



Rethinking Ways to Encourage Permanent Truss Bracing

by Frank Woeste, P.E., Professor Emeritus, Virginia Tech

For Component Manufacturers (CMs), it is generally well known that the Registered Design Professional (RDP) is responsible per *ANSI/TPI 1* for the *design* of the permanent bracing system for the wood truss system. However, the issue of responsibility is only the first part of the actual design and installation of a permanent bracing system required to meet the design assumptions given on the individual truss design drawing. The purpose of this article is to suggest the use of the *2015 BCSI Book*¹ (111 pages) as a tool for providing a practical path for RDPs to complete their bracing design responsibilities. If you haven't carefully reviewed pages 37–52 on permanent bracing design, you will find 16 tightly-packed pages of details and prescriptive design information for permanent truss bracing.

Reasons to Rethink Permanent Bracing Education

Truss bracing has been on my mind since 1972 when I met the late Professor Stan Suddarth at Purdue University. At Purdue, I learned about the importance of both temporary and permanent bracing along with the engineering side of bracing design such as the 2% rule. Starting in 1978, I religiously taught Virginia Tech engineering students about the need for truss bracing and the industry literature that was available at the time.

For the past 30 years, we have been developing and offering continuing education for RDPs, truss manufactures and designers, suppliers, and the building code community. The majority of participants have been RDPs. When covering the subject of permanent truss bracing, we were surprised to learn (early on) that a very small percentage of the group was familiar with the historic 2% rule used to design truss bracing. Additionally, few attendees had knowledge of the truss design standard content (now *ANSI/TPI 1*) and associated bracing documents referenced in our building codes. Naturally, we continued to cover truss bracing theory and demonstrate bracing design calculations in our courses with the goal of impacting permanent-bracing-design practice nationwide.

Fast forwarding to our 2015 VT short course, I decided to “pass around” a copy of the *BCSI Book* as a supplement to my traditional lecture on permanent truss bracing design. About a month later, a Building Official (BO) contacted me and shared the fact that two of his Building Inspectors who attended the course had made notes as to the scope and content of the *BCSI Book*. After learning that the *BCSI Book* was available from the SBCA, he immediately purchased copies for his inspection staff to keep in their vehicles for their framing inspection work.

In our 2016 short course, I adopted the *BCSI Book* as a textbook for the two-day program. At the beginning of the permanent bracing unit, I asked the group of 56 engineers and code folks if they had ever *seen* the book. A couple of *truss folks* raised their hands. We then spent about 30 minutes on bracing calculations and about 60 minutes on pp. 37–52 of the *BCSI Book*. The 2015–16 experiences caused me to rethink the implementation of permanent truss bracing at the field level and begin focusing on a “hybrid prescriptive approach” verses the “engineering analysis” design approach.

How the Component Manufacturer (CM) Can Help

In presentations on truss bracing, some RDPs have commented that they rarely see the Truss Design Drawings for a project, while others review them but do not prepare a permanent bracing plan. Because of the natural or required interaction between a CM and GC in securing trusses for a project, I believe the CM is in the best position to provide education for their customers on the content of the *BCSI Book* and how conveniently the book can be used by all parties involved in wood truss construction. A path to the RDP may be through your customer, typically the GC, for the project. An indirect way to educate the RDP on the subject of permanent truss bracing may be to share your knowledge or bracing resources with your customer.

¹ Building Component Safety Information 2013 Edition Updated March 2105 published by the Truss Plate Institute (TPI) and Structural Building Components Association (SBCA).



Some points to consider covering with the GC are:

1. The **2015 IBC** referenced standard for wood trusses is *ANSI/TPI 1*². This document requires the Contractor to have the “Truss Submittal Package” reviewed by the Building Designer prior to installing the trusses. From *ANSI/TPI 1–2014* (a free download):

2.3.4.3 Truss Submittal Package Review.

The Contractor shall not proceed with the Truss installation until the Truss Submittal Package has been reviewed by the Building Designer.

2. Assuming that the RDP does not provide permanent bracing guidelines for a truss package after they have reviewed and returned the Truss Design Drawings (TDDs), the Builder Designer/RDP for a wood truss project has not met the permanent bracing design responsibility defined by *IBC* referenced standard per *ANSI/TPI 1–2014*, Section 2.3.3.1.3.

3. *ANSI/TPI 1–2014* addresses the case wherein a permanent bracing plan *has not* been provided:

2.3.3.2 Absence of Truss Restraint/Bracing Method or Details.

If a specific Truss member permanent bracing design for the roof or floor Framing Structural System is not provided by the Owner, Building Designer or any Registered Design Professional, the method of Permanent Individual Truss Member Restraint and Diagonal Bracing for the Truss Top Chord, Bottom Chord, and Web members shall be in accordance with *BCSI-B3* or *BCSI-B7*.

