

# STRUCTURAL BUILDING COMPONENTS MAGAZINE

August 2004

## Technical Q & A

### Heel Blocking by Rachel Smith

For reader comments on this article, [click here](#).

*SBC's regular "Frequently-Asked Questions" column has a new name! Read on to learn the answers to more of our readers' technical questions.*

Have you ever heard of bird blocking? It's a term used for the block installed between roof truss heels at the top of the exterior wall. The blocks often have ventilation holes drilled in them, so they may have a piece of wire mesh attached on one side to prevent birds or other critters from traveling through the holes into the attic space (see Figure 1).

Some truss manufacturers supply bird blocking with roof truss deliveries; it is a nice service to the framer and a way for the truss manufacturer to put scrap lumber to good use. That is what one manufacturer in California does on a regular basis. One day he received a call from the project structural engineer asking for the capacity of the block to transfer lateral loads as part of the roof diaphragm design. He called WTCA with this issue and once we sorted it



FIGURE 1. MANUFACTURED BIRD BLOCKING

out, we thought it would make a good topic for this column. You will learn, as we did, that even though bird blocking is provided innocently enough by truss manufacturers, it can become an important part of the structural load path of the roof to the foundation.

**QUESTION:**

What is the shear transfer capacity for heel blocking if it is considered part of a roof diaphragm design?

**ANSWER:**

Let's first discuss the function of roof diaphragms. Structures can be designed to take a considerable amount of lateral (or sideways) load from high wind or earthquake events. In simple terms, lateral loads in the roof system are transferred through the roof diaphragm, which is the structural plane created by the roof sheathing. To design the roof diaphragm, building designers determine the thickness and grade of the roof sheathing panel, the nail size and frequency, the size of the supporting framing member and the amount of blocking required for the panel. The perimeter of the diaphragm then must have the ability to transfer loads into the side walls or shear walls. Shear walls then act essentially like the roof diaphragms, only installed

