Advanced Wind Mitigation Methodologies- Online Retrofit Course

Section 1: Addressing the NEED for Wind Mitigation Methodologies

Slide 1:Advanced Wind Mitigation Methodologies Part I- Online Retrofit Course

Slide 2: Welcome to your continuing education course- Advanced Wind Mitigation Methodologies Part I- Online Course!

Slide 3: I am your instructor Roy Terepka. If you have any questions or comments about the course material presented, I encourage you to contact me at the email address listed below.

Slide 4: By completing this course you will:

- Understand the NEED for Wind Mitigation in Florida,
- Learn installation techniques for hurricane mitigation retrofitting including:
    - Prescriptive Techniques for the installation of Gable-end Bracing,
    - Strengthening and fastening Roof-Decking Attachments, and
    - Secondary Water Barriers for Roofs.

Slide 5: Why is learning about wind mitigation important for Florida Contractors?

In 2002 the Florida Building Code adopted provisions to strengthen construction practices, to better resist damage from a hurricane-force storm event. This was spurred by the devastation caused by Hurricane Andrew in 1992. [**ASC Adhesive Systems for Roof Assemblies-** Insurance Incentives for Wind Mitigation Measures March 2007 Summary.] Although located in Texas, this image of a Galveston home is the perfect example of what can be achieved (and saved) with stronger building construction techniques. While other structures failed under the high winds of Hurricane Ike, this home, which was specifically constructed to withstand high wind damage, persisted. [**Their house survived Ike, but it's the only one left-** http://www.cnn.com/2008/US/09/18/ike.last.house.standing/index.html ; **Ike obliterated most homes, but spared one on Church Street-** http://www.chron.com/disp/story.mpl/hurricane/ike/6025525.html.] In Florida, we have seen significant improvements in mitigating losses due to high wind events since the Code changes were first adopted. [**F.S. 553.844-** Windstorm loss mitigation; requirements for roofs and opening protection.] However, in order to reinforce and strengthen buildings that were constructed before 2002, wind mitigation retrofitting must be achieved. That is why contractors are now REQUIRED to fulfill at least one hour of their continuing education requirements with a Wind Mitigation Methodologies course. [**F.S. 489.115-** Certification and registration; endorsement; reciprocity; renewals; continuing education.]

Slide 6: According to the Florida Statutes, the course should address the following mitigation techniques for existing site-built single family residential structures, including but not limited to:

1. Prescriptive techniques for the installation of gable-end bracing,
2. Secondary water barriers for roofs and standards relating to secondary water barriers,
3. Prescriptive techniques for improvement of roof-to-wall connections,
4. Strengthening or correcting roof-decking attachments and fasteners during reroofing, &
5. Adding or strengthening opening protections.

The Legislature finds that the integration of these specifically identified mitigation measures is critical to addressing the serious problem facing the state from damage caused by windstorms. [**F.S. 553.844-** Windstorm loss mitigation; requirements for roofs and opening protection.]

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The need to address wind mitigation in the legislature with such specificity is in part due to the insurance industry. In order to accurately assess premiums for wind insurance, insurers must offer discounts to those who install the proper safeguards, as well as for new construction projects that adhere to the minimum Florida Building Code as currently revised. Such safeguards include, but are not limited to:

- fixtures or construction techniques which enhance roof strength
- roof covering performance
- roof-to-wall strength
- wall-to-floor-to-foundation strength
- opening protection, and
- window, door, and skylight strength

[**F.S. 627.0629-** Residential property insurance; rate filings.]

The state also initiated the My Florida Safe House program which helps Floridians learn how to harden their homes to better protect themselves and their families from windstorm damage. As part of this program, the state required a home grading scale that could be used to accurately rate residences in the state for hurricane risk vulnerability. [**F.S. 215.5586-** My Safe Florida Home Program; **F.S. 215.55865-** Uniform home grading scale.] The initial home grading scale used by the program was the HRR (Home Resistance Rating). In the establishment of a more objective and accurate home grading scale the Home Structure Rating System (or HSRS) was born. The HSRS is similar to, but more complex than, the HRR. [Office of Insurance Regulation- Home Structure Rating System, March 30, 2007]

The Home Structure Rating System was developed by the Financial Services Commission, in conjunction with The Office of Insurance Regulation, The Department of Financial Services and the Department of Community Affairs, to provide a measure of the relative ability of a structure to withstand the forces that are associated with a sustained severe tropical windstorm or hurricane. [**F.S. 215.55865-** Uniform home grading scale.] It should be noted that upon adoption by the Financial Services Commission the HSRS was renamed the UHGS, Uniform Home Grading Scale.

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The UHGS produces scores between 1 and 100 and has been designed to include room at the top of its scale to accommodate future building code improvements and implementation of code-plus mitigation techniques.

The UHGS analyzes 8 Primary Factors, 11 Secondary Factors, and 4 *objective measures* regarding the home's construction, location and surrounding terrain to determine the final score. [**The Florida Senate Bill Analysis and Fiscal Impact Statement- SB 2306**, March 22, 2008; Office of Insurance Regulation- Home Structure Rating System, March 30, 2007]

All homeowners in Florida are encouraged to obtain an evaluation of their home, in terms of wind resistance, based on these measures. After such inspection they should receive an outline of steps to take to improve the wind resistance of their home, and are entitled to receive insurance premium discounts for any applicable fixtures or construction techniques used. [**F.S. 627.711-** Notice of premium discounts for hurricane loss mitigation; uniform mitigation verification inspection form.]

These Improvements must be carried out by properly licensed individuals, which may include Roofing Contractors, General, Building, and Residential Contractors, or Engineers, and in most cases must also be properly permitted and inspected by the local Building Department or qualified entity. [Building Officials Association of Florida- Guidelines for Implementing of the Hurricane Damage Mitigation Provisions of HB 7057.]

And so, for Homeowners, Insurers, and Contractors wind mitigation has become a necessary focus of attention in recent years.

Let's begin discussing the installation techniques for hurricane mitigation retrofitting in Section 2 of your course- Gable End Bracing!

Slide 9: **Learning Exercise 1**

Section 2: Gable End Bracing

Slide 1: Advanced Wind Mitigation Methodologies Part I- Online Retrofit Course

Slide 2: Welcome to Section 2 of your Advanced Wind Mitigation Methodologies course, Gable End Bracing!

Slide 3: In this portion of the course we will:

- Review Definitions and
- Outline Materials of Construction

Pertinent to the Prescriptive techniques for the installation of gable end bracing that we'll be discussing today, including:

- Use of Retrofit Studs,
- Horizontal Braces,
- Straps to connect between retrofit studs and horizontal braces, and
- Connecting the bottom of the gable end wall to wall below with right-angle brackets.

Slide 4:

Section 1601- General

Let's begin by discussing the requirements of Retrofitting Gable End Walls. **Section 1601.1** of the Florida Building Code -Existing Building, states that the retrofitting provisions outlined by Chapter 16, provide prescriptive solutions for the retrofitting of gable ends of buildings. [**F.B.C.- Existing Building-** Section 1601.1 -Intent and purpose.] By definition, Retrofitting includes work of a voluntary nature for the purpose of improving the ability of the building, its elements and components, to better serve the purpose that current building codes intend. [**F.B.C.- Existing Building-** Section 202 Definitions.] So this improvement is voluntary, but its purpose is to be in compliance with the current Florida Building Code, therefore permits and inspections are required. According to **Section 1604.1.1**, the intent is to increase the resistance of existing gable end construction for out-of-plane wind loads resulting from high wind events. [**F.B.C.- Existing Building-** Section 1604.1.1-Scope and intent.]
The retrofit method addresses four issues. [Figure 1604.1.1- Basic Gable End Retrofit Methodology]

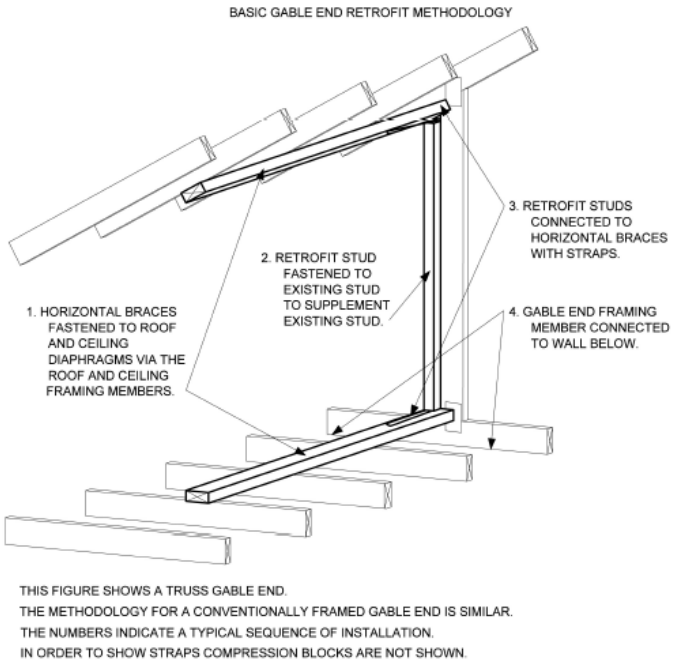


FIGURE 1604.1.1
BASIC GABLE END RETROFIT METHODOLOGY

These include:

1. Strengthening the framing members of the gable end itself with **retrofit studs** **[Section 1604.3]**.
2. Bracing the top and bottom of the gable end so that lateral loads are transmitted into the roof and ceiling diaphragms with **horizontal braces** **[Section 1604.2]**.
3. Making connections between horizontal braces and retrofit studs by the use of **straps** **[Section 1604.4]**. And lastly,
4. Connecting the bottom of the gable end wall to the wall below to help brace the top of that wall, with **right-angle brackets** **[Section 1604.5]**. [**F.B.C.- Existing Building-** Section 1604.1.1 -Scope and intent.]

Before we get into the various techniques however, let's review some pertinent definitions.

Slide 5:

Section 1602- Definitions

Anchor Block. A nominal 2-inch thick by at least 4" wide piece of lumber secured to horizontal braces and filling the gap between existing framing members for the purpose of restraining horizontal braces from movement perpendicular to the framing members.

Compression Block. A nominal 2-inch thick by at least 4" wide piece of lumber used to restrain in the compression mode, an existing or retrofit stud. The block is attached to a horizontal brace and bears directly against the existing or retrofit stud.

Conventionally Framed Gable End. A conventionally framed gable end with studs whose faces are perpendicular to the gable end wall.

Horizontal Brace. A nominal 2-inch thick by at least 4" wide piece of lumber used to restrain both compression and tension loads applied by a retrofit stud. It is typically installed horizontally on the top of floor framing members or on the bottom of pitched roof framing members.

Hurricane Ties. Manufactured metal connectors designed to provide uplift and lateral restraint for roof framing members.

Nail Plate. A manufactured metal plate made with a minimum of 20 gauge galvanized steel with factory punched holes sized for 8d common nails. A nail plate may have the geometry of a strap.

Retrofit Stud. A nominal 2-inch lumber member used to structurally supplement an existing gable end wall stud.

Right Angle Gusset Bracket. A 14-gauge or thicker metal right-angle bracket listed by the manufacturer for the material into which they will be attached (concrete masonry, CMU's, or wood), to have a MINIMUM specified load capacity of 350 lbs for uplift and lateral conditions, when the maximum number of fasteners specified by the manufacturer are used.

Stud-To-Plate Connector. A manufactured metal connector designed to connect studs to plates with a minimum uplift capacity of 500 lbs.

Truss Gable End. An engineered factory made truss or site built truss that incorporates factory installed or field installed vertical studs with their faces parallel to the plane of the truss and are spaced no greater than 24-inches on center. Web or other diagonal members *other than top chords* may or may not be present. Gable end trusses may be of the same height as nearby trusses or may be drop-chord-trusses in which the top chord of the truss is lower by the depth of the top chord or outlookers. [**F.B.C.- Existing Building**- Section 1602 -Definitions.]

Now let's review the materials of construction as outlined by the Code.

