

## 6.0 Implementation: Retrofitting Gable End Walls with L-Bent Straps

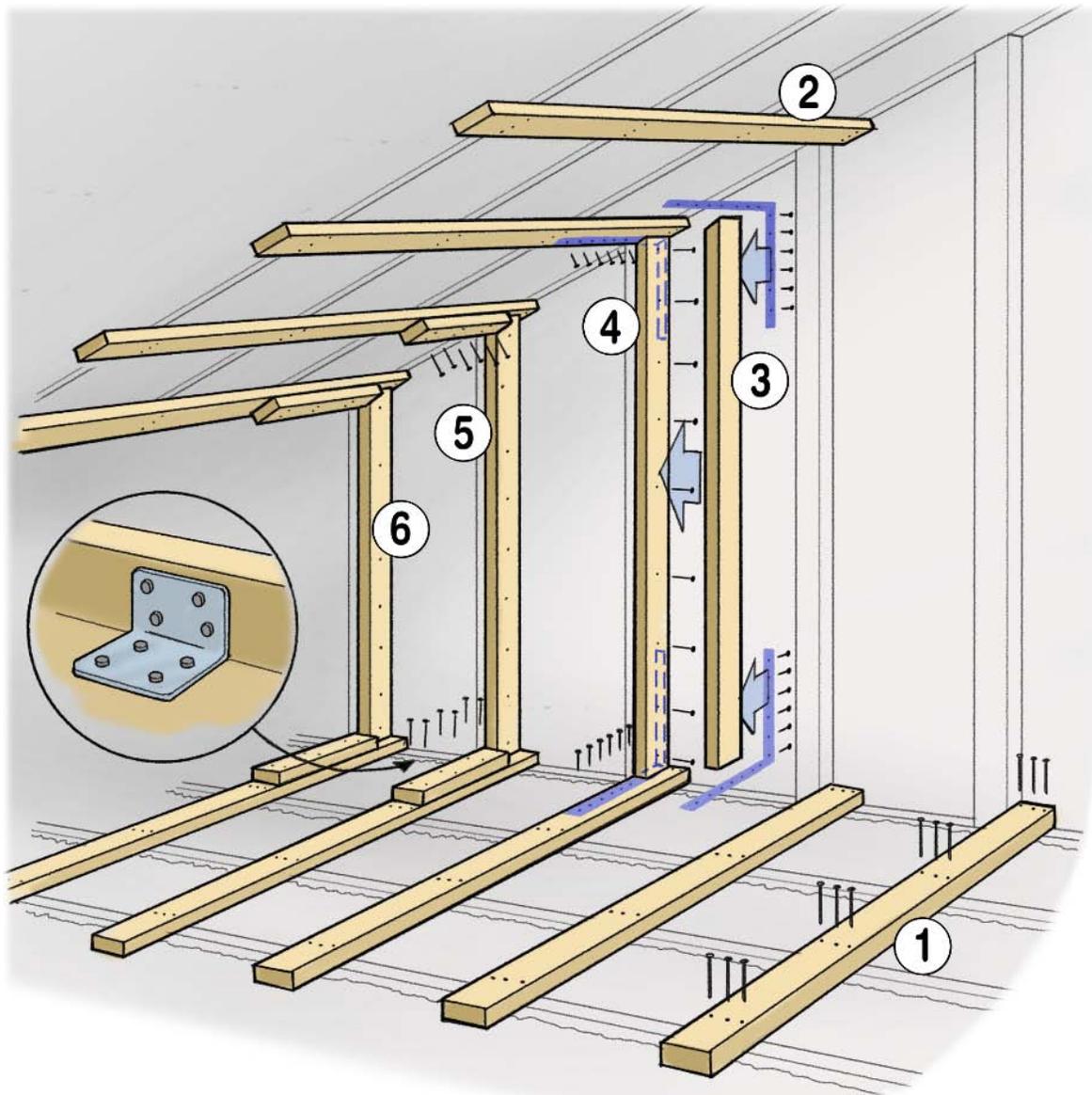
**Order of presentation:** To give you a better appreciation of what is involved in doing a gable end bracing retrofit, the first section of this chapter will cover the steps involved in the installation. After that we explain how to determine the materials you need, how to make a shopping list, how to decide on what materials to select (**Section 14**) and what tools you may need (**Section 15**).

