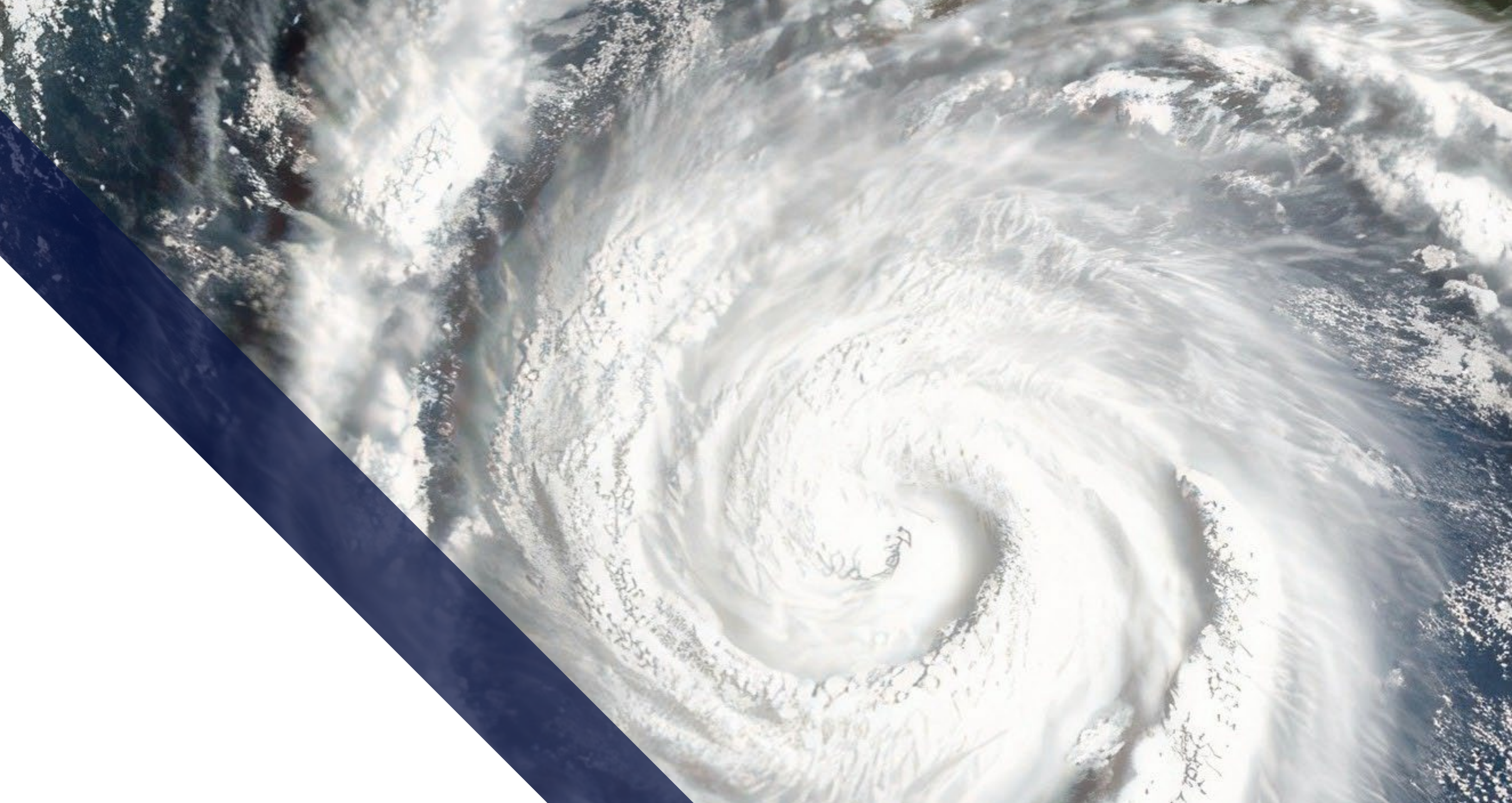


Performance of IBHS FORTIFIED Home™ Construction in Hurricane Sally

Alabama Department of Insurance &

Center for Risk and Insurance Research

Culverhouse College of Business
Center for Risk and Insurance Research

Performance of IBHS FORTIFIED Home™ Construction in Hurricane Sally

Alabama Department of Insurance and
Center for Risk and Insurance Research – University of Alabama
May 5, 2025

THE UNIVERSITY OF ALABAMA | Culverhouse College of Business
Center for Risk and Insurance Research

With technical support from

Insurance Institute for Business and Home Safety

RenaissanceRe Risk Sciences

Smart Home America

Forward

"You're not going to do anything about property insurance and insurance rates until you change the economics of what happens after the storm hits".

– Jim Ridling, former Commissioner, Alabama Department of Insurance

Those few words from Jim Ridling while surveying the damage of a one-two punch by Hurricanes Ivan and Katrina, started it all.

It seemed so simple. Common sense, in fact. Maybe that's why it had not been tried, at least not on a broad scale. Ridling, then a private citizen and former insurance executive, knew the storms would come no matter what. That meant we had to find ways to build stronger before the storm so we can have less damage after the storm. Less damage means fewer insurance claims. Less damage means less debris for local governments to pick up. Less damage means fewer displaced residents. Less damage means students can go back to school. Less damage means local businesses stay open for business. Less damage means employees can show up for work. Less damage means life can go on. Less damage means lives and livelihoods are potentially saved. The dominos of progress and positive change just keep on falling.

Fast forward just a few years. Jim Ridling had become Alabama's insurance commissioner and could work from that base to put those few words into action. What followed, among other important efforts, including a broad-based study on homeowners insurance and the establishment of a first-class academic research center, was a data-driven, state-based, home fortification grant program for Alabama homeowners, *Strengthen Alabama Homes* (SAH). The program was broadly supported by agents and industry, academia, nonprofits, consumer groups, governors, legislators, local governments and many others.

The Alabama Legislature approved a bill creating the program in 2012, funded it in 2015, and the Insurance Department issued its first set of grants in 2016. Lives were changed and the market began to stabilize. Since that first grant, the department has issued more than $86 million in grants and fortified more than 8,700 homes. Our state is now home to more than 53,000 IBHS certified FORTIFIED homes. So, as we had hoped it would all along, the private sector has caught on and is far outpacing the state grant program. All it took was Jim Ridling's few words along with, of course, a *great deal of grit and determination* by an awful lot of people, all pulling the wagon together, to see it through.

This report validates all that work, spanning some two decades. With this report, we see for the first time, in clear empirical data, the benefits of all that work, effort, determination, and commitment by all those people, far too many to name here.

For me, it has been the privilege of a lifetime to see this program go from idea to national model, to work for almost a decade beside former Commissioner Jim Ridling and many others here at the Insurance Department and beyond. Further, it is my honor of a lifetime to now serve as Alabama's insurance commissioner, carrying on his legacy and his vision and that of so many others who worked together to do something good by doing something different. That vision, their vision, has grown from a single state grant program to a resilience movement here at home in Alabama to one is catching on all over the nation. Make no mistake, we in Alabama didn't start the resilience movement, but we've had a hand in. For that, we are proud.

How this report came about is fairly simple. Hurricane Sally, a strong category 2 tropical cyclone, made landfall in Gulf Shores, Alabama, in September of 2020. It was the first hurricane that passed over a critical mass of the IBHS certified FORTIFIED roofs, many of which had been funded by SAH grants. Not long afterwards, we at the Insurance Department began receiving reports from insurers that the fortified roofs in our coastal counties, those in Sally's path, had performed very well, especially south of I-10. However, the data was mostly proprietary, so we couldn't use it. If the data was as good as the insurers were reporting, we needed something we could share publicly. In short, I wanted to shout the good news from the rooftops … FORTIFIED rooftops preferably.

Therefore, we decided to work with those same insurers to develop a data call that would give us the empirical basis for what you see here, a top quality, peer-reviewed study that proves fortification works. From this study, we have learned that the IBHS certified FORTIFIED roofs not only performed as advertised, but they also exceeded our expectations in terms of claim frequency, claim severity and loss ratio. We learned that IBHS certified FORTIFIED roofs even performed substantially better than those on houses built to an identical building code but not receiving the FORTIFIED designation. I think this report will rock the insurance world, in a good way, of course.

Thank you to Dr. Lars Powell, Director of the Center for Risk and Insurance Research at the University of Alabama for outstanding work in crafting this report and analyzing the data that was collected by the amazing, dedicated state employees at the Alabama Department of Insurance. They are without question among the finest professionals I have ever known. Thank you also to all those many people and organizations I referred to above, far too many to name, who worked so hard over the years in developing the SAH program and the larger concepts of resilience that will allow the people of our great state and beyond to build stronger, recover quicker, and live safer.

Mark Fowler
Commissioner of Insurance
State of Alabama

Contents

Figures and Tables

Performance of IBHS FORTIFIED Home™ Construction in Hurricane Sally

Alabama Department of Insurance and
Center for Risk and Insurance Research – University of Alabama
May 5, 2025

Executive Summary

Coastal property insurance has presented a challenge along the gulf coast since the active hurricane seasons of 2004 and 2005. Following a series of concerted efforts to address the problems of availability and affordability, Alabama chose to address the root cause of insurance market dislocations by promoting and funding the Insurance Institute for Business and Home Safety (IBHS) FORTIFIED Home™ (Fortified) program. Fortified prescribes a system of building features that mitigate hurricane wind and wind-driven-water damage in incremental levels of Fortified Roof, Fortified Silver, and Fortified Gold.

The Alabama Department of Insurance, in cooperation with the Alabama Legislature and the insurance industry, created and funded the Strengthen Alabama Homes program, which provides grants to help homeowners retrofit their houses to the Fortified standard. They also implemented benchmark insurance discounts for houses that earned Fortified designations. As this report is drafted in early 2025, Alabama leads the nation with more than 50,000 Fortified designations.

Hurricane Sally in 2020 was the first hurricane to strike a critical mass of Fortified houses, providing an important opportunity to evaluate the performance of Fortified construction. Although Fortified has been evaluated in state-of-the-art laboratory conditions, many insurers remain skeptical of the expected performance, because it has not been tested in real-world hurricane conditions. This report fills that void in the scientific literature by measuring and documenting the performance of Fortified during Hurricane Sally.

The Alabama Department of Insurance issued a data call for Hurricane Sally as Bulletin 2024-3.[1] The Bulletin required admitted insurance companies to provide detailed data on policies and claims in the area affected by Hurricane Sally. Eighty-six insurance companies responded to the data call, including a handful of non-admitted carriers who voluntarily provided data. The final sample of policies covering wind perils for single-family owner-occupied houses included 40,195 policies. Of these, 8,629 reported claims totaling $181,466,480. If we include deductibles paid by policyholders, the total cost of damage was $243,566,706.[2] Our sample includes 7,417 Fortified houses, of which 1,705 were designated Fortified Roof and 5,712 were Fortified Gold.

There is not a single obvious and best way to analyze insurance claims for our purposes. Instead, we employ several methods to produce a range of results that are useful to insurance companies, regulators, consumers, and engineers who continue to improve the Fortified system. For example, the houses in our sample faced different levels of wind and rain. As shown in Table 4, the levels of wind and rain differed across the categories of construction. We also note that 46% of the claims in our sample were caused by trees falling on houses. Although Fortified systems are not designed to mitigate treefall damage, insurers still must pay for treefall damage. Thus, the treefall claims are relevant to insurance companies and

[1] The Bulletin is available from http://www.aldoi.gov/pdf/legal/Bulletin No. 2024-03.pdf
[2] NOAA estimated that total damages for Sally exceeded $7.3B. We limit our sample to owner-occupied single-family houses, and we focus on the location in Alabama (south of I-10) that was hit hardest by hurricane force winds and rain.

consumers, but not to the scientists and engineers who want to know how well Fortified construction standards performed for the intended purpose.

We follow three empirical strategies, which share common performance metrics and construction categories, but differ by sample selection. The performance metrics are claim frequency, claim severity, and loss ratio. Claim frequency is the number of claims divided by the number of policies. Claim severity is the total amount of losses paid divided by the number of claims. Loss ratio is losses divided by premiums. The construction categories are conventional (not Fortified), Fortified Roof, and Fortified Gold.

The first empirical step is to compare the simple average of the three key performance metrics across the three construction categories. Next, we remove the treefall claims from the sample to measure performance in the intended setting. Finally, we control for location – and thereby wind speed and rainfall – by comparing the averages of the performance measures of each Fortified house to those of the nearest non-Fortified house within 0.25 miles.

We find that Fortified-designated construction performed better than conventional construction in Hurricane Sally. Depending on the selected designation, sample, and measure, Fortified construction reduced loss frequency by 55% to 74%, loss severity by 14% to 40%, and loss ratio by 51% to 72%.[3]

Insurance companies are not the only beneficiaries of Fortified construction. Policyholders also save money on deductibles they would otherwise pay. We calculate the expected savings for each party in Hurricane Sally if all the conventional houses were Fortified Roof, and if all houses were Fortified Gold. For simplicity, we use the average frequency and severity reduction percentages across the three analyses to estimate the alternative scenarios. Thus, the frequency reduction is 66% for Fortified Roof and 69% for Fortified Gold, and the severity reduction is 18% for Fortified Roof and 32% for Fortified Gold.

Policyholders represented in our sample paid $53.6 million in deductibles for damage caused by Hurricane Sally. If the 25,093 conventional houses had been built or been retrofitted to the Fortified Roof standard, we estimate that policyholders would have saved $32.6 million (61%) in deductibles paid. If all the houses were built to the Fortified Gold standard, policyholders would have saved $34.6 million (65%) in deductibles paid.

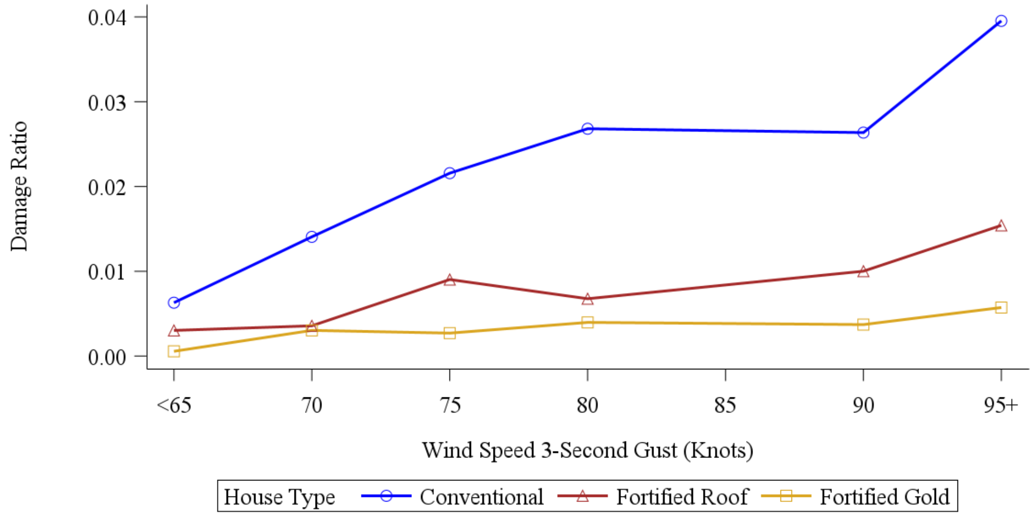
Insurance companies paid $149.3 million for claims in our sample of policies from Hurricane Sally. We estimate that if all conventional houses were built or retrofitted to the Fortified Roof standard, insurers would have saved $99.9 million (67%) in losses. If all the houses had been built to the Fortified Gold standard, they would have saved $111.8 million (75%) of the total they paid as claims for policies in our sample.

