ENGINEERED WOOD PRODUCTS: A RESPONSE TO THE CHANGING TIMBER RESOURCE

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The timber resource in the United States has changed in many ways during the last 50 years and continues to change. Much of the old-growth timber on public and private lands has been harvested, and harvesting on public lands has been greatly curtailed. with harvest levels in the West being well below one-third that of a decade ago. Available timber is now smaller in diameter and lower in quality than ever before. Many species that were deemed undesirable in the past are now being called upon to augment the reduced supplies of more desirable species. Despite these changes in the timber resource, demand for timber from the Nation's forests has increased. In 1996, an estimated 468×10^6 m^3 of roundwood were required to produce the wood and fiber products consumed in the United States (1). This is the highest consumption level reached so far in the 1990s and is just under the all time high of 488×10^6 m^3 set in 1987 (1). Because of the high levels of demand and reduced timber supplies, the cost of timber has increased rapidly (2). One response to decreasing supplies of high quality timber, increasing demands for wood and fiber products, and rising timber costs has been a shift from solid sawn to EWP. EWP are designed to replace solid sawn products or other EWP, are more efficient for using the available timber resource, and are cost effective. In this article. the size, species and changes in timber currently being used to produce softwood plywood. oriented strandboard (OSB), laminated veneer lumber (LVL), glued-laminated lumber (glulam), and wood I-joists are examined.

ENGINEERED WOOD PRODUCTS

Softwood Plywood is the "original" engineered wood product. The industry began on the West Coast in the early 1900s using the large diameter, old-growth timber. Mills west of the Cascade Mountains (coastal) used mostly hemlock and Douglas-fir: those east of the Cascades (inland) used primarily Douglas-fir and western larch. Reduced harvests from public lands in the 1980s severely impacted the industry in both the number of operating mills and capacity. The 32 coastal mills still operating in 1996 had a combined annual capacity of $4{,}234 \times 10^3$ m^3, down by more than half from 1965 (2). The number of operating mills was only about. one-fourth of that in 1965. The inland industry has maintained most of its capacity. In 1996, capacity was estimated at $2{,}185 \times 10^3$ m^3, down just 200×10^3 m^3 from 1965. However, the number of mills operating in 1996, 14, was only one-third that of mills operating in 1965. Most of the decline in the West Coast softwood plywood industry is directly attributable to reductions in timber availability, log size, and quality. Coastal mills are now using logs averaging 0.3 m (12 in.) in diameter, down from 0.46 m (18 in.) a few years ago (Table 1). Inland mills are in relatively better shape with logs averaging 0.4 to 0.5 m (16-20 in.). Average log size for both inland and coastal mills continues to decline.

In the 1960s. technology was developed to use the southern pine resource to make plywood. Capacity of the 57 mills using this technology in 1996 was $12{,}256 \times 10^3$ m^3 Overall capacity has increased steadily since the industry began operations. Unlike the West Coast, the industry in the South has always relied on small diameter logs from private lands for its resource. Log diameter in the southern industry currently averages about 0.3 m (12 in.), but as in the West, the average diameter has gotten smaller.

Oriented Strandboard (OSB) is a structural panel that competes directly with softwood plywood in many construction applications. particularly exterior wall and roof sheathing and nearly half of all floor decking. OSB was first produced in Canada in 1964. Since then, capacity has increased steadily, but it wasn't until the mid 1980s that capacity expanded rapidly. North American production capacity in 1996 was estimated at $15{,}276 \times 10^3$ m^3, nearly twice the 1990 capacity (2). The number of operating mills producing OSB increased by more than 50 percent between 1990 and 1996. This increase in the rate of industry expansion is a direct result of harvest restrictions on West Coast timber. OSB is made from small diameter softwoods and previously underutilized hardwoods and is therefore not dependent on the large diameter logs needed by the softwood plywood industry. West Coast inland mills producing OSB primarily use lodgepole pine logs averaging about 0.25 to 0.3 m (10 to 12 in.) in diameter. compared with the 0.4- to 0.5-m (16 to 20-in.) logs needed for softwood plywood (Table 1). Mills in the South producing OSB use pine plantation thinnings and Southern Pine and soft hardwood logs that average about 0.2 m (8 in.) in diameter. Log diameter in the South has gotten smaller. Northern mills rely almost exclusively on aspen logs 0.15 to 0.3 m (6 to 12 in.) in diameter. The diameter of these logs has remained fairly constant.

