Expanded markets for engineered wood products: the Forest Products Laboratory's view

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Abstract

Many wood products available for construction today are quite different than those traditionally used for wood construction. Builders have at their disposal many new wood products such as prefabricated wood I-joists, structural composite lumber, and oriented strandboard. By the year 2000, projections suggest that a total of 1.53×10^9 lineal feet (4.71×10^8 m) of these new engineered wood products will be produced in the United States. This paper presents the Forest Products Laboratory's (FPL) view of the market for these new engineered wood products and speculations on the opportunities and requirements necessary to capture this market share of growth.

Introduction

Many wood products available for construction today are quite different than those traditionally used for wood construction. Builders have at their disposal several new wood products, such as prefabricated wood I-joists, structural composite lumber, and oriented strandboard (OSB), that are changing the way we build wooden structures. This paper presents the FPL's view of the market for new engineered wood products and speculations on the opportunities and requirements necessary to capture this market share of growth.

Traditionally, wood products are produced and sold in a relatively captive commodity market. Today, we see a shift in the market-driven approach, with products meeting a specific need. This shift in marketing strategy has evolved for several reasons, including a leveling off in the housing market, a change in the natural resource base production of small logs (and decreasing availability of large logs), and a realization of the potentially large commercial and industrial (nonresidential) construction market.

The driving force behind advancements in the structural application of wood during the past 60 years has been the development of engineered wood components. With the development of waterproof adhesives in the 1930s, products such as glue-laminated timber and exterior grade plywood gained wide recognition and changed many attitudes toward wood as a structural material.

During the past 15 years, the wood industry has made a major effort to focus its attention on commercial/industrial applications of engineered wood components such as trusses, laminated veneer lumber (LVL), wood I-beams, and structural composite products.

Current trends

By the year 2000, projections suggest that a total of 1.53×10^9 lineal feet (4.71×10^8 m) of engineered lumber products, composed of 21 percent glulam, 27 percent parallel chord trusses, 23 percent LVL, 19 percent I-joists, and 5 percent parallel strand lumber, will be produced in the United States (2).

Glulam has been produced and used in the United States for more than 60 years. In the past, glulam found wide use in a combination of aesthetic and structural applications, such as dome and cathedral roof structures, bridges, and exposed arches and beams in public buildings. Today, glulam is still used in these applications; however, it is finding increased usage in commercial/industrial applications. Of the total lineal feet of engineered lumber products currently produced, glulam accounts for about 21 percent and is projected to hold that market share through the turn of the century (2).

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Efforts are also being made to improve the yield of currently underutilized species for glulam in timber bridge applications. Examples are red maple and yellow. poplar, which are low-density hardwoods not currently used in structural applications. To make these species economically feasible, existing sawing, grading, and manufacturing technologies for softwoods must be adapted to hardwoods.

Light-frame wood trusses, originally introduced to compete in the residential roofing market, are now used in a variety of structural applications. Trusses are currently about 80 percent of the residential roof market and more than 30 percent of all engineered lumber products. The use of trusses in light commercial building floor and roof assemblies has grown rapidly during the past 10 years, and research is currently underway to study the possibility of using them in timber bridges on secondary roadways.

Structural composite products, such as LVL, parallel strand lumber, and OSB, have provided ways of using our wood resource more efficiently. These products enable production of high-quality, low-variability structural components from materials that previously were used to provide medium- to low-grade lumber or were discarded as waste.

The picture for nonveneered structural panels, including OSB and waferboard, has changed dramatically since about 1980. At that time, waferboard was the only product produced and was used primarily for sheathing, making up only 1 or 2 percent of U.S. consumption. currently, almost all nonveneered panels are OSB, comprising about 25 percent of the structural panel market. Some projections give OSB a market share of more than 40 percent by the year 2000 (2). Current expanded uses include single-layer flooring, overlaid exterior siding, and webs of wood I-joists. The direct replacement of veneered panels with OSB is primarily resource and economic driven, decreasing supply and increasing cost of veneer logs. With few exceptions, OSB is an American- or Canadian-made product.