Next, we compare the average damage ratio for each construction type over wind speed and rainfall bins. The damage ratio is the ground-up loss divided by the total insured value (TIV). The ground-up loss is the total amount of losses paid for all coverages (including the wind deductible). TIV is the sum of all limits of insurance that apply to the house, plus the wind deductible.

The benefit of using the damage ratio, rather than the loss ratio or severity ratio, is that it describes the amount of damage done to a house, relative to total possible damage. It is not biased by choices of deductibles or coverage. Figure 1 presents the average damage ratio for each construction category across bins of wind speed.

[3] We develop and present these results in detail in Section 3 of the study.

Figure 1: Damage Ratio by Wind Speed



Sample Size	<65	70	75	80	85	90	95+
Conventional	8,101	3,953	5,445	4,846		1,405	1,343
Fortified Roof	413	315	464	353		91	69
Fortified Gold	458	583	1,740	2,022		408	501

Notes: Damage ratio is the losses and deductibles divided by total insured value.
Sources: ALDOI data call, IBHS, and RenaissanceRe Risk Sciences

In each construction category, the average damage ratio demonstrates a non-monotonic but general upward trend over wind speeds, indicating that the wind speed bins are reasonable, but not perfect representations of the damage function.

Results in Figure 1 are consistent with improving performance from conventional to Fortified Roof to Fortified Gold. In each wind speed bin, the average damage ratio for conventional construction is greater than that of either Fortified category. The average damage ratio for Fortified Roof houses is also greater than that of Fortified Gold houses in each wind speed bin.

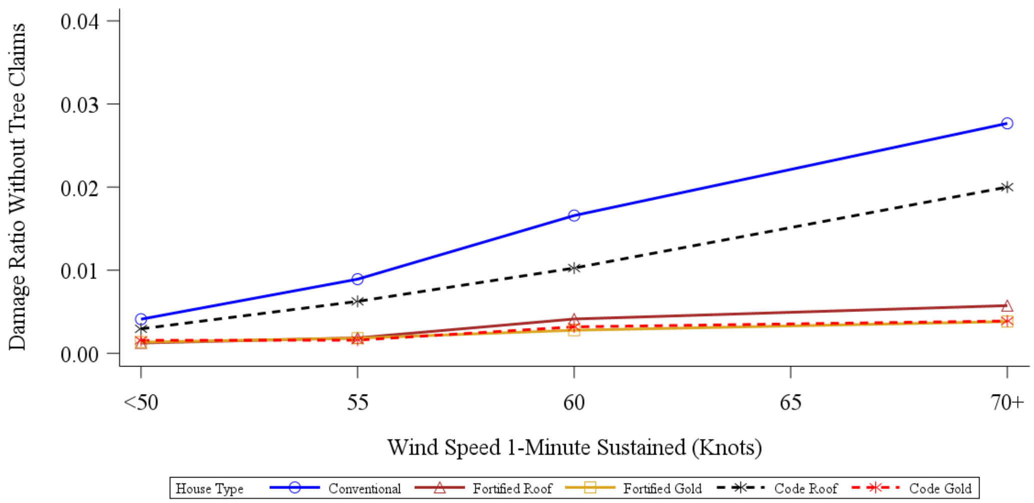
Another purported benefit of the Fortified designation program, in addition to its construction standards, is the private enforcement mechanism. Houses built or retrofitted to a Fortified standard are evaluated and inspected by Fortified Evaluators, and the information collected by Evaluators is verified by IBHS.[4] In several jurisdictions included in the data call, municipalities have enacted building codes that are very similar to the Fortified standards. The only difference is the enforcement process. The houses built to similar codes are inspected by local code officials rather than Fortified Evaluators. The Fortified inspection process requires verification of every aspect of the Fortified standard, whereas the code inspection process may not be able to observe every detail on a common inspection schedule.

The data call offers an opportunity to compare houses that receive a Fortified designation to those built to a local code that is similar to Fortified. In Section 4, we find that houses built to local codes similar to Fortified generally outperformed conventional houses, but that Fortified-designated houses outperformed conventional houses by a substantially larger margin. On average, the Fortified Roof-designated houses performed more than 50% better than similar code houses.

[4] The inspection process is detailed here https://fortifiedhome.org/wp-content/uploads/Evaluator-Checklist_2020-Full-Set.pdf

Adding the Code Fortified categories to the average wind speed analysis, Figure 2 presents the analysis across the five construction categories and four levels of wind speed. The Fortified categories and the code categories consistently outperform conventional construction, and the Code Gold houses performed similar to the Fortified Gold houses. However, the houses built to the supplemental Roof code (dashed black line in the figure) did not perform as well as the Fortified Roof designations (solid brown line). For robustness, we completed several iterations of this analysis, drawing the same conclusion in each.

Figure 2: Comparing Fortified Designation to Similar Codes



Sample Size

	<50	55	60	70+
Conventional	9,904	5,378	4,130	2,599
Fortified Roof	570	485	355	175
Fortified Gold	768	1,602	2,268	952
Code Roof	1,994	2,232	1,465	933
Code Gold	33	217	153	79

Notes: Damage ratio is the losses and deductibles divided by total insured value.
Sources: ALDOI data call, IBHS, RenaissanceRe Risk Sciences, and Smart Home America

In conclusion, we find that Fortified construction lived up to its promise in Hurricane Sally. Claims and deductibles paid by insurers and policyholders were much lower for the Fortified houses than for the conventional houses. We also find that Fortified houses and houses built to similar building codes are not equal. Fortified Roof houses perform at least 50% better than the similar code houses, and the difference is likely due to the private enforcement element of the Fortified program.

As Alabama continues to retrofit and build its coastal housing stock to Fortified standards, its residents can look forward to less weather damage and a more resilient economy in years to come.

Performance of IBHS FORTIFIED Home™ Construction in Hurricane Sally

Alabama Department of Insurance and
Center for Risk and Insurance Research – University of Alabama[5]
May 5, 2025

1. Introduction

In the two decades since hurricanes Ivan and Katrina struck the coast of Alabama, availability and affordability of coastal property insurance have presented challenges to consumers along the Gulf Coast. More recently and more broadly, property insurance markets present seemingly intractable problems throughout the country, as the frequency and severity of catastrophic losses appear to increase.

This study presents the first empirical evidence of a technological solution to property insurance availability and affordability concerns. We find that IBHS Fortified construction performs at least as well as modeled in a strong category-two hurricane. By building houses to the Gold Fortified standard, and retrofitting roofs to the Fortified Roof standard, communities can substantially reduce the cost of insurance and out of pocket costs (deductibles) when an event occurs.

We also find houses that earned the Fortified designation performed better than houses built to an identical code, but without a Fortified designation. This evidence suggests that the private enforcement mechanism included in the Fortified process adds value on its own.

1.1 Fortified construction

The Insurance Institute for Business and Home Safety (IBHS)[6] developed the Fortified Home™ Hurricane Standard (Fortified) in response to the growing need to mitigate hurricane wind and wind-driven rain damage. IBHS provides the following description, "[Fortified] is a voluntary, beyond-code construction program designed to help people protect their homes from severe weather. Centered around a standard that requires a series of science-backed construction and reroofing upgrades, the program also includes access to trained contractors and an independent, third-party verification system."[7]

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[5] Research conducted by the Center for Risk and Insurance Research (CRIR), Culverhouse College of Business, University of Alabama. CRIR thanks Commissioner Mark Fowler and the staff at the Alabama Department of Insurance for recognizing the benefit of this study, issuing the data call, and providing input throughout the process. We thank Martin Grace and Chuck Nyce for providing peer review of earlier drafts. Angela A'Zary, Alex Cary, Ian Giammanco, Graham Greene, Paul Martin, Michael Newman, Dail Rowe, Steve Simkins, Julie Shiyou-Woodard, and Kenny Wunder provided helpful advice, comments, and discussion. We especially appreciate the teams at IBHS, RenaissanceRe Risk Sciences, and Smart Home America for sharing data and technical expertise. Any remaining errors are CRIR's responsibility.

[6] See www.ibhs.org

[7] An accessible technical description is available from https://fortifiedhome.org/wp-content/uploads/1-pager-for-contractors_Hurricane.pdf. Complete details of the standard are available from https://fortifiedhome.org/wp-content/uploads/2020-FORTIFIED-Home-Standard.pdf.

HURRICANE TIES AND RING-SHANK NAILS ARE TWO COMPONENTS OF THE FORTIFIED STANDARD.


Features of the Fortified system protect the envelope of the house and prevent water intrusion. There are three levels of Fortified designations. Fortified Roof requires enhanced fasteners holding down fastening of the roof deck, a sealed roof deck to minimize water intrusion, enhanced edge details at the roof edges to keep the sealed roof deck and roof cover secured, and attic vents that are tested to mitigate wind-driven water intrusion. Fortified Silver requires all the features of Fortified Roof, plus impact-rated openings, including doors, windows, and garage doors, enhanced soffit attachment, gable end bracing, and properly anchored chimneys and attached structures such as porches and carports. Finally, the Fortified Gold designation builds on the Silver designation, requiring designed pressure rated openings including doors, windows, and garage doors, impacted resistant wall sheathing and a continuous load path which provides stronger connections between the roof and the walls, and the walls and foundation.

Laboratory testing and commercial catastrophe models estimate that Fortified construction decreases expected hurricane wind-related losses by 20% to 50%. However, some stakeholders remain skeptical of these bulk modeled results. Until Hurricane Sally, a robust comparison in performance with sufficient exposure of both Fortified designated homes and conventional construction wasn't possible.

Building to the Fortified standards costs more than building to the International Residential Code (IRC) in most locations. Estimates of the increased cost range from 0.5% to 3% for new construction to the Fortified Gold level, and 6% to 16% for retrofitting an existing home to the Fortified Roof standard (Ghosh et al. 2023).[8] As the IRC continues to move closer to the Fortified standard the cost differential will get even smaller with time. In areas which have adopted the latest IRC (2021 and soon 2024) with a design wind speed above 130 mph, the code now closely mirrors the IBHS Fortified standard. Awondo et al. (2024) show that on average buyers pay 7% more for Fortified houses than for an identical house that does not have a Fortified designation, indicating that Fortified is a sound investment.[9]

[8] See Ghosh, S., Bigelow, B.F., Smith, A. and Omole, O., 2023. A cost-benefit analysis of FORTIFIED™ home designation in Oklahoma. *Cityscape*, *25*(1), pp.303-314.
[9] See Awondo, S., Hollans, H., Powell, L. and Wade, C., 2023. Estimating the effects of wind loss mitigation on home value. *Southern Economic Journal*, *90*(1), pp.71-89.

1.2 Fortified in Alabama

Alabama was an early adopter of Fortified designations for wind loss mitigation. In 2025, there are more than 53,000 Fortified houses in the state. Most are in the two coastal counties (Mobile and Baldwin) where they comprise nearly 20% of all single-family homes. Alabama's success in promoting Fortified is largely due to three efforts by the Alabama Department of Insurance. The first is a set of benchmark insurance discounts that admitted insurers are required to apply to the wind portion of home insurance premiums.[10] The discounts range from 50% for new Fortified Gold houses to 20% for Fortified Roof designations earned more than five years earlier. The full range of discounts appears in Table 1.

The second strategy is to rebuild smarter after disaster events. To this end, Alabama Code Section 27-31D-2.1 requires insurers to offer (at market prices) an endorsement to coastal homeowners insurance policies that rebuilds damaged houses to the Fortified Roof standard.

Table 1: Fortified Mitigation Levels and Benchmark Discounts

Mitigation category	Existing Home Roof>5 years old	New and Existing Home Roof ≤ 5 years old
FORTIFIED Gold™	40%	50%
FORTIFIED Silver™	35%	45%
FORTIFIED Roof™	20%	35%

Source: Alabama Department of Insurance Bulletin Number 2016-7

The third effective strategy for encouraging Fortified construction is the Strengthen Alabama Homes (SAH) grant program. The SAH program issues grants to homeowners that offset the cost of reroofing their houses to the Fortified Roof standard. Supporting revenue is sourced from a percentage of insurance industry regulatory and licensing fees.

The SAH program is important for two reasons. First, it has paid nearly $86 million to retrofit 8,700 houses to the Fortified Roof standard.[11] Second, it created crucial demand for Fortified construction, which incentivized a critical mass of contractors, evaluators, and inspectors to learn the Fortified system. It is likely that the SAH program accelerated construction of the other 44,000 Fortified houses in Alabama.

1.3 Hurricane Sally

Hurricane Sally made landfall at Gulf Shores, Alabama on September 19, 2020 as a strong Category 2 storm with maximum sustained wind speeds of 105 mph.[12] Hurricane Sally is the first and only hurricane to strike a substantial number of Fortified houses. Our analysis of Sally provides the first empirical evidence of the performance of Fortified construction in hurricane force winds outside of laboratory full-scale experimental testing. We hope this evidence will lead more insurers to voluntarily provide wind insurance for Fortified houses at the coast.

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[10] The current discounts are set forth on Bulletin Number 2016-7 available from https://www.aldoi.gov/pdf/legal/2016-07 - modification to ala. Bulletins 2013-07, 2010-03 and2009-07.pdf. The discounts became effective in 2009 by Alabama Code Section 27-31D-1, et seq.

[11] SAH numbers are correct as of November 12, 2024. SAH pays up to $10,000 per roof. The average cost of retrofitting a house in the SAH program is about $13,000.

[12] See https://www.weather.gov/mob/sally. Category 2 on the Saffir-Simpson Hurricane Wind Scale involves sustained winds of 96 mph to 110 mph. Category 3 begins at 111 mph.

Although this analysis is informative, we should also note that there is more to learn. As more Fortified houses are built and subsequently affected by weather events, it is important to follow up with similar analyses. Thus, another function of this report is to provide insight into the research process and lessons learned in gathering and analyzing these data.

Our primary research objective is to provide a comprehensive evaluation of Fortified construction in Hurricane Sally. We want to show how Fortified performed compared to standard construction, all else equal. This will offer a baseline "apples-to-apples" comparison. We also want to evaluate performance in a range of circumstances faced by insurers at the coast. For example, the intensity of a storm and the location of a house expose certain houses to higher or lower wind speeds. In addition, the presence of trees near a house can increase or decrease expected losses, depending on location, size, species, and health of the trees.

