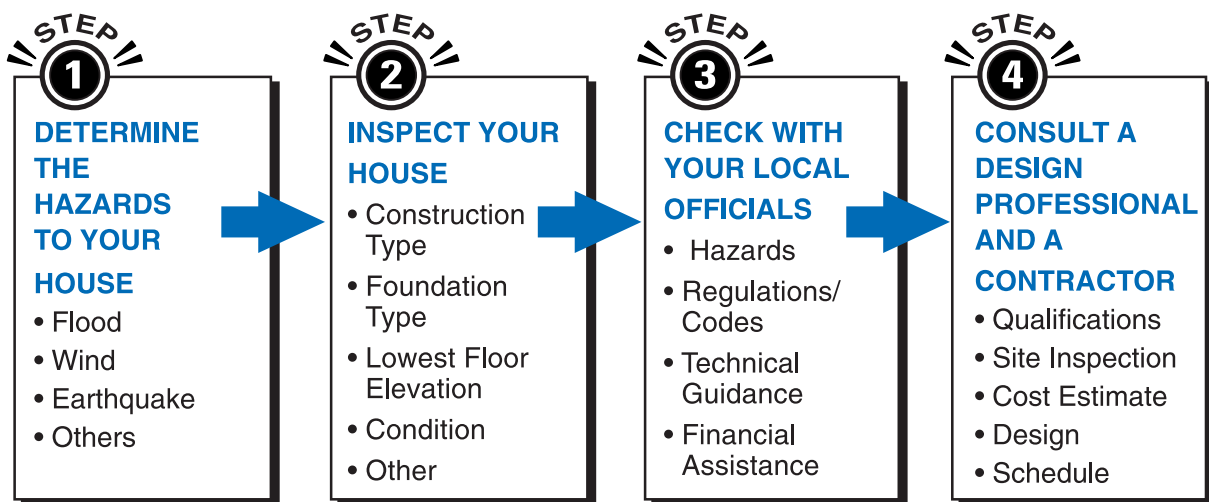


Deciding Which Method Is Right for Your House

Introduction

With the information from Chapters 2 and 3, you are ready to decide which retrofitting method is right for your house. Your decision will be based primarily on legal requirements, the technical limitations of the methods, and cost. Other considerations might include such things as the appearance of the house after retrofitting and any inconvenience resulting from retrofitting. Making a decision involves four steps:



The four steps are described in the next section. At the end of this chapter you will find a retrofitting checklist that will help you work with local officials, design professionals, and retrofitting contractors. The checklist includes places where you can record the results of Steps 1 and 2, important questions you should ask, and decision making matrixes that will help you choose a retrofitting method. Before you go any further, you may want to make a copy of the checklist (see pages 76 through 82) so that you can begin filling it out.

**NOTE**

The results of Steps 1 and 2 will help your local official advise you and will also be useful when you consult a design professional or retrofitting contractor.

**DEFINITION**

A **tsunami** is a great sea wave produced by an earth movement or volcanic eruption.

Making Your Decision

Step 1 – Determine the Hazards to Your House

If you are using this guide, it is probably because your house has been damaged by flooding or because you know that your house is in a flood hazard area. Information about flooding in your area is available from local officials, as discussed later in Step 3. But if your house has been flooded, review what you already know. Look at the section of the checklist for Step 1. Answer as many of the questions as you can. Local officials, design professionals, and contractors can use the information you provide, along with the flood hazard information developed by the Federal Emergency Management Agency (FEMA) and other agencies and organizations, to advise you about your retrofitting options.

You also need to be aware of other hazards, such as high winds (see Figure 4-1), earthquakes (see Figure 4-2), fires, landslides, and **tsunamis**. If your house is in an area subject to one or more of these hazards, your retrofitting project should take the additional hazards into account. For example, as discussed in Chapter 3, elevating a house may make it more susceptible to high winds and earthquakes. As a result, the foundation may need to be reinforced and the connections between the foundation, walls, and roof may need to be strengthened as part of the retrofitting project. Depending on the nature of the hazards and your choice of retrofitting methods, State and local regulations may require that additional changes be made to your house, beyond those necessary for flood protection. Your local officials can tell you if such requirements apply and can give you more information.

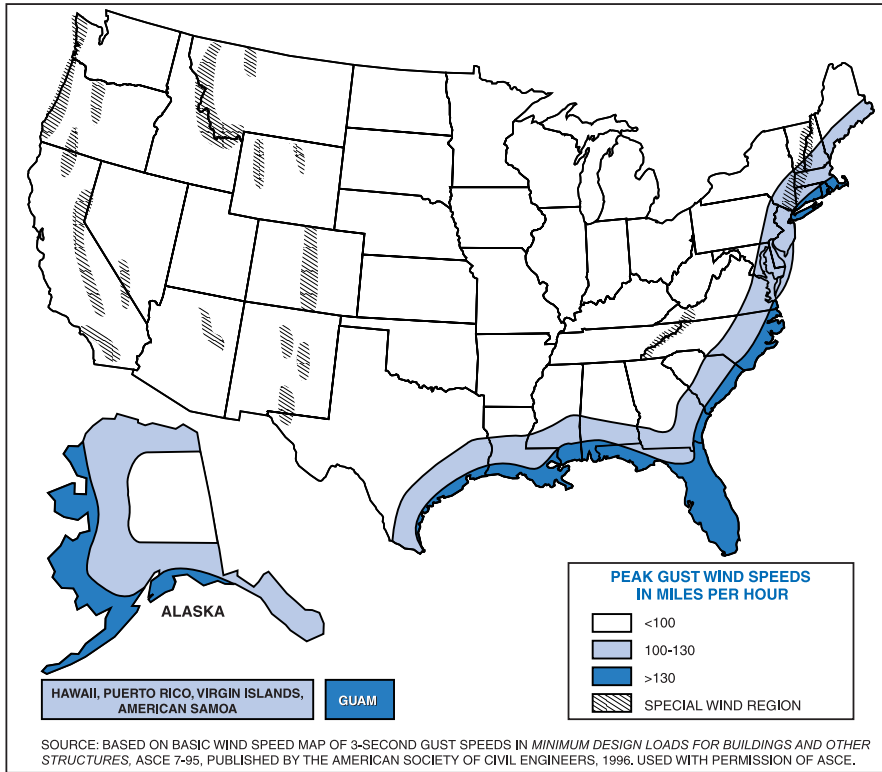


Figure 4-1
Peak gust wind speeds
in the United States.

