A New Taxonomy of Wood Products

Working Paper 96.05

by

David H. Cohen, Simon C. Ellis, Robert A. Kozak

and

Bill Wilson

July 1996

Funding

This project received funding support from the Canadian Forest Service and from the Opportunity Identification Program (Program 5), Canada-British Columbia Partnership Agreement on Forest Resource Development Agreement: FRDA II.

Acknowledgements

The authors would like to acknowledge TrusJoist MacMillan for the use of some of their photographs. The authors would also like to thank Kathy Campbell for her expertise and assistance in computer graphics and design.

Authors

David Cohen is Associate Professor in Forest Products Marketing and Management. Simon Ellis is Associate Professor in Wood Science. Robert Kozak is a Post Doctoral Fellow. All three are in the Department of Wood Science in the Faculty of Forestry at the University of British Columbia. Bill Wilson directs the Industry, Trade & Economics Program at the Canadian Forest Service in Victoria.

Disclaimer

This report is available from:

Publications
Pacific Forestry Centre
Canadian Forest Service
506 West Burnside Road
Victoria, B.C. V8Z 1M5

Fax: (604) 363-0797

Abstract

With the accelerating development of new wood products, it is time for a new taxonomy of wood products which can incorporate both existing and developing products. This taxonomy categorized both **composite** products and **solid** wood but does not deal with products which fall under the third broad category of **chemical processing** (pulp and paper). Each product group is described in a single page which focuses on products description, technical characteristics, existing and potential markets, existing and potential markets and information sources. Combining technical information with production and market information should help provide a good overview of each product group. Providing sources for further information should allow the reader to obtain more detailed information should it be desired. As new products are developed they can be fit into the existing typology.

Within the first major category of **composite** products there are two major classifications: **panels and engineered lumber components**. Panels include **wood/non-wood** combinations (*wood/cement*) and **wood based** panels (*I. waferboard/oriented strand board, ii. fiberboard/medium density fiberboard, iii. particleboard, and iv. softwood plywood*). Engineered lumber components include *i. laminated veneer lumber and ii. oriented strand lumber*.

In the second major category of **solid** wood there are four major classifications: ***softwood lumber, glued, treated,*** and ***hardwoods.*** Softwood lumber includes information sheets on *dimension, boards, machine stress rated*, and *timbers.* Glued products include *fingerjoined, edge glued,* and *glulam beams.* Treated products have information sheets on *CCA treated* products. *Hardwoods* are discussed in a single section.

Contents

WOOD / NON-WOOD PANELS:
Wood/Cement Composites
A structural or non-structural panel product produced by adhering wood elements together with a mineral-based binding agent (such as Portland cement) under pressure.

WOOD BASED PANELS:
Oriented Strand Board (OSB)
An engineered structural wood based panel composed of wood strands, flakes or wafers bonded under heat and pressure with a waterproof resin. Unlike Waferboard (where furnish is randomly oriented throughout), the furnish in OSB is aligned in the panel direction on the surface layers and either cross-aligned or randomly-oriented in the inner layers.
Medium Density Fiberboard (MDF)
A non-structural and homogenous wood based panel composed of randomly arranged wood fibres bonded together under heat and pressure.
Particleboard
A non-structural panel product produced by bonding small wood together with a resin under heat and pressure.
Softwood Plywood
A structural panel made up of softwood veneer layers glued under heat and pressure, with the grain direction of each adjoining layer being set at right angles to one another.

ENGINEERED LUMBER COMPOSITES:
Laminated Veneer Lumber (LVL)
An engineered wood product composed of layers of scarf-jointed veneer glued together under heat and pressure with the grain of each veneer running parallel to the longitudinal axis of the billet.
Oriented Strand Lumber (OSL)
Sometimes referred to as reconstituted lumber or parallel strand lumber, it is produced by aligning long strands of wood in parallel and binding them together using adhesives, pressure, and heat.

SOFTWOOD LUMBER:
Dimension Lumber
Softwood lumber with a nominal thickness of 2 to 4 inches, and a nominal width of 2 inches or more, including studs.
Boards
Lumber with a nominal thickness less than two inches, but a width of 2 or more inches.
Machine Stress Rated Lumber (MSR)

Structural lumber that, in addition to meeting visual grading requirements, has been tested by mechanical stress-rating machinery to determine the modulus of elasticity (the amount of stiffness in the lumber).

Timber

Structural softwood lumber which is greater than 5 inches in its smallest dimension.

GLUED WOOD:

Finger Joined Lumber

Lumber produced by a mechanical system which cuts fingers in each end of the lumber stock (joints) and glues the pieces together to extend the length, reduce defects, and increase straightness.

Edge Glued Panels

A non-structural product made of relatively narrow pieces of wood glued along their edges (sides or faces) to produce panels of greater widths.

Glue Laminated Timber (Glulam)

An engineered structural product composed of lumber pieces glued together such that the grain of all laminations runs parallel to the longitudinal axis of the product.

TREATED WOOD:

Preservative Treated Wood

Lumber treated with chemicals (typically chromated copper arsenate or CCA) or other liquids to reduce the susceptibility of decay and deterioration due to fungal/insect attack.

HARDWOODS:

Hardwoods

Pertaining to the large family of wood products (sawnwood, plywoods, veneers) that are manufactured from deciduous trees, either tropical or non-tropical.

ENGINEERED WOOD PRODUCTS:

I-Beams

An engineered structural product made by gluing a web of structural panel product (plywood, OSB) between two flanges of structural wood product (lumber, LVL, OSL) in the shape of an “I”.

Trusses

An engineered structural product which is a framework composed of a series of smaller wood pieces (chords and webs) arranged and fastened together (by steel truss plates) such that external loads are transferred to truss supports.

Introduction

Background

There has been, and continues to be, development of more and more new products composed, in part or in total, from wood. The traditional taxonomy of wood products separates basic production into two categories: wood and pulp & paper. This report focuses on the solid wood sector and does not address the chemical, or pulp & paper sector. Wood products have traditionally been further described as lumber or panels. Within each of these categories there are more detailed segmentations such as structural and non-structural lumber. However, the conventional taxonomy of wood products is proving to be inadequate in incorporating many of the more recent wood products.

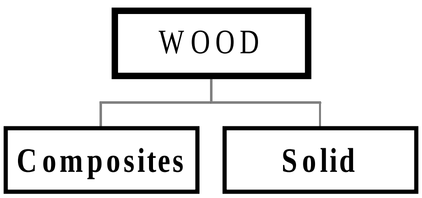
The explosion in product development encompasses a variety of product types. Included are new structural wood products, both solid wood engineered product components such as machine stress rated (MSR) lumber and engineered wood composite products such as wood I-beams. Also included are new composite panels such as oriented strand board (OSB) and composite lumber products such as oriented strand lumber (OSL). The traditional line between panels and lumber products is becoming less distinct. In addition, wood is being combined with a variety of non-wood products to produce some interesting combination materials. These include, but are not limited to, wood-cement, wood-plastics, wood-resins, wood-kevlar, and steel-reinforced wood products. A new taxonomy is proposed which is robust enough to incorporate these new products. Developing and presenting this taxonomy completes two objectives: 1) it provides a framework for categorizing new products currently under development which should help commercialization of new products; and 2) it facilitates the dissemination of information pertaining to existing and new wood products and helps to identify market-product opportunities.