Slide 6:

Section 1603- Materials of Construction

Existing Materials. All existing wood materials that will be part of the retrofitting work (such as trusses, rafters, ceiling joists, top plates, wall studs, etc.) shall be in sound condition and free from defects or damage that substantially reduces the load-carrying capacity of the member. Any wood materials found to be damaged or deteriorated shall be strengthened or replaced with new materials to provide a net dimension of sound wood equivalent to its undamaged original dimensions. [**F.B.C.- Existing Building-** Section 1603.1 –Existing Materials.]

New Materials. All materials approved by this code, including their appropriate allowable stresses, shall be permitted to meet the requirements of this chapter. [**F.B.C.- Existing Building-** Section 1603.2 –New Materials.]

Dimensional Lumber. All dimensional lumber for braces, studs, and blocking shall conform to applicable standards or grading rules. Dimensional lumber shall be identified by a grade mark of a lumber-grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. All new dimensional lumber to be used for retrofitting purposes shall be a minimum grade and species of #2 Spruce-Pine-Fir or shall have specific gravity of 0.42 or greater. In lieu of a grade mark, a certificate of inspection issued by a lumber-grading or inspection agency meeting the requirements of this code shall be accepted. [**F.B.C.- Existing Building-** Section 1603.3 –Dimensional lumber.]

Metal Plate Connectors, Straps and Anchors. Metal plate connectors, plates, straps and anchors shall have product approval. They shall be approved for connecting wood-to-wood or wood-to-concrete as appropriate. Straps and nail plates shall be manufactured from galvanized steel with a minimum thickness of 20 gauge. Nail plates shall have holes sized for a minimum of 8d nails. [**F.B.C.- Existing Building-** Section 1603.4 –Metal plate connectors, straps and anchors.]

Twists in Straps. Straps shall be permitted to be twisted 90 degrees in addition to a 90 degree bend where they transition between framing members or connection points. Straps shall be bent only once at a given location though it is permissible that they be bent or twisted at multiple locations along their length. [**F.B.C.- Existing Building-** Section 1603.5 –Twists in straps.]

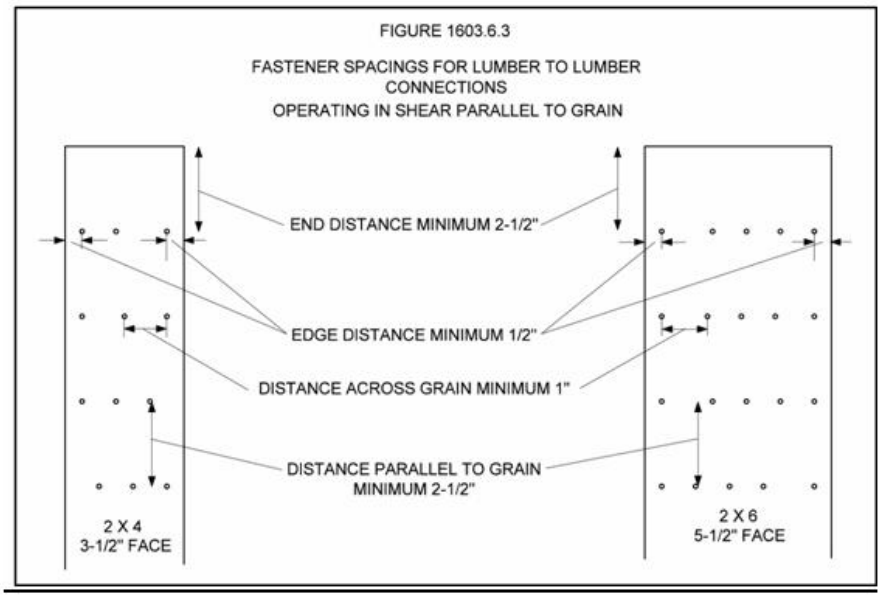
Fasteners. Fasteners shall be screws and nails meeting the minimum length requirement shown in figures and specified in tables. Fastener requirements and spacing are as follows: [**F.B.C.- Existing Building-** Section 1603.6 – Fasteners.]

Screws. Screws shall be a minimum #8 size with head diameters no less than 0.28 inches. Screw lengths shall be no less than indicated in the Figures and in Tables. Permissible screws include deck screws and wood screws. Screws shall have at least 1 inch of thread. Fine threaded screws or drywall screws shall NOT be permitted. Select the largest possible diameter screw such that the shank adjacent to the head fits through the hole in the strap. [**F.B.C.- Existing Building-** Section 1603.6.1 –Screws.]

Nails. Unless otherwise indicated in the provisions or drawings, where fastener lengths are indicated in Figures and Tables as 1-1/4 inch, 8d common nails are permitted. They should have a shank diameter of 0.131 inch and head diameters no less than 0.28 inches. Unless otherwise indicated in the provisions or drawings, where fasteners lengths are indicated in Figures and Tables as 3 inches, 10d common nails shall be permitted. They should have a shank diameter of 0.148 inch and head diameters no less than 0.28 inches. [**F.B.C.- Existing Building-** Section 1603.6.2 –Nails.]

This figure [Figure 1603.6.3-Fastener Spacings For Lumber to Lumber Connections] illustrates the fastener spacing requirements for shear connections of lumber-to-lumber. [**F.B.C.- Existing Building-** Section 1603.6.3 –General fastener spacing.] Fastener spacing must also meet these following conditions:

1. Distance between fasteners and the edge of lumber that is less than 3- ½ inches deep in the direction of the fastener, length shall be a minimum of ¾ inches.
2. Distance between fasteners and the edge of lumber that is more than 2 inches thick in the direction of the fastener, length shall be a minimum of ½ inches.
3. Distance between a fastener and the end of lumber shall be a MINIMUM OF 2- ½ inches.
4. Distance between fasteners parallel to the grain (center-to-center) shall be a MINIMUM of 2- ½ inches.
5. Distance between fasteners perpendicular to the grain (center-to-center) in the lumber that is less than 3- ½ inches deep in the direction of the fastener, length shall be 1 inch.
6. Distance between fasteners perpendicular to the grain (center-to-center) in lumber that is more than 2 inches thick in the direction of the fastener, length shall be ½ inches.



[**F.B.C.- Existing Building-** Section 1603.6.3.1 –General fastener spacing.] There are also specific fastening requirements for wood-to-wood connections and metal connectors to wood connections. [**F.B.C.- Existing Building-** Section 1603.6.3.2 –Wood-to-wood connections of two members each 2 inch or less thick; Section 1603.6.3.3 –Metal connectors to wood connections.] These specifications, as well as any other applicable specifications which have not been specifically outlined by this course can be obtained by following the link in the drop-down menu at the top right of your screen.

Now let's play a quick game to see how much you know.

Slide 7: GAME- VOCABULARY MATCH.

Slide 8:

Now that we're familiar with the intent of this Section and all of the pertinent definitions, let's get into the retrofitting specifications.

Section 1604-Retrofitting Gable End Walls

The following prescriptive methods are intended for applications where the gable end wall framing is provided by a wood gable end wall truss OR a conventionally framed rafter system. The retrofits are appropriate for wall studs oriented with their broad face parallel to OR perpendicular to the gable end surface. [**F.B.C.- Existing Building-** Section 1604.1.1 –Scope and intent.]

Let's start with **Horizontal Braces.**

Horizontal braces need to be installed perpendicular to the roof and ceiling framing members at the location of each existing gable end stud greater than 3-feet in length. Unless it is adjacent to an omitted horizontal brace location, horizontal braces shall be a minimum of 2x4 dimensional lumber. [**F.B.C.- Existing Building-** Section 1604.2 –Horizontal Braces.]

There are four retrofit configurations based on exposure and design wind speed, as illustrated by this Table. [Table 1604.2-Stud Length Limitations Based on Exposure and Design Wind Speed]

TABLE 1604.2
STUD LENGTH LIMITATIONS BASED ON EXPOSURE AND DESIGN WIND SPEED

EXPOSURE CATEGORY	MAXIMUM V_{asd} [a, d]	MAXIMUM HEIGHT OF GABLE END RETROFIT STUD[b]			
C	110	8′-0″	11′-3″	14′-9″	16′-0″
C	120	7′-6″	10′-6″	13′-6″	16′-0″
C	130	7′-0″	10′-0″	12′-3″	16′-0″
C	140	7′-0″	10′-0″	12′-3″	16′-0″
C	150	6′-6″	8′-9″	11′-0″	16′-0″
B	110	8′-0″	12′-3″	16′-0″	N/R[c]
B	120	8′-0″	11′-3″	14′-9″	16′-0″
B	130	8′-0″	11′-3″	14′-9″	16′-0″
B	140	7′-6″	10′-6″	13′-6″	16′-0″
B	150	7′-0″	10′-0″	12′-3″	16′-0″
	Retrofit Configuration —>	A	B	C	D

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm.

a. Interpolation between given wind speeds not permitted.

b. Existing gable end studs less than or equal to 3′-0″ in height shall not require retrofitting.

c. N/R = Not Required. Configuration C is acceptable to 16′-0″ maximum height.

d. V_{asd} shall be determined in accordance with Section 1609.3.1 of the *Florida Building Code, Building* or Section R301.2.1.3 of the *Florida Building Code, Residen-*

A single horizontal brace is required at the top and bottom of each gable end stud for Retrofit Configuration A, B, or C and two horizontal braces are required for Retrofit Configuration D. Maximum heights of gable end wall studs and associated retrofit studs for each Retrofit Configuration shall not exceed the values listed in this Table. [Table 1604.2-Stud Length Limitations Based on Exposure and Design Wind Speed] [**F.B.C.- Existing Building-** Section 1604.2 – Horizontal Braces.]

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C	150	6′-6″	8′-9″	11′-0″	16′-0″
B	110	8′-0″	12′-3″	16′-0″	N/R[c]
B	120	8′-0″	11′-3″	14′-9″	16′-0″
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d. V_{asd} shall be determined in accordance with Section 1609.3.1 of the *Florida Building Code, Building* or Section R301.2.1.3 of the *Florida Building Code, Residen-*

The horizontal braces shall be oriented with their broad faces across the roof or ceiling framing members, be fastened to a minimum of three framing members, and extend at least 6 feet measured perpendicularly from the gable end plus 2- ½ inches beyond the last top chord or bottom chord member (rafter or ceiling joist) from the gable end. [**F.B.C.- Existing Building-** Section 1604.2 –Horizontal Braces.]

Slide 9:

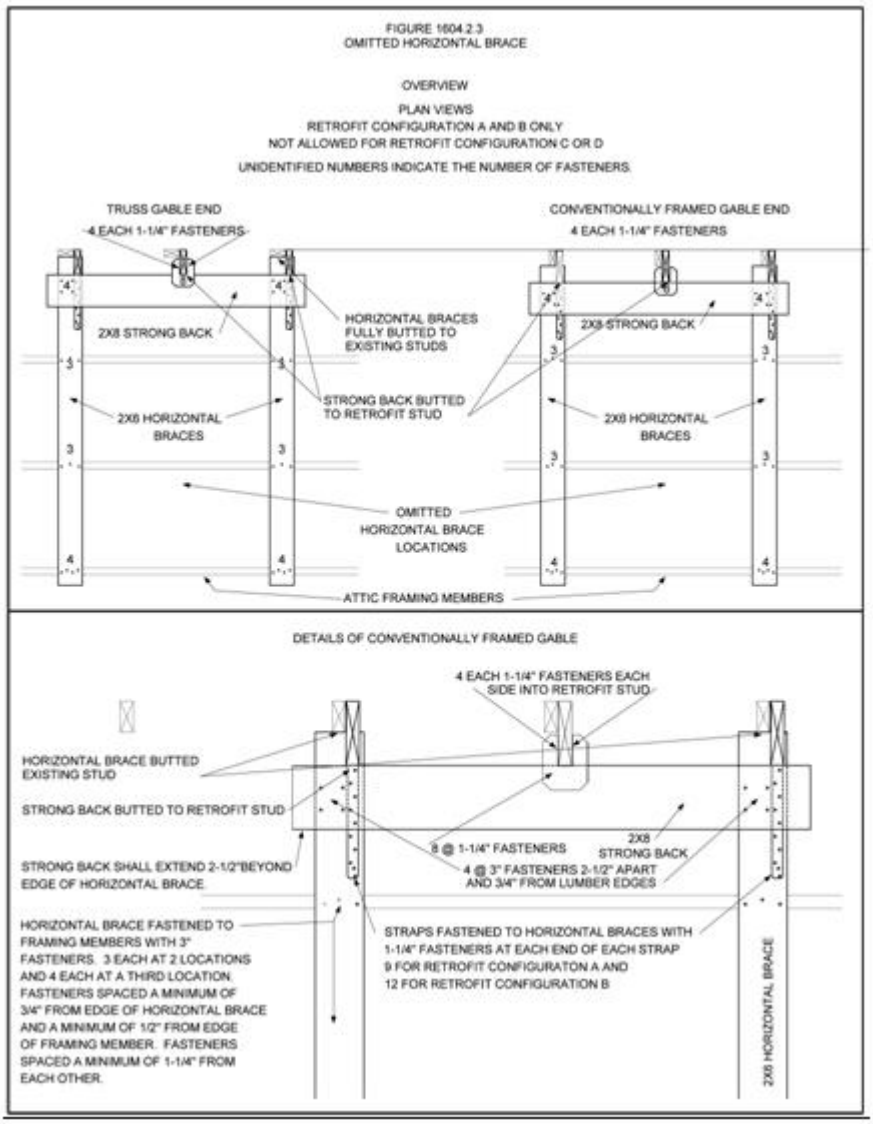
When analyzing the installation of Horizontal Braces you must also assess the **Existing gable end studs.**

