FORTIFIED

... for safer living.SM

Builder's Guide

Florida Edition June 2005

The Institute for Business & Home Safety (IBHS) is a nonprofit organization, supported by the insurance industry. IBHS conducts studies, public and professional educational activities, and data gathering to gain greater understanding of the effects of losses that occur as a result of natural disasters, and determine how best to reduce them.

IBHS envisions a nation that positions and builds its businesses and homes to keep its citizens and their property safe from natural disasters.

The mission of IBHS is to reduce the deaths, injuries, property damage, economic losses and human suffering caused by natural disasters. IBHS and its members seek ways to demonstrate what works to make homes and businesses safer. IBHS has targeted three areas in which it identifies ways to meet its goals. They are:

1. Evaluate the merits of disaster-resistant building practices and materials and recommend improvements.
2. Provide technical expertise in public policy and construction arenas on behalf of safe residential and commercial practices.
3. Conduct communications to stimulate property loss reduction activity by home and business owners.

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1.0 WELCOME

Fortified…for safer living® is a National program designed to help bring the value of a practical, yet strongly built and disaster resistant home into America's communities. It is well known that the home-buying public prefers a home that is built by a "good" builder. But, every builder will tell a prospective buyer that "my house is a strong house". Finally, the ***Fortified…for safer living®*** program provides a marketing edge on this claim for participating builders and offers "peace of mind" to discerning buyers with the type of practical construction features that are known to really make a difference at a time when it's most needed – before disaster strikes.

The *Fortified* program specifies construction, design and landscaping guidelines to enable homes to increase their resistance to the following natural hazards that are most likely to occur in the area:

Hurricanes Floods Wildfire

Why should you be *Fortified…for safer living®* when disaster strikes?

This section briefly explains the Florida perils or hazards addressed by participating builders in the ***Fortified…for safer living®*** Program.

Hurricanes – Catastrophic hurricanes can produce winds in excess of 150 mph. Hurricanes have resulted in thousands of deaths and injuries to residents in the Gulf and Atlantic coastal areas. They are also responsible for a large portion of the $5 billion per year damages to buildings due to wind. On the immediate coast, storm surge accounts for much of the damage and loss of life. The ***Fortified…for safer living®*** program offers simple, yet effective solutions to reduce a building's vulnerability to both catastrophic and common hurricanes.

Floods – Buildings built in the inland or coastal 100-yr flood plain are in serious jeopardy of complete loss in the event of a flood. For this reason, significant measures are necessary to protect buildings from this potential hazard. Therefore, the ***Fortified…for safer living®*** program only applies to buildings that comply with the strictest condition in the National Flood Insurance Program for both coastal and inland flood plains, when building is permitted in these areas.

Wildfires – Every year, and even more so in recent years, wildfires have threatened and destroyed hundreds of buildings and lives. While some wildfires are naturally ignited from lightening or other causes, many are the result of carelessness or arson. Simple site design, material usage and landscape features of the ***Fortified…for safer living®*** program can protect a home against this increasingly widespread hazard.

1.1 Benefits to the Builder and Consumer

The ***Fortified…for safer living***® program offers important benefits to builders and their homebuyers. These benefits are briefly listed below.

Key Benefits to the Builder

- Provides market differentiation through a nationally recognized program.
- Gives solid evidence as a "quality" house builder and that qualifying houses are built better and stronger than the competition.
- Offers marketable benefits to homebuyers (see below) through use of the practical optional construction features that are affordable.
- The program addresses only those hazards or types of disasters that are most relevant to local conditions and most recognized by the local market.
- Assurance that your homes are the "best in the market" when it comes to the safety and protection of your buyers and their investment.
- Potential favorable personal and business liability and "low risk" status for contractor liability insurance.

Key Benefits to the Home-Buyer

- Improved security and safety in your home
- Potential for reduced insurance premiums and discounts
- A peace of mind that you own a home that will not only be an upstanding investment, but will also be standing up in the face of disaster.
- Potential improved resale value

1.2 Building Code Requirements

Building codes set a baseline of performance for many features within the home. While the ***Fortified…for safer living***®program requires many items above and beyond building code requirements in terms of natural disaster resistance, it is still crucial that the home meet minimum requirements regarding electrical, mechanical, plumbing, and interior fire protection measures. In order to ensure that all Fortified homes receive an adequate minimum level of protection in these fields, homes built in locales where the Building Code Effectiveness Grading Schedule (BCEGS) rating is greater than 5 (lower values reflect more effective code jurisdiction) must be inspected by a registered architect or professional engineer to certify that the home meets all applicable requirements of a specific model building code.

1.3 Program at a Glance

General

The process starts with a plan review. Based on compliance with the Fortified program, the builder is permitted to advertise the house as a ***Fortified…for safer living***®home. Following

satisfactory completion of construction, inspection checklists, product verification and/or other documentation, final designation as a ***Fortified…for safer living***®home is issued by IBHS.

Quality Criteria

Inspection – An IBHS Certified Inspector verifies that materials, installation, construction and building techniques meet program criteria for the location.

"Fortified for Hurricane" Criteria

The house is built in accordance with the WFCM or SSTD-10, or is specially engineered to resist design wind loads according to ASCE 7-02 *Minimum Design Loads for Buildings and Other Structures*.

"Fortified for Flood" Criteria

Houses located in the coastal or inland 100-yr flood plain must be built on elevated foundations. The bottom of the lowest horizontal structural member of the lowest livable floor must have a minimum of 2 feet of "freeboard" above the base flood elevation (BFE). In addition, areas of the building below the lowest floor shall not be enclosed by solid walls in V or Coastal A zones. In these zones, piles used to elevate the building shall be driven to required depth of penetration and bearing as prescribed and certified by a registered design professional.

"Fortified for Wildfire" Criteria (applicable to homes at moderate (or higher) risk of wildfire)

Homes located in areas at moderate (or higher) risk of wildfire, as determined using the Wildfire Assessment that can be found at www.ibhs.org, shall adhere to the criteria given in Section 5.0. Landscape features and construction materials used in such homes are chosen such that their risk of being adversely affected by wildfire is minimized.

Verification Process

Inspectors will meet with the builder prior to construction to discuss the appropriate criteria and review the building plans. The intent of this step is to set the stage for most of the field inspections. The *Fortified* inspector will review the drawings for all relevant criteria and communicate the requirements of the program to the builder. In order to effectively complete the drawing review, the builder will need to supply the following information:

- **Architectural drawings showing floor plans and elevations**
- **Window/Door Schedule**
- **Structural drawings if applicable**
- **Flood Elevation Certificate (if applicable)**
- **Truss drawings from the truss manufacturer**
- **Documentation on wall and roof sheathing, fastening schedules and roof covering materials used**

The inspector will visit the site approximately 4 times during the construction of the building to verify compliance to the *Fortified…for safer living* standards. After the last inspection, the builder or homebuyer will receive a certificate from IBHS designating compliance with the ***Fortified…for safer living***® program. (Figure 1-1)

Figure 1-1: Sample of *Fortified…for safer living* Certificate

2.0 DEFINITIONS OF FLORIDA PERILS

2.1 Hurricane Prone Region

ASCE 7-02 defines hurricane prone regions for the United States as areas along "the U.S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 mph…". These regions include the Atlantic and Gulf Coasts, Hawaii, and the US territories of Puerto Rico, Virgin Islands, Guam, and American Samoa. The ***Fortified…for safer living***® program uses a slightly modified version of the ASCE 7-02 definition to delineate areas where *Fortified* homes meet Hurricane Requirements as described in this manual. Simply put, the Fortified hurricane provisions are required in all counties or parishes having areas where the ASCE 7-02 basic wind speed is 100 mph or greater. In

Florida, they are required in all counties, regardless of basic wind speed. There is not a geographic location within Florida that is over 65 miles from either the Gulf of Mexico or Atlantic Ocean. Hurricanes Andrew and Charlie clearly demonstrated that 100+ mph winds can be maintained across the entire state and ***Fortified…for safer living***® hurricane criteria should be considered with new home construction.

2.2 Wildfire

Wildfire criteria of the Fortified program may apply anywhere in the country where a home is located in proximity to areas of natural vegetation. Applicability is determined by site-specific risk assessments of vegetation, topography, and many other factors. Such assessments are conducted using the Wildfire Risk Assessment form found at www.ibhs.org. If, by using this assessment form, it is determined that the home is at a "moderate", "high", or "extreme" risk from wildfire, the home must be built, and the yard must be landscaped according to the prescriptive requirements of Section 5.0.

2.3 Flood Zones

Homes in Special Flood Hazard Areas (A or V zones) as determined by the Flood Insurance Rate Map (FIRM) from the National Flood Insurance Program (NFIP) must meet the *Fortified…for safer living* Flood Criteria. Your community flood plain management official, mortgage lender, or insurer/insurance agent can help you determine the applicable flood zone for your site. **Homes not in a Special Flood Hazard Area are exempt from the *Fortified* flood criteria.**

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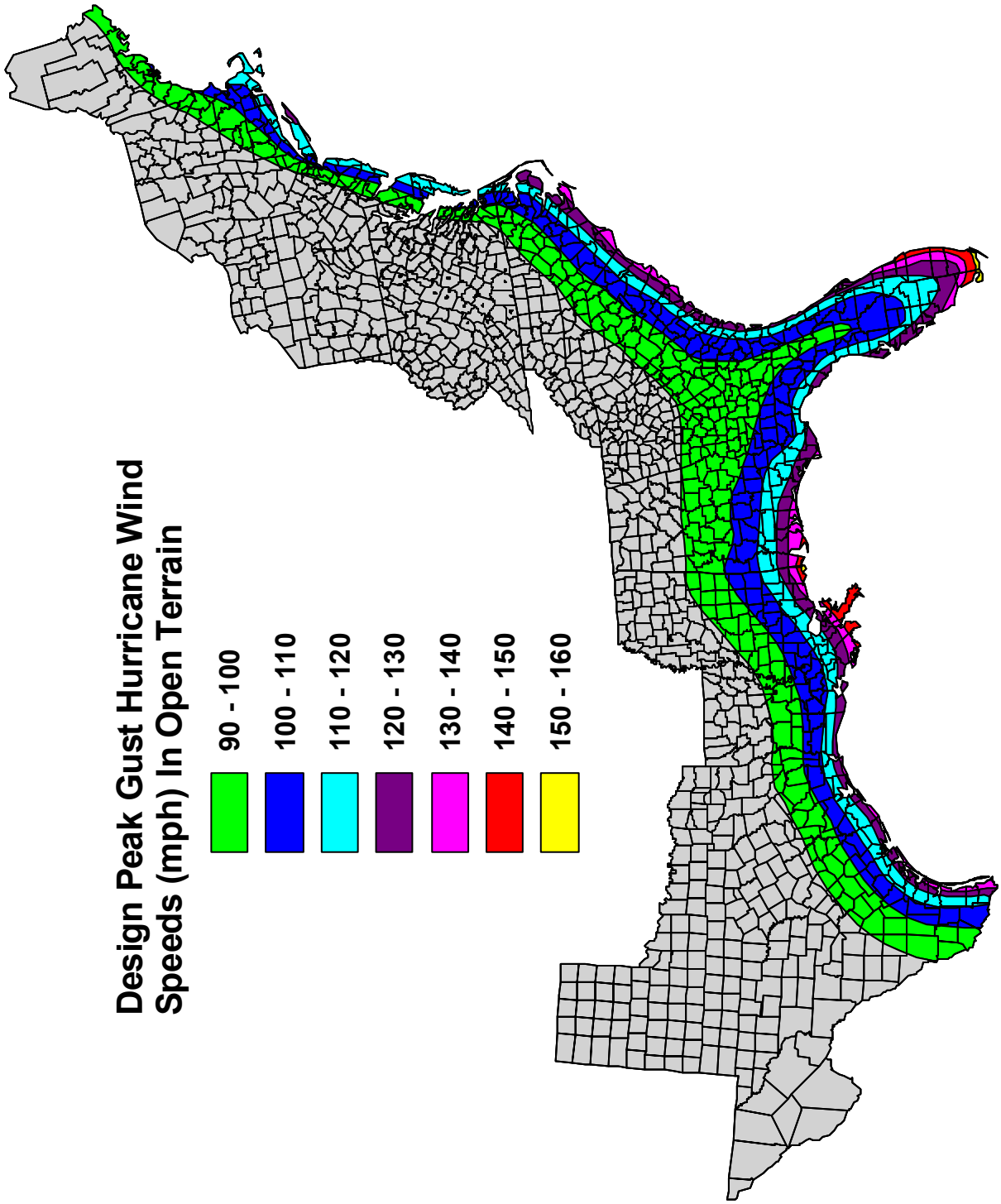


