

The condition of truss arching is explored.

by Ryan J. Dexter, PE.

Partition separation is defined by our industry as the cracking that develops at the interface between interior partition walls and ceiling or floor finishes, usually characterized by gaps that open in the winter and close in the summer. There are many reasons that cause partition separation, including what is termed "truss arching" by many in the field. From the calls we receive on this issue, truss movement is often blamed; but in actuality, truss movement causes partition separation in only a minority of the cases.

Let's take a look at why arching occurs and the degree to which it impacts truss deflection.

Truss arching is best described as an upward deflection of a truss resulting from a differential elongation or shrinkage between the top and bottom chords. Recall that wood swells as its moisture content increases and shrinks as its moisture content decreases. Therefore, an increase in the moisture content of the top chord relative to the bottom chord will cause an elongation of the top chord relative to the bottom chord. Similarly, a decrease in the moisture content of the bottom chord relative to the top chord will cause shrinkage in the bottom chord relative to the top chord. Since typically the top and bottom chords of a roof truss are firmly connected at the heel joint by a metal connector plate, if the differential movement between the chords is large enough, an "arching" or upward deflection (most pronounced at the midspan of the truss) can occur.

Truss arching has been known to occur during the winter following "close-in"; this is when the trusses were installed late in the year after having been subjected to wet or humid weather. The bottom chords of the trusses are typically enclosed in insulation and immediately begin "drying out" due to the heat from the living area below. In this scenario, the bottom chord begins to dry at a much faster rate than the top chord, causing shrinkage in the bottom chord relative to the top chord, which results in an upward movement of the trusses. If these trusses cross over interior partition walls that are nailed directly to the bottom chord of the truss, the arching of the bottom chord can cause a crack or gap to form at the corner joint between the ceiling and the top of the partition wall, or can actually lift the partition off of the floor below. In this situation, the arching will typically dissipate as the moisture content of the top and bottom chords equilibrate to the same level.

Truss arching has also been known to occur in existing structures on a seasonal basis, which usually indicates that the ventilation in the attic is inadequate, or that moisture from the house is escaping into the attic as opposed to being vented directly outdoors.

### Example Calculation for Truss Arching

The following table shows the average longitudinal elongation/shrinkage values per 1% change in moisture content of three lumber species commonly used in metal plate connected wood truss construction:

Species	Changes Per 1% Loss in Moisture Content
Southern Pine	0.0127%
Douglas Fir-Larch	0.0073%
Hem-Fir	0.0063%

Continued on page 12

## New WTCA Members

### REGULAR MEMBERS

**A-1 Roof Trusses**  
4451 Saint Lucie Blvd  
Fort Pierce, FL 34946-9035  
772/409-1010  
Mr. John Herring

**A. Potvin Construction**  
PO Box 969  
Rockland, ON K4K 1L6  
613/446-2203  
Mr. Guy Simard

**Bellbird Building Supplies**  
235 Princes Hwy  
Melbourne, VIC 3803 AUSTRALIA  
+61 3 9703 2444  
Mr. Michael Tremewen

**Circle Three Industries**  
PO Box 3036  
Post Falls, ID 83877  
208/773-7755  
Mr. Carl Broadbent

**Maki Corp.**  
101 Linus Allain Ave  
Gardner, MA 01440  
978/630-3916  
Mr. Kevin LaClaire

**Modu-Tech**  
1200 E Patapsco Ave  
Baltimore, MD 21225-2233  
410/355-1014  
Mr. Mike Pigozzi

**Mountain Grove Components**  
211 S Oak St  
Mountain Grove, MO 65711  
417/926-1311  
Ms. Melanie W. Thompson

**Pecos Valley Homes**  
96 San Marcos Loop  
Santa Fe, NM 87508  
505/424-1141  
Mr. Carl Douglass  
Sponsor: Mr. James Swanson

**Penn-Truss Manufacturing, Inc.**  
PO Box 418  
Saltcoats, SK S0A 3R0  
306/744-2403  
Mr. Colin Penner

**Pine Lodge Truss, Inc.**  
103 W Pine Lodge Rd  
Roswell, NM 88201-9435  
505/623-9500  
Mr. Gordon Wheat

**Precision Framing System, Inc.**  
11922 General Dr  
Charlotte, NC 28273  
704/588-6680  
Mr. Phillip Zurawski  
Sponsor: Mr. Glenn Traylor

