Buckling of plywood roof decks

by **Mark S. Graham**

Q: *What causes buckling in a plywood roof deck?*

A: Buckling of structural panel wood sheathing, such as plywood and oriented strand board, can result when dry panels are subjected to increased moisture, which causes them to expand. Panel buckling is likely to appear between the structural framing that supports the panels or along the supports between the panel fasteners.



Such structural panel buckling typically is caused by excessive construction-related moisture, leakage in the roof covering, excessive moisture within the building or inadequate ventilation of internal building moisture.

Similar to all wood products, structural wood panel sheathing absorbs moisture or releases it to the environment until the panels reach moisture contents that are in equilibrium with their surroundings. This results in gradual swelling or shrinking of the panels as moisture content changes.

For typical structural wood panel sheathing applications, the relative humidity may vary between 40 and 80 percent, with the panels' corresponding equilibrium moisture contents ranging from about 6 to 14 percent. Under these conditions, an unrestricted 4- by 8-foot (1219- by 2438-mm) panel's total dimensional change will be about ⅛ of an inch (3 mm). If conditions cause panels to have higher moisture contents, greater dimensional changes can occur. Dimensional changes in installed panels are partially restrained, however, by fasteners, adjacent panels and framing.

To accommodate dimensional changes, it is important that panel ends and edge joints be spaced properly during sheathing installation and that panels be fastened adequately. Generally, spacing of about ⅛ of an inch (3 mm) is recommended at all panel edges and ends. For ordinary sheathing applications, fastener spacings of 6 inches (152 mm) on center (o.c.) at all supporting edges and 12 inches (305 mm) o.c. at intermediate supports, are adequate to hold panels flat under most circumstances. Other fastener spacings may be necessary for certain engineered constructions (e.g., roof diaphragms, high wind areas).

It also is important that structural wood panel sheathing decks be vented adequately. This prevents the development of excessive heat and humidity that may result in increased moisture content in the sheathing. Information regarding attic ventilation was provided in "Adequate attic ventilation critical for performance," June 1995 issue, page 52.

Aside from buckling, other factors can cause a wavy appearance in structural wood panel sheathing (buckling is just one cause of waviness); these include inadequate attachment of the panels or improper alignment of or movement in the structure that supports the panels.

Q: *Short of replacing the deck, can a buckled plywood deck be repaired?*

A: Because buckling in itself typically does not affect the structural properties of wood panel sheathing, it sometimes is possible to repair a buckled deck without replacing large areas of deck sheathing.

If buckling of wood sheathing is suspected, and repair is being considered, it should be determined that the deck's waviness is not actually caused by improper alignment or warping of the structural framing. (Framing that is misaligned or warping may make sheathing appear wavy.) It also should be determined that the panels are fastened properly to the framing.

If buckling is identified, it is important to discover and correct its cause. For example, if buckling occurs after the building has been roofed and occupied, inadequate ventilation or excessive moisture from within the building should be suspected. The source of the moisture then should be located and appropriately corrected.

Once the cause of the buckling is corrected, deck repair can be implemented. Although no repair technique has been 100 percent effective for correcting buckling, the following techniques have been successful:

- Tightly butted edges or ends of structural panels may be saw-cut to relieve pressure and provide a gap adequate for future expansion.
- Wood blocking may be added under buckled areas or unsupported panel edges. Sheathing then can be flattened and fastened to the new blocking.
- A panel clip can be inserted at the joint between the buckled panels to bring adjacent panels into alignment. This may be done by cutting a small hole at the joint, inserting the clip and sliding it into the desired position within the joint.
- Where buckling occurs between fasteners along a common support, additional fasteners can be added to force the panel down to the supports. If buckling is severe, a short saw-cut in the panel edge can relieve pressure.

Editor's note: *Additional information regarding the use and application of structural wood panel sheathing is available from APA The Engineered Wood Association, 7011 S. 19th St., P.O. Box 11700, Tacoma, Wash. 98411-0700; telephone (206) 565-6600.* PR

Each month in this column, one of NRCA's technical services staff members will answer readers' technical questions. If you have a specific question that you would like answered in this column, send it to Professional Roofing *magazine, 10255 W. Higgins Road, Suite 600, Rosemont, Ill. 60018-5607; or fax (847) 299-1183.*