CHAPTER 3

Evaluating Existing Homes

Retrofitting existing buildings has always been a potentially complicated task. Existing homes may be custom designed to complex shapes and configurations. Material types and construction methods can vary widely. Codes to which buildings were originally designed and constructed can be well below modern requirements, and as previously mentioned, may even have been constructed in a location that had no adopted code at the time of construction. Therefore, in order to execute a successful retrofit on any home, an evaluation of its existing condition should be performed to determine:

- Age and condition of the home
- Overall structural integrity of the home
- Weaknesses in the home's envelope
- Weaknesses in the home's structure
- Weaknesses in the home's foundation
- Whether the home can be retrofitted to effectively improve resistance to wind-related damage
- How a home can be retrofitted for the different Mitigation Packages and how much each would cost
- The most cost-effective retrofit project for the home

A qualified individual should evaluate the home and provide recommendations to the homeowner based on the findings. For the purposes of this Guide, this person will be referred to as an *evaluator*. An acceptable evaluator should possess the level of residential building construction knowledge that meets the minimum requirements of a State or local wind mitigation program. Acceptable evaluators may include building science professionals such as registered architects and engineers, building officials, and evaluators that are certified through State or locally recognized wind retrofit programs (such as the IBHS FEH program).

3.1 Evaluating a Home

The purpose of the evaluation is to determine whether the home is a good candidate for any of the wind retrofit Mitigation Packages. It also serves to identify any repairs that must be performed before a wind retrofit project can be undertaken and clarify the applicability of the wind retrofit Mitigation Packages from a construction standpoint. The evaluation will also identify whether

prescriptive retrofits can be performed on the home or a specific engineering solution should be developed. The purpose of the evaluation is not to determine if the building meets current code.

Before an evaluation is performed, homeowners should compile any available documentation on the design and construction of the home. Where available, the following information should be provided to the evaluator:

- Documentation regarding the foundation of the building
- Documentation regarding the existing roof covering
  - If the roof covering has not been replaced, the purchase contract, building permit, or property tax record showing the age of the property
  - If at least a portion of the roof covering has been replaced, a copy of the work order for the roofing or a receipt for its installation
- If a secondary water barrier (SWB) has been installed on the roof, a receipt for its installation
- If a termite inspection has been conducted within 12 months on the home, the termite inspection report or bond issued
- Documentation regarding windows, entry doors, garage doors, and impact-rated products (such as shutters systems)
  - Owner's manuals
  - Original labels
  - Any form of verification that they are impact-rated, if applicable
- If insulating foam has been applied to the underside of the roof deck, information on the foam product used
- Any additional documentation regarding the condition of the building or prior work done to the building, such as design plans or inspection reports
- Photographic documentation of the building and any improvements (such as previous work performed, renovations, or deck construction)

Having all available information prepared for the evaluator when he/she arrives can greatly increase the accuracy and timeliness of the evaluation. When the evaluation begins, homeowners (and other parties involved in the decision-making process) should have an idea of which Mitigation Package they will implement based on available budget, perceived condition and age of the home, cost-effectiveness of retrofits, Federal assistance, and other savings. The evaluator should be able to provide preliminary advice on which Mitigation Package to consider; this can be discussed before the evaluation begins. The selected Mitigation Package will affect how invasive the evaluation will be. The evaluator should conduct a full walkthrough of the home, assessing the condition of the areas that will be retrofitted as well as the overall condition of the home. For example, if there are significantly damaged components within the roof system, the evaluator should provide a detailed description of the damage in the evaluation report, including a description of any needed repairs required before the home is a suitable wind retrofit project candidate and whether those repairs will require a professional engineer's consultation.

The following sections discuss the evaluation process for the building envelope and structure. Additional guidance on evaluating buildings before starting a wind retrofit project, including what should be documented in the building evaluation, is presented in Appendix B of this Guide.

