ANALYZING THE EFFECTS OF THE MY SAFE FLORIDA HOME PROGRAM ON FLORIDA INSURANCE RISK

RMS Special Report

Summary of an analysis prepared for the Florida Department of Financial Services

May 14, 2009

Author:

Michael Young, Senior Director of Mitigation and Regulatory Affairs;
Michael.Young@rms.com

Contributors:

Kay Cleary, Bob Ricker (Focus Insurance Consultancy LLC), Joel Taylor, Patricia Grossi

Editors:

Shelly Ericksen, Beth Stamann

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EXECUTIVE SUMMARY

By request of the Department of Financial Services of the State of Florida, Risk Management Solutions (RMS) has conducted an impact analysis of the My Safe Florida Home (MSFH) program. The RMS® U.S. Hurricane Model was used to analyze the impact of the program on individual structures retrofitted with MSFH grant money. Unlike other studies that focus on the benefits to individual structures, this study explores the benefits on a statewide basis. The results of the study found that the MSFH program has reduced the statewide economic liability and the risk carried by the homeowners in Florida.

As of May 2009, less than 1% of the 4.9 million homes in Florida have been retrofitted under the program. Approximately $93 million in MSFH grants of the $250 million appropriation have been allocated to roughly 32,000 homes. Aware of the current debate about the merits of funding a continuation of the MSFH program, RMS offers the following four key recommendations based on its analysis.

Key Recommendations

Recommendation 1: Continue providing grants to retrofit homes in Florida.

The RMS impact analysis illustrates that the grants provided under the MSFH program are beneficial to all stakeholders—the state of Florida, individual homeowners, and the insurance industry. To date, the mitigation grants in the current MSFH program, when combined with homeowner investments, have reduced the total Florida hurricane risk by approximately $1.50 per dollar in mitigation grants. Risk is measured here by the 100-year loss to the entire single-family residential building stock and is estimated to be approximately $62 billion (i.e., 1% annual probability of exceeding a loss of $62 billion). The reduction of $1.50 per dollar invested in grant money equates to a reduction in the 100-year loss of approximately $140 million, an amount significantly larger than the $93 million invested in grants.

Recommendation 2: Prioritize grant eligibility for the homes with the highest risk.

The RMS analysis illustrates that larger benefits per investment dollar are possible if future mitigation grants for the program are targeted at homes contributing the most to the overall state risk. The State of Florida can achieve reductions in statewide 100-year loss of as much as $2.75 per $1.00 in mitigation grants, up from the $1.50 achieved under the current program. The existing program already focused grants in coastal areas subject to wind-borne debris; however a more thorough building-specific rating approach to grant allocation could achieve even greater impacts.

Recommendation 3: Expand the grant program to include roof retrofits.

The current MSFH program provides matching grants for certain improvements, such as window protection or reinforced garage doors. The RMS analysis shows that expanding mitigation investments to include roofing component upgrades, such as new high wind roof covers, roof deck reinforcements, and roof straps on older structures, will further reduce statewide hurricane risk over time. For example, if all of the homes in Florida were mitigated under the existing program, the maximum reduction in the 100-year loss would be 35%. The inclusion of roofing component mitigation would reduce the 100-year loss by 55%.

Recommendation 4: Establish process to systematically collect and use detailed building information for insurance rate-making in Florida.

It is important that building information used to evaluate wind risk is collected in a manner that is both detailed and comprehensive. The MSFH program has gathered detailed building information, like roof deck attachment, roof anchors, and roof geometry, on 10% of the single family homes in Florida. RMS recommends this effort be continued, with a goal of collecting and making available such information for the entire population of single family homes in Florida.

Widespread availability of this detailed information would enable insurers to implement rating plans that would systematically account for a home's specific hurricane resistance. This would resolve some misalignments with the current insurance premium credits for mitigation and would position insurers to actively incentivize voluntary mitigation investments by homeowners above and beyond incentives provided by matching grants from the State.

INTRODUCTION

Risk mitigation, in its broadest sense, aims to reduce or limit the components of risk: hazard, vulnerability, and exposure. Due to the inherently uncertain and unpredictable nature of hazard, risk mitigation efforts tend to focus on reducing vulnerability and exposure, driven by a need to save lives and lessen injuries. In hazard-prone areas, engineers and builders often understand the need to design buildings to withstand strong winds or severe ground shaking, and building codes have been proven to reduce the impact of natural disasters. Although a greater expenditure is required during construction to invest in safer designs and materials, these construction methods have been shown to be cost-effective, when one compares the upfront cost to the reduction in potential losses[1].

Following the active hurricane seasons of 2004 and 2005, RMS research on claims data in Florida showed that homes and businesses constructed in compliance with the most up-to-date building codes suffered the least financial loss by far—up to a 50% lower loss than older properties. Catastrophe models can be utilized to illustrate the reduction in losses due to the implementation of more stringent building codes. Most of the individual features of a building specified in a code or building standard are captured in a model and identified as "secondary characteristics" that can be applied to each property in an exposure data set as appropriate. Some of these secondary characteristics, such as roof sheathing attachments or window protection, can serve to reduce the vulnerability of a property at risk, hence reducing damage and the resulting financial loss. The model can additionally quantify the net benefit of these secondary characteristics to applicable locations.

Total Possible Hurricane Risk Reduction

Figure 1 illustrates how rebuilding all of the single-family dwellings in Florida to a more stringent building construction standard, such as the Institute for Business and Home Safety's (IBHS) Fortified…for safer living® program (http://www.ibhs.org), can reduce risk. In this case, the 100-year loss is reduced by 77%—a significant reduction in claims liability. As rebuilding the 4.9 million homes in the state of Florida is not a feasible scenario, this analysis indicates an extreme bound for reference. In practical terms, then, the real issue is to determine the minimum amount of investment in retrofitting that could significantly reduce the 100-year loss level—perhaps even approaching a reduction to one-half of the current risk. The subsequent sections of this report address a recommended approach to attaining this goal.

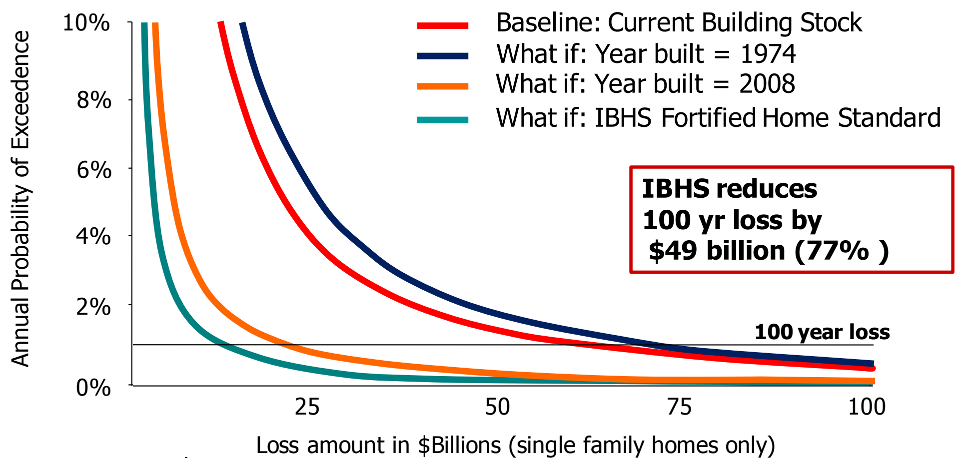


Figure 1: Exceedance probability curve for single-family dwellings in Florida, as modeled by the RMS® U.S. Hurricane Model

[1] Grossi, P. (2008). Chapter 10: Modeling seismic mitigation strategies. in *Risk Assessment, Modeling and Decision Support: Strategic Directions, (Risk, Governance and Society)*, Ed. Bostrom, French, Gottlieb, pp. 227-244.

Structure of Report

The objective of this report is twofold: first, to demonstrate how future investments in mitigation can impact the statewide hurricane risk levels, and second, to illustrate how the My Safe Florida Home (MSFH) program is an integral path to this goal.

The section, "The My Safe Florida Home Program" describes the MSFH data set and compares it to RMS data on statewide property characteristics. The section "Impact Analysis Approach" discusses the analysis, which involved merging the detailed attribute information contained in the MSFH data set with a comprehensive RMS aggregate data set representing the Florida single-family residential building stock. The resulting "hybrid" data set was used to measure first how the statewide risk metrics changed as a result of the current MSFH mitigation grant program, and second, how these same risk metrics might change for future investments in the program. The analysis considers two mitigation packages for each house, and a method of identifying the best mitigation candidates is proposed. The candidate homes are grouped into sub-portfolios that can be incrementally mitigated within the model. Then, a series of mitigation scenarios that incrementally apply these mitigation packages to portions of the population are created.

The section called "Impact Analysis Results" discusses the results of these mitigation scenarios on statewide losses, and "Using MSFH Data for Insurance Rating" explores how changes to the rating variables might affect the premiums charged within the state and how those changes might be used to maximize the mitigation credit signal. Finally, the report concludes with comments on other barriers in the risk transfer system from homeowner to primary insurer to reinsurer that can act as disincentives to fully promoting mitigation techniques.

THE MY SAFE FLORIDA HOME PROGRAM

Following the U.S. hurricane storm seasons of 2004 and 2005, in which Florida saw eight major named storms impact its residents, the Florida legislature created the My Safe Florida Home (MSFH) Program. The MSFH Program is a mitigation program operated by the Florida Department of Financial Services, assisting the general public with mitigating the risk of property damage due to high winds following a hurricane. By promoting retrofitting and education through an inspection program and public outreach campaign, the program aims to help Floridians better protect their property and save money on insurance premiums.

The MSFH program enables better risk management through two mechanisms. First, the collection of detailed wind risk attribute information on nearly 400,000 homes has improved the characterization of risk. Second, the provision of grant money has promoted the mitigation of 32,000 individual homes. This report demonstrates quantitatively how each of these two mechanisms contributes to the goal of reducing hurricane losses within the state of Florida.

The program, which was originally allocated $250 million dollars, has provided approximately 400,000 free home inspections and up to 35,000 matching grants for Floridian homeowners to protect their homes. Approximately $93 million of the funds allocated to the program have been used for the matching grant portion of the program.

The MSFH program evaluated the following seven classes of wind mitigation improvements for each home[2]:

1. Roof deck attachments
2. Secondary water barriers
3. Roof coverings
4. Gable-end bracing
5. Roof-to-wall connections
6. Opening protection for glazed openings (e.g., windows, skylights, sliding glass doors)
7. Opening protection for non-glazed openings (e.g., entry doors, garage doors, gable-end vents)

The MSFH program offered reimbursement for opening protection (i.e., items 6 and 7 above). Homeowner participation in the inspection portion of the program was voluntary, and the state mounted an advertising campaign to ensure adequate coverage across the state. The grant program, however, was limited to only those homes that were less than $300,000 in value, and were within the wind-borne debris zone as defined by the Florida Building Code—i.e., coastal properties.

