

# RETROFIT Improvements

Making Homes Safer & More Resilient in Disaster-Prone Areas

## Roof to Wall Connection



### SCOPE

This document provides homeowners with an overview of retrofit techniques for roof to wall attachments in hurricane-prone regions or other high-wind areas.

### PURPOSE

A strong roof to wall connection can help to minimize the risk of wind damage and water intrusion during hurricanes and windstorms.

### BENEFITS

- Minimizes risk of structural damage to the house during a hurricane or high-wind event.
- Minimizes the associated risk of water damage during a storm.
- Helps protect occupants and household contents.

### RETROFIT OPPORTUNITY

In some cases can be done within the attic as a smaller retrofit; may need to be done from outdoors at the soffit area or during a reroofing effort.

#### Wind Region Terminology

**Hurricane-Prone Regions:** Areas along the Atlantic and Gulf coasts where  $V > 115\text{mph}$ , and Hawaii, Puerto Rico, Guam, Virgin Islands, and American Samoa.

**High-Wind Areas (not code defined):** Generally where  $V > 115\text{mph}$  including portions of Alaska.

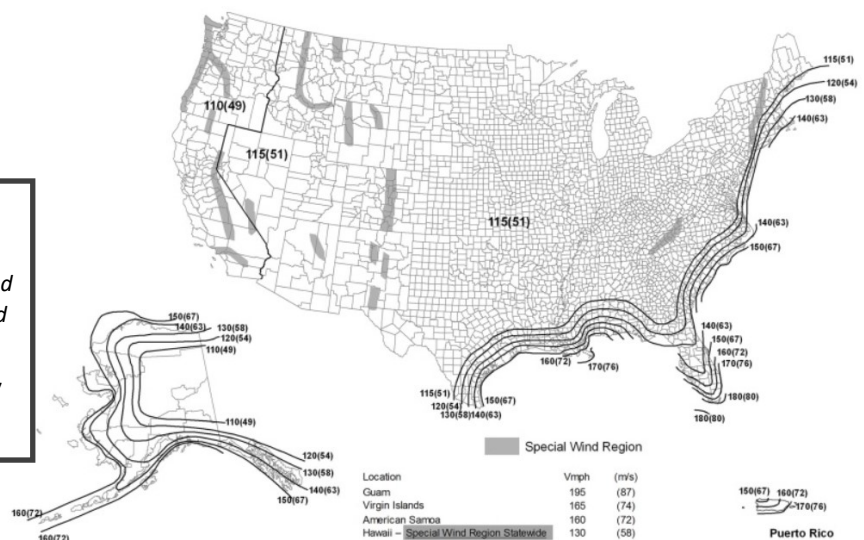
### HAZARD AND RISK

During a hurricane or other high-wind event, the connection between the roof framing and walls can fail, making the house susceptible to wind and water intrusion into the attic that can cause extensive damage and even building failure.

### SOLUTION

The connection of the roof framing to the walls must be strong enough to resist wind pressures that try to pull the roof up and away from the house. Typically, roof rafters or roof trusses are connected to the wall using nails driven at an angle through rafters or trusses into wood wall top plates or beams. This “toe-nailed” connection (modern building codes specify the nail type, size, and quantity) may not be sufficient to resist the uplift pressures and lateral wind forces experienced in hurricane-prone regions or high-wind areas (see Figure 1). In these areas, roof framing should be attached to walls using metal hurricane ties or straps, installed according to the manufacturer’s instructions or an engineer’s specification, to provide a positive connection between roof framing and wall framing to resist wind forces.

**Does the roof to wall connection at my house need to be upgraded?** First, determine how the roof framing is attached to the wall. It may be possible to inspect this connection from inside the attic, or it may be necessary to remove soffit panels and some siding to inspect this area from the outside. The connection can be a challenge to inspect as it may be hidden by ceiling insulation, interior drywall, or exterior wall sheathing. This retrofit is recommended for older homes located in high-wind areas that have toe-nailed connections only or do not have hurricane ties at each roof to wall connection .



**FIGURE 1. Wind Regions.** Source: Figure R301.2(5)A Excerpted from the 2018 International Residential Code; Copyright 2017; Washington, D.C.: International Code Council. Reproduced with permission. All rights reserved. [www.ICCSAFE.org](http://www.ICCSAFE.org)

## TIPS

- Plan this retrofit as a part of a larger home improvement project to maximize cost efficiency, as access to the wall and roof framing intersection (from inside or outside) is necessary.
- Inspect the framing to ensure a continuous load path is provided.
- If you are unsure whether your rafters and trusses are connected with metal ties or straps, have a home inspector or licensed contractor take a look and report to you. Inspect for existing metal hardware and determine additional hardware requirements.
- In the attic, place walking planks along truss bottom chords or ceiling joists to prevent damage to the ceiling below.
- Check the wall top plate-to-stud connections to ensure wind forces are transferred from the top plates to the studs.
- The gable end wall should also be securely connected to the rectangular wall bellow using brackets and fasteners.
- Your contractor may have additional ideas on how to improve the resilience of your home.