3.1.1 Basic and Intermediate Package Evaluations

For projects implementing the Basic or Intermediate Package, the evaluation should focus mainly on the building envelope. The following building elements should be inspected and their material type and existing condition documented during the evaluation:

- **Roof system** (the roof covering and roof structural system beneath)
- **Attic ventilation systems** (soffits, ridge, off-ridge, and gable end vents)
- **Wall systems** (wall framing and coverings, including gable end walls)
- **Openings** (windows, skylights, entry doors, and garage doors)
- **Attached structures** (porches, awnings, and carports)

Evaluation of these building elements for the Basic and Intermediate Packages will usually involve only minimal disturbance to the building during the evaluation.

The evaluation will include an assessment of the existing roof covering. While the homeowner may already know whether he or she wants to replace the roof covering, the evaluation will identify whether the roof covering is in need of replacement.

The evaluation of the roof covering will determine whether the roof covering needs to be replaced as part of the wind retrofit project. A home with a roof covering assessed as having 5 or more years of remaining useful life is a candidate for retrofit options that do not require roof covering replacement. To determine the remaining useful life of the roof covering, the evaluator should use any available documentation provided by the homeowner as well as visual observations of the roof covering condition. When evaluating the roof structure, the attic will need to be accessed in most cases. The evaluator should use a handheld metal-detecting scanner to assess the existing roof deck attachments without removing the roof covering or using other invasive measures.

The evaluator should also verify whether the home already has completed any of the retrofit projects including in the Mitigation Packages. For example, a home being evaluated may already have window protection that meets the opening protection requirements of the Intermediate or Advanced Mitigation Package. The evaluator should verify that the opening protection (e.g., shutters over openings or pressure- and impact-rated windows and doors) provides the level of protection for the respective Mitigation Package as defined in Chapter 4 of this Guide, and is in a satisfactory condition (e.g., shutters are functional and are properly anchored to the building). In the case of opening protection, this is typically verified through labeling or documentation the homeowner may have for the product(s), as shown in Figure 3-1. Identifying whether the house already has any completed retrofit projects will increase the cost-effectiveness of the overall mitigation effort.

FIGURE 3-1:
Example of a window product label

3.1.2 Advanced Package Evaluations

Providing a continuous load path is a part of the Advanced Mitigation Package, but not part of the Basic or Intermediate Mitigation Packages. For the Advanced Mitigation Package, the structural connections that create a continuous load path from the roof to the foundation need to be evaluated. The evaluator will need to identify any locations where the continuous load path is broken. Some controlled, destructive actions may be necessary to access structural connections. The level of invasiveness of an assessment for the Advanced Mitigation Package will depend on the construction type and structural configuration of the home.

Regardless of which Mitigation Package is chosen, the evaluation should cover the entire building envelope and look for conditions that would limit the effectiveness of the wind retrofit project. For example, if the wall covering is deteriorated, damaged, or not sufficiently fastened to the building, performing a wind retrofit would not provide the intended level of protection.

A continuous load path is an important part of a building's ability to resist wind-related damage. The continuous load path ensures that loads applied to any part of the building can be transferred through the building from the point of application (such as the roof or exterior walls) through the structure of the building and to the foundation (see Figure 3-2). A home for which the Advanced Mitigation Package is being sought does not have to have an existing continuous load path before the wind retrofit project is performed. However, having fewer adequate structural connections capable of transferring design wind loads usually correlates to higher costs when retrofitting the home to the Advanced Mitigation Package.