**Rosamond Truss Inc.**  
PO Box 1876  
Rosamond, CA 93561-1876  
661/256-8575  
Mr. Jim Browne

**The Truss Company**  
4520 N St Louis St  
Batesville, AR 72501-8233  
870/793-5134  
Mr. Vance Jarrett

### Timber-Tech Truss Inc.

Box 121  
Aldersyde, AB TOL 0A0  
403/601-4565  
Ms. Wendy Going

**Titan Truss LLC**  
1108 14th St #431  
Cody, WY 82414-3743  
307/587-2187  
Mr. Denny McVey

**WBC Building Components**  
PO Box 1447  
Columbia Falls, MT 59912  
406/892-2171  
Mr. Donald McGrady  
Sponsor: Mr. Larry Pomeroy

### ASSOCIATE MEMBERS

**Mr. Kevin Beckstead**  
2730 N 4800 W  
Corrine, UT 84307  
435/744-5511

**Bloch Lumber Company**  
123 N Wacker Dr Ste 1350  
Chicago, IL 60606-1772  
312/466-4500  
Mr. Gregg S. Riley

**Ferris Home Consulting**  
575 Bridge Rd Unit 10-5  
Florence, MA 01062-1089  
413/575-8802  
Mr. Bradley Ferris

**Fournier Industries**  
3787 West Frontenac Blvd  
Theftford Mines, QC G6H 2B5  
418/423-4241  
Mr. Gaston Tanguay

**Lenard Gabert & Associates**  
3801 Kirby Ste 415  
Houston, TX 72098  
713/527-0251  
Mr. Lenard M. Gabert

**My Builder LLC**  
5756 Lake Court NW  
Kennesaw, GA 30152  
770/595-5143  
Mr. Angelo Sciortino

**Packer Engineering**  
PO Box 353  
Naperville, IL 60566-0353  
630/577-1964  
Mr. Mike Cahill

16085 Fish Rd Ste 10  
Marysville, OH 43040-8925  
614/214-1487  
Mr. Michael R. Parks

**Trehel Corporation**  
PO Box 1707  
Clemson, SC 29678  
864/654-6582  
Mr. David Stokes

Listing as of 10/15/08.

For more information about WTCA membership, contact Anna (608/310-6719 or [astamm@qualtim.com](mailto:astamm@qualtim.com)) or visit [www.sbcindustry.com](http://www.sbcindustry.com).

**RRG Floor Truss System**  
9"-26" Trusses  
No Set-Up Changes

**M Series Floor Truss System**  
Why Buy Used!

**Roadrunner PCT**  
High Production Multi-Family

**RoIsplicer**  
OFTEN IMITATED - NEVER MATCHED  
Chord Splicing Machine  
Every floor truss starts with a tight splice!

LET US SHOW YOU HOW!

**KLAISLER MFG. CORP.**  
1800 MUSICLAND DRIVE  
FRANKLIN, IN 46131  
PHONE: 877-357-3898  
WWW.KLAISLER.COM

**FLOOR TRUSS SYSTEMS**

For reader service, go to [www.sbcmag.info/klaisler.htm](http://www.sbcmag.info/klaisler.htm)

**MASTER PLANK®**  
**BEAMS & HEADERS**  
STRONG • LIGHTWEIGHT • STABLE

**MASTER STAIR®**  
**MASTER PLY®**  
**MASTER JO®**  
**MASTER Q®**

BUILDING A TRADITION OF QUALITY PRODUCTS

- LVL Attractive Beams & Headers
- LVL Structural Stair Stringer Blanks
- LVL Specialty Plywood
- LVL Truss Chords (Alpine™ & MiTek® plate values)
- LVL 3-1/2" One-Piece Garage Door Headers
- LVL Scaffold Plank & Other Industrial Applications

