STRUCTURAL ENGINEERED WOOD PRODUCTS (SEWPs) IN NORTH AMERICA AND JAPAN - WHAT DOES THE FUTURE HOLD?

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Since conducting the first intensive study of LVL for Raute a decade ago, the world of SEWPs has exploded, exceeding my own optimistic expectations. No longer do we have to explain what a SEWP is. Yes, they have a strong hold on the present. But what of the future? Let's review the current situation.

- ❑ Long, wide dimension lumber and timbers are still, increasingly, unavailable;
- ❑ The quality of what is available in long and wide dimension stock is decreasing;
- ❑ There is an increasing stress on the reliability of products;
- ❑ Litigation resulting from product and structure failures is on the rise;
- ❑ Industry's experience and familiarity with SEWPs is growing; and
- ❑ SEWPs are able to stand on their own merits with respect to performance and reliability.

SEWPs perform better, may look better and, in most cases, cost less in use than standard wood products. They are straighter, stronger and available in sizes, which do not exist in lumber. They allow us to do things that cannot be done with commodity wood products, or at any reasonable cost. In short, SEWPs offer an effective alternative - (Figure 1).

Figure 1 - STRUCTURAL ENGINEERED WOOD PRODUCTS

Product	Comment
Glulam beams	Oldest, simplest SEWP; graded boards or dimension lumber glued together to make a beam
LVL	More sophisticated; graded and tested veneers are glued together to produce lumber equivalents which are stronger than solid wood
Wood I-joists	A joist which uses SEWP as flanges and chords, and air to displace solid wood
Parallel strand lumber (PSL)	By controlling the dimensions of the strands, the species and adhesive, closely definable properties are achieved
Parallel strand beams (Parallam^{R})	Comparable to PSL, controlling veneer strands, species used, adhesive, etc. allows close control of final properties
New innovative products (Scrimber)	Possibly others

SEWPs are comprised of small pieces of wood recombined into larger pieces of wood using adhesive. It is a process by which each wood product is sorted into categories for use, the most important of which are strength and appearance. Strength parameters comprise resistance to side or end compression loads; resistance to tension or flexion; breaking points under load; nail holding; and others.

<u>North America</u> –

The key elements that affect SEWPs utilization and future potential

Old growth has disappeared or been set aside, replaced by second or third growth, and species (e.g. SPF) not considered commercial 40 years ago. Today, a piece of visually graded wood can no longer be counted on to perform as it is supposed to. The variance in any selected strength factor is too wide, so that any individual piece could fall below what we expect of it, although the average in that parameter could still resemble that of the original measurement.

In SEWP the range of performance or variance in strength measurements is much narrower. This is because the manufacturing process homogenizes the raw material, mitigating the effect of defects.

A related incentive for using SEWPs is the fear of litigation. In construction, the responsible people are the architects, engineers, contractors, builders and owners. Using SEWPs won't prevent them from being sued but, as a precaution, specifiers need to know specifically what a SEWP can do in terms of load carrying ability. In this respect, SEWPs can be relied on to a greater extent than lumber and timbers.

FIGURE 2 VOLATILITY IN DIMENSION LUMBER PRICES

As to cost, the advantage of SEWPs is most apparent in larger pieces. In lumber, for example, dimensions over 16' long and 12" wide are hard to get. When demand is high, shortages cause price jumps that have opened the door wider for SEWPs and, once builders and contractors have used it, they seldom abandon it when prices of standard lumber and other wood products drop as indeed they have this past year. In fact, the constant cycling of wood products prices discourages their use. When demand is high, prices soar and builders with a fixed price contract face a financial dilemma. When prices drop, retailers carrying high priced inventory are stuck. Although they are not immune to cost cycling, SEWP pricing tends to fluctuate less.

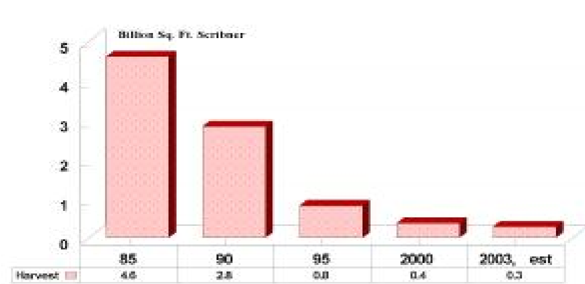
Finally, let's consider the complexity of present construction design. Single-family homes, the largest consumer of wood products like lumber and structural panels, have become more expensive due to their larger size and greater complexity. Wood elements are used in cathedral ceilings and cantilevered supports, areas that cannot utilize conventional wood products, effectively or inexpensively.