Bear in mind that you may want to make the wall-to-wall connections before strengthening and bracing the gable end. This will depend on how you will be making wall-to-wall connections. Generally, it is better to retrofit the gable end wall first so the HGA or HGAM connectors will not be in the way of that work. To help you decide which to do first, see **Section 9** for frame walls and **Section 10** for masonry walls.

There are two types of obstructions addressed in this retrofit guide and that are incorporated in the *2007 Florida Building Code for Existing Buildings* and the *2012 International Building Code for Existing Buildings*. Specific guidance is provided for ways to work around these obstructions without reducing the effectiveness of the retrofits. One type is where there are obstructions that prevent the effective installation of a retrofit stud. These include gable end vents where the existing framing (existing studs have been cut so that a gable end vent could be installed), pipes or other objects are in the way. The alternative measure for this is discussed in **Section 11**. The other type of obstruction is where there are impediments on the floor or ceiling of the attic that prevent the installation of horizontal braces that extend the minimum of 6' into the attic. Alternative measures for this are discussed in **Section 10**.

### **Gable end retrofit installation steps using L-bent straps**

**Step 1. Install bottom horizontal braces.** For Step 1 **Figure 6.1** shows installation of a 2x4 horizontal brace 6' feet plus 2-1/2" long or whatever additional length is required to cross three framing members and extend 2-1/2" past the last member. The horizontal brace must be fastened to at least 3 framing members, and it must be fastened any other framing member(s) it crosses that are at the same elevation. The brace must extend beyond the last framing member by at least 2-1/2" so that the fasteners don't pull out of the brace when wind pressure pulls the wall outward and so the fasteners do not split the end of the brace when they are installed. The fasteners on the horizontal braces should be placed at least a 1/2" from the edges of the brace and 1" from each other. Those spacings do not leave much margin for error of placement. Just do the best you reasonably can. Most people will find it easiest to work in the attic by first installing all the braces on the attic floor. That gives a broader walking surface. Remember you can run the brace at an angle to avoid an obstacle, but you must maintain the 6' length and attachment to three framing members. If you have many gable end studs to retrofit, you are apt to make the mistake of installing a brace on the wrong side of an existing stud.



**Figure 6.1 The L-bent strap installation steps**

When you install horizontal braces onto attic floor framing members you may notice that some floor framing members are lower or higher than the rest resulting in gaps between the horizontal brace and one or more flooring members. Gaps need to be filled with wood shims. Gaps tend to be more of a problem with block walls than frame walls. Start installing fasteners at the wall end to ensure that the brace will be on the correct side of the existing stud and jammed against the existing stud. Install fasteners to attach the horizontal braces to every framing member over which the brace passes. Fastening to a rafter used solely to support ceiling material, and located next to the exterior wall

below, is not necessary. Nevertheless, fastening needs to be made to at least three primary framing members unless blocking or decking is used.

**Step 2. Install top horizontal braces.** With the bottom braces installed, one or all of the top horizontal braces can be installed. Remember to place the top ones on the same side of the existing stud as the bottom brace.

**Step 3. Straps on retrofit stud.**

**Step 3a. Cut retrofit stud to length.** Measure the length for each retrofit stud. Measure the length of the existing stud along the side where you intend to install the retrofit stud and the maximum allowable length of the retrofit stud 1-1/2" away from the existing stud on the side where the retrofit stud is to be connected. Use the shorter of the two lengths for each retrofit stud. The top of the stud can be cut square and does not need to match the pitch of the roof. Cut the stud.

**Step 3b. Bend and attach straps.** Select the appropriate strap by referring to row 15 of **Table 5.1**. L-bent straps need to be bent, BUT NOT in the middle, so that the fastener closest to the end of the retrofit stud is at least 2-1/2" from the end of the stud. By selecting the strap length from the table one can bend the strap at the point determined by counting the number of fastener holes from the end of the strap and adding 2-1/2". Row 16 of the table states the number of inches from the center to bend the L-strap. This ensures there will be enough holes for fastening to the horizontal brace. Install a strap to each end of the retrofit stud. One can bend the strap using a bench vice or install a strap on the stud so the bend point is at the end of the stud, fasten the strap and then bend the strap by hand and making the bend tighter by finishing the bend with a hammer. Remember that the fastener closest to the end of the brace must be at least 2-1/2" from the end of the brace.