Characteristics of the MSFH Portfolio

The MSFH program database, current as of November 2008, was made available to RMS as part of this project to determine the impact of the MSFH program. The data set—identified herein as a "portfolio" when discussing the aggregate impact of the program—represents approximately 10% of the entire population of single-family dwellings in Florida, with a total value of approximately $212 billion. Note that at the time at which RMS received the database, not all of the available grant money had been allocated to the public. Thus in order to evaluate the status at the end of the program, RMS has identified about 32,000 locations (approximately 1% of the population) that will likely receive a total of $93 million in grants at the conclusion of this phase of the program as shown in Table 1. The locations included in the set of grant locations were identified by their application for a grant—consideration of whether they are eligible was not considered here. Thus, it is possible that the final set of grant recipients will be slightly different than the set used in this analysis.

[2] For more details, see http://www.mysafefloridahome.com/.

Table 1. Characteristics of the MSFH portfolio relative to all single-family dwellings in Florida

	Total Florida Building Stock	**MSFH Portfolio**		**Grant locations in MSFH Portfolio**	
		Quantity	% of FL	Quantity	% of FL
Number of Locations	4,900,000	400,000	8%	32,000	0.7%
Total Value	$ 2,019 billion	$ 212 billion	11%	$ 12 billion	0.6%

Figure 2 shows a comparison of some of the key characteristics of the MSFH portfolio and the entire residential building stock in the State of Florida. These include: the size of living area, the roof geometry (e.g., hip or gable roof), the roof deck construction (e.g., nail size/spacing), and the presence of any window protection. The information on the entire residential building stock is based on RMS research into building characteristics and represents statewide averages.

Each of these attributes affects the hurricane resistance of a building. For example, based on RMS research, larger homes have lower loss ratios than smaller buildings; hip roofs are better than gable roofs; and it is better to have impact rated shutters than pressure rated shutters than no shutters. Roof deck strength is related to the size and spacing of the nails used to attach the roof deck to roof trusses. In general, the larger the nail size and the tighter the nail spacing, the stronger the roof deck will be[3]. Thus, 10d nails are better than 8d nails which are better than 6d nails. In Figure 2, nail patterns with 6"/6" spacing are superior to patterns with 6"/12" spacing.

Figure 2 illustrates that the MSFH portfolio is not representative of the whole state, but includes a higher proportion of larger homes (i.e., greater than 4,500 square feet), with some degree of existing hurricane protection features (i.e., higher percentage of window protection). It is assumed that the MSFH portfolio exhibits these characteristics due to the project's advertising and promotional efforts, which were focused toward areas with higher risk and higher valued properties (i.e., along the coastal and southern parts of the state).

[3] Roof decks are typically made of plywood, and the nail spacing is nominally specified first by the spacing along trusses that support the edge of the plywood sheet, and second along the trusses that support the middle of the sheet.

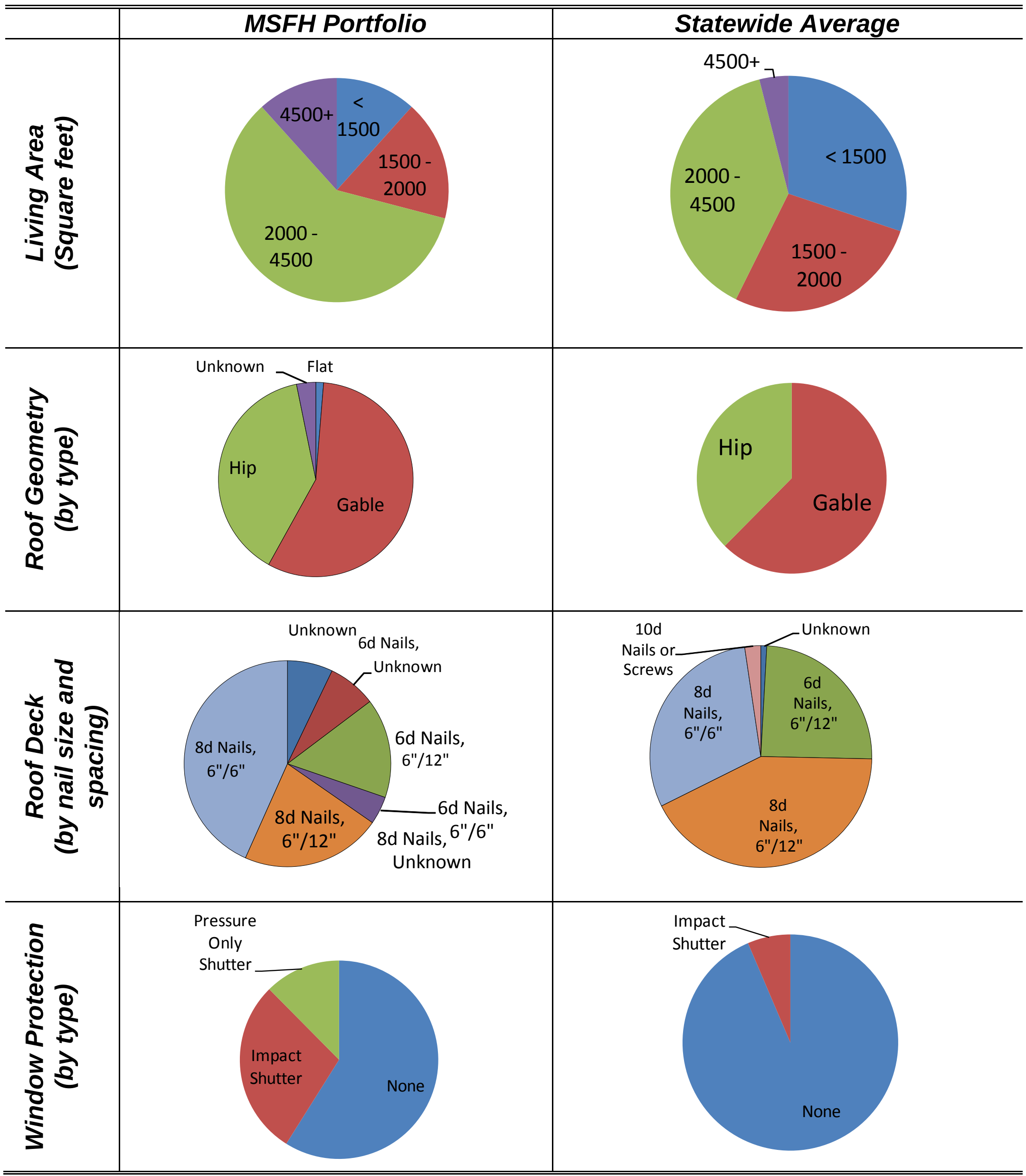


Figure 2: Key characteristics of the MSFH portfolio versus the Florida statewide building stock: size of living area (in square feet); roof geometry (by type of roof); roof deck construction (according to nail size and nail spacing); window protection (by type)

IMPACT ANALYSIS APPROACH

In order to determine the impact of the MSFH program on statewide risk levels, the current MSFH portfolio must be analyzed in conjunction with the remaining insured residential structures in the state of Florida. The approach taken in this study involves three steps:

1. Creation of a representative "hybrid" exposure set that merges the homes in the MSFH program portfolio with the Florida residential building stock in the RMS® U.S. Industry Exposure Database (IED) to represent the range of wind risk attributes found in the 4.9 million locations in the state

2. Identification of the homes for which mitigation would most effectively reduce the state's overall liability

3. Development of mitigation scenarios that simulate, step-wise, how the application of future grant money will reduce the statewide liability

The following sections outline in more detail the various building blocks of the analysis: the key risk metrics, the creation of the hybrid exposure data set, and the creation of mitigation scenarios, based on the "hybrid" exposure set and its sub-portfolios of similar at-risk homes.

Key Risk Metrics

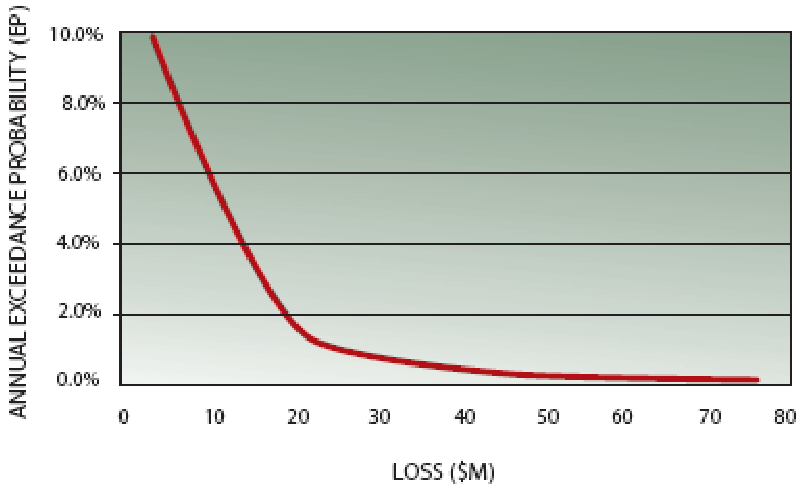
This analysis was conducted using the RMS® U.S. Hurricane Model.[4] This catastrophe loss model estimates the financial losses from wind and storm surge perils associated with hurricanes striking the U.S. coastline from Maine to Texas. The model allocates these losses to the various financial stakeholders involved in the risk transfer process, which in this case are the homeowner, the primary insurance company, and the reinsurance companies that help diversify the risk borne by primary companies.

For quantifying the impact of the mitigation scenarios on the building stock and insurance industry in this study, two key risk metrics were considered: the 100-year probable maximum loss (PML) and the average annual loss (AAL). The 100-year PML is the loss associated with the 100-year return period on an exceedance probability (EP) curve and is a metric that insurance companies utilize for capital adequacy requirements. An exceedance probability (EP) curve is a key output of a probabilistic catastrophe model, illustrating the annual probability of exceeding a certain level of loss. Typically, EP curves are displayed graphically, but they can also be summarized by key return period loss levels (Figure 3).

The average annual loss (AAL) is the area under the exceedance probability curve. It represents an estimate of the annual premium needed to cover losses from the modeled peril(s) over time, assuming that the exposure remains constant. This metric can be used to evaluate the catastrophe load portion of an insurance rating plan. The insured or "gross" AAL is often referred to as the pure premium or "burn cost." In this analysis, the "gross" AAL is the risk metric of choice, measuring the loss that is attributed to the insurance and reinsurance companies. In addition, "ground-up" AAL, which represents the total losses to the exposure at risk, regardless of liability for the loss, is utilized to determine the baseline or current risk of the exposure.