The richness of the data provides opportunities to compare performance across several additional factors including roof age, roof shape, roof covering, dwelling height, proximity to other structures, and several other secondary factors. In the interest of releasing the primary findings quickly, these factors will be considered in following reports. We welcome suggestions for additional research from interested parties.[13]

1.4 Preview of Results

As a preview of the results, we find that Fortified construction substantially decreases loss frequency and loss severity. Moreover, even with the benchmark premium discounts, the reduction in losses results in reduced loss ratios. Specifically, we find that Fortified Roof designated houses showed loss frequency reduction of 55% to 73%, loss severity reduction of 14% to 20%, and loss ratio reduction of 55% to 72%. Likewise, Fortified Gold designated houses experienced loss frequency reduction of 63% to 74%, loss severity reduction of 20% to 40%, and loss ratio reduction of 51% to 62%.

Imposing averages of these performance metrics on the houses and policies in our sample, we show that if all standard houses utilized a Fortified Roof, the cost of damage caused by Sally would be reduced by $140 Million or 66%. Further, if all houses were constructed to the Fortified Gold level, the cost of damage would be reduced by $152 Million or 71%. This includes claims paid by insurance companies and deductibles paid by policyholders.

We also find that municipal building codes – even when the requirements are identical to Fortified standards – are not as effective as obtaining a Fortified designation. The difference may lie in the enforcement mechanism, indicating that the third-party Evaluators used in the Fortified process added value for the houses affected by Sally.

2. Data and Sample Selection

The Alabama Department of Insurance issued a data call for policies and claims in the area affected by Hurricane Sally as Bulletin 2024-3.[14] The call specified "For each house insured for hurricane wind coverage on September 16, 2020, south of I-10 in Alabama, please provide the following information in the spreadsheet template provided. Claims and underwriting information should be from the policy year in force on September 16, 2020, and include claim information for losses caused by Hurricane Sally on an accident year (AY) basis."

[13] Please contact Dr. Lars Powell at lars.powell@ua.edu with questions or suggestions for further research.
[14] The Bulletin is available from http://www.aldoi.gov/pdf/legal/Bulletin No. 2024-03.pdf

Before issuing the data call, we met with representatives of the insurers with the largest market shares in the affected area to identify the intersection of useful and available data. Given the differences across insurers in data collection, this was an important step in the data collection process. For example, we reduced the area of the data call to houses south of I-10, because insurers expressed concerns about needing to hand collect a few of the variables requested.

The ALDOI received information on 44,686 policies located south of Interstate 10 in Mobile and Baldwin counties. Before analyzing these data, we cleaned the sample to ensure we were comparing like policies and structures. First, we dropped two categories of Fortified houses because there were too few of them to make valid comparisons. We dropped 67 houses built to the Fortified For Safer Living (FFSL) standard and 114 houses built to the Fortified Silver standard.[15] Next, we dropped 600 mobile homes and 325 multifamily residences. We omitted 1,546 policies that excluded wind coverage, and 1,534 policies that did not provide replacement cost coverage. Next, we dropped 193 policies with replacement costs less than $50,000 and 112 policies with premium less than $250. The small premium policies appear to cover storage buildings placed next to recreational vehicle parking areas. These filters leave us with 40,195 policies in the sample.

In addition to cleaning the data, we identified the several jurisdictions that implemented supplemental building codes with construction features equivalent to those of Fortified Gold or Fortified Roof.[16] The jurisdictions and years appear in Table 2. Many of the houses built or reroofed in these jurisdictions after the supplemental codes were adopted did not get IBHS Fortified designations. The houses were neither evaluated, nor inspected by IBHS certified professionals. The code inspection process is not equal to that of an IBHS designation. In fact, as we explain in Section 4, some of the houses built to equivalent building codes, but not inspected, evaluated, or designated by IBHS, did not perform as well as the Fortified houses. However, they did perform better than houses that were neither Fortified, nor built to a supplemental code.

THE DATA CALL INCLUDES INFORMATION ABOUT

- 40,195 POLICIES
- 7,417 FORTIFIED HOUSES
- 8,628 CLAIMS
- $181 MILLION LOSSES PAID
- $17 BILLION TOTAL INSURED VALUE

[15] Results are similar if we combine FFSL with Gold and Silver with Roof; however, the analysis is cleaner if we delete these observations.
[16] The Coastal Code Supplements were in fact developed by IBHS and Smart Home America to extend the reach of the Fortified program.

Table 2: Jurisdictions with Building Codes Similar to Fortified

City	Year Implemented	Re Roofed Level	New Construction Level
Baldwin County (unincorporated)	2012	Roof	Roof
Mobile County (unincorporated)	2015	Roof	Roof
Bay Minette	2012	Roof	Roof
Daphne	2012	Roof	Roof
Elberta	2012	Roof	Roof
Fairhope	2012	Roof	Roof
Foley	2017	Roof	**Gold**
Gulf Shores	2015	Roof	Roof
Loxley	2012	Roof	**Gold**
Magnolia Springs	2012	Roof	Roof
Orange Beach	2012	Roof	**Gold**
Perdido Beach	2012	Roof	**Gold**
Robertsdale	2012	Roof	**Gold**
Silverhill	2012	Roof	**Gold**
Spanish Fort	2013	Roof	**Gold**
Summerdale	2019	Roof	**Gold**
Dauphin Island	2019	Roof	Roof

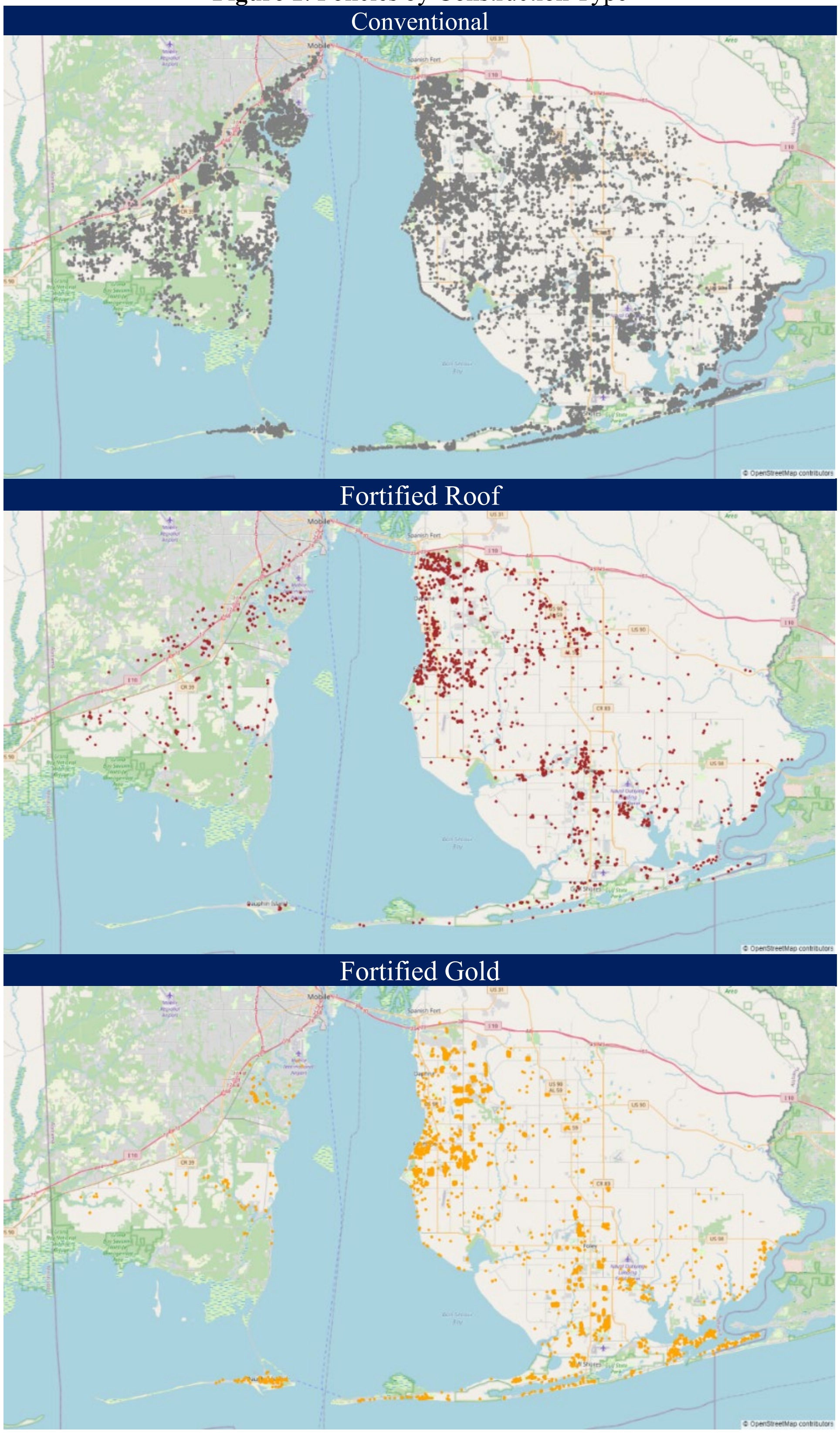
Notes: The Re-Roofed Level indicates the Fortified designation level similar to the building code applied when replacing the roof of an existing house. New Construction Level indicates the Fortified designation level similar to the building code applied to new house construction.
Source: Smart Home America

Among the 40,195 policies, we found 7,685 (7,185 Roof and 500 Gold) that were built or re-roofed to a supplemental code, but do not appear in the IBHS designation database. We analyze these houses carefully in Section 4; however, we believe it is appropriate to drop them from the sample in the analysis comparing Fortified houses to conventional houses. This final cut leaves us with 32,510 policies. It is important to note that some policies submitted in response to the data call did not report the age of the roof. Therefore, it is possible that a significant number of the houses classified as conventional were reroofed to a supplemental code that mimics the Fortified Roof designation. To the extent that such "false negatives" exist, the reported efficacy of the Fortified system will be muted.[17]

Figure 1 shows the policies in the sample by construction type. Note that the sample is evenly distributed across the inhabited areas, and that Fortified policies are represented throughout the area, although they are more common in some areas than in others.

[17] Early readers expressed concerns that there could be a delay between adoption and implementation of local codes. We reran the analysis after adding one year to each enactment date. Conclusions did not change.

Figure 1: Policies by Construction Type



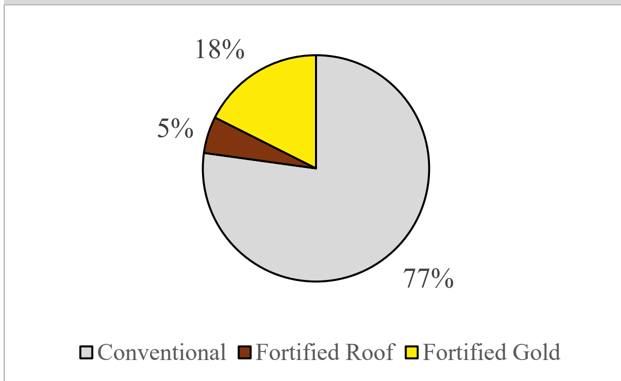
Sources: ALDOI data call and IBHS

Table 3 presents summary statistics for the houses in the final sample by construction type. Claim Frequency is the number of claims paid. Claim Severity is the total amount of claims paid divided by the number of claims paid. Average Claim is the amount of claims paid per policy. Premium is the amount of premium paid. Replacement Cost is the amount it would cost to replace each house. Deductible Paid is the amount paid by policyholders. The Ground-Up Loss is the Average Claim plus the Deductible Paid. The Loss Ratio is the Average Claim divided by the Premium.

The summary statistics offer readers a feel for the data and the basic outcomes. From Table 3, we learn that 7,629 of the 34,442 houses in our sample (22%) received insurance claim payments. Claims paid ranged from $2 to over $1.2 million, with an average of $20,603. Premium paid per house ranged from $255 to $44,851, which is nearly proportional to the range of replacement cost. The average replacement cost of houses in the sample was $250,000, with somewhat lower average replacement cost in the conventional category ($238,379), and higher average replacement costs in the Fortified Roof ($259,782) and Fortified Gold ($302,060) categories. This indicates that it will be important to control for replacement cost when comparing claim severity across categories.

TABLE 3 SHOWS THAT FORTIFIED HOUSES REPRESENT 23% OF POLICIES AND ONLY 9% OF CLAIMS

Policies



Claims

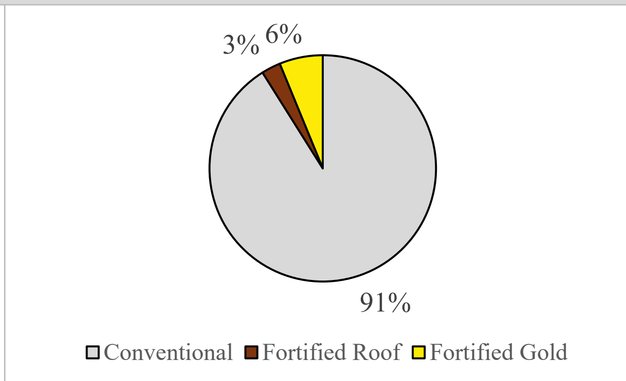


Table 3: Summary Statistics

House Type	Variable	N	Mean	Sum	Minimum	Maximum
All	Claim Frequency	32,510	0.22	7,225	0	1
All	Claim Severity	7,225	20,670	149,338,287	0	1,244,391
All	Average Claim	32,510	4,594	149,338,287	0	1,244,391
All	Premium	32,510	1,969	64,010,142	255	44,851
All	Replacement Cost	32,510	251,409	8,173,312,491	50,437	7,637,400
All	Deductible Paid	7,225	7,225	53,626,226	250	93,450
All	Ground-Up Loss	32,510	6,243	202,964,513	0	1,274,941
All	Loss Ratio	32,510	2.33			
Conventional	Claim Frequency	25,093	0.26	6,580	0	1
Conventional	Claim Severity	6,580	21,058	138,564,884	17	1,244,391
Conventional	Average Claim	25,093	5,522	138,564,884	0	1,244,391
Conventional	Premium	25,093	2,135	53,581,517	255	44,851
Conventional	Replacement Cost	25,093	239,311	6,005,019,288	50,437	7,637,400
Conventional	Deductible Paid	6,580	5,593	49,387,805	250	93,450
Conventional	Ground-Up Loss	25,093	24,039	187,952,688	0	1,274,941
Conventional	Loss Ratio	25,093	2.59			
Fortified Roof	Claim Frequency	1,705	0.12	197	0	1
Fortified Roof	Claim Severity	197	18,179	3,581,293	2	203,322
Fortified Roof	Average Claim	1,705	2,100	3,581,293	0	203,322
Fortified Roof	Premium	1,705	1,821	3,105,578	390	13,476
Fortified Roof	Replacement Cost	1,705	259,782	442,927,801	73,000	2,602,050
Fortified Roof	Deductible Paid	197	6,855	1,350,360	500	36,000
Fortified Roof	Ground-Up Loss	1,705	2,892	4,931,652	0	213,972
Fortified Roof	Loss Ratio	1,705	1.15			
Fortified Gold	Claim Frequency	5,712	0.08	448	0	1
Fortified Gold	Claim Severity	448	16,054	7,192,111	13	168,216
Fortified Gold	Average Claim	5,712	1,259	7,192,111	0	168,216
Fortified Gold	Premium	5,712	1,282	7,323,047	267	14,399
Fortified Gold	Replacement Cost	5,712	302,060	1,725,365,402	58,500	3,027,600
Fortified Gold	Deductible Paid	448	6,447	2,888,061	500	61,913
Fortified Gold	Ground-Up Loss	5,712	1,765	10,080,172	0	220,757
Fortified Gold	Loss Ratio	5,712	0.98			

