Industrial Revolution

Every home that is built is a representation of compromises made between different and often competing goals: comfort, convenience, durability, energy consumption, maintenance, construction costs, appearance, strength, community acceptance, and resale value. Consumers and developers tend to make tradeoffs among these goals with incomplete information which increases risks and slows the process of innovation in the housing industry. The slowing of innovation, in turn, negatively affects productivity, quality, performance, and value. This department piece features a few promising improvements to the U.S. housing stock, illustrating how advancements in housing technologies can play a vital role in transforming the industry in important ways.

A Cost-Benefit Analysis of FORTIFIED™ Home Designation in Oklahoma

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Abstract

Natural disasters such as hurricanes, tornadoes, and thunderstorms with high winds and hail occur worldwide. These disasters bring a proportional amount of strife in the forms of injury, property damage, and loss of life. Homeowners can take measures to protect their properties and interests, but at an additional cost, one of which comes from the Insurance Institute for Business & Home Safety (IBHS). It is FORTIFIED™ home designation, which is a collection of construction requirements regarding certification and designation. This study sought to identify the cost associated with meeting FORTIFIED home standards, then investigate its return on investment. Depending on a homeowner's financial approach, some levels of FORTIFIED home designation have a return on investment even if a natural disaster does not occur; however, it is not universal.

Introduction

The year 2021 witnessed an estimated insured loss of $145 billion in the United States due to natural disasters (Walsh, 2022). Of those losses, Hurricane Ida was the single most damaging at $75 billion (Smith, 2022). In terms of natural disasters, 2021 was among the top three costliest and deadliest years in the past 5 decades (Smith, 2022; Walsh, 2022). Given the considerable costs associated with natural disasters, it is important to note that for every dollar spent on disaster mitigation design, approximately four times of that amount can be saved when a disaster occurs (Szoke, 2014). Not only monetarily but also with lives at stake, the design and construction of buildings that can mitigate those risks are substantially beneficial. FORTIFIED home is a program that has risen from this need and has shown to be effective in mitigating losses from natural disasters.

The FORTIFIED home program comes from the Insurance Institute for Business & Home Safety (IBHS). The IBHS is a nonprofit research organization that property insurers and reinsurers support. The organization seeks to raise consumer awareness and advance public policy action toward preventing avoidable property losses (FORTIFIED, n.d.a.). Those aims are achieved through ongoing research into mitigation strategies against threats from natural disasters. The FORTIFIED home program is a product of that research and is a collection of standards and certification processes by which new and existing homes can be designated and constructed as "FORTIFIED" (FORTIFIED, n.d.a.). IBHS's interest is largely financial, as the institute seeks to mitigate claims paid. However, it shares in the savings, because homes with the FORTIFIED designation qualify for a homeowner's insurance discount. In the state of Oklahoma, that potential discount is particularly important, because Oklahoma has the highest homeowner's insurance rates in the country. On average, Oklahoma homeowners pay 168 percent more for the same coverage as homeowners in any other state in the United States (Bankrate, 2022).

Currently, 24 designations are available through the FORTIFIED home program. They are divided into three broad categories: FORTIFIED Roof, FORTIFIED Silver, and FORTIFIED Gold. Under the three categories are additional subcategories: hurricane, high wind, hurricane and hail, and high wind and hail. This study considered specifications related to the high wind and high wind and hail subcategories. In the context of this article, FORTIFIED refers to the high wind and hail subcategory, because it is the most applicable to Oklahoma weather. Exhibit 1 summarizes the basic requirements for each of the levels of designation.