There has been an explosion of commercial successes for many new (and old) wood products. One result of this explosion is that many people associated with the forest sector do not know what types of raw materials are required for proposed and new facilities. Some may possess little knowledge about how wood products are produced and used. For example, it is difficult to develop silvicultural regimes when the final wood products and their end uses are not considered and, as a result, the desired wood quality is not known. The old taxonomy described products and logs as either pulp (fiber) or sawlogs. As products become more complex, so too do the types and uses of logs and thus the variability of industry-based silvicultural regimes. This report provides an overview of the taxonomy as well as brief information sheets on some of the most important products and product categories within the taxonomy.

Basis of the New Taxonomy

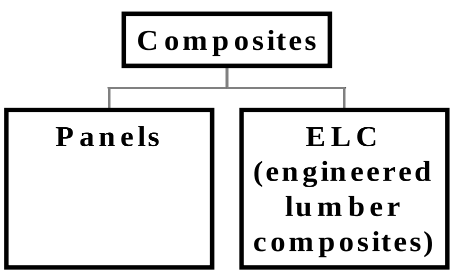
The new taxonomy has been developed to be able to incorporate the continued development of new wood products. This taxonomy divides non-chemically processed wood products into two categories. However, rather than the old division of lumber and panels, the new taxonomy uses the following bipolar division: composites and solid.

The stream under composites includes both panel and lumber products produced by amalgamating smaller pieces of wood. This is in contrast to the second stream, the solid group, which consists of products produced from solid pieces of lumber, either on their own or combined with other solid pieces of wood.
There is a third category which is not part of the hierarchical taxonomy. It is made of combinations of products from the hierarchical taxonomy used in the production of engineered wood products. These are complex systems manufactured by combining products from either or both of the two major streams of non-chemical wood products. This is currently a growing field and can even include certain non-wood products. Wood/non-wood combinations are discussed at the end of this introduction. The next level of discrimination within the hierarchical taxonomy differs for both the composite side and the solid side.



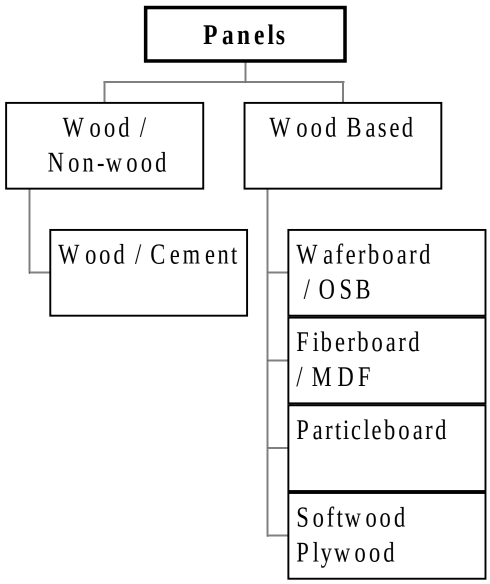
Taxonomy: Wood - Composites

Within the composites section, products are segmented as either panel products produced from composite wood products or as lumber products produced from composite wood products. The lumber products are identified as engineered lumber composites since almost all lumber substitutes are actually designed for specific strength characteristics and are used as engineered products. Engineered lumber composites is a new and growing class of products and is one area targeted for growth.



Within panels, the taxonomy once again is grouped into two distinct categories. The first category is wood/non-wood composite panels. This category currently only has a single product with wide commercial acceptance, wood/cement panels, which are discussed as a fact sheet in the body of this report. There are other wood/non wood panels which are under development but not yet commercially proven.
One such panel product currently under development is a wood/plastic combination which can be used as an exterior decking material (made from an oil-based plastic used as a matrix to suspend recycled wood waste). Products like this are beginning to provide strong competition to radius edge treated SYP decking as well as Redwood and Cedar

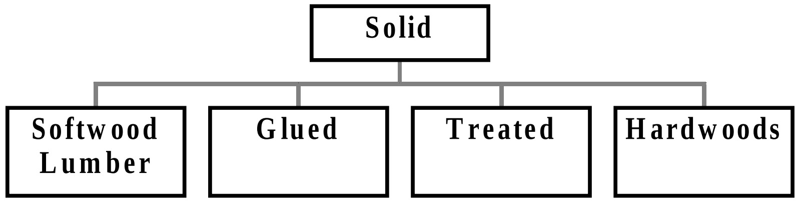
decking materials. Another developing product group are panels made from agricultural products. These include panels made from kenaf, sugar cane stalks, wheat and agricultural wastes. Few of these panel products have yet to be commercialized, and are not included in this taxonomy. That said, each of the (purely) wood-based panels shown below do have a fact sheet in the body of this report.



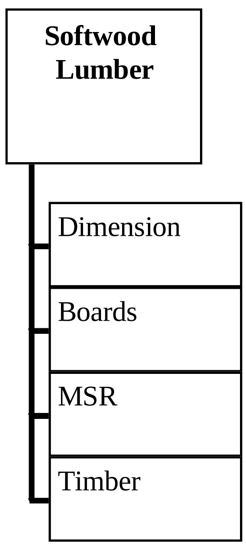
The second major grouping under composites are engineered lumber composites. These products can be thought of as reconstituted, high strength lumber. They are produced by taking the tree and breaking it down into smaller component pieces. These pieces (strands, chips or veneers) are regrouped using adhesives, heat and pressure to produce a uniformly strong structural material of very specific performance characteristics; hence the term engineered.. The two major commerical categories are laminated veneer lumber (LVL) and oriented strand lumber (OSL). Each of these have a fact sheet in the body of this report.

Taxonomy: Wood - Solid

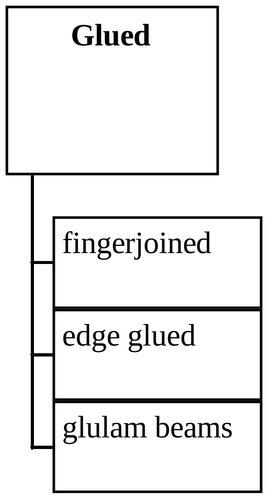
This second level grouping consists of both solid wood products and those wood products produced by treating or combining solid wood products. The four main categories of this second level grouping are shown below.



Softwood lumber is broken down into four main categories: dimension, board, machine stress rated (MSR) and timbers. Dimension lumber is used predominantly for construction purposes both in North America and in Japan (for platform frame construction). This group encompasses the “2 by’s” such as 2 by 4’s, 2 by 6’s, etc. Boards include one inch thick material used for joinery, cabinetry, shelving and the like. MSR consists of lumber which is tested on a piece by piece basis for stiffness. It is most often used as a component in the manufacture of engineered wood products and is typically two inches in depth. Different species and growth patterns determine the strength characteristics of each piece of wood. Timbers are solid pieces of softwood that are at least 5.5 inches in the smallest dimension. They are often used as architectural pieces in construction, in post and beam construction for supports or for remanufacture into specific sizes and shapes for particular end uses.



