

Reinforce or Replace Garage Doors



FEMA

PROTECTING YOUR PROPERTY FROM HIGH WINDS

High winds from hurricanes and tornadoes can damage garage doors or even blow them in. If wind enters a garage, it can cause dangerous and expensive structural damage. Reinforcing your garage door helps to protect not only your garage, but its contents as well.

As shown in the figure, you can reinforce a garage door by adding girts (usually wooden boards) across the back of the door and by strengthening the glider wheel tracks. If your existing door is old or damaged, you might want to replace it with a stronger door and tracks. Even if you decide to buy a new door, reinforcing it is still a good idea. Hardware and home supply stores, as well as companies that specialize in overhead door sales and installation, can advise you about stronger doors and track systems.

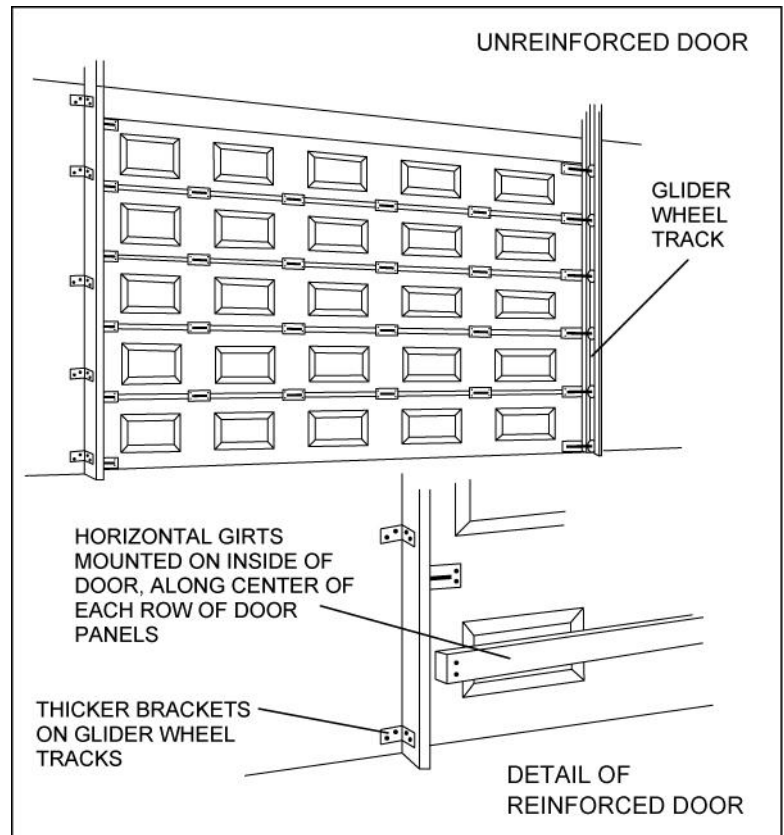
BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent structural damage
- Helps to prevent damage to or loss of contents in the garage

TIPS

Keep these points in mind when you reinforce or replace your garage doors:

- ✓ Reinforcing an existing garage door is something you may be able to do yourself if you have the necessary skills and tools. Otherwise, you can hire a contractor to do the work. The necessary materials, including metal brackets and wood boards for girts, can usually be found at a lumber yard, hardware store, or home supply store.
- ✓ Single-car garage doors usually resist wind forces better than two-car garage doors.
- ✓ Don't wait until a hurricane or tornado warning is issued to reinforce your garage door; you probably won't have time.
- ✓ Installing a new garage door is more than a one-person job and is not the type of work that most property owners who lack the necessary skills and equipment would want to undertake. If you buy a new door, you may want to either have the seller install it or hire a contractor.



- ✓ If you are buying a new door, get one without windows. Unless covered, glass is easily broken by high winds and windblown debris. Again, one reason for protecting your garage door is to prevent wind from entering the garage and damaging the contents inside.
- ✓ Check local code requirements in your area.

ESTIMATED COST

If you hire a contractor to reinforce an existing two-car garage door, you can expect to pay about \$300. The cost of replacing a door, including installation, can vary greatly, depending on the size and type of door.

OTHER SOURCES OF INFORMATION

FEMA 247, *Against the Wind, Protecting Your Home from Hurricane Wind Damage*, December 1993, <http://www.fema.gov/library/viewRecord.do?id=1641>.

FEMA 488, *Hurricane Charley in Florida: Mitigation Assessment Team Report, Observations, Recommendations, and Technical Guidance*, Chapter 8, "Recommendations," April 2005, <http://www.fema.gov/library/viewRecord.do?id=1444>.

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA's Library online at <http://www.fema.gov/library>.

Brace Gable End Roof Framing



FEMA

PROTECTING YOUR PROPERTY FROM HIGH WINDS

Gable end roofs are more susceptible to damage from high winds than hip or flat roofs. The gable end presents a large, flat obstacle to the wind and receives its full force. If the framing of the gable end and the entire roof is not adequately braced to resist the wind, the roof can fail. Roof failures, especially in unbraced gable roofs, are a common cause of major damage to structures and their contents in high winds.

If your property has a gable roof, check to see whether the roof framing is braced. The top figure shows a cutaway view of an unbraced gable end roof. This is a truss roof, but some gable end roofs are constructed with rafters rather than trusses. Both types should be braced as shown in the bottom figure. If you are unsure whether your gable end roof is adequately braced, check with your local building department. After inspecting your roof framing, a building official can tell you whether bracing is required and if so, how it should be added.