These metrics focus on the hurricane portion of Florida residential insurance premiums. Typically, the hurricane premium is about one-half of the total homeowners premium, but varies by location. Therefore, any relative differences shown in this analysis should not be equated to absolute reductions in homeowners' premiums. The gross AAL metric is also utilized, as the state of Florida has a significant stake in the insurance market.

[4] Model developed for the RiskLink® version 8.0.



After running an EP analysis, the summary results are as follows:

EP	RETURN PERIOD	LOSS AMOUNT ($M)
0.02%	5,000	76
0.10%	1,000	57
0.20%	500	48
0.40%	250	40
1.00%	100	28
2.00%	50	20
10.00%	10	4

Figure 3: An example of an exceedance probability curve, with return periods and associated losses [5]

Step 1: Creation of Hybrid Exposure Data Set

For this project, RMS created a hybrid exposure data set of the entire Florida building stock by combining the MSFH portfolio with the RMS® U.S. Industry Exposure Database (IED). Specifically, RMS merged the homes in the MSFH program portfolio—approximately 400,000 individual locations representing approximately 10% of Florida single-family dwellings—with the Florida residential building stock in the RMS® U.S. IED, containing approximately 1,000 aggregate locations which represent the 4.9 million homes that constitute the Florida residential building stock. The 32,000 individual homes receiving grants in the MSFH portfolio are identified within the resulting hybrid exposure data set.

IED Characteristics

The RMS® U.S. IED consists of aggregate exposures at the ZIP Code level of geographic resolution and is a representation of insured property exposure by line of business in the U.S. Using proprietary RMS data, the IED exposures for the approximate 1,000 ZIP Codes in Florida were divided into 114,000 locations, representing classes of structures by living area, roof shape, roof cover, roof anchor, opening protection, and year of construction. In order to perform this disaggregation, RMS utilized its ExposureSource database, and the inventory data that forms a basis of the vulnerability module of the RMS® U.S. Hurricane Model. The inventory data in the RMS model assumes a distribution for the number of stories, and other attributes of structures throughout Florida, such as roof shape, shutter usage, and construction class. The ExposureSource database contains over 60 million residential locations and 10 million commercial and industrial properties from a variety of third party data sources, field surveys, and remote sensing work that can be used to judge the data quality and completeness of insurance data sets. It contains tax record information on nearly every property in the state of Florida, and has been used to create an explicit distribution of square footage or living area and year built within the aggregate portfolio.

To account for the differences in the characteristics of exposure data sets, the IED portion of the exposure set must be adjusted to offset the distributions of characteristics found in the MSFH data. For example, the MSFH portfolio contains wind-specific risk information on almost 400,000 locations in Florida, including roof cover, roof shape, roof deck, construction, year built, opening protection, and roof anchors. As shown in Figure 2, the MSFH exposure data exhibits a greater proportion of wind-resistive characteristics than the general building stock. This means that the straight incorporation of the MSFH data into the hybrid exposure set would result in a slight bias toward lower statewide loss results. To compensate, the disaggregated IED portion of the hybrid database must contain the complement of the wind-resistive

[5] Source: The Review (2008). A Guide to Catastrophe Modeling. Available at http://www.rms.com/Publications/RMS%20Guide%202008.pdf

features so that the average across the hybrid exposure set remains the same as the statewide average. This was accomplished using additional data sources and extensive research to ensure that the resulting hybrid exposure data set represents the range of wind risk attributes found throughout all locations in the state. A baseline analysis on this hybrid exposure set was conducted, measuring the risk associated with the current building stock.

Thus, the hybrid exposure data set combines the detailed location-specific information of the MSFH portfolio with the comprehensive aggregate location information in the IED. Once combined, the resulting hybrid data set was then disaggregated into sub-portfolios (discussed in Step 2), representing various sets of structures with similar characteristics and applicable retrofit techniques.

MSFH Characteristics

In the creation of the hybrid exposure data set, it is assumed that building values in the MSFH portfolio represent replacement cost value of the building only, excluding land. Note that building values were collected from each homeowner applicant, and thus may include land value. There was a tendency for the aggregated MSFH building values in some ZIP Codes to exceed the aggregate values in the IED. However, this was generally less than 2% of the total state value and thus does not affect this analysis. With no value associated with contents or time element insurance coverages in the MSFH portfolio, contents value is assumed to be 50% of the building value and additional living expense (ALE) coverage is valued at 10% of the building replacement cost.

Deductible amounts, supplied by homeowner applicants in the MSFH portfolio at the time of the inspection, were utilized in this exposure set. Any inconsistencies in data were treated with reasonable assumptions. For example, a 2% deductible was assumed if no other information was supplied; similarly, structures were assumed to be one story if no information was provided.

Moreover, the living area of a home was estimated using the plan area collected by the inspector and the known or assumed number of stories. Living area, denoted in square footage, is a key parameter in properly analyzing a structure's susceptibility to risk. As the MSFH program currently collects only a general estimate of living area, it should consider ways to augment the data set with tax records or other such data sets, such as the RMS ExposureSource database.

Step 2: Identify Locations to Mitigate—Mitigation Sub-Portfolios

This report is designed to show how the focused application of mitigation grant dollars would accelerate the reduction of the state's overall liability. RMS research and analysis demonstrates that certain homes contribute to the total risk profile in a manner that is disproportionate to the home's exposure value. In other words, certain homes are more likely to be damaged due to their locations (i.e., proximity to the coast), as well as property-specific factors, such as living area, year built, and overall protection level. As stated earlier, it is unlikely that all homes in the state could be mitigated. So, alternatively, the grant money could be allocated to have the maximum impact on statewide liability.

To this end, the hybrid exposure set is subdivided into mutually exclusive mitigation sub-portfolios, or "slices" of the exposure at risk, according to a location's contribution to the overall risk level, based on the results from the baseline or current risk analysis. These exposure slices represent portions of the total exposure set that can be retrofitted in incremental steps.

Locations currently receiving grants are identified as the first sub-portfolio (sub-portfolio 'A' in the MSFH portfolio) of the hybrid exposure set. The grant portion of the MSFH program is focused on specific areas of the state—namely the wind-borne debris region and buildings with a value of less than $300,000. While this policy focuses the mitigation dollars where funds are generally most needed, it does not consider an individual home's contribution to the state's overall risk. By identifying these locations separately, one can gauge the effectiveness of the present program separate from the strategy used for future grant programs.

Therefore, in order to determine if there are other more optimal ways in which to apply grant funds, the remaining portion of the hybrid exposure data set is divided into sub-portfolios of exposure and the change in risk is measured as each sub-portfolio is mitigated. In this analysis, contribution to the statewide ground-up average annual loss (AAL) in the baseline analysis (i.e., before mitigation techniques are applied) is used as the basis to determine the mitigation grant priorities for the remaining homes.

Note that there are other methods and metrics that could be used instead of the ground-up AAL, such as the contribution to the 100-year probable maximum loss (PML), or metrics more specifically tailored to reducing the Florida Hurricane Catastrophe Fund (FHCF) liabilities. These other metrics would identify slightly different sets of homes, and their use should be considered for the next phase of the grant program. For the purpose of this analysis, the ground-up AAL is considered adequate.

It is assumed that the state is considering further investment solely in the grant portion of the MSFH program, and that no other homes will receive free inspections. Furthermore it is reasonable to assume that these grants will first go toward those homes that have already been inspected. Thus, this analysis has identified sub-portfolios to incrementally mitigate in two phases—first by splitting up the MSFH portfolio of the hybrid exposure into sub-portfolios, and then second by splitting the IED portion of the hybrid exposure into sub-portfolios. As described later, each sub-portfolio will be mitigated in steps starting with the MSFH sub-portfolios, and then moving to the IED sub-portfolios.

Note that the assumption of future grants being allocated to MSFH locations first means that there is a possibility that grants are not allocated in the "most" optimal manner. Because this analysis does not consider a blended portfolio of the MSFH and IED portfolios during the grant allocation process, it is possible that a location in the IED portfolio could be a better candidate for mitigation grants than some of the locations in the MSFH portfolio. However, given this limitation, the results presented here will actually be more directly applicable to how the program is expected to operate in the immediate future.

My Safe Florida Home (MSFH) Portfolio: 5 Sub-Portfolios

MSFH sub-portfolio 'A' includes the locations that are likely to receive grants to assist with mitigation under the current program—approximately 32,000 homes. The division of the remaining portion of the MSFH portfolio into sub-portfolios is based on each location's contribution to the portfolio's overall (or ground-up) AAL. Sub-portfolios 'B' through 'E' are compiled assuming that future grant money will be focused on those locations that participated in the inspection program, as well as their contribution to overall risk. The 25% of the locations with the highest individual AAL were assigned to sub-portfolio 'B', the next 25% of the locations to sub-portfolio 'C' and so on. Thus, an equal number of locations are apportioned to each of the sub-portfolios within the MSFH portfolio, excluding the current grant locations.

Figure 4 shows each of the approximately 400,000 locations in the MSFH portfolio, plotted according to their ground-up AAL. Red locations represent exposures with the highest risk and the top contributors to the statewide AAL (AAL of $1,500 or greater). Likewise the green locations represent those exposures with the lowest risk or have the lowest contribution to the statewide AAL (AAL of $200 or less). As expected, Figure 4 shows that higher AALs are generally found along the coastline rather than inland, and also in southeastern Florida and along the Gulf Coast, where the hazard levels are generally highest. However, there is a wide range of AAL loss levels within the southeastern Florida counties (shown in the inset in Figure 4), because structure-specific features, as well as location, determine a property's risk level.

It is important to emphasize that it is not just geography that determines the overall risk level. Figure 5 is a close-up of one ZIP Code in Palm Beach County, illustrating the variation in ground-up AAL for individual homes. Within this generally high risk region, there are some locations with low AAL values. Moreover, the figure also illustrates that the AAL is generally lower after the application of opening and roofing retrofits to all the structures (i.e., map on right versus map on left in Figure 5). However, even after mitigation, there are still some high risk homes. Because of these variations in risk, a structure-specific rating mechanism, like the ground-up AAL or another index that takes into account a home's specific features, as well as its location, is ideal to distribute future grant funds.