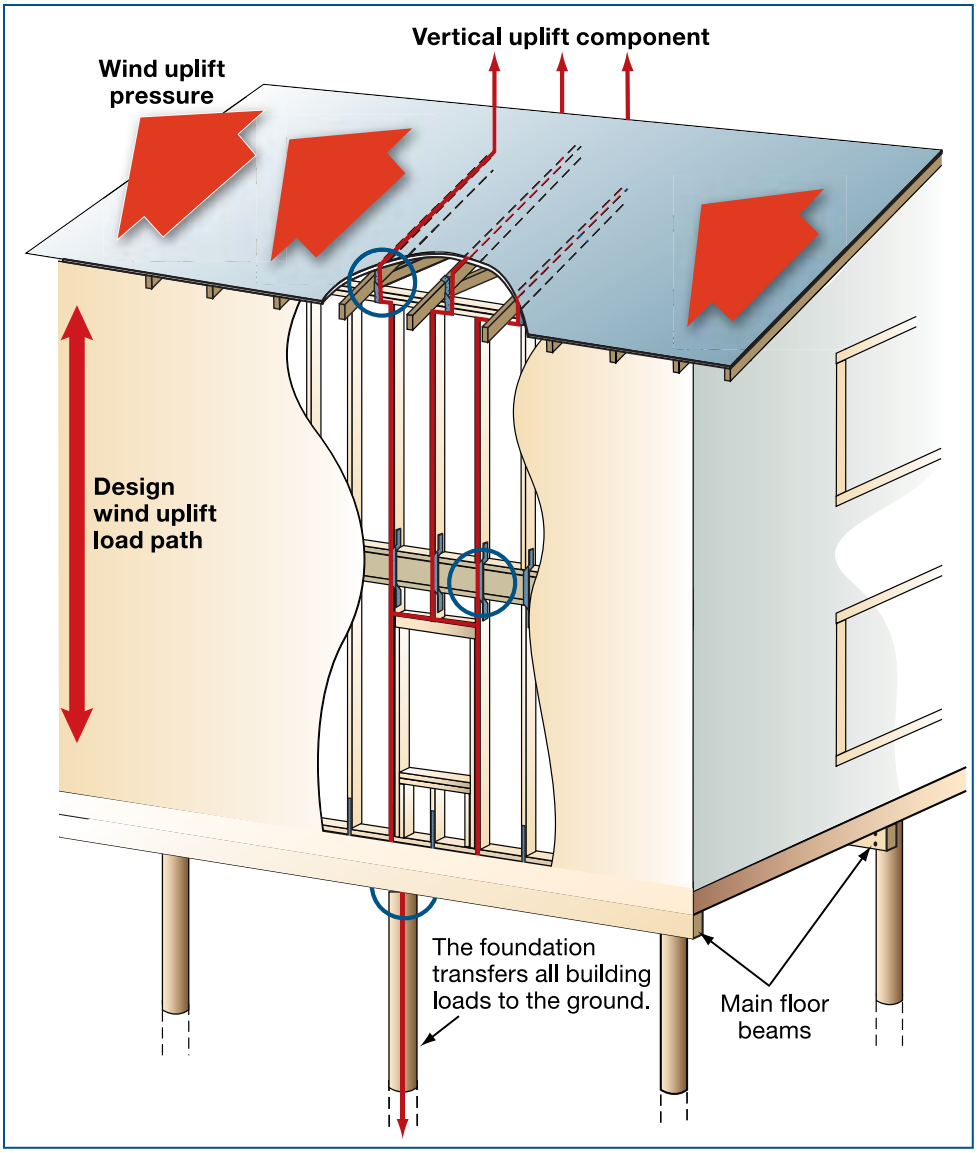

FIGURE 3-2:
Continuous load path for wind uplift of a residential, wood-frame building

3.2 Determining Whether a Home Is a Good Candidate for a Wind Retrofit Project

Once the evaluation has been completed, the evaluator and homeowner should discuss the findings of the evaluation. The evaluation process highlights any deficiencies found in the home that should be repaired to ensure that the wind retrofit project can be effectively implemented. Further, the evaluation should determine whether any prescriptive solutions provided in this Guide can be used for the project. If the evaluation finds that no prescriptive solutions apply, a design professional should be consulted to develop an engineered solution in place of the prescriptive solution. Some existing conditions may prevent the use of prescriptive solutions.

The following conditions, if found to exist in the home being evaluated, would preclude the home from prescriptive criteria in this Guide:

- Roof framing with:
  - Spacing greater than 24 inches on-center (o.c.)
  - Members less than nominal 2 inches
- Roof slope less than 2/12
- Roof deck panels less than nominal 7/16-inch thickness (for wood structural panels)
- Gable end walls with:
  - Structural panels less than nominal 7/16-inch thickness (or no structural panels)
  - Heights greater than 16 feet
- Rooftop equipment that adds significant dead load to the roof

Although any home can be mitigated, it may be in such poor condition, may have been damaged, or may have an existing condition that must be addressed for any of the proposed Mitigation Packages to be effective. In these instances, additional work may be needed before, or during, the wind retrofit project. This does not mean that such a home cannot undergo wind retrofits in accordance with this Guide, but additional effort would likely need to be expended before the home can be considered a good candidate for one of the Mitigation Packages presented in this Guide.