The Future of SEWPs

In order to forecast the future, we have to start with an understanding of where we are, how we got where we are, and where we are likely like to go. Consider the sharp decline in the allowable harvest of timber on federal lands in the Pacific Northwest. In 1986, about 12 billion board feet were made available. Today, regulations have reduced that volume to about 1 billion bd. ft. In reality it is much lower, since almost all of it is tied up in the courts (Figure 3).

As a result of this withdrawal and, due to the fact much of the timber held in federal lands and other government lands has been larger, old growth timber, the availability of larger structural wood is declining.

FIGURE 3
Decline Of Harvests From National Forests in WA & OR



Generally, the 10" and 12" dimension lumber of all North American western species combined has dropped to less than 20% of total production. Continuing decline in the availability of large structural wood is assured, simply because we are running out of large trees. Figure 4 shows the decline of larger timber in the West. It can be seen that between 1952 and now, the nature of the forest has changed. The amount of large trees defined as 29" d.b.h. and up halved. It is now less than 21%, when it had been the majority of standing timber. Larger wood simply no longer exists, a fact borne out by lumber mills that are trying to make wide dimension lumber from “toothpicks” and by plywood mills that have to process more stems in order to get similar volumes as in prior years.

There are also specifying influences that affect SEWP. Architects want the freedom to design what they want and still have it hold together. Structural engineers need reliability and predictability. They want to avoid litigation; if they get sued they want to win. Contractors want proven materials and easy access to those materials, preferring to buy from one place rather than having to run around trying to get a piece here and a piece there.

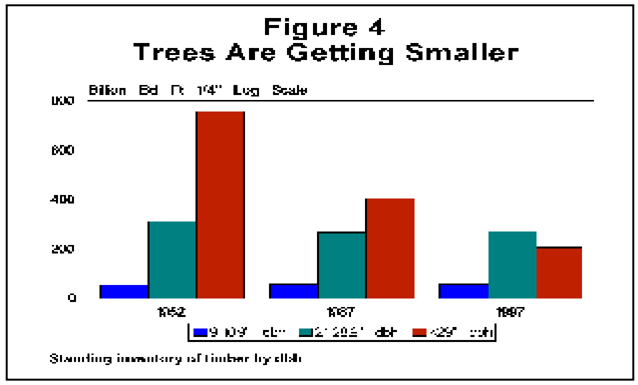


Figure 4
Trees Are Getting Smaller

Retailers now sell SEWPs, like LVL and wood I-joists. In a recent study, LGA contacted 30 of the largest chain yards and home centers involving several thousand individual store units. Most now stock SEWP, whereas a few years ago only one or two stocked it. As an example, compare dimension lumber and LVL. Figure 5 shows attributes that enable us to compare advantages and disadvantages of LVL. Specified lengths are of prime importance. For whatever reason, lumber in North America is manufactured and can be bought only in 2 ft. increments. If a piece needed is 1” over the 2 ft. increment, 23” are discarded. LVL, on the other hand, can be ordered in any length if made in the available continuous presses or up to press size if made in a batch process.

Figure 5 – Comparing Dimension Lumber and LVL

ATTRIBUTE	DIMENSION LUMBER	LVL
Length	2’ increments, lengths over 24’ in dry lumber very scarce	Any length
Width	12” mostly, 14” available	Widths to 8’
Strength	Downgraded from old growth	Stronger by 2x+
Uniformity	Variable	Uniform
Waste	Considerable	Minimal
Price	Highly variable and fluctuating	More stable
Appearance	Knots, defects, wane	Uniform

Widths are also a major issue. Dimension lumber comes in nominal 2x 4, 6, 8, 10 and 12 inches. Generally, if greater widths are required, they are ripped from the next larger dimension. LVL comes in any width up to press width, now 8 feet.