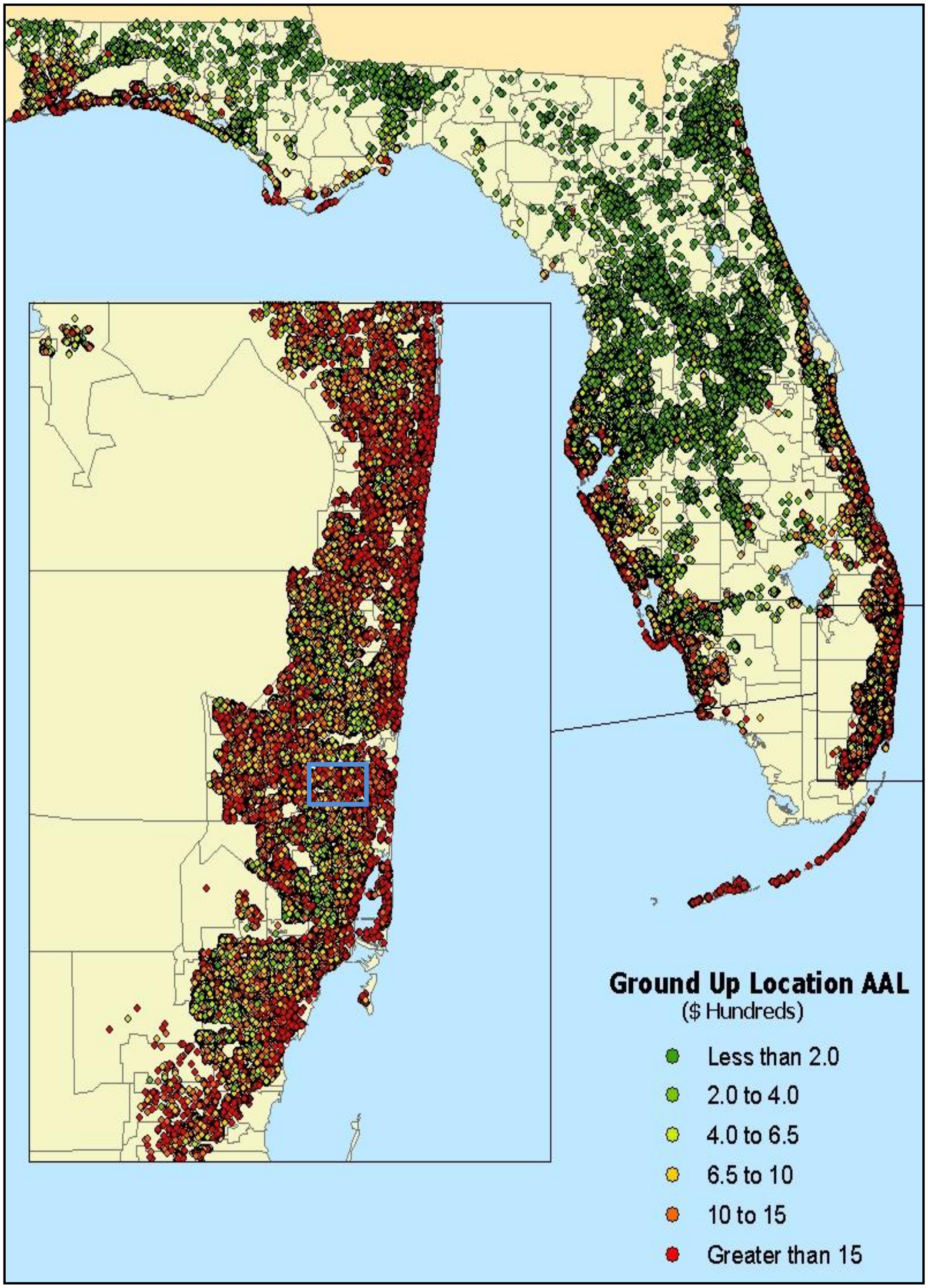


Figure 4: MSFH portfolio locations mapped according to ground-up AAL; inset shows distribution within the southern Florida counties of Dade, Broward and Palm Beach—blue box on the inset denotes region shown in Figure 5

Before Mitigation **After Mitigation**

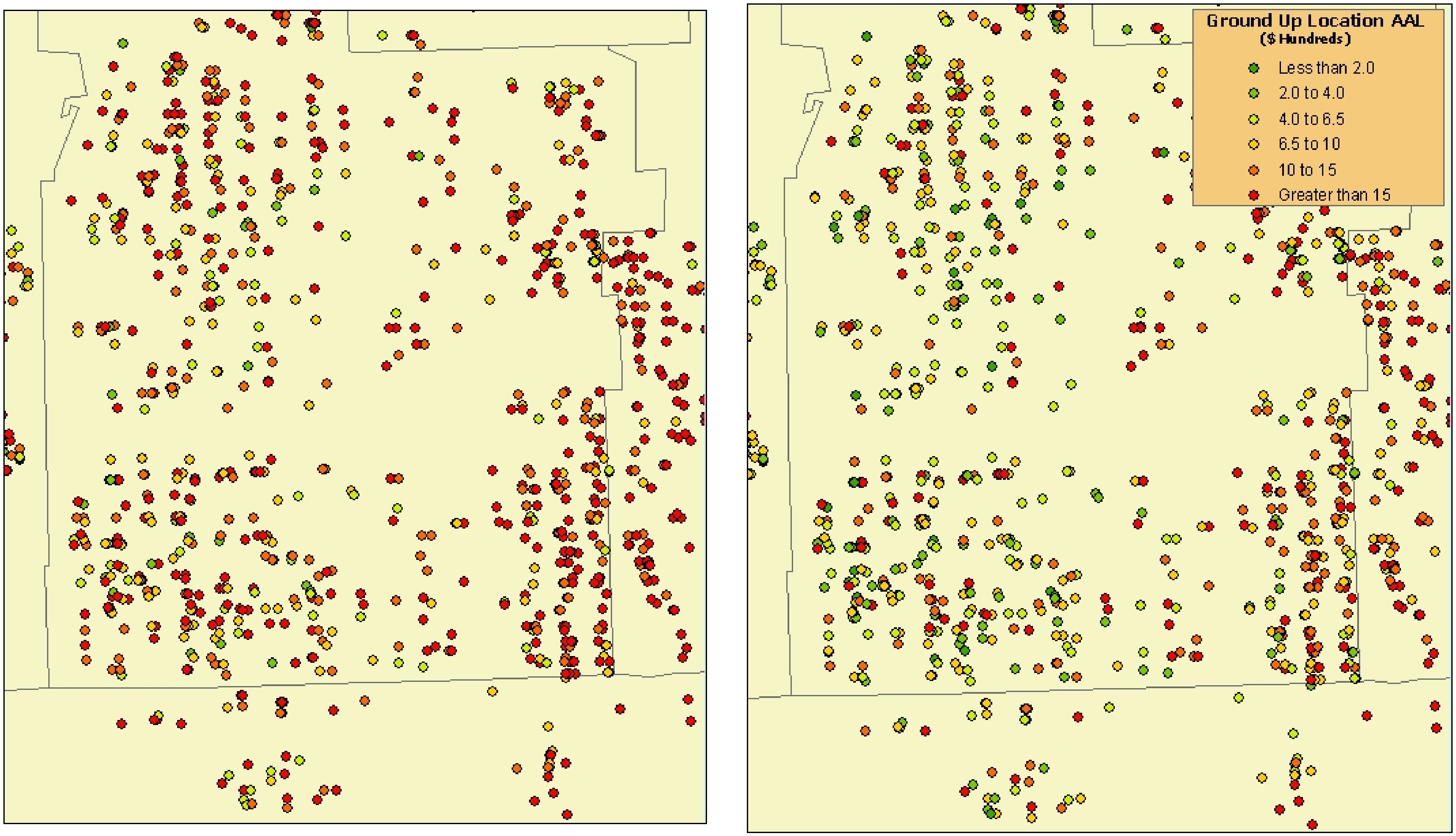


Figure 5: MSFH portfolio locations: close up of ground-up average annual loss (AAL) map in Figure 4 showing ground-up AAL by location before mitigation (left) and ground-up AAL with opening and roof mitigation applied (right). For details on mitigation, see section "Mitigation Packages"

A summary of how the sub-portfolios' overall exposure value (i.e., sum of building, contents, and time element coverages) compares to their contribution to statewide risk (i.e., ground-up AAL) is illustrated in Figure 6. This figure illustrates that each mitigation sub-portfolio contributes to the total risk in a disproportionate manner. For example, while sub-portfolio 'B', containing the top 25% at risk locations, is 37% of overall exposure value, it is 55% of the total risk or ground-up AAL for the state. In this analysis, sub-portfolio 'A' is mitigated first, then sub-portfolio 'B', and so on.

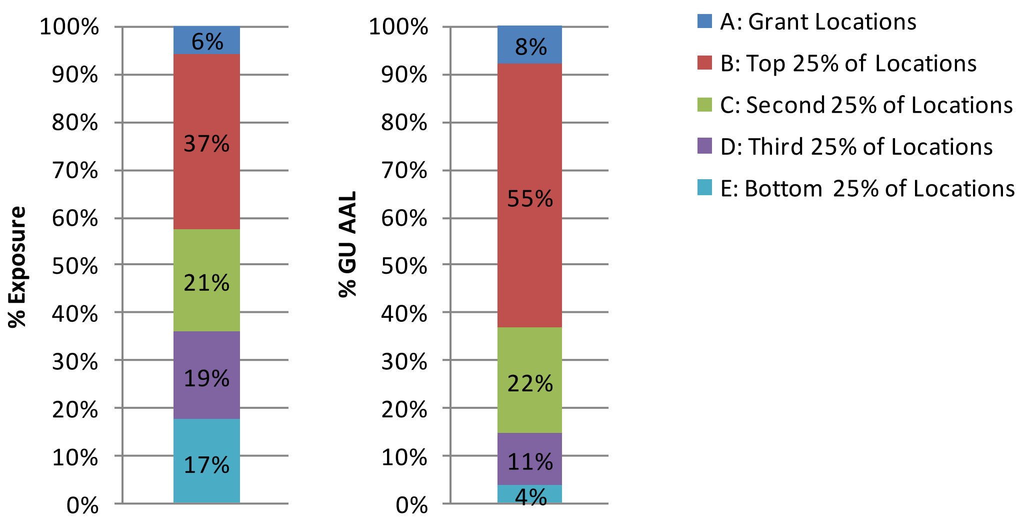


Figure 6: The MSFH sub-portfolios: comparison of the distribution of exposure value (% Exposure on left) to the contribution to ground-up AAL (% GU AAL on right)

Industry Exposure Database (IED) Portfolio: 5 Sub-Portfolios

After the first phase of identifying exposure sub-portfolios of the MSFH portfolio was complete, the remaining exposure in the hybrid exposure set (hereafter referred to as the IED portfolio) was also disaggregated to illustrate the impacts of the grant program if it were continued to a point where nearly every location is mitigated.