Figure 2-1: Design Wind Speed Map from ASCE 7-02

3.0 HURRICANE WIND CRITERIA

The following sections summarize the Hurricane, requirements developed by IBHS for the ***Fortified…for safer living***® program.

The ***Fortified…for safer living***® hurricane requirements use prescriptive building techniques developed based on the 110 mph fastest mile wind (equivalent to about 130 mph 3 second peak gust) provisions of the SSTD-10-99 Standard for Hurricane Resistant Residential Construction to protect homes. The prescriptive requirements listed can be applied if the following conditions are met:

- ✓ Construction type is either wood frame, timber frame, cold-formed steel, reinforced masonry, or reinforced concrete construction.
- ✓ Horizontal building dimensions are between 18’ to 60’ in length and 18’ to 36’ in width.
- ✓ The length-to width ratio of the home’s plan dimensions is less than or equal to 2
- ✓ The distance from grade level to the eaves does not exceed 30 feet at any point around the perimeter of the home
- ✓ If the home is wood frame construction, the following requirements apply:
  - Commercial species grouping of wood used in construction must be either 1) Southern Pine, 2) Douglas Fir, 3) Douglas Fir-Larch, 4) Hem-Fir, or 5) Spruce-Pine-Fir, in order to meet minimum density requirements, and shall not be less than grade No. 2
  - Maximum spacing of 2x4 studs in exterior wood frame walls is 16 inches on center. If 2x6 studs are used, the maximum allowable spacing is 24”.
  - Story heights are 10 feet or less
  - Home is either 1 or 2 stories high
- ✓ If the home is reinforced masonry construction, the following requirements apply:
  - Concrete masonry units must meet certain standards for composition and strength. Additionally, certain types of mortar are not allowed.
  - Story heights are 20 ft or less
  - Home is not more than 3 stories high

If these conditions are met, the *Fortified* Inspector will verify that the following prescriptive requirements are in place. If any of these conditions are not met, then a registered Professional Engineer or Architect must certify that the structure was designed for wind loads corresponding to at least 130 mph (3 second peak gust) for a home to be considered *Fortified*.

3.1 Elements of a *Fortified…for safer living*® Hurricane Home

A continuous and adequate load path from the roof to the foundation of the home must exist. To be considered *Fortified*, the building must have positive connections from the roof to foundation as a means to transmit wind uplift and shear loads safely to the ground. This includes providing roof-to-wall connection hardware (e.g. hurricane straps), inter-story connection hardware, anchorage to the foundation, and exterior walls fully-sheathed with structural wood panels meeting the stiffness ratings and minimum thickness specified in this guide. The required minimum allowable loads for all connection hardware to be installed within the house shall be identified on the building plans and checked during the plan review. Required minimum allowable loads for connections at specific locations within the load path are given in this section. Metal hardware and fasteners used in applications where they are either exposed to the exterior, or in contact with pressure treated wood must be either stainless steel or galvanized with a rating of G185 or greater. In Coastal A and V flood zones (discussed in Chapter 4), all exposed hardware and fasteners must be stainless steel. Dissimilar metals shall not be used in contact with each other. Thus, if stainless steel hardware is used, the fasteners used with it shall also be stainless steel.

In addition, the roof framing, sheathing and covering must all be constructed to resist wind loads and wind effects. This includes thicker roof sheathing fastened with ring-shank nails, bracing of gable ends, wind resistant roof covering materials and thicker roofing underlayment with a secondary moisture barrier or water resistant membrane over the entire deck.

Anchor Bolts

All anchor bolts shall be minimum 5/8” in diameter, with 3”x3”x3/16” washers. Bolts having a 90 or 180-degree hook (i.e., “J” bolts) shall have a minimum 7” embedment into the concrete or grout. Bolts without a hook shall have a minimum embedment of 18”

Sill plates shall have anchor bolts every four feet and within 6 to 12 inches of the end of each plate. (Figure 3-1).

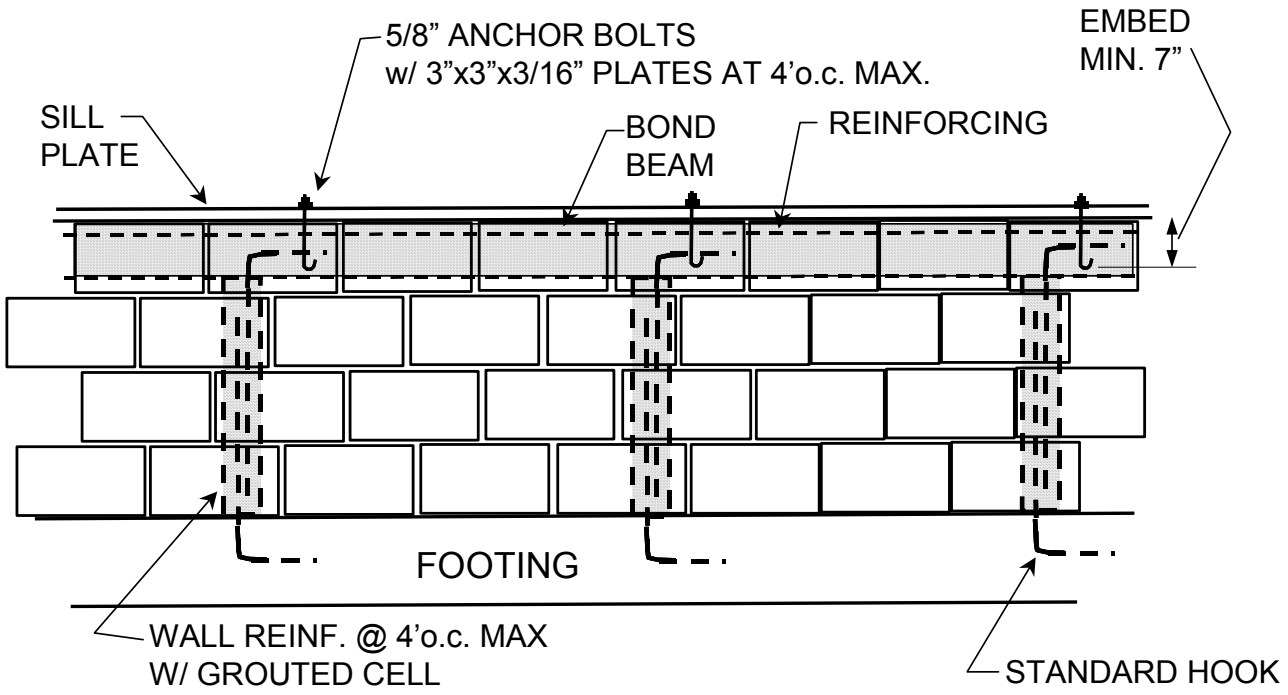


Figure 3-1: Typical foundation details for wood wall construction. Fortified inspectors are only required to check for proper anchor bolts size and spacing.

3.1.1 Wood Shear Walls

All exterior wood framed walls must be fully sheathed with minimum 15/32" thick 32/16 rated wood structural panels. Either plywood or OSB may be used. Sheathing shall overlap both top and bottom sill plates and be continuous from the plate for at least 2 feet into the wall (as shown in Figure 3-2). In two story homes, sheathing shall also overlap wall framing in both stories by no less than 2 feet to provide sufficient inter-story connections. Nailing schedule shall be 10d nails at 6" spacing along the 8' edges, 6" staggered double row along the 4' edges, and 12" spacing in the field of each structural panel.

In one story wood frame walls, blocking shall be provided at 48" on center in the first two framing spaces of wood framed walls from all corners and at either end of garage door openings. In two story wood frame walls, blocking shall be provided where needed in all framing spaces to allow nailing around the perimeters of wall sheathing panels.

All exterior walls shall be constructed as "shear walls" for at least 50% of their length. Fully sheathed wall segments wider than 48 inches without any openings larger than 144 square inches are considered shear walls provided that they have hold downs at the end of each segment (Figure 3-4) with minimum allowable load capacities as follows:

Top story end wall	3,100 lbf.	Top story Sidewall	2,600 lbf.
1st story (under 2nd)	10,000 lbf.	1st story (under 2nd)	5,300 lbf.