Exhibit 1

Summary of Requirements for Each Level of Designation

Designation Level	3/8" Oriented Strand Board or Plywood Decking*	7/16" Oriented Strand Board or Plywood Decking†	Roof Framing Members Designed for Minimum Wind Speed of 130 mph (Gold Only)	Use Minimum 8D x 2 3/8" Shank Nails With Minimum 1" Plastic or Metal Nail Caps	Use Minimum 8D x 2 3/8" Ring Shank Nails With Minimum 1" Plastic or Metal Nail Caps	Properly Sealed Roof Deck	Code Minimum Drip Edge	Fasteners Spaced at 6" on Center Along Laps and 12" on Center Vertically and Horizontally in the Field	Acceptable Impact Rating for Skylight(s)‡	Photovoltaic Systems Conform to Specific Installation Requirements	Appropriately Pressure-Rated Garage Doors§	Gable End Wood Structural Panel Wall Sheathing 7/16" Minimum	Attached Structures Have Adequate Connections to Prevent Uplift Pressures¶	Prescriptive Continuous Load Path for Wood Framing	Asphalt Shingles With IBHS Rating of "Excellent" or "Good"**	Adequate Bracing for Chimney Structures¶¶
Roof—high wind	X			X		X	X	X				X				
Roof—high wind and hail	X			X		X	X	X				X			X	
Silver—high wind	X			X		X	X	X			X	X	X			X
Silver—high wind and hail	X			X		X	X	X	X	X	X	X	X		X	X
Gold—high wind		X	X		X	X	X	X			X	X	X	X		X
Gold—high wind and hail		X	X		X	X	X	X	X	X	X	X	X	X	X	X

** 3/8 inch oriented strand board or plywood qualifies for a designation only if the spacing of the roof framing is 16 inches on center or less. (Plywood is preferred to oriented strand board.)*

† For FORTIFIED™ Gold designation, roof framing may be 24 inches on center or less.

‡ Skylights shall meet at least one of the following rating requirements: American Society for Testing and Materials (ASTM) E 1886 cyclic pressure test requirements and an ASTM E1996 missile impact rated B, C, D, or E; or FM approved per American National Standards Institute (ANSI)/Factory Mutual (FM) 4431, with Severe Hail rating.

§ ANSI/ Door & Access Systems Manufacturers Association International) DASMA 108 or ASTM E330 (Products are tested to 1.5 times design pressure.)

¶ Attached structures.

Single-level attached structures: Roof framing must be directly connected to roof beam with metal connectors; roof beam must be directly connected to columns with metal connectors or a minimum of two bolts; columns must be connected to foundation with metal connectors or a minimum of two bolts.

Multilevel attached structures: Roof framing must be directly connected to roof beams with metal connectors; roof beam must be directly connected to columns with metal connectors or a minimum of two bolts; upper-level columns must be connected directly to either lower level columns with metal connectors or two bolts minimum or to middle-floor structural support beams with metal connectors or two bolts minimum; middle-floor beams must be attached to lower level columns, pilings, and piers with metal connectors or a minimum of two bolts; lower level columns must be directly connected to foundation with metal connectors or a minimum of two bolts or have proper embedment depth and footing specified.

¶¶ Chimneys up to 5 feet high to be anchored to the home to help spread the load and prevent tear-offs.

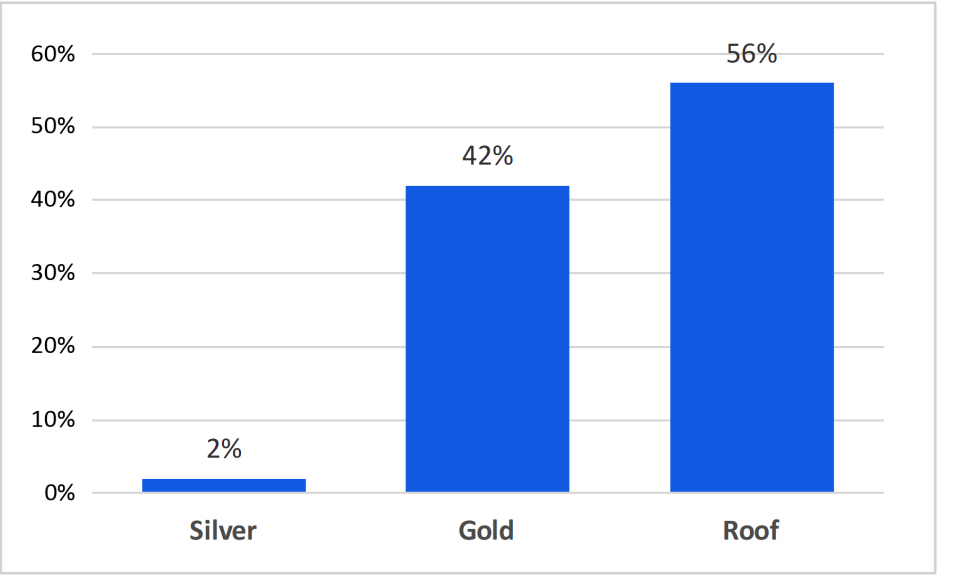
*** Asphalt shingles shall be tested in accordance with ASTM D7158 and meet the classification requirements listed in exhibit 1 for the design wind speed at the building site.*