Within the IED portfolio, the sub-portfolios are identified such that locations that contribute to the top 20% of the risk are designated as sub-portfolio 'A', the next 20% as sub-portfolio 'B', and so on. This method of splitting up the IED portfolio is slightly different than for the MSFH portfolio. Specifically, the IED is split into equal parts by AAL, whereas the MSFH portfolio is split into equal number of locations. The same conclusion can be drawn from each portfolio—i.e., that there is a disproportionate amount of risk associated with different locations. In this analysis, sub-portfolio A is mitigated first, then sub-portfolio B, and so on.

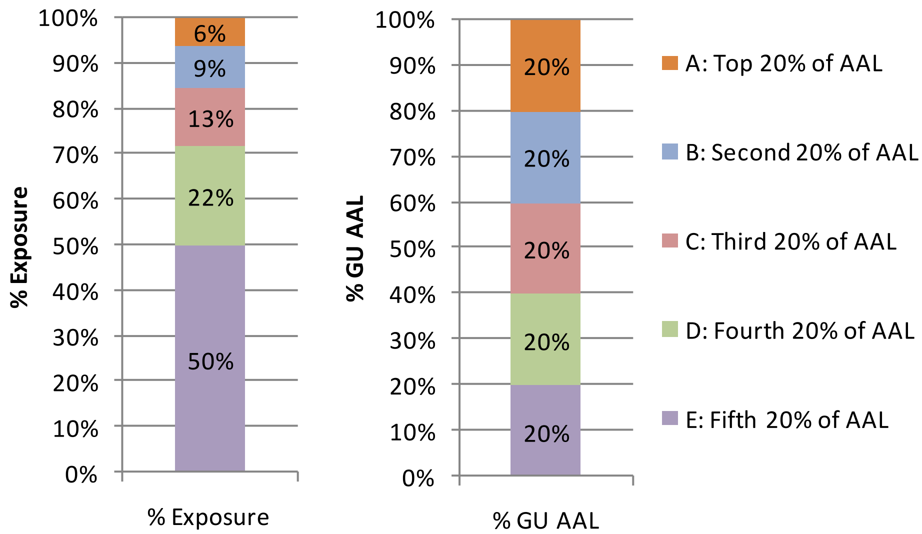


Figure 7: The IED sub-portfolios: comparison of distribution of exposure value (% Exposure on left) to the ground-up AAL (% GU AAL on right)

Mitigation Packages

While the RMS® U.S. Hurricane Model has the capability to analyze all seven classes of improvements recommended by the MSFH program, the focus of this study is on two major categories: opening protection and roofing upgrades. As such, two mitigation packages are considered: one focused on opening protection, denoted Mitigation I, and one considering opening protection plus roofing component retrofitting, denoted Mitigation II.

Mitigation (Mit) I: Opening Protection

Opening protection involves the retrofitting of windows, doors and garage doors with shutter products that meet large missile impact test standards (e.g., as established by Miami-Dade County or other similar standards established by the American Society for Testing and Materials). These standards require hurricane shutters to be able to withstand the impact of 2x4s thrown in the wind.

Mitigation (Mit) II: Opening Protection plus Roofing Upgrades

Opening protection plus roofing upgrades involves the mitigation as outlined above plus roof anchoring, roof deck upgrades, and roof covering upgrades. Roof anchoring involves upgrading the roof straps that hold the trusses down to an equivalent of 900 pound uplift. Roof decking upgrades entail re-nailing the roof deck with 10d nails at 6”/6” spacing. Finally, roof covering upgrades on shingle roof covers include the installation of a secondary water resistance barrier, and the installation of a shingle that meets the equivalent of the high wind test standards (i.e., rated for a nominal 110 mph).

These mitigation techniques are applied to the MSFH portfolio as applicable. For example, a home with impact-rated shutters does not need opening protection mitigation. Likewise for the roof components, only those homes that need the specific upgrades are retrofitted. For the aggregated portfolio based on the IED, only those aggregate locations that have the appropriate combination of features that require upgrades are retrofitted. The costs associated with these mitigation techniques are shown in Table 2 and are based on RMS research on retrofit costs within the state of Florida.

Table 2: Estimated mitigation cost per home and the portion covered by the MSFH grant program

Mitigation Item		Average Cost Per Home	Proportion currently covered or potentially covered by MSFH Grants[6]
Opening Protection	Shutters	$7,500	$3,500
Roofing Upgrades	Roof Anchoring	$1,200	$600
	Roof Covering Upgrades	$7,700	$3,850
	Roof Decking Upgrades	$660	$330

Summary of Mitigation Sub-Portfolios

Table 3 summarizes the disaggregation of the MSFH and IED portfolios. This table reports each sub-portfolio's exposure value, contribution to the total statewide or ground-up AAL, the average gross loss cost, and the cost to mitigate using Mitigation I and Mitigation II.

The average gross loss cost for each sub-portfolio is the ratio of the gross AAL per $1,000 coverage value. The gross perspective, unlike the ground-up perspective, represents the risk after homeowner insurance deductibles are applied to the loss, and is related to the loss attributed to the insurance company. Other than the initial grant locations in the MSFH portfolio (MSFH sub-portfolio 'A'), the loss cost decreases as one moves from sub-portfolio 'B' through 'E'- from $2.66 to $0.31, as expected since AAL was used to sort the locations into sub-portfolios. As noted earlier, this table confirms that the MSFH locations do not necessarily represent the properties with the highest risk in the state, as the average gross loss cost for sub-portfolio 'A' in the IED exposure is $7.60 – over twice the average for MSFH sub-portfolio 'B'.

[6] In the current program, grants are only available for opening protection. Other costs are used to examine the impacts if the grant program were extended to include roofing upgrades as well.

Table 3: Summary of attributes of sub-portfolios within hybrid exposure data set: MSFH sub-portfolios (top) and IED sub-portfolios (bottom)

Portfolio / Sub-portfolio		Description	Number of Locations	Exposure		Ground-Up AAL		Average Gross Loss Cost	Mitigation I Cost		Mitigation II Cost	
				($B)	(%)	($M)	(%)	($/$k)	Total ($M)	Grant ($M)	Total ($M)	Grant ($M)
MSFH	A	Grants	32,368	$12	1%	$37	1%	2.34	$186	$93	$413	$207
MSFH	B	Top 25% of locations	91,564	$78	4%	$260	5%	2.66	$526	$263	$1,203	$601
MSFH	C	Second 25% of locations	91,563	$45	2%	$102	2%	1.71	$518	$259	$1,198	$599
MSFH	D	Third 25% of locations	91,563	$40	2%	$51	1%	0.92	$505	$252	$1,180	$590
MSFH	E	Bottom 25% of locations	91,563	$37	2%	$18	0%	0.31	$506	$253	$1,191	$596
IED	A	Top 20% of AAL	259,023	$115	6%	$1015	18%	7.60	$1,943	$971	$4,187	$2,094
IED	B	Second 20% of AAL	393,576	$168	8%	$1015	18%	5.09	$2,899	$1,450	$5,896	$2,948
IED	C	Third 20% of AAL	571,461	$240	12%	$1016	18%	3.50	$4,075	$2,037	$8,099	$4,050
IED	D	Fourth 20% of AAL	956,327	$398	19%	$1015	18%	2.05	$6,682	$3,341	$12,758	$6,379
IED	E	Fifth 20% of AAL	2,395,829	$927	45%	$1015	18%	0.84	$16,677	$8,338	$29,882	$14,941
		Total	**4,974,837**	**$2,061**	**100%**	**$5,544**	**100%**		**$34,517**	**$17,258**	**$66,009**	**$33,005**

Step 3: Definition of Mitigation Scenarios

Scenarios for the application of the two mitigation packages discussed earlier (Mitigation I and Mitigation II), are developed in Step 3. These ten scenarios represent how the sub-portfolios of the hybrid industry exposure set are mitigated incrementally for each of the techniques (i.e., there are 20 analyses in total—10 scenarios for 2 techniques). In Figure 8, the ten mitigation scenarios are presented, illustrating how this analysis is structured to examine the incremental investment in mitigation by retrofitting the sub-portfolios of the MSFH portion of the hybrid exposure set and then the sub-portfolios of the IED portion. Each mitigation scenario is compared to the baseline scenario, representing the current exposure at risk with no mitigation—i.e., before the MSFH grant program has taken effect.

The first mitigation scenario represents the current application of MSFH grants to homes, to measure the effectiveness of the present grant program. This scenario is compared to the baseline and represents the change in risk after the current grant applicants have retrofitted their homes. Subsequent scenarios, numbered 2 to 10, are projections of future investments to mitigate additional sub-portfolios until all sections of the Florida residential exposure are retrofitted.

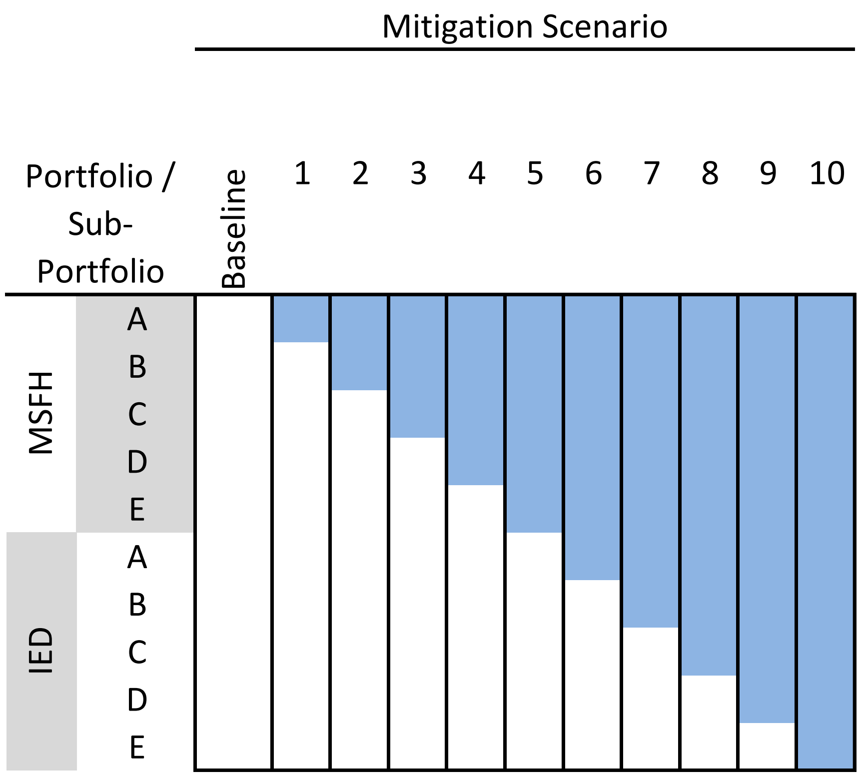


Figure 8: Ten mitigation scenarios as compared to the baseline: the sub-portfolios are incrementally mitigated in each scenario and are denoted in blue

IMPACT ANALYSIS RESULTS

The analysis results are split into two sections. The first section presents the change in the statewide 100-year probable maximum loss (PML) for each of the 20 analyses (i.e., 10 scenarios with 2 mitigation packages). In the second section, comparisons are made to the cost of mitigation and conclusions are drawn about the effectiveness of the current program and future grant programs.