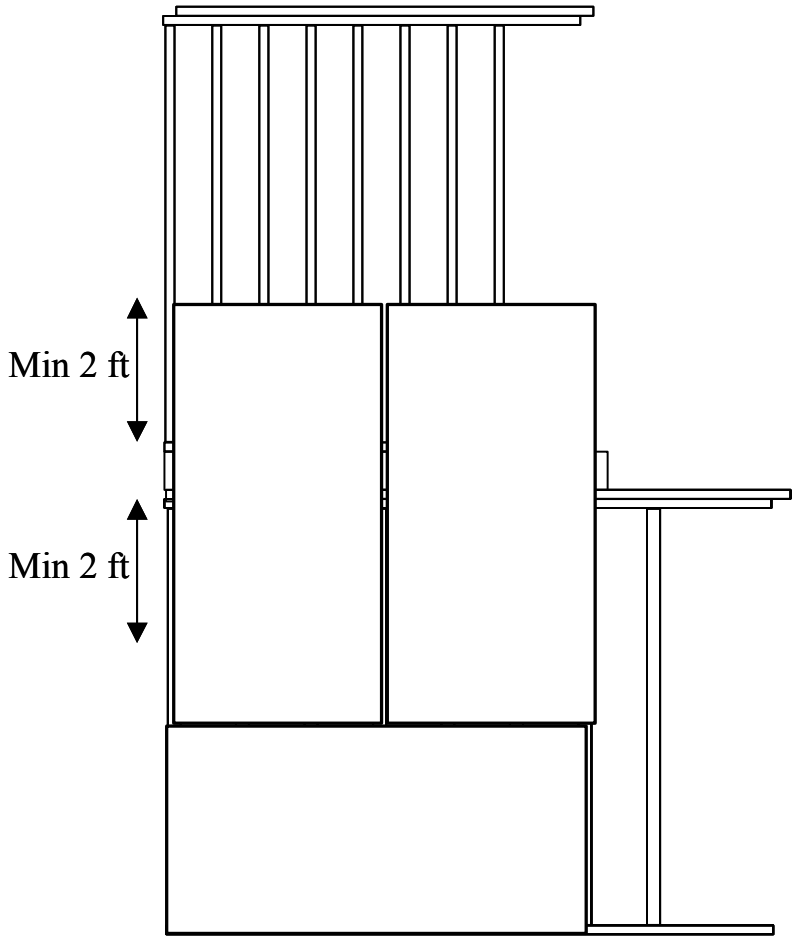


Figure 3-2: Example of how sheathing should overlap inter-story connection by at least 24 inches.

Note that these values reflect only the hold-down capacities required to resist overturning. Additional uplift resistance must be provided through separate stud-to-sill hardware having a minimum capacity of 520 lbs on each full length wall stud, except in end walls supporting gabled roofs. Stud-to-sill connections on studs supporting headers must have sufficient allowable loads to resist uplift not only from the stud itself, but also from any additional roof framing members (i.e., rafters, truss ends, or gable end wall studs) that are supported by the header. Since headers are assumed to be simply supported beams, it is reasonable to evenly divide the cumulative uplift loads on the header among the studs supporting the header. Table 3.1 gives required uplift resistances for studs supporting headers, which, in turn, support one or more roof framing members. The uplift values given for "end walls" are for gable end walls only. If the end wall supports a hip roof, use the values given for "sidewall." For studs at the ends of shear wall segments, stud-to-sill hardware may be replaced with hold-down connectors having sufficient capacity to resist both overturning and uplift. Ideally, the shear wall segments, and therefore the hold-down connectors, will be aligned vertically. However, there is no specific requirement for vertical alignment in the *Fortified* program. Specific Simpson Strong-Tie connectors that will meet the hold-down requirements for overturning resistance alone are shown in Figure 3-5 below. Depending upon the required uplift resistance, this hardware may also be sufficient for the combined hold-down requirement. Note that a single hold-down may be used when two shear walls meet at a corner. This is

allowed as long as the hold-down is sized for the larger of the two required capacities, and connected to studs used for both shear wall segments as detailed in Figure 3-6. When a single hold down is used at a corner on the first of two stories, the 16d nail spacing must be reduced to 4". See Section 305.7 of SSTD 10-99 for more information on hold-down connectors. Also note that hold-down connectors for second stories must extend across floor framing to connect first and second story walls (as shown in Figure 3-7). Note that this figure shows three types of connectors, and does not reflect the required spacing of the hold-down connectors.

Table 3.1: Required uplift resistance for stud-to-sill hardware on studs supporting headers. Note: where end walls support a hipped roof, use values given for "Sidewall." (Values given in pounds)

		No. of Roof Framing Members Over Adjacent Header								
		0	1	2	3	4	5	6	7	8
Roof Framing Spacing = 16"	Sidewall	710	1160	1610	2060	2510	2960	3410	3860	4310
	Endwall	0	0	50	110	170	230	290	350	410
Roof Framing Spacing = 24"	Sidewall	1155	1828	2500	3173	3845	4518	5190	5863	6535
	Endwall	0	80	170	260	350	440	530	620	710

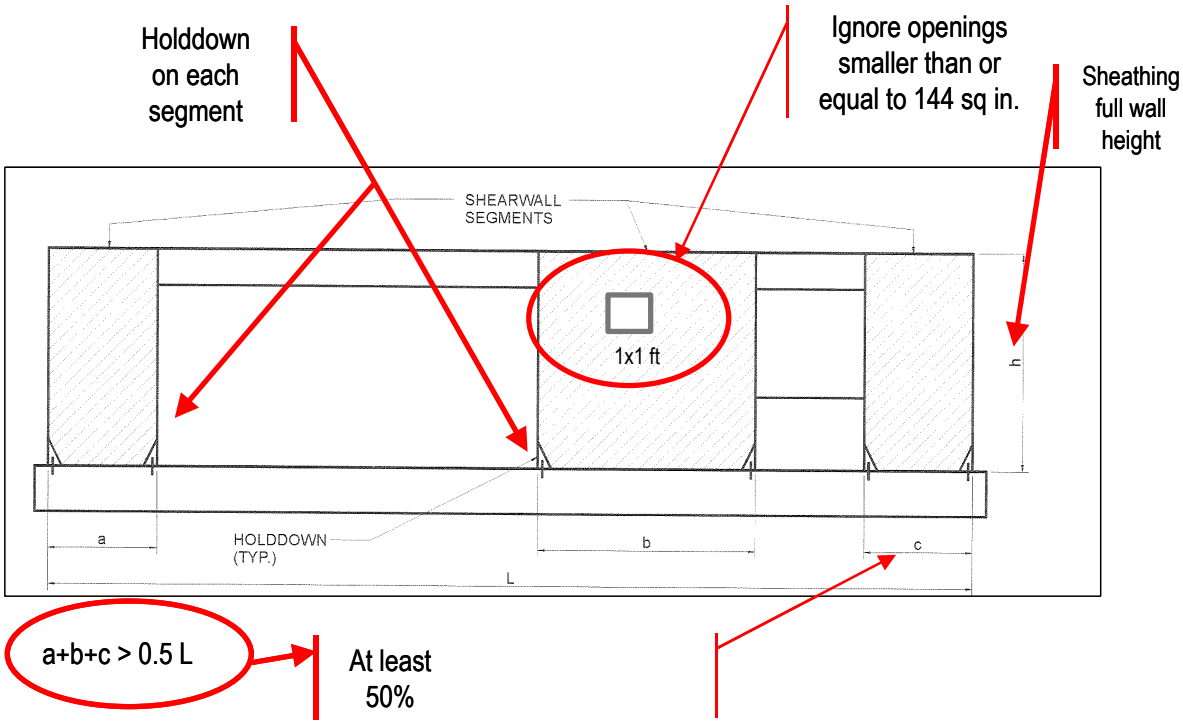


Figure 3-3: Illustration of Shear wall length criteria.

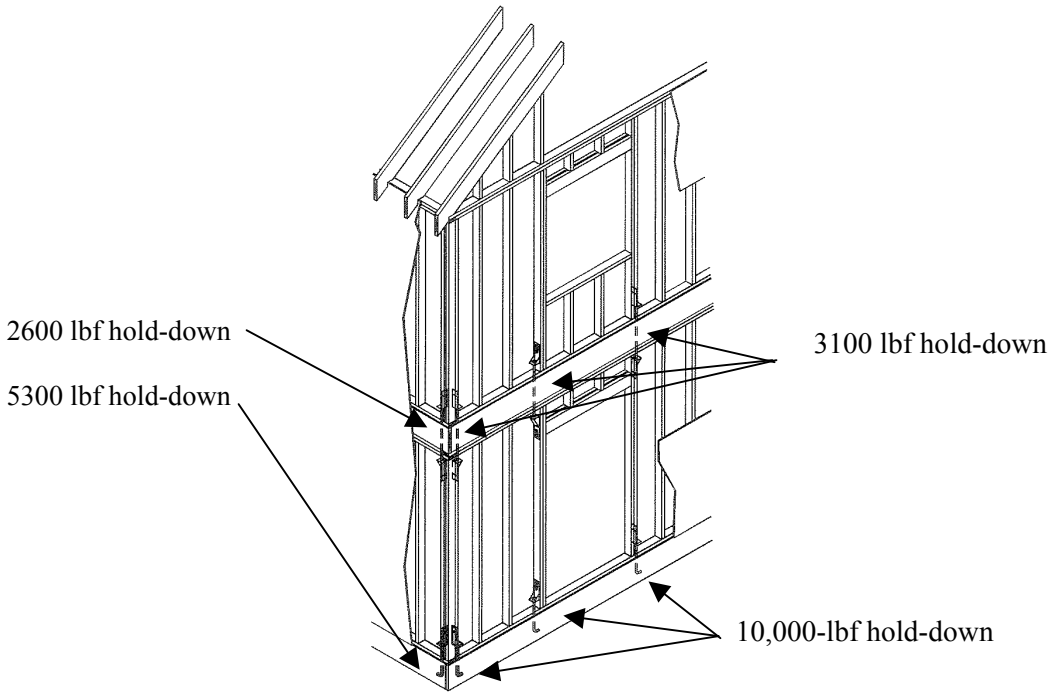


Figure 3-4: Typical Locations of hold-down connectors on 2-story house (adapted from SSTD10-99 from Southern Building Code Congress International. 1999)

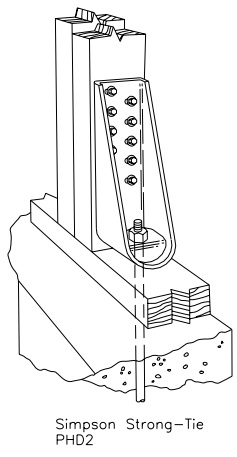
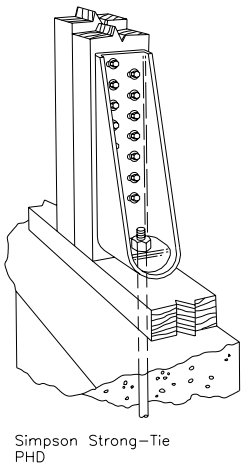
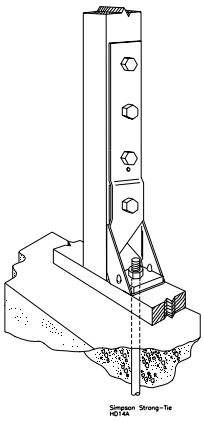
		
PHD2 = 3610 lb allowable load One story and top story of 2 story sidewall and end wall	**PHD6 = 5860 lb allowable load Lower story sidewall**	**HD14A = 11,080 lb allowable load Lower story end wall**

Figure 3-5: Examples of hold-down connectors from Simpson Strong-tie that will qualify for the *Fortified* hold-down requirements. (Simpson Strong Tie, 2002).