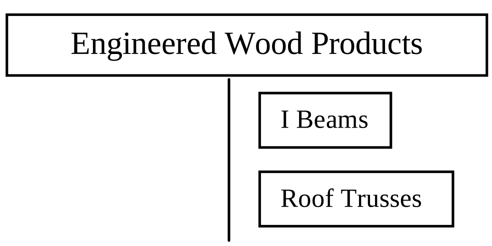
Glued products are those products in which solid pieces of softwood lumber are glued together to form different sizes and shapes. There are three distinct categories of glued products: fingerjoined lumber, edge glued lumber and glue laminated (glulam) beams. Fingerjoined lumber attaches short pieces of lumber together using joins which look like fingers intertwined to produce longer pieces of lumber. Edge glued lumber joins pieces on their edge to produce wider pieces of lumber which can then be used in items such as table tops or cutting boards. Glulam beams glue lumber together on the longitudinal axis to produce thick beams which can be curved and of great depth. Glulam beams are often used for supports in buildings, such as churches, where architectural appearance is an important consideration.



The third category of solid wood products are treated products, which includes solid wood that is treated with chemicals. The most common type of chemical treatment is to prevent decay through fungal attach in exterior uses (decking) or when wood comes in contact with water (sill plates). Another, less common, type of treatment chemically treats wood with a fire retardant. Unfortunately, this type of treatment tends to make wood brittle and impacts on its strength characteristics.
The last category under solid wood is titled hardwoods. This taxonomy focuses on products produced predominantly from softwoods. Thus, the hardwood category includes both lumber and panels.

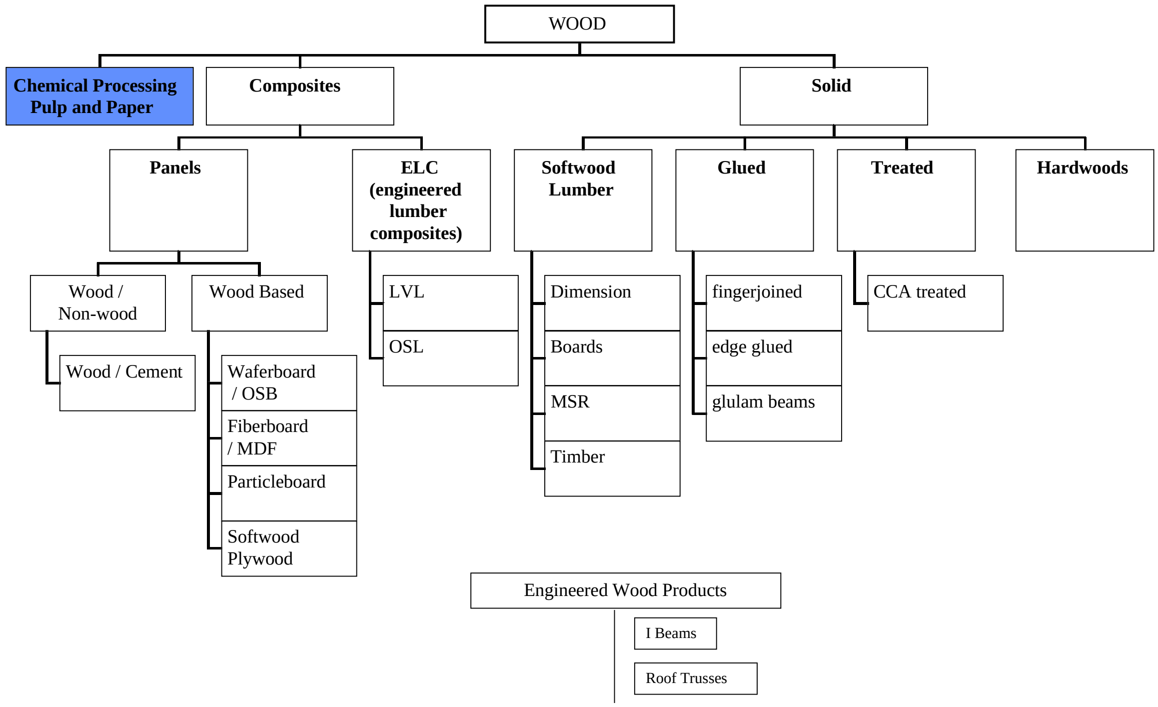
Engineered Wood Products

This category will witness the greatest expansion of new products over the next few years as more and more combinations of both wood and non-wood materials are being designed to meet specific engineering requirements. Currently, the two largest product groups are I-beams and roof trusses, which are both predominantly used in construction.