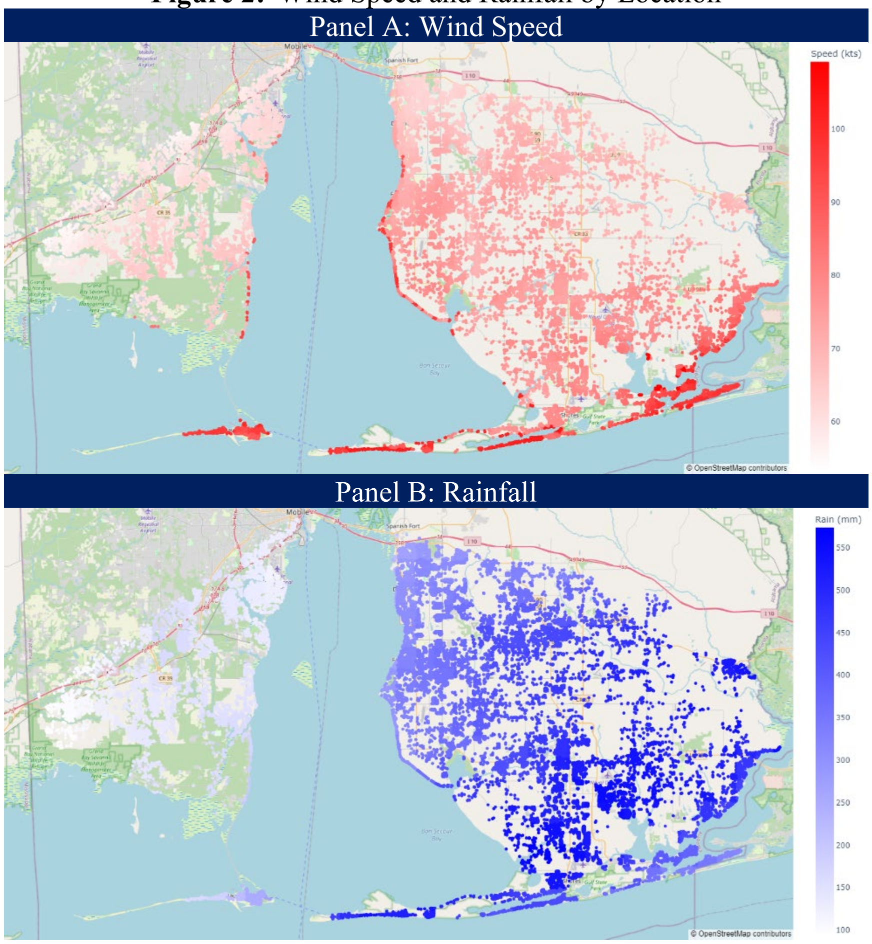
Notes: Claim Frequency is the number of claims paid. Claim Severity is the total amount of claims paid divided by the number of claims paid. Average Claim is the amount of claims paid per policy. Premium is the amount of premium paid. Replacement Cost is the amount it would cost to replace each house. Deductible Paid is the amount paid by policyholders. The Ground-Up Loss is the Average Claim plus the Deductible Paid. The Loss Ratio is the Average Claim divided by the Premium. N is the number of observations used to calculate each statistic.
Sources: ALDOI data call and IBHS

2.1 Wind and Rain Data

We merged data on windspeed and rainfall with the policy and claims data by matching the latitude and longitude coordinates of each house to that of the nearest wind and rain readings. RenaissanceRe Risk Sciences provided the windspeed data in one-kilometer intervals.[18] NOAA is the source of the rainfall data. The most granular interval for these data is two kilometers.[19] If each type of house is exposed to significantly different conditions of rain and wind, it will be important to control for location of each house or wind and rain exposure in the analysis.

Figure 2 shows the nearest wind speed and rainfall readings for each policy in our sample. Panel A displays wind speed by location. Wind speed is fastest at the coast and drops as the wind encounters friction and cooler temperatures across land. Panel B displays rainfall by location. In contrast to the wind speed figure, rainfall is highest at the southeast corner, and the heaviest rain continues inland farther than the wind.

Figure 2: Wind Speed and Rainfall by Location



Notes: Wind speed is shown in knots. Readings are separated by one kilometer. Rainfall is shown in millimeters. Readings are separated by two kilometers.
Sources: ALDOI data call, NOAA, and RenaissanceRe Risk Sciences

[18] See https://www.renre.com/reinsurance/renaissancere-risk-sciences/
[19] NOAA Stage IV Daily Accumulations are available from https://water.noaa.gov/about/precipitation-data-access

Table 4 shows that both categories of Fortified houses faced stronger winds of longer duration, and more rainfall, compared to houses without a Fortified designation. Likewise, the Fortified Gold houses experienced stronger wind and rain conditions than most Fortified Roof houses.[20] This outcome is intuitive, because people are more likely to build Fortified where they are exposed to greater perils. Moreover, the underlying building codes differ by exposure to wind and rain, leaving a smaller financial hurdle to meet the Fortified standard and obtain a designation from the underlying building code. The difference also demonstrates the importance of controlling for wind, rain, and location when comparing Fortified houses to conventional houses.

Table 4: Average Wind Speed and Rainfall by Construction Type

Designation	Wind Speed: 1 Minute Sustained (Knots)	Wind Speed: 3 Second Gust (Knots)	Wind Speed Duration (Hours)	Rainfall (Millimeters)
None	52	71	11.7	344
Roof	53	72	12.0	366
Gold	57	76	12.7	412

Notes: One-minute sustained wind is the fastest wind speed measured consistently for 60 seconds. Wind speed 3-second gust is the fastest wind speed measured for at least three seconds. Wind speed duration is the duration of wind speed exceeding 40 knots in hours. Wind speed is measured in nautical miles per hour (knots). One knot is 1.15 miles per hour. Rainfall is the amount of rain falling in each area measured in millimeters.
Sources: Wind speed and rainfall data provided by RenaissanceRe Risk Sciences. Fortified designation data are from IBHS. Locations of the houses are from the ALDOI data call.

3. Analytical Approach

The primary goal of this analysis is to evaluate the performance of Fortified construction in a way that is useful to insurance and reinsurance companies, as well as other decision makers concerned with the resilience of single-family houses. However, we also have an opportunity to provide valuable feedback to the scientists and engineers who develop and evaluate Fortified construction methods in the laboratory. Thus, we approach the analysis using multiple methods, producing a range of results that are useful to each interested party.

Table 4 shows that the levels of wind and rain affecting each house differed systematically across the categories of construction, indicating that simple average comparisons across construction types will not tell a complete story of Fortified performance. We also note that 46% of the claims in our sample were caused by trees falling on houses. Although Fortified systems are not designed to mitigate treefall damage, insurers must pay for treefall damage, and the resulting wind and water damage caused once a tree pierces the envelop of a house. Thus, the treefall claims are relevant to insurance companies and consumers, but less so to the scientists and engineers who want to know how well Fortified construction performed for its intended purpose.

We follow three empirical strategies, which share common performance metrics and construction categories, but differ by sample selection. The performance metrics are claim frequency, claim severity, and loss ratio. Claim frequency is the number of claims divided by the number of policies. Claim severity is the total amount of losses paid divided by the number of claims. Loss ratio is losses divided by premiums. The construction categories are defined by their Fortified designations, none, Roof, and Gold.

[20] The differences between each mean are statistically significant at less than the 0.001 level.

The first empirical step is to compare the simple average of three key performance metrics across three construction categories.

Next, we remove the treefall claims from the sample to measure performance in the intended setting. Then, we control for location – and thereby wind speed and rainfall – by comparing the averages of the performance measures of each Fortified house to those of the nearest non-Fortified house.

In Section 3.5, we compare the average damage ratio across bins of wind speed and rainfall. The Damage Ratio is the ground-up loss divided by the total insured value (TIV). The ground-up loss is the total amount of losses paid for all coverages (including the wind deductible). TIV is the sum of all limits of insurance that apply to the house, plus the wind deductible.

3.1 Average Performance

Comparing average performance metrics across construction types is a logical first step in the analysis. It provides a baseline reading that is easy to understand, and it allows us to compare the simple average to the other measures, which demonstrates the importance of refining the analysis. Results appear in Table 5.

Panel A shows the reduction of the loss frequency rate across the three construction types. The frequency rate is the number of claims in each category divided by the number of claims in each category. There are 27,025 conventional houses, and with 6,984 claims, resulting in a frequency rate of 0.26 (6,984÷27,025). The frequency rate for Fortified Roof policies is 0.12 (197÷1,705), and that of Fortified Gold policies is 0.08 (448÷5,712). The frequency reduction percentage for Fortified Roof policies is the percentage reduction from 0.26 to 0.12, or 55%. The frequency reduction percentage for Fortified Gold policies is 70% (1-[0.08÷0.26]).

Panel B presents the claim severity analysis. Again, we measure the difference across construction types. The average claim is the total amount paid for claims in each category divided by the number of claims in each category. The measure would be incomplete without controlling for the replacement cost of houses in each category. The average home value is the average replacement cost for houses in each category. Percent of value is the average claim divided by the average home value. Severity reduction is the percentage difference between the percent of value for conventional houses and each of the Fortified categories. Fortified Roof houses experienced 20% less loss severity than conventional houses. Fortified Gold houses experienced 40% less loss severity than conventional houses.

Panel C presents the loss ratio analysis. The loss ratio analysis is important because insurers in Alabama must offer at least the benchmark discounts shown in Table 1 for Fortified houses. Therefore, it is necessary to measure any change in losses relative to changes in premiums. The loss ratio is the average loss divided by the average premium. The loss ratio is 2.57 for conventional houses, 1.15 for Fortified Roof houses, and 0.98 for Fortified Gold houses. Fortified Roof is associated with a 55% reduction in loss ratio, and Fortified Gold is associated with a 62% reduction in loss ratio.

Table 5: Simple Average Analysis

Panel A: Claim Frequency Analysis

Designation	Policies	Claims	Frequency Rate	Frequency Reduction
None	25,093	6,580	0.26	
Roof	1,705	197	0.12	56%
Gold	5,712	448	0.08	70%

Panel B: Claim Severity Analysis

None	21,058	239,311	8.8%	
Roof	18,179	259,782	7.0%	20%
Gold	16,054	302,060	5.3%	40%

Panel C: Loss Ratio Analysis

Designation	Average Loss	Average Premium	Loss Ratio	Loss Ratio Reduction
None	$5,522	$2,135	2.59	
Roof	2,100	1,821	1.15	55%
Gold	1,259	1,282	0.98	62%

Notes: Policies is the total number of policies in each group. Claims is the number of policies with claims in each group. Frequency Rate is Claims divided by Policies. Frequency Reduction is percentage difference between the non-Fortified Frequency Rate and each Fortified designation. Average Claim is the total amount paid for claims in each designation group divided by Claims in each group. Average Home Value is the total amount of replacement cost reported for houses in each group divided by Policies in each group. Percent of Value is Average Claim divided by Average Home Value. Severity Reduction is percentage difference between the non-Fortified Percentage of Value and that of each Fortified designation. Average Loss is the total amount of losses divided by Policies. Average Premium is the total amount of premiums divided by Policies. Loss Ratio is Average Loss divided by Average Premium. Loss Ratio Reduction is the percentage difference between the non-Fortified Loss Ratio and that of each Fortified designation.
Sources: ALDOI data call and IBHS

3.2 Average Performance without Tree-Fall Claims

The simple average comparison in Section 3.1 Average Performance provides an accurate account of insurers' experience in Hurricane Sally. However, it is not the best analysis to determine how well Fortified construction performed, or how well it could perform under alternative conditions.

The Fortified system is not designed to mitigate losses caused by trees falling on houses. At the margin, it is possible that a Fortified roof deck could prevent water entry when a tree falls on a house, but the cost of building a house engineered to completely withstand tree fall claims is prohibitive. In our sample, 3,509 (46%) claims were due to falling trees. Conventional houses incurred 3,267 tree claims, Fortified Roof houses incurred 120 tree claims, and Fortified Gold houses incurred 122 tree claims. If the tree cover is systematically different across the area we study, then including tree claims in our analysis will bias the relative efficacy of the Fortified designations.

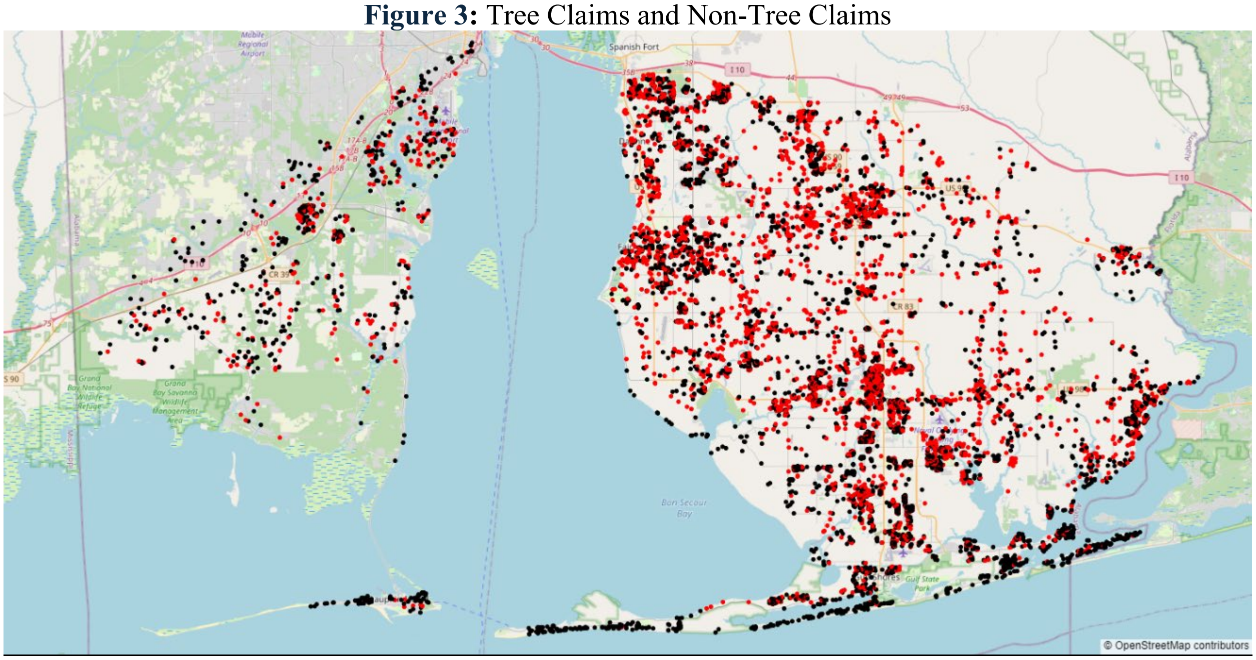
Figure 3 plots the claims in our sample by tree status. The red dots are claims that involved a tree, and the black dots are claims that did not involve a tree.[21] It is clear from the figure that tree claims are not uniformly distributed across the sample. It is less likely to have a tree claim on the beach, where trees are less common than they are inland. Intuitively, we can also assume that tree claims are more likely for old houses than for new houses, because it takes years for a tree to grow large enough to damage a house. The first Fortified houses were built only about a decade before Hurricane Sally.

