills		X
Laguna Niguel		X
Laguna Woods		X
Lake Forest	X	
Mission Viejo		X
Modjeska	X	
Newport Beach		X
Orange		X
Rancho Santa Margarita	X	
San Clemente	X	
San Juan Capistrano		X
Silverado	X	
Trabuco Canyon	X	
Trabuco Highlands	X	
Unincorporated Orange County (1)		X
Unincorporated Orange County (2)		X
Villa Park		X
Yorba Linda	X	

The Code

The establishment of the building code for fire safety in local jurisdictions must consider the resources of the responsible fire agency. This would include how much money is to be spent on fire equipment and the type of fire equipment to be purchased. One of the critical judgments is how many houses are allowed to burn in a potential conflagration and how important it is to save another. This would also require the consideration of a sufficient water supply and pressure for large conflagrations. If known hazards exist, then the fire fighting resources must be available. Limited fire

fighting resources in Orange County are demonstrated during Santa Ana wind conditions by the pre-staging of equipment near vulnerable areas.

The California Building Code defines the minimum standards acceptable in California.[4] In a defined Very High Fire Hazard Severity Zone (VHFHSZ), generally a wildland area, new structures and existing structures with 50 percent or more of the roof replaced will have a Class A roof. The Fire Safe Council and the California Fire Alliance list communities that have been defined as "At Risk," by the federal government. Of the 1,238 communities listed in California, 27 are in Orange County. These all have a Hazard Level of 3, where 2 would denote a moderate fire threat, and 3 denotes high. The data for Orange County are listed in Table 2. The Federal Threat column indicates some or all of the wildland fire threat comes from federal lands.

Local jurisdictions normally adopt ordinances that implement or amend the California Building Code. In Orange County only 16 out of 35 jurisdictions require a Class A roof for new construction. For re-roofing of 50 percent or more, only 10 jurisdictions require a Class A roof (see Table 3). Measuring re-roofing projects in units of squares (100 sq. ft.) appears to be more practical than as a percentage and is easier to explain and enforce, as is done by the City of Los Alamitos.

Some jurisdictions have tried to prohibit the use of wood roofs; lawsuits have followed. One of the arguments against such an ordinance is that it deprives the companies of their inherent right to engage in the lawful occupation that is their livelihood.[5] The following nearby communities have an ordinance which *prohibits* wood roofs: City of Los Angeles, Santa Barbara County, City of Santa Barbara, Carlsbad, Del Mar, El Cajon, and Vista. Twelve other cities have various ordinances prohibiting wood.[6] In Orange County, only Laguna Beach will prohibit wood roofs beginning in the year 2017.

The objective of governmental regulations is the protection of the lives and property of citizens from loss of life and loss of property from fire. However, a serious problem exists for firefighters to distinguish treated roofs from untreated roofs during a fire. In the event there was a conflagration or major fire, this distinction may be necessary in order to perform a triage operation, i.e., which house to save first.

Table 3

Residential Code Requirements of Orange County Jurisdictions

Agency	New Construction Class			Re-roof Class A		Comments
	A	B	C	10-50%	> 50%	
Aliso Viejo	X					Re-roof & additions no lower than Class B
Anaheim		X				50% or more Class A in VHFHSZ (Anaheim Hills)
Brea			X			Wildland areas - Class A; re-roof - min Class C
Buena Park			X			Re-roof same as new construction
Costa Mesa			X			Re-roof - Class C or better
Cypress		X	X			Re-roof no lower class than existing, max 2 layers shingles
Dana Point	X					Re-roof & additions no lower than Class B; VHFHSZ Class A
Fountain Valley			X			Re-roof - Class C or better
Fullerton			X			Re-roof - Class C or better
Garden Grove			X			Re-roof - Class C or better
Huntington Beach			X			Re-roof - Class C or better; no amendments
Irvine		X				Re-roof & additions - no lower than Class B; if wood, must be Class A; VHFHSZ Class A
La Habra			X			Re-roof - Class C or better
La Palma	X				X	Metal not allowed over existing
Laguna Beach	X				X	Exception - historic register homes; re-roof under 25% - min Class C; all existing wood replaced by 2017
Laguna Hills		X	X			Proposed: VHFHSZ Class A or B
Laguna Niguel	X				X	
Laguna Woods	X					Re-roof min Class B
Lake Forest	X			X	X	Allows metal over wood
Los Alamitos	X			X	X	No roof over wood shingles; re-roof over 100 sq. ft. Class A
Mission Viejo	X					Re-roof & additions - min Class B; metal allowed over existing
Newport Beach		X	X			VHFHSZ Class A or B
Orange	X				X	<25% Class B
Orange County		X				Special fire protection area- Class A, new const & additions min Class B
Placentia	X					Re-roof & additions - no lower than Class B; 3 tab not allowed
Rancho S. Margarita		X	X			VHFHSZ Class A or B; re-roof min Class C
San Clemente	X			X	X	Re-roof within 1 year
San Juan Capistrano	X			X	X	
Santa Ana			X			Re-roof - Class C or better
Seal Beach	X					>40% re-roof Class B or better
Stanton		X				Re-roof >10% Class B; Non-treated wood surfaces prohibited
Tustin		X				Re-roof & additions no lower than Class B; Hillside district Class A
Villa Park	X				X	> 40% re-roof Class A
Westminster		X				Re-roof Class B
Yorba Linda	X			X	X	<10% Class B

