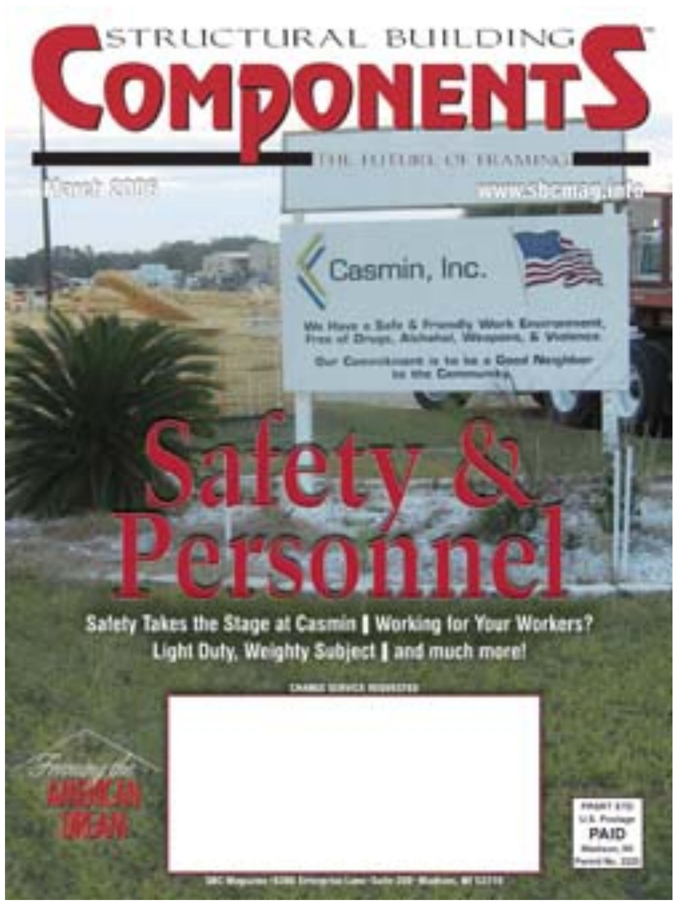
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# Technical Q & A

## Wall Girders, Part 2

Prompted by a recent column on second story wall girders, one reader continues the dialogue on this topic by sharing an engineer's perspective.

by Scott Coffman, P.E., Builders FirstSource

**Editor's Note:** *Scott Coffman, an engineer in Sumter, SC, prepared an installment of this column before he knew the topic of wall girders was covered by Steve Kennedy in the December 2005 issue. Scott makes several good points in addition to Steve's original article, so we thought it worthwhile to continue the discussion in this month's column.*

Many truss technicians and manufacturers recommend pre-manufactured wood trusses to form the wall while the top and bottom chords support structural framing. Many contractors see these "wall girders" as an ideal solution because costly beams and field framing are virtually, if not totally, eliminated. Unfortunately, the truss industry typically promotes wall girders considering only vertical gravity and uplift loads while neglecting lateral loads induced by wind or seismic forces. Before a truss manufacturer suggests a wall girder as a viable alternative, it should recognize the limitations and have the Truss Designer perform a thorough structural analysis of the wall girder.

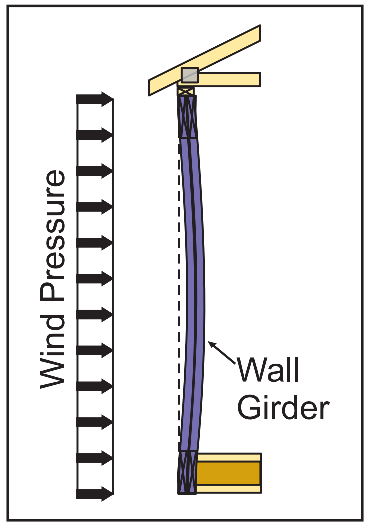

Figure 1. Lateral forces can cause lateral buckling of wall girders.

The primary issue that must be considered is out-of-plane bending when some or all of a wall girder is exposed to wind pressure (see Figure 1). A firm understanding of how a wall performs is the most direct approach to exploring wall girder viability and limitations. The building code is used for this study since it details minimum and maximum requirements for wall construction, including minimum sheathing and stud framing that must be used.

