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# WTCA/TPI's Position on Permanent Bracing of Piggyback Trusses & A Message from the President and Executive Director on Behalf of the Board of Directors of WTCA

During the past year, our industry has been subjected to and dealt with opinions expressed in a *Journal of Light Construction* article that stated:

- "A piggyback truss roof braced incorrectly (with only lateral braces on the top chord of the truss) is in danger of collapse," and
- "It may take 50 years to get the load level needed to buckle the top chord, but it might also happen next week. If you have piggyback trusses with only lateral braces (on the top chord of the truss) you should put down this magazine (*Journal of Light Construction, March 1998*) and contact the building designer immediately."

**IN RESPONSE, THE QUESTIONS OUR INDUSTRY ASKED WERE:**

- How many buildings have been constructed in the past 47 years with only the lateral braces as called out on the truss design drawings? If these questions caused hysteria among building designers (who are typically the builders of the residential buildings to whom we sell our trusses) who is going to get called to deal with the questions? Who will be required to provide any necessary field repairs and who will pay the cost?
- If **ALL** these buildings are truly subject to collapse as suggested by the article, what specific action should our industry be taking?

We asked TPI to help us address these critical industry questions. TPI members perform the vast majority of the truss designs and provide the bracing policies for the truss design drawings that we provide to our customers when we build piggyback trusses. As such, they are the most knowledgeable and experienced group to provide us with the truss design information and guidance we needed in the development of our industry's position on this topic.

The outcome of this effort is expressed in the *"TPI/WTCA Position Paper*," printed below. We thank all those who participated in addressing and clarifying this important issue. All the hard work is greatly appreciated.

**TPI/WTCA's POSITION ON PERMANENT BRACING OF PIGGYBACK TRUSSES**

The Truss Plate Institute and Wood Truss Council of America, the two United States trade associations most knowledgeable about the design, construction, and bracing of metal plate connected (MPC) wood trusses, do not believe that there is a significant problem, as has been

suggested by others, with MPC wood trusses that are a component of a piggyback trussed roof system. TPI, whose members manufacture truss plates and provide the designs for wood truss components, and WTCA, whose members build trusses, based on their combined 47 years of industry experience are able to state unequivocally that the number of reported instances of piggyback truss performance problems is infinitesimal when compared with the number of piggyback roof trusses in buildings.

What are piggyback trusses? Long span or high pitched MPC wood trusses which are too large to be manufactured, shipped, and erected in one piece. At times, the building designer or truss designer may choose to design trusses in two or more pieces to be assembled on the jobsite. In general terms, a supporting-or -carrying truss that is topped with a smaller, supported (cap) truss carried directly on top of the supporting truss is often referred to as a piggyback truss assembly.

After an article raising concerns about the performance about MPC piggyback wood trusses appeared in the March 1998 *Journal of Light Construction*, TPI conducted a preliminary telephone survey of a limited number of forensic investigators and truss incidents to determine whether it could reach a conclusion whether there was a problem or potential problem with buildings containing piggyback trusses and, if so, the magnitude of the problem. TPI has not been able to conclude, as the author suggests, that piggyback truss assemblies are in imminent danger of collapse due to *"incomplete bracing of the piggyback system*." To the contrary, it would appear that the number of incidences of piggyback trussed roofs experiencing performance problems are de minimus when compared with the hundreds of thousands of piggyback trusses sold, manufactured and erected in the U.S. each year. Further, it is impossible based on available data to attribute any performance problem solely to one specific cause, such as the lack of diagonal bracing, installing trusses out of plumb, installing damaged trusses, inadequate anchorage of continuous lateral bracing, inadequate anchorage of trusses, inadequate fastening of the diaphragm to the pitched portion of the truss, etc.

As described in a forthcoming* publication entitled; "COMMENTARY FOR PERMANENT BRACING OF METAL PLATE CONNECTED WOOD TRUSSES" by John F. Meeks, P.E., with contributions from TPI's Technical Advisory Committee and WTCA's Engineering Review Committee, it is important to remember that while the truss designer and truss manufacturer may provide recommendations for temporary bracing, it is up to the building designer (who is the individual or organization responsible for the overall design of the building, and is typically one of the following - owner, contractor, architect or engineer) to provide complete engineered structural framing systems, including proper permanent bracing to support in-service loads both for piggyback and for other type of trusses. The truss designer is not in a position to know how the building designer intends to analyze and transfer loads due to the effect of vertical or lateral loads of the trusses on the building or the effect of vertical or lateral loadings of the building on the trusses. The truss designer only applies the loads determined by the building designer to the trusses he or she designs.