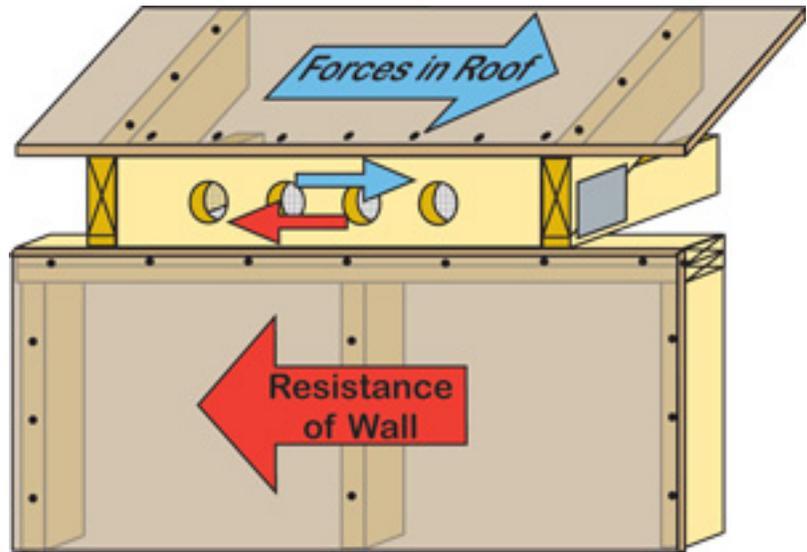


FIGURE 2. SHEAR FORCES ACTING ON HEEL BLOCK

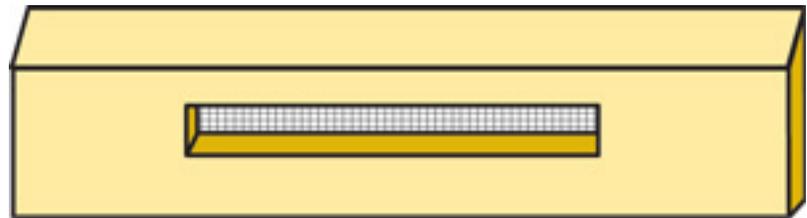


FIGURE 3. A LETTERBOX TYPE VENTILATION BLOCK

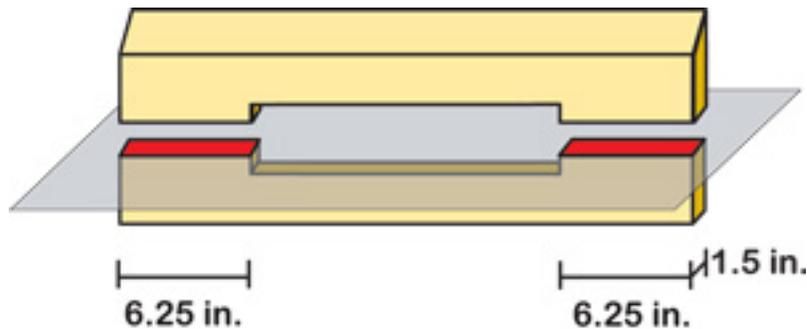


FIGURE 4. AREA OF BLOCK THAT RESISTS SHEAR

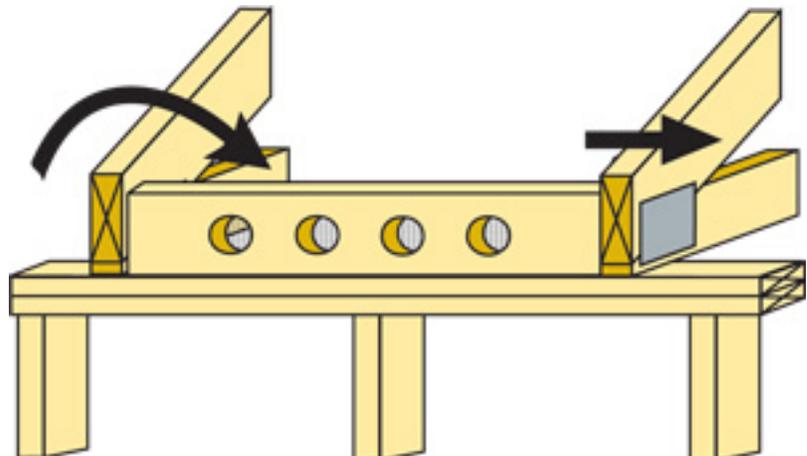


FIGURE 5. BLOCKING PREVENTS ROTATION AND LATERAL DISPLACEMENT

vertically. Horizontal blocking between truss heels can function as the perimeter blocking of the roof diaphragm and become the load path from the roof diaphragm into the shear wall.

The building designer cannot assume heel blocking will perform the same function as perimeter blocking for the roof diaphragm, especially if they are uncertain of the blocking material and how it is being installed.

The block will be subject to two opposing horizontal forces like the ones shown as red and blue arrows in Figure 2.

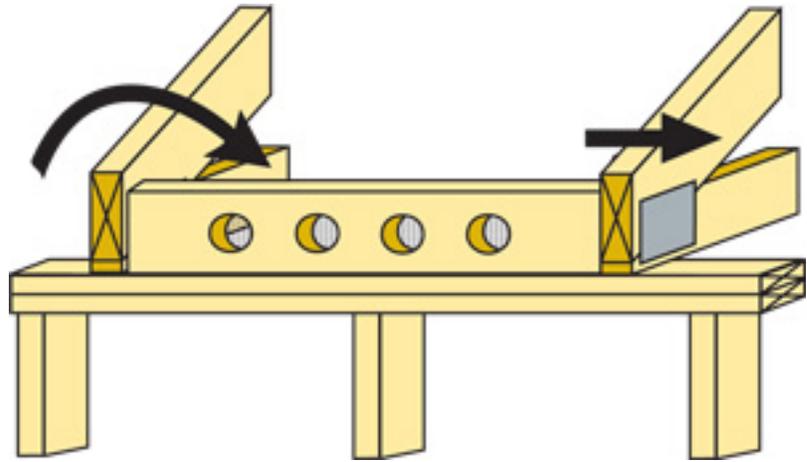


FIGURE 6. BLOCKING PANELS ARE AN OPTION FOR HIGH HEEL OR FLAT TRUSSES

The ability of the block to resist these forces depends on the allowable shear stress value of the lumber grade and species as well as the amount of material removed to create the ventilation holes. In this case, the truss manufacturer uses 2x6 beveled blocks with a letterbox type ventilation hole that is two inches high by ten inches long as shown in Figure 3. Imagine a horizontal plane cutting through the block at the location of the least material, see Figure 4. This is the area of block left to resist the shear forces being transferred from the roof diaphragm to the wall below. In this case it's a total of 18.75 square inches.