Most importantly, as lumber gets longer and wider, its price goes up disproportionately. For example, 28' Douglas fir green 2x6 Std & Btr (there is no 28' Kiln Dry) is 4' (16%) longer than 24'. On February 13, 2004 it cost $540 per MBF compared to $435 or 25 percent more. And it cost 42% more than 16’. LVL, on the other hand, costs the same per lineal foot in any width, no matter how long. (Figure 6)

FIGURE 6 - PRICES OF LUMBER VS LVL

Item	Length	Price	%+
Douglas fir green	16’	330	-
Douglas fir green	24’	435	25
Douglas fir green	28’	540	42
LVL	Any	Same	0

Source: Crow’s

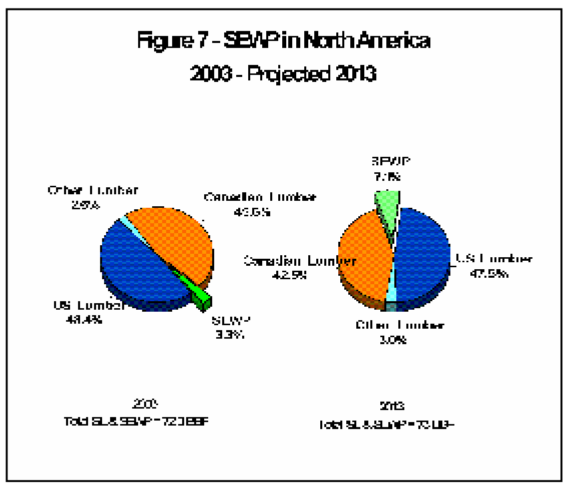
Are there feasible alternatives to SEWP?

Prominent options are steel framing, concrete and plastics. As lumber prices soared, interest in steel framing grew. As the price of lumber dropped, so did interest in steel framing. Steel has its virtues in residential building. After all, it is commonly used in non-residential construction. Steel goes up quickly, if everything fits together. However, when things don't go to plan, steel is difficult and expensive to modify on site. Cutting steel is more difficult than cutting wood and, while there are hundreds of thousands of carpenters, steel crews are scarcer, and they are used to the higher wages paid to non-residential workers. It is possible that thousands of homes will be built out of steel framing, however, out of 1.6 million or so starts we see as the average in the decade ahead, we will not see much steel framing.

Are there obstacles that could negatively affect an otherwise optimistic outlook for SEWP?

Yes; there always are.

- LVL competes with plywood for good veneer. While LVL is worth more, it can pay more. Yet, there is still a growing shortage of good veneer. And then there is the impact of using juvenile wood. LVL already uses species other than the Douglas fir and SYP it originated with, all of which are weaker. What will happen if some manufacturer stretches the envelope too far and there is a failure?
- The rise of proprietary products. When sources are limited to a single company, this limits its appeal to some users.
- “E” values are shrinking. The original LVL E value was 2.2, based on Douglas fir and SYP. LVL is now made of aspen (1.6) and SPF, as well as white fir and other species, all with lower values. How well is this understood by engineers and architects who usually do not know much about wood in the first place? Will this lead to skinny members to save cost, and a catastrophic failure? It could.
- Most SEWP applications in North America are horizontal, although most framing applications are vertical. However in other countries, SEWP are routinely used for vertical members such as posts. Figure 7 shows a vertical use of wood I-joists. And, of course, expectations for housing starts and other economic factors may shift.