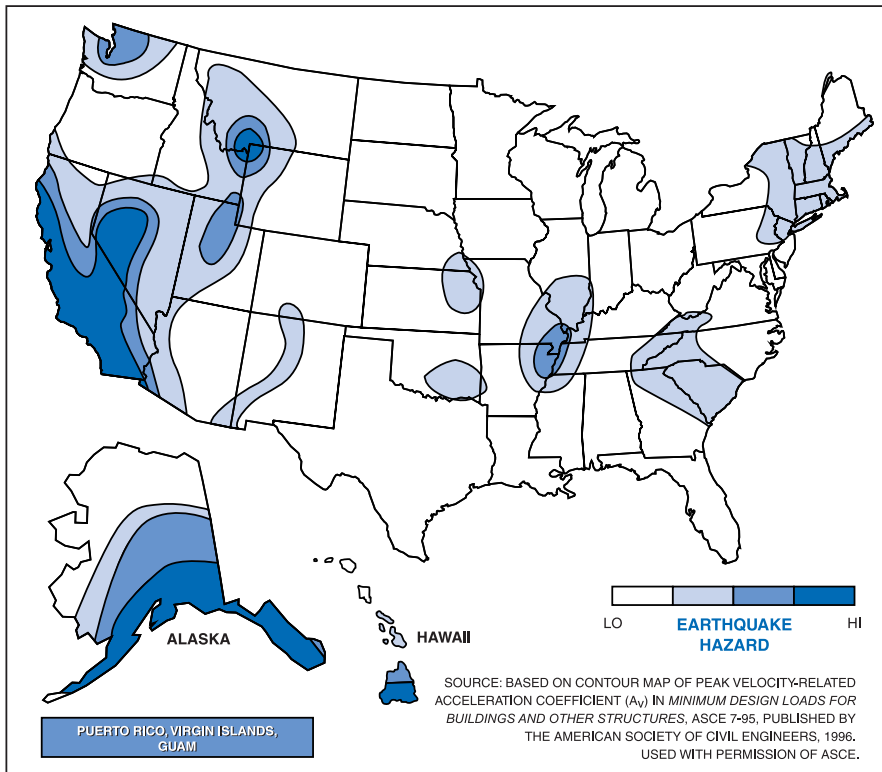


Figure 4-2
Earthquake hazards in
the United States.

Step 2 – Inspect Your House

The discussion in Chapter 3 may have prompted you to begin thinking about your house, specifically how it is constructed and the type of foundation it has. Before you check with your local officials or consult a design professional and contractor, you should inspect your house and fill out the section of the checklist for Step 2. Four characteristics of your house that are particularly important in retrofitting are construction type, foundation type, lowest floor elevation, and condition. (When you fill out the portion of the checklist concerning construction and foundation type, you may want to refer to the descriptions that begin on page 35, in Chapter 3.)



WARNING

If you are retrofitting a house that has been substantially damaged or is being substantially improved, your community's floodplain management ordinance or law will not allow you to have a basement, as defined under the National Flood Insurance Program (NFIP). The NFIP regulations define a basement as “any area of the building having its floor subgrade on all sides.” If your house has such a basement, you will be required to fill it in as part of any elevation project. Note that the NFIP definition of basement does not include what is typically referred to as a “walk-out-on-grade” basement, whose floor would be at or above adjacent grade on at least one side.

Construction Type

As explained in Chapter 3, the construction type for most houses will be frame, masonry veneer, masonry, modular home, manufactured home, or a combination of two or more of these types. The following generalizations can be made about the effect of construction type on retrofitting:

- The most appropriate elevation technique for frame houses, and manufactured homes usually is to elevate on extended foundation walls or open foundations.
- The most commonly used elevation technique for masonry houses usually is either (1) to extend the walls of the house upward and raise the lower floor or (2) abandon the lowest floor and move the living area to an upper floor.
- Frame houses, masonry veneer houses, and manufactured homes are easier to relocate than masonry homes.
- Masonry and masonry veneer houses are usually easier to dry floodproof than other types of houses, because masonry is a more flood-resistant material than the materials used in other types of houses.

Foundation Type

As explained in Chapter 3, most houses of the construction types listed above are built on a basement, crawlspace, slab-on-grade, or open foundation or on a combination of two or more of these types. The following generalizations can be made about the effect of foundation type on retrofitting:

- Slab-on-grade houses are more difficult to elevate than houses on basement or crawlspace foundations.

- Elevating houses on basement foundations normally involves elevating or relocating utility system components usually found in basements, such as furnaces and hot water heaters.
- Houses on basement foundations should not be dry floodproofed or protected by levees or floodwalls unless an engineering evaluation conducted by a design professional shows that it is safe to do so. This precaution is necessary because neither dry floodproofing nor the construction of levees or floodwalls prevents saturated soils from pressing on basement walls. This pressure, which is unequalized because water is not allowed to enter the basement, can damage basement walls or even cause them to fail.
- For some houses on basement foundations, the same type of engineering evaluation is a necessary part of a wet floodproofing project. If the house is in an area where saturated soils begin to press on basement walls before water enters the basement, the unequalized pressure may damage walls or cause them to fail. If wet floodproofing is to be used in this situation, the engineering evaluation must show that the basement walls can resist the expected pressure.