Given the differences in tree cover and tree claims among our sample of policies, we can glean important information from the data by analyzing the non-tree claims separately.

Table 6 presents the same results as Table 5, except that tree claims are excluded from the analysis. Removing tree claims from the sample has substantial effects on the results. The frequency rate shown in Panel A decreases for each category compared to results in Table 5, but relatively more so for the Fortified Roof houses. Without tree claims, the frequency reduction is 69% for Fortified Roof and 63% for Fortified Gold. As we will see in the next section, Roof is not outperforming Gold, rather, Gold houses are located in more perilous areas than Roof houses relative to the impacts of Hurricane Sally.

The claim severity results in Table 6 are very similar to those in Table 5. The average severity reduction for Fortified Roof houses is 19% and the average severity reduction for Fortified Gold houses is 37%.

Figure 3: Tree Claims and Non-Tree Claims



Note: Tree claims are red and non-tree claims are black.
Source: ALDOI data call

[21] One method insurers used to determine if a tree cause a claim was to search the text of each claim file for "tree."

The loss ratio results in Panel C of Table 6 are different from those in Table 5. Without tree claims, the loss ratios are lower for each category, as expected. The loss ratio for Fortified Roof houses is only 0.48, which is not bad for an average year, but it is extremely low for an area hit by a Category 2 hurricane, as is the 0.75 loss ratio for Fortified Gold houses. The loss ratio reduction is 68% for Fortified Roof houses compared to conventional houses, and 51% for Fortified Gold houses compared to conventional houses.

Tree-fall claims were a substantial portion of total hurricane damage.

One takeaway from this analysis is that tree-fall losses contribute heavily to total hurricane damage. Although the details of implementation would be complex, it may be worthwhile to encourage homeowners to manage trees on their properties in return for lower insurance premiums. Managing trees is much easier and less expensive before there are large trees adjacent to a house. It is likely that the species of tree is important as well. These facts suggest that an education program directed at people who buy new houses could be effective. Most individuals can cut down a pine tree sapling on their own. Ten years later, it will be a more expensive job.

Table 6: Average Analysis without Tree Claims

Panel A: Claim Frequency Analysis				
Designation	Policies	Claims	Frequency Rate	Frequency Reduction
None	22,011	3,498	0.16	
Roof	1,585	77	0.05	69%
Gold	5,590	326	0.06	63%
Panel B: Claim Severity Analysis				
None	$20,747	$240,834	8.6%	
Gold	16,403	302,240	5.4%	37%
Panel C: Loss Ratio Analysis				
Designation	Average Loss	Average Premium	Loss Ratio	Loss Ratio Reduction
None	$3,297	$2,143	1.54	
Roof	877	1,825	0.48	69%
Gold	957	1,281	0.75	51%

Notes: Sample does not include claims from trees falling on houses. Policies is the total number of policies in each group. Claims is the number of policies with claims in each group. Frequency Rate is Claims divided by Policies. Frequency Reduction is percentage difference between the non-Fortified Frequency Rate and each Fortified designation. Average Claim is the total amount paid for claims in each designation group divided by Claims in each group. Average Home Value is the total amount of replacement cost reported for houses in each group divided by Policies in each group. Percent of Value is Average Claim divided by Average Home Value. Severity Reduction is percentage difference between the non-Fortified Percentage of Value and that of each Fortified designation. Average Loss is the total amount of losses divided by Policies. Average Premium is the total amount of premiums divided by Policies. Loss Ratio is Average Loss divided by Average Premium. Loss Ratio Reduction is percentage difference between the non-Fortified Loss Ratio and that of each Fortified designation.
Sources: ALDOI data call and IBHS

3.3 Average Performance Controlling for Location and Trees

Hurricanes are fueled by warm sea surface temperatures. When a hurricane makes landfall, the storm cools and loses moisture as it moves away from the water. This decreases the wind speed and rainfall of the storm. Items such as trees and buildings also create friction with the storm, which further reduces wind speed.[22] Across our sample of houses, we see significant differences in wind speed and rainfall, suggesting it is important to control for location in the analysis.

Table 7 presents the results from a nearest-neighbor analysis, in which we compare loss outcomes of each Fortified house to the nearest conventional house. Only the Fortified houses within 0.25 miles of the nearest conventional house are included in the analysis, ensuring that the houses experience very similar weather conditions. We also exclude tree-fall claims from the sample for this analysis. The nearest-neighbor analysis without tree-fall claims produces the best estimate of the performance of Fortified construction for its intended purpose in an "all-else-equal" scenario.

The frequency reduction for Fortified Roof is 73% and that of Fortified Gold is 74%, indicating that, all else equal, Roof and Gold outperform conventional construction similarly in a Category 2 hurricane. It does not indicate that Roof and Gold are equivalent, because the average Fortified Roof house is three miles further from the coast than the average Fortified Gold house. However, we would not expect large differences in performance between Roof and Gold at peak winds speed less than 104 knots, when the primary sources of damage will be related to roof performance and cladding elements (e.g., soffits, fascia, and siding).[23]

Severity reduction is also closer between the two Fortified categories in this analysis than in Table 5 and Table 6. Severity reduction is 14% for Fortified Roof and 20% for Fortified Gold. Loss ratio reduction is 72% for Fortified Roof and 62% for Fortified Gold. Given the similarity in frequency and severity reductions, and Alabama's benchmark discount requirement, this is not surprising.

> Without Tree-fall claims, Fortified Roof policies would have incurred a loss ratio of 43% during Hurricane Sally.

[22] See https://www.hurricanescience.org/science/science/hurricaneandland/index.html.
[23] See for example, Done, J.M., K.M. Simmons, and J. Czajkowski, 2018: Relationship between residential losses and hurricane winds: Role of the Florida Building Code, J. Risk Uncertain. Eng. Sys. Part A: Civ. Eng., 4, https://doi.org/10.1061/AJRUA6.0000947 or Giammanco, I.M., E. Newby, W.H. Pogorzelski, and M. Shabanian, 2023: Observations of building performance in southwest Florida during Hurricane Ian (2022): Part II: Performance of the modern Florida Building Code, *Insurance Institute for Business & Home Safety*, Technical Report, 21 pp. https://ibhs1.wpenginepowered.com/wp-content/uploads/HurricaneIan_PartII_FBC.pdf

Table 7: Nearest Neighbor Analysis without Tree Claims

Panel A: Claim Frequency Analysis

None	1,558	277	0.18	
None	5,150	1,228	0.24	

Panel B: Claim Severity Analysis

Designation	Claim	Home Value	Value	Reduction
None	$18,791	$254,324	7.4%	
Roof	16,434	261,236	6.3%	15%
None	$20,536	$285,257	7.2%	
Gold	16,657	305,572	5.5%	24%

Panel C: Loss Ratio Analysis

Designation	Average Loss	Average Premium	Loss Ratio	Loss Ratio Reduction
None	$3,341	$2,163	1.54	
Roof	791	1,830	0.43	72%
None	$4,897	$2,265	2.16	
Gold	938	1,303	0.72	67%

Notes: Sample does not include claims from trees falling on houses. Policies is the total number of policies in each group. Claims is the number of policies with claims in each group. Frequency Rate is Claims divided by Policies. Frequency Reduction is percentage difference between the non-Fortified Frequency Rate and each Fortified designation. Average Claim is the total amount paid for claims in each designation group divided by Claims in each group. Average Home Value is the total amount of replacement cost reported for houses in each group divided by Policies in each group. Percent of Value is Average Claim divided by Average Home Value. Severity Reduction is percentage difference between the non-Fortified Percentage of Value and that of each Fortified designation. Average Loss is the total amount of losses divided by Policies. Average Premium is the total amount of premiums divided by Policies. Loss Ratio is Average Loss divided by Average Premium. Loss Ratio Reduction is percentage difference between the non-Fortified Loss Ratio and that of each Fortified designation.
Sources: ALDOI data call and IBHS

3.4 Summary of Average Performance Analyses

Considering the analyses presented above, it is clear that Fortified Roof and Fortified Gold houses suffered less damage than conventional houses in Hurricane Sally. Table 8 consolidates the results from Table 5 through Table *7* to facilitate comparison.

Table 8: Comparison of Results from each Analysis

Measure / Designation	(1) Average Effects	(2) Average without Trees	(3) Nearest Neighbor without Trees
Frequency Reduction			
Roof	56%	69%	73%
Gold	70%	63%	76%
Severity Reduction			
Roof	20%	20%	15%
Gold	40%	37%	24%
Loss Ratio Reduction			
Roof	55%	69%	72%
Gold	62%	51%	67%

Notes: The percentages shown in the three columns (Average Effects, Average Without Trees, and Nearest Neighbor without Trees) indicate the average reductions in three measures (Frequency, Severity, and Loss Ratio) compared to conventional construction. Nearest neighbor analysis compares the average measure for houses in each Fortified category to the average of the nearest conventional houses within 0.25 miles of the Fortified houses.
Sources: ALDOI data call and IBHS

It is also useful to consider how the outcomes of Hurricane Sally could have been different if coastal residents had started building Fortified in 1960 or 1980, instead of 2010. This gives us a glimpse of the future as Alabama continues to retrofit and build to the Fortified standard.

We apply the frequency and severity reduction percentages to estimate the losses from Hurricane Sally if all the conventional houses were Fortified Roof or if all the houses were Fortified Gold. For simplicity, we use the average frequency and severity reduction percentages across the three analyses to estimate alternative scenarios. Thus, the frequency reduction is 66% for Fortified Roof and 70% for Fortified Gold, and the severity reduction is 18% for Fortified Roof and 34% for Fortified Gold. Table 9 shows the estimated savings for policyholders and insurance companies.

Table 9: Potential Savings from Fortified

	(1) Amount Reported In Data Call	(2) If All Houses Fortified Roof	(3) If All Houses Fortified Gold
Policyholders			
Deductibles Paid	$53,626,226	$21,030,275	$19,000,748
Percent Saved	0%	61%	65%
Insurers			
Claims Paid	$149,338,287	$49,405,293	$37,515,912
Percent Saved	0%	67%	75%

Notes: Column (1) is the amount reported in the data call. Column (2) is the estimated amount if all the conventional houses had been built to the Fortified Roof standard. Column (3) is the estimated amount if all the houses had been built to the Fortified Gold standard.
Sources: ALDOI data call and IBHS

Policyholders represented in our sample paid $53.6 million in deductibles for damage caused by Hurricane Sally. If the 25,093 conventional houses had been built or been retrofitted to the Fortified Roof standard, we estimate that policyholders would have saved $32.6 million (61%) in deductibles paid. If all the houses were built to the Fortified Gold standard, policyholders would have saved $34.6 million (65%) in deductibles paid.

Insurance companies paid $149.3 million for claims in our sample of policies from Hurricane Sally. We estimate that if all conventional houses were built or retrofitted to the Fortified Roof standard, insurers would have saved $99.9 million (67%) in losses. If all the houses had been built to the Fortified Gold standard, they would have saved $111.8 million (75%) of the total they paid as claims for policies in our sample.

If all houses had been built to the Fortified Gold standard, losses in Hurricane Sally would have been 75% less.

3.5 Average Performance Across Wind Speed and Rainfall Measures

We can evaluate the performance of construction categories by taking averages across bins of wind speed and rainfall. In this section, we assign wind speed and rainfall to each house in our sample by the nearest wind speed and rainfall reading, as in Figure 2. We expect loss frequency and severity to be positively correlated with wind speed and rainfall.

In this analysis, we employ the Damage Ratio, which is the ground-up loss divided by the total insured value (TIV). The ground-up loss is the total amount of losses paid for all coverages (including the wind deductible). TIV is the sum of all limits of insurance that apply to the house, plus the wind deductible. In our sample, we collect data on limits and losses for Coverage A (Dwelling) Coverage B (Other Structures), Coverage C (Contents) and Coverage D (Loss of Use).

A common configuration for a homeowners insurance policy is for the policyholder to choose an amount for Coverage A equal to the replacement cost of the house, and the other coverages are set to percentages of Coverage A. Coverage B is often 10% of Coverage A. Coverage C is often 50% of Coverage A, and Coverage D is often 20% of Coverage A.[24] In this case, if the replacement cost of a house is $100,000 and the wind deductible is 5% of Coverage A, the TIV would be $185,000 ($100,000 A + $10,000 B + $50,000 C + $20,000 D + $5,000 deductible = $185,000).

The benefit of using the damage ratio, rather than the loss ratio or severity ratio, is that it describes the amount of damage done to a house, relative to total possible damage. It is not biased by choices of deductibles or coverage. This measure was specifically recommended by some of the insurance and reinsurance companies we spoke with before beginning the data call.

We consider three measures of wind speed and one measure of rainfall. The wind speed measures are maximum speed of three-second gusts, maximum speed of one-minute sustained winds, and duration of sustained winds greater than forty knots. The first two wind speed measures are provided in nautical miles per hour, or knots. The third is provided in hours. Rainfall is shown in millimeters. Table 10 presents summary statistics for each measure based on the number of houses that are nearest to each wind speed and rainfall reading.

Table 10: Summary Statistics for Wind and Rain

Measure	Mean	Std Dev	Minimum	Maximum
Wind Speed: 1-Minute Sustained (Knots)	53.1	8.1	37.9	85.3
Wind Speed: 3-Second Gust (Knots)	72.0	9.5	53.7	109
Wind Speed Duration (Hours)	11.8	1.8	5.8	18.5
Rainfall (Millimeters)	356	139	95.6	573

Sources: ALDOI data call, NOAA, and RenaissanceRe Risk Sciences

Table 11 presents the Pearson correlation coefficients among the wind and rain measures and the damage ratio. The correlation between wind speed by three-second gusts and wind speed by one-minute sustained is very high at 97%. We do not expect to learn much from one measure that we do not learn from the other. Because the measure of three-second gusts has a higher correlation with the damage ratio than the measure of one-minute sustained wind speed, we do not present results for one-minute sustained wind speed here.[25]

[24] In most cases, policyholders can choose higher limits for each coverage based on their exposure.
[25] Results for the excluded measure are available by request.