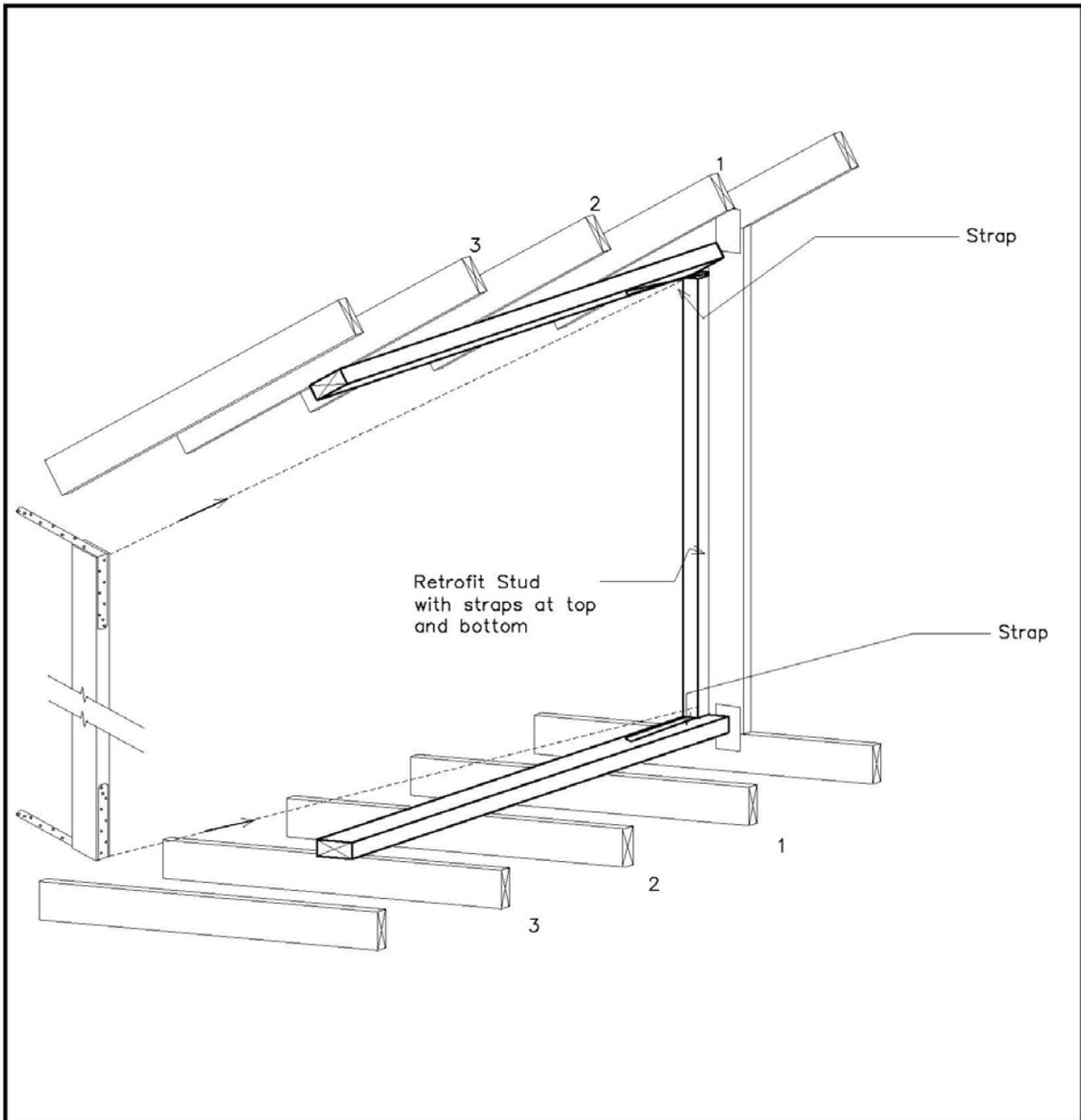
**Step 4. Install retrofit stud.** With the retrofit stud having a strap attached to the edge of each end, it is ready to be fastened to the existing stud. If the attachment of wall sheathing or siding is at all suspect, a best practice is to apply a heavy bead of AFG-01 rated construction adhesive on the sheathing where the edge of the retrofit stud will be placed. **See page 44 in Section 8 for more details about this best practice.** Push the stud in place against the sheathing and against the existing stud. Fasten the retrofit stud to the existing one in that position by using 3" fasteners no closer than 2-1/2" from the ends of the retrofit stud and no farther apart on the stud than 6" and no closer than 2-1/2" to each other. With the completion of this step you have made the existing stud at least twice as strong as it was, and if the existing stud is flat on the wall, you have made the stud almost three times stronger. Finish fastening the retrofit stud by fastening the straps to the horizontal braces. These straps restrain the retrofit stud from being pulled out by wind pressure. They provide the tension connection.

