PLYWOOD NICHE NARROWS BUT PRODUCERS STILL HAVE AMPLE OPPORTUNITIES

The surge of oriented strandboard is causing plywood producers to re-think manufacturing and marketing strategies.

BY HENRY SPELTER

Plywood manufacturing has been a major part of the Pacific Northwest forest products industry, but lately the sector has faced challenges as its markets and resource base change. Today, 35 fewer plants operate in the U.S. West and Canada than in 1989. These mills embody approximately 4.4 million m^3 of lost capacity, or one-third of the total. What options are available to the remaining producers in an increasingly competitive structural panels market ?

The plywood marketing problem is clearly evident from a visit to any building materials store where stacks of plywood and OSB are displayed. An inspection of their grade stamps reveals nearly identical ratings for similar thicknesses in terms of allowable spans and suitability for exterior use. In essence, these say that the two panels are functionally equivalent. Then a look at their costs shows a $3-5 per panel difference in favor of OSB—effectively the same performance at a lower price. Without more information. the choice is obvious and over the years thousands of builders have made that choice, substituting OSB for plywood in its principal commodity markets. As a result, OSB is on a growth track to exceed all plywood around the turn of the century.

When OSB first appeared, a number of us believed that modern, efficiency boosting technologies could reduce plywood manufacturing costs to OSB levels (e.g. Spelter and Sleet, 1989). Although efficiencies in plywood plants did rise, the equally rapid evolution of OSB technology has confounded those calculations: OSB press widths have tripled, lengths have nearly doubled and adhesive cure times have been reduced by more than a third.

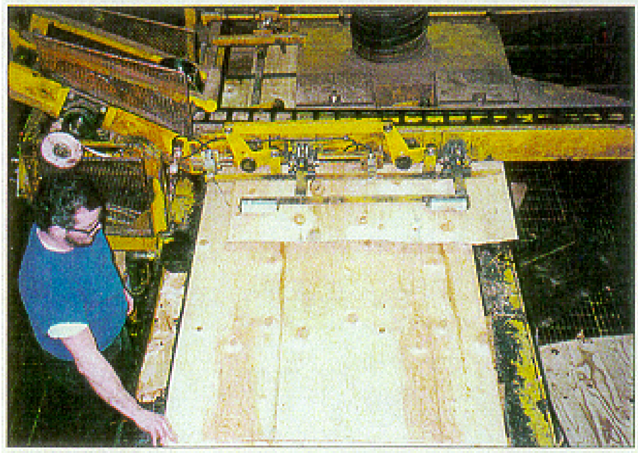
These changes have greatly increased throughput and productivity in the newest OSB plants. Meanwhile, the practicalities of peeling limit plywood lengths to 24-3 m. To increase capacity, more lines are needed, but that limits the potential economies of scale since additional labor is also required to run each line.

On the West Coast, a number of factors have aggravated plywood's situation. Older technology less adapted to small log peeling. reduced timber availability due to forestland withdrawals and the liquidation of timber on some properties (Powell et al., 1993), federal timber harvest reductions, and difficult logging terrain which makes West Coast harvesting costs 50% higher than elsewhere are some of the reasons why it costs nearly 75% more to make Western plywood than OSB (Spelter et al., 1997).

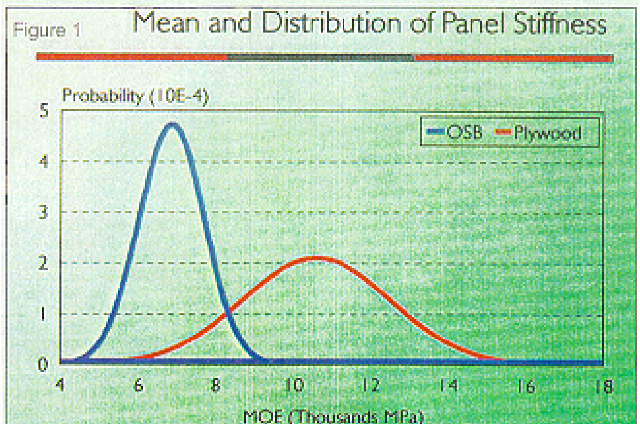
In short, while mills should not overlook cost-reducing improvements, pulling even with OSB seems to be out of reach.