The Environment

The environment within Orange County can be very severe for fire safety. Southern California mostly has a desert climate. Seasonal temperatures can be in the 100+ degrees Fahrenheit. During the latter part of the year, the very dry Santa Ana winds are more prevalent.

Santa Ana winds are generally defined as warm, dry winds that blow from the east or northeast with exceptional speed through the Santa Ana Canyon (the canyon from which it derives its name). The term "Santa Ana" is reserved for winds greater than 30 mph. The complex climate and topography of Southern California combined with strong winds from a high pressure over Nevada or Utah create Santa Ana winds. The humidity is reduced to 10 to 15 percent that increases the fire hazard. Santa Ana winds commonly occur between October and February with December having the highest frequency of events. Stronger Santa Ana winds can have gusts up to 100 mph in favored areas. Santa Ana winds are an important forecast challenge because of the high fire danger associated with them.

The Choice

Table 4
Cost Comparisons of Roofing Materials

Type	Warranty (yrs)	Average Cost*	Cost per yr per sq.
Asphalt Shingles			
Class A	20	$27	$1.35
Class A	30	$36	$1.20
Wood Shakes**			
Class B	20	$208	$10.40
Class C	20	$193	$9.65
Slate			
Class A	75	$500	$6.67
Fiber Cement Shakes			
Class A	40	$190	$4.75
Metal Panels			
Class A**	50	$200	$4.00
Class B	40	$150	$3.75
Class C	40	$100	$2.50
Light Weight Concrete			
Class A	50	$110	$2.20
Clay Tile (light)			
Class A	50	$155	$3.10
* cost is per square (100 sq. ft.) material only, does not include labor.			
** Class A system is Class B covering with solid sheathing at extra cost			

The use of wood shake and shingles became very popular due to their rustic appearance. However, as their flammable condition became an issue, fire retardant chemicals were applied. Concrete tile roofs started appearing in the southwestern United States sometime after World War II, and slowly gained in popularity. Today they are the fastest growing

segment of the roofing material industry.[7] Re-roofing products include all steel roofs as well as the lightweight concrete products. There are pros and cons about each product available for re-roofing a structure. All of these can fulfill the requirements for a Class A roof. Table 4 was compiled with input from Orange County suppliers and installers.

The impact on an individual homeowner, when changing roof materials, may be negligible when all costs for the materials are amortized over the life of the roof covering. Considering installation costs, life expectancy, and warranty, treated wood shakes can be four times the cost of concrete tile and twice the coated metals. When a roof covering is changed, the weight of the new roof must be taken into account. Some cities have a requirement that a load calculation be completed when a specified load limit is reached. Most roofers perform this calculation or evaluation as part of their installation cost.

The choice of roof products may also be influenced by insurance. Insurance coverage on homes with wood roofs is gradually changing across the United States. In some states applicants are denied coverage, charged a different rate or non-renewed because of the age, condition or type of roof, especially wood roofs and composition over wood shingle roofs.[8] As time passes, more policies are adding these stipulations. In California, some companies provide a discount for homes without wood roofs. On an insurance web site[9], the following suggestion to reduce premiums when shopping for insurance is provided: "When you buy a home, look for fire-resistant construction, such as brick, masonry or rock. You may pay a lower premium for hail-resistive roofs, such as those made of concrete tile, while wood roofs may bring a surcharge."