**KRB GLULAM®**  
COLUMNS • WINDOW & DOOR HEADERS

Finnforest USA *Out-performs solid sawn lumber and offers...*

- High strength to depth ratios
- Multiple span capabilities
- Building Code approvals and OSHA compliance

**AN EXCELLENT VALUE!**

*We produce thousands of products from wood...  
The only limit is your imagination.*

**finnforest** **Finnforest USA**  
Engineered Wood Division

[www.finnforestus.com](http://www.finnforestus.com) • 800/622-5850 • Fax: 586/296-8773

For reader service, go to [www.sbcmag.info/finnforest.htm](http://www.sbcmag.info/finnforest.htm)

## We Sleep Well at Night!

Why? Because we sell solutions, not machinery. Of course, the solutions ultimately result in machinery sales, but we are promoting the equipment that fits the solution, not the equipment that optimizes our commission. Add the fact that we promote truss, wall panel and door equipment manufacturers that take pride in quality and service, and it's easy to see why we don't toss and turn.



WASSERMAN & ASSOCIATES, INC.  
800/382-0329 phone • 402/438-2524 fax  
sales@wasserman-associates.com

## Not Comfortable with Used Equipment?

Please consider the following:

- Satisfaction Guaranteed—if it's not right, we'll buy it back!
- Installation Services Available
- Leasing Available
- Shipping Coordination Is Included

Please contact us to sell your excess equipment!

For reader service, go to [www.sbcmag.info/wasserman.htm](http://www.sbcmag.info/wasserman.htm)

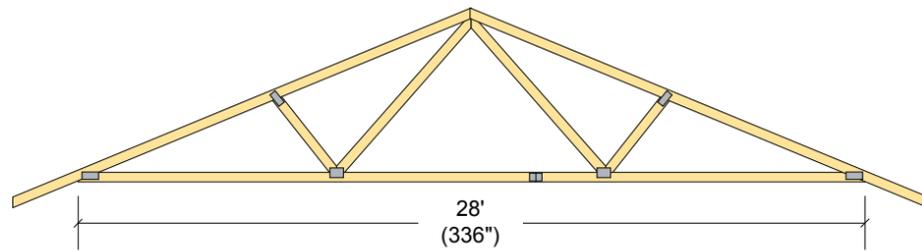


Figure 1.

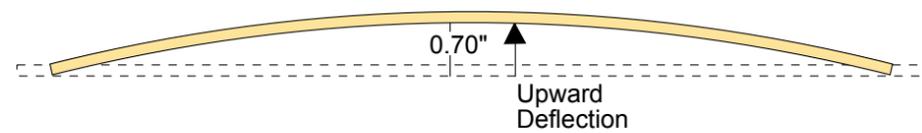


Figure 2.

chord of approximately 0.70 in. using the mathematical relationships between an arch and chord of a circle (see Figure 2).

The above example is idealized. Remember that the percentages listed in Figure 1 are *averages*. This means that because of variations between species, variations between trees from different forests, the age of the trees when cut, and variations in the lumber within the same tree, elongation and shrinkage does not always take place uniformly, and sometimes does not occur at all. In addition, slight slippage of the wood around the metal teeth of the truss plate, the orientation of the growth rings in the lumber, the number of pieces used to form the lower chord, the way the trusses are fastened to the walls, the amount of ventilation, the relative humidity, and the thickness of the insulation make predicting when partition separation will occur very difficult if not impossible.

Because of all these reasons and the fact that truss movement is not typically found to be the cause when a rigorous assessment of movement in the building is made, it is generally not reasonable to blame trusses for partition separation. The only way to know for sure that truss movement is taking place is to use a laser level to assess all the areas of potential movement in the structure. The foundation must be level, the walls square, the top plates level, the floor level and so forth. Building shrinkage/movement can come from a variety of sources. Once the cause is known, remediation is easier.

Again, truss arching is just one of several factors that can cause partition separation. We have provided a way to quickly assess the amount of relative shrinkage that the lumber used in a truss may accrue. This is intended to provide information that will help the evaluation of truss movement in a building. To learn more about the factors that can cause partition separation refer to WTCA's Truss Technology on Building (TTB) brochure, *Partition Separation Prevention and Solutions*, available at [www.sbcindustry.com/ttbpartsep](http://www.sbcindustry.com/ttbpartsep). **SBC**

To pose a question for this column, call the WTCA technical department at 608/274-4849 or email [technicalqa@sbcmag.info](mailto:technicalqa@sbcmag.info).