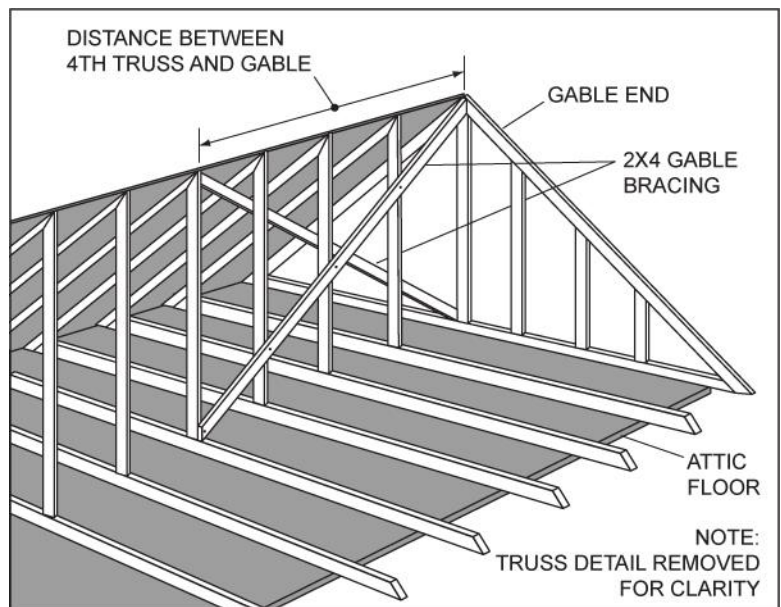
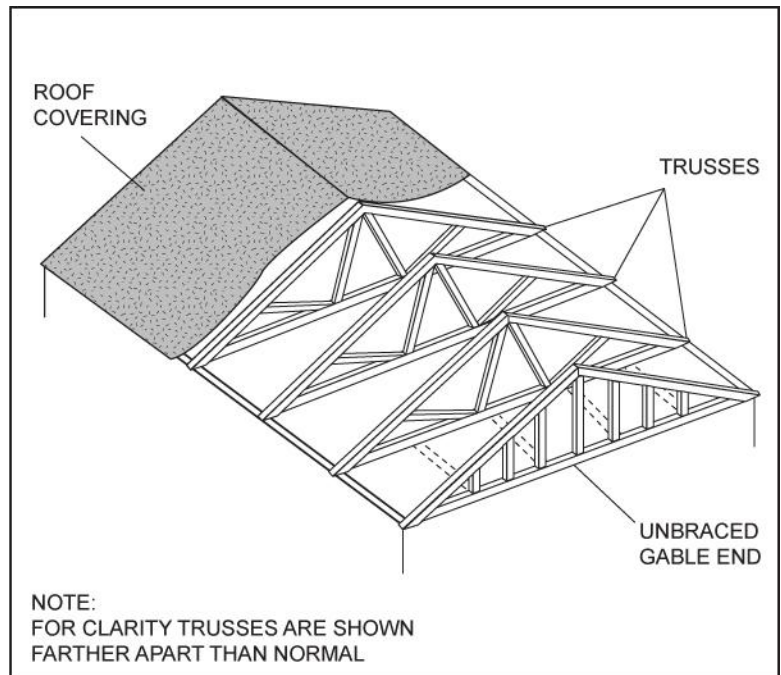
BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent roof failure, which can lead to major damage of a structure and its contents
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind if you have bracing added to a gable end roof:

- ✓ Bracing can be added fairly easily, but you should have a contractor perform the work to make sure that the bracing is properly designed and attached.
- ✓ If you have a building official inspect your roof framing, ask about other changes you may be able to make to your property to protect it from high winds.



ESTIMATED COST

If you hire a contractor to brace a gable end roof, you can expect to pay about \$100 for each gable end. This figure is for a gable end about 30 feet long. Bracing longer gable ends may be slightly more expensive.

OTHER SOURCES OF INFORMATION

Institute for Business & Home Safety (IBHS), <http://www.disastersafety.org>.

FEMA 247, *Against the Wind: Protecting Your Home from Hurricane Wind Damage*, December 1993, <http://www.fema.gov/library/viewRecord.do?id=1641>.

FEMA 488, *Hurricane Charley in Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, Chapter 8, "Building Envelope Performance," April 2005, <http://www.fema.gov/library/viewRecord.do?id=1444>.

FEMA 489, *Hurricane Ivan in Alabama and Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, August 2005, <http://www.fema.gov/library/viewRecord.do?id=1569>.

FEMA 499, *Home Builder's Guide to Coastal Construction*, Technical Fact Sheets No. 18, August 2005, <http://www.fema.gov/library/viewRecord.do?id=1570>.

FEMA 549, *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance*, July 2006, <http://www.fema.gov/library/viewRecord.do?id=1857>.

The Federal Alliance for Safe Homes (FLASH), <http://www.flash.org>.

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA's Library online at <http://www.fema.gov/library>.