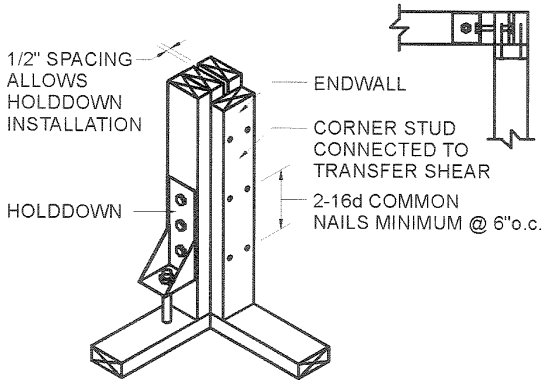


Figure 3-6: Example of single hold-down connection detail at corner. When used on the first of two stories, reduce 16d nail spacing to 4". (adapted from SSTD10-99)

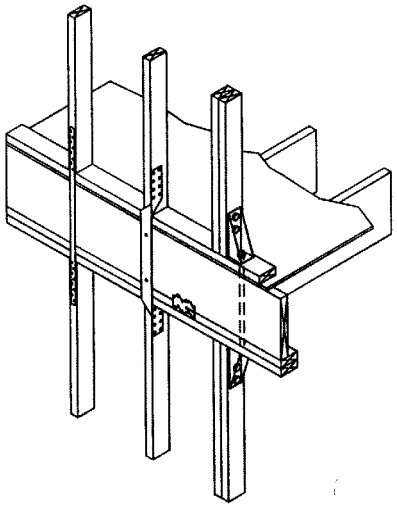


Figure 3-7: First to Second story hold-down installation examples. (adapted from SSTD10-99).

3.1.2 Inter-story connections

Inter-story (2nd story to 1st story) details must include metal strapping every 48 inches (every 3rd stud) along exterior walls with an allowable load capacity of at least 1500 lb and be sheathed with continuous wood structural panels (either plywood or OSB), with a minimum span rating of 32/16, and a minimum thickness of 15/32 inches. Figure 3-8 shows four types of acceptable strapping. Note that the hold-down connectors for the 1st to 2nd story connections (Figure 3-7) required for the wood shear walls can be counted as inter-story connections if they are sized for both uplift and overturning forces.

In addition to the straps the builder should install sheathing so that the horizontal joints between the panels are at least 2 feet above/below the floor connection as shown in Figure 3-2. This essentially mandates that sheathing be oriented vertically across the inter-story connection.

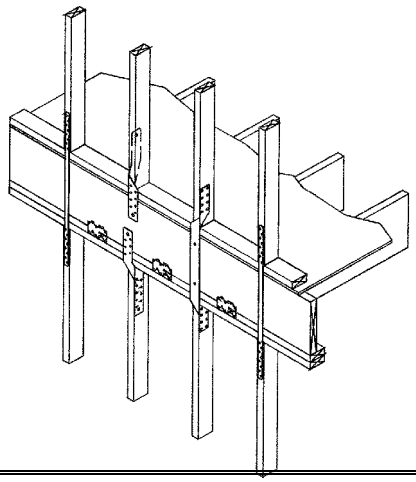


Figure 3-8: Metal Strapping used for inter-story connections (adapted from SSTD10-99 from Southern Building Code Congress International. 1999)

3.1.3 Flooring

All wood framed floors must have full depth 2x blocking in the first two spaces between the floor joists at each end of the floor diaphragm. Blocking

shall be spaced no more than 4 feet on center, and shall correspond with the joints between subflooring panels for edge nailing purposes. Subflooring shall be nailed to floor framing using 10d common nails at 6"/12" spacing on the 1st floor and 4"/12" spacing on the 2nd floor for shear resistance. Where subflooring overlaps the first two framing spaces at each end of the diaphragm, proper edge nailing must be used to connect the subflooring to the blocking below.

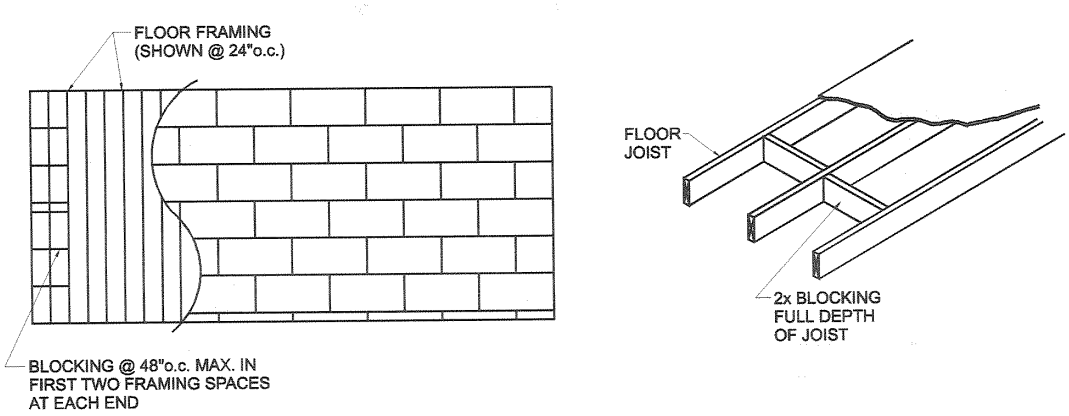


Figure 3-9: Required blocking of floor joists for wood frame floors (SSTD 10-99).

3.1.4 Roof-Wall Connectors

Hardware connectors must be provided from all roof framing members to wall frames. All connectors shall wrap over the top of the roof truss or rafter and be installed according to the manufacturer's recommendations. The minimum allowable load for these straps is 1345 lb for roof framing spaced at 24", and 900 lb for roof framing spaced at 16". (per SSTD 10-99) These uplift loads are based upon the SSTD 10-99 110 mph fastest mile requirements for a building 36' wide, having a roof dead load of 7 psf.

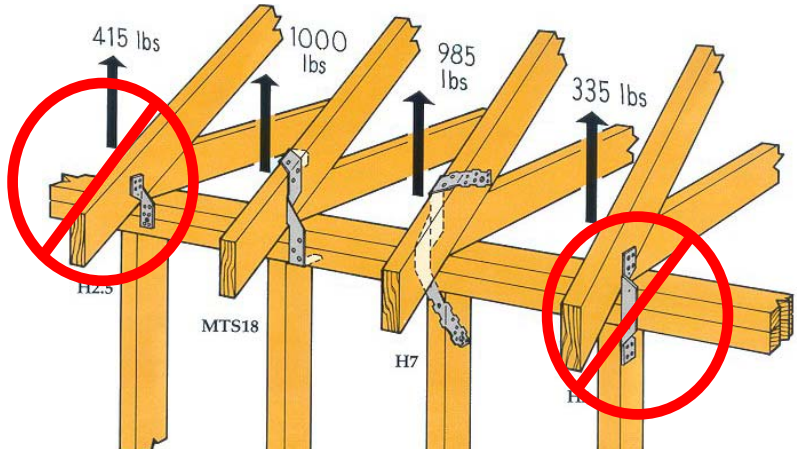


Figure 3-10: Strap types used in wood construction. Note that the non-wrapping clip styles on the left and right are not accepted by the *Fortified* program. (used with permission from Simpson Strong-Tie, 1991).

3.1.5 Attached Structures

Securely anchor connections for exterior attached structures such as carports and porches that attach to the main structure of the house (Fig 3-11 and 3-12). Stainless steel or hot dipped galvanized hardware with a minimum rating of G185 shall be used for any connections that will be exposed to weathering in service. Fasteners used with such hardware shall consist of a similar metal to prevent accelerated corrosion. In Coastal A and V flood zones (Chapter 4), all exposed hardware and fasteners must be stainless steel. Stainless steel hardware and fasteners must also be used when applied to preservative treated lumber.

Figure 3-11: Connection of column to foundation with post anchor.

Figure 3-12: Strapping of top of porch column to supporting beam.

3.1.6 Roof Truss and Gable Bracing

Gable end bracing shall be provided at all gable end walls to resist lateral loading and uplift of the gable truss. This shall include lateral bracing of the bottom chord, anchoring of the bottom chord, cross-bracing, and lateral bracing of top chord.

The following specifications and guidelines apply only to gable end construction with flat ceilings constructed with truss or rafters/joists. Other configurations such as cathedral ceilings may be accepted, but may require review by the *Fortified* inspector or by a design engineer.

Note that for truss roofs, the truss manufacturer has designed the truss under the guidance of a professional engineer. In such cases, roof trusses shall be designed to resist the wind loading brought about by a basic wind speed of 130 mph (3-second gust). The truss manufacturer shall provide documentation that the trusses have been designed for said wind loads.

Installation instructions provided by the truss manufacturer should come with details for properly bracing the gable end. If the *Fortified* requirements are different than the specifications from the truss manufacturer, the truss manufacturer's engineer shall review the bracing requirements specified here prior to construction in the same way that any other modifications or repairs to the trusses must be reviewed by the truss manufacturer's engineer.

3.1.6.1 Lateral Bracing of Bottom Chord

Install horizontal braces, running perpendicular to the bottom chords of the roof trusses, at 4 feet on center and extending back 8 feet from the gable end wall. The brace will consist of a 2x4 fastened with 2 16d nails at each truss chord and 4 16d nails into the blocking in the first framing space, as shown in Figure 3-13. These lateral braces must be aligned with studs in the end wall below so that it is possible to connect the braces to wall studs using metal strapping. Such metal strapping, when properly installed, helps to resist both lateral forces, and uplift on the gable end wall. Proper application of this strapping is discussed in the following section.

3.1.6.2 Bottom Chord Anchoring for Uplift

For the platform styles of wall construction (wood or masonry), it is important to transfer the uplift loads from the gable truss/frame wall to the end wall below. In order to ensure complete load paths at these points, metal straps rated for a minimum tensile load of 770 lb shall be installed at each lateral brace as illustrated in Figure 3-13. In addition, for wood construction, the wall sheathing shall overlap the connection between the end wall and gable truss/frame by at least 12 inches (Figure 3-15).

3.1.6.3 Cross Bracing

This type of bracing will transfer lateral loads from gable truss to the ceiling and roof sheathing planes where loads can be effectively transferred into shear walls. The ***Fortified…for safer living***® program requires cross bracing to be installed at the same spacing as the lateral bottom chord braces described above (every 4 feet). This bracing is to be installed in all configurations with flat ceilings. Keep the orientation of the X in the vertical plane, and make sure that the connection between the cross braces and trusses is done into the side of the top chord and bottom chord of the trusses, as shown in the inset of Figure 3-16.

3.1.6.4 Top Chord Bracing

Install 2x4x8' blocking along the top chords of gable ends at all locations where cross bracing is installed (i.e., with a horizontal projection of not more than 48" O.C.). This bracing shall be constructed

in a manner that is identical to the bottom chord bracing, with the exception that the metal strapping is not required. Proper installation of top chord bracing is illustrated in Figure 3-13.

