

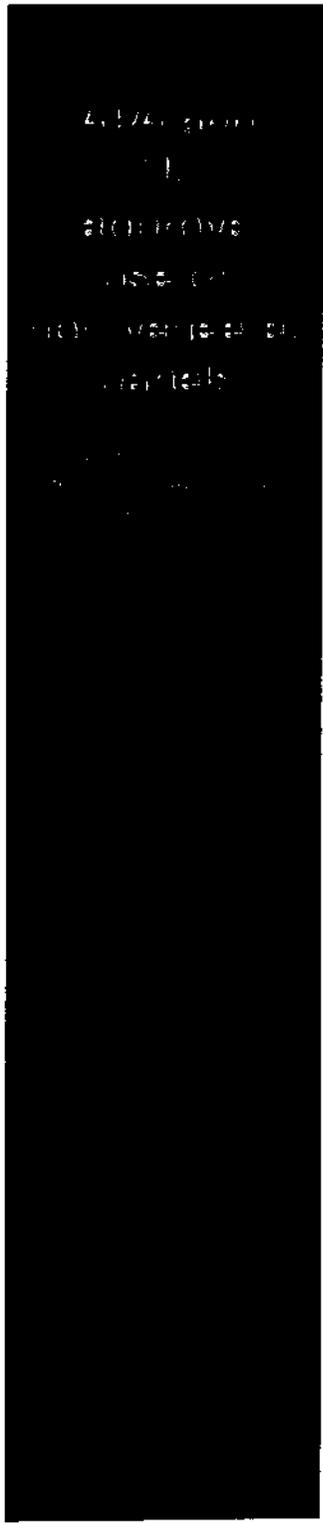
Industry groups examine plywood decking changes

With increasing frequency, decking manufacturers and builders are deviating from the standard practice of using plywood with a minimum 1/2-inch thickness as roof decking. In May 1983, NRCA learned from representatives of the American Plywood Association (APA) that manufacturers were marketing plywood decking with a nominal thickness of 15/32 inch. At the time some contractors expressed concern that the 15/32-inch decking was not fire-rated by Underwriters Laboratories (UL) and that the thinner panels would deflect excessively.

After numerous meetings with concerned industry organizations and a battery of performance tests by both APA and UL, it was determined that many 15/32-inch boards performed as well as the 1/2-inch panels. APA said that the U.S. Department of Commerce Product Standard PS-1-83 now includes performance standards that allow 15/32-inch panels to meet the same 32/16 span rating under which many of the 1/2-inch panels were trademarked. The span rating means that the thinner panel could be used in spans of up to 32 inches on roof decks and 16 inches for flooring.

Non-veneers come on board

Recently, NRCA has received reports of another roof decking change that is causing concern among roofing contractors. According to these accounts, builders are beginning to use oriented strand board and waferboard in place of all-veneered plywood in steep and low-sloped roof assemblies.



Oriented strand board is made of compressed strand-like wood particles arranged in three to five perpendicular layers and bonded with phenolic resin. Waferboard is made of compressed wafer-like wood particles or flakes bonded with phenolic resin. Waferboard flakes may range in size and thickness and may be either randomly or directionally oriented. In some cases, the wafers may also be arranged in layers according to size and thickness. Both waferboard and strand board differ from plywood, which consists of an odd number of cross-laminated wood veneers arranged in one or more plies.

ARMA and APA explain ridging

Contractors have reported that when these non-veneered products have been used in steep roofing instead of plywood, both the glass fiber and organic shingles installed over them have buckled or formed ridges because of decking movement. Releases circulated recently by the Asphalt Roofing Manufacturers Association (ARMA) and APA have attempted to explain this problem. The explanations don't always agree, however.

In the ARMA bulletin, "Plain Facts About Buckled Shingles," the problem is blamed on the movement of the roof deck. The bulletin says this movement is caused by changes in the decking's moisture content; moisture gains cause the panels to expand, while moisture losses cause them to shrink. "A change in the dimension of the deck will cause the fasteners holding the shingles to the deck to move with the deck and force the shingles closer together or farther apart," the bulletin says.

ARMA's suggestions for preventing shingle buckling include:

- Use only non-veneered decking or approved exterior-grade plywood properly conditioned to be at moisture equilibrium with the jobsite's environment.
- Prevent non-veneered or plywood decking from getting wet before and after application.

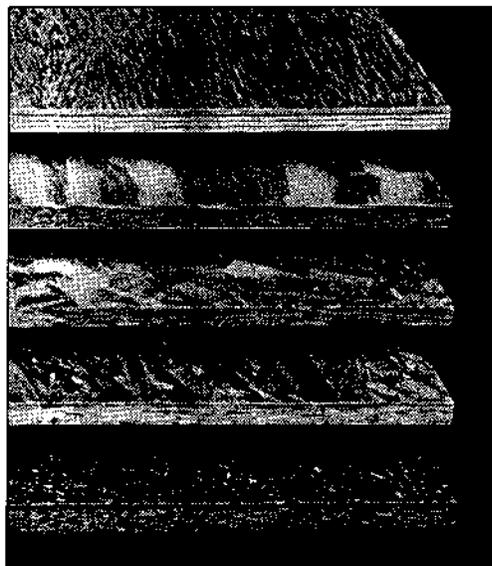
While panel thickness is important, the panel's span capability is key.