To be conservative, we will use the lowest allowable value of shear stress  $F_v=110$  psi which is for "Northern Species" according to the AF&PA National Design Specification for Wood Construction Design Values Supplement (2001). The only other factor to consider is load duration. We will use 1.6 since in California the force is most likely created by an earthquake event. The amount of shear capacity for the block then is:

Shear Capacity of Block =  $F_v' \times \text{Area}$

Shear Capacity of Block =  $(110\text{psi} \times 1.6) \times 18.75 \text{ sq.in.} = 3300 \text{ pounds}$

Shear loads are expressed in terms of pounds per lineal foot (plf), so a 22.5 inch block with 3300 pounds of shear capacity would convert to 1760 plf (3300 pounds divided by 1.875 ft. [22.5 inches]). Is that enough? Yes. This is well above the magnitude of lateral loads that we expect will be generated in light frame wood construction. The APA Engineered Wood Association publishes a booklet called Introduction to Lateral Design with charts for designing diaphragms and shear walls. In it, the highest recommended load listed is 820 plf for roof diaphragms and 870 plf for shear walls. Therefore, even our low grade "bird block" with a large horizontal ventilation opening will more than suffice as perimeter blocking provided the building designer properly details the roof-to-block and the block-to-wall connections.

**QUESTION:**

I am a building inspector and have some questions regarding heel blocking. Do truss designers account for the forces that cause rotation and lateral displacement at the bearing in their truss design or is this the responsibility of the structural engineer or building designer?

**ANSWER:**

The truss designer assumes that the truss will be installed in-plumb and in-plane and will carry only in-plane loads. The building designer is responsible for designing the system to resist any loads and forces not in-plane with the truss, which would include the means to resist rotation and lateral displacement.

Some local code jurisdictions, mostly in the earthquake prone west, require blocking at the truss heels because there is a greater expectation of lateral loads causing rotation and displacement, see Figure 5. The rest of the country generally doesn't require blocking because the truss-to-bearing connections and the relatively close roof sheathing attachment are sufficient to prevent any movement. Note that the block doesn't need to go the full height of the heel to effectively block it and keep it from rotating, nor is a block always required in every space between trusses.

Another option building designers may specify for high heel or flat trusses is a blocking panel (see Figure 6). Truss manufacturers can provide these as long as they have enough information to complete the design.

Roof diaphragm, shear wall, truss rotation restraint and the connections needed to resist all loads are all issues that the building designer must account for when designing the building. The component manufacturer may already be supplying products like bird blocks and blocking panels that can easily provide the design values needed to resist lateral loads. This certainly can be a win-win for everyone—the lateral loads are easily resisted and the component manufacturer gets to supply another structural component that has solid design values while also using up what otherwise may be waste material.

---

To pose a question for this column, email us at [technicalqa@sbcmag.info](mailto:technicalqa@sbcmag.info). To view other questions visit the [WTCA website](#).

---

[SBC HOME PAGE](#)

Copyright © 2004 by Truss Publications, Inc. All rights reserved. For permission to reprint materials from SBC Magazine, call 608/310-6706 or email [editor@sbcmag.info](mailto:editor@sbcmag.info).

The mission of Structural Building Components Magazine (SBC) is to increase the knowledge of and to promote the common interests of those engaged in manufacturing and distributing of structural building components to ensure growth and continuity, and to be the information conduit by staying abreast of leading-edge issues. SBC will take a leadership role on behalf of the component industry in disseminating technical and marketplace information, and will maintain advisory committees consisting of the most knowledgeable professionals in the industry. The opinions expressed in SBC

are those of the authors and those quoted solely, and are not necessarily the opinions of any of the affiliated associations (SBCC, WTCA, SCDA & STCA).