**Step 5. Install compression blocks.** Place compression block on the bottom horizontal brace and butt the block snugly up against the retrofit stud. Secure the block to the brace using the number of 3" fasteners indicated on row 17 of the table. The compression blocks restrain the gable end wall from being pushed into the attic.

With all retrofit studs completed at a gable end you are done except for making the wall-to-wall connections.



**Figure 6.2.** Installation of retrofit stud. The retrofit stud for this L-bent strap installation has straps already attached to the back edge. Construction adhesive has been applied to the wall where the retrofit stud will be butted.



**Requirements**

- The number and size of retrofit studs shall be as specified in the Table 1.
- The retrofit stud must fit so snugly between framing members that the gap should not exceed 1/2".
- Carefully center the strap on the edge of the retrofit stud to minimize chances of splitting the stud.
- Fasteners must be 10d nails or #8 screws.
- Fasteners must be a minimum of 1-1/4" long, but should be no longer than 1-5/8" to minimize chances of splitting the stud.
- The fasteners at the far ends of the retrofit stud must be no closer than 2-1/2" from the end of the stud.

**Retrofit Studs**

**Figure 6.3**

### Gathering materials

**Table 6.1** along with your worksheets will make determining the number of each kind of material very easy. Notice that at most 10 different kinds of materials are used. For most gable ends, only eight kinds are required. Instructions for using the table are given immediately below it in the notes.

**Table 6.1. Materials takeoff form for the L-bent strap method. Instructions for use are given immediately above this caption and below the table.**

<b>L-Bent Strap Method Materials Takeoff</b>									
Item	<b>Retrofit Configuration</b>								<b>Grand Total Number Needed</b>
	<b>A</b>		<b>B</b>		<b>C</b>		<b>D</b>		
	Num @	X @	Num @	X @	Num @	X @	Num @	X @	
2x4x8' for Horizontal Braces	2		2		2		2		
2x4x8' for Retrofit Studs	1		---	---	---	---	---	---	
2x6x12' for Retrofit Studs	---	---	1		---	---	---	---	
2x8x16' for Retrofit Studs	---	---	---	---	1		2		
24" straps 20 gauge	2		---	---	---	---	---	---	
30" straps 20 gauge	---	---	---	---	---	---	4		
36" straps 20 gauge	---	---	2		---	---	---	---	
49" straps 20 gauge	---	---	---	---	2		---	---	
1-1/4" fasteners	24		36		48		64		
3" fasteners	47		59		71		150		
Pounds 1-1/2" screws	0.14		0.21		0.28		0.37		
Pounds 3" screws	0.62		0.78		0.94		1.98		
<b>Number of retrofits for this Configuration --&gt;</b>	# =		# =		# =		# =		

**To use this table to determine quantities:**

First, in the bottom row enter the number of retrofits for each of the Configurations.

Next, multiple that number by Num @ for each row entry.

Finally, total the numbers across each row and enter that number in the Total column.

Screw weights will vary according to the particular brand and model selected.

**Right and wrong: Figure 6.4**



**Wrong:** Retrofit stud so weakened by bevel cut that is it not very effective.  
The compression blocks do not bear on the full width of the retrofit studs.  
**Right:** The horizontal brace does make up for the ineffective compression block.  
An H10 connector is in place to hold down the outrigger/outlooker. Great!



**Wrong:** Those nails that hit straps don't do anything. Maybe there are enough good nails.  
**Right:** The plywood that was already on the floor of the attic is a very valuable way to distribute the loads imposed by the gable end wall to the rest of the floor system. The compression block butts the retrofit properly. It is assumed that the white wire at the end of the horizontal brace is really not being compressed by the brace.



**Wrong:** Some of the fasteners for connecting the compression block to the horizontal brace do not penetrate the brace by the gap between the two.