Source: FORTIFIED Homes website

Among homes that have the FORTIFIED designation, most (56 percent) have FORTIFIED Roof. Exhibit 2 displays the breakdown of designation levels. It is unknown why so few homes have sought the FORTIFIED Silver designation. A plausible explanation might be that FORTIFIED Gold does not require much more than is required to achieve FORTIFIED Silver designation; thus, more clients prefer to pursue the higher designation.

Exhibit 2

Breakdown of Designation Levels

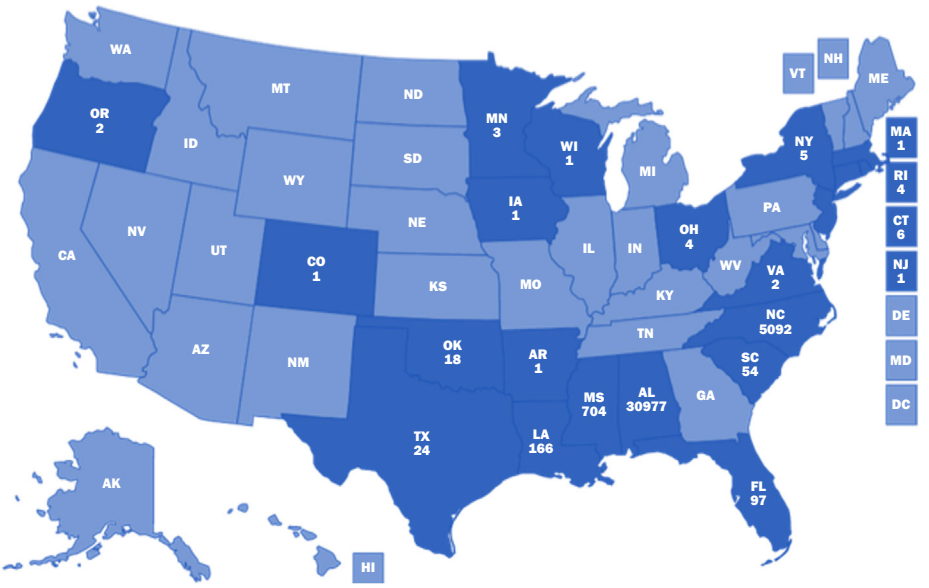


Source: FORTIFIED Homes website

Although the FORTIFIED home program has existed for many years and has more than 37,000 homes designated, its adoption has been limited to a few states. The FORTIFIED homes program is most prevalent in coastal states, but noncoastal areas like Oklahoma are also affected by weather-related disasters. More than 1,000 tornadoes are reported in the United States each year, and a considerable portion of them occur in Oklahoma (NOAA, 2021; Rauber, Walsh, and Charlevoix, 2017). Given the frequency and intensity of these severe weather events in the state, the need for mitigation measures in home design is apparent. However, as of June 2022, only 18 homes in Oklahoma had been designated as FORTIFIED. Currently, 96 percent of all homes with FORTIFIED designations in the United States are in Alabama (82 percent) and North Carolina (14 percent). Exhibit 3 displays FORTIFIED home designations by state in the United States.