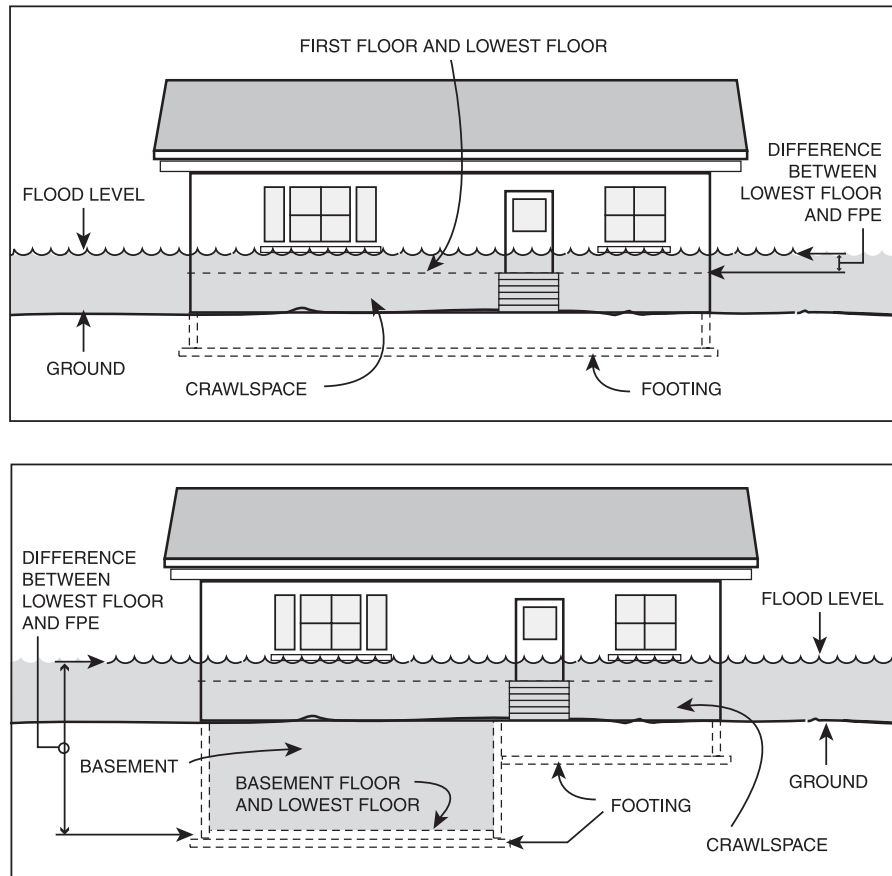
Lowest Floor Elevation

As noted in Chapter 3, the “lowest floor” of your house, as defined by your community’s floodplain management ordinance or law, is not necessarily the first or finished floor. For example, the lowest floor could be the floor of a basement or the floor of an attached garage. As shown in Figure 4-3, the location of your lowest floor can vary with foundation type. For houses that are to be elevated, wet floodproofed, or dry floodproofed, the difference between the elevation of the lowest floor and the Flood Protection Elevation (FPE) determines how high the house must be elevated or how high the wet or dry floodproofing protection must reach. In general, as the difference between the lowest floor elevation and the FPE increases, so does the cost of elevating, wet floodproofing, or dry floodproofing. This difference is particularly significant for dry floodproofing. As noted in Chapter 3, even masonry walls should not be dry floodproofed higher than 3 feet unless a structural evaluation by a design professional shows that it is safe to do so.

The elevation of your lowest floor can be established by a survey, which may be necessary as part of your retrofitting project. But even if you do not know your lowest floor elevation, you can estimate the difference between it and the FPE. If you haven’t yet decided on an FPE, don’t worry. Your conversations with your local officials, contractors, and design professionals will help you determine the level of flood protection you

should provide. Remember, if your house has been substantially damaged or is being substantially improved according to your community's floodplain management ordinance or law, your FPE must be at least equal to the Base Flood Elevation (BFE). As explained in Step 3, your local officials can tell you about this requirement.

Figure 4-3
Difference between flood level and lowest floor in houses on crawlspace and basement foundations.



Condition

Your design professional or contractor should conduct a detailed inspection of your house before beginning any retrofitting work. You can help by first conducting your own assessment of the condition of your house and recording any information you have about past or current damage. This information may also be helpful to community officials who advise you about floodplain management and building code requirements and appropriate retrofitting methods.

If your house has been damaged by a flood, hurricane or other high-wind event, earthquake, fire, or other disaster, make a note of the extent of the damage, when it occurred, and whether it was repaired. If repairs were made, make a note of who made them and describe what was

done. Any structural damage and repairs to walls, floors, foundations, and roofs is particularly important. You should also describe any damage resulting from other causes, such as foundation settlement, dry rot, and termite damage. Your goal is to give your design professional and contractor as much information as possible so that they can determine how the condition of your house will affect your choice of a retrofitting method.

Other Considerations

In addition to construction type, foundation type, and lowest floor elevation, you should make note of interior and exterior service equipment that must be protected as part of your retrofitting project. Interior service equipment must be protected if you wet floodproof your house. This equipment includes furnaces, heating and air conditioning ductwork, hot water heaters, large appliances, and electrical system components such as service panels, outlets, and switches. Exterior service equipment must be protected if you elevate, wet floodproof, or dry floodproof and, in some situations, if you build a levee or floodwall. This equipment includes air conditioning and heat pump compressors and electric and gas meters.

In a house that is dry floodproofed, all openings below the FPE must be sealed, including not only doors and windows but also the openings for water pipes, gas and electric lines, dryer vents, and sump pump discharge pipes. In a house that is dry floodproofed, wet floodproofed, or protected by a levee or floodwall, backflow valves must be installed on all water and sewer lines with openings below the FPE. These valves prevent flood waters and wastewater from backing up into your house. Chapter 8 describes how to protect interior and exterior service equipment.