What can a commodity producer do when cost parity with the competition seems unattainable? One course is to position the product as a higher value item by identifying and stressing those aspects of its performance that provide users benefits commensurate with the premium price. However, this is difficult under the main panel marketing tool, the structural panel performance standards. Within these standards. panels are qualified in three basic areas: strength and stiffness, dimensional stability and bond durability and products have to meet basic targets to qualify. But the tests are in many cases of a pass/fail nature and plywood. which often displays superior attributes in many areas, gains little credit.

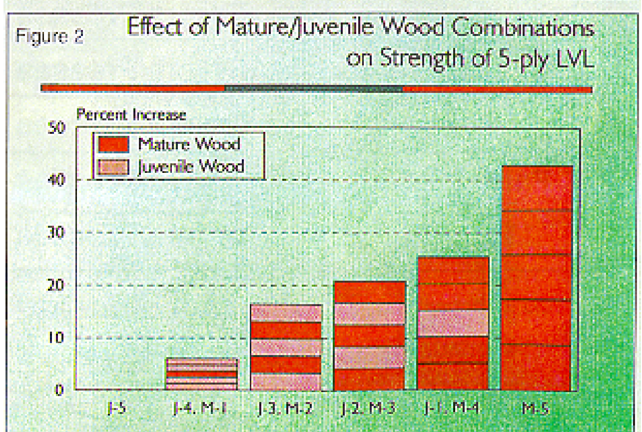
Long-term deflection under load is one of several such examples. In general, the smaller the particles in a panel. the greater is its tendency to deflect under load (Lehmann et al., 1975). In dry conditions the creep behavior of both OSB and plywood is good. but in severely humid or cyclic environments, OSB creeps about three times as much as plywood (Laufenberg et al., 1997).



Northwest has lost one-third of plywood capacity.



Source: Laufenberg et. al. (1997)



Source: Jo et. al. (1981)

Creep in humid climates can become a concern when long-term loading is near design levels. While this is rare in residential construction, in more rigorous uses, such as industrial shelving, plywood's properties could offer a performance advantage.

Another is linear expansion. This property in OSB varies according to the type and amount of adhesive and wax used, but a compilation of results from several tests of both commercial and trial boards shows an average linear expansion of 0.16 and 0.23% in the grain and transverse directions, respectively, compared to 0.06 and 0.08% for plywood (e.g. Ellingson, 1979; Davis, 1988; Biblis, 1989). To the extent that builders maintain the recommended gap between adjacent panels, this is not a problem; but when panels are tightly butted and subsequently get wet, the resulting pressure on the ends can cause them to buckle. Because of its lower expansivity, the use of plywood reduces the odds of a complaint or callback due to this phenomenon.

A third area of difference is thickness swell. All wood swells when it gets wet, but the condition is exacerbated in OSB. Tests show up to three times as much thickness swell in sheathing grade OSB as in plywood (e.g. Chow et al., 1988). It is notable that market penetration of the floor sheathing market by OSB is the least among sheathing applications and builders who use plywood despite its higher cost cite its better swelling performance as one reason.

But the most important consideration in building is structural adequacy. In this regard, too. plywood properties are significantly higher (Figure 1). But plywood variability is also much wider and. because it is the lower 5% of the distribution that controls, a significant downgrade in assigned design values results.

PRODUCT OPTIONS

This leads to the first suggested product option to buttress plywood's position-namely to change, in both the marketing and manufacturing senses, from making "plywood" to something one might call "value-engineered plywood."

Products are "engineered" to the extent that their properties can be manufactured to predictably narrow tolerances. The wide range in plywood strength and stiffness demonstrates an area in need of improvement.

Throughout most of its history, veneer has been graded according to visible surface characteristics such as knots and splits. But mechanical properties also correlate strongly with variations in density and slope of grain which are difficult to discern by sight. This results in large variability in property values of veneers within a given visual grade (Kunesh, 1978).