Remove Trees and Potential Windborne Missiles

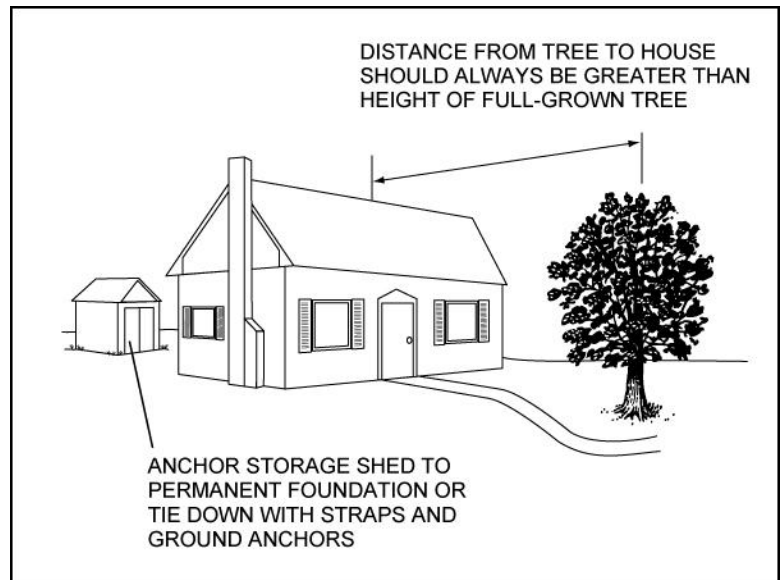


FEMA

PROTECTING YOUR PROPERTY FROM HIGH WINDS

If the area immediately surrounding your home contains trees, outbuildings, trash cans, yard debris, or other materials that can be moved by the wind, your house will be more likely to be damaged during a hurricane or tornado. The wind can topple trees onto your house and can pick up smaller objects and drive them through windows and glass doors.

You should ensure that all trees on your property are far enough away to prevent them from damaging your home if they should fall. The distance between the structure and any nearby tree should always be greater than the height the tree will reach when it is fully grown. All storage sheds and other outbuildings should be securely anchored, either to a permanent foundation or with straps and ground anchors. Smaller objects, such as trash cans, barbecue grills, and outdoor furniture should also be anchored or, if you have adequate warning, moved indoors. You should also clear away any debris, such as fallen tree branches.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent damage to a structure and its contents
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you remove trees and potential windborne missiles:

- ✓ Remove large trees near your property. They can be extremely dangerous for both you and your home. Therefore, this is a job for a skilled contractor.
- ✓ Use the straps and ground anchors also used for manufactured homes to anchor outbuildings, especially small garden sheds that are usually not placed on a permanent foundation.
- ✓ Secure outdoor furniture and barbecue grills by bolting them to decks or patios or by attaching them to ground anchors with cables or chains.
- ✓ Secure trash cans with cables or chains attached to ground anchors or wood posts firmly embedded in the ground. Trash can lids should be attached to cans with cables or chains.

ESTIMATED COST

If you hire a contractor to remove a large tree, you can expect to pay about \$1,000 to \$1,500. Having a contractor anchor a storage shed with straps and ground anchors will cost about \$100 to \$200.

OTHER SOURCES OF INFORMATION

FEMA 247, *Against the Wind: Protecting Your Home from Hurricane Wind Damage*, December 1993, <http://www.fema.gov/library/viewRecord.do?id=1641>.

FEMA 549, *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance*, Chapter 11, "Recommendations," July 2006, <http://www.fema.gov/library/viewRecord.do?id=1857>.

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA's Library online at <http://www.fema.gov/library>.

Maintain EIFS Walls

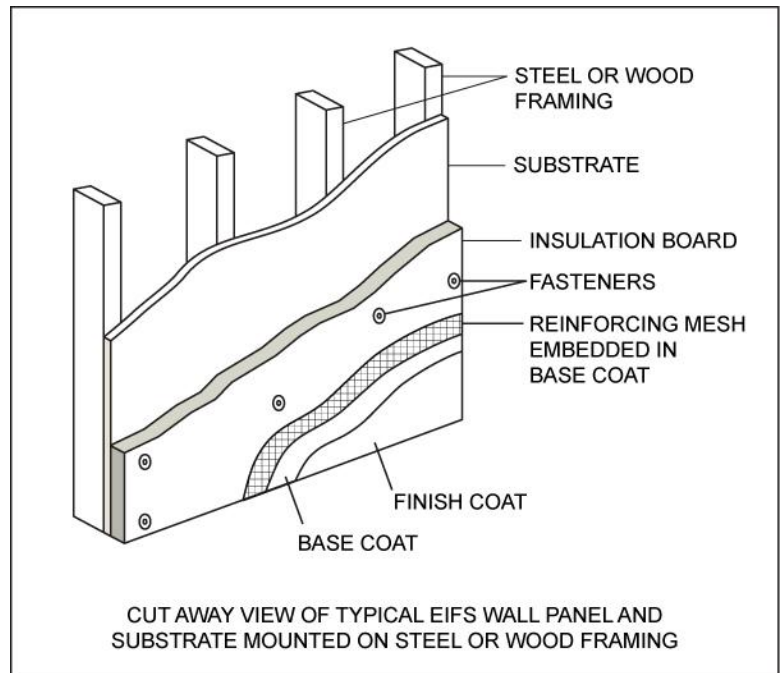


FEMA

PROTECTING YOUR PROPERTY FROM HIGH WINDS

An Exterior Insulation Finishing System (EIFS) wall typically consists of several layers of materials sandwiched together into a single panel, which is then attached to a substrate mounted on the wall studs (see figure). The exterior of an EIFS wall is water resistant, but the wall can be weakened by moisture that becomes trapped behind the wall. The sources of this moisture are usually leaks around doors and windows and where the wall joins the roof. Once an EIFS wall has been weakened, it is more likely to be torn away or penetrated by high winds and windborne debris. If wind enters a building, the likelihood of severe structural damage increases, and the contents of the building will be exposed to the elements.