Step 3 – Check with Your Local Officials

This is a particularly important step. Your local officials will have copies of the Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) published for your community by FEMA. Your officials will be able to tell you whether your house is in your community's regulatory floodplain and, if so, the BFE at the location of your house. They may also have information about flood conditions near your house, including flow velocity, the potential for wave action and debris flow, rates of rise and fall, warning time, and duration of inundation.

Local officials will inform you of Federal, State, and local regulations, codes, and other requirements that can determine what retrofitting methods you will be allowed to use and how changes can be made to your house. They can also tell you about Federal, State, and local programs that provide financial assistance for homeowner retrofitting projects, and they can help



NOTE

Professional termite exterminators will often perform free or low-cost inspections for termite damage.

**NOTE**

Be sure to ask local officials about State or local freeboard requirements that may apply to your retrofitting project.

you determine whether you are eligible for such assistance. With the information you recorded in Steps 1 and 2, local officials may also be able to advise you about the most appropriate retrofitting method for your house. The officials you need to talk to will depend on how your community has assigned responsibilities for floodplain management and construction permitting. If you do not know who has these responsibilities in your community, you should begin with an official such as a city clerk, mayor, or county administrator.

Remember to contact your State Historic Preservation Office (see Appendix E) if your property is 50 or more years old and you are receiving Federal financial assistance for your retrofitting project. Your local officials may not be aware of this requirement if they do not normally deal with federally assisted projects.

When you talk to your local officials, be sure to do the following:

- Bring this guide with you.
- Bring your completed retrofitting checklist.
- Discuss what you already know about your house and the hazards that affect it.
- Work through the points listed in the section of the checklist for Step 3.
- Ask any other questions you may have.
- Work through the decision making matrix with the official. Use the matrix that applies to your situation: Substantial Damage/Substantial Improvement or No Substantial Damage/No Substantial Improvement.
- Take notes about everything you discuss.

Remember that your goal is to find out what you can legally do to retrofit your house, identify the requirements you must comply with throughout the retrofitting process, and eliminate retrofitting methods that do not meet your needs. You may find that the restrictions and requirements of Federal, State, and local regulations will eliminate some retrofitting methods from consideration. Ultimately, your decision will be based on technical limitations of the methods, cost, and other considerations, such as the effect that retrofitting will have on the appearance of your house. The decision making matrix will help guide you through this process.

Your next step, whether you have chosen one method or are considering two or more, is to consult a properly licensed, bonded, and insured design professional and retrofitting contractor.

Step 4 – Consult a Design Professional and Contractor

To complete this step, you will need to know what types of services are required for your retrofitting project and how to evaluate and select contractors and design professionals.

You will probably need the services of a contractor regardless of the retrofitting method you select. The type of contractor you hire will depend on the method. You will probably also need to consult a design professional, such as a structural engineer. Alternatively, you can hire a general contractor who will arrange for all the necessary services, including those of a design professional. Table 4.1 shows the types of contractors and design professionals that may be required for each of the retrofitting methods.

Knowing the types of services required for your retrofitting project is important, but so is making sure that your design professional and contractor are reputable and competent.

If you have used a licensed design professional and a licensed contractor in the past and were satisfied with the work, use them again. Even if they do not provide the types of services you now need, they may be able to recommend someone who can. Otherwise, you can check the Yellow Pages or call or write to the professional association that represents the types of specialists you are looking for. Appendix F contains a list of the addresses and telephone numbers of several of these associations. They can usually give you a list of members in your area who specialize in the type of work you need. Before you hire a design professional or a contractor, you should check with your local Better Business Bureau, consumer protection agency, or licensing authorities. These organizations can tell you whether there have been any complaints about the quality of the design professional's or contractor's past work, including whether the work was completed on time.

Next, you will need to meet with the contractor and design professional to discuss your project. At the meeting, be sure you do the following:

- Provide the information you collected in Steps 1, 2, and 3.
- Ask the questions listed on the checklist at the end of this chapter, as well as any others you may have.
- Verify that the contractor is licensed, bonded, and insured as required by State and local laws.
- Verify that the design professional is licensed and registered in the state where the work will be done.



WARNING

Areas recovering from floods are often prime targets for less-than-honest business activities. Here are some pointers that can help you avoid problems:

Beware of “special deals” offered after a disaster by contractors you don’t know.

Beware of unknown contractors who want to use your house as a “model home” for their work.

Do not sign any contract under pressure by a salesperson. Federal law requires a 3-day cooling-off period for unsolicited door-to-door sales of more than \$25.

Beware if you are asked to pay cash on the spot instead of with a check made out to the name of a business.







REQUIREMENTS FOR CONTRACTOR AND DESIGN PROFESSIONAL SERVICES

Table 4.1



WARNING

Never sign a blank contract or one with blank spaces. You may want to have your attorney check the contract if a large amount of money is involved.