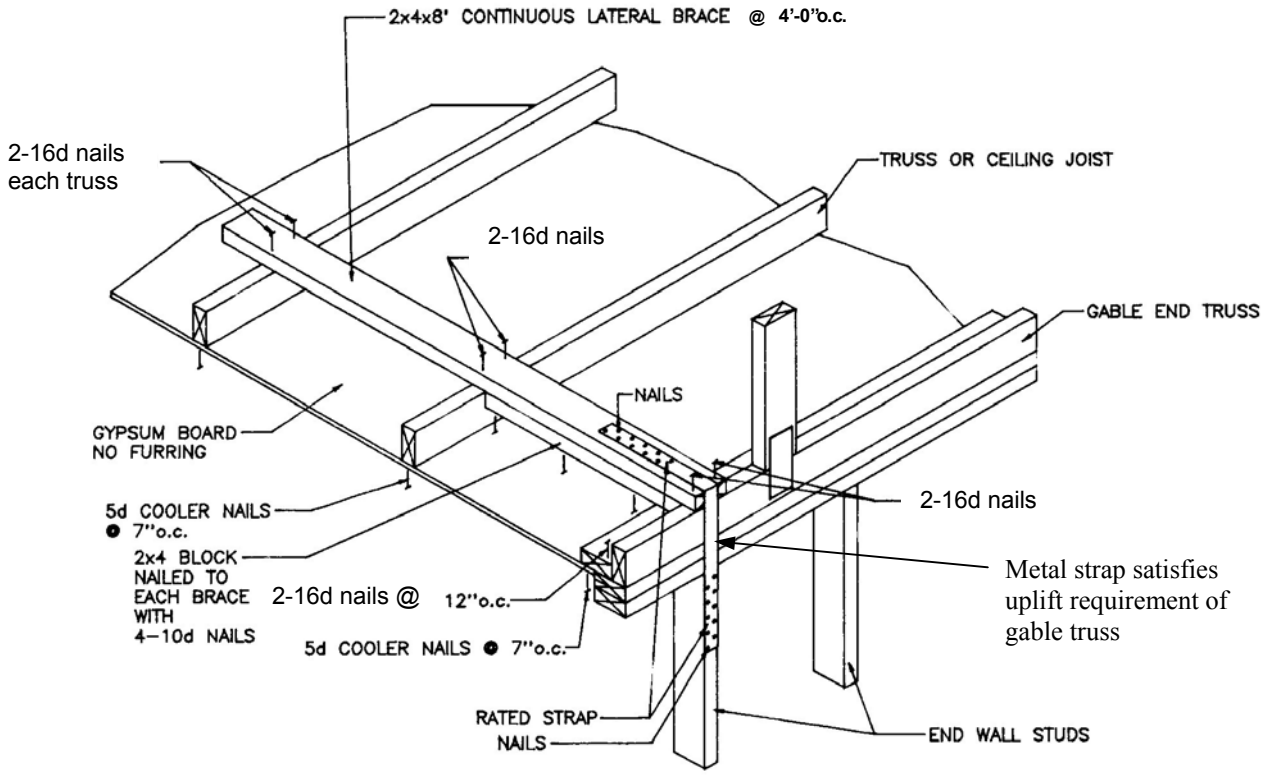


Figure 3-13:Horizontal Lateral Bracing Construction Details (adapted from SSTD10-99 from Southern Building Code Congress International, Inc., 900 Montclair Rd., Birmingham, AL, 35213-1204).

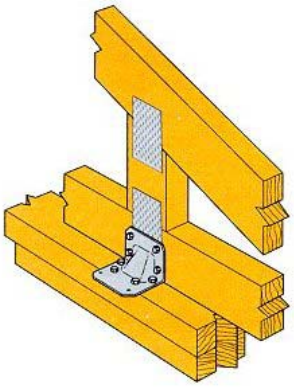


Figure 3-14: Hurricane Gusset Angle is designed to transfer uplift and lateral loads from gable end truss to the wall below (Simpson Strong Tie, 2000). This can be used as alternative to metal strap in Figure 3-13.

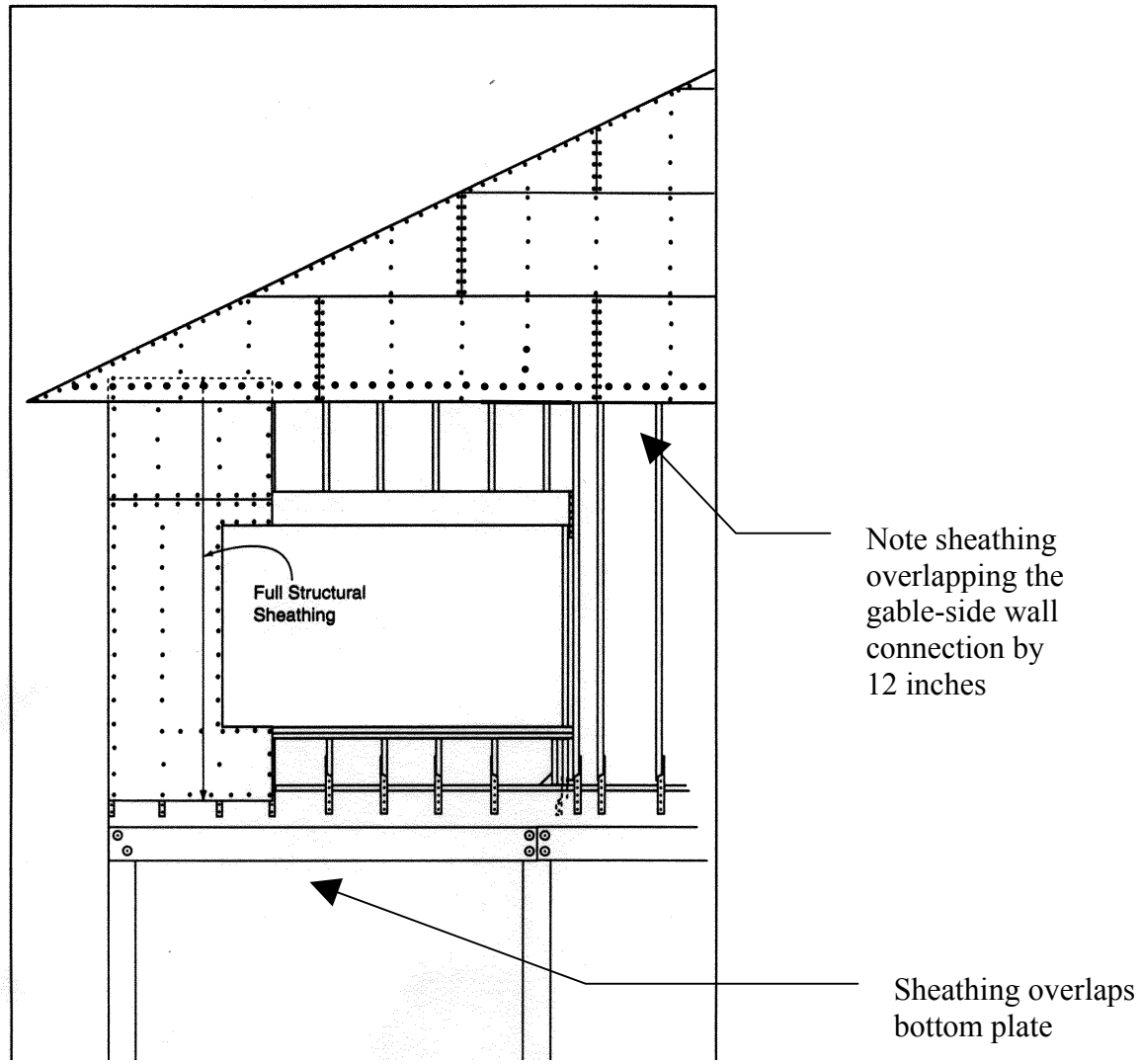


Figure 3-15: Example of how wall sheathing should overlap the gable wall-side wall connection.

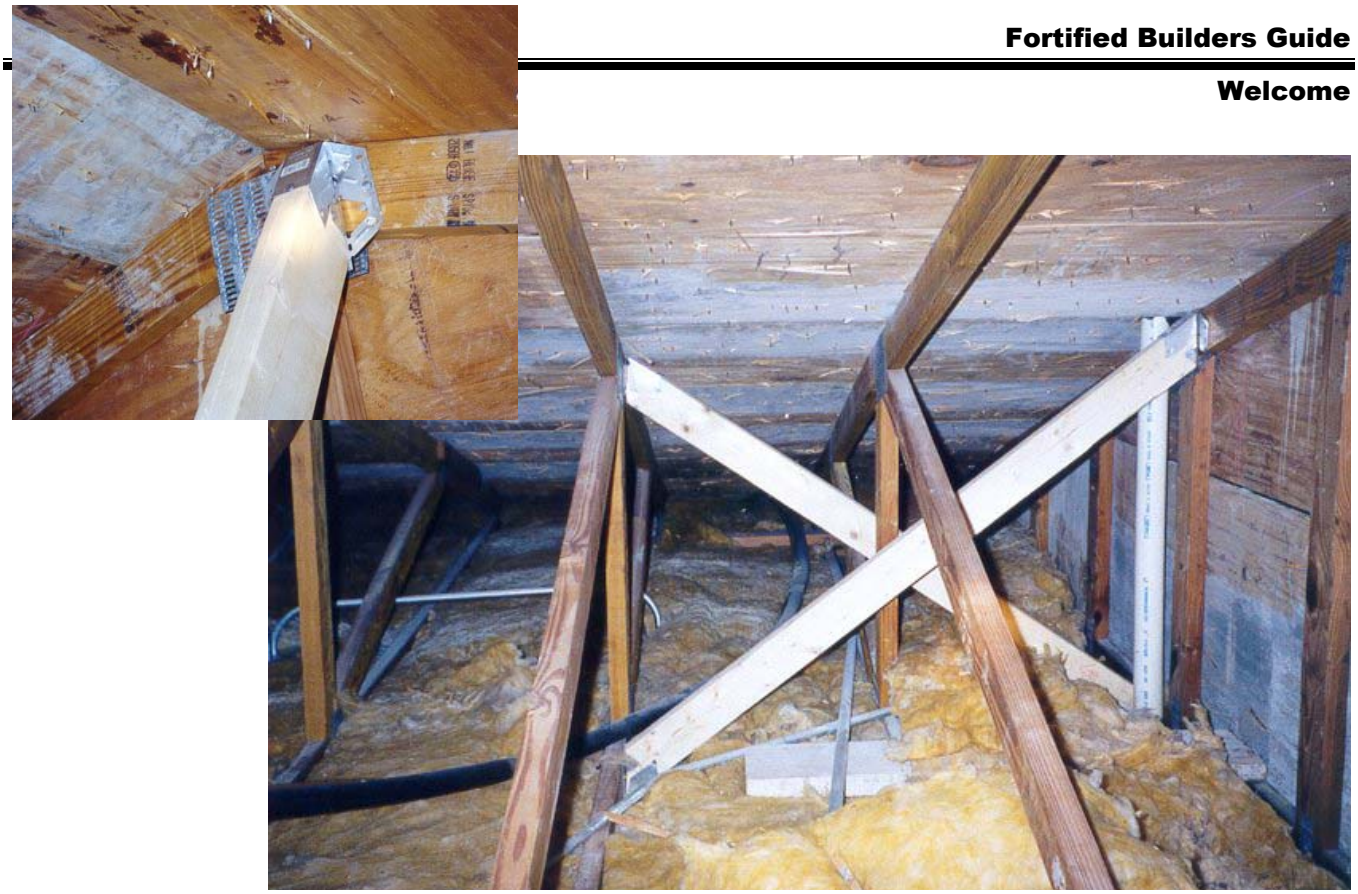


Figure 3-16: Gable End Wall Cross Bracing. [Inset: Cross Bracing should connect to truss as close to the sheathing as possible. In this case, a special metal connector was used to make installation easier in existing attic] Top and bottom chord bracing not shown.