The building code recognizes the United States Department of Commerce PS 1-95 "Construction and Industrial Plywood" and PS 2-92 "Performance Standard for Wood-based Structural-use Panels" for design values of structural wood panels. Structural panel grading agencies like APA, TECO and PSI use a span rating to indicate performance for a particular structural panel when used as roof or floor sheathing. The span rating consists of two numbers separated by a slash, such as 32/16. The left number indicates the maximum roof support spacing in inches when the panel is used on a roof, whereas the number to the right of the slash is the maximum spacing for floor supports. A typical 7/16" panel used to sheath exterior walls would be assigned a span rating of 24/16 indicating a maximum 24" on center support spacing. Using the roof number is appropriate since sheathing applied to both roof and wall supports must resist lateral wind pressures.

The sheathing is fastened to wall studs that must resist lateral wind pressure along with either axial tension or compression loads. Fortunately, the 2003 International Residential Code (IRC) and International Building Code (IBC) provide enough insight into minimal wall stud design by creating tables that use panel span rating. IRC Table R602.3(3) limits the allowable stud spacing to either 16" or 24" depending on panel nominal thickness. Additionally, IRC Table R602.3(5) also limits maximum stud spacing to 24" for bearing walls comprised of either 2x4 or 2x6 studs. Similar information can be located in IBC Tables 2308.9.1 and 2308.9(3). Fastener spacing is also addressed in the code. Without going into shear wall design, we can use IRC Table R602.3(1) to identify minimum fastener spacing at the panel edges and intermediate supports. (Visit **Support Docs** at www.sbcmag.info to view the IRC and IBC tables referenced above.)

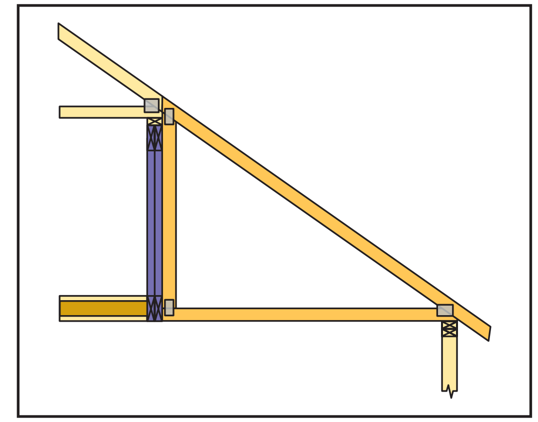
Figure 2. An interior wall girder.

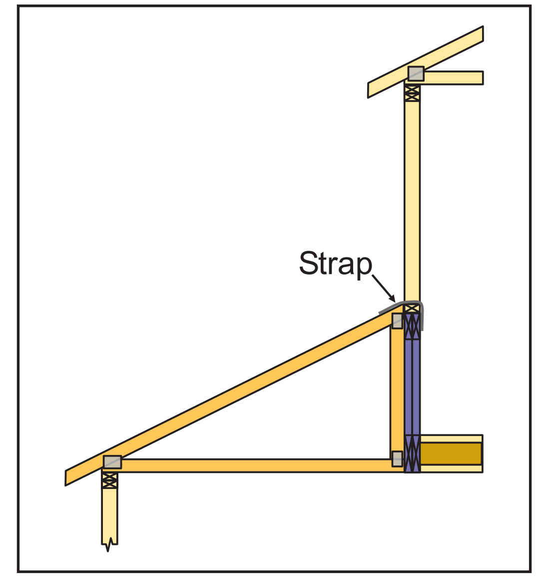

Figure 3. Wall girder protected from exterior exposure.

Using this straightforward approach, the three general conclusions that can be made are a minimum 3-½" wall thickness must be present, the wall sheathing must be supported at no more than 24" on center and panels must be fastened to supports anywhere from 3" to 12" on center. This creates a real dilemma for truss wall girders that typically have large panels connected by diagonal members and a thickness of only 1-½". Nevertheless, some design guidelines and suggestions can be made for the appropriate use of premanufactured wood truss wall girders.

### Question

*What are some guidelines to use when deciding to use wall girders?*

### Answer

Use these general guidelines when deciding to use wall girders.

**General Guideline 1: Limit Wall Girders to Interior Applications.** The key is not to expose any portion of the wall girder to external wind pressure that creates out-of-plane bending. Figure 2 demonstrates an interior wall girder application where sheathing attachment is not critical and design loads are generally the vertical gravity or uplift loads easily applied by most truss design software.