To improve on this, more accurate and discriminating veneer grading is needed. Several nondestructive evaluation methods have been proposed, but the one most widely adopted is based on measuring the travel time of sound between two fixed points on a veneer. The density and slope of the piece's grain which, as noted, correlate with strength and stiffness influence the propagation time.

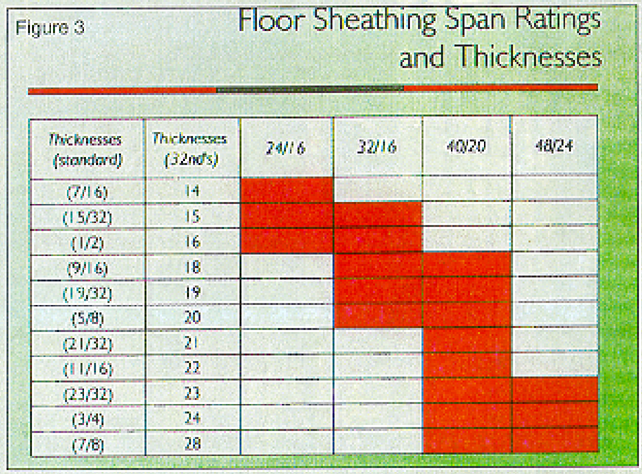
So, for example, the more variation in grain angle, the longer it takes for the sound to travel, which, in turn, affords a more accurate assessment of a piece's true mechanical potential.

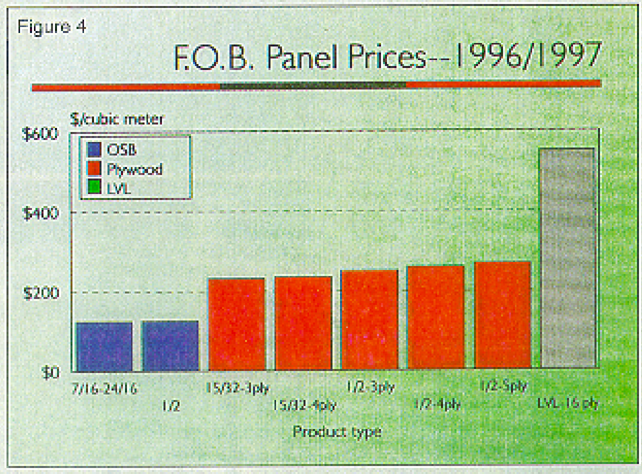
To what extent does better grading of veneer for strength improve panel properties? This depends on the type of wood available. A plant aiming to compete in commodity sheathing by peeling low cost but small, fast grown, plantation timber or low-density hardwoods would generate little high-strength veneer because such timber consists of weak wood to begin with. But more traditional peeler grade timber yields higher proportions of strong veneers even among the lower visual grades, in some instances up to 90% although 30-50% is more typical.

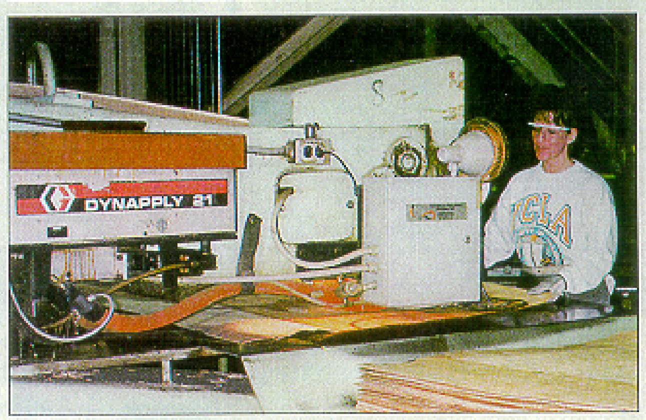
Given a good representation of high- and low-strength veneers, an example of the potential impact of unsorted layups on the physical properties of 5-ply LVL is shown in a study measuring the effect of various combinations of mature and juvenile wood (Jo et al., 1981) (Figure 2). Assemblies with an ascending number of mature wood plies produced progressively stronger panels of up to 43% relative to an all juvenile layup.