You should periodically inspect your EIFS walls, particularly the flashing where the walls meet the roof and all the seals around doors, windows, and any objects that pass through the wall, such as utility lines. Make sure that the flashing and seals have been properly installed and are not damaged.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent damage to a structure and its contents
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when maintaining your EIFS walls:

- ✓ A licensed contractor can test EIFS walls for moisture content and advise you on repairs.
- ✓ EIFS walls should be installed only by experienced contractors who have completed a manufacturer's training program. Contact the manufacturer or the EIFS Industry Members Association (EIMA) at 1-800-294-3462 or online at <http://www.eima.com> for more information.
- ✓ Most EIFS walls are susceptible to damage from windborne debris; however, impact-resistant walls have been developed by some EIFS manufacturers. Ask manufacturers whether their walls meet the wind load and impact standards established for your area. Your local building official can advise you about these standards.

- ✓ Ask your local building official about state and local code restrictions on the use of EIFS walls.
- ✓ EIFS walls have had mixed degrees of success in different parts of the country. Ask your local building official about the performance of EIFS walls in your area.
- ✓ EIFS manufacturers provide different types of fasteners and adhesives for buildings designed to withstand high wind loads. Ask the EIFS manufacturer and installer what the highest allowable wind speed is for your building and what can be done to help the walls withstand even higher wind speeds.

ESTIMATED COST

EIFS wall costs vary; however, the cost of a typical EIFS wall is approximately \$4 to \$6 per square foot.

OTHER SOURCES OF INFORMATION

EIFS Industry Members Association (EIMA), <http://www.eima.com>.

FEMA 489, *Hurricane Ivan in Alabama and Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, Chapter 5.3, "Non-Load-Bearing Walls, Wall Coverings, and Soffits," August 2005, <http://www.fema.gov/library/viewRecord.do?id=1569>.

FEMA 549, *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, July 2006, <http://www.fema.gov/library/viewRecord.do?id=1857>.

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA's Library online at <http://www.fema.gov/library>.

Secure Metal Siding and Metal Roofs



FEMA

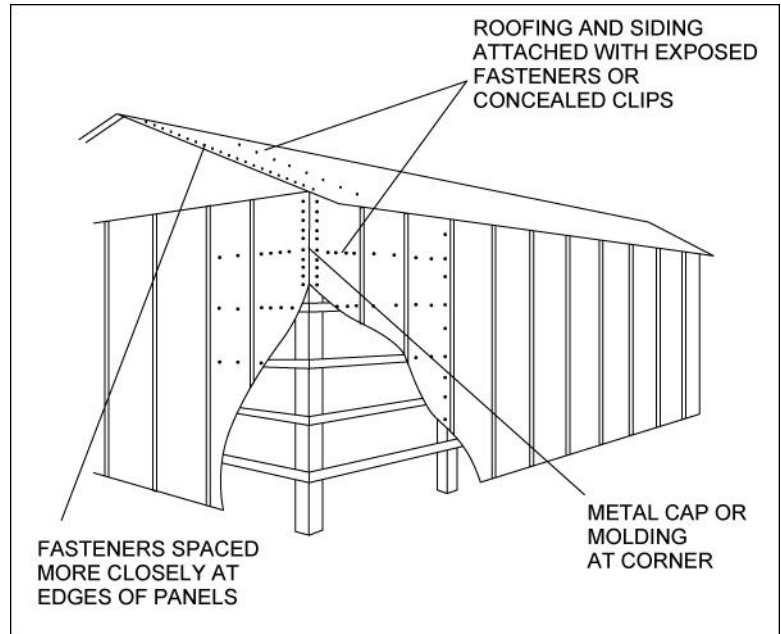
PROTECTING YOUR PROPERTY FROM HIGH WINDS

High winds can damage buildings with metal siding and metal roofs in primarily two ways:

- If the siding and roofing panels are not adequately attached to the frame of the building, the force exerted by the wind can lift them, possibly to the point where the fasteners pull through or break. When this occurs, entire panels can be torn off.
- Windborne debris can puncture siding or roofing panels and make them more susceptible to further wind damage.

In both situations, wind will be able to enter the building, increasing the likelihood of severe structural damage inside as well as injuries.

Metal siding and roofing in high-wind areas should be securely attached to the frame of the building with exposed fasteners such as screws or bolts or with concealed clips. The spacing of the fasteners or clips will depend on their strength and on the design and strength of the siding and roofing panels. In general, fasteners should be more closely spaced at the edges of panels (see figure). Also, all edges of siding, such as along the corners of the building, should be covered with a metal cap or molding and secured so that wind cannot work its way underneath. For information on additional types of siding (vinyl, wood, and fiber cement), refer to FEMA 499, *Home Builder's Guide to Coastal Construction*, Technical Fact Sheet No. 25.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent damage to a structure and its contents
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you inspect and repair metal siding and roofs:

- ✓ Have your buildings inspected periodically and repaired as necessary. Loose or missing connectors, rust, and damage caused by past storms can leave metal siding and roofing more vulnerable to serious damage from high winds.
- ✓ If the siding or roofing on your building is attached with metal clips, make sure they are strong enough to resist the force of the wind without bending. If you can bend a clip with your hands, it is likely to fail when high-winds act on the siding or roofing.