4. A presentation of *ANSI/TPI 1*, Section 2.3.3.2, could open the door to presenting the content of the *BCSI Book*. CM customers can be encouraged to understand the importance of truss bracing (topics to help with that task will be listed shortly). The CM can also encourage the GC to provide *BCSI* permanent bracing information and details to the RDP for their potential use in preparing permanent bracing designs for their projects.

5. Truss Bracing Background

- *The purpose of permanent* truss bracing is to satisfy the design assumptions of the truss designer such that the truss system will safely support design loads through the design life of the structure. Early truss industry *temporary* bracing recommendations (DSB-89)³ were based on an assumed dead loading of about 5–10 psf based on the truss span, whereas the truss design total load (gravity) commonly varies from 40–60 psf.
- The dramatic difference in assumed load levels acting during truss installation verses in-service loading is helpful in understanding that the bracing needed for a “safe installation” is only the *first part* of a complete truss system that will satisfy the design assumptions of the truss designer/engineer.
- **2015 BCSI**, pp. 1–36, provides background, data, and *recommendations* for the “safe installation” of trusses spaced up to 2-ft. on-center and up to 80-ft in length. After a quick review of these 36 pages, some GCs may be surprised by the extent of the information and then entertain the book as a “check-it-out item” for their truss installation sub-contractors.

² <http://www.tpinst.org/technical-downloads>

³ DSB-89: Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses published by the Truss Plate Institute (TPI).



6. **BCSI–B3** Discussion Topics—Permanent Bracing for Chords and Webs

a) In the interest of time, only the “high points” can be covered to generate interest in the scope of the book. It may be instructive to review the bottom paragraph of the 2nd column on page 37:

“As defined in many engineering laws and building codes, the Builder Designer is responsible for the overall design and flow of Loads through the building. This includes...”

It can be quickly noted that, for most commercial projects involving an Architect or Structural Engineer (RDP), the roof truss bracing system *design/specifications* is not the responsibility of the **Contractor** per **ANSI/TPI 1–2015**, Section 2.3.4.10.

b) As you page through the book with your customer, I believe some will be fascinated by the extent of information and bracing details available for consideration and possible use by the RDP for a project.

c) Turning to page 41 on Web Member Permanent Bracing, you will find a discussion about the importance of Diagonal Braces (DBs) and Continuous Lateral Restraints (CLRs). Figure B3–11 then depicts CLRs in green, DBs in red. A note in two locations on page 41 states:

“Repeat Diagonal Bracing every 20’ or as specified. Closer spacing may be required by the Building Designer.”

d) A similar note is given in other locations of **BCSI–B3** and it points to the fact that industry and engineering experts can only publish an upper limit on the DB spacing—*not the actual spacing* that might be required due to the design level of axial compression in a web or chord (typically produced by a design snow load combination).

e) Returning to the case where the RDP does not provide a permanent bracing design for a truss package after it has been reviewed and returned to the CM, the GC must understand the RDP has not provided a definitive specification on the required DB spacing for the roof truss installation as required by the building code and **TPI 1** (because **BCSI–B3** defers the issue of DB spacing to the RDP).

f) This discussion leads me to an “a-ha moment”—if the RDP for the project was advised about the availability of the **BCSI Book** and introduced to the permanent bracing content, would it be unreasonably burdensome to ask the RDP to:

- Consider the **BCSI Book** as an industry standard for permanent bracing and possibly adopt it for a specific project,
- Make notes in the book as to what is needed in terms of DB spacing(s),
- Note any other additional permanent bracing requirements for the project,
- Sign, seal, and add their professional work to the Construction Documents?

A Call to Action

This article suggests the idea that CMs should become more proactive in the education of their customers with respect to permanent bracing resources and the same information can be shared with the RDP for their specific project. The issue of permanent bracing design and installation is present for every truss installation based on the assumptions, bracing requirements, and information given on the truss design drawings. The natural link between the CM, GC, and RDP is the only link that I can identify whereby permanent bracing education by one party could be reliably shared with the other parties. Additionally, the CM could meet with local code departments and design professionals and provide a copy of the **BCSI Book**.

By this article, I challenge CMs and truss industry leaders to consider the current permanent bracing practices in the field and suggest other proactive ideas to establish a reliable path for sharing permanent bracing design resources with the GC and ultimately the RDP.

Letters to the Editor should be sent to the Editor (Anna Stamm, e-mail: anna@componentadvertiser.org). The author welcomes comments and can be contacted by e-mail: fwoeste@vt.edu.