Impacts of Mitigation on Statewide Risk—100-year PML

The results of this analysis are summarized in Table 4 and 5 in two distinct ways. Table 4 examines the costs and benefits on a cumulative basis to reflect the establishment of the mitigation scenarios as cumulative scenarios—sub-portfolio 'A' is retrofitted, then 'B', and so on. Table 5, in contrast, is designed to show each of the sub-portfolios on an individual rather than cumulative basis, so that an estimate of the maximum savings per investment can be determined. Both tables also report estimates of the mitigation cost assuming a 50% split between the homeowner and the grant program, and the number of homes retrofitted under each sub-portfolio or scenario.

Savings from Current Grant Program

In Table 4, the cumulative changes in the 100-year PML under each mitigation scenario are compared to the cumulative mitigation investment considered for each scenario. The impact of opening protection (Mitigation I) is presented at the top of the table, with the impact of opening protection plus roofing retrofits (Mitigation II) presented at the bottom of the table. Therefore, this table illustrates how a given investment in the grant program could reduce the statewide risk, based on the 100-year PML risk metric. All benefits are quantified as the difference between the 100-year PML for the mitigation scenario in question and the 100-year PML for the baseline analysis, which is approximately $61.9 billion. For example, the benefits or savings of mitigation scenario 5 for opening protection is $61,896 million - $60,522 million = $1,374 million.

This analysis shows that the current grant program produces a savings in 100-year PML of $136 million ($61,896 million - $61,760 million = $136 million). When compared to the baseline 100-year PML of $61.9 billion, this $136 million represents less than a 0.2% reduction in 100-year PML for the 0.6% of homes that have been mitigated (e.g., 32,000 of 4.9 million). An alternative way to look at the value of the investment is to examine the reduction in 100-year PML relative to the money invested in grants—the change in 100-year PML liability is approximately $136 million/$93 million = $1.46 per dollar spent on grants. This represents a lower bound on the savings per dollar invested by the state, as roofing upgrades which are not covered by the current grant program and are paid for by the homeowner, could translate to a 100-year PML savings as high as $241 million (as estimated in Table 4, mitigation scenario 1 for Mitigation II technique). So by comparing the $93 million in opening protection grants with the total potential PML savings of $241 million the reduction per grant dollar could be as high as $2.50 (not shown in Table 4). Without a clear perspective of the number of people voluntarily undertaking roof upgrades, a more realistic estimate of savings is closer to the calculated value of $1.50 per grant dollar.

Savings from Future Grant Programs

Table 5 shows how future installments of grant funds could further reduce the 100-year PML. If the grant program continues to cover only opening protection, then the next grant level (sub-portfolio 'B' of the MSFH portion) would save $2.73 in 100-year PML liability per grant dollar invested. Table 5 also shows that the savings per grant dollar decreases with each additional sub-portfolio being mitigated, as there are diminishing returns on investment. This is a function of the mitigation funds being focused on those locations with the highest wind risk. For example, in Table 5, sub-portfolio 'B' shows a savings per investment of $2.73, but it is only $0.61 in savings per dollar invested for sub-portfolio 'D' of the MSFH portion.

Table 4: Cumulative changes in statewide 100-year PML verses mitigation cost for each mitigation scenario

Mitigation Scenario			100-year PML			Mitigation Cost ($M)				
			Loss ($M)	Change from Baseline ($M)	Percent Diff	Grant Portion	Home-owner Portion	Total Cost	Cumulative Num Home Mitigated (thousand)	Cumulative Savings in 100-yr PML per Grant $
		Baseline	61,896							
Mit I	MSFH	Mit I: 1 - Current Grants	61,760	-136	-0.2%	93	93	186	32	$ 1.46
Mit I	MSFH	Mit I: 2	61,043	-853	-1.4%	356	356	712	103	$ 2.40
Mit I	MSFH	Mit I: 3	60,716	-1,180	-1.9%	615	615	1,230	172	$ 1.92
Mit I	MSFH	Mit I: 4	60,563	-1,333	-2.2%	867	867	1,735	239	$ 1.54
Mit I	MSFH	Mit I: 5	60,522	-1,374	-2.2%	1,120	1,120	2,241	306	$ 1.23
Mit I	IED	Mit I: 6	55,989	-5,907	-9.5%	2,092	2,092	4,184	565	$ 2.82
Mit I	IED	Mit I: 7	51,508	-10,387	-16.8%	3,541	3,541	7,083	952	$ 2.93
Mit I	IED	Mit I: 8	47,143	-14,752	-23.8%	5,579	5,579	11,157	1,495	$ 2.64
Mit I	IED	Mit I: 9	43,118	-18,778	-30.3%	8,920	8,920	17,840	2,386	$ 2.11
Mit I	IED	Mit I: 10	39,797	-22,099	-35.7%	17,258	17,258	34,517	4,610	$ 1.28
Mit II		Baseline	61,896							
Mit II	MSFH	Mit II: 1 - Current Grants	61,655	-241	-0.4%	207	207	413	32	$ 1.17
Mit II	MSFH	Mit II: 2	60,368	-1,527	-2.5%	808	808	1,616	103	$ 1.89
Mit II	MSFH	Mit II: 3	59,783	-2,113	-3.4%	1,407	1,407	2,814	172	$ 1.50
Mit II	MSFH	Mit II: 4	59,505	-2,391	-3.9%	1,997	1,997	3,994	240	$ 1.20
Mit II	MSFH	Mit II: 5	59,423	-2,473	-4.0%	2,593	2,593	5,185	312	$ 0.95
Mit II	IED	Mit II: 6	51,639	-10,257	-16.6%	4,686	4,686	9,373	571	$ 2.19
Mit II	IED	Mit II: 7	44,819	-17,077	-27.6%	7,635	7,635	15,269	958	$ 2.24
Mit II	IED	Mit II: 8	38,346	-23,550	-38.0%	11,684	11,684	23,368	1,501	$ 2.02
Mit II	IED	Mit II: 9	32,421	-29,475	-47.6%	18,063	18,063	36,127	2,392	$ 1.63
Mit II	IED	Mit II: 10	27,544	-34,351	-55.5%	33,005	33,005	66,009	4,616	$ 1.04

Table 5: Incremental changes in 100-year PML for each sub-portfolio with respect to the baseline analysis (i.e., no mitigation); the cumulative 100-year PML is reproduced from Table 4 to illustrate derivation of incremental change in 100-year PML

Mit Package		Sub-Portfolio	Num Homes Mitigated (thousand)	Cumulative 100-year PML ($M)	Incremental Change in 100-year PML: Δ Loss ($M)	Incremental Change in 100-year PML: % wrt Baseline	Incremental Mit Cost Grant Portion ($M)	Incremental Savings in 100-yr PML per Grant $
Mit I		*Baseline PML*		61,896				
Mit I	MSFH	A - Grants	32	61,760	136	-0.2%	93	$ 1.46
Mit I	MSFH	B	70	61,043	717	-1.2%	263	$ 2.73
Mit I	MSFH	C	69	60,716	327	-0.5%	259	$ 1.26
Mit I	MSFH	D	67	60,563	153	-0.3%	252	$ 0.61
Mit I	MSFH	E	67	60,522	40	-0.1%	253	$ 0.16
Mit I	IED	A	259	55,989	4,533	-7.5%	971	$ 4.67
Mit I	IED	B	387	51,508	4,480	-8.0%	1,450	$ 3.09
Mit I	IED	C	543	47,143	4,365	-8.5%	2,037	$ 2.14
Mit I	IED	D	891	43,118	4,025	-8.5%	3,341	$ 1.20
Mit I	IED	E	2,224	39,797	3,321	-7.7%	8,338	$ 0.40
Mit II		*Baseline PML*		61,896				
Mit II	MSFH	A - Grants	32	61,655	241	-0.4%	207	$ 1.17
Mit II	MSFH	B	70	60,368	1,287	-2.1%	601	$ 2.14
Mit II	MSFH	C	69	59,783	585	-1.0%	599	$ 0.98
Mit II	MSFH	D	68	59,505	278	-0.5%	590	$ 0.47
Mit II	MSFH	E	72	59,423	82	-0.1%	596	$ 0.14
Mit II	IED	A	259	51,639	7,784	-13.1%	2,094	$ 3.72
Mit II	IED	B	387	44,819	6,819	-13.2%	2,948	$ 2.31
Mit II	IED	C	543	38,346	6,473	-14.4%	4,050	$ 1.60
Mit II	IED	D	891	32,421	5,925	-15.5%	6,379	$ 0.93
Mit II	IED	E	2,224	27,544	4,876	-15.0%	14,941	$ 0.33

Although the ratio of 100-year savings to grant monies drops below the dollar-for-dollar level, one should not assume that mitigation is not worthwhile. This relatively simple analysis considers only a single metric to quantify the benefits for each sub-portfolio in the larger data set, but the benefits may outweigh the costs on a per structure basis.

The savings per grant dollar is significant for the first sub-portfolio of the IED portfolio, measuring $4.67 per dollar invested, confirming the earlier observation that there are some high risk locations in the IED portfolio that would benefit more than some of the locations in the sub-portfolios of the MSFH program. If the MSFH program were to continue, future versions of the program should include home inspections, focusing on gathering more complete information about each individual structure for the remaining single-family dwellings in the state of Florida.

Comparison of Mitigation Packages

The results in Table 4 and 5 allow one to compare the investment in Mitigation I package—opening protection, with those investments in Mitigation II package, which includes roofing retrofits in addition to opening protection. This data can be used to evaluate whether or not expanding the grant program to include the roofing retrofits is a worthwhile investment.

RMS research has shown that roofing is, by far, the largest component of the insurance claims for hurricane wind damage. Almost 50% of the claims in a given storm can be attributed directly to roofing. As most of the interior or contents damage is also attributable to roofing failures, roofing retrofits become even more important.

In general, the cost to include the roofing retrofits doubles the amount of needed matching grant dollars, but the reduction in 100-year PML doubles as well. For example, the cost of the roofing retrofits in the form of a 50% match, as done in the current grant program, would increase the mitigation cost for the 32,000 homes from $93 million to $207 million. The corresponding PML reduction changes from $136 million to $241 million. In this case, the PML savings per grant dollar is slightly smaller at $1.17 versus $1.46 for scenario 'Mit I:1', as shown in Table 4.