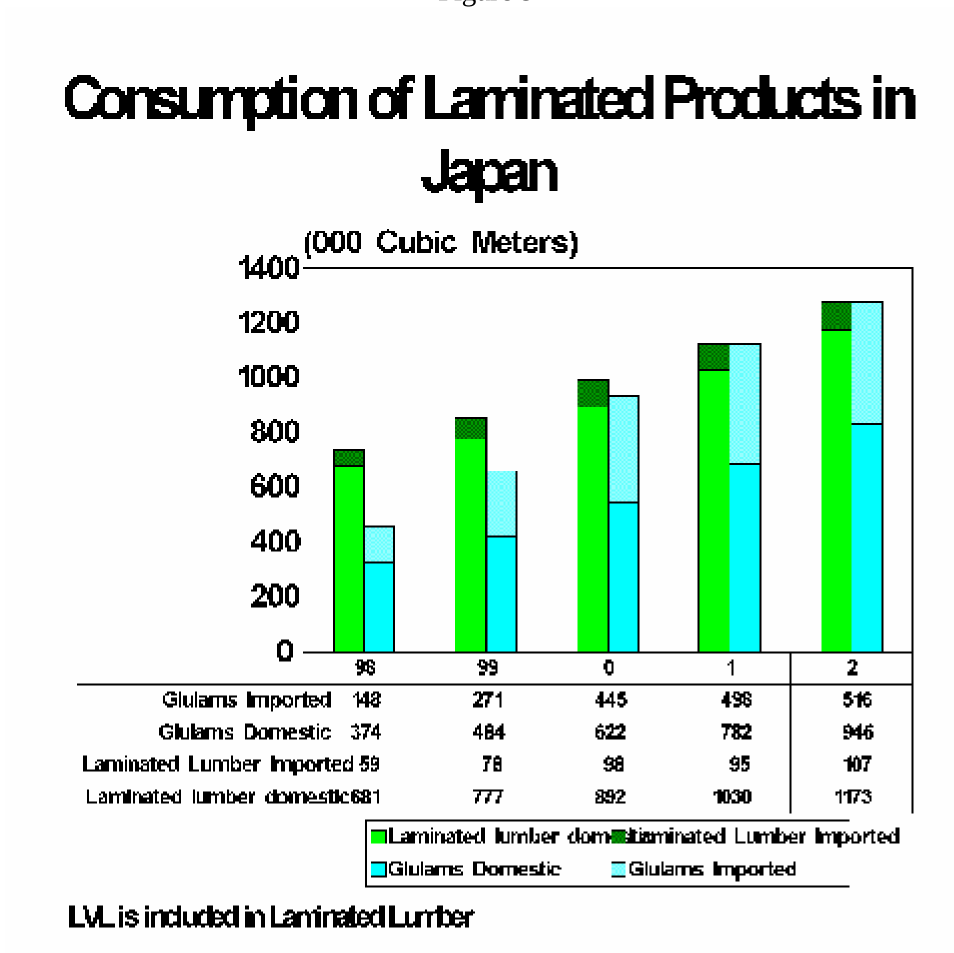


Taking all this into account, Figure 7 summarizes the current SEWP situation in North America, my assumptions, and shows my forecasts for SEWP, taken as a group.

Japan

While North America is the major locus of production and consumption of SEWP, because of its heavily wood-oriented residential construction modes, there are numerous examples of the use and growth of these useful products in many other countries. Simply as an illustration, let us consider the use of glulam beams and LVL in Japan, another country where the use of wood residential construction is widespread and traditional. Glulam beams and LVL are used in both traditional Japanese housing and the newer '2x4 or North American style' housing, modified of course to meet Japanese requirements. Japan's consumption of engineered wood products including glulams and LVL has been steadily rising since the Great Hanshin earthquake of 1995, as have its imports, since the domestic mills cannot supply the country's needs despite recent expansions. Japan's SEWP industry, like all its wood industries, is supply constrained. Figure 8 shows the growth of laminated wood consumption in Japan in recent years, despite the recent recession and the comparatively slack housing market there (at least compared to a decade ago).

Figure 8

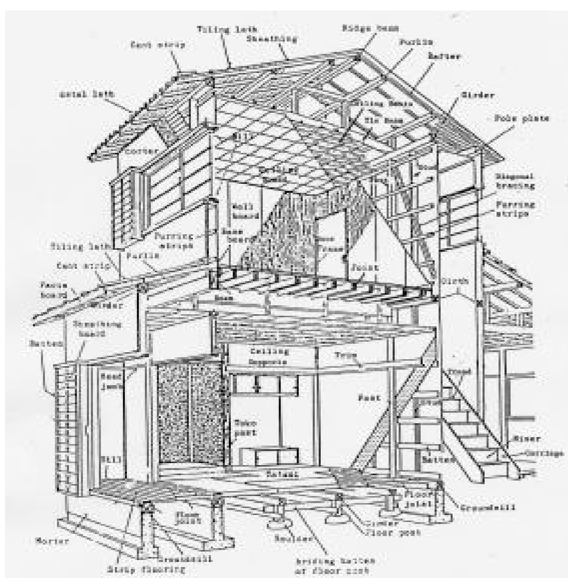


0Since the Great Hanshin earthquake of 1995 Japanese building codes have been made much more severe. This has generated an increasing demand for engineered wood products, which find their place in both the Japanese version of 2x4 North American housing, and the much larger traditional wood house market (505,000 even in the slow year of 2003). Figure 9 shows housing starts in Japan over the last decade; they are well down from the peaks of the early 1990s.

Figure 9 - Housing Starts In Japan

Year	Traditional Post & Beam Wood	2x4 North American Type	Total Starts (MM)
1994	736	64	1.570
1995	666	74	1.470
1996	754	94	1.643
1997	611	79	1.387
1998	545	68	1.198
1999	566	76	1.214
2000	556	79	1.191
2001	529	77	1.200
2002	506	79	1.146
2003	505	79	1.110

Finally, the preferred method of wood housing construction in Japan is still the traditional concept. This is shown in Figure 10.



There is little doubt that the future growth of SEWPs is assured and that there is tremendous opportunity for qualified new ones.