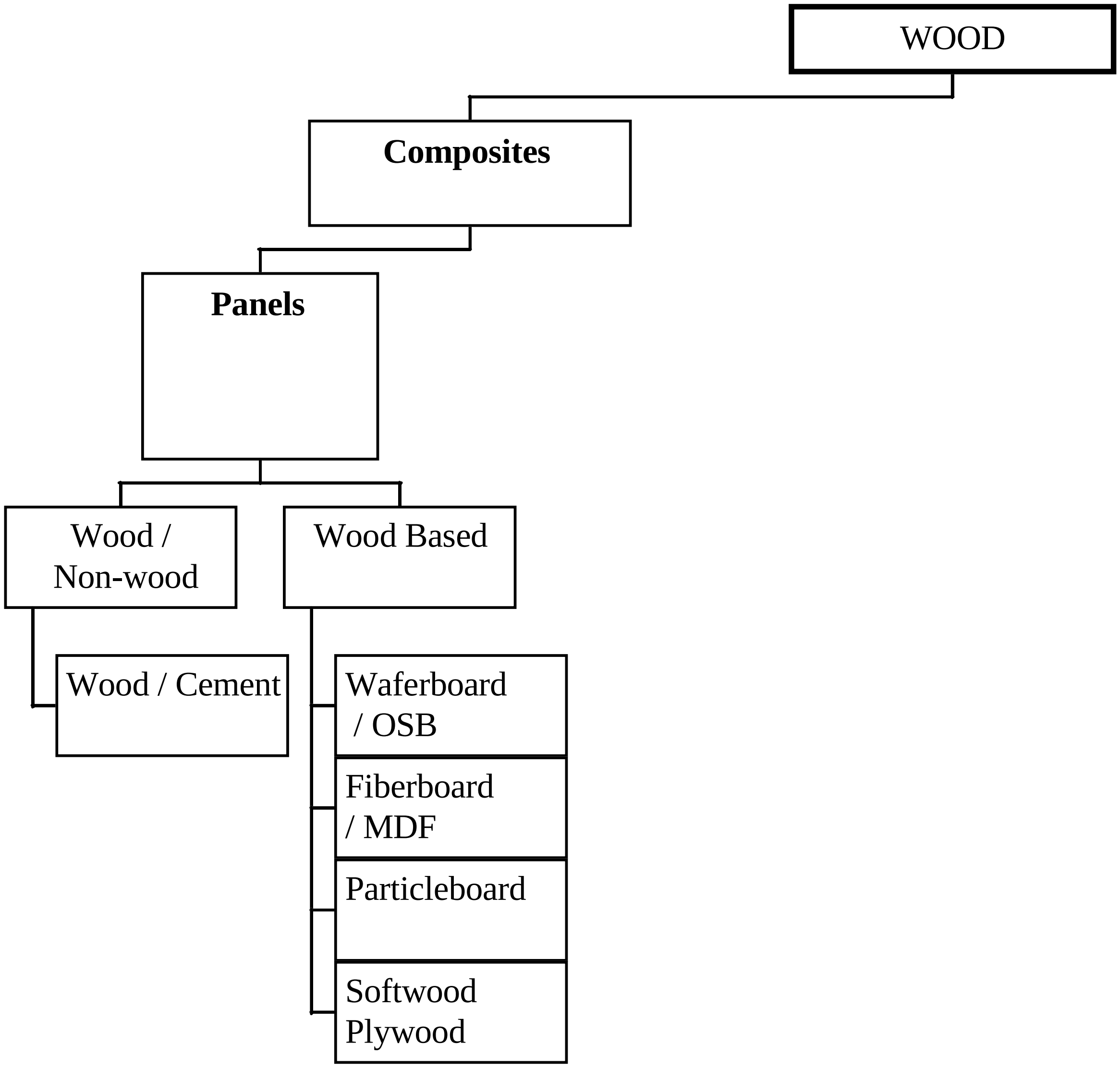


Summary

This taxonomy attempts to provide a framework for understanding and identifying wood products. It is meant to be open to continual revision as new products emerge, whether they fit into existing categories or require additional categories. Maps will be provided throughout this report to place each product category within the taxonomical framework.


WOOD
Chemical Processing
Pulp and Paper
Composites
Solid
Panels
ELC
(engineered
lumber
composites)
Softwood
Lumber
Glued
Treated
Hardwoods
Wood /
Non-wood
Wood Based
LVL
OSL
Dimension
Boards
MSR
Timber
fingerjoined
edge glued
glulam beams
CCA treated
Wood / Cement
Waferboard
/ OSB
Fiberboard
/ MDF
Particleboard
Softwood
Plywood
Engineered Wood Products
I Beams
Roof Trusses

Panels



WOOD
Composites
Panels
Wood /
Non-wood
Wood Based
Wood / Cement
Waferboard
/ OSB
Fiberboard
/ MDF
Particleboard
Softwood
Plywood

Wood/Cement Composites

Product Description

Wood/cement composites can be both structural or non-structural products. They are produced by sticking wood elements together with a mineral-based binding agent under applied pressure. The mineral binder most commonly used is Portland cement although magnesia cement (Sorel) and gypsum have also been used. Panels can be made from a variety of different sized and shaped wood elements. A porous low density panel is made from wood excelsior (long thin slivers or wood wool). A product more similar to conventional particleboard is made from wood particles and shavings. Sawdust and fibers can be used to make a molded product. The selection of wood species used is very important since many species contain sugars or extractives which can inhibit the cure of the cement. The hardening time of these inorganic binders is much longer than the synthetic resins generally used in the production of wood-based panels. Final strengths are often attained after curing for 28 days. Mineral based wood composites use a much greater proportion of binder than those produced with traditional synthetic adhesives. Prices of cement are low on a weight basis but due to the high amounts used this price advantage may be nullified.

Technical Characteristics

Wood/cement composites have very good moisture resistance, dimensional stability, exterior durability, fire resistance and rot resistance. They tend to be heavy, difficult to transport and do not respond well in freeze-thaw-freeze cycles. They are more difficult to cut and fasten than traditional wood based panels but can be screwed, nailed, drilled and riveted. Wood wool board has a density of 350-500 kg/m^3 and desirable acoustic properties. Cement bonded particleboard has a density of 950-1200 kg/m^3.

Existing And Potential Markets

In Australia and Asia products made from a combination of wood and cement are commonly used as exterior siding and roof products. In Japan surface technologies have been developed which produce a deep embossed brick and block or wood grain finish to wood/cement siding. While the material properties of wood/cement panel products had always been acceptable to Japanese customers, market research had shown that the surface needed to look like more traditional finishing materials. Now that the finish can appear like brick or wood grain the popularity of wood cement siding is growing. Australian production has focused on developing an exterior finish similar to Cape Cod shingles.

Boards made from wood and cement are used in prefabricated housing, as cladding, balcony parapets, sound barriers, fence walls and as a replacement panel for asbestos. Some countries are constructing buildings by using flanged wood/cement panels to erect walls without studs but with interlocking panels. Interior applications include wall partitions, non-flammable walls and ceilings, shielding for steel supports, lining for high-humidity rooms such as bathrooms, and underlayment for wood, vinyl or other laminates.

In North America, wood/cement board embossed with a wood shake texture has become an acceptable substitute for cedar shakes and shingles as a response to more restrictive fire regulations regarding flammable roofing materials. Past efforts have not been successful in areas where climate and freezing caused splits. However performance in climates with little freezing such as the southern and western US provide ideal market conditions.

Markets for wood/cement composites are expected to grow, particularly for exterior use. Since these composites contain no hazardous chemicals and can withstand outdoor exposure exterior siding and roofing markets are expected to grow significantly as technology currently in use in Asia and Australia is transplanted and adapted for use in North America. For the next five years markets for cement bonded siding products are predicted to grow 30% annually. Markets for similar roofing products are expected to continue to grow at 20% annually.

Existing And Potential Production

Currently there are two wood/cement roofing and/or flat panel facilities in Canada. In the United States there are 6 plants producing either roofing, flat panels or siding. An additional two facilities are located in Mexico. Currently there are two additional plants scheduled for completion in the next two years to produce textured cement-based roof shakes to compete with existing products produced by MacMillan Bloedel and other companies.

Currently about 300 million square feet of cement-bonded fibre products are produced in North America. Additional volumes are imported from Europe and Asia. Production is expected to increase at the rate of 50-75 million square feet annually for the next five years.

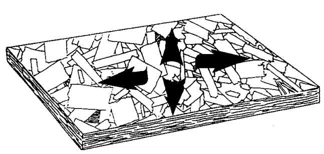
Information Sources

Forintek Canada Corporation
Eastern Division
319 rue Franquet
Ste-Foy, Quebec
Canada G1T 4R4
Tel: (418) 659-2647
Fax: (418) 659-2922

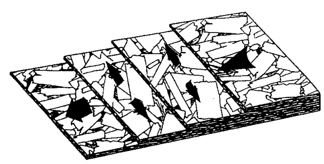
Oriented Strand Board

Product Description

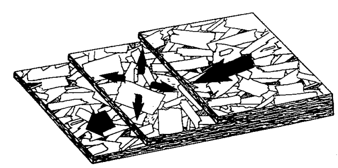
Oriented strand board (OSB) is an engineered structural wood based panel. It is composed of wood strands, flakes or wafers bonded under heat and pressure with a waterproof resin adhesive. Since it is possible to cut the strands to a uniform size and thickness, specific performance qualities can be designed into a panel. OSB makes efficient use of small diameter logs in the production of the strands. Predominantly aspen and poplar species are utilized in Canada, while yellow poplar, southern yellow pine and mixed hardwoods are also utilized in the US. All of the debarked tree is made into flakes at least 1 cm by 2 cm. Flakes used on the surface are often 10 cm or more in length. Phenol formaldehyde resins and to a lesser extent isocyanate adhesives are the binders used in the production of OSB. OSB is made with the strands in the surface layers aligned in the panel direction and those strands in the inner layer either cross-aligned or randomly oriented. Waferboard (the predecessor to OSB) was made with the strands in all layers randomly oriented.