If spacing of existing vertical gable end studs is greater than 24 inches, a new stud and corresponding horizontal braces shall be installed such that the maximum spacing between existing and added studs shall be no greater than 24 inches. Additional gable end wall studs shall not be required at locations where their length would be 3 feet or less. Each end of each required new stud shall be attached to the existing roofing framing members using a minimum of two 3-inch toenail fasteners and metal connector with minimum uplift capacity of 175 pounds, or nail plates with a minimum of four 1- ¼ inch long fasteners. [**F.B.C.- Existing Building-** Section 1604.2.1 –Existing gable end studs.]

Okay, let's talk about the **Main method of installation.** Each horizontal brace shall be fastened to each existing roof or ceiling member that it crosses using three 3-inch long fasteners as indicated in this figure. [Figure 1604.2(1). Alternative methods for providing horizontal bracing of the gable end studs as provided in Sections 1604.2.3 through 1604.2.9 shall be allowed in lieu of this primary method of installation. We will not discuss each of these in detail, but you should be aware that the Code has developed specifications for each of the following alternative retrofitting scenarios: [**F.B.C.- Existing Building-** Section 1604.2.2 –Main method of installation.]

Slide 10: **Interactive FLIPBOOK**- Alternative Installation Methods for Horizontal Braces

Omitted horizontal brace.- Horizontal braces may be omitted for height limitations in Retrofit Configurations A and B, however several conditions do apply. [Figure 1604.2.3- Omitted Horizontal Brace] [**F.B.C.- Existing Building-** Section 1604.2.3 –Omitted horizontal brace.]



Omitted horizontal brace and retrofit stud. - Retrofit studs and horizontal braces shall be permitted to be omitted from locations which prevent installation by installation of ladder assemblies. Again this method is for Retrofit Configurations A and B only and several conditions must be met. [Figure 1604.2.4(1) - Detail of Ladder Bracing for Omitted Retrofit Stud (Truss Gable End)] [**F.B.C.- Existing Building-** Section 1604.2.4 –Omitted horizontal brace and retrofit stud.]

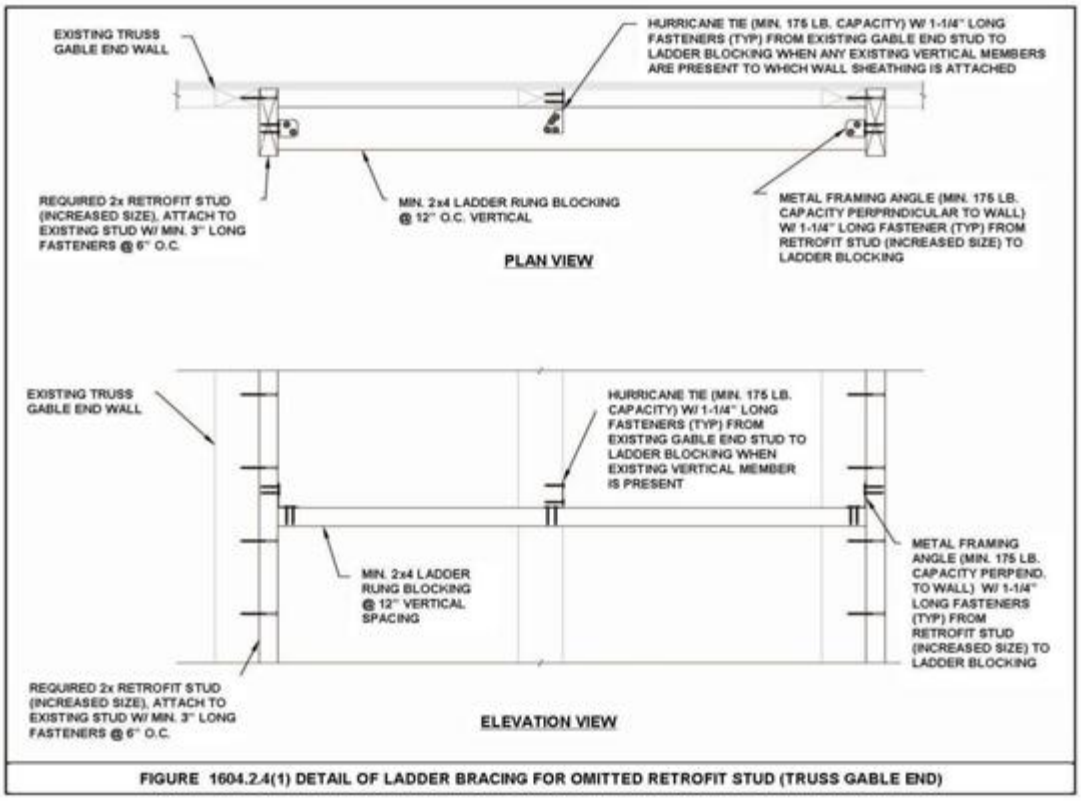


FIGURE 1604.2.4(1) DETAIL OF LADDER BRACING FOR OMITTED RETROFIT STUD (TRUSS GABLE END)

Short horizontal brace.- Where conditions exist that prevent the installation of horizontal braces across three framing members, extend 6' from the gable end wall, and 2- ½ " beyond the last roof or ceiling framing member, the horizontal brace may be shortened, however the conditions below must be met. [Figure 1604.2.5-Detail of Anchor Block Installation] [**F.B.C.- Existing Building-** Section 1604.2.5 –Short horizontal brace.]

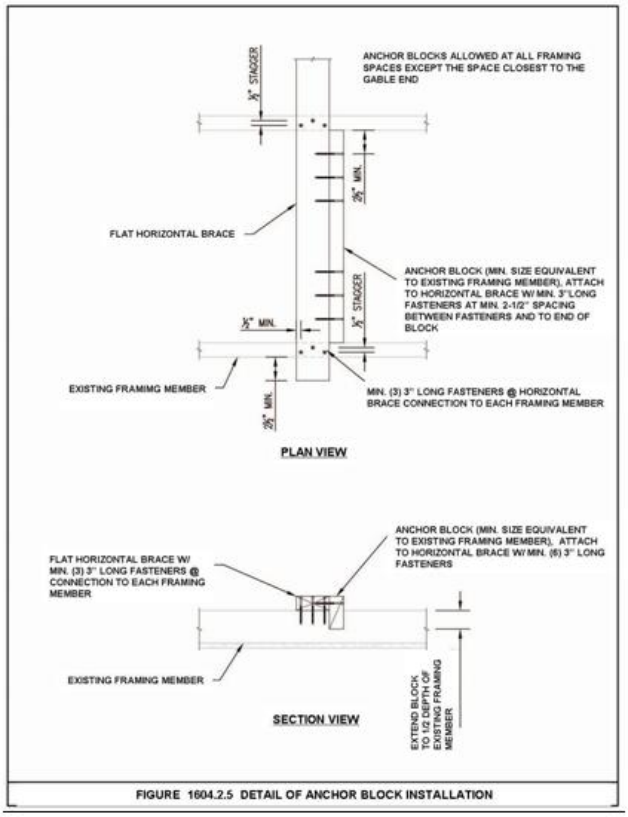


FIGURE 1604.2.5 DETAIL OF ANCHOR BLOCK INSTALLATION

Installation of horizontal braces onto webs or vertical members of trusses.- Installation of horizontal braces onto webs or vertical members of trusses.- Where existing conditions preclude installation of horizontal braces on truss top or bottom chords they shall be permitted to be installed on truss webs or vertical members of trusses, however there are 3 conditions listed below which must be met. [**F.B.C.- Existing Building-** Section 1604.2.6 –Installation of horizontal braces onto webs or vertical members of trusses.]

Alternative methods of installation of horizontal braces at truss ridges. – Where there are impediments for installing fasteners which limits or restricts installing the horizontal braces near roof peaks, ridge ties can be added to support the brace. There are specific installation conditions and requirements. [Figure 1604.2.7- Detail of Retrofit Tie Installation] [**F.B.C.- Existing Building-** Section 1604.2.7 –Alternative method of installation of horizontal braces at truss ridges.]