METHOD	NEED FOR CONTRACTOR AND/OR DESIGN PROFESSIONAL	PRIMARY SERVICES
 ELEVATION	Design Professional	Evaluating the condition, stability, and strength of the existing foundation to determine whether it can support the increased load of the elevated house, including any wind and seismic loads
	Contractor: House Elevation Contractor	Disconnecting utilities, jacking the house up, increasing the height of the foundation, and connecting utilities
 WET FLOOD-PROOFING	Design Professional	Designing any necessary replacements of vulnerable structural materials and relocated utility systems.
	Contractor: General Construction Contractor	Replacing vulnerable structural and finishing materials below the FPE with flood-resistant materials, raising utilities and appliances to a location above the FPE, and installing openings required to allow the entry of floodwaters
 RELOCATION	Design Professional	Designing any new building, foundation, and site improvements that may be required, such as new utility systems.
	Contractor: House Moving Contractor	Jacking the house up, moving it to the new site, and installing it on the new foundation
	Contractor: General Construction Contractor	Preparing the new site (including grading, foundation construction, and utilities) and cleaning up the old site (including demolition)
 DRY FLOOD-PROOFING	Design Professional	For masonry walls to be dry floodproofed higher than 3 feet and for masonry veneer or frame walls to be dry floodproofed higher than 2 feet, evaluating the condition, stability, and strength of the existing walls to determine whether they can withstand the pressure from flood waters at the FPE; designing or selecting flood shields for openings
	Contractor: General Construction Contractor	Applying waterproof sealants and membranes, installing flood shields over openings below the FPE, installing backflow valves in sewer and water lines, and, if necessary, bracing or modifying walls so that they can withstand the pressure from flood waters at the FPE
 LEVEES AND FLOODWALLS	Design Professional	Assessing the adequacy of soils at the site, preparing the engineering design to ensure that the levee or floodwall, including any closures required, will be structurally stable under the expected flood loads and will be able to resist erosion, scour, and seepage
	Contractor: General Construction Contractor	Constructing the levee or flood wall
 DEMOLITION	Design Professional	Designing any new building, foundation, and site improvements that may be required, such as new utility systems
	Contractor: Demolition Contractor	Disconnecting and capping utility lines, tearing down the damaged house, hauling away debris, and cleaning up the old site
	Contractor: General Construction Contractor	Building the new house on the new site (May also be able to do all demolition work.)

- Ask for proof of insurance. If the contractor or design professional does not have disability and worker's compensation insurance, you may be liable for accidents that occur on your property.
- Ask for references. Reputable contractors and design professionals should be willing to give you the names of previous customers. Call some of them and ask how well they were satisfied with the work. Ask if they would hire the contractor or design professional again.
- If you are trying to decide between two or more retrofitting methods, discuss your preferences and ask for more information.

Any contractor or design professional you hire will need to conduct a site visit to inspect your house and determine how the work should be carried out. During the site visit, you should expect your contractor or design professional to check the structural condition of your house and determine what changes will be required by the retrofitting method you choose. If you agree on a method and decide to proceed with the project, be sure to do the following:

- Get a written, signed, and dated estimate. It should cover everything you expect to be done. (Some contractors and design professionals will charge a fee for this service.)
- Decide whether you, the contractor, or the design professional will obtain the necessary permits.
- Ask for a warranty or guarantee. Any warranty or guarantee from the contractor or design professional should be written into the contract. The contract should clearly state the terms of the warranty or guarantee, who is responsible for honoring it (such as a manufacturer or the contractor), and how long it will remain valid.
- Get a written contract. It should be complete and clearly state all work to be done, the estimated cost, the payment schedule, and the expected start and completion dates for the work.

**WARNING**

Areas recovering from floods are often prime targets for less-than-honest business activities. Here are some pointers that can help you avoid problems:

Check with your local Better Business Bureau, consumer protection agency, or licensing authorities before you hire a contractor.

Ask contractors for references. A reputable contractor should be able to give you a list of past clients in your area who can comment on the quality of the contractor's work.

**WARNING**

Do not sign completion papers or make the final payment until all work is completed to your satisfaction.

RETROFITTING CHECKLIST

Use this checklist when you follow the four steps described in this chapter. The information you record here will help you work with local officials, contractors, and design professionals; use the decision making maxtrixes that follow this checklist; and decide which retrofitting method is right for your house.

Step 1 – Determine the Hazards to Your House

1. How long have you lived in your house? ___ years
2. Was your house ever flooded during that time? ___ yes ___ no
(If your answer is yes, go to question 3; if your answer is no, go to question 14.)
3. How many times has your house been flooded? _____
4. What were the dates of flooding?

Flood #1 _____**Flood #2** _____**Flood #3** _____**Flood #4** _____**Flood #5** _____

For each flood, answer questions 5 through 13 as best you can.

5. To your knowledge, were frequencies assigned to any of the floods (for example, 50-year flood, 100-year flood)? If so, what were they?

Flood #1 _____**Flood #2** _____**Flood #3** _____**Flood #4** _____**Flood #5** _____

6. How high did the flood water rise in your house? (If you can, state the height of the water above the lowest floor, including the basement floor.)

Flood #1 _____**Flood #2** _____**Flood #3** _____**Flood #4** _____**Flood #5** _____

7. About how long did your house remain flooded? (You can give your answer in days, weeks, or months, as appropriate.)

Flood #1 _____**Flood #2** _____**Flood #3** _____**Flood #4** _____**Flood #5** _____

8. Did you have any warning before your house was flooded? If so, how much warning?
 (You can give your answer in days or hours as appropriate.)

- Flood #1** ___ No Warning ___ Warning _____ Days / Hours
- Flood #2** ___ No Warning ___ Warning _____ Days / Hours
- Flood #3** ___ No Warning ___ Warning _____ Days / Hours
- Flood #4** ___ No Warning ___ Warning _____ Days / Hours
- Flood #5** ___ No Warning ___ Warning _____ Days / Hours

9. Did the flood waters cause scour and/or erosion around your house or elsewhere on your lot?
 If so, describe the effects.

Flood #1 ___ No Erosion/Scour Occurred ___ Erosion/Scour Occurred
 Description _____

Flood #2 ___ No Erosion/Scour Occurred ___ Erosion/Scour Occurred
 Description _____

Flood #3 ___ No Erosion/Scour Occurred ___ Erosion/Scour Occurred
 Description _____

Flood #4 ___ No Erosion/Scour Occurred ___ Erosion/Scour Occurred
 Description _____

Flood #5 ___ No Erosion/Scour Occurred ___ Erosion/Scour Occurred
 Description _____

10. Was your house damaged by wave action or the impact of ice or other floodborne debris?
 If so, describe the damage.

Flood #1 ___ No Waves or Debris ___ Waves ___ Debris
 Description of Damage _____

Flood #2 ___ No Waves or Debris ___ Waves ___ Debris
 Description of Damage _____

Flood #3 ___ No Waves or Debris ___ Waves ___ Debris
 Description of Damage _____

CHAPTER 4

Flood #4 ___ No Waves or Debris ___ Waves ___ Debris
Description of Damage _____

Flood #5 ___ No Waves or Debris ___ Waves ___ Debris
Description of Damage _____

11. How difficult and/or expensive was cleaning up after the flood waters receded? (If you can, describe what you had to do to clean up both inside your house and around your lot, how long the cleanup took, and how much you spent on cleanup.)