- ✓ Windows and glass doors are usually more susceptible than walls and roofs to penetration by windborne debris. You should consider protecting windows and glass doors with permanent or temporary covers that can be closed or installed before a storm arrives. For more information, refer to the separate high wind protection fact sheet titled “Protect Windows and Doors with Covers.”
- ✓ You can also help protect your building against damage by windborne debris by removing or securely anchoring any loose objects on your property that could be picked up and moved by the wind. Trash, construction debris, warehouse pallets, and other loose materials should be removed or stored inside. Other objects, such as signs and trash cans, should be bolted down or held in place with chains or cables.

ESTIMATED COST

A contractor will probably charge to inspect the exposed fasteners in a building with metal siding or a metal roof. If any modifications are necessary, the cost will depend on what must be done.

OTHER SOURCES OF INFORMATION

FEMA 488, *Hurricane Charley in Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, “Hurricane Recovery Advisories,” April 2005, <http://www.fema.gov/library/viewRecord.do?id=1444>.

FEMA 489, *Hurricane Ivan in Alabama and Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, August 2005, <http://www.fema.gov/library/viewRecord.do?id=1569>.

FEMA 499, *Home Builder's Guide to Coastal Construction*, “Siding Installation and Connectors,” Technical Fact Sheet No. 25, August 2005, <http://www.fema.gov/library/viewRecord.do?id=1570>.

FEMA 549, *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance*, July 2006, <http://www.fema.gov/library/viewRecord.do?id=1857>.

NRCA Architectural Sheet Metal and Metal Roofing Manual, 2006 Edition, National Roofing Contractors Association, <http://www.nrca.net/rp/pubstore/details.aspx?id=320>.

Protect Windows and Doors with Covers fact sheet, FEMA, April 2008, <http://www.fema.gov/plan/prevent/howto/index.shtm>.

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA’s Library online at <http://www.fema.gov/library>.

Secure Built-Up and Single-Ply Roofs

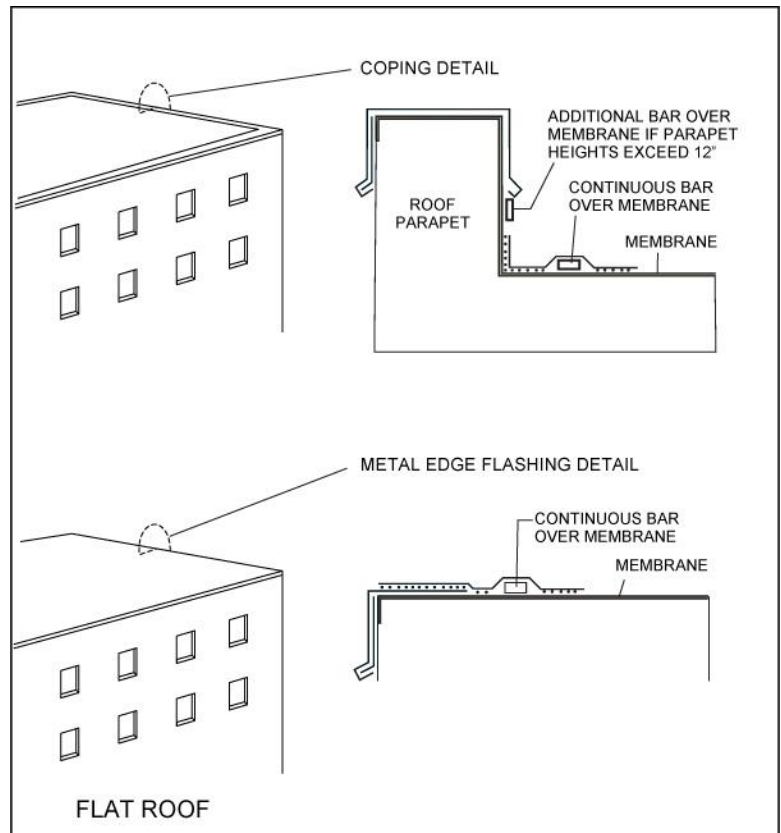


FEMA

PROTECTING YOUR PROPERTY FROM HIGH WINDS

Built-up and single-ply roofs are common on commercial buildings. Built-up roofs consist of multiple layers of felt and asphalt; single-ply roofs consist of one waterproof membrane. These roofs are often damaged when high winds tear away the metal edge flashing or coping around the perimeter of the roof. Once the flashing or coping is gone, the wind can peel back the roofing material and expose the interior of the building to the elements. The major building codes do not address the wind resistance of flashings and copings.

Whenever your built-up or single-ply roof is repaired or replaced, your roof designer or roofing contractor should ensure that the flashing and coping are made of a corrosion-resistant metal, such as aluminum, and are securely attached to the building with screws, concrete spikes, or a continuous cleat. Using a supplementary attachment method to provide additional strength is recommended. For single-ply roofs, a continuous bar placed over the membrane (see detail figures) is an effective means of strengthening the attachment.



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent damage to a structure and its contents
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you have your built-up or single-ply roof repaired or replaced:

- ✓ Single-ply membranes that are fully adhered are less susceptible to damage than mechanically attached or loose-laid air-pressure-equalized membranes.
- ✓ Some local building codes may require that roofs meet design standards for resisting uplift forces (an example is the American Society of Civil Engineers Standard ASCE 7-05). Ask your local building official whether any special requirements apply in your area.
- ✓ Your local building official may be able to inspect your roof and recommend changes that will help protect it from high winds.

- ✓ If you add stone ballast or pavers to your roof, make sure the roof parapet is high enough and that the pavers or individual stones are large enough to resist being picked up and carried by the wind (refer to *Wind Design Standard for Ballasted Single-Ply Roofing Systems*).
- ✓ Roof warranties typically will not cover damage caused by strong storms.