The different types of APA performance-rated panels are (from top to bottom): plywood, COMPLY (composite), waferboard, oriented strand board and structural particle board.

- Cover wood deck with asphalt-saturated felt shingle underlayment or with No. 15 non-perforated asphalt-saturated felt before applying shingles.
- Ensure adequate attic ventilation based on the Federal Housing Administration's minimum requirements.
- Apply shingles in accordance the manufacturers' recommendations.

APA says in its release, "Ridging of Roof Coverings," that buckling may be caused by movement of either the deck or the roof covering. The release also suggests that buckling problems may be caused by recent changes in the manufacture of roofing products. "Ridging is not a new phenomenon, particularly with built-up roofing, but is now reported more frequently with shingles as their weight and composition have changed," the publication says.

Like the ARMA bulletin APA's release also recommends using decking panels that have been conditioned to a higher ambient moisture content before installing the roof covering. "Panels will become conditioned in a matter of a few days where moist air (80 percent to 90 percent relative humidity) is free to circulate over the entire panel surface," according to the APA release.



Both the ARMA and the APA publications suggest roof designs that incorporate good ventilation to avoid the buildup of moisture in the deck. The APA release adds, "A vapor retarder on the warm side of the ceiling will reduce the ventilation requirements."

APA states position on non-veneers

NRCA recently requested information from the plywood association that would outline APA's position on the use of wood-based, structural-use (non-veneer) panels for roof decks. Daniel H. Brown, manager of APA's Engineering Technology Department responded to this request and sent NRCA the following statement.

Wood-based, structural-use panels, including oriented strand board, waferboard, COMPLY and structural particleboard that are performance rated by APA are suitable for use under all types of roof coverings. These products are tested and rated under conditions specifically designed to evaluate their performance as roof decks.

APA's ratings begin with PS 1

To better understand APA's performance-rating concept it's necessary to go back a few years. The first edition of PS 1, the manufacturing standard for plywood, was issued in 1966. Under this new standard panels were marked with an index that indicated the maximum roof and floor spans possible for that particular panel. New products such as non-veneered panels are also marked with span ratings.

When considering a panel's performance it is important to remember that while panel thickness is important in some applications, the panel's span capability is the key. Because of differences in the species of wood used, and the panels' orientation and density, the same span rating can be applied to several different thicknesses. Table 1 shows, for example, that a panel having a 24/16 rating may be either $7/16$ inch or $1/2$ inch thick. Both thicknesses would be expected to perform comparably because each has met the performance requirements for a 24-inch roof span and a 16-inch floor span. Note also that these panels can be used over their full 24-inch rated roof span without edge support. Where edge support is required it can be provided with panel edge clips, tongue-and-groove edges or lumber blocking.

APA RATED SHEATHING		ROOF									
PANEL SPAN RATING	PANEL THICKNESS	MAXIMUM SPAN(in.)		ALLOWABLE LIVE LOADS(psf)							
		With Edge Support ²	Without Edge Support	Spacing of Supports Center-to-Center (inches)							
Roof/Floor Span	(Inch)			12	16	20	24	32	40	48	60
12/0	5/16	12	12	30							
16/0	5/16, 3/8	16	16	55	30						
20/0	5/16, 3/8	20	20	70	50	30					
24/0	3/8, 7/16, 1/2	24	20 ³	90	65	55	30				
24/16	7/16, 1/2	24	24	135	100	75	40				
32/16	15/32, 1/2, 5/8	32	28	135	100	75	55	30			
40/20	7/16, 15/32, 5/8, 3/4, 7/8	40	32	165	120	100	75	55	30		
48/24	23/32, 3/4, 7/8	48	36	210	155	130	100	65	50	35	

NOTE 1. The allowable spans were determined using a dead load of 10 psf. If the dead load exceeds 10 psf then the live load should be reduced accordingly.

NOTE 2. Tongue-and-groove edges, panel edge clips (one between support, except two between supports 48 inches on center), lumber blocking, or other.

NOTE 3. Twenty-four inches for 1/2-inch panels.

Rated panels must meet standards

APA's performance standards involve extensive testing to evaluate a panel's resistance to concentrated loads, uniform loads and impact loads. Load tests are conducted on both dry and wet panels.

It is also important for roof decking to be able to resist fastener withdrawal. APA evaluates the fastener pull-out resistance of panels that have been kept dry as well as panels that have been wetted and redried. Lateral nail-bearing tests are also conducted.

For panels to qualify for a span rating they must exceed certain minimum requirements that are comparable to the minimum requirements of regular plywood with the same span rating or based on actual loading requirements.

APA's standards also set a limit on the amount of linear expansion a panel may experience. This limit governs how much a panel's length and width may change as it picks up moisture. A degree of bond durability is also specified in the standards. Under these standards, non-veneered panels are expected to perform comparably to regular plywood.