Flood #1 Cleanup Description _____
_____ Cost \$ _____ Time _____

Flood #2 Cleanup Description _____
_____ Cost \$ _____ Time _____

Flood #3 Cleanup Description _____
_____ Cost \$ _____ Time _____

Flood #4 Cleanup Description _____
_____ Cost \$ _____ Time _____

Flood #5 Cleanup Description _____
_____ Cost \$ _____ Time _____

12. What was the total cost to repair all flood damage, not including the cleanup costs listed above?

Flood #1 \$ _____	Flood #4 \$ _____
Flood #2 \$ _____	Flood #5 \$ _____
Flood #3 \$ _____	

13. What was the total value of all house contents (furnishings, belongings, etc.) damaged by flooding?

Flood #1 \$ _____	Flood #4 \$ _____
Flood #2 \$ _____	Flood #5 \$ _____
Flood #3 \$ _____	

14. Is your house either in or near one of the shaded areas on the wind hazard map in Figure 4-1?
 ___ yes ___ no

15. Has your house ever been damaged by a hurricane or other high-wind event?
 ___ yes ___ no. If your answer is yes, note how many times and describe both the damage and the repairs made.

16. Is your house either in or near one of the shaded areas on the earthquake hazard map in Figure 4-2? ___ yes ___ no

17. Has your house ever been damaged by an earthquake? ___ yes ___ no. If your answer is yes, note how many times and describe both the damage and the repairs made.

18. Has your house ever been damaged by other hazard events, such as fires or landslides?
 ___ yes ___ no. If your answer is yes, note how many times and describe both the damage and the repairs made.

Step 2 – Inspect Your House

Provide as much of the following information as you can about your house.

1. When was your house built? ____
2. Construction type (see page 35.) Check as many as apply: ____ frame ____ masonry veneer
____ masonry ____ manufactured home
3. Foundation type (see page 36.) Check as many as apply: ____ basement (subgrade on all sides)
____ walkout-on-grade basement ____ crawlspace ____ slab-on-grade
____ piers ____ posts/columns ____ pilings
4. Describe any other damage and repairs to your house other than those you described in Step 1. Other damages would include foundation settlement, dry rot, and termite damage.

To answer questions 5 through 9, you will need to have at least a rough idea of the FPE for your retrofitting project. If you don't have enough information to answer these questions now, go to Step 3 and determine your FPE when you talk with your local official(s).

5. Approximate difference between elevation of lowest floor (including basement) and Flood Protection Elevation (FPE) (see Figure 4-3): ____ feet
6. Interior utilities below the FPE (check as many as apply): ____ furnace ____ ductwork
____ hot water heater ____ electrical panel ____ electrical outlets ____ electrical switches
____ baseboard heaters ____ sump pumps
other _____
7. Exterior utilities below the FPE (check as many as apply): ____ air conditioning /heat pump
compressor ____ electric meter ____ fuel tank ____ septic tank ____ well ____ gas meter
other _____
8. Major appliances below the FPE (check as many as apply): ____ washer ____ dryer
____ refrigerator ____ freezer
other _____
9. How many drains (such as sink, tub, and floor drains) and toilets are below the FPE?

Step 3 – Check with Local Officials

When you meet with your local official(s), be sure to discuss the issues below. Also, make note of the information you receive. (You may find that you will need to talk with more than one person to get all the information you need.)

1. Explain your retrofitting needs, go over the information you recorded in Steps 1 and 2, and discuss any preferences you may have regarding the retrofitting methods described in Chapter 3.
2. Provide the official with photographs of your house and a copy of a plat map that shows the dimensions of your lot and the location of your house. If you do not have a plat map, ask how you can get one.
3. Ask whether your house is in the regulatory floodplain. If the answer is yes, ask what the BFE is at your house and whether your house is in the floodway or Coastal High hazard Area (V zone). Ask whether any restudies or revisions are underway that might provide updated flood hazard information for the area where your house is located. Also, ask for additional flood hazard information concerning characteristics such as flow velocity, the potential for wave action and debris flow, rates of rise and fall, warning time, and duration of inundation. This additional information may be useful to your design professional.
4. Ask whether your community's regulatory requirements concerning substantially damaged and substantially improved structures apply to your house. (See the definitions of substantial damage and substantial improvement on page 20 and the discussion on page 28.)
5. Ask whether your house is subject to high-winds, earthquakes, and other hazards, such as wildfires. Refer to the maps in Figures 4-1 and 4-2.
6. Ask whether your state and/or community enforces building codes or other regulations that could affect your retrofitting decision, including any floodplain management regulations more stringent than those required by the NFIP. For example, ask whether the state or community requires freeboard for flood protection measures.
7. In your discussion of building codes, ask whether retrofitting will require that you upgrade other components of your house (such as electrical and plumbing systems) to meet current code requirements.
8. Ask about the types of permits and fees that may be required in connection with any retrofitting methods you are considering.
9. Ask whether the official is aware of any Federal, State, or local historic preservation regulations affecting your property. Follow-up by contacting your State Historic Preservation Office (see Appendix E) to be sure that your retrofitting project is in compliance with all preservation laws.
10. Ask about Federal, State, and local programs that provide financial assistance for homeowner flood protection retrofitting projects. Ask whether you are eligible for assistance.
11. Go through the appropriate decision making matrix (see pages 83-86) with the official and discuss any questions you may have about the advantages and disadvantages of the alternative retrofitting methods.
12. Ask for any guidance that local officials can provide to help you find a good contractor or design professional.