While the savings are slightly smaller, the mitigation package that includes roofing retrofits is also higher than the dollar-for-dollar threshold. In addition, the maximum PML reduction for the Mitigation I package is limited to 36% (as shown in Table 4), while Mitigation II has a maximum reduction of close to 56%. Therefore, roofing retrofits should be promoted within the industry to ensure a continued path to absolute loss reduction.

Thus, RMS recommends that the MSFH program consider some level of roofing retrofits within future grant programs as roofing upgrades will reduce the absolute risk levels.

USING MSFH DATA FOR INSURANCE RATING

This section examines how highly detailed data sets, like the MSFH data, can potentially be used in underwriting to maximize the mitigation credit signal.

One of the barriers to creating an effective motivating force for mitigation within the insurance rating system is the degree to which an individual risk is "subsidized" with respect to other peers in its class. When high risk locations are subsidized by low risk locations, the amount of credit granted for a given mitigation measure becomes smaller because the difference between high and low risk locations is compressed. When this occurs, the motivation to retrofit a structure reduces, as it may become uneconomical to invest in mitigation and/or incentives are taken out of the insurance credit mechanism.

Subsidization is a natural part of insurance, as an underlying premise of insurance is the pooling of similar risks.[7] The degree of subsidization can be thought to be a function of the "data fidelity" or the ability of a set of variables to accurately reflect the underlying risk. The choice of the proper set of variables largely involves balancing the accuracy with which a risk can be classified against the practicality of collecting and classifying the risk with the given information. In theory, the more data collected on a given location, the easier it is to characterize and assess the risk profile. Unfortunately, more data has a cost associated with it, as collecting and processing the information takes time and effort.

The MSFH program provides an excellent opportunity to examine how this data fidelity relates to the degree of subsidization in residential insurance. The approach taken here is quite simple. First, the MSFH portfolio locations are analyzed, assuming that they are rated with low fidelity data—commonly referred to as primary variables. These variables are slightly different for each insurance company, but typically include location (rating territory), construction class, occupancy type, number of stories, and year built. Then, the same rating estimate for each location is examined, considering high fidelity data, which is the detailed information in the MSFH program (e.g., roof shape, roof covering, cladding, roof anchor, roof deck attachment, opening protection, and living area).

In this example, the change in insurance rates is studied through the change in the gross or insured average annual loss (AAL) for the properties at risk with low fidelity data and then high fidelity data. Insurance premiums, of course, include additional costs associated with expected loss from other causes, loss adjustment, overhead, cost of capital, and so on. Recall also that hurricane coverage is typically one-half of the total residential homeowners premium, so that that percent changes reported here will not translate directly to changes in insurance rates. So, for analysis purposes, the relative change in the AAL allows one to measure the potential change in insurance rates for high verses low fidelity data.

It is important to recognize that this analysis does not comment on whether the current insurance rates within Citizens or other companies in Florida are sound or reflect the current hurricane risk. In addition, this analysis is limited to the MSFH program, and further study to quantify the effects on the statewide population or other company portfolios is necessary. The results presented here are for illustrative purposes only and could potentially be substantially different if one considers other insurance portfolios within the state.

High Fidelity versus Low Fidelity Data

The AAL for each sub-portfolio of the MSFH portfolio, prepared with both the low fidelity and high fidelity data, is presented in Table 6. Specifically, the residential buildings within the MSFH portfolio were "stripped" of their detailed property characteristics and analyzed (i.e., with low fidelity data) and compared to the as-is MSFH portfolio (i.e., with high fidelity data). Mitigation was not evaluated as part of this analysis.

As illustrated in Table 6, there is a 27% reduction in the gross AAL across the entire MSFH portfolio, considering high fidelity data. While this result might indicate that more detailed data will always lead to a

[7] A key challenge for catastrophe risk, however, is the allocation of risk among stakeholders in a manner similar to what is done for more frequent, non-extreme events.

reduction in AAL and hence lower premiums, this is not a foregone conclusion. A closer examination of the portfolio characteristics indicates that this overall reduction is a reflection of how this portfolio differs from the industry average utilized in the model with low fidelity data. The MSFH portfolio is comprised of larger homes with some degree of hurricane protection features, as compared to the general population of structures in Florida. More generally, it is possible for a given portfolio to either under- or over-estimate the risk when considering the fidelity of the data used in the process.

In addition, as illustrated in Table 6, the average reduction in AAL for all five sub-portfolios of the MSFH portfolio ranges from less than $70 per year to over $620 per year. These absolute dollar savings are largest for the sub-portfolios with the highest risk (e.g., sub-portfolio 'A' has larger savings than sub-portfolio 'B', which is larger than sub-portfolio 'C', etc.). Note however, that the percentage reduction in AAL increases slightly with each incremental sub-portfolio, while the magnitude of the difference in dollars decreases. For example, sub-portfolio 'B' has a 20% reduction in AAL, but sub-portfolio 'E' has a 36% reduction. Thus, a consideration of the absolute, as well as the percentage differences, is needed to fully understand the changes in AAL.

Table 6: Average reduction in insured average annual loss (AAL) when using MSFH detailed information (high fidelity) data versus primary building (low fidelity) data for each sub-portfolio in the MSFH portfolio

		Average Gross AAL ($) per Home			
MSFH Sub-Portflio	**Number of Locations**	**Low Fidelity Data**	**High Fidelity Data**	**Difference in AAL**	**Percent Reduction in AAL Using More Detailed Informaiton**
A – Grants	32,000	$1,183	$875	$309	27%
B – Top 25%	92,000	$2,867	$2,282	$624	20%
C – Second 25%	92,000	$1,126	$841	$295	25%
D – Third 25%	92,000	$549	$400	$153	27%
E – Bottom 25%	92,000	$190	$125	$67	36%
Total	**399,000**	**$1,183**	**$909**	**$284**	**27%**

The distribution of changes in AAL is needed in order to fully understand the impacts of more detailed information. The authors note that many insurance rate filings to the Florida Department of Insurance report only the average and extremes of proposed changes to rates and do not fully disclose how many policies are expected to increase or decrease by a certain amount. When only the average and extremes are presented, it makes it hard to determine the severity of the impact on the entire population. To illustrate the impacts of high fidelity data on individual policies, a distribution of changes in the loss costs for the close to 400,000 structures in the MSFH portfolio is presented in Figure 9. Recall that gross loss costs are used as a proxy for the hurricane-only portion of insurance premiums, and that changes in loss costs do not directly translate to changes in insurance premiums.

Figure 9 indicates that almost two-thirds of the locations, 70% in this example, would see a decrease in loss cost with the use of the high fidelity information. Nearly 50% of these locations would have loss costs drop by more than half. In addition, only 13% of the locations would see significant increases in loss costs, ranging from increases of 10% to as high as 150% for the locations with the highest absolute risk from wind damage.

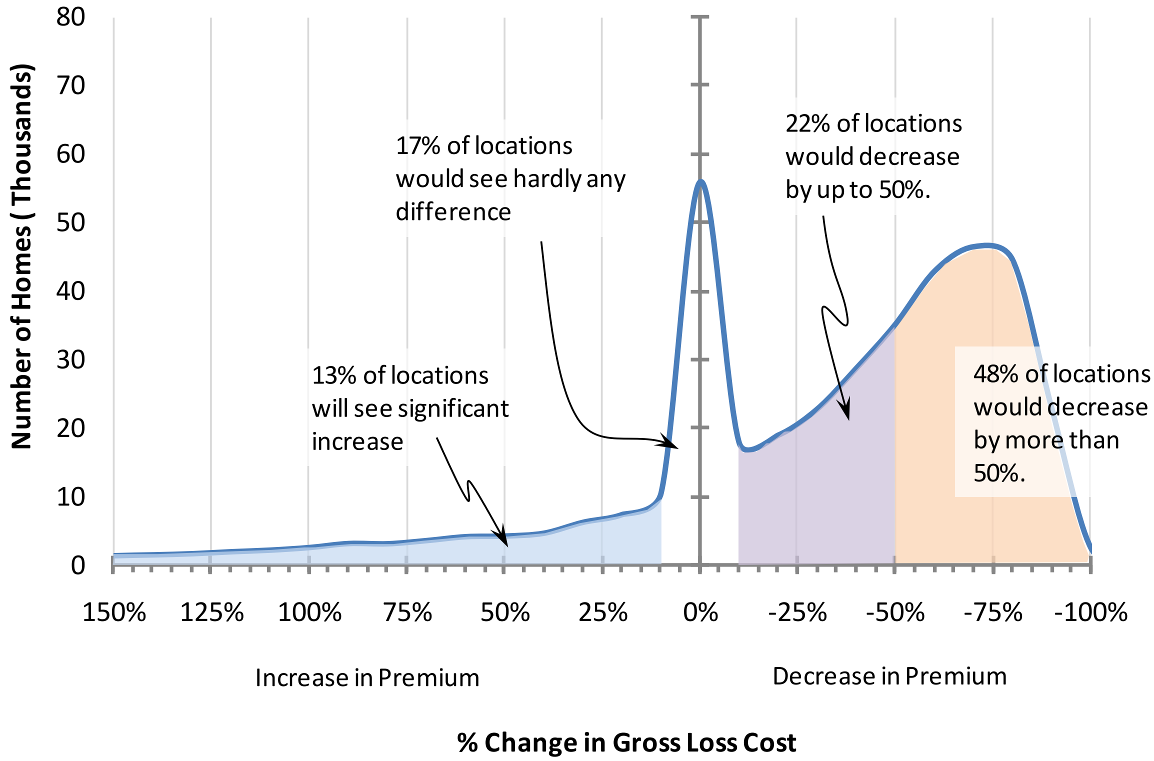


Figure 9: Distribution of changes in gross loss cost in the MSFH portfolio, as a result of changing from low fidelity to high fidelity data

If one considers these loss costs as a proxy for premiums, only 13% of the locations show an increase in premiums. This presents an opportunity for the grant funding under the MSFH program to target the investment to offset an increase in insurance rates. For example, if this 13% of the portfolio (approximately 50,000 homes) were provided with funds for mitigation, then it could be possible to eliminate the portion of the portfolio that would see rate increases with high fidelity information. Focusing the mitigation grants on the homes that could face increased insurance rates makes the mitigation signal clear to the homeowner, and could make a new rate filing more acceptable to the regulators and other stakeholders.