ESTIMATED COST

A roofing contractor will charge approximately \$1 to \$2 per linear foot to replace aluminum fascia cap when the roof is being replaced. The cost would be much higher if the fascia is replaced separately.

OTHER SOURCES OF INFORMATION

FEMA 488, *Hurricane Charley in Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, Chapter 8.5, "Architectural, Mechanical, and Electrical," April 2005, <http://www.fema.gov/library/viewRecord.do?id=1444>.

FEMA 489, *Hurricane Ivan in Alabama and Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, August 2005, <http://www.fema.gov/library/viewRecord.do?id=1569>.

FEMA 549, *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance*, July 2006, <http://www.fema.gov/library/viewRecord.do?id=1857>.

Single Ply Roofing Industry (SPRI), <http://www.spri.org>.

Wind Design Standard for Ballasted Single-Ply Roofing Systems, ANSI/SPRI RP-4-2002. (Available from SPRI, <http://www.spri.org>, info@spri.org, tel: (781) 647-7026).

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA's Library online at <http://www.fema.gov/library>.

Protect Windows and Doors with Covers

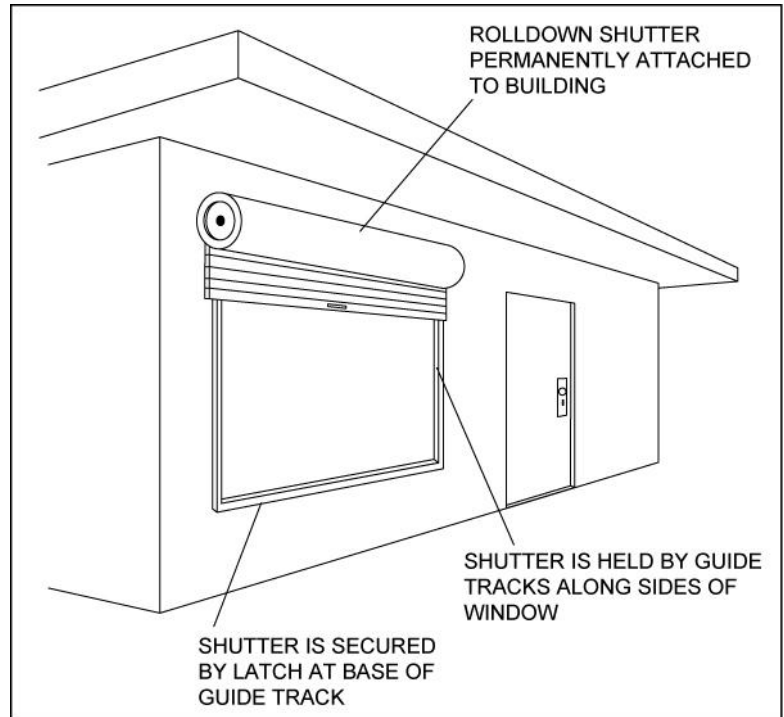


FEMA

PROTECTING YOUR PROPERTY FROM HIGH WINDS

High winds and windblown debris can easily break unprotected windows and cause doors to fail. Once wind enters a structure, the likelihood of severe structural damage increases, and the contents of the building will be exposed to the elements. The most reliable method of protecting windows and doors is installing permanent storm shutters. Alternatives include using temporary plywood covers, mesh or screen systems, and replacing existing windows and doors with impact-resistant windows and doors.

Permanent storm shutters are usually made of aluminum or steel and are attached to a building in such a way that they can be closed quickly before a storm arrives. One type is the “rolldown” shutter (see figure on this page), which is contained in a housing mounted above the window and lowered when necessary. Manually operated and motor-driven models are available.



While permanent storm shutters can usually be closed quickly and easily, temporary covers can be an economical alternative and can be installed fairly quickly if the necessary preparations are made. Plywood covers can also be used to protect sliding glass doors and French doors (see figure on page 2).

BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

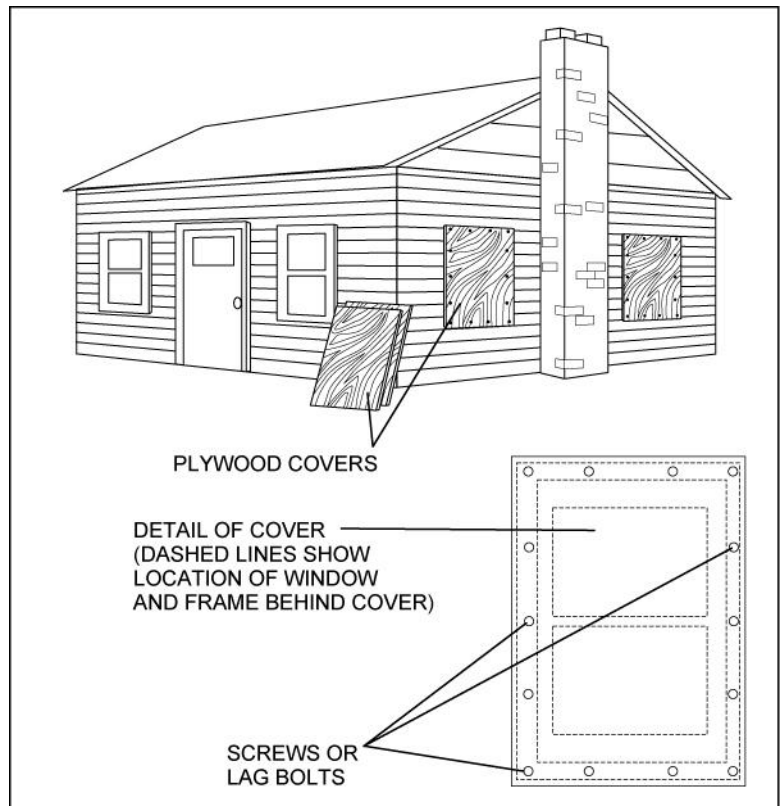
- Helps to prevent damage to a structure and its contents
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you install shutters or use temporary plywood, fiberglass, metal panel, or mesh covers to protect your windows and doors:

- ✓ Always consider using permanent storm shutters if you live in an area where you know you will need to act quickly to protect your windows. If your property is in an area where you will have little warning of high winds, permanent shutters that can be closed quickly, such as the rolldown shutter, are better than temporary plywood covers, which must be retrieved from storage and mounted with bolts or screws.
- ✓ If you decide to buy permanent shutters, look for models that meet the wind load and impact standards established for your area. These standards can be obtained from your local building official. If you have any questions about the strength of a specific model, check with the manufacturer. Permanent shutters are available in a wide range of sizes, so you can use them to protect many types of windows and doors, as well as large areas of glass.

- ✓ If you decide to use temporary plywood covers, you may want to hire a contractor or handyman to make them for you. If you do the work yourself, you will need to cut the plywood and drill holes for screws or lag bolts in each cover and in the wall around each window. The screws or lag bolts should be placed along the top, bottom, and sides of each cover, and they should be long enough to penetrate the wall studs around the window, and not just the siding or wall covering.
- ✓ Don't wait until a hurricane or tornado warning is issued to make temporary covers; you probably won't have time. Make them during the "off season" so that you'll be ready to install them at any time. Store the mounting screws or lag bolts with the covers, in a place where they are readily accessible – don't stack heavy boxes or other hard-to-move materials on top of or around the covers. Use a numbering or lettering system that shows which cover goes with which window.
- ✓ If you buy motor-driven shutters, make sure they also can be operated manually if the power fails.
- ✓ If you are constructing a new building in an area subject to high winds, avoid designs that include large areas of glass, windows with multiple panels, and double entry doors. The widths of individual doors and windows should not exceed 3 feet.
- ✓ Check the local building code for windborne debris protection requirements in your area.



ESTIMATED COST

Storm shutters can cost \$50 to \$60 per square foot of window. A set of shutters for a 3-foot by 4-foot window will cost approximately \$600 to \$720. The cost of a plywood cover will also depend on the size of the window. If you do the work yourself, you can expect plywood to cost about \$0.60 per square foot. Screws or lag bolts, including washers, will cost about \$0.10 to \$0.15 each. For example, protecting a window that is 3 feet wide and 4 feet high will cost about \$10. This figure covers only the materials you will have to buy and excludes the cost of any tools you use and the value of your time. If you hire a contractor or handyman to do the work, you will have to pay for time as well as materials.

OTHER SOURCES OF INFORMATION

Institute for Business & Home Safety (IBHS), <http://www.disastersafety.org>.

The Federal Alliance for Safe Homes (FLASH), <http://www.flash.org>.

FEMA 247, *Against the Wind: Protecting Your Home from Hurricane Wind Damage*, December 1993, <http://www.fema.gov/library/viewRecord.do?id=1641>.

FEMA 488, *Hurricane Charley in Florida: Mitigation Assessment Team Report, Observations, Recommendations, and Technical Guidance*, "Hurricane Recovery Advisories," April 2005, <http://www.fema.gov/library/viewRecord.do?id=1444>.

FEMA 489, *Hurricane Ivan in Alabama and Florida: Mitigation Assessment Team Report, Observations, Recommendations, and Technical Guidance*, August 2005,
<http://www.fema.gov/library/viewRecord.do?id=1569>.

FEMA 499, *Home Builder's Guide to Coastal Construction*, Technical Fact Sheet No. 26, August 2005,
<http://www.fema.gov/library/viewRecord.do?id=1570>.

FEMA 549, *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance*, July 2006,
<http://www.fema.gov/library/viewRecord.do?id=1857>.

FEMA P-757, *Hurricane Ike in Texas and Louisiana: Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance*, April 2009.
<http://www.fema.gov/library/viewRecord.do?id=3577>.

FEMA P-762, *Local Officials Guide for Coastal Construction: Design Considerations, Regulatory Guidance, and Best Practices for Coastal Communities*, February 2009.
<http://www.fema.gov/library/viewRecord.do?id=3647>.

International Residential Code® (IRC®) for One- and Two-Family Dwellings, Section R301.2.1, Wind Limitations, 2009.

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA's Library online at <http://www.fema.gov/library>.