A typical example of Figure 2 is a bonus room over a garage. This application requires the wall to be furred to provide minimum sheet rock attachment per IBC Table 2304.6.

**General Guideline 2: Use solid sawn framing in those regions exposed to wind.** The girder truss in Figure 3 is completely protected by the roof envelope with wall studs framed along the top chord. The wall studs are installed to meet building code requirements and the girder truss can be a minimum two-ply.

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### at a glance

- Many contractors see wall girders as an ideal solution because costly beams and field framing are eliminated.
- Wall girders must meet the provisions for wall construction in the IBC or IRC.
- The primary issue that must be considered is out-of-plane bending when some or all of a wall girder is exposed to wind pressure.
- No matter which approach is chosen with wall girders, it must account for all the applied loads, connections and permanent bracing.

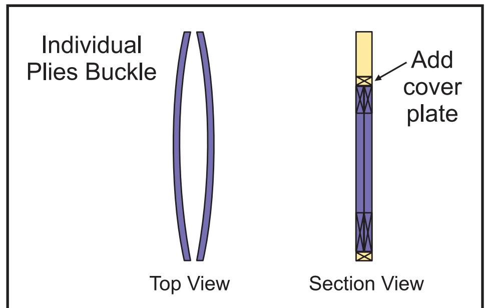


Figure 4. Cover plates prevent improperly fastened plies from separating.

## Technical Q&A

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Metal straps may be required to prevent the top chord from buckling toward the inside. Although providing lateral resistance to the top chord through the roof diaphragm is part of building design, the truss technician needs to be aware that lateral forces applied to the wall cause the girder truss to move laterally, which must be resisted. Additionally, furring may be required, depending on girder depth, for sheet rock attachment to the inside.

**General Guideline 3: Solid sawn cover plates may be fastened to the girder truss top and bottom chord.** Individual girder plies perform as a unit when fastened per the requirements detailed in the *National Design Specification for Wood Construction (NDS)*. Insufficient field nailing generally does not become obvious because structural sheathing across the chords assist in tying these members together and pre-fabricated metal hangers provide a sufficient concentration of fasteners. Wall girders do not have this redundancy, especially along the top chord, which may be supporting trusses at intervals of 24" or more on center. The simple solution is to install a wood cover plate that ties the plies together to function as a unit.

The wall sole plate performs this function when a wall is constructed above a wall girder. Also, nails may be inadvertently driven between the plies when perpendicular framing is toe-nailed to the top edge of the top chord of a multi-ply truss. Attaching a cover plate or attaching structural framing to the girder truss with pre-fabricated metal tie-downs eliminates this possibility.

**General Guideline 4: The Peter & Paul Principle.** Robbing Peter to pay Paul demonstrates the truth behind the old adage...you cannot get something for nothing. Consider the following:

1. Exposed wall girders must have vertical webs no more than every 24" on center for wall sheathing attachment.
2. Exposed wall girders must be a minimum of two plies with a "T" or "I" brace fastened to each web to resist the applied lateral wind pressures.
3. Any interior wall girders must be furred for sheet rock attachment.
4. The truss industry promotes the design of components for the loads specified. Replacing a beam and wall studs with a wall girder requires a thorough analysis of the applied lateral loads by a Building Designer who then needs to work with the truss designer to ensure that all required loads are properly applied to the wall girder and the resulting flow of loads through the wall girder are transferred down to the foundation. The loads to be applied and the permanent bracing of the wall girder are typically outside the scope of work of the truss technician and truss design engineer. If this analysis is not conducted properly, the component manufacturer may find greater truss performance risk.

Wall girders can provide a very sound structural engineering alternative to framing situations that would be difficult to handle with any other method. Each case should be thoroughly analyzed to determine the best and most economical structural solution, balancing truss design with prescriptive framing practices in the building code. No matter what approach is used, it must account for all the applied loads (gravity and lateral), connections and permanent bracing. This generally requires working closely with the Building Designer to ensure that sound field performance is achieved. This is particularly true with exterior wall girders exposed to wind loads. SBC

*Scott Coffman works for Builders FirstSource in Sumter, SC and has more than 25 years in the wood design and component industry. To pose a question for this column, call the WTCA technical department at 608/274-4849 or email technicalqa@sbcmag.info.*

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