The outcome of the evaluation should be a report describing the evaluator's findings. The report should include a description of the existing condition of the building and a recommendation of one or more of the Mitigation Packages. If repairs are needed before the wind retrofit project can proceed, a general assessment of the work required should be provided. Some conditions, if found to exist in the home, can require extensive and invasive work and have very high associated costs. Appendix B contains further guidance on such situations.

The evaluation for a wind retrofit project may identify existing conditions that need to be remedied. Performing repairs while undergoing a wind retrofit project may be cost-effective. Chapter 5 provides further information on repair/improvement situations, as well as guidance on Federal grant funding.

In contrast, some homes may already incorporate some of the elements of the Mitigation Packages even before the retrofit process has begun. In this situation, the evaluator should verify that the existing components of the building are in accordance with the retrofits defined for the selected Mitigation Package.

It should not be assumed that an evaluator will provide a cost estimate, but doing so in coordination with the evaluation report facilitates the decision-making process for the homeowner. The evaluation report should be detailed enough for an individual with an appropriate level of building science knowledge to use it to prepare a basic cost estimate. The cost estimate should be detailed enough to provide the homeowner and other decision-making parties with enough costing information to make a decision in most cases, but for a more complete estimate, it may be necessary to obtain cost estimates from building contractors. Based on the findings of the evaluation process, the report should result in one of three determinations:

1. The prescriptive solutions in this Guide may be used for the retrofit projects. The report should identify which projects of the selected Mitigation Package can be implemented using prescriptive solutions.

2. Some of the construction elements of the retrofit projects for the Mitigation Package are already present in the home. The report should identify which portions of the home already accomplish which items of the selected Mitigation Package, and how the remainder of the items can be addressed.

3. The prescriptive solutions in this Guide cannot be used because there are existing building conditions that differ from those assumed for this Guide; therefore, at least some portion of the wind retrofit project cannot be implemented as presented in this Guide without additional effort. A registered design professional should develop a solution for retrofits to any building elements for which prescriptive solutions cannot be used.

Homes that fall under one of the first two determinations are typically the most cost-effective candidates, as less site-specific design work is needed. The third determination typically occurs when a home has a condition for which the prescriptive solutions in this Guide cannot be applied.

3.3 Deciding What Level of Protection to Achieve

Buildings are not constructed to resist all damage from hazard events. Homeowners must decide what level of risk is acceptable to them. The cost of the wind retrofit project undertaken must be weighed against the potential of losses due to wind-related damages and higher insurance premiums. Doing no work on an existing building that is not well protected from wind-related damages represents high risk and high insurance premiums (but no associated project costs), while doing extensive work to retrofit a home as much as possible from wind-related damages represents a resulting lower risk and lower insurance premiums (but higher associated retrofitting costs). The mitigation presented in this Guide provides intermediate levels of protection and associated cost. It is important to remember that, whether a home is constructed beyond the minimum requirements of building codes or is being retrofitted to improve its hazard resistance, the homeowner must decide what level of risk from high-wind events is acceptable.

Once an evaluation has been performed, the homeowner—in consultation with the evaluator—should make a final decision on the desired level of protection to achieve by the retrofits. Each level of the three Mitigation Packages described in this Guide—Basic, Intermediate, and Advanced—provides increasing resistance to wind-related damage; each level of protection can only be achieved if the retrofit projects included in the lower levels have been implemented. For instance, the level of protection provided by the Advanced Mitigation Package can only be met if the projects included in both Basic and Intermediate Mitigation Packages have been implemented.

Different buildings will be better suited to different levels of retrofitting. Newer buildings that are built to more recent codes and standards may be easier to retrofit to the Advanced Mitigation Package level of protection. As discussed in Section 3.1, some buildings may even already meet one or more of the levels of mitigation described in this Guide. Further, a home may meet some of the criteria of one or more of the Mitigation Packages, and implementing the remaining retrofit projects may be a cost-effective solution. On the other hand, retrofitting an older building to provide a continuous load path, as required when applying the Advanced Mitigation Package, may not be cost effective.