The top chord of the piggyback truss assembly or supporting truss will require some type of lateral restraint to prevent the top chord from buckling out from under the supported truss, and from moving out of plane. This is most often accomplished by 4x2 dimension lumber continuous lateral bracing. The required spacing of this bracing is generally provided on the truss design

drawing by the truss designer, together with the assumed thickness of the bracing and the minimum connection requirements between the cap truss and the carrying truss.

It is imperative that the building designer, in turn, review this information and ensure that all potential loading conditions have been accounted for. Further, the building designer must integrate the truss member (chords & webs) requirements for continuous lateral bracing, as specified by the truss designer, into the overall building design. The building designer can anchor the continuous lateral bracing into solid end walls or other load resisting elements, and/or stabilize the continuous lateral bracing with bays of diagonal bracing at intervals along the length of the building, or some other equivalent means. If the building designer neglects transferring the lateral top chord forces into the building, the top chord members and the continuous lateral bracing can move in unison in the same direction. This type of shift may gradually occur over time and may progressively worsen, although little is known about the specifics of in-place system buckling and all the construction factors that may lead to in-place performance problems. Our industry experience indicates that such occurrences are rare and are usually caused by construction or installation practices that disregard bracing, bracing anchorage, proper truss connection details, and/or proper nailing schedules. Regardless of all of this, it is important for the building designer to assure that truss reactions (uplifts, horizontal thrusts, and gravity) and truss member lateral forces are transferred into the building structure which must have adequate strength to resist them.

Industry documents which provide recommended design and handling procedures for trusses include ANSI/TPI 1-1995, WTCA 1-1995, and HIB-91. *National Design Standard for Metal Plate Connected Wood Truss Construction* (ANSI/TPI 1-1995, model code approved), and *Standard Responsibilities in Design Process Involving Metal-Plate-Connected Wood Trusses*. WTCA 1-1995 (pending ANSI approval as ANSI/TPI/WTCA 4-2000) both specify that the anchorage of the truss and the stabilization and anchorage of continuous lateral bracing per truss design requirements are the responsibility of the building designer. *Commentary and Recommendations for Handling. Installing & Bracing Metal Plate Connected Wood Trusses* -HIB-91 recommends temporary bracing for use during installation to hold trusses true to line and plumb and to prevent toppling or dominoing collapse of the trusses. Most of the major building codes recognize HIB-91 as an acceptable method of installation for many truss installation applications. The document, however, is not intended to supersede the building designer's specific installation method for a particular project.

TPI and WTCA will continue to review and provide information concerning piggyback and other trusses their members design and build in their ongoing effort to responsibly design and build structurally-sound trusses for integration by the building designer into buildings across America.

Towards this end, WTCA has formed a Product Safety and Loss Control Committee, which is comprised of representatives having a broad exposure to the wood truss industry, such as engineering, production, quality control, and business development. Among the many activities of this committee will be receiving and acting on field reports and truss incidents where appropriate, ensuring compliance with applicable regulations, standards and codes, and educating truss manufacturers, building designers, contractors, owner and consumers on truss product safety. The committee is furthermore committed to work on all issues in an immediate manner. The committee and its representatives may be reached by contacting WTCA at 608/274-

4849, 608/274-3329 (fax). TPI may be reached at 608/833-5900, 608/833-3764 (fax).

WTCA's Board annually prepares its top priorities for the work it is undertaking for the forthcoming year. This year, two of the top ten priorities are Temporary Bracing Revisions and Permanent Bracing Issues Testing and Analysis. Our goal is to learn as much as we can about these issues and provide sound guidance to our customers, so buildings will perform as expected over their lifetime. Unfortunately, we are often called upon to single-handedly fix all the problems that involve our product, and very often are blamed for building performance problems that show up in the trusses, but which have nothing to do with the trusses or the work we have undertaken.

Building design and construction is a very complex process of interrelated professions tackling separate and distinct design and construction activities. If there is to be a solution to the gaps that exist in this process, there needs to be a multidisciplinary approach to arriving at a solution. The truss industry cannot take on this issue and solve it by itself, since we only have control over the design and manufacture of the various components we have been contracted to provide to the job.

If we are forced to seek solutions, which we may be, it will mean changing the way we currently transact business. We will have to become the building designer of record and perform total building engineering and design services. The real challenge is to resist the temptation to bury these valuable services in the cost of the trusses, and slowly but surely erode our ability to get paid for taking on the challenge and risks of performing complete building design. Our industry challenge will be to watch this process over the next five-to-ten years and develop a strategic plan that fits into the significant changes taking place.

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