3.1.7 Roof Sheathing

Roof decks must be fully sheathed with 40/20 rated wood panels having a minimum thickness of 19/32". Either plywood or OSB may be used. Sheathing shall be attached with 8d ring shank (2.5" long by 0.120" diameter) nails at 4" on center on any panel adjacent to a gable end (those panels shown in color in Figure 3-18). The same nails are required at a spacing of 6 inches on center everywhere else on the roof deck. Roof sheathing must be nailed to roof trusses/rafters, as well as to the blocking formed by the gable end brace of the top chord. A minimum withdrawal design value of 60 lb per fastener is required of all nails used to attach roof decking. This requirement will be met or exceeded, provided that the roof framing lumber (i.e., roof trusses or rafters) consists of either Mixed Southern pine or Southern Pine. If required due to roof geometry, piecework (panels ripped lengthwise to a width less than 4 ft) is to be located in a strip located at least 4' away from the ridge or eaves. This is illustrated in Figure 3-18.

Note that the nails must be a full 2.5-inch long to qualify. Shorter nails may be qualified by the *Fortified* inspector through comparative analysis using information about the nail size and wood species from NER 272. All nails shall be installed such that they do not protrude out the side of the framing members as shown in Figure 3-17.

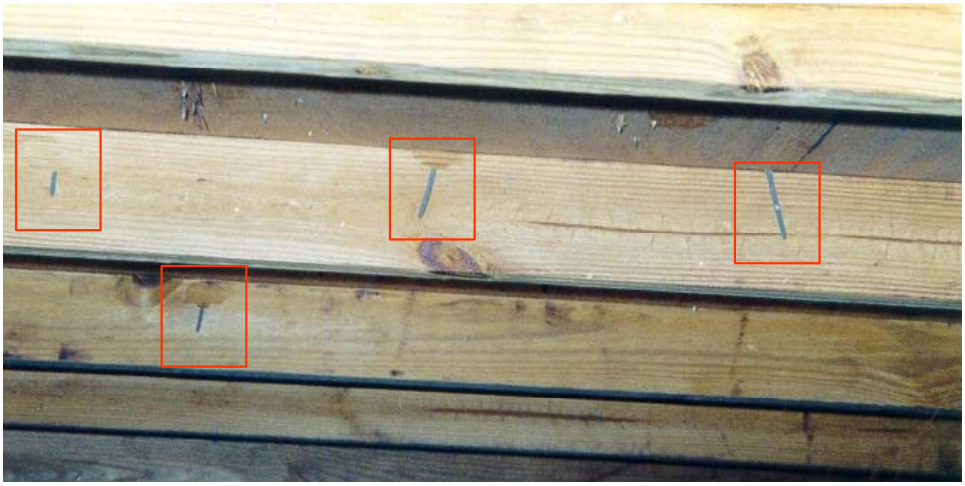


Figure 3-17: Avoid sidesplitting nails in deck to rafter connections. Note frequency of misses in this case causes roof deck to be very vulnerable to wind damage.

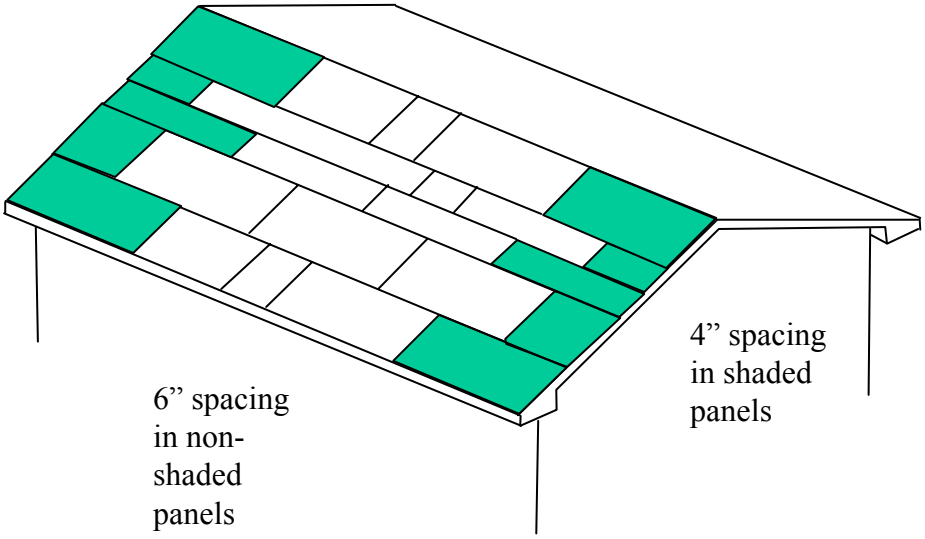


Figure 3-18: Nail Spacing requirements for plywood or OSB roof deck

3.1.8 Secondary Water Resistance

All roof panel joints shall be covered with a self-adhering polymer modified bitumen tape of at least 4” width to provide secondary water resistance. Alternatively, a self-adhering polymer modified bitumen membrane may be used in lieu of both the underlayment and self-adhering tape. Self-adhering polymer modified bitumen tape and membranes must comply with ASTM D1970 “Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection”.

Figure 3-19: Installation of secondary water resistance using self-adhering strips.

3.1.9 Roof Underlayment

At a minimum, roofing underlayment shall consist of either a single layer of 30# felt with a minimum 2" overlap or two layers of 15# felt with a 19" overlap. Both underlayment application methods require a minimum 6" end lap. Alternatively, a self-adhering polymer modified bitumen membrane meeting ASTM D1970 may be used in lieu of both the underlayment and self-adhering tape. In cases where the manufacturer of the roof covering to be used specifies more stringent underlayment requirements, the more stringent procedures shall be followed. Nail spacing shall be no greater than 6" along the laps and 12" in the interior of each strip using low profile roofing nails with load distribution disks or capped head nails. Roofs within 3000 feet of salt water require hot dipped galvanized fasteners for attachments of all roof coverings, including the underlayment.

3.1.10 Roof Covering

Roofing systems on homes built under the Fortified program must be built to withstand a design 3-second gust wind speed of at least 130 mph. The most common residential roof types and their respective Fortified requirements are given below. Provided that the roof covering is selected and applied in accordance with the applicable criteria given within this section, the roofing system will be deemed to comply with Fortified standards.

- **Asphalt shingle** roof coverings shall meet one of the test standards listed below, and be installed in accordance with the manufacturer's recommendations for high-wind regions. Additionally, each strip shall be attached to the roof deck with no less than 6 roofing nails. The tabs of shingles adjacent to, or along the eaves, hips, and ridges must be manually adhered to the underlying surface with at least three 1" diameter dabs of asphalt roof cement per tab. Along rake edges, shingles shall be manually adhered to the underlying surface with 1" diameter dabs of asphalt roof cement at spacings of 2" on

center. Shingles – including hip and ridge materials – must meet one or more of the following standards:

- ASTM D3161. Note: If materials tested under this standard are used, it must be verified that they were tested to a minimum wind velocity of 130 mph.
- UL 2390 and ASTM D6381. Note: These standards must be used together in order to determine whether or not the shingles will be able to withstand a design wind speed of 130 mph.

- **Clay and concrete tile** roof coverings shall be installed in accordance with the manufacturer's recommendations for high-wind applications of 130 mph or greater. Except along the hips and ridges, each tile shall be attached using two (2) mechanical fasteners consisting of either #8 screws or 10d ring-shank nails. Mortar-set attachment is not permitted. Nailer boards shall be installed along all hips and ridges with 1.5" wide, 26 gage galvanized steel straps screwed to the roof deck with two (2) #8 wood screws at a maximum spacing of 37". Hip and ridge tiles shall be mechanically attached to the nailer board using a minimum of one (1) #8 screw per tile.

- **Metal panel** roofing systems shall be designed for a minimum of 130mph 3-second gust basic wind speed at exposure C using ASCE 7 to determine applicable loads, and ASTM E1592 to determine resistance.

For all other roof coverings, documentation showing confirmation that hurricane level wind loads were used in determining the fastening requirements. Any documentation showing acceptance in Miami-Dade county will be adequate. All roof coverings, regardless of type, must be installed in accordance with the manufacturer's recommendations for high wind regions.

3.1.11 Soffits and Fascias

All soffits and fascias shall have a minimum design pressure of +33/-43 psf, as determined by the AAMA 1402-86 test standard. Unsupported soffit lengths shall not exceed the maximum dimensions of the tested configuration, as reported by the manufacturer. Soffits shall be installed according to the manufacturers recommendations for high wind regions.

3.1.12 All Openings: Flashing and Installation

Windows and doors are installed according to manufacturers specifications. The *Fortified* program has specific requirements for flashing around all windows and doors in wood frame walls that may exceed requirements from manufacturer. Confirm that flashing meets the following specifications. Note that there is no requirement for flashing in masonry walls. The intent of these details is to prevent moisture penetration into the wall cavities as well as the interior spaces. As a builder, you are encouraged to obtain training and certification through the AAMA (American Architectural Manufacturers Association) InstallationMasters™ Residential and Light Commercial Window and Door Installation Program. Contact Larry Livermore at (540) 877-9957 to obtain more information.

The steps presented below are consistent with Method "B" from the AAMA InstallationMasters™ guide for windows with mounting flanges and weather resistant barriers applied after installation of the windows. These recommended steps are presented in a step-by-step format as well as in Figure 3-20. Other types of windows or installations methods are acceptable as long as the AAMA InstallationMastersTM guide, or ASTM E 2112-01 – *Standard Practice for Installation of Exterior Windows, Doors, and Skylights*, recommends them.

The following five sections give instructions for installing windows with mounting flanges.

3.1.11.1 Step 1: Sill Flashing

Install a 9" wide piece of flashing flush with the rough opening of the window allowing the flashing material to overlap the sheathing below. Fasten with staples at the top edge and do not remove release paper until weather resistant barrier is installed in Step 5. Extend the flashing 9" beyond the rough opening at the side jambs.

3.1.11.2 Step 2: Jamb Flashing

Install 9" wide flashing on the side jambs of the windows opening letting the material extend above the top opening 8.5" and extending below the sill for a minimum of 9". Jamb flashing should overlap the sill flashing. Attach entire length except for lowest 9" to allow weather resistant barrier to be installed in Step 5.

3.1.11.3 Step 3: Install the window

Apply a continuous bead of sealant to back of perimeter of mounting flange in line with the pre-punched holes. Install window in wall according to the manufacturers recommended schedule. Cover up any pre-punched holes in nailing flange with sealant.

3.1.11.4 Step 4: Head Flashing

Apply a bead of sealant to outside of top mounting flange and then install 9" wide flashing overlapping nailing flange. Head flashing must cover top edge of jamb flashing and should extend a minimum of 9" past side jambs of window. .

