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## Cost-Effective Retrofits

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Estimating the cost effectiveness of various hurricane retrofits is a complex and difficult process. There are so many things that can fail in a hurricane that can result in losses that it is difficult to isolate and attribute specific benefits to specific retrofits. The analyses that we have seen tend to suggest that the best approach is usually a system of retrofits that attack a number of the typical vulnerabilities. For example, installing shutters on all of your windows and replacing or protecting your entry and garage doors will significantly reduce the chances that windborne debris breaches a window or door and may reduce the chances of water intrusion through these openings. However, if the soffit panels fail and significant water is blown into the attic, you still



**Some roof cover damage plus some soffit damage equals significant interior water damage**

[\(click image for larger version\)](#)

may end up with enough damage to ceilings and drywall to require ripping out sections and redoing the interior of at least parts of the house. If windows, doors and soffits are all retrofitted so that they don't fail but you have an older shingle roof that loses enough covering to result in water pouring into the attic, you may still end up with collapsed ceilings and a major rebuilding job. In other words, reducing some of the vulnerabilities may reduce the damage and loss from what it could have been without the retrofits but it may not reduce the losses as much as you hope.

In homes not built to the latest high wind codes and standards, one potential consequence of failure of a garage door or a large window is that the entire roof might be lifted off. However, it will normally take a direct hit of a very strong storm before the chance of that consequence occurring becomes very large. In contrast, if your roof has ten year old shingles, there is a reasonably high chance that you may lose enough shingles to result in collapsed ceilings and lots of interior damage in a more modest storm. Risk modelers have developed computer programs that

attempt to weigh the chances of various types of damage and the cost impacts of that damage as a means of estimating the potential economic benefits of various retrofitting options. These analyses typically boil down to weighing the costs of the retrofits against the expected reductions in losses, savings on insurance premiums if there are any and potential savings on deductibles over the life of the retrofits. All of the costs and benefits are converted to the "present value" (the value of the money spent on the retrofits and the future benefits all converted to today's dollar value) of the money. If the benefits are greater than the costs in today's dollars, then the retrofit is said to have a positive benefit-cost ratio.

A number of houses throughout the state of Florida have been subjected to detailed inspections to determine how they were built and how vulnerable they might be to hurricane damage. The results of these inspections were then entered into a computer program that subjected the houses to years and years worth of hurricanes and calculated the expected damage and losses for the as built case as well as with a number of individual retrofits as well as several combinations of retrofits. Many of these inspections and analyses were conducted as part of a state funded mitigation program known as the Florida Construction Mitigation Program that was sponsored by the Florida Department of Community Affairs.

The results of these inspections and analyses suggest that protecting windows and doors, at least with code minimum protection, almost always have a positive benefit-cost ratio for homes in areas where the design wind speeds are greater than 120 mph. In some cases, there is also a positive benefit-cost ratio for protecting windows in homes in areas where the design wind speeds are greater than 110 mph, provided there are relatively few trees in the area. Results also indicate that there is rarely a positive benefit-cost ratio for re-roofing a house simply to reduce the chances of roof damage in a hurricane. However, if it is time to re-roof your house because the roof cover has worn out, then doing additional retrofits such as re-nailing the roof deck to meet new stronger requirements and adding a self adhesive flashing tape over the seams between the roof sheathing panels generally have extremely high positive benefit-cost ratios.

For example, the Incentives portion of this website shows that just re-roofing your house that already needs a new roof may make you eligible for up to a 6% discount on your wind insurance. If your wind insurance premium is about \$1000, this results in an annual savings of about \$60. However, if you re-nail your roof sheathing and add secondary water resistance when you re-roof, these steps can increase the discount you are eligible for up to 20%. This would result in a \$200 annual savings on a wind insurance premium of \$1000. Savings at this level will certainly pay for the increased costs within a few years in addition to providing added peace of mind that your home and possessions will be better protected in the face of a hurricane.

The structural retrofits that then to have a positive benefit-cost ratio are bracing the gable ends of a house with a gable roof and strengthening the anchorage of a porch roof. Both of these retrofits can be

accomplished without major disruptions to your home and with a relatively small investment in materials.

Note that the website also includes ideas for a number of retrofits that can be accomplished at relatively low costs by a do-it-yourself person. Consequently, many of these could have a positive benefit-cost ratio.

While retrofits that improve the structural resistance of walls and of the connections between roofs and walls are important in giving an older home a fighting chance of surviving a direct hit by a strong hurricane, these retrofits rarely have a positive benefit-cost ratio. There are a number of other retrofits that frequently have a negative benefit-cost ratio that would help reduce damage and the disruption caused by a hurricane and consequently could significantly help return life to normal after a storm by reducing the cleanup, the arranging of contractors to make repairs, etc. However, it has been very difficult to



**Many people have had to move out of their damaged homes to await repairs and have lost lots of irreplaceable possessions in the past two years alone**

(click image for larger version)

quantify these benefits in purely economic terms. Consequently, you will need to factor these concerns into your own evaluation of what kinds of retrofits actually make sense for your home and situation.

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