Secure Composition Shingle Roofs



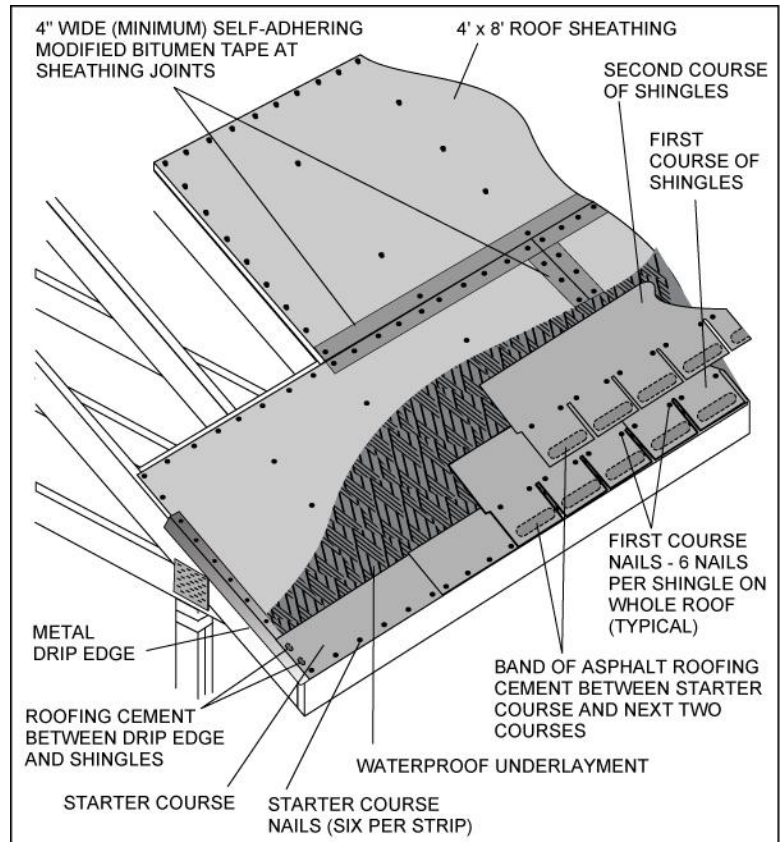
FEMA

PROTECTING YOUR PROPERTY FROM HIGH WINDS

When composition shingles are not securely attached, they can be damaged or torn away by high winds. When this happens, the interior of the structure becomes vulnerable to rainwater infiltration. If your composition shingle roof is being repaired or replaced, your roof designer or roofing contractor should make sure that the following requirements have been met (see figure):

- Each shingle should be held by at least six nails or staples, which should be installed below the edge of the upper, overlapping row of shingles.
- A waterproof underlayment should be installed beneath the shingles. When well attached, it temporarily protects the building from rain if shingles are torn away by the wind.

The roof sheathing (typically plywood panels) should be at least 15/32-inch thick and should be securely attached to the roof trusses. (Nails in older wood roof sheathing are often farther apart than recommended, especially in areas subject to high winds. Your roof designer or roofing contractor should check with local building officials for nailing requirements.)



BENEFITS OF UTILIZING THIS MITIGATION STRATEGY

- Helps to prevent damage to a structure and its contents
- Helps to prevent injuries to occupants

TIPS

Keep these points in mind when you have your composition shingle roof repaired or replaced:

- ✓ If you are having an old roof replaced, your contractor should remove the existing shingles and underlayment rather than install new shingles over them. This approach allows the contractor to inspect the sheathing and make any repairs that may be necessary.
- ✓ All nails or staples used to attach the roof sheathing must penetrate the underlying roof trusses, otherwise the sheathing will not be securely attached and can be more easily torn away by high winds. Inadequate

attachment of roof sheathing, resulting from poor workmanship, has been a common cause of roof failures during hurricanes and other storms with high winds.

- ✓ If your building is in a hurricane-prone area, the following precautions are recommended:
 - The general recommendations given in the Fifth Edition of the National Roofing Contractors Association (NRCA) *Steep-Slope Roofing Manual* should be followed.
 - Shingles should be attached with nails instead of staples.
 - The first course of shingles should be sealed to the starter strip with dabs or bands of roof cement. Details are provided in FEMA 499, Technical Fact Sheet No. 20.
 - If your building is within 3,000 feet of saltwater, the nails should be hot-dip galvanized or stainless steel.
 - Your roofing designer should try to obtain information from manufacturers about bond strength and nail pull-through resistance, and then use products with values in the upper ranges of available strengths.
- ✓ Check local code requirements for roof repair or replacement criteria. Your local building official should be able to provide additional recommendations.

ESTIMATED COST

A roofing contractor will charge approximately \$10 to \$15 per square foot of roof area to remove and replace shingles and underlayment.

OTHER SOURCES OF INFORMATION

The Federal Alliance for Safe Homes (FLASH), <http://www.flash.org>.

FEMA 488, *Hurricane Charley in Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, "Hurricane Recovery Advisories," April 2005, <http://www.fema.gov/library/viewRecord.do?id=1444>.

FEMA 489, *Hurricane Ivan in Alabama and Florida: Mitigation Assessment Team Report, Observations, Recommendations and Technical Guidance*, Appendix D, Recovery Advisories No. 1 and 2, August 2005, <http://www.fema.gov/library/viewRecord.do?id=1569>.

FEMA 499, *Home Builder's Guide to Coastal Construction*, Technical Fact Sheets No. 19 and No. 20, August 2005, <http://www.fema.gov/library/viewRecord.do?id=1570>.

FEMA 549, *Hurricane Katrina in the Gulf Coast: Mitigation Assessment Team Report, Building Performance Observations, Recommendations, and Technical Guidance*, July 2006, <http://www.fema.gov/library/viewRecord.do?id=1857>.

Institute for Business & Home Safety (IBHS), <http://www.disastersafety.org>.

NRCA Steep-Slope Roofing Manual, National Roofing Contractors Association, Fifth Edition, 2003, <http://www.nrca.net/rp/pubstore/details.aspx?id=445> or <http://www.nrca.net/rp/pubstore>.

To obtain copies of FEMA documents, call the FEMA Publications Warehouse at 1-800-480-2520 or visit FEMA's Library online at <http://www.fema.gov/library>.