## Technical Q&A

Continued from page 10

As an example of how truss arching can occur, let's assume we have a 28-ft span truss with an average moisture content of 19% that is installed in the roof of a house in northern Virginia in late November. Assume that Southern Pine is used in the chords and webs of this truss. Assume also that the house is quickly enclosed after the trusses are set with heat applied to the interior to aid with the finishing of the drywall and that the bottom chord is completely enclosed in insulation soon after (see Figure 1). Under these conditions the bottom chord dries over a couple of months from 19% to 7%. This equates to a 12% difference in moisture content. Meanwhile, the moisture content in the top chord remains relatively unchanged.

If southern pine shrinks 0.0127% per each 1% loss in moisture content, we can expect shrinkage of approximately 0.001524 in./in. due to the 12% loss (i.e.,  $0.000127 \times 12 = 0.001524$  in./in.). The bottom chord is 336 in. long (i.e., 12 in./ft.  $\times$  28 ft.). Therefore, the potential overall shrinkage of the bottom chord is approximately  $0.001524 \times 336$  in. = 0.512 in.

Because the bottom chord is restrained by the top chord and the webs (also because the chords are typically constrained at the heels due to the bearing connection), this shortening could potentially produce an upward deflection of the bottom

# READY TO JOIN THE SCORE RANKS?



**Cascade Mfg Co**  
[www.cascade-mfg-co.com](http://www.cascade-mfg-co.com)  
Cascade, IA

**Tri-County Truss, Inc.**  
[www.tricountytruss.com](http://www.tricountytruss.com)  
Burlington, WA

**Lumber Specialties**  
[www.lbrspec.com](http://www.lbrspec.com)  
Dyersville, IA

**ProBuild Manufacturing**  
[www.carterlee.com](http://www.carterlee.com)  
Indianapolis, IN

**True House, Inc.**  
[www.truehouse.com](http://www.truehouse.com)  
Jacksonville, FL

**Truss Craft**  
[www.dakotacraft.com](http://www.dakotacraft.com)  
Cheyenne, WY

**Dakota Craft Truss**  
[www.dakotacraft.com](http://www.dakotacraft.com)  
Rapid City, SD

**Shelter Systems Limited**  
[www.sheltersystems.com](http://www.sheltersystems.com)  
Westminster, MD

**Truss Systems, Inc.**  
[www.trussystemsinc.com](http://www.trussystemsinc.com)  
Oxford, GA

**Plum Building Systems, LLC**  
[www.plumbuildingsystemsinc.com](http://www.plumbuildingsystemsinc.com)  
West Des Moines, IA

**Sun State Components of Nevada, Inc.**  
[www.sunstatenv.com](http://www.sunstatenv.com)  
North Las Vegas, NV

## Buy a package subscription and be well on your way!

- ★ SCORE package subscriptions are available for each level of certification. ★
- ★ These packages bundle required programs together and offer them all to you at an average of **50% OFF STANDARD PRICES!** ★
- ★ This is your way to get SCORE certified quickly, economically and at whatever level you choose. ★
- ★ Find out more, and how to get your dues reduced, at [www.sbcindustry.com/scorepackages.php](http://www.sbcindustry.com/scorepackages.php). ★



Structural Component Operations Reaching for Excellence

For reader service, go to [www.sbcmag.info/sbca.htm](http://www.sbcmag.info/sbca.htm)

# STRUCTURAL BUILDING **COMPONENTS**<sup>TM</sup>

THE FUTURE OF FRAMING

[www.sbcmag.info](http://www.sbcmag.info)

Dear Reader:

Copyright © 2008 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 affiliated association (WTCA) .



6300 Enterprise Lane • Suite 200 • Madison, WI 53719  
608/310-6706 phone • 608/271-7006 fax  
[www.sbcmag.info](http://www.sbcmag.info) • [admgr@sbcmag.info](mailto:admgr@sbcmag.info)