Step 4 – Consult a Design Professional and Retrofitting Contractor

Initial Meeting

1. Explain your retrofitting needs; go over the information you recorded in Steps 1 and 2; discuss the results of your meeting with your local official(s), including the decision making matrix; and discuss any preferences you may have regarding retrofitting methods.
2. Verify that the contractor is licensed, bonded, and insured as required by State and local laws.
3. Verify that the design professional is licensed and registered in the state where the work will be done.
4. Ask for references and proof of proper bonds and insurance, including disability and workers' compensation.
5. Decide whether you, the design professional, or the contractor will be responsible for obtaining and managing the work of subcontractors and for obtaining all permits required by State and local agencies.
6. Schedule a site visit.

Site Visit

1. Ask the contractor or design professional to tell you about any characteristics of your house or lot that would affect your selection of a retrofitting method.
2. Once you decide on a retrofitting method, ask for a written estimate of the project cost and schedule.

Contract

1. If you are satisfied with the cost estimate and schedule, get a written, signed, and dated contract that describes the work to be done and states the estimated cost, the payment schedule, and the start and completion dates of the work.
2. Ask whether the contractor will provide a warranty or guarantee for the work performed. Any warranty or guarantee should be written into the contract. The contract should state the terms of the warranty or guarantee, who is responsible for honoring it, and how long it will remain valid.

Notes




Decision Making Matrix

Condition: Substantial Damage / Substantial Improvement

This matrix can help you decide which retrofitting method best meets your needs. You may need guidance when using the matrix, so take it with you when you meet with local officials and contractors/design professionals.

Because your house either has been substantially damaged or is being substantially improved, the National Flood Insurance Program regulations limit your choice of retrofitting methods to elevation, relocation, wet floodproofing, or demolition. Regulations, ordinances, or laws established by other agencies and organizations may further limit your choice. Also, you may have already decided that one or more methods will not meet your needs. The first step in using the matrix is to identify any methods eliminated by regulations or by your own needs. Mark each eliminated method by placing an “X” in the box directly below the name of the method (on the line labeled “Prohibited by Federal, State, or Local Regulations or Eliminated by Law”). An “X” in this row means that the method will not be considered in your decision.

The next step is to evaluate the remaining methods (those without an “X” under their names). Your evaluation will be based on the factors listed on the left hand side of the matrix. (The factors are explained on the back of this page.) For each evaluation factor under each method, discuss your concerns with your local official, design professional, and contractor. If your concerns cannot be resolved, place an “X” in the appropriate box. For example, if you decide that you would not be satisfied with the appearance of your house if it were elevated on extended foundation walls, you would place an “X” in the box on the *Appearance* line under the heading *Elevation on Extended Foundation Walls*. After you have worked through the entire matrix, add the number of “X’s” under each method and show the sum on the *Total “X’s”* line. The method with the lowest total is the one that best meets your requirements.

RETROFITTING METHODS						
Substantially Damaged or Substantially Improved Houses						
EVALUATION FACTORS	ELEVATION			RELOCATION	WET FLOOD-PROOFING ¹	DEMOLITION
	 Elevation On Extended Foundation Walls	 Elevation On Open Foundation	 New Living Area Over Abandoned First Floor			
Prohibited by Federal, State, or Local Regulations or Eliminated by Homeowner						
Appearance						
Cost						
Accessibility						
Code-Required Upgrades						
Human Intervention						
Other						
TOTAL “X’s”						

¹ Wet floodproofing is allowed only if the part of your house below the BFE is used solely for parking, storage, or building access.

EVALUATION FACTORS

Federal, State, and Local Restrictions – Federal, State, and local regulations may restrict a homeowner’s choice of retrofitting measures. Such regulations may include State and local building codes, floodplain management ordinances or laws, zoning ordinances, Federal regulations concerning the alteration of buildings classified as historic structures, deed restrictions, and the covenants of homeowners associations. The homeowner and the homeowner’s contractor or design professional should check with community officials to determine whether such regulations apply.

Appearance – The final appearance of a house and property after retrofitting will depend largely on the retrofitting method used and the Flood Protection Elevation (FPE). For example, elevating a house several feet will change its appearance much more than elevating only 1 or 2 feet, and a house elevated on an open foundation will not look the same as a house elevated on extended foundation walls. However, a change in appearance will not necessarily be a change for the worse. The homeowner should discuss the potential effects of each method with local officials and with the contractor or design professional.

Cost – The cost of retrofitting will depend largely on the retrofitting method used and the FPE. For some methods, the construction type (frame, masonry, etc.) and foundation type (crawlspace, slab, etc.) will also affect the cost. In general, costs will increase as the FPE increases, but there may be tradeoffs between alternative methods. For example, elevating may be less expensive than relocation when a house is raised only 1 or 2 feet, but may become more expensive at greater heights.

Accessibility – Accessibility refers to how easy or difficult it is to routinely reach and enter the house after the retrofitting project is completed. The retrofitting methods described in this guide affect accessibility in different ways. For example, elevating a house will usually require the addition of stairs, which may be unacceptable to some homeowners. Wet floodproofing will have little if any effect on accessibility. The effect of relocation on accessibility will depend on the location and configuration of the new site.

Code-Required Upgrades – State and local regulations may require that a retrofitted house be upgraded to meet current code requirements that were not in effect when the house was built. Portions of the electrical, plumbing, and heating/ventilation/air conditioning systems could be affected. For example, the electrical panel might have to be upgraded from fuses to circuit breakers. These changes are required for the safety of the homeowner. Other code-required upgrades include those necessary for increased energy efficiency. Any required upgrade can add to the scope and cost of the retrofitting project. The homeowner and the homeowner’s contractor or design professional should check with community officials to determine whether such regulations apply.