3.1.11.5 Step 5: Weather Resistant Barrier

Install weather resistant barrier consisting of house wrap or building paper in weather board fashion starting from base of the wall and working upward. The first course of weather resistant barrier should be tucked up under the sill and loose ends of jamb flashing. Attach sill and jamb flashing to barrier. Apply next courses of barrier to overlap the jamb flashing as shown in Figure 3-20.

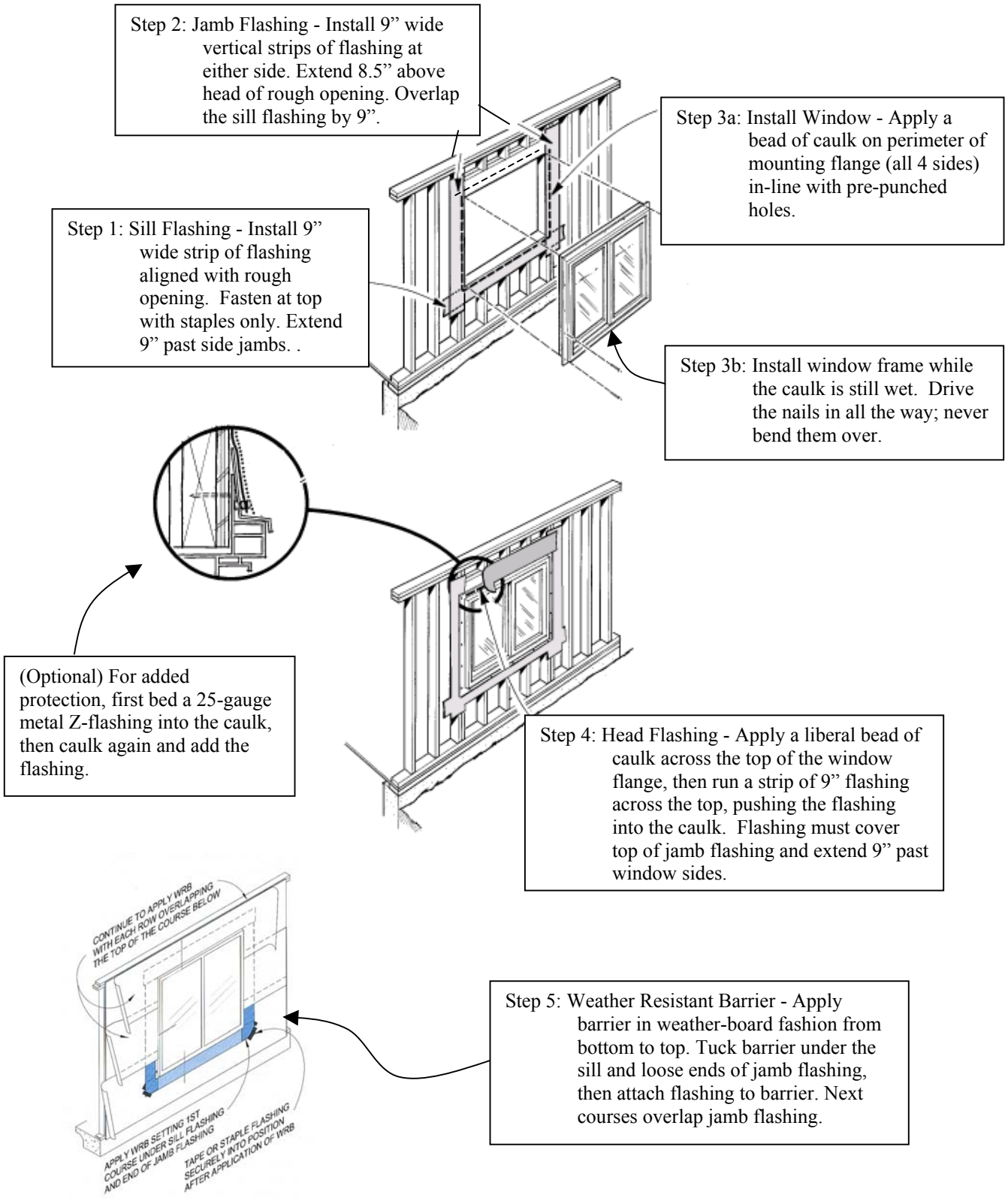


Figure 3-20: Water Penetration Resistant Window Flashing Details (diagram provided by AAMA).

3.2 Openings

All entry doors, windows, skylights, patio doors and garage doors must be tested and certified to meet impact resistance and pressure standards. If the units themselves are not tested, then they must be protected by a protection system (storm shutter or screen) that meets the impact resistance standards. Systems must be compliant with at least one of the following:

ASTM E 1996
SSTD-12
Miami-Dade County Protocol A 201
Florida Building Code TAS 201

4.0 FLOOD REGION CRITERIA

The IBHS flood requirements are, in general, no different than the minimum requirements of the National Flood Insurance Program (NFIP), except in two respects. First, the building must be at least 2 feet higher than the BFE, and second, the foundations in Coastal A zones must adhere to the same requirements as those in V zones. That is, only open elevated foundations are allowed in the Coastal A zone in the *Fortified* program.

4.1 Flood Zones

V Zone – Areas along coasts subject to inundation by one percent annual chance flood events with the additional hazards associated with storm induced waves. Mandatory flood insurance purchase requirements apply.

Coastal A zone – A zone landward of a V zone, or landward of an open coast without mapped V zones (e.g., the shorelines of the Great Lakes), in which the principal sources of flooding are astronomical tides, storm surges, seiches, or tsunamis - not riverine sources. An example an elevation showing V and Coastal A zones is given in Figure 4-1.

A Zone – other areas subject to inundation by one percent annual chance flood event (e.g., along inland rivers, lakes and lowlands).

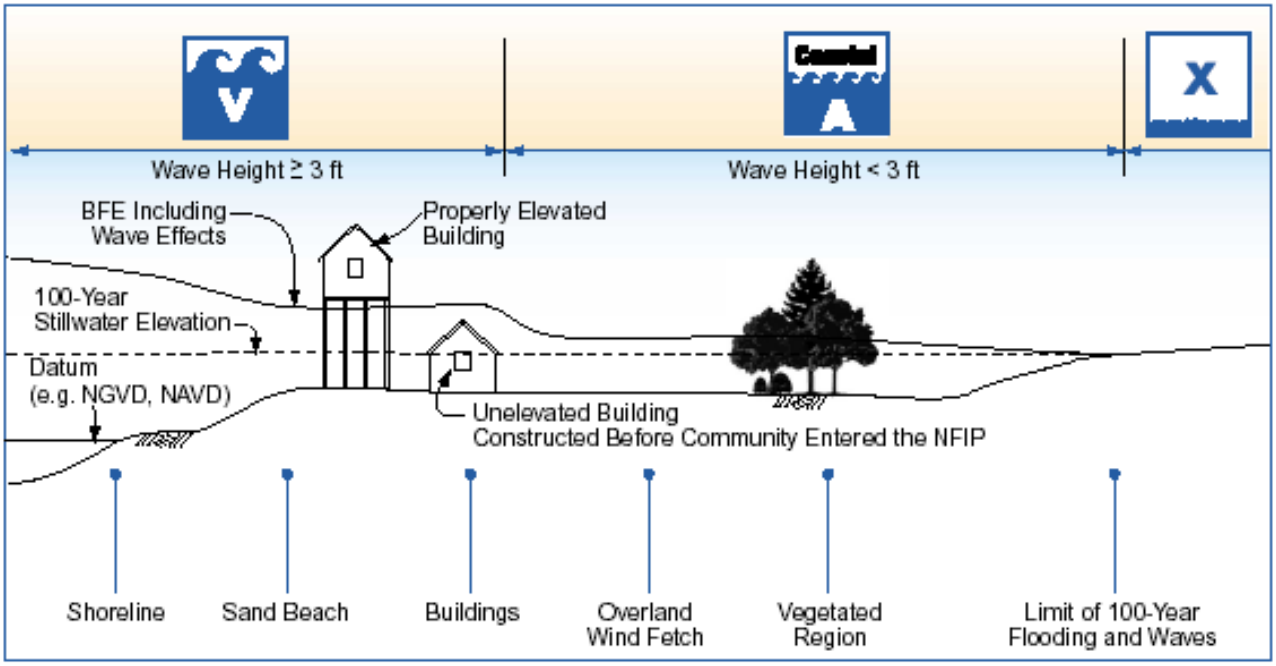


Figure 4-1: Typical shoreline elevation showing flood zones V, Coastal A and X (from Coastal Construction Manual, 3rd edition FEMA 55. Federal Emergency Management Agency).

4.2 Building Requirements

4.2.1 Foundation

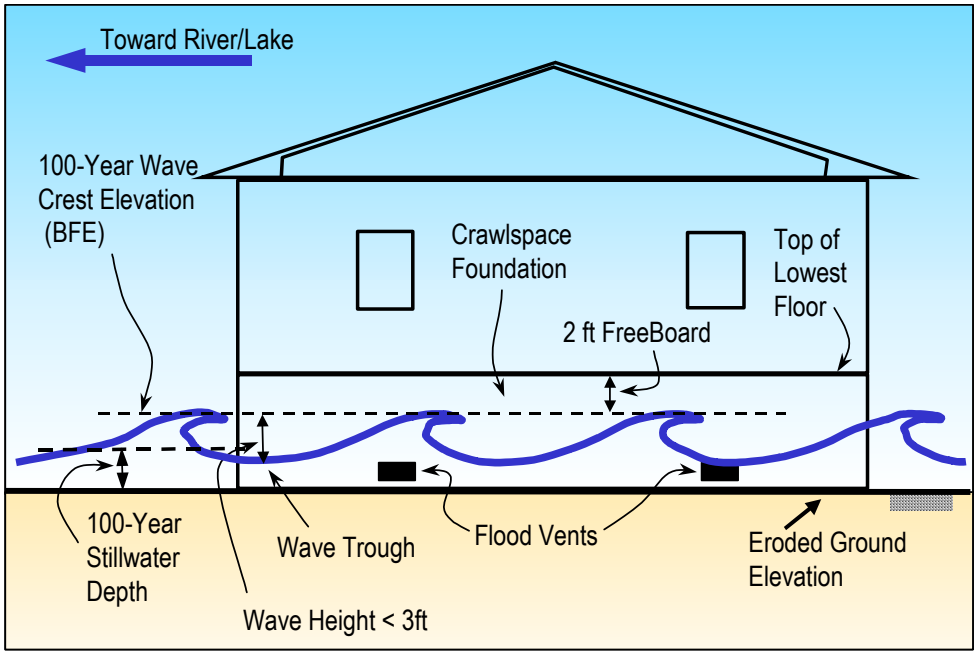
Homes in Non-Coastal A zones must be designed and constructed with the lowest habitable floor (including basements) above the Base Flood Elevation (BFE) by at least 2 ft. Community records or a licensed survey are required to determine the BFE. (Figure 4-2)

Homes in V or Coastal A zones must be constructed on open foundation (including elevated-enclosed with breakaway walls) with continuous piles in accordance with the FEMA Coastal Construction recommendations. The bottom of the lowest horizontal support member must be above the BFE by at least 2 ft. Note that the NFIP would normally allow other foundation types such as crawlspaces with flood vents in the Coastal A zone. (Figure 4-2)

4.2.2 Utilities

Electrical, heating, ventilation, plumbing, air conditioning equipment and other service facilities must be elevated above the BFE by at least 2 ft in Special Flood Hazard Areas.