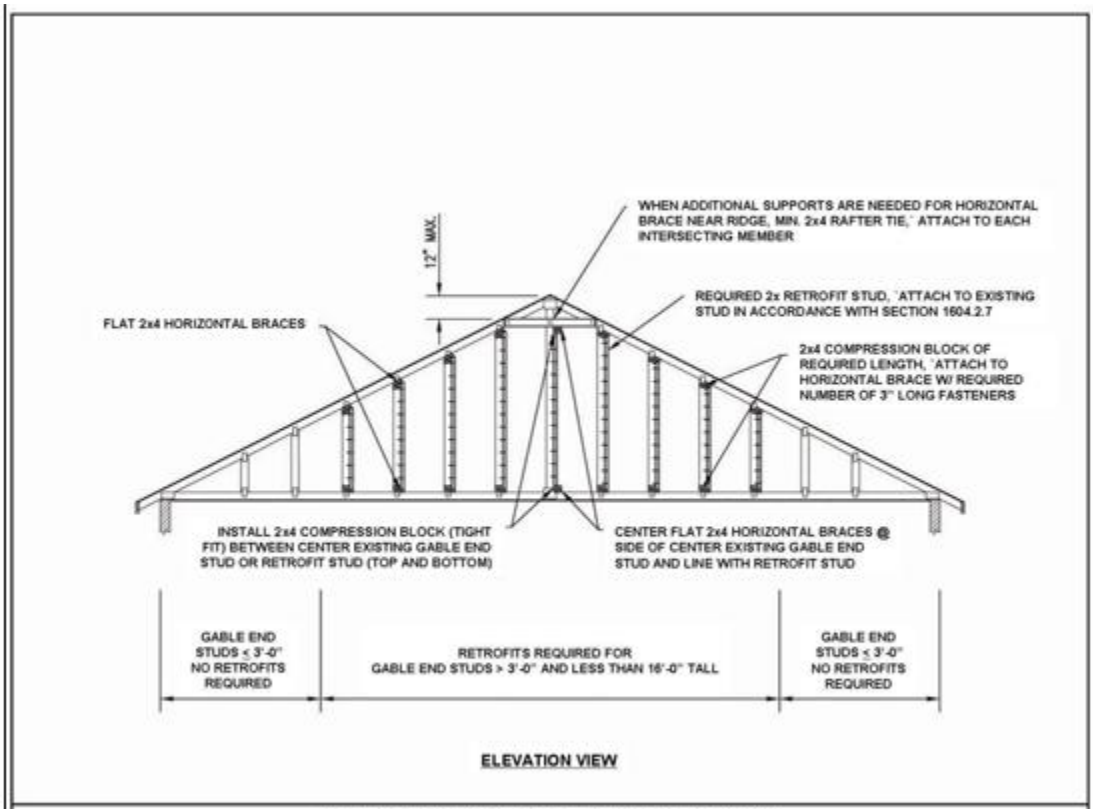
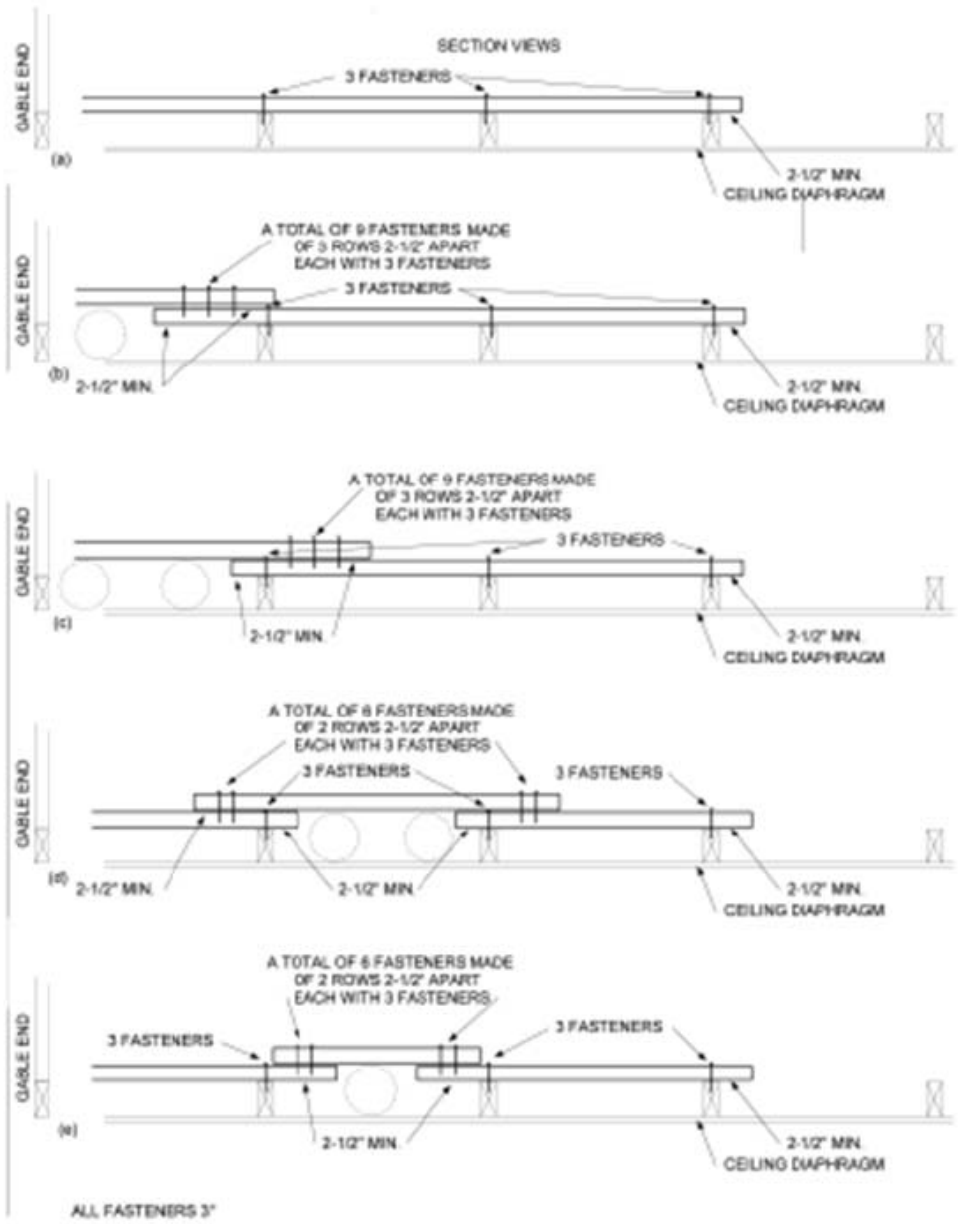


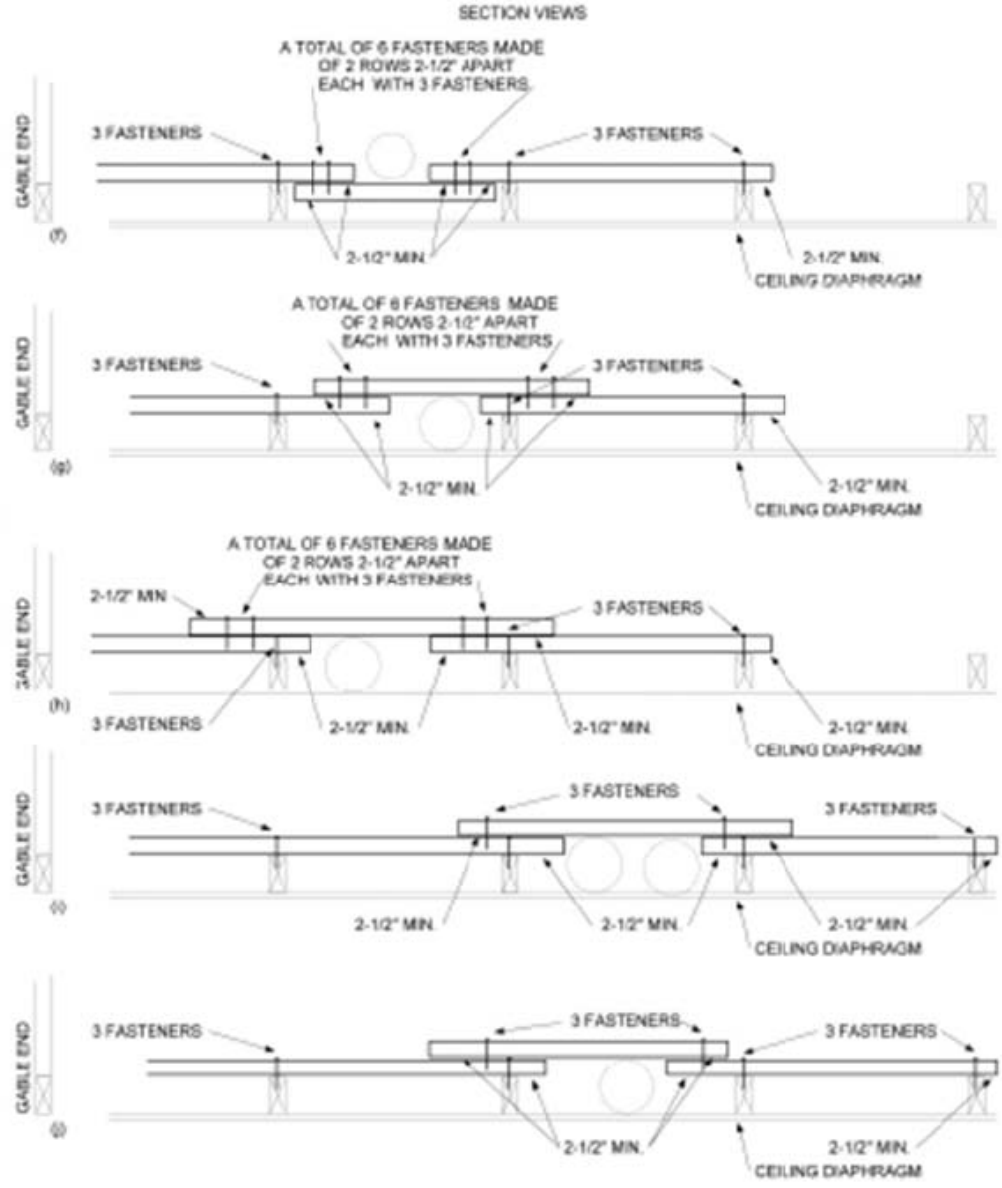
FIGURE 1604.2.7 DETAIL OF RETROFIT TIE INSTALLATION

Interrupted horizontal braces.- Where conditions exist that prevent installing the horizontal braces as single continuous braces, they can be allowed to be interrupted. A few specific requirements do apply. There are 12 methods for splicing horizontal braces show by this Figure and those in the next few pages of this FLIPBOOK. [Figure 1604.2.8 (1)- (3) Spliced Horizontal Braces] [**F.B.C.- Existing Building-** Section 1604.2.8 –Interrupted Horizontal Braces.]



For SI: 1 inch = 25.4 mm.

FIGURE 1604.2.8(1)
SPLICED HORIZONTAL BRACES



ALL FASTENERS 3"

For SI: 1 inch = 25.4 mm.

FIGURE 1604.2.8(2)
SPLICED HORIZONTAL BRACES

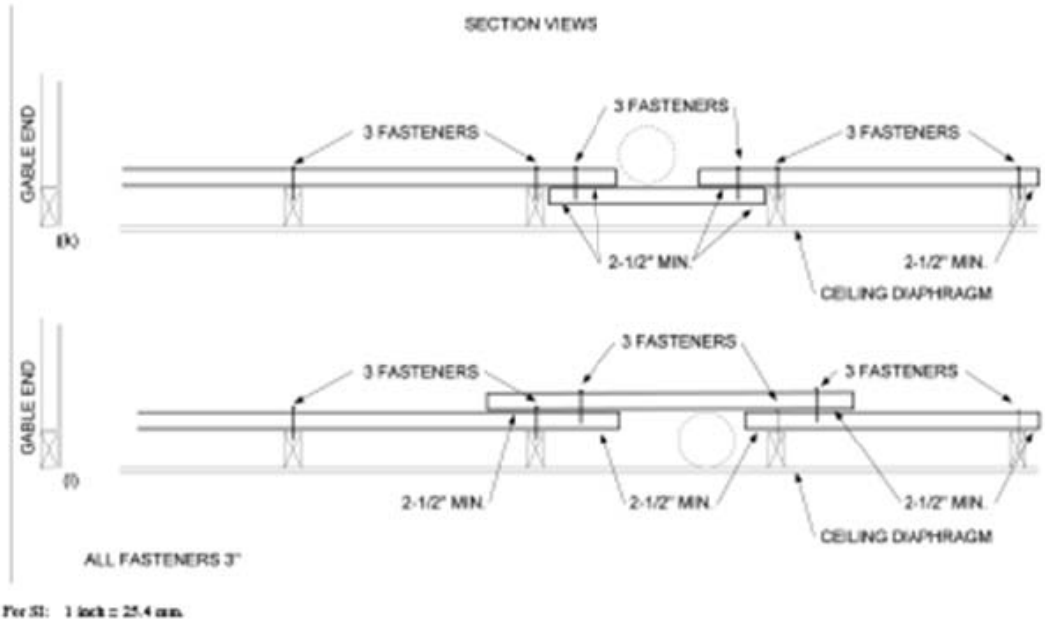


FIGURE 1604.2.8(3)
SPLICED HORIZONTAL BRACES

Piggyback trusses.- Trusses composed of two members, one above the other, are referred to as *Piggyback Trusses.* They shall be permitted to be retrofitted if either of the following cases are true:

1. The existing studs in both the upper truss and the lower truss to which wall sheathing, panel siding, or other wall façade are attached, are sufficiently in line that retrofit studs can be installed and connections made between the two with retrofit studs.