Exhibit 3

Homes with FORTIFIED™ Designation in the United States as of May 2022



Source: Insurance Institute for Business & Home Safety, 2022

Each FORTIFIED designation comes with an increase in direct cost through labor, materials, and inspections, because the requirements are above and beyond building codes. This study aims to explore how the additional costs of the FORTIFIED home designation relates to available savings (through discounted insurance premiums). More specifically, this study seeks to determine how the FORTIFIED home designation might be a viable option for home builders to offer their clients. Specifically, the research questions this study answers are (1) What is the additional cost of FORTIFIED home designation on a typical home in Oklahoma? (2) How much time is required to recover the additional costs for FORTIFIED designation through discounted insurance premiums? (3) Can FORTIFIED home be a viable option for home builders to offer to buyers?

Methodology

A mixed-method research approach was adopted for this study, collecting both quantitative and qualitative data to understand the costs and benefits of the FORTIFIED-designated homes for homeowners and home builders in Oklahoma.

Some previous research on the FORTIFIED home program used IBHS-provided numbers to account for the additional cost of designation (Gould, 2020). According to the IBHS, a FORTIFIED home costs 3 to 7 percent more than a nondesignated house (FORTIFIED, n.d.a.). To ensure an independent evaluation of the FORTIFIED home program and given the very limited adoption of FORTIFIED home designation in Oklahoma, it was imperative that costs be quantified based on numbers specific to Oklahoma.

To provide a baseline, this study is based on four homes ranging from 1,806 to 2,483 square feet. Two production home builders built these homes, and the homes selected represent typical new construction for the Oklahoma City metropolitan area. Using these four homes, a systematic approach with a work breakdown structure tracked all FORTIFIED home requirements and the associated costs with additional labor and materials. Prices for each item were obtained through local suppliers, and labor costs were generally obtained from the RSMeans database (RSMeans Data, 2021).

The IBHS advertises a wide range of insurance discounts for FORTIFIED designation—from 3 to 42 percent (FORTIFIED, n.d.a.). To identify discount percentages in the Oklahoma City metropolitan area, data were first collected from insurance agents in the metropolitan area market. An online search identified insurance agents in the Oklahoma City area and returned contact information for 61 agents. Snowball sampling identified six additional insurance agents. All 67 agents were contacted for the study, and 27 interviews were conducted via telephone. The insurance agents were questioned regarding their awareness and knowledge of the FORTIFIED home program and its respective standards and designations.

Ultimately, with only 18 FORTIFIED designated homes in Oklahoma, information on available discounts could not be obtained through interviewing agents. Further, carriers closely guard insurance rate information. Therefore, homeowner's insurance premium discounts were based on an average from specific discount percentages reported by IBHS. Insurance premium rates were computed based on information from the Oklahoma Insurance Department (OID). In addition to the formal data collection and analysis conducted for this study, four interviews with FORTIFIED home professionals were conducted. Although these interviews were informal, they represent an important contribution to this study, as they provide context and depth to the collected data.

Analysis

Analysis of the data collected was conducted sequentially, beginning with the quantitative analysis of the cost to buy a new home with the FORTIFIED home designation, then the qualitative analysis of interviews with insurance agents follows, culminating with consideration of both data streams to compare costs with benefits.

Cost to Construct FORTIFIED™

In identifying the costs associated with constructing a new FORTIFIED home, the study determined the amount of the increased cost required for the respective designation levels. The additional requirements for designation were compared with the plans and specifications of the four sample homes used in the study. The cost of each category of FORTIFIED home was calculated for the four different homes, and a standard production builder's markup of 100 percent for home options was applied to derive the cost that a homebuyer would experience. The results of this analysis indicate that a FORTIFIED home designation in Oklahoma would range from 1 to 2.6 percent of the home sales price. Specifically, FORTIFIED Roof averaged 1.1 percent, FORTIFIED Silver averaged 1.6 percent, and FORTIFIED Gold averaged 2.25 percent of home sales prices. Exhibit 4 displays the full results of this cost analysis. The figures are consistent with the 1 to 3 percent cost range Gould (2020) reported but are less than the 3 to 7 percent range that the FORTIFIED program director provided (Malik, 2021).