Random waferboard
and oriented core



OSB with aligned face
and random core



OSB with aligned face

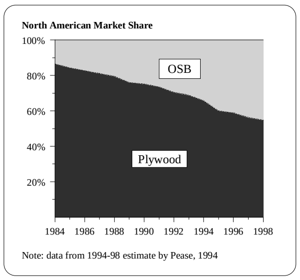
Technical Characteristics

OSB is produced in thicknesses ranging from 1/4" to 1 1/4". The mats produced (commonly 8 by 24 feet) are cut to size (commonly 4 by 8 feet) and may be square edged or tongue and grooved. The typical density of OSB is around 640 kg/m^3 (40 lbs/ft^3) although the density will depend upon the moisture content and the manufacturer. The strength of OSB is comparable to that of structural plywood and it is highly workable, being easily drilled, sawed, nailed, planed, or sanded. It has particularly good nail holding properties. OSB can be glued with normal wood adhesives and can be painted with quality wood-paint systems. The in-plane dimensional stability of OSB is good but the thickness swelling of OSB under severe humidity conditions is perhaps its greatest weakness.

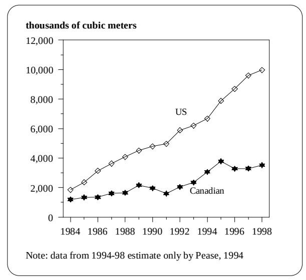
Existing And Potential Markets

During the past decade the growth of OSB use has predominantly been from replacing plywood as a structural panel in construction and packaging. It is already widely used as wall sheathing, roof sheathing, and packaging material in containers. As technology for producing OSB has become more sophisticated new products and markets have been developed. Currently in North America these include lap and panel exterior siding for residential construction, furniture frames, and manufactured house components. In the construction industry new structural products that incorporate OSB include webs for I-beams, floor joists and roof trusses.

Potential markets include both the export market to Japan and other countries in the Pacific Rim to substitute for shrinking supplies of Lauan plywood. Potential products/markets include using OSB as interior, finished wall paneling, flooring (called ActiveFloor in Japan), ceiling tiles, and core stock for veneered, non-structural posts and beams.



Changing North America Market Share for Plywood and OSB



OSB Production in Canada and US 1984-1998

Existing And Potential Production

OSB is produced in a process which starts with the whole log and produces a board that has specific performance characteristics due to the techniques of production. Facilities often require more than 500,000 cubic meters of logs per year to be economically viable. In Canada the shift from using softwood construction plywood to OSB has been more rapid than in the US. Continued market share gains for OSB are expected as shown in the following figure. In late 1994 there were 14 OSB plants scheduled to be built and in production between 1994 and 1996 in all regions of Canada from New Brunswick to British Columbia. The majority of these are clustered in Quebec and Ontario. Within North America over 28 plants are scheduled to be opened by the end of 1996. Actual and predicted production volumes for Canada and the US are shown in this figure.

Information Sources

Structural Board Association
42 Sheppard Avenue East, Suite 412
Willowdale, Ontario
Canada, M2N 5W9
Tel: (416) 730-9090
Fax: (416) 730-9013

APA—The Engineered Wood Association
P.O. Box 11700
Tacoma, WA
USA, 98411-0700
Tel: (206) 565-6600
Fax: (206) 565-7265

Medium Density Fiberboard

Product Description

Medium density fiberboard (MDF) is a non-structural wood based panel. It is composed of wood fibres bonded together with resin under heat and pressure. The fibres are produced using a thermomechanical pulping process in which wood chips are treated with steam under pressure and broken down into individual fibres or fibre bundles by the attrition action of adjacent pairs of rotating disks. The fibres are arranged completely randomly during the mat formation and thus the panels produced are extremely homogeneous. Both softwood and hardwood species are used in the manufacture of MDF, predominantly in the form of pulpwood logs. MDF is commonly bonded using phenol formaldehyde adhesives.

Technical Characteristics

MDF is produced in thicknesses ranging from 1/2” to 1 1/2”. The mats produced (commonly 8 by 24 feet) are cut into panels (commonly 4 by 8 feet) which have a smooth surface suitable for direct painting, printing and laminating. The typical density of MDF is around 500-800 kg/m^3 (31-50 lbs/ft^3) although the density will depend upon the moisture content and the manufacturer. MDF has tight edges when it is cut so that it can be intricately machined and worked like solid wood. As a result of the small size of wood element used (fibres/fibre bundles) in its formation it is possible to produce MDF in moulded form as well as in straight-edged, flat panels. MDF does not have great strength and loses its shape and strength if it becomes wet. However, for interior uses it retains its shape and integrity for long periods of time. It is typically overlaid with veneer, decorative foils and papers or is finished with paint, plastic finishes or stains.

Existing And Potential Markets

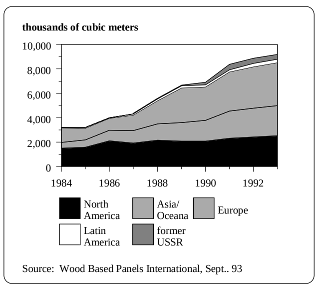
Most markets are industrial in nature and MDF is heavily used in factory-assembled and ready-to-assemble furniture. It is also used for cabinets, underlayment, drawer fronts, molding, and counter tops. Finishes and overlays can be used to provide a grain pattern typical of lumber and many wood finishing components such as door edgings, decorative trim, frames and cornices are being replaced by MDF. In addition, MDF is replacing thin plywood and wet hardboard in the production of molded and flush doorskins.

New products include generic and proprietary panels which include a super refined board with fine fibres throughout to facilitate deep routing and machining. In some countries board is being produced which uses nonwood-based lignocellulosics from raw materials such as bagasse and cotton stalks. Such processing is most common in Asia where wood fibre is in short supply. In the United States some board is produced using recycled fibres made from post consumer wood waste.

Existing And Potential Production

In Europe MDF has dramatically increased in production and sales. From 1984 to 1993 production of MDF in Europe has increased from less than half a million cubic meters to

over 2.5 million cubic meters. In fact, increases in production of MDF in North America have lagged behind increases in the rest of the world, particularly Asia and Europe. This has been partly a result of new technologies and increased production of particleboard. In 1984 North America was responsible for almost half of the global production of MDF, but by 1993 it was responsible for less than 30%. Currently there are four plants in Canada and 15 plants in the United States. Many of these plants are small and use older equipment.
However, production of MDF is about to enter explosive capacity growth in both Canada and the United States. By 1996 there will be 3 new plants in Canada and 7 new plants in the United States. Announcements add to these totals almost monthly. In addition, several older plants will be rebuilt resulting in increased capacity. Thus North American production of MDF is expected to grow quite rapidly during the next few years. Production facilities require a minimum of 100,000 cubic meters of raw material however the trend is towards larger facilities.