Wood I-joists, fabricated using either solid-sawn or LVL flanges and plywood or OSB webs, are capturing a growing share of the commercial/industrial market as well as a share of the residential floor and roof framing market. By the year 2000, I-joists are projected to make up 19 percent of the 1.53×10^9 lineal feet (4.71×10^8 m) of engineered lumber products produced in the United States (2).

Future challenges

Although the opportunities for engineered wood structural components appear bright, new challenges accompany this growth. Better definitions of lumber performance will be required through advanced grading and material selection techniques as well as improved measures of engineering performance and serviceability. Additional concerns include fire performance and long-term product performance, which relies heavily on the integrity of the adhesives, truss plates, or nails that hold these products together.

Defining the performance of individual components will be challenging. Visual grading procedures historically used and derived for solid lumber may not be suitable for evolving engineered wood products. Grading techniques directly linked to the mechanical properties of lumber, such as machine stress grading and nondestructive testing, will increase as the market for engineered products increase. In addition, with the increased dependency on manufacturing quality of the engineered product, quality control measures will need continued refinement to ensure that expected performance levels of individual components are met.

Better definitions of overall system performance will be needed because the use of highly engineered structural wood components that span long distances at increased spacings will, in many cases, create wood structures with less structural redundancy. Maximizing the efficiency of these products, while meeting the serviceability expectations of the consumer, will require a better understanding of structural system behavior. This understanding will necessarily come from advanced engineering research on component, connection, and full-system behaviors. For the most part, existing laboratory test facilities are designed for small-specimen testing. To evaluate the described component and structural system performance, we need to invest in facilities that can evaluate full-size components and building systems.

The wood industry is actively responding to concerns regarding the fire performance of many lightweight engineered wood components currently being produced. Although efficient structurally, the often small cross-section elements of engineered wood components do not have the thermal mass to resist long-term fire exposure. Opportunities exist to develop alternative protection systems using benign coatings or chemical treatments to reduce the effects of fire exposure.

Additional marketing issues

Many of the engineered wood products previously discussed have found prominence in several markets, and in some cases, new wood products are simply replacing existing wood products (e.g., OSB for plywood). Although this is a natural market progression, effort is also required to expand the wood market by using wood in applications currently utilizing other materials. This is especially true in the commercial/industrial applications where wood has great potential to effectively compete in a market currently dominated by steel and concrete.

This is not to say progress has not been made. Wood I-joists are replacing steel bar joists in many applications, and although in many cases still in infancy, the use of timber for bridges holds promise for competing with precast concrete in short-span applications. However, we believe that capturing a significant share of the commercial/industrial market requires the wood industry to further unify its marketing efforts for wood products.

It is apparent that the demand for engineered wood structural components will continue to grow and create new challenges for the wood industry. Changes in our timber resource,, accompanied by demands for less energy-intensive fabrication and more energy-efficient structures, point to continued interest in and need for the development of engineered structural components from wood. Although not often emphasized, wood structures are much more benign environmentally than are other construction products.

Wood construction is much less energy-intensive than is comparable construction in steel or concrete. Koch showed that if the full cycle of manufacture is considered (i.e., harvesting or mining the raw material, manufacturing and transporting the finished product, and constructing a finished structure), steel or concrete construction requires, on average, ten times more energy than does wood construction (1).

Although these positive attributes of wood can help us market engineered wood products in the future, the growing sensitivity to domestic and global environmental concerns, including forestry practices, cannot be ignored. Projections suggest increases in demand for housing worldwide. To effectively and responsibly meet this growing need, efficient and environmentally acceptable practices must be developed to utilize available resources. This may involve the use of reconstituted wood combined with other materials such as those that may be reclaimed from waste recycling. New challenges to the wood industry will include the development of these products, the processes to mass produce them, and the methods and tools to use them.

Literature cited

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