Exhibit 4

Additional Cost of FORTIFIED™ Home Designation, Including Builder Markup

House	Base Sale Price	FORTIFIED Roof Cost	%	FORTIFIED Silver Cost	%	FORTIFIED Gold Cost	%
1–1806 SF	$274,395	$3,122	1.03	$4,781	1.63	$6,982	2.4
2–2,026 SF	$357,125	$4,157	1.05	$5,717	1.52	$7,928	2.14
3–2,343 SF	$432,430	$4,434	1.00	$6,094	1.34	$8,304	1.85
4–2,483 SF	$295,058	$4,144	1.30	$5,804	1.87	$8,015	2.61
Average			1.1		1.6		2.25

SF = square feet.

Source: Cost estimated by authors

Insurance Agents and Carriers

The study conducted semi-structured interviews with 27 independent insurance agents to consider the payback for the additional cost required for a home with the FORTIFIED designation. The interviews were intended to identify the discounts in homeowner's insurance available for FORTIFIED home designation and agents' familiarity with the FORTIFIED home program. However, the interviews also provided context regarding the limited adoption of FORTIFIED in Oklahoma. In the interview process, it quickly became apparent that most agents (67 percent) were completely unaware of the program.

In the absence of actual market data on insurance premium discounts offered to homes designated as FORTIFIED in Oklahoma, the study used IBHS-provided data to consider the financial benefit of FORTIFIED home designation. On its website, FORTIFIED lists discounts available from 11 insurance carriers, and it reports that the discounts range from 3 to 42 percent (FORTIFIED, n.d.b). The mean for the reported discounts was 18 percent (mode and median of 15 percent). Exhibit 5 displays the discounts available in Oklahoma, according to the IBHS.

Exhibit 5

Insurance Discounts Offered for Designated FORTIFIED™ Homes by Insurance Carrier

Oklahoma Insurance Discounts	
Armed Forces Insurance Exchange	15%
Employers Mutual Casualty Company	15%
Foremost Insurance Company	10%
Goodville Mutual Casualty Company	20%
IDS Property Casualty Insurance	20%
National Security Fire and Casualty	42%
Nationwide Mutual Fire Insurance Company	6%
QBE Insurance Group	3%
Shelter Mutual Insurance Company	14%
State Farm Insurance Companies	30%
Union Mutual Insurance Company	25%

Source: FORTIFIED, n.d.b.

Given the range of discounts reported, for the cost-benefit analysis calculation, discounts of 10, 15, and 20 percent were applied to reflect the range of potential discounts and the differences in discounts between Roof, Silver, and Gold designations. The 10 percent discount was applied for Roof, 15 percent for Silver, and 20 percent for Gold. Because of the absence of data from insurance carriers specifying their levels of discount, the 10-, 15-, and 20-percent discounts for each level's FORTIFIED designation are assumed. Regardless of the discount applied, the specific insurance carrier plays a significant role in whether a financial return on investment for FORTIFIED home designation is achieved.

Cost-Benefit Analysis of FORTIFIED™ Homes

The average annual cost of a homeowner's insurance policy in Oklahoma is based on information from the Oklahoma Insurance Department. Although it does not represent exact costs, it is the closest and most reliable data on insurance costs available. According to OID, a frame-structure home in the Oklahoma City area with the following coverage amounts ranges from $1,965 to $7,428 among 20 different insurance carriers (OID, 2022).

- 80 percent of dwelling = $250,000.
- $1,000 deductible.
- $125,000 contents.
- $100,000 personal liability.
- $1,000 medical expenses.

Mean and median premiums were $4,380 and $4,533, respectively. Because these parameters did not represent the exact value of any of the four homes used in this study, a homeowner's insurance premium was computed using the mean and median premium costs from OID to arrive at $0.0176 per $1.00 of dwelling value. Dwelling value was determined by taking 80 percent of the sales price. Further, because insurance premiums are related directly to the value of the real property and real property generally appreciates at approximately 3 percent a year, the annual savings calculated were increased 3 percent yearly to reflect increasing home values, thus, increasing home premiums. As premiums go up, the dollar value of savings also increases.

