Minimizing Buckling of Wood Structural Panels in High Risk Applications

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Buckling of wood structural panel sheathing such as plywood and oriented strand board (OSB) occasionally results when moisture conditions cause the panels to expand. Although structural properties are not affected, the waviness affects the appearance and may cause concerns about serviceability. Builders can significantly reduce the potential for buckling by understanding the factors that contribute to buckling risk and by providing for the natural increase in panel dimensions that results from moisture exposure.

The tendency of expansion to cause buckling is related to mechanical and physical properties of the panels, natural variability of wood and installation techniques. Mechanical properties such as panel stiffness are important for resisting the stresses, that develop as the panels try to expand. The physical properties of the panels, such as the orientation of veneers or strands, will influence the panels' dimensional response to moisture conditions. Installation practices, such as panel edge spacing and nailing sequence, are important to minimize the build-up of stresses that can cause buckling. The APA literature referenced at the end of this Technical Note provides basic installation recommendations.

Laboratory and field experience indicate that certain types of installation involve increased buckling risks that merit special attention. When one or more of the following factors are present, additional techniques should be considered to help assure best performance:

- Shear wall or diaphragm applications with panels applied parallel to supports and/or edge nail spacing 4 inches o.c. or closer
- Use of 3-ply plywood panels with the face grain parallel to supports (i.e., walls)
- Use of oversized panels larger than 4 x 8 feet
- Panels installed within a few days of their manufacture
- Long-lasting rainy weather where panels may become saturated with water

These applications can be high risk because the conditions may reduce the standard panel edge gap's effectiveness in absorbing the panel expansion. This is because: 1) The increased nailing schedule in some diaphragms and shear walls may essentially prevent any panel expansion, 2) Low panel stiffness in spans between the supports can lead to buckling from relatively low moisture-induced axial loads, 3) An oversize panel dimension allows panel expansion to build up over a longer length, 4) To facilitate proper gluing, all panels are very dry at the time of manufacture – a condition that can lead to higher-than-expected expansion after the panels are in place, 5) During long periods of wet weather and ponding water, panels may pick up more moisture than anticipated by the normal 1/8-inch spacing recommendation.

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For these applications, the following techniques help offset the increased buckling risk:

Panel Edge Spacing: Additional attention to edge spacing may be required to mitigate the higher buckling risk. For newly manufactured panels, a 1/8-inch gap at edges and ends may be insufficient. **For example, for oversized panels and/or factory-dry panels, consider increasing the panel gaps at ends and edges to 1/4 inch.** This may require additional trimming of the panels to fit the framing module or by specifying a special size from the panel manufacturer (such as 1/4-inch undersized). Such special-cut panels are denoted with edge gapping recommendations on the panels.

Panel Nailing: In applications where high-density nailing schedules are followed, such as some diaphragms and shear walls, simple edge gapping may not be effective. To allow for expansion of more densely nailed panels (nail spacing 4 inches o.c. or closer) and for panels subjected to total jobsite water saturation, the following nailing sequence should be considered:

- Temporarily nail panels with a nail spacing of 12 or 24 inches o.c. at ends, edges and intermediate supports (rather than at the closer, specified shear wall or diaphragm schedule) during the framing phase of construction. For this initial nailing, use the nail size specified. With this lighter-than-specified nailing schedule, resultant panel expansion is more readily absorbed by the panel edge gaps.

After the panels become acclimated to jobsite moisture conditions and immediately prior to covering with siding or roofing, complete final nailing. Be aware that when the spaces between the panels close as the panels become acclimated, finish roofing materials installed too early in the moisture-absorption process may buckle upward over the closing panel-joint spaces. Waiting until the panels have absorbed the moisture will minimize the potential for shingle ridging or other types of buckling over panel joints.

Note: Panel spacing is an APA **Recommendation,** but not a model building code requirement, to provide installers with a means of minimizing the potential for panel buckling which can lead to an unsightly appearance and customer complaints. Panel buckling may be an aesthetic or serviceability issue but is not a structural deficiency. There is no reason to expect this recommended space to be maintained when the panels become acclimated after installation. Gaps that were initially present may have closed due to normal moisture-related expansion. If the flatness of sheathing or flooring panels is acceptable, APA generally recommends that any finish flooring, siding or roofing be installed as planned regardless of whether gaps are present.

References:

APA Builder Tip: *Cut Callbacks with Proper Spacing and Nailing,* Form M300
APA Engineered Wood Construction Guide, Form E30
APA Technical Note: *Buckling of Structural Panel Sheathing,* Form D481
APA Technical Note: *Jumbo Panels for Nonresidential Roofs,* Form W220

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