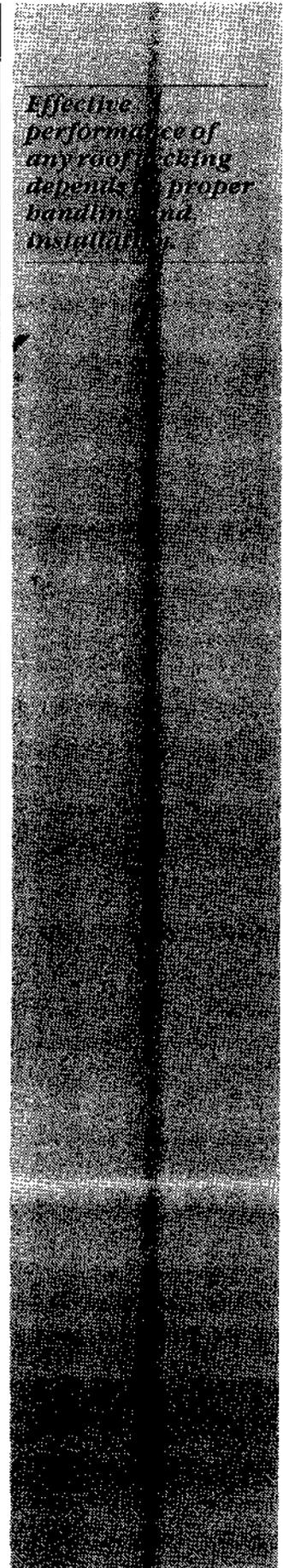
These standards are recognized by the nation's model code groups through a report issued by the National Evaluation Service. Copies of the report, NER-108, are available from APA.

Fire tests also conducted

To evaluate different deck panels' influence on the fire-resistance of various roof coverings, Underwriters Laboratories, Inc. conducted a number of tests on different combinations of decking and covering. Results indicated that 7/16-inch, APA-rated sheathing with 24/0 and 24/16 span ratings can be used under Class A roof coverings without affecting the classification. Thicker panels with greater span ratings can also be used. It should be emphasized that this conclusion applies to all Class A roof coverings regardless of whether they are for low-slope or steep roofing.

Non-veneered panels are expected to perform comparably to regular plywood.

Table 1. Allowable uniform roof live loads for APA-rated sheathing installed with long dimension perpendicular to supports and continuous over two or more spans.



Effective performance of any roof decking depends on proper handling and installation.

Span-rated non-veneered decks ok

APA's and UL's tests indicate that if non-veneered panels such as oriented strand board and waferboard are span-rated to show their performance capability, they can be safely used in accordance with the rating under all types of roof coverings. As with all types of decks, the roofing manufacturer should be consulted for specific requirements.

Effective performance of any roof decking depends on proper handling and installation, however. Good practice dictates that panels, which can be very dry when they leave the mill, should be allowed to condition, or increase in moisture content, before the roofing is installed. Because the amount of linear expansion that may take place is a function of the initial and final moisture content of the decking, conditioning will prevent an undue amount of dimensional change once the decking is on the roof. If panels increase in length or width after installation, the gap between adjacent panels will close, possibly causing a ridge or buckle to develop in the roof covering. This can happen with any type of roof panel, including oriented strand board, waferboard, or regular plywood.

Once conditioned, APA structural-use panels install the same way as regular plywood panels. They should be spaced $\frac{1}{8}$ inch apart at end and side joints. This allows the panels to expand in length and width if they pick up moisture after conditioning. Structural-use panels are fastened to the framing with the same size nails and spacing that are used with plywood panels of the same thickness.

UL also gives blessing to non-veneers

NRCA had received reports that oriented strand board and waferboard were being used in low-sloped roof systems that had not been tested or approved by UL for use in any fire-rated roof assembly. In response to these reports, NRCA contacted UL representatives in April. UL said it had completed its APA-sponsored tests on these

products and found them to be suitable substitutes for $\frac{1}{2}$ -inch plywood. UL's test report will not be available for a couple of months, however, so with APA's permission, NRCA requested a letter from UL stating its approval of these products.

UL's letter said in part, "We have completed the UL 790 fire tests on various roof coverings applied to $\frac{7}{16}$ -inch thick non-veneered roof decks identified as oriented strand board, waferboard, wood particle-board and COMPLY.

"All test results complied with the requirements specified in our Standard UL 790. Accordingly, these results indicated that the above-mentioned four non-veneered materials are suitable substitutes for $\frac{1}{2}$ -inch-thick plywood as roof deck material for roofing systems that are UL-classified or UL-listed for resistance to external fire.

"When the test report has been prepared and released to the American Plywood Association—the sponsor of this investigation—we shall revise our Guide Cards for both prepared and built-up roof covering materials to indicate that these four APA-approved $\frac{7}{16}$ -inch thick roof deck materials are permissible substitutes for APA-approved $\frac{1}{2}$ -inch-thick plywood."

If contractors still have questions or problems involving the use of these non-veneered roof decking materials, they should contact NRCA's Technical Services Department for more information.