Table 11: Correlation Matrix for Wind, Rain, and Damage Ratio

	Wind Speed 1 Minute Sustained (Knots)	Wind Speed 3 Second Gust (Knots)	Wind Speed Duration >40 (Hours)	Rainfall
Wind Speed: 3-Second Gust	0.97			
Wind Speed Duration >40	0.79	0.76		
Rainfall	0.55	0.64	0.48	
Damage Ratio	0.13	0.14	0.11	0.15

Notes: The table presents Pearson Correlation Coefficients. Each coefficient is statistically significant at less than the 0.0001 level.
Sources: ALDOI data call, NOAA, and RenaissanceRe Risk Sciences

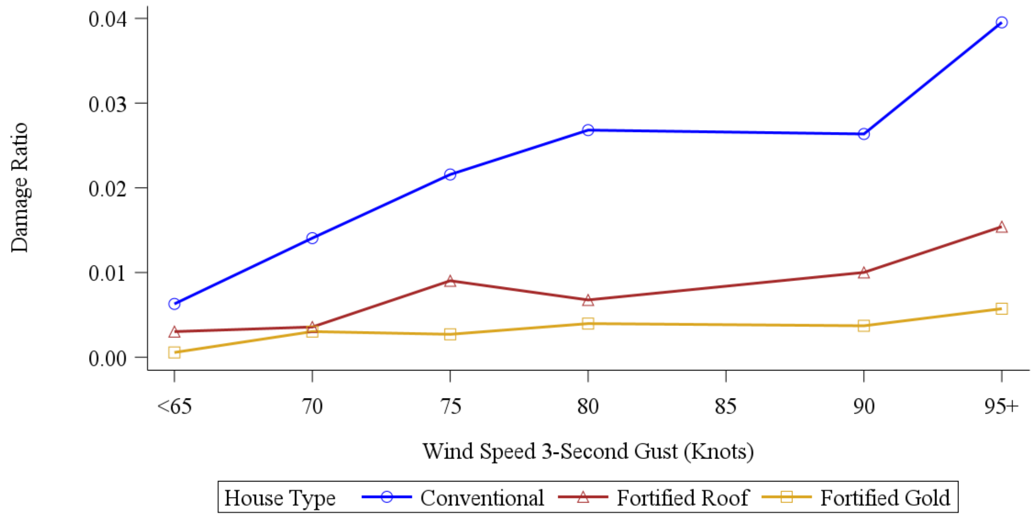
The first step of this analysis is to create bins of wind speed and rainfall. The purpose of the bins is to calculate averages of the damage ratio for each construction category within each bin. The goal in setting bins is to have a statistically meaningful number of observations of each construction category within each bin, such that the results in each bin are credible or reliable. For example, if there were only 10 Fortified Gold houses in a bin, we would not be confident that the average of those 10 houses is representative of all Fortified Gold houses. We set the bins such that each bin contains at least 100 observations where possible, while maintaining representative levels of wind speed and rainfall. This is not possible across every specification. The sample size for each bin is reported in the figures below.
Figure 4 shows the average damage ratio by construction type across wind speeds measured as three-second gusts. In each construction category, the average damage ratio demonstrates a non-monotonic, but general upward trend over wind speeds, indicating that the wind speed bins are reasonable, but not perfect representations of the damage function.

Results in Figure 4 are consistent with improving performance from conventional to Fortified Roof to Fortified Gold. In each wind speed bin, the average damage ratio for conventional construction is greater than that of either Fortified category. The average damage ratio for Fortified Roof houses is also greater than that of Fortified Gold houses in each wind speed bin. The lower chart in Figure 4 indicates that the difference in performance across wind speeds between Fortified Roof and Fortified Gold is largely caused by tree fall exposure, until the highest wind speed bin (greater than 95 knots). This is consistent with the expectations of engineers at IBHS who design and test the Fortified system. We would anticipate greater separation between Roof and Gold in a stronger storm with winds exceeding 104 knots.

Figure 5 charts the damage ratio over bins of wind speed duration for the three construction categories. We expect damage from sustained winds to be different than damage from three-second gusts. Table 11 shows that the correlation between hours of sustained wind and speed of three-second gusts is 76%, indicating that there are locations where sustained winds occurred without the strongest gusts. Sustained winds are effective at removing roof coverings, such as shingles. If the seams of the roof deck are not covered with a waterproof membrane (as they are in Fortified Roof and Gold designations) water will enter the house as soon as the roof covering fails. Therefore, we are not surprised to see strong performance of Fortified Roof and Fortified Gold houses across the distribution of sustained wind duration, compared to conventional houses.

Figure 4: Damage Ratio by Wind Speed 3-Second Gusts

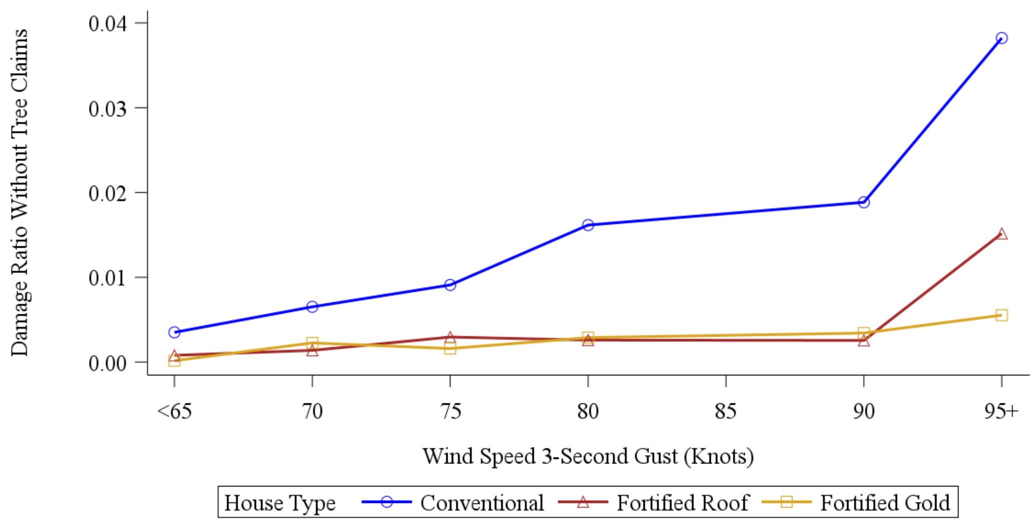
Panel A: With Tree Claims



Sample Size

	<65	70	75	80	85	90	95+
Conventional	8,101	3,953	5,445	4,846		1,405	1,343
Fortified Roof	413	315	464	353		91	69
Fortified Gold	458	583	1,740	2,022		408	501

Panel B: Without Tree Claims



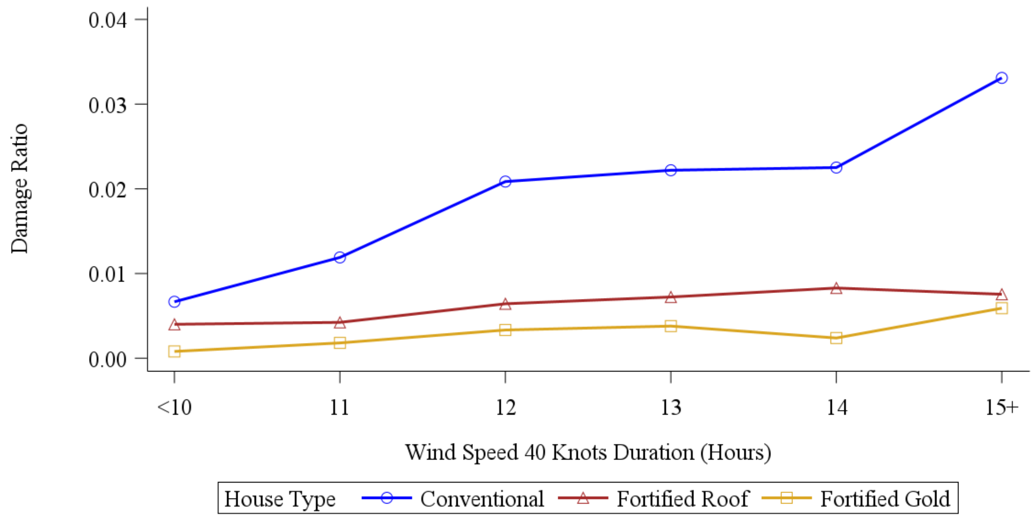
Sample Size

	<65	70	75	80	85	90	95+
Conventional	7,733	3,471	4,383	3,926		1,206	1,292
Fortified Roof	402	300	406	326		83	68
Fortified Gold	452	573	1,696	1,971		402	496

Notes: Damage ratio is the average damage ratio in each wind speed bin. The first bin includes houses that incurred wind speed of less than 65 knots. The last bin includes houses that incurred wind speed of 95 knots or greater. The strongest gust in our sample is 109 knots. The sample size table on the X-axis shows the number of houses in each category and wind speed bin. The upper chart includes tree claims. The lower chart excludes tree claims.
Sources: ALDOI data call, IBHS, and RenaissanceRe Risk Sciences

Figure 5: Damage Ratio by Wind Speed Duration

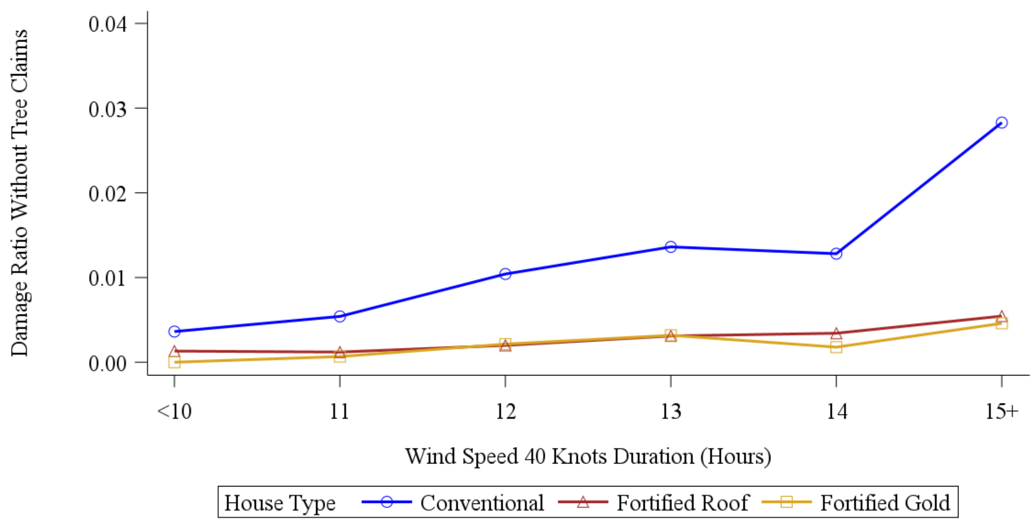
Panel A: With Tree Claims



Sample Size

Conventional	5,731	3,476	4,778	5,909	3,366	1,833
Fortified Roof	230	248	336	469	313	109
Fortified Gold	126	315	1,311	2,188	1,320	452

Panel B: Without Tree Claims



Sample Size

Conventional	5,474	3,155	3,900	4,992	2,817	1,673
Fortified Roof	227	232	302	436	284	104
Fortified Gold	122	306	1,271	2,150	1,296	445

Notes: Damage ratio is the average damage ratio in each wind speed bin. The first bin includes houses that incurred sustained 40-knot winds for less than 10 hours. The last bin includes houses that incurred sustained 40-knot winds for more than 15 hours. The longest duration in the sample is 18.5 hours. The sample size table on the X-axis shows the number of houses in each category and wind duration bin. Panel A includes tree claims. Panel B excludes tree claims.
Sources: ALDOI data call, IBHS, and RenaissanceRe Risk Sciences

With or without tree claims, wind speed duration has a much larger effect on conventional houses than on either Fortified category. Again, we find that the differences between Fortified Roof and Fortified Gold are driven by tree fall claims. In these charts, the result holds even in the highest category of wind speed duration.

In Figure 6, we compare damage across the three construction categories over rainfall bins, with and without tree fall claims. We do not have strong prior expectations for the effects of rainfall on the damage ratio. Table 11 shows that the correlation between rainfall and wind speed (64%) or wind duration (48%) is smaller than the correlation between the two wind measures (76%). On its own, rainfall is less likely to damage a house than wind speed or wind duration, because rainfall cannot easily penetrate the envelope of a house. However, combined with wind, rainfall increases damage once the envelope begins to fail. We also note in Table 11 that rainfall demonstrates a higher correlation with the damage ratio than either of the wind measures.

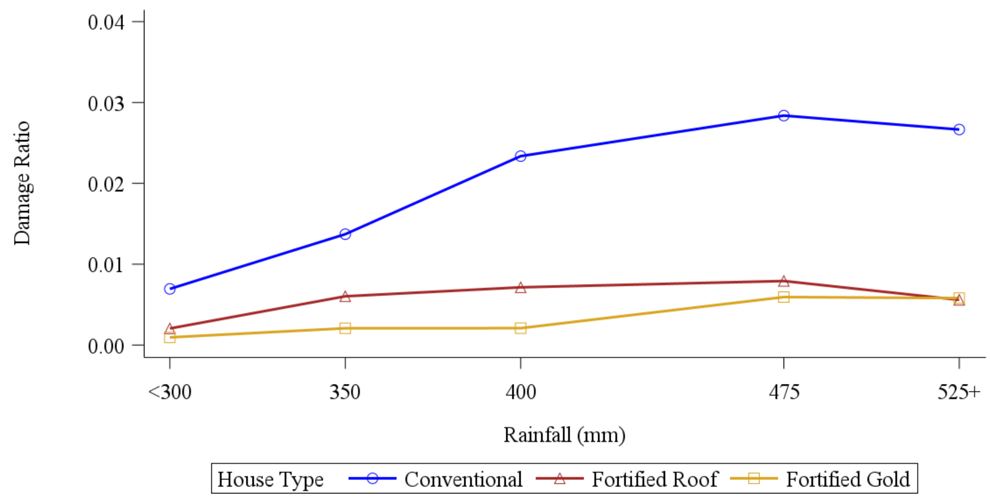
We find that damage mostly increases over levels of rainfall in the upper chart. We also see that Gold outperforms Roof and conventional houses in all but the highest rainfall bin. In the lower chart representing analysis without treefall claims in the sample, Fortified Roof appears to outperform Fortified Gold at higher levels of rainfall. However, multivariate analysis confirms that the Fortified Roof houses with lower damage ratios than Fortified Gold houses for higher levels of rainfall were subject to lower wind speed and lower wind duration.