***In this scenario both the lower and upper studs shall be retrofitted.**

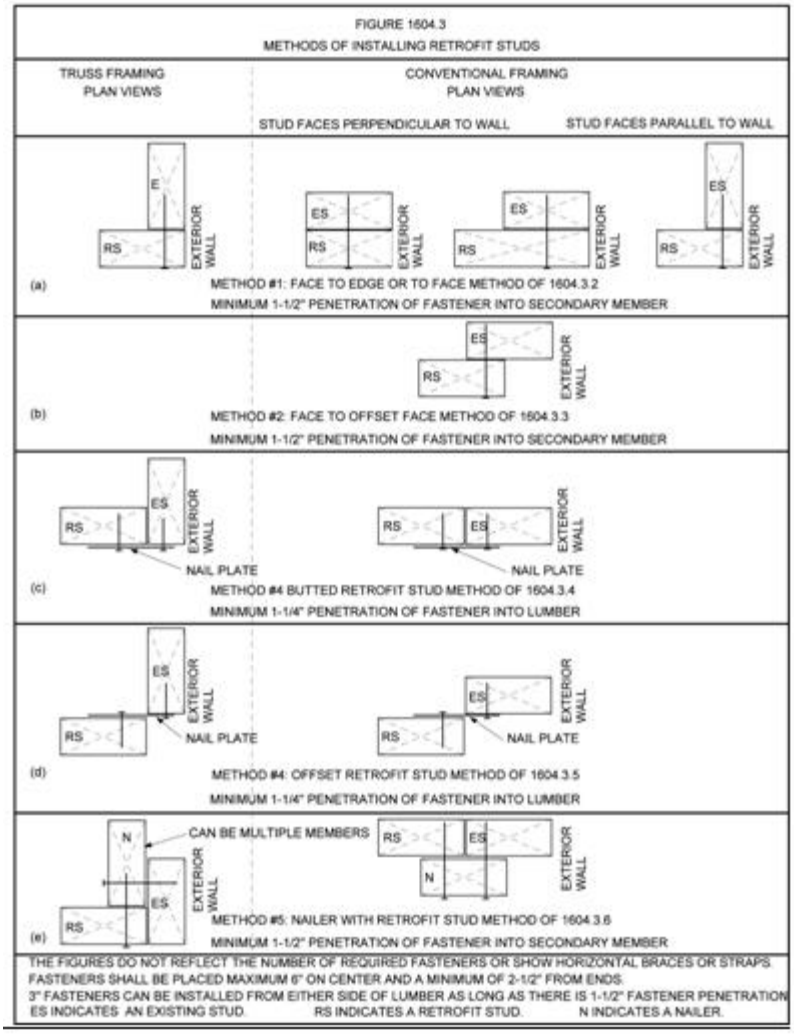
2. The same as condition (1) except the studs in the upper truss are not sufficiently in line with ones below and the existing studs in the upper truss are 3 feet or shorter.

***In this case the retrofit stud shall be connected to the lower studs using the methods described in Section 1604.3-Retrofit Studs, and must be continuous from the bottom horizontal brace to the top horizontal brace. No connection is required between the retrofit studs and the upper stud.**

In both conditions the bottom chord of the piggyback truss section shall be fastened to each retrofit stud using a connector with minimum axial capacity of 175 lbs. [**F.B.C.- Existing Building-** Section 1604.2.9 –Piggyback trusses.]

Slide 11: **Retrofit Studs**

There are 5 methods for installing retrofit studs as shown in this Figure [Figure 1604.3- Methods of Installing Retrofit Studs]. After determining the appropriate Retrofit Configuration based on Table 1604.2, the size of the retrofit studs can be found by utilizing either Table 1604.4.1- For L-Bent Retrofit Method or Table 1604.4.2- For U-Bent Retrofits. We're going to take a look at these tables in a few minutes when we discuss connecting the retrofit studs to the horizontal braces.



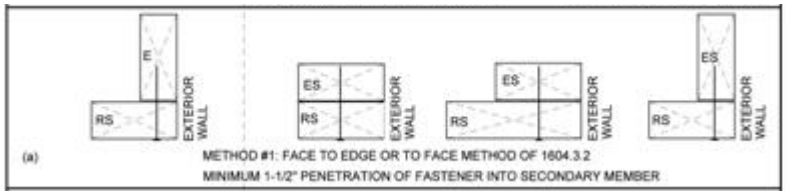
Retrofit studs shall extend from the top of the lower horizontal brace to the bottom of the upper horizontal brace. A maximum gap of 1/8- inch is permitted at the bottom and ½-inch is permitted at the top. Where wall sheathing, panel siding, or other wall façade is fastened to gable end studs, which are not manufactured into the truss, the retrofit studs should be installed according to Section 1604.2.1- Existing Gable End Studs, which we discussed on Slide 9. [**F.B.C.- Existing Building-** Section 1604.3 –Retrofit Studs.]

Retrofit Stud Fastening

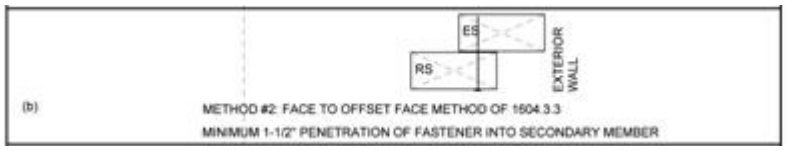
Each retrofit stud shall be fastened appropriately for the Method of installation. Where nail plates are not used, retrofit studs shall be attached to existing studs using 3-inch fasteners at a maximum of 6 inches on center but no closer than 2- ½ inches on center with fasteners no closer to ends of members that 2- ½ inches. [**F.B.C.- Existing Building-** Section 1604.3.1 –Fastening.]

Slide 12:

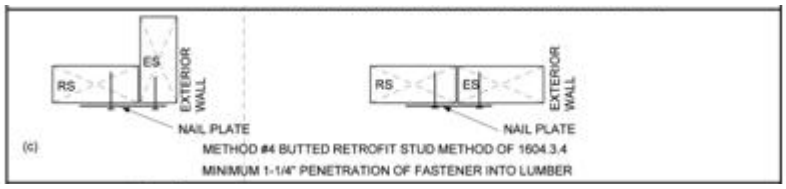
Method #1: Face to edge or to face method. Retrofit studs shall be installed immediately adjacent to existing gable end wall studs as indicated in the Figure [Figure 1604.3(a)- Method #1]. The retrofit studs shall overlap the edge or side of the existing stud by a minimum of 1- ¼ inches. [**F.B.C.- Existing Building-** Section 1604.3.2 –Method #1: Face to edge or to face method.]



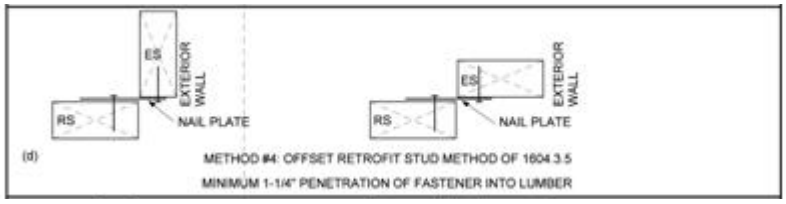
Method #2: Face to face offset method. Retrofit studs shall be installed against the face of existing studs as indicated in this Figure [Figure 1604.3(b)- Method #2], such that the faces overlap a minimum of 1- ½ inches and the edge distance to fasteners is no less than ¾ inch. [**F.B.C.- Existing Building-** Section 1604.3.3 –Method #2: Face to face offset method.]



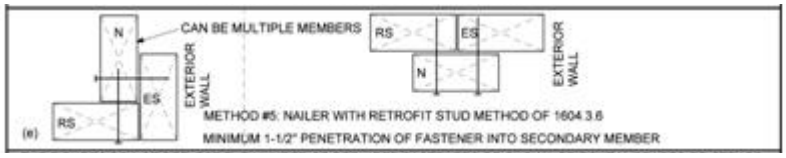
Method #3: Butted retrofit stud method. If a variety of fastening conditions are met, retrofit studs shall be permitted to be butted by edge or face to existing studs with the addition of nail plates as indicated in the Figures [Figure 1604.3(c)- Method #3] [**F.B.C.- Existing Building-** Section 1604.3.4 –Method #3: Butted retrofit stud method.]



Method #4: Offset retrofit stud method. Where retrofit studs are placed as indicated by this Figure [Figure 1604.3(d)- Method #4], retrofit studs may be offset from existing studs by use of nail plates such that the vertical corner of a retrofit stud shall be placed at the vertical corner of an existing stud, provided a variety of fastening conditions are met. [**F.B.C.- Existing Building-** Section 1604.3.5 –Method #4: Offset retrofit stud method.]



Method #5: Nailer with retrofit stud method. Retrofit studs and existing studs shall be permitted to be connected using non-continuous 2x4 nailers as indicated in this Figure [Figure 1604.3(e)- Method #5], provided a few conditions are met. [**F.B.C.- Existing Building-** Section 1604.3.6 –Method #5: Nailer with retrofit stud method.]



Don’t forget, you can access all Figures and Tables referenced in this course along with the specific conditions not mentioned here by following the link in the drop-down menu at the top right of your screen.

Slide 13:

Reduced Size of Retrofit Studs. Retrofit studs may be reduced in size by notching, tapering, or other methods at any number of locations along their length, provided a few conditions are met. [**F.B.C.- Existing Building-** Section 1604.3.7 –Reduced size of retrofit studs.]

Retrofit Stud Splices

Retrofit studs greater than 8-feet in height may be field spliced as shown in this Figure [Figure 1604.3.8- Detail of Retrofit Stud Splice]. [**F.B.C.- Existing Building-** Section 1604.3.8 –Retrofit stud splices.]

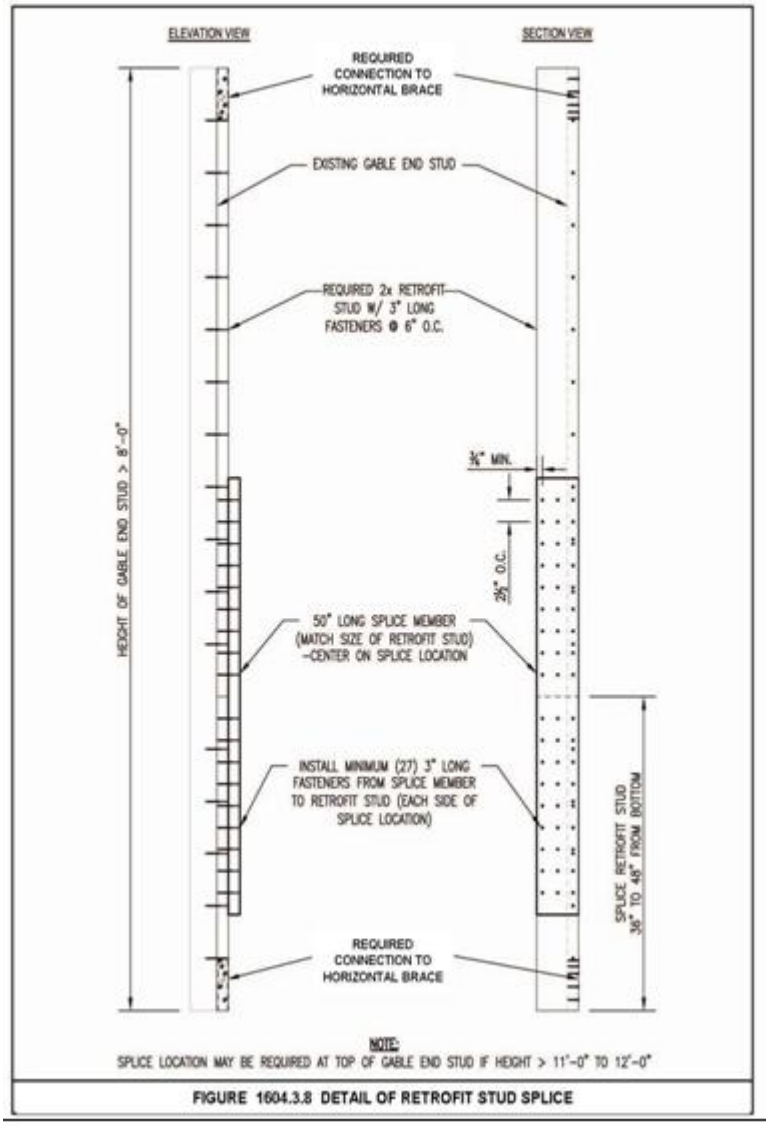


FIGURE 1604.3.8 DETAIL OF RETROFIT STUD SPLICE

Slide 14:

Connections between the horizontal braces and the retrofit studs.

Connections between horizontal braces and retrofit studs shall comply with the L-bent Strap Method **[Section 1604.4.1]** or the U-bent Strap Method **[Section 1604.4.2]**. Each retrofit stud shall be connected to the top and bottom horizontal brace members with a minimum of a 20-guage 1- ¼ inch wide flat or coil metal strap with pre-punched holes for fasteners. Straps shall be fastened with 1- ¼ inch long fasteners with the number as

indicated on Table 1604.4.1 for L-bent Retrofit Method and Table 1604.4.2 for U-bent Retrofit Method. Fasteners shall be no closer to the end of lumber than 2- ½ inches. [**F.B.C.- Existing Building-** Section 1604.4– Connections between horizontal braces and retrofit studs.]

L-bent Strap Method: Retrofit studs shall be connected to horizontal braces or to strong backs and shall comply with the following conditions.