When considering whether to undertake a retrofit project, homeowners should consider all of the benefits and costs of the project. The benefits and costs associated with implementing a wind retrofit project should be effectively conveyed by the evaluator and well understood by the homeowner before a decision is made. Some factors to consider when understanding the costs and benefits include the following:

Costs

The total cost for the wind retrofit project. The cost of the project is often the primary factor when determining whether to undertake a wind retrofit project and which Mitigation Package to implement. The project cost will be affected by several factors, one of which is whether the prescriptive solutions of this Guide are applicable for the project. If prescriptive solutions cannot be used for the project, then the services of a design professional will need to be obtained to develop specific solutions. This may result in higher costs for the project. Other factors that affect the project cost are the level of protection chosen (i.e., which Mitigation Package will be implemented) and the location of the home (which can affect opening protection and design wind speed requirements).

Compliance with codes and local building departments. Modern building codes contain provisions for existing buildings that, when triggered by proposed work on the home, may require additional work. Similarly, requirements of local building departments can vary, and in some circumstances can place additional requirements on the wind retrofit project process. The evaluator should have a good understanding of the applicable building code provisions and local permitting and inspection requirements, because these are often specific to the community in which the project is being performed. Section 5.2 further discusses these issues.

Effects of construction. When considering a wind retrofit project, homeowners should consider that they may be displaced for a short time. While the displacement may not last long, there are costs and other obstacles associated with being displaced that the homeowner should take into account, even if it is only for a few days.

Benefits

Damage resistance. The reduction in anticipated damages for retrofitted houses is a quantifiable benefit to society and the individual. Homes that survive high-wind events achieve the benefits of avoided building damages, reduced damage to building contents, and reduced or no displacement of the occupants. When a BCA is performed for a home undergoing a wind retrofit project, these benefits are taken into account to determine the cost effectiveness of the project.

Wind hazard insurance plans and premiums. Homes in areas prone to high-wind events generally have homeowners' insurance policies that include coverage for wind damage. For these homes, risk-based premiums should account for the higher risk the home faces due to its location, as well as the increased likelihood and greater severity of losses after frequent high-wind events. Many insurance companies encourage their policyholders to retrofit their homes to resist wind-related damage, and some companies have established discount programs to reduce premiums, or other types of financial incentives, to reflect the risk reduction for homes that have been properly retrofitted. Some State insurance departments

also have put in place insurance discount programs for properly retrofitted homes. The IBHS FEH program has been designed with the support of IBHS member insurance companies, although each individual company makes its own decisions about how it is implemented.

Federal assistance through HMA grant programs. As described in Chapter 5, homeowners can obtain Federal funding assistance for hazard mitigation projects. Through FEMA's HMA grant programs, applications for an individual home or groups of homes undergoing wind retrofit projects can be submitted for approval. If applications are approved, Federal funding is provided for 75 percent of the total project cost, significantly reducing the homeowner's expenses for the project. The remaining 25 percent of eligible project costs can be paid for directly, or covered by donated labor, time, and materials. Consult FEMA's HMA Unified Guidance for more details on cost sharing. More information on Federal assistance through HMA programs can be found in Chapter 5.

Homeowners should consider both qualitative and quantitative benefits and costs when deciding on a wind retrofit project. To apply for Federal assistance through HMA programs (as described in Chapter 5), an analysis or comparison of the benefits to society compared to the cost of the project must be conducted. Benefits such as reduced insurance premiums are not considered in the equation because they are an individual benefit. To assist in the process of calculating the quantitative benefits and costs, the FEMA BCA Tool was created to provide a consistent approach for this determination (refer to Appendix C for additional information on using the FEMA BCA Tool). Communities are encouraged to use the software, regardless of whether they will apply for Federal funding or not. The software will calculate benefits gained by performing the project, such as avoided damage to the home, avoided displacement costs, and avoided loss of building contents. The evaluation report discussed in Section 3.2 should identify all of the necessary input data needed for using the FEMA BCA Tool. Appendix C provides a step-by-step guide to using the FEMA BCA Tool to evaluate the cost effectiveness of a wind retrofit project.