Given inflation, opportunity cost, and the uncertainty of future payments, the time value of money asserts that $1 received today is worth more than $1 received in the future because of the dollar's potential earning capacity. Investors are aware of this principle when choosing how to allocate capital expenditures—especially during long periods. This study is primarily a cost-benefit analysis, so the future value of the additional cost of FORTIFIED designation had to be considered, because that money has potential earning capacity if not spent on designation requirements. Four different interest rates were modeled for 15 years to consider future value, such as 0 percent as if the money were simply spent elsewhere; 1.9 percent, the rate of a U.S. Department of Treasury note; 5 percent, a conservative investment return; and 10 percent, an aggressive investment return.

To consider the return on investment for FORTIFIED™ home designation, the future value of the additional cost to meet FORTIFIED standards, along with a reinspection cost of $300 every 5 years, was subtracted from the cumulative homeowner's insurance premium savings to consider the financial impact on a yearly basis and allow for the identification of a breakeven point. Homeowners, who do not actively invest when expected interest rates are 0 or 1.9 percent, can recover the costs of FORTIFIED designation in years 7, 8, or 9, depending on the designation. For a conservative investor who expects a return of 5 percent, it takes 13 or 14 years to recover the cost of designation. However, when considering future value with an interest rate of 10 percent, the homeowner gains no recovery of the cost of designation through insurance premium savings.

Conclusion

The analysis section of this article addressed the first two research questions: What is the additional cost of FORTIFIED home designation on a typical home in Oklahoma? And, how much time is required to recover the additional costs of FORTIFIED designation through discounted insurance premiums? However, the third question is less obvious: Can FORTIFIED homes be a viable option for homebuilders to offer buyers? From a purely financial standpoint, a homeowner who can realize a return of 10 percent or greater on investments would require a natural disaster to recover the cost of FORTIFIED home designation. The potential exception here would be an insurance discount greater than those modeled (10, 15, and 20 percent) or a reduction in cost to meet the designation requirements. However, we have not accounted for the intangible benefit of reduced content loss for homeowners of FORTIFIED-designated homes and the less hassle of home repairs in the aftermath of a natural disaster.

Although most of the additional costs associated with FORTIFIED requirements are unlikely to decrease, two costs remain that production builders could reduce. Nearly one-third of the additional cost of FORTIFIED Gold designation is attributable to the engineering required to confirm the continuous load path. Although custom home builders must pay the engineering fee for every house they build, production homebuilders should be able to pay the engineering fee only once for one type of floor plan, then build it multiple times. This type of economy of scale could represent a significant cost reduction, thereby increasing the appeal of the FORTIFIED Gold designation.

The data suggest that regarding research question three, a production homebuilder is best equipped to offer FORTIFIED home as an option—and profit from it. A production builder can leverage the weather events common to Oklahoma, use economy of scale to reduce costs, and increase the return on investment during a typical homeownership period. According to the National Association of REALTORS® (2020), the average homeowner stays in a home for more than 13 years, which gives adequate time to realize a return through insurance premiums alone. For small, low-volume and custom builders, the viability of FORTIFIED home designation as an option is related directly to the individual customer. Weather events, as in Oklahoma, will almost certainly evoke interest. However, whether buyers opt for FORTIFIED designation or spend money on different options likely will depend on how they manage personal finances, on whether they have been victims of severe weather events, and their insurance carriers.

The outcome of the analysis implies that the only return on investment from the FORTIFIED™ home designation is a result of a reduction in homeowner's insurance premiums. However, that would ignore the returns available in the event of a natural disaster. A natural disaster that causes damage requiring an insurance claim would result in a very different return on investment. By avoiding a deductible payment and potentially increased premiums from making a claim, a homeowner's realized financial savings would offset a significant portion of the cost of FORTIFIED designation. The associated hassles of home repair would also be avoided, representing additional value. Further, a homeowner who has previously experienced a natural disaster is likely to see greater value in claim and repair avoidance. These variables are real and have differing levels of value based on individual homeowners. This analysis did not consider natural disasters because they are unpredictable.

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