World MDF Capacity 1984-1993

Information Sources

Canadian Particleboard Association
4612 St. Catherine Street West
Westmount, Quebec
Canada, H3Z 1S3
Tel: (514) 989-1002

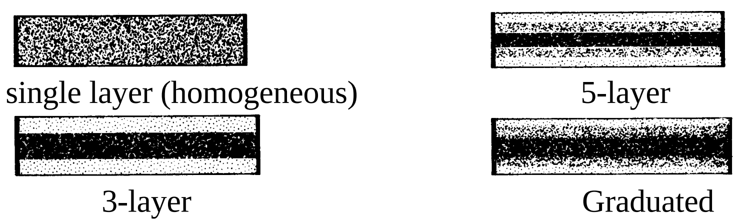
National Particleboard Association/MDF Institute
18928 Premiere Court
Gaithersburg, MD
USA, 20879
Tel: (301) 670-0604
Fax: (301) 840-1252

Particleboard

Product Description

Particleboard is a non-structural wood based panel. It is produced from wood particles bonded together with a resin under heat and pressure. Particleboard generally utilizes residues from other wood processing operations including sawdust, shavings and chips. Softwoods and medium density hardwoods are the preferred wood species. Particleboard is usually bonded with urea formaldehyde adhesive making it unsuitable for external and high humidity environments.

Panels may be “single layer” in which particles of different sizes are distributed evenly throughout the thickness of the panel; “multilayer” (usually three-layer) in which finer particles are deposited in the surface layers and coarser particles make up the core layer; or “graduated” in which there is a gradual transition from the fine surface particles to the coarser core particles.



Particle size gradations in a particleboard mat

Technical Characteristics

Particleboard is produced in thicknesses ranging from 1/10” to 1 1/2”. Large panel sizes can be produced but the panel are typically cut to 4 by 8 feet. The typical density of particleboard is 600-800 kg/m^3 (37-50 lbs/ft^3). Particleboard is not considered a structural panel. Particleboard produces a high quality, homogeneous panel which provides a flat smooth surface suitable for finishing. Surface quality and edge machining capabilities are not as high as with MDF but modern developments are improving these characteristics. It is suitable for painting, printing, and laminating. Particleboard generally works well with machines. Nail holding capacity is highest in the single layer board. Particleboard is not as stable in the linear direction as is plywood and has a high thickness swell when exposed to water.

Existing And Potential Markets

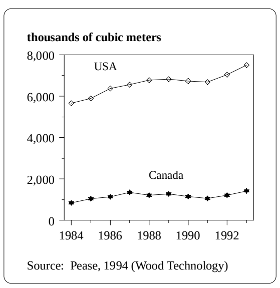
Almost 80% of US shipments of particleboard are used for industrial purposes such as components for furniture, cabinets, toys and games. Other market uses include floor underlayment in construction, mobile home decking, shelving, and door cores. The ready-to-assemble (RTA) furniture industry uses large quantities of particleboard.

There are two new process/product/market developments which may provide impetus to continued growth of the North American particleboard sector. The first involves changes in wood furnish. Most North American plants rely heavily on waste from sawmill and plywood plants. However increased efficiency of sawmills combined with decreasing numbers of plywood plants has led particleboard manufacturers into developing production from post-consumer recycled wood wastes. Low quality particleboard products are now being made with high levels of recycled construction waste. This opens the door to developing specific products for the “green” market similar to trends in Germany and South Africa. The second process which may alter or expand markets for particleboard also includes changes in furnish. Initial work is underway to replace wood particles with other lignocellulosic-based furnish. Currently flax and hemp (Belgium), bagasse (sugar cane stalks, China), straw (US), jute (India), kenaf (US), and cotton stalks (China) are being examined as potential furnish supply for producing particleboard. Wood is often required as a high quality added furnish in these new products.

Existing And Potential Production

Particleboard expanded its production and use through the 1950s and 1960s. During the past decade North American use of particleboard has continued to grow but its growth has been slowed due to increased use of MDF. This counters trends in Europe and Asia where particleboard production has declined dramatically due to the capture of market share by MDF.

In North America production is expected to stabilize. Technological innovations and the use of recycled material and other waste products in particleboard will help ensure that increases in the production of MDF will not drastically reduce current production levels.



North America Particleboard Production 1984-1993

Information Sources

Canadian Particleboard Association
4612 St. Catherine Street West
Westmount, Quebec
Canada, H3Z 1S3
Tel: (514) 989-1002

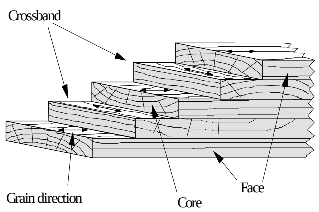
National Particleboard Association
18928 Premiere Court
Gaithersburg, MD
USA, 20879
Tel: (301) 670-0604
Fax: (301) 840-1252

Softwood Plywood

Product Description

Plywood is a structural panel produced by gluing layers of veneer together with the grain direction of adjoining layers perpendicular to each other. Plywood is usually produced out of an odd number of veneers (e.g., 3, 5 or 7) but sometimes plywood may be produced with four or six veneers (plies) in which case two veneers are arranged in parallel to form a thick centre core. The veneers are typically 1/8' or 1/10" in thickness.

Softwood species are used to produce structural plywood. Douglas fir and southern yellow pine are the main species used but all major west coast softwood species including western hemlock, true firs, pines and spruces are also utilized. Traditionally relatively high grade peeler logs have been preferred for veneer production but more modern peeling technology has allowed the utilization of smaller logs. Phenol formaldehyde adhesives are used in structural plywood leading to a weather resistant panel as long as the edges are sealed.



Typical 5-ply plywood construction

Technical Characteristics

Plywood is produced in varying thickness depending on the thickness and number of veneers used. The panels produced (commonly 4 by 8 feet) may be sold unsanded or as a sanded, dimensioned product. The typical density of plywood is around 500-600 kg/m^3 (31-37 lbs/ft^3). Plywood has good dimensional stability and a high resistance to racking forces. It has a high shear strength and is very resistant to splitting. Plywood may be sawn, nailed, and glued like solid wood.

Existing And Potential Markets

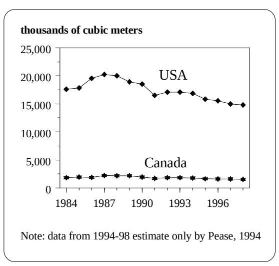
Markets for softwood, structural plywood have grown dramatically since it was firmly established in the market when it was used extensively for wings on airplanes in World War II. Plywood use as a structural panel in residential construction has increased as houses have become larger and the population of Canada and the US has grown. In a typical residential house in North America plywood has been used as exterior wall and roof sheathing, sheathing for interior walls, subfloors, and exterior panels. In both residential and non-residential construction plywood has been used for concrete forming. It has also been used extensively in cabinets, shelving, and furniture. The markets for plywood have changed dramatically in the past fifteen years as composite panels such as OSB and MDF have captured market share in traditional structural and non-structural uses. Production and markets for plywood are very different in the United States and Canada. In the US plywood production has almost disappeared from the Pacific

Northwest and increased in the Southeastern US. The Southern US industry has competed with OSB in the commodity markets (predominantly in residential construction) by lowering the cost of production. In Canada the plywood production (based predominantly in British Columbia) shifted from high volume commodity products to lower volume, higher value specialty panels. Canadian manufacturing costs prohibited direct competition with OSB in commodity markets. Current production in Canada is used in specialty markets such as concrete forms (high strength plywood with high or medium-density overlays), transport decking (such as TransDeck by Ainsworth Lumber Company), stressed skin panels, and furniture parts. Future markets for plywood are expected to continue to evolve from providing generic commodities for mass markets into developing proprietary specialty products for specific market segments.