Human Intervention – For retrofitting methods that require human intervention, homeowners must be willing, able, and prepared to take the necessary action, such as operating a closure mechanism in a floodwall or placing flood barriers across the doors of a dry floodproofed house. Also, the homeowner must always have adequate warning of a coming flood and must be at home or near enough to reach the house and take the necessary action before flood waters arrive. If these conditions cannot be met, retrofitting methods that require human intervention should be eliminated from consideration.

Other – Homeowners may need to consider other factors, such as the availability of Federal, State, and local financial assistance; the current value of the house vs. the inconvenience and cost of retrofitting; the amount of time required to complete the retrofitting project; and the need to move out of the house during construction (including the availability and cost of alternative housing).




Decision Making Matrix

Condition: NO Substantial Damage / NO Substantial Improvement

This matrix can help you decide which retrofitting method best meets your needs. You may need guidance when using the matrix, so take it with you when you meet with local officials and contractors/design professionals.

Because your house has **NOT** been substantially damaged and is **NOT** being substantially improved, the National Flood Insurance Program regulations do not prohibit your use of any of the methods described in this guide. However, regulations, ordinances, or laws established by other agencies and organizations may. Also, you may have already decided that one or more methods will not meet your needs. The first step in using the matrix is to identify any methods eliminated by regulations or by your own needs. Mark each eliminated method by placing an “X” in the box directly below the name of the method (on the line labeled “Prohibited by Federal, State, or Local Regulations or Eliminated by Law”). An “X” in this row means that the method will not be considered in your decision.

The next step is to evaluate the remaining methods (those without an “X” under their names). Your evaluation will be based on the factors listed on the left hand side of the matrix. (The factors are explained on the back of this page.) For each evaluation factor under each method, discuss your concerns with your local official, design professional, and contractor. If your concerns cannot be resolved, place an “X” in the appropriate box. For example, if you decide that you would not be satisfied with the appearance of your house if it were elevated on extended foundation walls, you would place an “X” in the box on the *Appearance* line under the heading *Elevation on Extended Foundation Walls*. After you have worked through the entire matrix, add the number of “X’s” under each method and show the sum on the *Total “X’s”* line. The method with the lowest total is probably the one that best meets your requirements.

RETROFITTING METHODS for Houses that are NOT Substantially Damaged or Improved								
EVALUATION FACTORS	ELEVATION			RELOCATION	DRY FLOOD-PROOFING	WET FLOOD-PROOFING	LEVEES OR FLOOD-WALLS	DEMOLITION
	 Elevation On Extended Foundation Walls	 Elevation On Open Foundation	 New Living Area Over Abandoned First Floor					
Prohibited by Federal, State, or Local Regulations or Eliminated by Homeowner								
Appearance								
Cost								
Accessibility								
Code-Required Upgrades								
Human Intervention								
Other								
TOTAL “X’s”								

EVALUATION FACTORS

Federal, State, and Local Restrictions – Federal, State, and local regulations may restrict the homeowner’s choice of retrofitting measures. Such regulations may include State and local building codes, floodplain management ordinance or laws, zoning ordinances, Federal regulations concerning the alteration of buildings classified as historic structures, deed restrictions, and the covenants of homeowners associations. The homeowner and the homeowner’s contractor or design professional should check with community officials to determine whether such regulations apply.

Appearance – The final appearance of a house and property after retrofitting will depend largely on the retrofitting method used and the Flood Protection Elevation (FPE). For example, elevating a house several feet will change its appearance much more than elevating only 1 or 2 feet, and wet floodproofing will change its appearance very little. However, a change in appearance will not necessarily be a change for the worse. The homeowner should discuss the potential effects of each method with local officials and with the contractor or design professional.

Cost – The cost of retrofitting will depend largely on the retrofitting method used and the FPE. For some methods, the construction type (frame, masonry, etc.) and foundation type (crawl space, slab, etc.) will also affect the cost. In general, costs will increase as the FPE increases, but there may be tradeoffs between alternative methods. For example, elevating may be less expensive than relocation when a house is raised only 1 or 2 feet, but may become more expensive at greater heights. Other costs include those for both routine and long-term maintenance.

Accessibility – Accessibility refers to how easy or difficult it is to routinely reach and enter the house after the retrofitting project is completed. The retrofitting methods described in this guide affect accessibility in different ways. For example, elevating a house will usually require the addition of stairs, which may be unacceptable to some homeowners. Levees and floodwalls can make access more difficult unless they are equipped with openings, which require human intervention (see below). Wet floodproofing and dry floodproofing will have little if any effect on accessibility. The effect of relocation on accessibility will depend on the location and configuration of the new site.

Code-Required Upgrades – State and local regulations may require that a retrofitted house be upgraded to meet current code requirements that were not in effect when the house was built. Portions of the electrical, plumbing, and heating/ventilation/air conditioning systems could be affected. For example, the electrical panel might have to be upgraded from fuses to circuit breakers. These changes are required for the safety of the homeowner. Other code-required upgrades include those necessary for increased energy efficiency. Any required upgrade can add to the scope and cost of the retrofitting project. The homeowner and the homeowner’s contractor or design professional should check with community officials to determine whether such regulations apply.

Human Intervention – For retrofitting methods that require human intervention, homeowners must be willing, able, and prepared to take the necessary action, such as operating a closure mechanism in a floodwall or placing flood barriers across the doors of a dry floodproofed house. Also, the homeowner must always have adequate warning of a coming flood and must be at home or near enough to reach the house and take the necessary action before flood waters arrive. If these conditions cannot be met, retrofitting methods that require human intervention should be eliminated from consideration.

Other – Homeowners may need to consider other factors, such as the availability of Federal, State, and local financial assistance; the current value of the house vs. the inconvenience and cost of retrofitting; the amount of time required to complete the retrofitting project; and the need to move out of the house during construction (including the availability and cost of alternative housing).