Non-Coastal A zone requirements



V zone and Coastal A zone

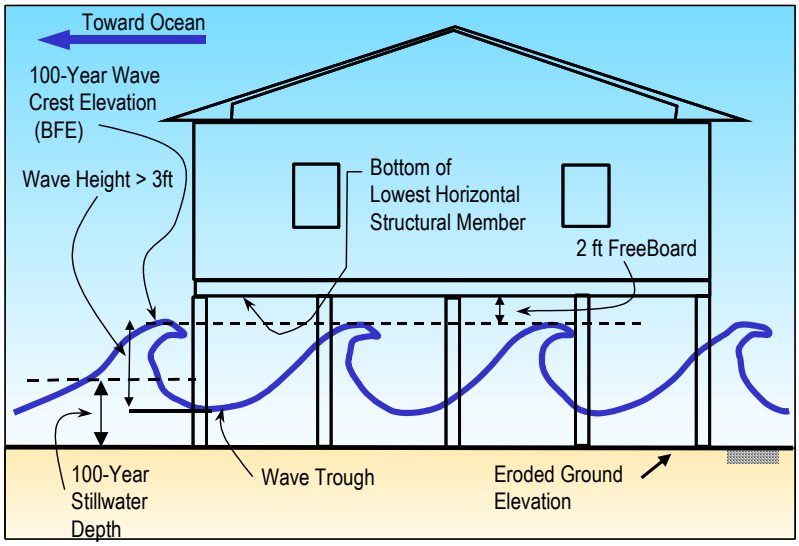


Figure 4-2: Requirements for Fortified foundations (adapted from Coastal Construction Manual, 3rd edition FEMA 55. Federal Emergency Management Agency).

5.0 WILDFIRE REGION CRITERIA

The Wildland/Urban Interface is an area where structures and other improved property meets or intermingles with wild land or vegetative fuels.

5.1 Site Evaluation

The *Fortified* Inspector will identify the wildfire hazard level for the site by examining the following items:

Ingress and egress into subdivision
Road widths
Road condition
Road terminus
Surrounding vegetation (fuel)
Topography/slope of surrounding area
History of fire occurrence due to lightning, railroads, burning debris, arson, etc.
Building setback
Fire protection systems (fire hydrants)
Utilities: gas and electric

Each factor is assigned a point value and the cumulative value of the points determines whether the site is in a low, moderate, high or extreme wildfire hazard setting. Note that if the hazard level is determined to be Low, then none of the wildfire criteria are applicable. For a risk assessment checklist, visit www.ibhs.org.

5.2 Wildfire Protection Criteria Common to Extreme, High and Moderate Wildfire Hazard Levels

The following items are applicable to all extreme, high, and moderate Wildfire Hazard Areas. These requirements must be augmented by the hazard specific requirements that follow this section.

A non-combustible street number at least four inches high, reflectorized, on a contrasting background, at each driveway entrance, visible from both directions of travel.

Firewood storage and LP gas containers must be at least 50 feet away from any part of the home structure, and have at least 15 feet of survivable space around them.

Non-combustible, corrosion-resistant screening with a mesh size no greater than ¼" covering the attic and sub-floor vents. Vent openings shall not exceed 144 square inches at each vent.

Spark arrestors in all chimneys (Figure 5-1)

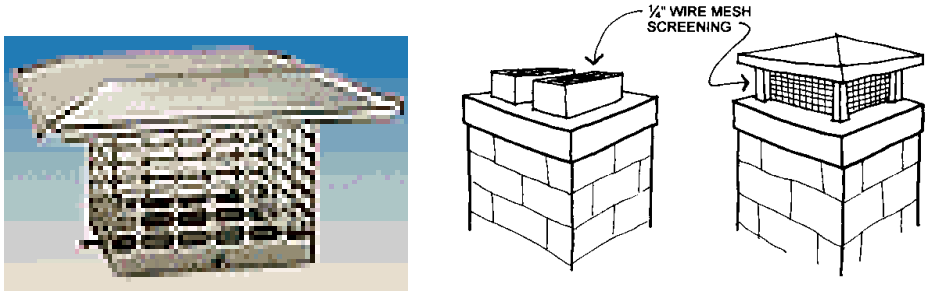


Figure 5-1: Spark Arrestor for chimney

Eaves of noncombustible materials as defined in Table 5-1. For materials not listed in Table 5-1, any material that has passed when tested in accordance with Section 8 of ASTM E 136 "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C (1382°F)" are generally considered to be non-combustible.

Table 5-1: Combustible and Non-combustible Soffit Materials

• Combustible:	• Noncombustible:
• Vinyl • PVC • Wood boards or panels less than or equal to ½" thick (including plywood and OSB)	• Aluminum • Wood boards or panels greater than ½" in thickness (including plywood and OSB)

Gutters and downspouts of noncombustible materials. Typical aluminum gutters and downspouts are considered to be acceptable

Driveways must be at least 12 feet wide with at least 13.5 feet of vertical clearance.

If gated, the gate must open inward,have an entrance at least two feet wider than the driveway, and be at least 30 feet from the road. If secured, the gate must have a key box of a type approved by the local fire department.

Individual Fire Extinguishers

5.3 Wildfire Protection Criteria that Varies by Wildfire Hazard Level

5.3.1 Survivable Space Characteristics

The following characteristics shall be applied in the survivable space whose extent is defined by the wildfire hazard level below.

Grass mowed below 6 inches

Provide regular irrigation

- For trees taller than 18 feet, prune lower branches within 6 feet of ground.

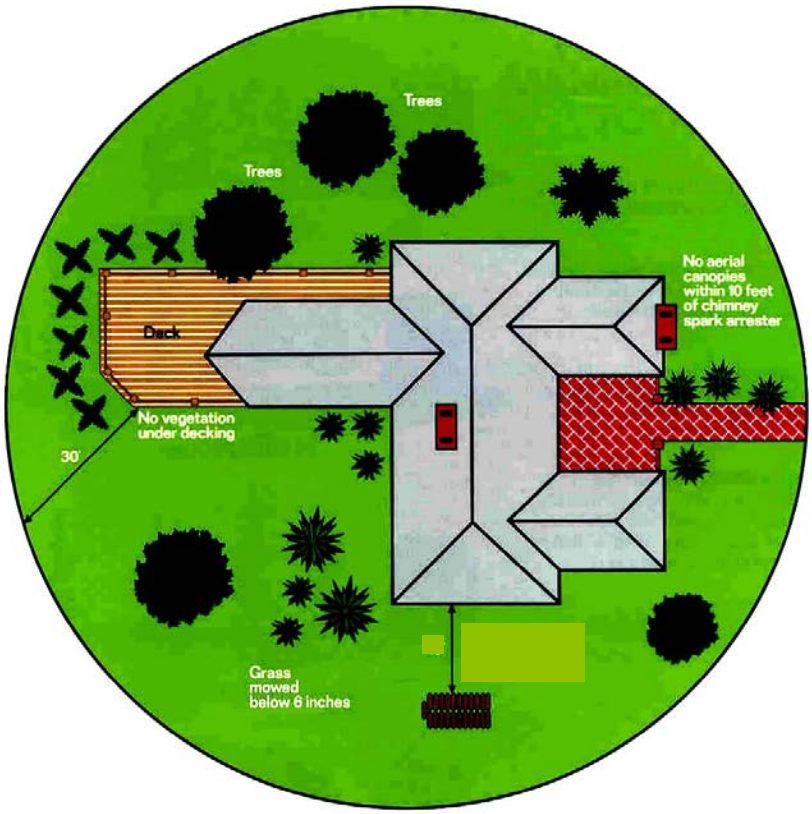
Trees are 10 feet apart from each other

No tree limbs within 10 feet of home

All plants or plant groups are more than 20 feet apart.

No vegetation under decks

Remove all dead/dying vegetation



5.3.2 Extreme Hazard Areas

If your home is in a wild land/urban interface area and has an "Extreme" hazard rating, it must have the following additional items:

A survivable space of 100 feet.

A roof covering assembly with a Class A fire rating according to UL 790. Other standards that are also accepted include ASTM E 108 Class A, or UBC 15-2 ratings. Consult the product packaging or other manufacturer literature to determine if the product meets this standard. There are also publications available from the National Roofing Contractors Association that list fire ratings (and other information) by manufacturer and product name [NRCA 1999a, 1999b]. Wood shakes and wood shingles do not qualify regardless of rating.

Non-combustible material enclosing the undersides of aboveground decks and balconies.

Exterior windows are double-paned glass with a tempered outside lite and non-combustible, corrosion resistant screens OR have non-combustible shutters.

Exterior glass doors and skylights are double paned, tempered glass.

Exterior wall assemblies must have one-hour fire resistive rating with non-combustible exterior surfaces. The following materials are considered to be Non-combustible exterior surfaces: brick veneer, concrete block, concrete, stone.

Monitored smoke alarms.

In-home sprinkler system that complies with NFPA 13-D-1999: *Installation of sprinklers in 1 and 2 family dwellings*.

5.3.3 High Hazard Area

If your home is in a wild land/urban interface area and has a "High" hazard rating, it must have the following additional items:

A survivable space of 50 feet.

A roof assembly with a Class A fire rating. Wood shakes and wood shingles do not qualify regardless of rating.

Non-combustible material enclosing the undersides of aboveground decks and balconies.

Exterior windows are double-paned glass and non-combustible, corrosion resistant screens OR has non-combustible shutters.

Exterior glass doors and skylights are double-paned glass.

Exterior wall assemblies must have one-hour fire resistive rating with fire resistant exterior surfaces. The following materials are considered to be fire-resistive: wood boards or panels greater than ½" in thickness (including plywood and OSB), stucco, plaster, and brick or stone veneer.

Non-monitored smoke alarms.

5.3.4 Moderate Hazard Area

If your home is in a wild land/urban interface area and has a "Moderate" hazard rating, it must have the following additional items:

- A survivable space of 30 feet.

A roof assembly with a class B fire rating.

Fire-resistive material enclosing the undersides of aboveground decks and balconies. .

Exterior windows and skylights are double-paned glass.

Exterior walls are fire resistant materials. The following materials are considered to be fire-resistive: wood boards or panels greater than ½" in thickness (including plywood and OSB), stucco, plaster, and brick or stone veneer.

Non-monitored smoke alarms.

6.0 Reference

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UL 2390 "Test Method for Wind Resistant Asphalt Shingles with Sealed Tabs" Underwriters Laboratories Inc., Northbrook, Illinois, 1996. ISBN 0-7629-0033-4

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