It's easy to see how an uncontrolled mix of weak and strong veneers inflates panel variability. The reduction in the coefficient of product variation when veneer was sorted nondestructively was found to be on the order of 6% (from 16-18% to 10-12% (Sharpe, 1985)). Reducing plywood variability to such levels would be significant because it would place it on the same plane as OSB.

What are the tangible benefits to a plywood manufacturer of improved veneer grading? A look at the rated sheathing tables reveals that a given rat-







Softwood veneers have the advantage of versatility.

ing can be applied over a wide range of thicknesses (Figure 3). Ideally, the product should be as thin as possible for a given rating or rated as highly as possible for a given thickness. With more precise grading. the potential exists to reduce panel thicknesses and still obtain the same span rating: 1/16 in. for 24/16 rated panels; 5/32 in. for 32/16 and as much as 10/32 in. for 40/20 grades.

Most importantly, the producer is in a better position to make panels tailored for a given use or. more to the point, avoid putting high strength veneers into products where they are neither necessary nor rewarded.

The second conversion opportunity relates to the first and is immediately apparent from a glance at recent panel and laminated veneer lumber (LVL) prices (Figure 4). The same veneer that earns a given amount of dollars when placed in plywood, earns twice as much when sorted and placed in LVL. Even with three-to-six additional gluelines and longer press times, the economic advantages of this are clear. It's not accidental that LVL growth has accelerated in the past seven years with capacity doubling to nearly 1.5 million m^3.

About half of LVL is used for I-joists, which is also a rapidly expanding product. At present prices they are competitive with solid lumber, yet have less than one-fifth of their market, thus leaving room for growth.

How can plywood producers participate in the LVL business? Perhaps the least costly way is to high-grade veneers and sell the best to an LVL manufacturer. Most of the veneer industry has followed this course.

The second is to manufacture the product directly of which there are two options. One is to install a fully dedicated LVL line with its own layup station and press. Some recent examples include Union Camp's plant being built in Thorsby, Ala. and Sunpine's line in Alberta, Can. Both sites use a Dieffenbacher continuous press with approximately 80,000 m^3 of annual capacity. Raute also offers LVL lines with equal or greater capacity.

Alternatively, a less expensive approach would be to make LVL with existing production equipment modified slighlly to produce billets in the longer and thicker LVL dimensions. The basic approach-in which veneer is laid up in 19 mm thick panels and pressed in conventional plywood presses, then scarf jointed and doubled into 38 mm thick billets where the two layers are laminated in an RF press or with a cold setting adhesive-has been tested and found technically feasible almost two decades ago (Youngquist et al., 1984). This method has apparently been used by only one company, but it offers a potentially lower cost means of entry to those wanting to test the market.

CONCLUSIONS

Plywood faces a challenge in its traditional markets inasmuch as it faces competition from a lower cost product. To bolster its position, two courses of action seem logical.

One is to differentiate it from competing products by emphasizing attributes that offer benefits to the user. This is a challenge because it pits a known, certain and immediate benefit (the cost differential) against an unknown, probabilistic, future cost (a possible callback or litigation over product failure). To make a convincing case, a sophisticated market survey would be required to quantify actual user experiences (or product claims) and to characterize the risks of a cost incurring event with the respective products.

A second option, used in tandem with the first, is to do a better job of sorting veneer in order to make the best use of it in applications where its inherent qualities reap the greatest credit, such as LVL. This works to the extent that an operation actually possesses a wood source yielding a significant volume of requisite strength veneers. In such cases, sheathing products would take on more the role of byproduct, similar to cores and chips.

Veneer-based products will continue to play a role in the building materials market because they are best suited for the most rigorous applications. The challenge is to better sort through the spectrum of property values that exist in wood and use the various grades in products that more tightly target what a given market requires. With astute marketing and precise manufacturing, veneered panels can continue to participate in both the traditional sheathing markets as well as in the newer engineered wood applications. PW

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