Use of Proprietary Sheathing Fasteners with Trus Joist® Engineered Wood Products

Several different manufacturers produce proprietary sheathing fasteners for use in light-frame wood construction. These fasteners – typically screws or deformed shank nails – usually claim equivalence to larger diameter commodity sheathing nails based upon evaluations conducted in accordance with industry standards such as ICC-ES Acceptance Criteria AC120 or AC116.

Weyerhaeuser has received questions regarding whether proprietary sheathing fasteners have the ability to:

- provide the composite action of a glue-nailed floor system when installed in a nailed-only floor system framed with Trus Joist® engineered wood products, or
- be utilized in the construction of shearwalls, braced walls, or floor/roof diaphragms framed with Trus Joist® engineered wood products.

In general, Weyerhaeuser does not specifically evaluate or endorse proprietary sheathing fasteners for use with Trus Joist® engineered wood products (EWP). Roof, floor, and wall assemblies framed with Trus Joist® EWP are typically evaluated using smooth-shank sheathing nails and other commodity sheathing fasteners. These economical sheathing fastener choices are assumed in our design guidance and have proven sufficient for the vast majority of applications.

Nonetheless, there may be some situations where a building designer elects to use a proprietary sheathing fastener instead of a commodity sheathing fastener. Ultimately, it is the building designer's responsibility to select an appropriate sheathing fastener for their application and to judge its suitability in consultation with the local building code official. The following information provide some insight that may assist with that decision.

Floor Composite Action

When providing design guidance for floor systems, the engineered wood industry typically accounts for the stiffness improvement provided by a "glue-nailed" attachment between the subfloor sheathing and floor framing. For a given floor system, this stiffness increase improves both the spanning capabilities and vibration characteristics relative to the same floor system installed without subfloor adhesive.

Weyerhaeuser has received several inquiries related to performance claims that suggest proprietary sheathing fasteners improve sheathing-to-joist attachment to the point where the benefits of a glue-nailed floor can be achieved without using subfloor adhesive. Based upon a limited review of proprietary sheathing fasteners on the market today, Weyerhaeuser recommends the following:

- The building designer should specify a high-quality subfloor adhesive to be used in conjunction with the proprietary sheathing fastener to achieve the glue-nailed floor system stiffness assumed in Weyerhaeuser's published span tables and design software (i.e. Forte®, Javelin®).
- The proprietary fastener should provide the same depth of penetration into the framing as the commodity fastener that it is replacing.
- In the absence of subfloor adhesive, the building designer should not assume that the proprietary sheathing fastener provides the composite action associated with a glue-nailed floor.
  - **For TJI® joist floor systems in the US,** it is appropriate to reduce the span recommendation for a glue-nailed floor system by 12 in. when a proprietary sheathing fastener is installed without subfloor adhesive. For joists that were specified using published span tables, this can be done by subtracting 12 in. from the published spans. For joists specified using Weyerhaeuser design software, the designer should confirm that the joists can span 12 in. further than the actual span when the attachment option "Glued and Nailed" is selected.
  - **For TJI® joist floor systems in Canada,** a nailed-only floor system with a proprietary sheathing fastener must also consider the impact of the fastener upon the Canadian vibration control criteria. When a proprietary fastener is used without sub-floor adhesive, consult your local Weyerhaeuser technical representative for details.

Shearwall, Braced Wall, and Floor/Roof Diaphragms

Sheathing fasteners play a critical role in the construction of light-frame wood structural panel shearwalls, braced walls, and floor/roof diaphragms. These important assemblies provide most light-frame structures with much of their resistance to lateral load induced by wind and earthquakes. The mechanical attachment between the framing and the wood structural panel sheathing should perform in a way that supplies the beneficial attributes normally associated with light-frame wood structural panel shearwalls, braced walls, and floor/roof diaphragms.

When reviewing a proprietary sheathing fastener as a replacement for a commodity sheathing fastener in a shearwall, braced wall, or diaphragm application framed with Trus Joist® EWP, the building designer may choose to consider:

- Has sheathing fastener equivalence been established in a way that addresses each relevant shearwall, braced wall, and floor/roof diaphragm failure mode (i.e. framing splitting, sheathing edge tear-out, fastener head pull-through, dowel bearing, and fastener withdrawal)? Does that review adequately consider the wood structural panel thickness/grade, minimum fastener edge distances, and framing products used in the project?
- Are the deformation characteristics of the sheathing-to-framing connection created by the proprietary sheathing fastener defined and appropriate for the desired application? In many cases, the proprietary sheathing fastener has a smaller diameter than the commodity fastener being replaced. As such, even if the proprietary sheathing fastener proves equivalence on the basis of ultimate strength, it may not provide equivalent stiffness. This may lead to deformations that potentially differ from those associated with an assembly constructed using the “equivalent” commodity sheathing fastener. The impact of any difference in stiffness between the proprietary sheathing fastener and the equivalent commodity fastener should be considered by the building designer.
- When compared to the commodity fastener that it replaces, does the proprietary sheathing fastener induce more installation damage to the sheathing or framing (i.e. differential framing splitting, fastener head indention into the sheathing, sheathing edge tear-out, etc.)?
- For seismic shearwall and braced wall applications, were full-scale cyclic assembly tests conducted to review the wall performance attributes of the proprietary sheathing fastener? Does that review adequately address the wood structural panel thickness/grade, minimum fastener edge distances, and framing products used for the project? Wood structural panel shearwalls framed with commodity sheathing fasteners product a level of ductility, drift capacity, and overstrength that creates favorable seismic resistance. Has the impact on these attributes by the proprietary sheathing fastener been sufficiently evaluated?
- Do the proposed design loads and fastener spacings for the project fall within the range permitted for the framing and sheathing products? For example, some engineered shearwall and diaphragm framing products like TimberStrand® LSL and TJI® joists have design load and minimum sheathing fastener spacing limitations developed using commodity sheathing fasteners. Shearwall and diaphragm design provisions provided by the proprietary sheathing fastener manufacturer should not be used to justify applications that exceed Weyerhaeuser’s published design guidance for the equivalent commodity sheathing fastener.
- Does the proprietary fastener provide the same depth of penetration into the framing as the commodity fastener that it is replacing?

A proprietary sheathing fastener review for equivalence to a commodity sheathing fastener in accordance with ICC-ES Acceptance Criteria AC120 and AC116 may address some, but not necessarily all, of the issues outlined above.

Instead of proving equivalence to a commodity fastener, some proprietary sheathing fastener products may also promote proprietary design loads and fastener spacings for shearwall, braced wall, and floor/roof diaphragm design (i.e. increased design loads for the same sheathing fastener spacings, increased sheathing fastener spacings for the same design loads, etc.). This sort of approach falls outside the scope of a normal EWP framing review and would require detailed consideration of the interaction between the specific framing, sheathing, and fastener in a manner not typically considered by the fastener industry. At this stage, Weyerhaeuser recommends against the use of increased proprietary design loads and fastener spacings promoted by sheathing fastener manufacturers for use with EWP. The use of a proprietary sheathing fastener should be limited only to situations where it is considered as a direct replacement for a commodity sheathing fastener.