## COST

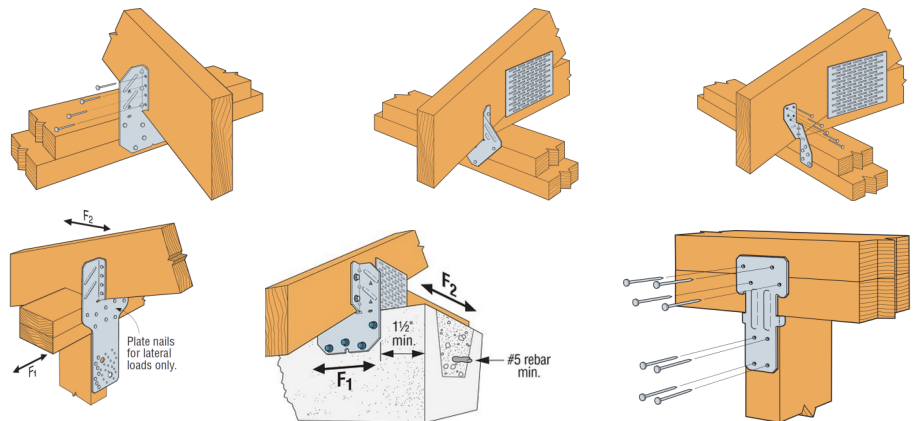
Installation costs can vary significantly depending on access to the roof to wall connection points and local labor rates. For a typical 2,500 sq. ft. home, an estimated cost for a professional installation range from approximately \$2,300 to \$3,600. The estimated cost of materials only ranges from \$350 to \$800.

**Code Considerations.** The International Residential Code (IRC) requires the roof to wall connection be capable of resisting wind pressures for the building location and provide a continuous load path through other connections down to the foundation. For some high-wind regions, the IRC requires wind design in accordance with other methods including the International Building Code (IBC). Some jurisdictions may also require specific product approvals. For example, the Florida Building Code for Existing Buildings specifies a minimum 20-gauge galvanized sheet steel metal strap approved for connecting wood to wood. Ask the local building department if your house is in a high-wind or hurricane-prone region or if local retrofit requirements exceed those of the national code.

**Best Practices.** Install metal hurricane ties or straps where the truss/rafter to wall/beam connection is only toe-nailed. In coastal areas, select galvanized or stainless-steel hardware to minimize corrosion. Wind uplift pressures tend to be highest along the edges and at outside corners of the roof, so the critical areas are within 8 ft. of those edges or corners, but it is best to install hurricane ties or straps on every rafter or truss.

There are many different types of hurricane ties. Ties must be selected based on the load resisted by the connection and the connection type, such as wood truss/rafter to wall top plate, wood truss/rafter to top plate and wall stud where the truss/rafter is aligned with the stud below (Figure 4), or wood truss/rafter to masonry wall. Ties can be installed from inside the attic (if accessible), outside from the soffit area, or even from the roof during a re-roofing where roof decking can be cut out as needed to gain access to the roof-wall connection and then patched.

Always follow manufacturer's installation instructions including using the correct quantity, type, and length of fasteners (nails). This may require removing wall sheathing so that ties can be attached directly to framing members. Some manufacturers offer long structural screws that can be installed through the truss/rafter into the top plate in lieu of ties or straps [5].



**FIGURE 2.** Example Hurricane Ties. Simpson Strong-Tie H10A (top left), H1 (top middle), H2.5A (top right), H10S (bottom left) HM9 (bottom middle), RSP (bottom right).

Source: Simpson Strong-Tie Catalog.

## ADDITIONAL RESOURCES

- [1] [Florida Building Code for Existing Buildings 2017](#)
- [2] [Hurricane Retrofit Guide](#) (floridadisaster.org)
- [3] [Home Builder's Guide to Coastal Construction](#) (see TFS 4.3) (FEMA 499)
- [4] [Insurance Institute for Business and Home Safety](#) (IBHS Standard)
- [5] [Simpson Strong-Tie 2021-2023 Wood Construction Connectors Catalog](#)