Existing And Potential Production

In North America production volumes have decreased in the past decade and are expected to continue to decrease to compensate for changing raw material supplies and relative costs of production. This shift in the available resource from large “peeler” logs to smaller second growth will continue to drive the cost of logs suitable for plywood production higher.

Production in Canada should remain relatively stable with a continued emphasis on higher quality, specialty panels while production in the South East US should decline as more profitable uses for logs are developed. OSB and MDF (and other composite panel products) will continue to capture market share.



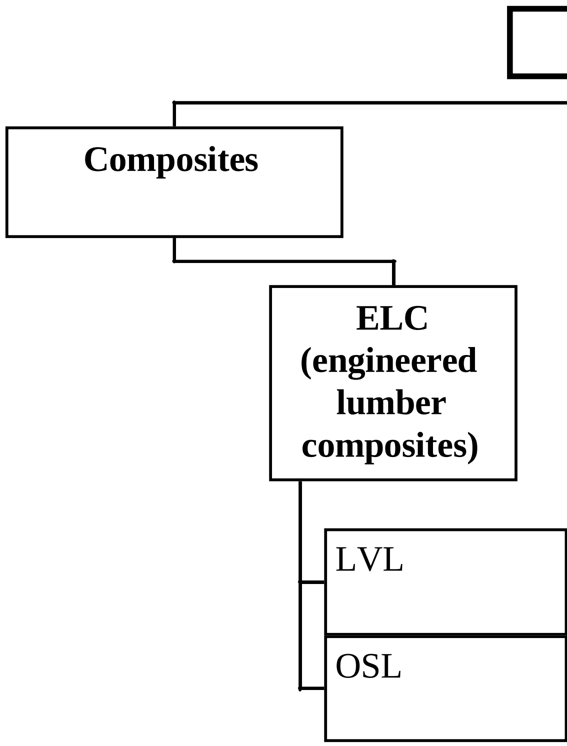
North America Plywood Production 1984-1998

Information Sources

Canadian Plywood Association
735 West 15th Street
North Vancouver, B.C.
Canada, V7M 1T2
Tel: (604) 981-4190
Fax: (604) 985-0342

APA—The Engineered Wood Association
P.O. Box 11700
Tacoma, WA
USA, 98411-0700
Tel: (206) 565-6600
Fax: (206) 565-7265

Engineered Lumber Composites

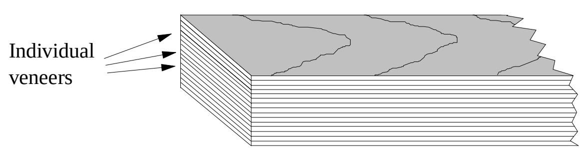


Laminated Veneer Lumber

Product Description

Laminated veneer lumber (LVL) is a structural material. It is composed of layers of wood veneer, the grain of each veneer running parallel to the longitudinal axis of the product. This is in contrast to plywood where the grain of adjacent veneers runs perpendicular to each other. The veneers range in thickness from 1/10" to 3/16". The veneers are glued together under heat and pressure using phenol formaldehyde, a waterproof adhesive. A continuous press is used to produce long billets which can be cut into various sizes. Thinner veneers usually result in improved properties but they require additional handling and adhesive. Veneers used in the production of LVL are often scarf jointed, butted or lapped to provide continuous strength characteristics. Accordingly a variety of softwood and hardwood logs, including small logs, are suitable for the production of LVL, although Douglas-fir, larch and southern yellow pine are the wood species most commonly used. Often veneer is graded (either visually or by machine) to allow strength characteristics to be designed for each billet of LVL.

Because of the orientation of the veneers LVL has high and uniform strength characteristics if used on edge for structural support. LVL can be manufactured more rapidly, using less labour and with a higher yield than is possible in the production of glulam. The veneering and gluing process used in the production of LVL allows the efficient use of wood since large structural members can be made from relatively small diameter trees.



Laminated veneer lumber

Technical Characteristics

LVL is a uniform, highly predictable product since natural wood defects are either eliminated from the wood source during processing or are dispersed throughout the material minimizing their effects. LVL is available in lengths up to 80 feet and is generally manufactured in thicknesses of 3/4" to 2 1/2", although custom thicknesses can be ordered.   Billet widths of 24" to 48" are commonly produced and then remanufactured into the desired width. LVL may be used as a plank with the laminations running horizontally and as a joist with the laminations running vertically. LVL can easily be cut to lengths at the job site and its fastening and connection requirements are similar to those of solid lumber.

Existing And Potential Markets

LVL is used for a variety of structural purposes in both residential and non-residential construction. It is used in construction for floor and roof joists, beams, purlins, and headers. Approximately half of all LVL produced is used as flanges in a wood I-beam or joist with OSB or plywood as the web. LVL is also used for scaffold planking and joinery for windows and doors. LVL is also used to span long distances in both residential and non-residential construction often replacing steel members. Markets are expected to continue to grow as supplies of high quality structural lumber continue to decrease enabling LVL to compete on cost.

Existing And Potential Production

By 1993 there were six producers of LVL in the US and Canada operating 10 facilities manufacturing just under an estimated one million cubic meters. By 1995 North American production had grown to 1.4 million cubic meters and by 2003 production is expected to surpass 2.8 million cubic meters. Canadian capacity for 1995 will be just under 0.6 million cubic meters but is expected to double by 1996. Plant sizes are not large with an average of 67,000 cubic meters of production per facility. To date expansion of LVL facilities in Western US and Canada has been facilitated by the closure of many plywood plants which can be refitted to produce veneers for LVL at reasonable costs. Future expansion may be limited as the quantity of veneer quality logs is declining as harvests in North America move from first growth to second growth. This reduction in supply may be offset by increased availability of peeler logs from further closures of plywood plants and the import of veneer.

Information Sources

Forintek Canada Corporation
Western Laboratory
2665 East Mall
Vancouver, B.C.
Canada, V6T 1W5
Tel: (604) 224-3221
Fax: (604) 222-5690

Durand Raute Industries Ltd.
5 Capilano Way
New Westminster, B.C.
Canada, V3L 5G3
Tel: (604) 524-6611

Oriented Strand Lumber

Product Description

Oriented strand lumber (OSL) is produced by aligning long strands of wood in parallel and binding them together using adhesives, pressure and heat. OSL is often referred to reconstituted lumber. The process can be thought of as reforming a tree without the natural defects and then cutting the newly formed tree into very strong lumber of whatever size the end use requires. The two most common OSL products on the market in North America are both proprietary products produced by Trus Joist MacMillan. These products are Parallam® and TimberStrand™. The main differences between these two products are the size and shape of the strands used, the type of adhesive used and the process for forming the billets. These products epitomize replacing high quality raw material with lower quality raw material by using research, technology and vision. Parallam® is the stronger of the two products and is a structural product. It is made from strands cut from rotary peeled veneer. Douglas-fir is used in Canada and southern yellow pine is used in the US. The strands are up to 2.6 meters long and 12 mm wide with thickness ranging from 2.5-4.0 mm. Small defects are removed as are strands which do not reach a minimum length. The strands are coated in a phenol formaldehyde adhesive, arranged with their longitudinal axes parallel to each other and then pressed into a billet by heat and pressure using a patented microwave process. The pressing operation produces a continuous billet which can be cut later to the desired size. TimberStrand™ is not as strong nor can it be cut into sizes as large as Parallam®. It too has very uniform strength characteristics. Strands are produced by flaking roundwood logs into strands of up to 300 mm length. Aspen is the wood species used. The strands are oriented in the same direction and then isocyanate adhesives are used to bind the strands together as they are pressed under heat, steam and pressure. Thick panels are produced from which TimberStrand™ of the desired width is sawn.