Like the wind speed and wind duration analyses, we find that the difference in performance between Fortified Roof and Fortified Gold is due to trees falling on Fortified Roof houses. The average difference between Roof and Gold approaches zero in the lower chart. This is consistent with wind-engineering expectations described in Gurley and Masters (2011) and other studies.[26]

[26] Gurley, K.R. and F.J. Masters, 2011: Post-2004 Hurricane field survey of residential building performance, Nat. Haz. Rev., 12 (4) https://doi.org/10.1061/(ASCE)NH.1527-6996.0000044.

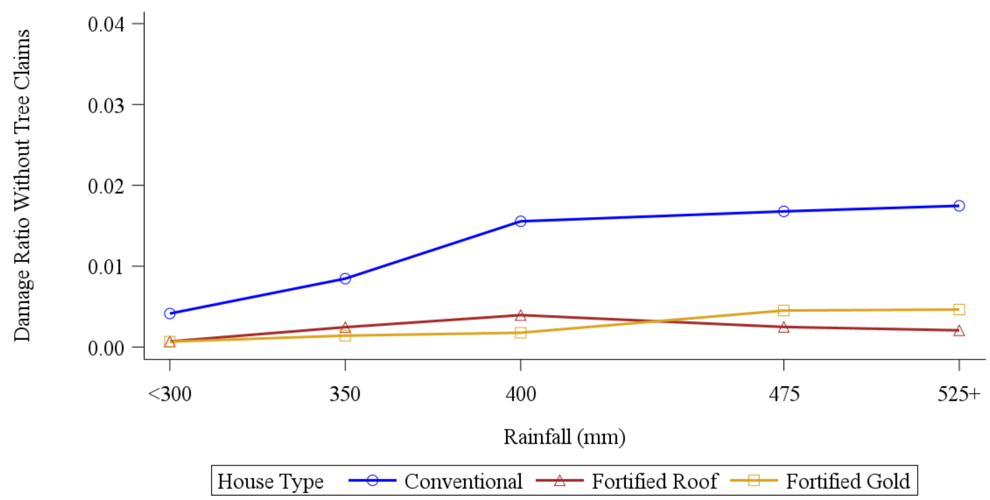
Figure 6*:* Damage Ratio by Rainfall

Panel A: with Tree Claims



Sample Size					
Conventional	8,484	4,146	2,500	4,045	2,673
Fortified Roof	389	410	232	287	175
Fortified Gold	329	1,666	930	820	846

Panel B: Without Tree Claims



Sample Size					
Conventional	8,112	3,768	2,136	3,258	2,196
Fortified Roof	379	394	214	255	160
Fortified Gold	326	1,641	922	796	821

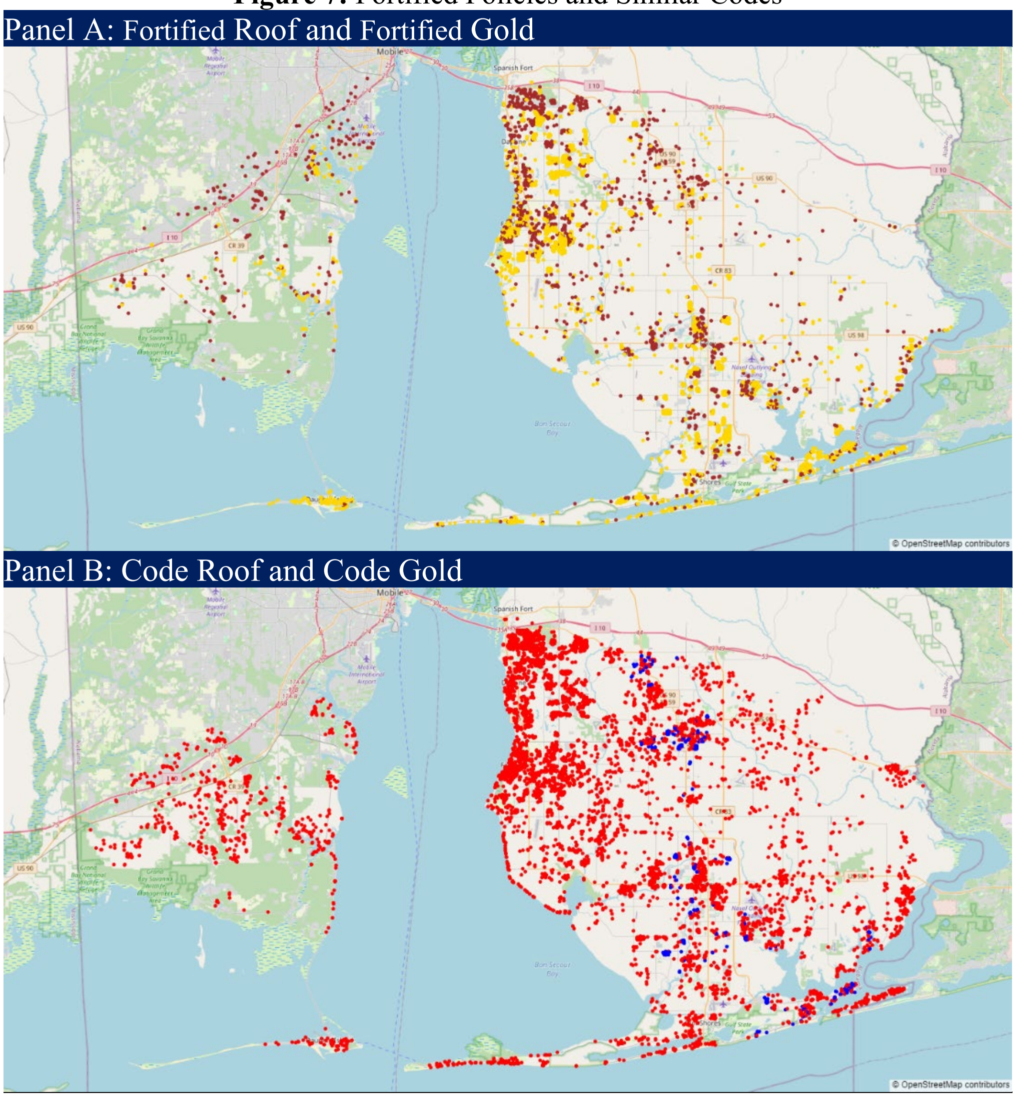
Notes: Damage ratio is the average damage ratio in each rainfall bin. The first bin includes houses that incurred rainfall less than 300 mm. The last bin includes houses that incurred rainfall greater than 525 mm. The greatest rainfall observed in our sample is 574 mm. The sample size table on the X-axis shows the number of houses in each category and rainfall bin. The upper chart includes tree claims. The lower chart excludes tree claims.
Sources: ALDOI data call, IBHS, and NOAA

4. IBHS Fortified Compared to Similar Building Codes

One feature of the IBHS Fortified designation process is the use of IBHS Fortified Evaluators to verify that all specifications of the Fortified standard are followed. In the area of this study, there were 5,753 policies written on houses that were built or reroofed to a building code equivalent to IBHS Fortified standards, except that they were neither evaluated nor inspected by Fortified Evaluators. This provides an opportunity to evaluate this unique feature of the Fortified designation program.

Figure 7 shows the locations of Fortified designations and houses built to similar codes, which we call "Code Roof" and "Code Gold." The upper map shows IBHS Fortified locations, and the lower map shows the Code Roof and Code Gold locations. Comparing the two maps indicates that the locations of houses in both categories are similar.

Figure 7: Fortified Policies and Similar Codes



Notes: In Panel A, brown dots represent Fortified Roof policies and gold dots represent Fortified Gold policies. In Panel B, red dots represent Code Roof policies and blue dots represent Code Gold policies.
Source: ALDOI data call, IBHS, and Smart Home America

We compare the Code Roof and Code Gold houses to the non-Fortified houses using the nearest neighbor method without tree claims in the sample, just as we did in Section 3.3 with the Fortified houses. Results appear in Table 12.

We do not directly compare the Fortified houses to Code houses here because the observations are fewer and farther in between, which reduces the benefit of the nearest neighbor method. We compare Fortified houses to Code houses in Section 4.1 using a coarser measure to control for wind speed.

Table 12: Performance of "Code Fortified" Construction

Panel A: Claim Frequency Analysis				
None	6,411	1,149	0.18	
None	460	80	0.17	
Code Gold	460	27	0.06	66%
Panel B: Claim Severity Analysis				
None	$20,925	$257,084	8.1%	
Code Roof	25,424	262,219	9.7%	-19%
None	$20,949	$217,829	9.6%	
Code Gold	12,694	234,073	5.4%	44%
Panel C: Loss Ratio Analysis				
Designation	Average Loss	Average Premium	Loss Ratio	Loss Ratio Reduction
None	$3,750	$2,192	1.71	
Code Roof	3,018	1,902	1.59	7%
None	$3,643	$1,707	2.13	
Code Gold	745	1,219	0.61	71%

Notes: The sample does not include claims from trees falling on houses. Code Roof (Gold) indicates houses built under a building code that is equivalent to Fortified Roof (Gold), except they are not evaluated, inspected, or designated by IBHS. Policies is the total number of policies in each group. Claims is the number of policies with claims in each group. Frequency Rate is Claims divided by Policies. Frequency Reduction is percentage difference between the non-Fortified Frequency Rate and each Fortified designation. Average Claim is the total amount paid for claims in each designation group divided by Claims in each group. Average Home Value is the total amount of replacement cost reported for houses in each group divided by Policies in each group. Percent of Value is Average Claim divided by Average Home Value. Severity Reduction is percentage difference between the non-Fortified Percentage of Value and that of each Fortified designation. Average Loss is the total amount of losses divided by Policies. Average Premium is the total amount of premiums divided by Policies. Loss Ratio is Average Loss divided by Average Premium. Loss Ratio Reduction is percentage difference between the non-Fortified Loss Ratio and that of each Fortified designation.
Sources: ALDOI data call, IBHS, and Smart Home America

Table 13 facilitates comparison of IBHS Fortified Roof and Gold to Code Roof and Code Gold, relative to the conventional houses, by displaying only the reduction percentages of each.

Table 13*:* Comparing Conventional to Fortified and Code

Designation	Frequency Reduction	Severity Reduction	Loss Ratio Reduction
Fortified Roof	73%	15%	72%
Code Roof	34%	-19%	7%
Fortified Gold	76%	24%	67%
Code Gold	66%	44%	71%

Notes: The sample does not include claims from trees falling on houses. Code Roof (Gold) indicates houses built under a building code that is equivalent to Fortified Roof (Gold), except they are not evaluated, inspected, or designated by IBHS. Frequency Reduction is percentage difference between the conventional Frequency Rate and that of each Fortified designation or code. Severity Reduction is percentage difference between the conventional severity ratio and that of each Fortified designation or code. Loss Ratio Reduction is percentage difference between the conventional Loss Ratio and that of each Fortified designation or code.
Sources: ALDOI data call, IBHS, and Smart Home America

Comparing the performance of the Code Roof houses to the Fortified Roof houses, relative to the nearest conventional houses, we see that the frequency reduction percentage for Code Roof is 34%, 39 percentage points less than that of Fortified Roof houses. Severity Reduction is 15% for the Fortified Roof policies and -19% for the Code Roof houses. Given the lagging performance in frequency reduction and severity reduction, it is not surprising that the Code Roof policies also have a much smaller Loss Ratio Reduction than the Fortified Roof policies.

The overall performance of Code Gold houses is very similar to that of Fortified Gold houses. The Code Gold houses show somewhat smaller Frequency Reduction, but a larger Severity Reduction than Fortified Gold houses, resulting in similar Loss Ratio Reductions.

Although this analysis is not a perfect head-to-head comparison, it suggests that the Fortified Roof houses outperformed the Code Roof houses, and the Fortified Gold houses performed the same as Code Gold houses. We cannot test what caused the difference in performance between Fortified Roof and Code Roof construction, but the only difference we can point to is the use of Fortified Evaluators in the Fortified Roof construction process. It is not clear why we find a difference at the Fortified Roof level and not at the Fortified Gold level.

4.1 Comparing Fortified to Similar Codes Across Wind Speeds

We can compare the performance of Fortified construction to similar codes by charting the damage ratio by construction category across wind speed levels as we did in Section 3.5. Figure 8 compares the damage ratio for each category of construction across bins of one-minute wind speed.[27] We use one-minute sustained wind speed in this analysis because it allows for larger sample sizes in the upper wind speed bins. In addition to conventional construction, Fortified Roof, and Fortified Gold, we include the houses built to codes identical to Fortified Roof and Fortified Gold, which we label Code Roof and Code Gold.

The solid blue line with circles representing the conventional houses shows a higher average damage ratio than the other categories across each level of wind speed. The black dashed line marked by asterisks represents Code Roof houses. The Code Roof houses performed better than conventional houses, but worse than Fortified Roof houses. The damage ratios for Code Roof houses also increased over each wind speed bin. The Code Gold Houses (red dashed line with asterisks) performed better on average than conventional houses, Code Roof houses, and Fortified Roof houses, but not as well as Fortified Gold houses.

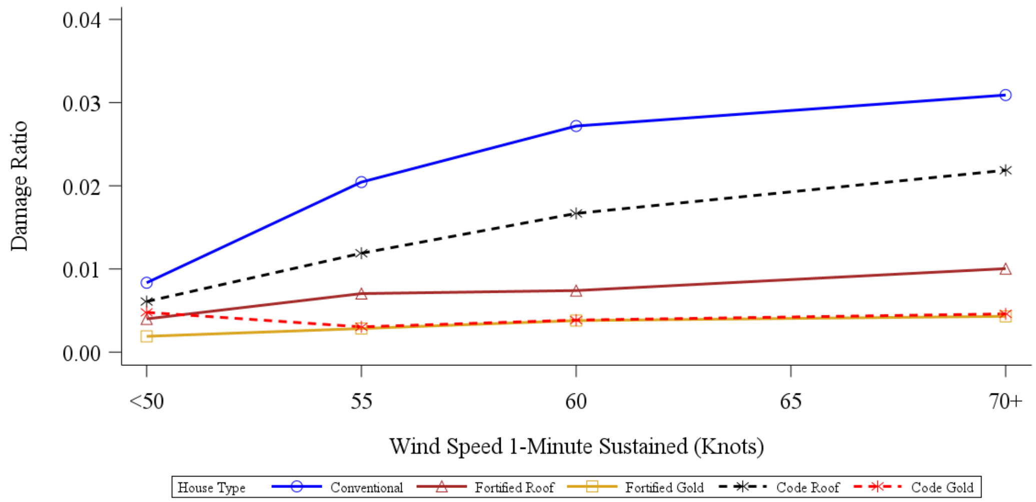
In the lower chart of Figure 8, we perform the same analysis without the tree fall claims. The performance ranking of construction categories remains unchanged, but the differences across categories decrease in size when tree claims are removed from the sample. Similar to the analyses in Section 3.5, we find that Fortified Roof and Fortified Gold perform similarly after removing the tree claims. We also see that the differences in average damage ratios between Code Gold and Fortified Gold decrease by a noticeable amount, as do the differences in the average damage ratios between conventional construction and Code Roof. These results suggest that the inspection of Code Gold houses is of higher quality than that of Code Roof houses. We cannot tell from this analysis if the difference is created by the performance of jurisdictions (i.e., the places that inspect Code Gold houses do a better job than the places that inspect Code Roof houses) or details specific to inspecting Code Roof and Code Gold (i.e., it is more difficult for local code inspectors to inspect Code Roof than Code Gold). Future research should address this question.