1. Straps: A strap shall be applied to the edges of a retrofit stud nearest the gable end wall and to the face of horizontal braces using at each end of the straps the number of fasteners specified in this Table [Table 1604.4.1- L-bent Retrofit Method]. Straps shall be long enough so that each strap extends sufficient distance onto the vertical face of the retrofit stud that the fastener closest to the ends of the studs is a minimum of 2- ½ inches from the end of the stud. Straps shall be allowed to be twisted to accommodate the transition between the tops of retrofit studs and horizontal bracings following roof pitches.

TABLE 1604.4.1
ELEMENT SIZING AND SPACING FOR L-BENT RETROFIT METHOD

	RETROFIT CONFIG.	RETROFIT CONFIG.	RETROFIT CONFIG.	RETROFIT CONFIG.
Retrofit elements	A	B	C	D
Minimum size and number of horizontal braces	2 × 4	2 × 4	2 × 4	2 each 2 × 4
Minimum size and number of retrofit studs	2 × 4	2 × 6	2 × 8	2 each 2 × 8
Minimum number of fasteners connecting each end of straps to retrofit studs or to horizontal braces #8 screws or 10d nails $1^1/_4$″ long	6	9	12	8 on each strap
Minimum number of fasteners connecting compression blocks to horizontal braces #8 screws or 10d nails 3″ long	6	8	10	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

2. Compression Blocks: Compression blocks shall be installed on the horizontal braces directly against either the existing vertical gable end wall stud or the retrofit stud. Compression blocks shall be allowed to be placed over straps. Compression blocks shall be fastened to the horizontal braces with at least the minimum number of 3-inch long fasteners specified in this Table [Table 1604.4.1- L-bent Retrofit Method]. End and edge distances for fasteners shall be in accordance with **Section 1603.6.3- General Fastener Spacing** which we discussed on Slide 6. [**F.B.C.- Existing Building-** Section 1604.4.1 –L-bent strap method.]

TABLE 1604.4.1
ELEMENT SIZING AND SPACING FOR L-BENT RETROFIT METHOD

	RETROFIT CONFIG.	RETROFIT CONFIG.	RETROFIT CONFIG.	RETROFIT CONFIG.
Retrofit elements	A	B	C	D
Minimum size and number of horizontal braces	2 × 4	2 × 4	2 × 4	2 each 2 × 4
Minimum size and number of retrofit studs	2 × 4	2 × 6	2 × 8	2 each 2 × 8
Minimum number of fasteners connecting each end of straps to retrofit studs or to horizontal braces #8 screws or 10d nails $1^1/_4$″ long	6	9	12	8 on each strap
Minimum number of fasteners connecting compression blocks to horizontal braces #8 screws or 10d nails 3″ long	6	8	10	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

TRUSS FRAMED GABLE END. L-BENT STRAP. Figure 1604.2 (1)- This Figure is for referencing a Truss Framed Gable End. It is illustrating a metal strap bent into an L-shape and secured to the back of the retrofit stud and the face of the horizontal brace. [Figure 1604.2 (1)-Truss Framed Gable End. L-Bent Strap]

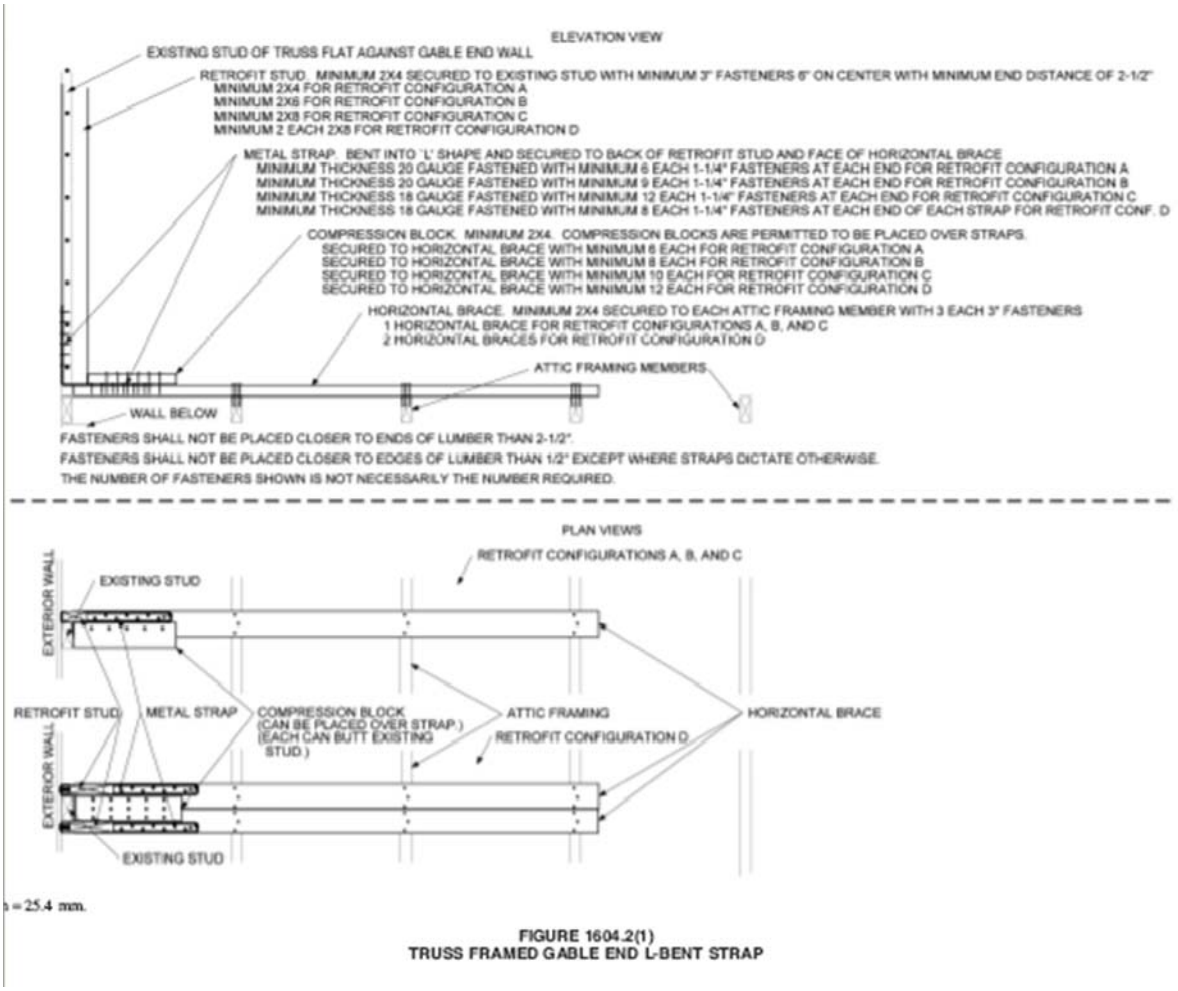
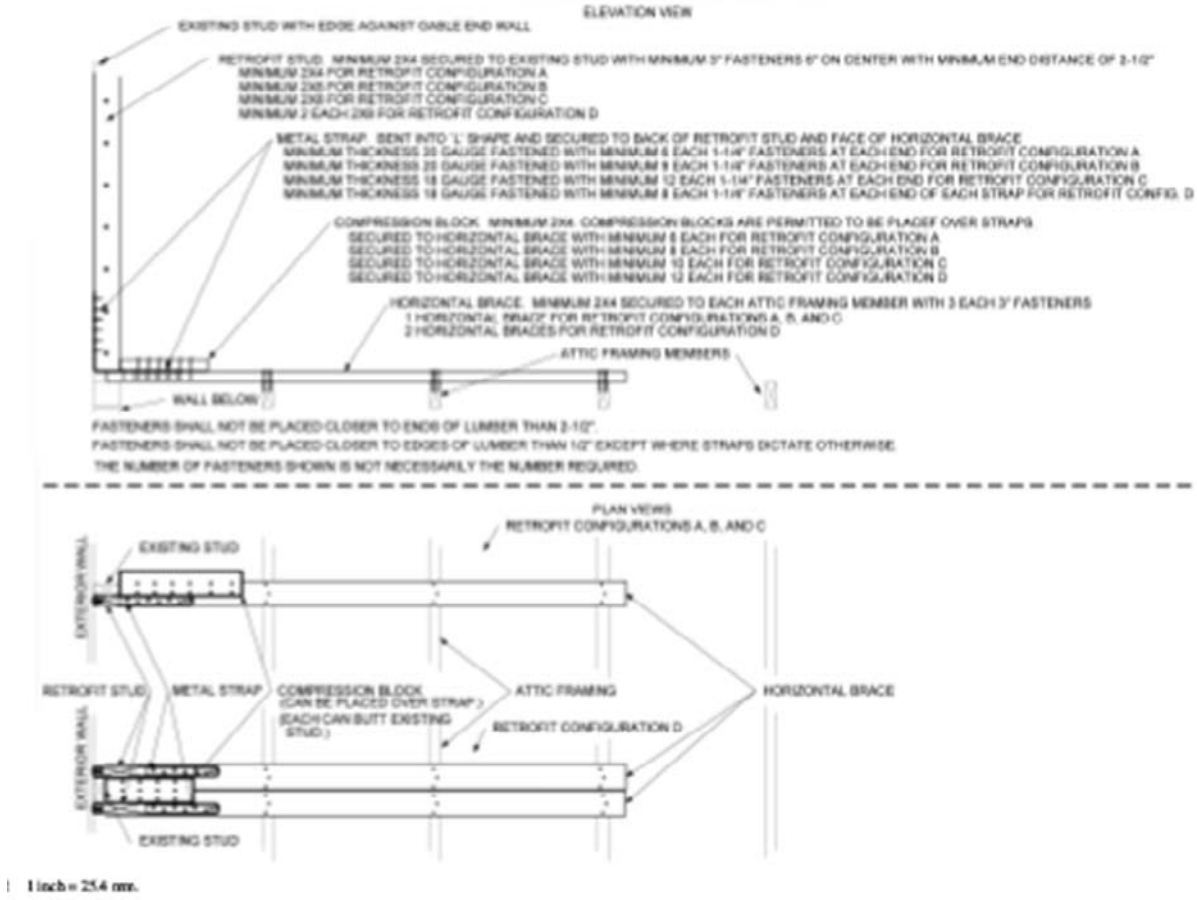


FIGURE 1604.2(1)
TRUSS FRAMED GABLE END L-BENT STRAP

CONVENTIONALLY FRAMED GABLE END. L-BENT STRAP. Figure 1604.2 (2). This Figure is referencing a Conventionally-Framed Gable End utilizing an L-Bent Strap secured to the back of the retrofit stud and the face of the horizontal brace. [Figure 1604.2 (2)- Conventionally Framed Gable End. L-Bent Strap]



1 inch = 25.4 mm.

FIGURE 1604.2(2)
CONVENTIONALLY FRAMED GABLE END L-BENT STRAP

U-bent Strap Method: Retrofit studs may be connected to horizontal braces for Retrofit Configurations A and B only and shall comply with the following conditions.

1. Straps of sufficient length to meet the requirements of this Table [Table 1604.4.2- U-bent Retrofit Method] and meet the end distance requirements of the **General Fastener Spacing** section shall be shaped around retrofit studs and fastened to the edges of horizontal braces. Straps shall wrap the back edge of the retrofit stud snuggly with a maximum gap of ¼ inch. Rounded bends of straps shall be allowed. One fastener shall be installed that connects each strap to the side of the associated retrofit stud.

TABLE 1604.4.2
ELEMENT SIZING AND SPACING FOR U-BENT RETROFIT METHOD

	RETROFIT CONFIG.	RETROFIT CONFIG.	RETROFIT CONFIG.	RETROFIT CONFIG.
Retrofit elements	A	B	C	D
Minimum size and number of horizontal braces	2 × 4	2 × 4	2 × 4	2 each 2 × 4
Minimum size and number of retrofit studs	2 × 4	2 × 6	2 × 8	2 each 2 × 8
Minimum number of fasteners connecting straps to each edge of horizontal braces #8 screws or 10d nails $1\frac{1}{4}$" long	6	7	7	6 on side of each strap

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

2. The horizontal brace shall butt snugly against the retrofit stud with a maximum gap of ¼ inch.

3. Straps shall be allowed to be twisted to accommodate the transition between the tops of retrofit studs and horizontal braces that follow the roof pitch. [**F.B.C.- Existing Building-** Section 1604.4.2 –U-bent strap method.]

