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Technical Q & A

Differential Deflection by WTCA Staff

With proper awareness and the right questions, the issue of differential deflection can be handled easily in the building design process.

Many of us have heard the term “differential deflection” but do not necessarily know how trusses are affected by it. Differential deflection describes a condition where adjacent structural elements (i.e., trusses) demonstrate different deflection characteristics relative to one another. In simple terms this means adjacent trusses deflecting different amounts.

Floor systems are more affected by differential deflection than roofs, since the difference in the response of a floor to walking on it is an immediate reaction. Differential deflection may occur in roof systems that include situations like a flat bottom chord truss next to a scissors truss, a common truss next to a girder truss or a step-down hip truss next to a hip girder. Differential deflection is most often an issue that is related to visual appearance or perception/feel rather than an actual structural performance problem.

The evaluation of differential deflection requires an awareness of the areas where it could potentially be a problem. You could either design to avoid these known areas all together or adjust the stiffness of adjacent trusses to become more equal. However, there are limits to the stiffness that can be designed into wood structural members.

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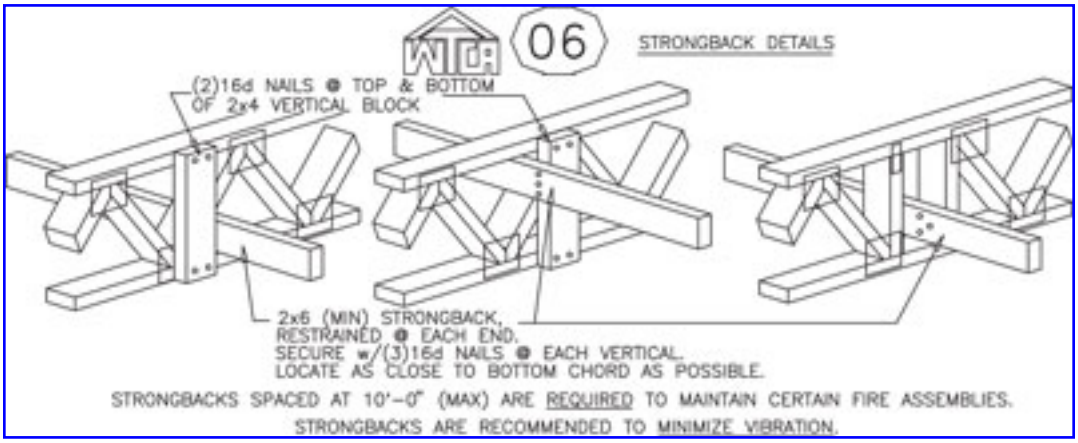

STRONGBACK BRIDGING CAN REDUCE THE EFFECTS OF DIFFERENTIAL DEFLECTION IN FLOOR TRUSSES.

The management of differential deflection is a critical issue for building designers to consider as they lay out the trusses for the roof and floor system. A few important questions to ask include:

- Where are the girder trusses located?
- What is the dead load deflection of the girder truss compared to any adjacent trusses?
- What is the live load deflection contribution?
- Can the deflection limits be adjusted to accommodate the deflection differences?
- Are all the spans of adjacent trusses the same? If not, what are the deflection differences along each truss and how will that affect the ceiling surface?

ANSI/TPI 1-2002 includes information in the commentary to Section 7.5.2.4 regarding the use of strongback bridging to reduce the effects of differential deflection in floor trusses. The following text has been reprinted with permission from the publisher, the Truss Plate Institute (TPI), www.tpinst.org:

> §7.5.2.4 - strongbacking is recognized for serving two purposes: reducing floor vibrations and limiting differential deflection. strongbacking does not, however, contribute to or enhance the strength or structural integrity of the system.
>
> strongbacks are typically used to control potential vibration problems, as the addition of strongbacks has proven to stiffen the trusses and increase the dampening of transient oscillations. vibration in a floor joist due to normal human activity (e.g., walking) includes vibration movements from side to side, and while floor sheathing prevents lateral vibration of the top chord, the bottom can still vibrate back and forth. thus, placing a strongback at the bottom of the floor truss helps control the side-to-side movement at the bottom and improves the overall perceptible performance of the floor. even when there is a ceiling on the bottom of the trusses, in which case the drywall will reduce lateral movement, the addition of strongbacks can still help to further restrict vibration. it should be recognized that, while it will not affect the structural integrity of the system, cutting, removing or failing to provide such strongback bracing can result in degradation of the floor system's ability to dampen vibration.

Another purpose of strongbacking is to limit differential deflection between adjacent floor trusses by developing supplemental two-way action in the floor framing in addition to the floor sheathing. Floor trusses with design live load deflections less than 0.67" are unlikely to have differential deflections large enough to develop two-way action from strongbacking.

Strongbacking concepts can also be used in roof systems to develop the two-way action needed to smooth out the deflection among several trusses.

Over the last year, WTCA staff has worked to standardize how our industry interprets ASCE 7 (Minimum Design Loads for Buildings and Other Structures) and loads trusses. The above information was taken from part of the Guide to Good Practice for Loading Metal Plate Connected Wood Trusses. This comprehensive guide will be available online soon and will provide our industry with universal load interpretations and applications that we have needed for some time.

To pose a question for this column, email us at techincalqa@sbcmag.info. To view other questions visit the WTCA web site.

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