In summary, we note that the difference between Fortified and Code construction demonstrates the important role of uniform code enforcement in building resilient communities. To the extent that code enforcement resources are limited, it may be efficient to focus on inspection of Code Roof projects, or to encourage residents of these jurisdictions to pursue the Fortified designations.

[27] Charts of the damage ratio across the other three wind and rain measures support the same conclusions.

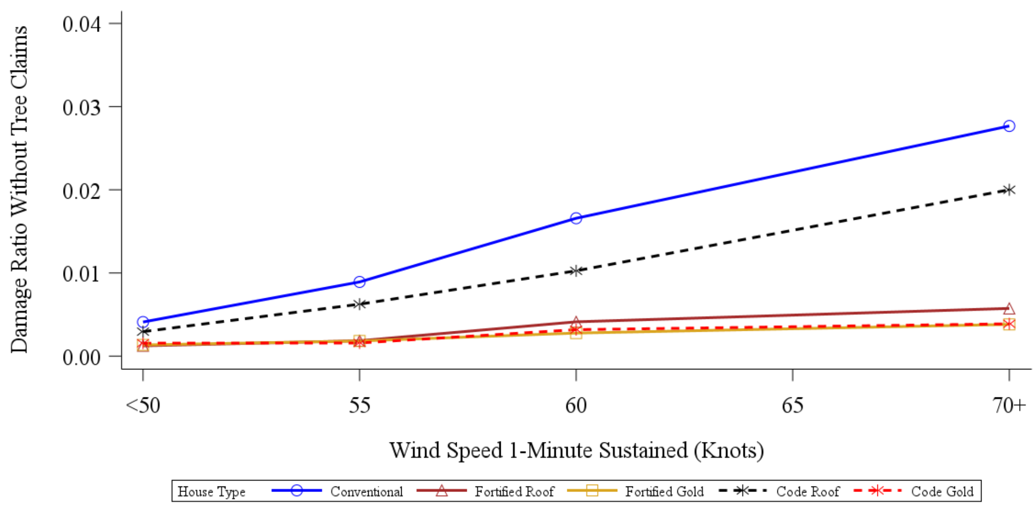
Figure 8: Damage Ratio by Wind Speed 1-Minute Sustained

Panel A: With Tree Claims



Sample Size	<50	55	60	70+
Conventional	10,567	6,609	5,083	2,834
Fortified Roof	593	543	381	188
Fortified Gold	779	1,648	2,318	967
Code Roof	2,099	2,483	1,622	981
Code Gold	38	226	155	81

Panel B: Without Tree Claims



Sample Size	<50	55	60	70+
Conventional	9,904	5,378	4,130	2,599
Fortified Roof	570	485	355	175
Fortified Gold	768	1,602	2,268	952
Code Roof	1,994	2,232	1,465	933
Code Gold	33	217	153	79

Notes: Damage ratio is the losses and deductibles divided by total insured value.
***Sources*:** ALDOI data call, IBHS, RenaissanceRe Risk Sciences, and Smart Home America

5. Conclusions

This study presents evidence of the performance of IBHS Fortified Home™ construction in Hurricane Sally. Sally made landfall on Gulf Shores, Alabama in September of 2020 as a strong Category 2 storm with top wind speeds of 105 knots.

The analysis of the performance of Fortified construction during Hurricane Sally provides compelling evidence of its effectiveness in reducing losses for both policyholders and insurance companies. The findings demonstrate that homes built to the Fortified Roof and Fortified Gold standards experienced significantly lower claim frequency, claim severity, and loss ratios compared to conventional homes.

The most robust measure of Fortified performance—excluding tree-fall claims and using the nearest-neighbor methodology—reveals that Fortified Roof houses reduced claim frequency by 73%, claim severity by 15%, and loss ratios by 72%. Fortified Gold houses performed even better, showing a 76% reduction in claim frequency, a 24% reduction in claim severity, and a 67% reduction in loss ratios. These reductions translate into substantial financial savings: had all conventional homes been retrofitted to Fortified Roof or built to Fortified Gold standards, policyholders could have saved up to 65% on losses below their deductibles, while insurers could have reduced their losses by up to 75%.

The significant advantage of the IBHS Fortified Roof designation over similar building codes without third-party verification is an important finding. While homes built to codes identical to the Fortified Roof standard performed better than conventional homes, they did not match the performance of homes with official Fortified Roof designations. This discrepancy underscores the critical role of private enforcement through Fortified Evaluators, which ensures adherence to rigorous construction standards.

Looking forward, Alabama's continued promotion of Fortified construction through grants and insurance discounts is likely to build a more resilient coastal community. The state's proactive approach, including the Strengthen Alabama Homes program, serves as a model for other hazard-prone regions. Future research should continue to monitor Fortified construction in subsequent storms to further validate these findings and explore additional opportunities for resilience and cost savings.

Overall, this study establishes a strong case for the adoption of Fortified construction standards as a practical and economically advantageous strategy for mitigating hurricane-related damage and enhancing community resilience.

Appendix: Data Call Bulletin

The data call bulletin used to collect the data used in this report appears below. Our approach to the data call was open and cooperative with the participating insurance companies. We met with several carriers to discuss the data call to ensure that data were available, and that the call was not excessively onerous. The carriers helped inform our data collection efforts both in availability and technical relevance.

We encourage future researchers to learn from our experience. With the benefit of hindsight, we realize that a few more variables could have added value to this effort. The first is the date when the claim was filed. The second is the amount of loss adjustment expenses. These variables would have shed light on the validity of claims and the cost of litigation in Hurricane Sally. As a technical matter, we could have learned more details about losses, if we had requested information about the nature of losses. For example, was the roof damaged or did water enter the house? In the latter case, we do not know if this information was readily available to all insurers, but we could have discussed availability and looked for the most efficient way to collect the information.

Finally, we could have saved effort by requesting information about the coverage provided by each policy, rather than the policy form. For example, it would have been more efficient to ask if the policy provides wind coverage, replacement cost coverage, named perils coverage, or open perils coverage with yes/no responses. In several cases, we had to review the policy forms to determine coverage.

Despite these minor imperfections, we remain pleased with the wealth of new knowledge gained from this study. Should another state choose to consider a data call following a catastrophic event, we will be pleased to discuss the process in more detail.

KAY IVEY
GOVERNOR

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COMMISSIONER

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BULLETIN NO. 2024-03

TO:	All Insurers providing residential property coverage in Alabama for properties located South of Interstate 10 as of September 16, 2020
FROM:	Mark Fowler Commissioner of Insurance
DATE:	July 9, 2024
RE:	Hurricane Sally Data Call
EFFECTIVE:	July 15, 2024

The purpose of this bulletin is to announce a data call from which to evaluate the performance of loss mitigation features during Hurricane Sally relative to the benchmark FORTIFIED™ mitigation discounts set forth in Bulletin No. 2016-07. As such, this shall be considered an examination by the Commissioner and all information provided in response to this data call will be treated as "confidential by law and privileged" and will not be considered a public record as provided in Ala. Code § 27-2-24(g).

Responses to this data call must be reported by August 23, 2024. Please direct questions regarding the data call to rates.forms@insurance.alabama.gov and include "Hurricane Sally Data Call" in the subject line. Please direct IT questions regarding system access and submission of required data to ITHelp@insurance.alabama.gov.

Required data reporting must be submitted electronically at https://aldoi.gov/Hurricane/Default.aspx. This link will become active on or about July 15, 2024. Please provide the claims and underwriting data in the spreadsheet template provided here: https://aldoi.gov/Excel/Companies/SallyDataCallTemplate.xlsx. Instructions for each data element appear below in the **Instructions** section.

For each house insured for hurricane wind coverage on September 16, 2020, south of I-10 in Alabama, please provide the following information in the spreadsheet template provided. Claims and underwriting information should be from the policy year in force on September 16, 2020, and include claim information for losses caused by Hurricane Sally on an accident year (AY) basis.

1) Company name
2) NAIC company code
3) Eligible
4) Location Address
    - 4.a. Street Address
    - 4.b. Unit Number
    - 4.c. City
    - 4.d. ZIP Code
5) Latitude
6) Longitude
7) Policy Form
8) Annual premium
9) Replacement cost
10) Coverage A limit (dwelling)
11) Coverage B limit (other structures)
12) Coverage C limit (contents)
13) Coverage D limit (additional living expense / loss of rent)
14) Hurricane deductible
15) AOP deductible
16) Year built
17) Building code
18) Construction
19) Year roofed
20) Roof material
21) Roof shape
22) Square feet
23) Stories
24) Claim Coverage A
25) Claim Coverage B
26) Claim Coverage C
27) Claim Coverage D
28) Claim Ordinance or Law
29) Treefall claim

Instructions

The purpose of this data call is to evaluate the performance of loss mitigation features during Hurricane Sally. Data provided in response to the call will be treated by ALDOI as confidential and privileged and will not be deemed a public record.

Please provide the following claims and underwriting data in the spreadsheet template provided.

Claims and underwriting information should be from the policy year in force on September 16, 2020, and include claim information for losses caused by Hurricane Sally on an accident year (AY) basis.

For each house insured for hurricane wind coverage on September 16, 2020, south of I-10 in Alabama, please provide the requested information.

All data should be:

- Reported on a legal entity basis
- Reported on a direct business basis before effects of reinsurance
- Based on Accident Year information (AY)

Required participation: All insurers providing residential property coverage in Alabama south of Interstate 10 on September 16, 2020.

Responses to this data call must be reported by **August 23, 2024**.

Required data reporting must be submitted electronically at **https://aldoi.gov/Hurricane/Default.aspx**. This link will become active on or about July 15, 2024.

Each data element is described below, followed by an example in brackets. Please do not enter data with brackets in the spreadsheet template.

Please direct questions regarding the data call to **rates.forms@insurance.alabama.gov** and include "Hurricane Sally Data Call" in the subject line.

Please direct IT questions regarding system access and submission of required data to **ITHelp@insurance.alabama.gov**.

1) Company name

   The legal reporting name of the insurance company [ABC Ins Co]

2) NAIC company code

   [12345]

3) Eligible

Did the company insure one or more single family homes south of Interstate 10 in Baldwin County or Mobile County on September 16, 2020. [YES or NO]

If NO, please record the answer and submit the spreadsheet. You are finished.

If YES, please continue with the data call.

4) Location Address

Address of the subject property. Do not enter PO Box addresses.

4.a. Street Address: [*19199 Scenic Highway 98]*

4.b. Unit Number (if applicable) else leave blank: [B]

4.c. City: [Fairhope]

4.d. ZIP Code: [36532]

5) Latitude

Latitude of the insured property location in decimal degrees to as many digits as available [30.503169655360594]

6) Longitude

Longitude of the insured property location in decimal degrees to as many digits as available [-87.9230294768848]

7) Policy Form

Describes the perils covered by the policy. Enter the policy form number that most closely matches the policy written on the subject property.
Enter HO1, HO2, HO3, HO5, HO7, HO8, DP02, DP01, Wind only, or other. [HO3]

8) Annual premium

Dollars of premium charged for subject exposure [3175]

9) Replacement cost

Amount required to replace the dwelling and attached structures in the event of a total loss. Does not include land. Enter NA if the dwelling is not insured for replacement cost. [250000]

10) Coverage A limit (dwelling)

Amount of insurance provided by the policy for damage by covered perils to the dwelling and attached structures [250000]

11) Coverage B limit (other structures)

Amount of insurance provided by the policy for damage by covered perils to the other, unattached structures on the insured premises [25000]

12) Coverage C limit (contents)

Amount of insurance provided by the policy for damage by covered perils to personal property of the insured [125000]

13) Coverage D limit (additional living expense / loss of rent)

Amount of insurance provided by the policy for additional living expenses made necessary by a covered property loss [40000]

14) Hurricane deductible

Enter the amount of deductible that applies to hurricane losses. If the deductible is a dollar amount, enter the amount (500, 1000, etc.). If the deductible is a percentage, enter the percentage as a whole number (1, 2, 5, 10). [5]

15) AOP deductible

Enter the amount of deductible that applies to losses from all perils other than hurricane. If the deductible is a dollar amount, enter the amount (500, 1000, etc.). If the deductible is a percentage, enter the percentage as a whole number (1, 2, 5, 10). [1000]

16) Year built

The year the house was built [2017]

17) Building code

Building code / FORTIFIED status per Bulletin 2016-07 (N/A, IRC, Bronze/Roof, Silver, Gold) [Gold]

18) Construction

Construction class of the subject property (frame, masonry veneer, concrete block, mobile home, etc.) [frame]

19) Year roofed

The most recent year when the roof of the subject property was constructed or replaced (year or unknown) [2017]

20) Roof material

Roof material type (asphalt shingle, metal, tile, unknown, etc.) [asphalt shingle]

21) Roof shape

Shape of the roof (hip, gable, irregular, unknown, etc.) [hip]

22) Square feet

Square feet of livable space in the subject property [2200]

23) Stories

Number of stories in the subject property (1, 1.5, 2, etc.) [2]

24) Claim Coverage A

Amount paid for damage to dwelling and attached structures caused by Hurricane Sally. Do not leave this cell blank. Enter zero (0) if no covered loss occurred. [50000]

25) Claim Coverage B

Amount paid for damage to other structures caused by Hurricane Sally. Do not leave blank. Enter zero (0) if no covered loss occurred. [2000]

26) Claim Coverage C

Amount paid for damage to personal property caused by Hurricane Sally. Do not leave blank. Enter zero (0) if no covered loss occurred. [25000]

27) Claim Coverage D

Amount paid for additional living expenses caused by Hurricane Sally. Do not leave blank. Enter zero (0) if no covered loss occurred. [10000]

28) Claim Ordinance or Law

Amount paid for required code upgrades or paid by the Fortified endorsement offered pursuant to Ala. Code § 27-31D-2.1, due to damage caused by Hurricane Sally. Do not leave blank. Enter zero (0) if no covered loss occurred. [5000]

29) Treefall claim

Was damage caused by a tree falling on the house or outbuilding? Do not leave this cell blank. Enter NO if no covered loss occurred. Enter YES if damage caused by falling tree. Enter UNKNOWN if information is not available. A word search in the claim file for "tree" is an acceptable process for identifying treefall claims. [NO]

Access spreadsheet template here:
https://aldoi.gov/Excel/Companies/SallyDataCallTemplate.xlsx

RMF/RN/ct