TRUSS FRAMED GABLE END. U-BENT STRAP. Figure 1604.2 (3)- This Figure is for referencing a Truss Framed Gable End. It illustrates a U-Bent Metal Strap wrapped around the retrofit stud and secured to 2 edges of the horizontal brace. [Figure 1604.2 (3)- Truss Framed Gable End. U-Bent Strap]

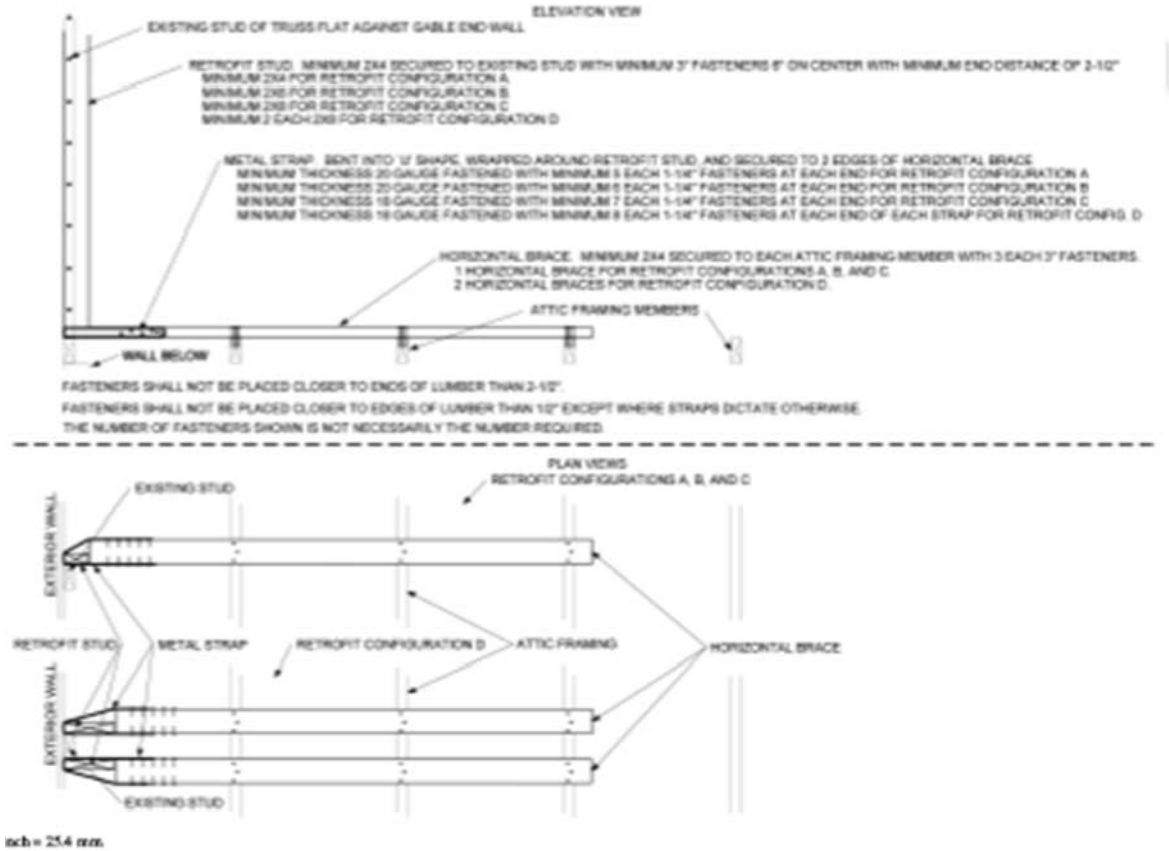


FIGURE 1604.2(3)
TRUSS FRAMED GABLE END U-BENT STRAP

CONVENTIONALLY FRAMED GABLE END. U-BENT STRAP. Figure 1604.2 (4)- This Figure is for referencing a Conventionally Framed Gable End utilizing a U-Bent Metal Strap wrapped around the retrofit stud and secured to 2 edges of the horizontal brace. [Figure 1604.2 (4)- Conventionally Framed Gable End. U-Bent Strap.]

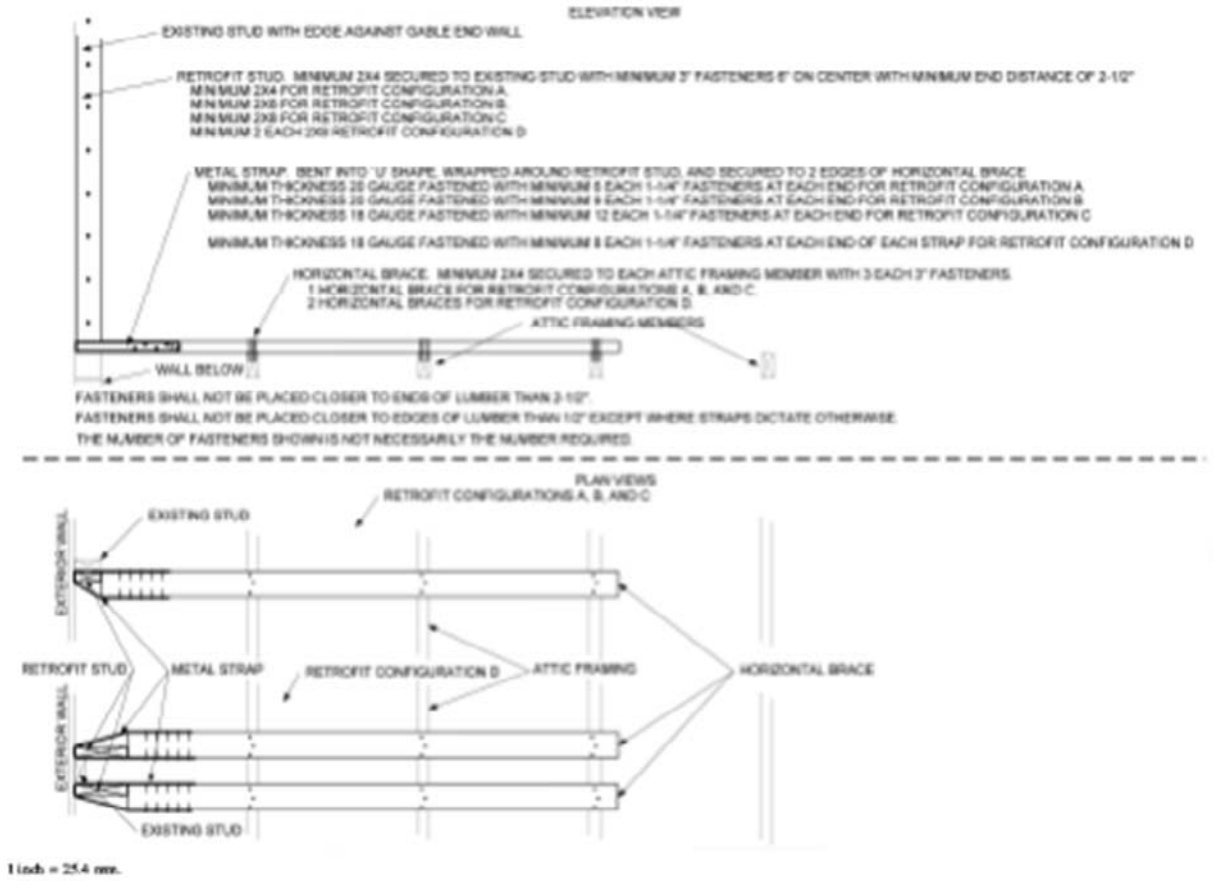


FIGURE 1604.2(4)
CONVENTIONALLY FRAMED GABLE END U-SHAPED STRAP

Slide 15:

Connection of gable end wall to wall below.

The bottom chords or bottom members of wood framed gable end walls shall be attached to the wall below using either the Truss Gable End Wall Method **[Section 1604.5.1]** or the Conventionally Framed Gable End Wall Method **[Section 1604.5.2]**. The particular method chosen needs to correspond to the framing system and type of wall construction encountered. **[F.B.C.- Existing Building-** Section 1604.5 –Connection of gable end wall to wall below.]

Truss Gable End Wall Method.

The bottom chords of the gable end wall shall be attached to the wall below using right angle brackets. The right angle brackets shall be installed throughout the portion of the gable end where the gable end wall height is greater than 3 feet and spaced in accordance with this Table [Table 1604.5.1- Spacing of Right Angle Brackets]. A minimum of two of the fasteners shall engage the body of the bottom chord.

TABLE 1604.5.1
SPACING OF RIGHT ANGLE BRACKETS

EXPOSURE CATEGORY	MAXIMUM V_{asd}*	SPACING OF RIGHT ANGLE BRACKETS*
C	110	38 inches
C	120	32 inches
C	130	28 inches
C	140	24 inches
C	150	20 inches
B	110	48 inches
B	120	40 inches
B	130	36 inches
B	140	30 inches
B	150	26 inches

For SI: 1 inch = 25.4 mm.

a. V_{asd} shall be determined in accordance with Section 1609.3.1 of the *Florida Building Code, Building* or Section R301.2.1.3 of the *Florida Building Code, Residential*.

Slide 16:

Connection to the wall below shall be by one of the following methods:

1. For a **wood frame wall below**, a minimum of two fasteners shall be installed. The fasteners shall be of the same diameter and style specified by the bracket manufacturer and sufficient length to extend through the double top plate of the wall below.

2. For a **concrete or masonry wall below without a sill plate**, the type and number of fasteners into the wall shall be consistent with the bracket manufacturer's specifications for fasteners installed in concrete or masonry.

3. For a **concrete or masonry wall below with a 2x sill plate**, the fasteners into the wall below shall be of the diameter and style specified by the bracket manufacturer for concrete or masonry connections; but, long enough to pass through the wood sill plate and provide the required embedment into the concrete or masonry below.

Alternatively, the bracket can be anchored to the sill plate using 1- ½ inch long fasteners consistent with the bracket manufacturer's specifications for wood connections provided, the sill plate is anchored to the wall on each side of the bracket by a 1/4-inch diameter masonry screw with a 2- ¾ inch embedment into the concrete or masonry wall. ¼-inch washers shall be placed under the heads of the masonry screws. [**F.B.C.- Existing Building-** Section 1604.5.1 –Truss gable end wall.]

Slide 17:

Conventionally Framed Gable End Wall Method.

Each stud in a conventionally framed gable end wall, throughout the length of the gable end wall where the wall height is greater than 3-feet shall be attached to the bottom or sill plate using a stud-to-plate connector

with minimum uplift capacity of 175 pounds. The bottom or sill plate shall then be connected to the wall below using one of the following methods:

1. For a **wood frame wall below**, the sill or bottom plate shall be connected to the top plates below using ¼-inch diameter lag bolt fasteners of sufficient length to penetrate the bottom plate of the upper gable end wall and extend through the bottom top plate of the wall below. A washer sized for the lag bolt shall be placed under the head of each lag bolt. Spacing shall be installed as indicated in this Table [Table 1604.5.2- Spacing of lag or masonry screw used to connect sill plate of gable end wall to top of the wall below].

TABLE 1604.5.2
SPACING OF LAG OR MASONRY SCREWS
USED TO CONNECT SILL PLATE OF GABLE END
WALL TO TOP OF THE WALL BELOW

EXPOSURE CATEGORY	MAXIMUM V_{asd}[a]	SPACING OF LAG SCREWS OR MASONRY SCREWS
C	110	19 inches
C	120	16 inches
C	130	14 inches
C	140	14 inches
C	150	10 inches
B	110	24 inches
B	120	20 inches
B	130	18 inches
B	140	15 inches
B	150	13 inches

For SI: 1 inch = 25.4 mm.

a. V_{asd} shall be determined in accordance with Section 1609.3.1 of the *Florida Building Code, Building* or Section R301.2.1.3 of the *Florida Building Code, Residential*.

