

by Steve Kennedy, E.I.

Take a few minutes to increase your knowledge of knee braces.

The use of knee braces seems to be increasing. In the past, knee braces have been used primarily in post frame buildings to help supplement the lateral resistance of the building against wind loads. More recently, however, I have seen them used in light commercial, residential and large agricultural buildings (see Figure 1) to help stiffen the connection between the truss and the top of the wall to allow taller and more cost effective structures. Knee braces will induce primary and/or secondary bending moments into the walls and truss chords that must be considered in the design of these structural elements. It is crucial, therefore, that the Truss Designer be made aware if knee braces are to be used and that the appropriate design information be provided to enable the Truss Designer to properly design the trusses.



Figure 1. Knee brace used on an agricultural building.

One objective of this article is to make Truss Designers aware of key questions that should be asked of and answered by the Building Designer when knee braces are specified in a building. Questions everyone should be concerned with include:

1. Are the Truss Designer and/or Truss Design Engineer aware that a knee brace will be connected to the truss?
2. Is there a Registered Design Professional for the project who can provide the required connection and load information to enable the Truss Designer and Truss Design Engineer to properly load the trusses?
3. Are the details of how the brace is being connected to the truss provided so that load distribution can be determined?
4. Is there a member to connect to and enough room to accommodate the connection required?
5. Is the Truss Designer and/or Truss Design Engineer and their design software capable of handling the input of all necessary loads and load cases that may be required?

Construction documents for "non-exempt" buildings (i.e., those that require a RDP) typically indicate if knee braces are to be used, their location, the connection detail to the truss, and the magnitudes and directions of the loads to the truss. If knee braces are shown, the trusses must be designed for them using the loads provided by the RDP.

"Exempt" buildings are a different matter. In the Midwest, for instance, knee braces are used in many post frame buildings for which a RDP is neither required nor involved. For these situations, the expectation may be that the Truss Designer will be responsible for determining the magnitude and direction of the loads that the knee brace will impart on the truss. This rapidly forces the Truss Designer into the position of designing building elements that ought to be specified by the person responsible for the overall building design. In these instances, consideration may

Key Definitions¹

Building Designer: The owner of the building or the individual or organization (including either an architect or engineer or the contractor) that contracts with the owner for the design of the building structural system and/or who produces the structural design documents.

Registered Design Professional (RDP): An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

The Registered Design Professional in responsible charge shall be responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the building.²

Truss Design Drawing: The written, graphic and pictorial depiction of an individual truss.

Truss Designer: The individual or organization responsible for the design of trusses.

Truss Manufacturer: An individual or organization engaged in the manufacturing of trusses.

¹ Definitions are taken from Chapter 2 of ANSI/TPI 1-2002 (revision date - January 2005) unless otherwise noted.

² IBC section 106.3.4.1 for definition of a Registered Design Professional's responsibilities in the context of the code.

need to be given to becoming the overall Building Designer. No matter what the case is, the Truss Manufacturer will need to set up policies for handling the design of trusses within both exempt and non-exempt buildings. The truss manufacturer may want to review Chapter 2 of ANSI/TPI 1 to determine their standard scope of work in the context of overall responsibilities for the application of structural building components within a construction project. Chapter 2 as well as other technical information related to structural building components can be viewed at: www.sbcindustry.com/technical.php.

Let's assume we are working on a non-exempt structure for which there is an RDP. The RDP indicates that the brace load on the truss has a magnitude of 800 lbs but doesn't provide any more detail. Based on my experience, the load provided is typically the maximum axial load in the brace that the RDP has used to design the connection between the brace and the column or truss. Having this information is helpful but more is typically required to properly design the truss.

Without further guidance some may assume that since the knee brace is mainly in place to resist the racking of the structure under wind load, one need only apply the knee brace load in conjunction with the main wind force load cases. However, these may not always be the controlling load cases for the truss. The knee brace loads should be applied in conjunction

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Technical Q&A

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with each of the applicable load cases specified in ASCE 7, Minimum Design Loads for Buildings and Other Structures. The load case with dead, 0.75 wind, and 0.75 snow may control in the northern parts of the country. The magnitude of the brace force will most likely change under these various load combinations and must be provided by the Building Designer.

The conservative approach is to use the maximum brace force with all of the load cases. However, this may then cause the uplift reactions to be incorrect on the Truss Design Drawing. Ultimately, the Building Designer and Truss Designer should work together in determining how to properly load the truss.

The structural building components industry has greatly advanced the design of structural components, and structures as a whole, in the past 20 years. Knee braces can help make the wall/post and truss work together making a more economic and stronger structure. In the end, it is up to the Building Designer to make sure all the components are designed appropriately and that they work together as expected. **SBC**

Steve Kennedy has over twenty years of experience in the metal plate connected wood truss industry. He has worked for several component manufacturers and two plate suppliers. Steve has also volunteered on numerous WTCA committees. 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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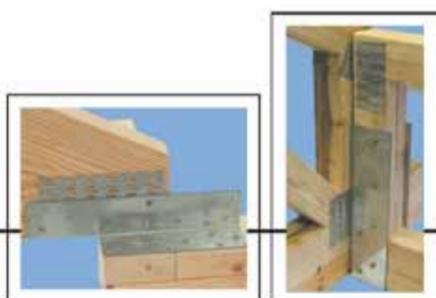
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