The Sacramento Business Journal has reported that some insurance carriers, as part of the overall tightening of their underwriting, won't insure homeowners with wood roofs.[10] A syndicated columnist, in writing about metal roofs, says "since metal roofs are fireproof, you may get a discount on your insurance."[11] The decision suggests that wood roofs may no longer be the material of choice. As such, cost may be a factor in the selection of a roof or in the consideration of adoption of a local building code.

Findings

Under California Penal Code Section 933 and Section 933.05, responses are required to all findings. The 2002-2003 Orange County Grand Jury arrived at four findings:

1. There is a lack of uniformity in local building codes involving roofs for identical environmental conditions within Orange County.

2. The testing and qualification standards of wood shakes and shingles are below the environmental conditions of Orange County.

3. The cities' and county's roofing codes do not adequately take into account the climate, particularly the Santa Ana winds, and topographical conditions unique to Orange County.

4. Fire conflagrations stress finite fire fighting resources especially during the period of Santa Ana winds.

A response to Findings 1 through 4 is required from the Orange County Board of Supervisors and the Cities of: Aliso Viejo, Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Dana Point, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Habra, Laguna Hills, Laguna Woods, Mission Viejo, Newport Beach, Placentia, Rancho Santa Margarita, Santa Ana, Seal Beach, Stanton, Tustin, Westminster.

Recommendations

In accordance with California Penal Code Section 933 and Section 933.05, each recommendation must be responded to by the government entity to which it is addressed. These responses are to be submitted to the Presiding Judge of the Superior Court of Orange County. Based on the findings, the 2002-2003 Orange County Grand Jury recommends that:

1. Each responding jurisdictional agency should consider amending the building code to require the most fire retardant class of roof covering (Class A) for new construction of all residential structures (Group R) in all fire zones. (Findings 1 through 4)

2. Each responding jurisdictional agency should consider amending the building code to require the most fire retardant class of roof covering (Class A) for re-roofing of all residential structures (Group R) in all fire zones, when more than 50 percent of the roof is replaced within one year. (Findings 1 through 4)

A response to Recommendation 1 is required from the Orange County Board of Supervisors and the cities of: Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Habra, Laguna Hills, Newport Beach, Rancho Santa Margarita, Santa Ana, Stanton, Tustin, Westminster.

A response to Recommendation 2 is required from the Orange County Board of Supervisors and the cities of: Aliso Viejo, Anaheim, Brea, Buena Park, Costa Mesa, Cypress, Dana Point, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine, La Habra, Laguna Hills, Laguna Woods, Mission Viejo, Newport Beach, Placentia, Rancho Santa Margarita, Santa Ana, Seal Beach, Stanton, Tustin, Westminster.

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[1] California State Fire Marshal, California Incident Reporting System: http://osfm.fire.ca.gov/pdf/cfirs/residentialstruc.pdf

[2] CHEMCO Inc., The Finest Exterior Fire Retardant treatment For Wood Roofs, http://www.chemco.org/subpages/qa.html#how-long.

[3] Wesco Cedar, Inc, FTX Fire Retardant Shakes and Shingles are Legal and Safe in California, *Approval & Specifications*, http://www.wescocedar.com/approvalspecs.html

[4] 2001 California Building Code, Chapter 15, Section 1501.

[5] Firehouse, *Fire Politics*, November 1994.

[6] California State Fire Marshal, *Fire Hazard Zoning and Mitigation Code Adoption*: http://osfm.fire.ca.gov/pdf/LocalAdoption.pdf

[7] Committee for Firesafe Dwellings, *Concrete Roof Tiles*, Report BRC.01, page 1.

[8] Office of Public Insurance Counsel, *Homeowners Insurance Underwriting Guidelines, Changes in the Market*, http://www.opic.state.tx.us/homeguide.html.

[9] USAA Educational Foundation, Good Information for Good Decisions, Insurance, *How to Reduce Your Premiums*, http://www.usaaedfoundation.org/insurance/home/hi04/hi04.htm.

[10] Sacramento Business Journal, July 8, 2002, http://www.bizjournals.com/sacramento/stories/2002/07/08/story7.html.

[11] Dulley, James, *New residential metal roofs are attractive, long lasting and efficient*, The Press-Enterprise, Riverside, CA, update bulletin 782 (http://www.dulley.com).