2. For a **concrete or masonry wall below**, the sill or bottom plate shall be connected to the concrete or masonry wall below using ¼-inch diameter concrete or masonry screws of sufficient length to provide a 2- ¾ inch embedment into the top of the concrete or masonry wall. Use washers and spacings as we just described for a wood frame wall below. [**F.B.C.- Existing Building-** Section 1604.5.2 – Conventionally framed gable end wall.]

Slide 18:

That completes our discussion of Gable-end Bracing. We covered a lot of material in this Section so let's have a quick learning exercise to test your understanding of it.

Slide 19: **Learning Exercise 2**

Section 3: Roof Sheathing and Secondary Water Barriers

Slide 1: Advanced Wind Mitigation Methodologies Part I- Online Retrofit Course

Slide 2: Welcome to Section 3 of your Advanced Wind Mitigation Methodologies Course- Roof Sheathing and Secondary Water Barriers.

Slide 3: In this portion of the course we will:

- Review roof system mitigation techniques including:
  - Strengthening Roof Sheathing and Fastening, and
  - Installing a Secondary Water Barrier
- And Outline important costs associated with these improvements

Slide 4:

According to the Federal Alliance for Safe Homes, the roof covering and particularly the underlying sheathing (also called decking) form a primary defense for a home's protection from damage due to high wind and rain. Unfortunately, this shield is often the first to be lost during a high-wind event. Loss of the sheathing can result in excessive damage due to water infiltration because once it's gone the interior is completely exposed to the elements. [FLASH- Federal Alliance for Safe Homes, Hurricanes- Animated How-To: Roof Systems http://www.flash.org/peril_inside.php?id=116]

How do the mitigation provisions deal with this element of the roof system? Well, according to the Building Code the following retrofits are permitted to be performed by Roofing Contractors on single family residential structures when a roof is replaced or removed:

1. Roof-decking attachment and fasteners need to be strengthened and corrected as outlined by Section 611.7.1 of the Florida Building Code for Existing Buildings, and
2. A secondary water barrier shall be provided as outlined by Section 611.7.2.

[**F.B.C.- Existing Building-** Section 611.7.]

According to the Building Officials Association of Florida (BOAF), these improvements do require an inspection (or affidavit certification) by a Florida Professional Engineer, Registered Architect, Licensed General, Building, or Residential Contractor, Roofing Contractor, or other persons certified in the structural discipline under Florida Statute 468. [Building Officials Association of Florida- Guidelines for Implementing of the Hurricane Damage Mitigation Provisions of HB 7057.]

So let's discuss the specifics as outlined in the Code.

Slide 5: **Section 611.7.1 Roof decking attachment for site-built single family residential structures** says 8d nails need to be a minimum of 0.113 inch in diameter and a minimum of 2- ¼ inches long to qualify for the provisions of this section for existing nails, regardless of head shape or head diameter. Fastening shall be in accordance with one of the following methods: [**F.B.C.- Existing Building-** Section 611.7.1 –Roof decking attachment for site-built single family residential structures.]

1. Roof decking consisting of sawn lumber or wood plank up to 12" wide and secured with at least two nails, of a minimum size of 8d, to each roof framing member it crosses shall be deemed to be sufficiently connected.

Sawn lumber or wood plank decking secured with smaller or fewer nails shall be deemed sufficiently connected if fasteners are added such that two clipped head, round head, or ring shank nails, minimum size of 8d, are in place on each framing member it crosses. [F.B.C.- Existing Building- Section 611.7.1.1]

2. For roof decking consisting of wood structural panels, fasteners and spacing required in columns 3 and 4 of this Table [Table 611.7.1.2- Supplement Fasteners at Panel Edges and Intermediate Framing] are deemed to comply with

the requirements of Section 606.3 of the Florida Building Code for Existing Buildings for the indicated design wind speed range.

6. Minimum 2-1/4 inch nail length.

TABLE 611.7.1.2
SUPPLEMENT FASTENERS AT PANEL EDGES AND INTERMEDIATE FRAMING

EXISTING FASTENERS	EXISTING SPACING	V_{asd} 110 MPH OR LESS SUPPLEMENTAL FASTENER SPACING SHALL BE NO GREATER THAN	V_{asd} GREATER THAN 110 MPH SUPPLEMENTAL FASTENER SPACING SHALL BE NO GREATER THAN
Staples or 6d	Any	6″ o.c.[b]	6″ o.c.[b]
8d clipped head, round head, smooth or ring shank	6″ o.c. or less	None necessary	None necessary
8d clipped head, round head, smooth or ring shank	Greater than 6″ o.c.	6″ o.c.[a]	6″ o.c.[a]

For SI: 1 inch = 25.4 mm.
a. Maximum spacing determined based on existing fasteners and supplemental fasteners.
b. Maximum spacing determined based on supplemental fasteners only.
c. V_{asd} shall be determined in accordance with Section 1609.3.1 of the *Florida Building Code, Building* or Section R301.2.1.3 of the *Florida Building Code, Residential.*

Wood structural panel connections retrofitted with a two part urethane based closed cell adhesive sprayed onto the joint between the sheathing and framing members are deemed to comply with the requirements of Section 606.3 of the Florida Building Code for Existing Buildings provided testing using the manufacturer's recommended application on panels connected with 6d smooth shank nails at no more than a 6-inch edge and 12-inch filed spacing demonstrate an uplift resistance of a minimum of 200 psf. [F.B.C.- Existing Building- Section 611.7.1.2.]

Slide 6:

If the connections are found to be insufficient or deteriorated, the supplemental fasteners and spacings can be determined by consulting this Table . [Table 611.7.1.2- Supplement Fasteners at Panel Edges and Intermediate Framing].

6. Minimum 2-1/4 inch nail length.

TABLE 611.7.1.2
SUPPLEMENT FASTENERS AT PANEL EDGES AND INTERMEDIATE FRAMING

EXISTING FASTENERS	EXISTING SPACING	V_{asd} 110 MPH OR LESS SUPPLEMENTAL FASTENER SPACING SHALL BE NO GREATER THAN	V_{asd} GREATER THAN 110 MPH SUPPLEMENTAL FASTENER SPACING SHALL BE NO GREATER THAN
Staples or 6d	Any	6″ o.c.[b]	6″ o.c.[b]
8d clipped head, round head, smooth or ring shank	6″ o.c. or less	None necessary	None necessary
8d clipped head, round head, smooth or ring shank	Greater than 6″ o.c.	6″ o.c.[a]	6″ o.c.[a]

For SI: 1 inch = 25.4 mm.
a. Maximum spacing determined based on existing fasteners and supplemental fasteners.
b. Maximum spacing determined based on supplemental fasteners only.
c. V_{asd} shall be determined in accordance with Section 1609.3.1 of the *Florida Building Code, Building* or Section R301.2.1.3 of the *Florida Building Code, Residential.*

The Code specifies that supplemental fasteners must be 8d ring shank nails with round heads and the following minimum dimensions:

- 0.113 inch nominal shank diameter
- Ring diameter of 0.012-inch greater than shank diameter
- 16 to 20 rings per inch
- Minimum 0.280 inch full round head diameter
- 2-1/4 inch nail length

[F.B.C.- Existing Building- Section 611.7.1.2.]

The Florida Roofing Sheet Metal & Air Conditioning Contractors Association (FRSA) estimates that the Cost of this improvement ranges from $60.00 to $70.00 per 100 square feet. [FRSA- Hand Delivery to Mo Madani- RE: Rule Workshop Proposed Rule 9B-3.0475, Mitigation Retrofits Required, Florida Administrative Weekly, Volume 33, Number 30, July 27, 2007, Page 3324- http://www.dca.state.fl.us/fbc/thecode/tracking_chart_mitigation/tracking_chart/munell%20comment.PDF .]

Now let's talk about the second portion of the requirement:

Slide 7:

2. A secondary water barrier shall be installed using one of the following methods when roof covering is removed or replaced. [F.B.C.- Existing Building- Section 611.7.2- Roof secondary water barrier for site-built single family residential structures.]

1. In either HVHZ or Non-HVHZ regions:

A secondary water barrier shall be installed using one of the following methods when reroofing.

a) All joints in structural panel roof sheathing or decking shall be covered with a minimum 4 inch wide strip of self-adhering polymer modified bitumen tape, commonly called "peel and seal" or "peel and stick", applied directly to the sheathing or decking. The deck and the tape shall then be covered with one of the underlayment systems approved for the particular roof covering to be applied.

b) The entire roof deck shall be covered with an approved asphalt impregnated 30# felt underlayment or approved synthetic underlayment installed with nails and tin-tabs in accordance with Sections R4402.7.2, R4402.7.3, or R4402.7.4 of the Florida Building Code for Residential Buildings. No additional underlayment shall be required over the top of this sheet. The synthetic underlayment shall be fastened in accordance with the manufacturer's specifications.

[F.B.C.- Existing Building- Section 611.7.2- Roof secondary water barrier for site-built single family residential structures.]

Slide 8:

2. Outside the High Velocity Hurricane Zone:

a) The entire roof deck shall be covered with an approved self-adhering polymer modified bitumen sheet meeting ASTM D 1970 or an approved self-adhering synthetic underlayment installed in

accordance with the manufacturer's installation instructions. No additional underlayment shall be required on top of the sheet for new installations.

b) An underlayment system approved for the particular roof covering shall be applied with the following modification:

(1) For roof slopes that require one layer of underlayment, a layer of approved asphalt impregnated ASTM D 226 Type I or Type II underlayment or approved synthetic underlayment shall be installed. The felt is to be fastened with 1" round plastic cap or metal cap nails, attached to a nailable deck in a grid pattern of 12 inches staggered between the overlaps, with 6-inch spacing at the overlaps. The synthetic underlayment shall be fastened in accordance with the manufacturer's recommendations.

(2) For roof slopes that require two layers of underlayment, an approved asphalt impregnated ASTM D 226 Type I or Type II underlayment shall be installed in a shingle-fashion and lapped 19" and fastened as described above. An approved synthetic underlayment shall be installed in accordance with the manufacturer's installation instruction. No additional underlayment shall be required over the top of this sheet. [F.B.C.- Existing Building- Section 611.7.2- Roof secondary water barrier for site-built single family residential structures.]

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There are two exceptions.

1. Roof slopes < 2:12 having a continuous roof system shall be deemed to comply with these secondary water barrier requirements.

2. Clay and Concrete tile roof systems installed as required by the Florida Building Code are deemed to comply with these secondary water barrier requirements. [F.B.C.- Existing Building- Section 611.7.2- Roof secondary water barrier for site-built single family residential structures.]

According to the FRSA the estimated cost for this improvement as outlined in the Manual is $130.00 per square. [FRSA- Hand Delivery to Mo Madani- RE: Rule Workshop Proposed Rule 9B-3.0475, Mitigation Retrofits Required, Florida Administrative Weekly, Volume 33, Number 30, July 27, 2007, Page 3324- http://www.dca.state.fl.us/fbc/thecode/tracking_chart_mitigation/tracking_chart/munell%20comment.PDF .]

Slide 10:

Here are a few additional resources you might find helpful in your continued effort to understand the complex nature of wind mitigation in Florida.

- To access a Wind Insurance Calculator, follow the links at **FloridaDisaster.org**
- For information on the Residential Mitigation Program as well as access to many important resources, follow the links at **FloridaDisaster.org**
- For a very informative .pdf with comprehensive information on approved products for secondary water barriers, follow the links at **DCA.State.Fl.US**
- There are quite a few municipalities that have released their own information guides on how to best implement the Hurricane Mitigation Provisions to suit the regulations of their particular jurisdiction.

Boca-Raton and Miami-Dade are two examples. For a Hurricane Mitigation Retrofit Q&A for reroofing in Boca-Raton, follow the link at **Ci.Boca-Raton.Fl.US.**

- Follow the links at **Miami-Dade.Gov** for answers to Frequently Asked Questions about the Hurricane Mitigation requirements of Florida Statute 553.844.
- To participate in a re-roof mitigation guidelines forum, follow the links at **BOAF.Net.**
- You can also find an additional link at **BOAF.Net** to access non-binding interpretations of the Florida Building Code.

Slide 11:

Now that we've learned about Roof Sheathing and Fastening and Secondary Water Barriers, let's have a quick learning exercise to see how much you know.

Slide 12: **Learning Exercise 3**

END OF COURSE