The Need for Comprehensive Data Sets

In order to make the mitigation signal strong for all risk stakeholders, the benefits of mitigation to the reinsurance industry must be highlighted as well. This can be accomplished through the gathering of high fidelity data—as it relates to wind mitigation—for all risks throughout the state.

In Florida, there are two distinct reinsurance mechanisms: the coverage offered by the Florida Hurricane Catastrophe Fund (FHCF) and the coverage offered from the private reinsurance market. Currently in Florida, information on the mitigation features of a structure and associated credits (for homeowners to reduce their premiums) is collected at most insurance companies on a voluntary basis. Since 2003, homeowners have had the option of hiring a wind certification inspection firm at a cost of \$100–\$150 to complete a "Uniform Mitigation Verification Inspection" (UMVI) form and submit it to their insurance company. The UMVI form collects information that is nearly identical to the data attributes in the MSFH dataset. This form is typically submitted to an insurance company only when it is beneficial to the homeowner (i.e., he will receive a reduction in premium due to mitigation features of the property). Thus, there is a bias in the mitigation data reporting mechanism which could result in an underestimation of the portfolio risk levels. Practically, this bias means that the reinsurance underwriter, who carries the risk to the aggregate portfolio, might view the mitigation impacts more skeptically.

A more effective way to signal the benefits of mitigation to the re/insurance market is to find a mechanism to collect this information on all the homes—on a comprehensive basis rather than a voluntary basis. In the case of the FHCF, only recently have primary insurance companies been asked to include detailed mitigation attributes (e.g., roof shape, opening protection, etc.) to the FHCF. Even more importantly, up until this year, the FHCF pricing of its coverage did not take these mitigation variables into account, so the cost of reinsurance coverage for a highly mitigated portfolio would be the same as an unmitigated portfolio. If the primary company does not get credit in its reinsurance pricing, they are also less likely to encourage the collection of this data. At the time of this writing, it is unknown if the FHCF pricing for 2009–2010 will include a mechanism to reflect the degree of mitigation in its portfolio.

In both these cases, it is clear that one solution to reflect mitigation in re/insurance pricing is to ensure data is collected on a comprehensive basis. This could be accomplished in a variety of ways, such as continuing the inspection aspect of the MSFH program or implementing a mandatory inspection at the time of a home purchase that is rolled into the cost of the mortgage.

CONCLUSIONS

The MSFH program provides two valuable services to the insurance industry: first, a wealth of high-resolution exposure information; and second, a reduction of absolute risk level through mitigation grants. This study quantifies the impact that the MSFH mitigation grant program has had to date, and could continue to have should its funding be continued. It illustrated that the existing MSFH grant program, that provides matching grants for opening protection to homeowners, has reduced the 100-year probable maximum loss (PML) by at least $1.50 per dollar invested in grants. This equates to a reduction of approximately $140 million in the 100-year PML of $61.9 billion. Although this is only 0.2% of the PML value, it is important to note that the savings of $140 million is larger than the $93 million invested in the grant program.

One must also consider the other un-quantified benefits of the MSFH program, such as reducing the possible loss of irreplaceable personal possessions, minimizing the disruption of use of the home, and family safety. It is clear that mitigation is one of the few ways to reduce hurricane risk within the state. This program provides an incentive to retrofit a home with wind-resistant features.

As successful as the current program is, this study has highlighted that the program benefits can be further maximized if the prioritization of grant money allocation considers the individual home rating variables, as captured in the MSFH program. The PML reduction per grant dollar can be increased from approximately $1.50 to as high as $2.75 if the grant program focuses on the MSFH portfolio, or can reach over $4.00 per grant dollar if other locations in the state are considered. This study has used a simple method of prioritizing based on the ground-up average annual loss (AAL), which illustrates that targeted planning can maximize the benefits. Other methods that consider an individual homes explicit contribution to the PML may push the relative benefits even higher and should be considered in any future analyses.

The results of this study also illustrate that the current program's policy of only providing grants for opening protection could be limiting the absolute risk reduction potential of the program. RMS estimates that the upper bound on the 100-year PML reduction for opening protection is 35%—less than half of the maximum reduction of 77% estimated at the beginning of the report. By including roofing upgrades in the matching grant program, RMS concludes that the costs and benefits increase in similar proportions, are still better than a break-even point, and will achieve higher absolute risk reduction levels in the long run.

Lastly, this study has examined the impact of using the MSFH information as insurance rating variables within insurance underwriting and rating plans in contrast to the typical primary rating variables. This study considered that if the MSFH data set were an insurance company portfolio, and started out with actuarially sound rates, then adopting the MSFH rating information (including square footage) as rating variables, would result in a net reduction of 27% in the average AAL for the portfolio. Admittedly, the assumption that rates in Florida are sound is a significant one, and further study of this issue with actual insurance rating plans is necessary. More importantly, this move to more detailed information can result in a wider variation between the highest and lowest risks, which will create larger incentives to mitigate. In the example presented here, significant rate increases for some homes are expected, but when coupled with a targeted mitigation grant program, the increases in premiums could be softened. This will reduce the industry loss levels, while making any new insurance rating system acceptable to the majority of people.

The key to making a new rating plan work depends on accurate data collection on a comprehensive basis. Data must be collected on every single risk so that the mitigation signal is loud and clear to the homeowner, and can be reflected at not only the primary insurer level, but also to the reinsurer as well.

APPENDIX A

Exhibit 1: PML Results by Mitigation Scenario for Mitigation Package I: Opening Protection

	Mitigation Scenario										
Return Period	**Baseline**	**Mit I: 1 Current Grant Locations**	**Mit I: 2**	**Mit I: 3**	**Mit I: 4**	**Mit I: 5**	**Mit I: 6**	**Mit I: 7**	**Mit I: 8**	**Mit I: 9**	**Mit I: 10**
	Gross PMLs for various Return Periods - Annual Exceedance Probability Levels ($M)										
10,000	221,945	221,519	219,345	218,376	217,877	217,734	209,622	200,793	191,534	182,430	174,531
1000	147,260	146,948	145,335	144,719	144,438	144,362	137,186	130,095	123,144	117,142	112,538
500	122,172	121,910	120,540	120,013	119,779	119,720	113,128	106,712	100,394	94,775	90,304
250	95,799	95,584	94,481	94,038	93,836	93,786	87,728	81,847	76,124	71,041	67,057
100	61,896	61,760	61,043	60,716	60,563	60,522	55,989	51,508	47,143	43,118	39,797
50	40,383	40,290	39,795	39,571	39,464	39,433	35,875	32,546	29,380	26,512	24,177
10	11,432	11,410	11,282	11,224	11,197	11,188	10,184	9,252	8,393	7,627	6,992
Pure Premium	4,522	4,513	4,462	4,439	4,428	4,425	4,069	3,726	3,401	3,108	2,865
	Percent Reduction Relative to Baseline Analysis										
10000		-0.2%	-1.2%	-1.6%	-1.8%	-1.9%	-5.6%	-9.5%	-13.7%	-17.8%	-21.4%
1000		-0.2%	-1.3%	-1.7%	-1.9%	-2.0%	-6.8%	-11.7%	-16.4%	-20.5%	-23.6%
500		-0.2%	-1.3%	-1.8%	-2.0%	-2.0%	-7.4%	-12.7%	-17.8%	-22.4%	-26.1%
250		-0.2%	-1.4%	-1.8%	-2.0%	-2.1%	-8.4%	-14.6%	-20.5%	-25.8%	-30.0%
100		-0.2%	-1.4%	-1.9%	-2.2%	-2.2%	-9.5%	-16.8%	-23.8%	-30.3%	-35.7%
50		-0.2%	-1.5%	-2.0%	-2.3%	-2.4%	-11.2%	-19.4%	-27.2%	-34.3%	-40.1%
10		-0.2%	-1.3%	-1.8%	-2.1%	-2.1%	-10.9%	-19.1%	-26.6%	-33.3%	-38.8%
Pure Premium		-0.2%	-1.3%	-1.8%	-2.1%	-2.2%	-10.0%	-17.6%	-24.8%	-31.3%	-36.6%

Exhibit 2: PML Results by Mitigation Scenario for Mitigation Package II: Opening Protection + Roofing Retrofits

	Mitigation Scenario										
Return Period	**Baseline**	**Mit I: 1 Current Grant Locations**	**Mit I: 2**	**Mit I: 3**	**Mit I: 4**	**Mit I: 5**	**Mit I: 6**	**Mit I: 7**	**Mit I: 8**	**Mit I: 9**	**Mit I: 10**
	Gross PMLs for various Return Periods - Annual Exceedance Probability Levels ($M)										
10000	221,945	221,150	217,012	215,208	214,284	213,893	198,156	183,603	168,664	154,271	142,206
1000	147,260	146,690	143,715	142,571	142,047	141,896	128,481	117,234	106,485	97,421	90,640
500	122,172	121,701	119,193	118,233	117,803	117,688	105,612	95,475	85,628	76,933	70,091
250	95,799	95,418	93,435	92,632	92,266	92,165	81,439	72,419	63,852	56,275	50,315
100	61,896	61,655	60,368	59,783	59,505	59,423	51,639	44,819	38,346	32,421	27,544
50	40,383	40,217	39,320	38,911	38,711	38,647	32,637	27,633	22,933	18,669	15,158
10	11,432	11,386	11,122	11,003	10,944	10,923	8,908	7,297	5,833	4,555	3,489
Pure Premium	4,522	4,504	4,403	4,358	4,336	4,328	3,647	3,072	2,538	2,065	1,673
	Percent Reduction Relative to Baseline Analysis										
10000		-0.4%	-2.2%	-3.0%	-3.5%	-3.6%	-10.7%	-17.3%	-24.0%	-30.5%	-35.9%
1000		-0.4%	-2.4%	-3.2%	-3.5%	-3.6%	-12.8%	-20.4%	-27.7%	-33.8%	-38.4%
500		-0.4%	-2.4%	-3.2%	-3.6%	-3.7%	-13.6%	-21.9%	-29.9%	-37.0%	-42.6%
250		-0.4%	-2.5%	-3.3%	-3.7%	-3.8%	-15.0%	-24.4%	-33.3%	-41.3%	-47.5%
100		-0.4%	-2.5%	-3.4%	-3.9%	-4.0%	-16.6%	-27.6%	-38.0%	-47.6%	-55.5%
50		-0.4%	-2.6%	-3.6%	-4.1%	-4.3%	-19.2%	-31.6%	-43.2%	-53.8%	-62.5%
10		-0.4%	-2.7%	-3.8%	-4.3%	-4.4%	-22.1%	-36.2%	-49.0%	-60.2%	-69.5%
Pure Premium		-0.4%	-2.6%	-3.6%	-4.1%	-4.3%	-19.4%	-32.1%	-43.9%	-54.3%	-63.0%