Laminated Veneer Lumber (LVL) is a structural composite lumber product designed to compete with solid sawn lumber, particularly large dimension lumber. Primary uses include headers, beams, and rafters in construction and flanges for wood I-joists (discussed later). LVL consists of thin sheets of wood veneer bonded with adhesive and oriented with the grain parallel in the long direction. Variations to

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LVL include parallel strand lumber (PSL), made from wood veneer strands rather than larger veneer sheets, and oriented strand lumber (OSL), made from wood flakes rather than veneer. The annual production capacity of the 16 North American LVL plants in 1996 was $1,327 \times 10^3$ m^3, up nearly 75 percent from 1990 (2). The number of mills increased by nearly 50 percent between 1990 and 1996. Sizes and species of timber used to produce LVL are the same as that for softwood plywood; therefore changes in the resource affect both the softwood plywood industry and the LVL industry equally (Table 1).

Glued-Laminated Lumber, Glulam, is an engineered stress-rated product made by gluing together 50-mm (2-in.) or thinner pieces of lumber. The final product can be a straight beam or a complex, curved structural member. Typical uses include headers, girders. beams. and arches. North American glulam production in 1996 was 550×10^3 m^3, about 5 percent below 1990 production (3). (Table 1).

Prefabricated Wood I-Joists are a structural, load carrying substitute for floor and roof framing applications. The wood I-joist is composed of an OSB or plywood web and two LVL, OSL, or lumber flanges. Wood I-joists are the newest and fastest growing EWP. Much of the growth of this product is attributable to declining availability of the high quality, large dimension lumber for which it substitutes. The 28 North American wood l-joist plants operating in 1996 had an annual capacity of 252×10^6 linear m. more than three times the 1990 capacity (2). Number of plants increased by just 50 percent between 1990 and 1996. Since wood I-joists are typically made from two EWP (OSB or softwood plywood and LVL or OSL), timber requirements for wood I-joists are determined by the requirements for their component parts (Table 1).

Summary

The changing timber resource has changed the way we use wood in the United States. One change has been the introduction of engineered wood products, which can more efficiently use the available timber resource. For example. this change to EWP allows the use of small diameter, low quality logs. the use of previously underutilized species, and an overall wood fiber savings. EWP are designed to substitute directly for solid sawn wood products in many applications or to replace higher priced EWP. Additional wood fiber savings result because EWP typically have smaller dimensions than their solid sawn counterparts and permit wider spacing in construction framing applications. The timber resource will undoubtedly continue to change, along with existing EWP, and new EWP will surely be developed.

REFERENCES

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Table 1. Timber species and average diameter[a] used for engineered wood products

Region and product[a]	Commonly used species	Average diameter[a] m (in.)	Comments
Coastal west			
Softwood plywood	Hem-Fir	0.3 (12)	Logs smaller, down from 18" in 1990
LVL	Hem-Fir	0.3 (12)	Same as above
Glulam	75% Douglas-fir, 25% Hem-Fir	0.45-0.6 (18-24)	Logs have gotten smaller
Inland west			
Softwood plywood	Douglas-fir, western larch	0.4-0.5 (16-20)	Logs have gotten smaller
OSB	Lodgepole pine	0.25-0.3 (10-12)	
LVL	Same as softwood plywood		Same as softwood plywood
Glulam	Inland Douglas-fir	0.45-0.6 (18-24)	Logs have gotten smaller
South			
Softwood plywood	Southern pine	0.3 (12)	Logs have gotten smaller
OSB	Southern pine, soft hardwoods	0.2 (8)	Thinnings unchanged
LVL	Same as softwood plywood	0.3 (12)	Same as softwood plywood
Glulam	Southern pine	0.4 (16)	Smaller, more plantation grown
North			
OSB	Aspen	0.15-0.3 (6-12)	No change
Glulam	Southern pine	0.4 (16)	Smaller logs

[a] Average diameters are based on general industry observations. Diameters used by individual mills or companies may vary.
[b] LVL, Laminated veneer lumber; OSB, oriented strandboard, Glulam, glued-laminated lumber.

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