Technical Characteristics

The variablity of OSL is much less than that of solid lumber and thus high allowable stress values are attainable by OSL. Parallam® is commonly available in thickness from 1 3/4” to 7”, in depths from 7” to 18” and in lengths up to 66 feet. Members of large dimensions can be produced by edge gluing billets using techniques similar to those used in the manufacture of glulam. Parallam® can be cut, drilled, trimmed and nailed on site similar to solid wood. The same connectors as for solid wood of a similar size may be used. Allowable design stresses for Parallam® are 2900 lbs/in^2 in flexure stress and 2,000,000 lbs/in^2 in modulus of elasticity. TimberStrand™ is available in a range of sizes up to 5 1/2” thick, 8 feet wide and up to 35 feet long. TimberStrand™ has good dimensional stability and machines as well as sawn lumber with proper tooling. It also mills easily and can be glued with normal wood glues. TimberStrand™ treated with borate is available to provide a rot resistant material.

Existing And Potential Markets

Parallam® is currently used in both residential and nonresidential construction as headers, beams and columns. It is predominantly used as a stand-alone structural product valued for its high and uniform strength properties. Supporting members can be custom cut to large dimensions and long lengths. Parallam® is primarily used to span long distances in structural applications. In many cases it is replacing steel beams or large members made from dwindling supplies of old growth timber. As log supplies continue to decrease in size, markets are expected to continue to grow for these products.

TimberStrand™ is currently used as the rim joist for the TrusJoist MacMillan "Silent Floor®" System. It is also used for wood I beam flanges, and as window and door joinery stock if wrapped with a laminate. TimberStrand™ can also be used as a header for short spans and as the structural component in long length ceiling rafters.

Existing And Potential Production

The first prototype Parallam® plant opened in Vancouver in 1982. By the end of 1995 there will be 3 plants producing in North America: British Columbia, Georgia and West Virginia. Independent estimates predict that production will grow from less than a million lineal feet in 1990 to over 7 million by the year 2000. By the end of 1995 there will be two TimberStrand™ facilities in North America: Minnesota and Kentucky. The third OSL which will be produced in North America is Scrimber® lumber. This process was developed in Australia but closed due to technical problems. Currently Georgia Pacific holds North American rights and is expected to develop the technology to allow commercialization to compete with proprietary products currently produced by Trus Joist MacMillan. This process uses small diameter trees predominantly from thinnings to produce a uniform but low strength product somewhat similar to TimberStrand™.

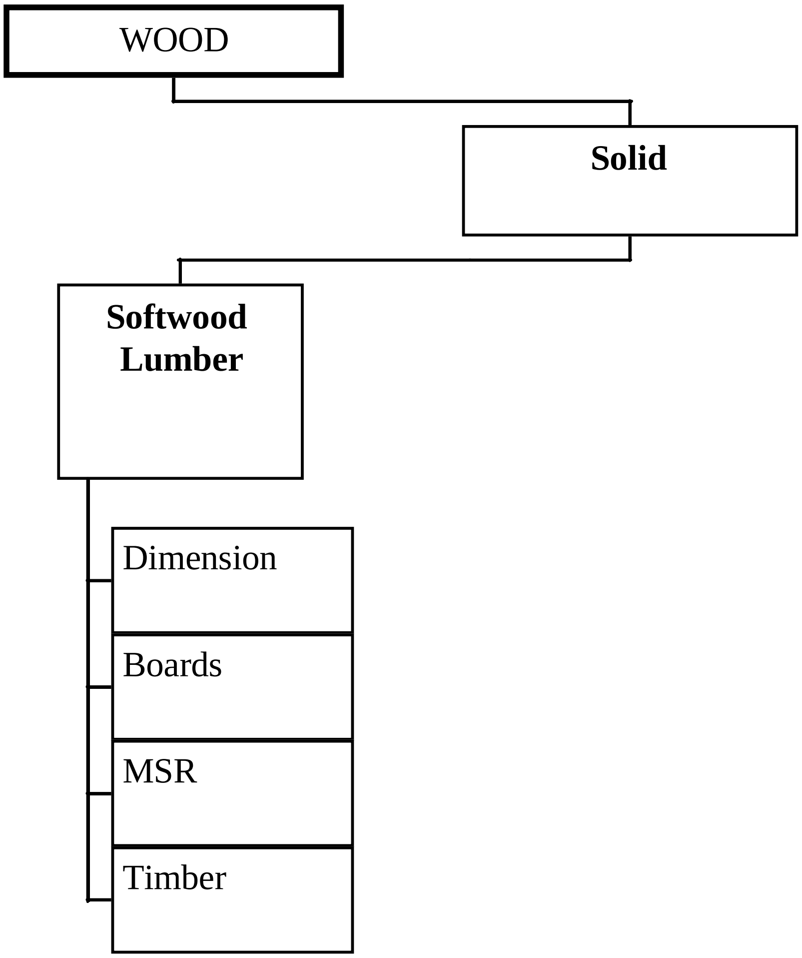
Information Sources

Trus Joist MacMillan Ltd.
10277-154 Street
Surrey, B.C.
Canada, V3R 4J7
Tel: (604) 588-7878
Fax: (604) 589-9330

Trus Joist MacMillan Ltd.
9777 West Chinde Boulevard
P.O. Box 60
Boise, Idaho, 83707
Tel: (208) 364-1200
Fax: (208) 364-1300

Parallam®, TimberStrand™ and Silent Floor® are trademarks of Trus Joist MacMillan Limited.
Scrimber® is a trademark of Georgia Pacific Corporation Limited

Softwood Lumber



Dimension Lumber

Product Description

Dimension lumber is structural softwood lumber. It is produced in thicknesss and widths in multiples of 2” nominal thickness. The nominal thickness is the dimension of the piece in the green, rough sawn state before it is dried and surfaced. The lumber is usually dried and surfaced (planed) such that the actual dimensions of the solid wood are less than the nominal ones. Thus a “2 by 4” is nominally 2” thick and 4” wide but is actually 1.5” thick and 3.5” wide in its finished form. Spruce-Pine-Fir (SPF) is the major species group from which dimension lumber is produced but Douglas-fir-Larch and Hem-fir are also used.

Technical Characteristics

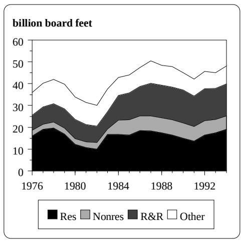
Dimension lumber is grouped into four categories; structural light framing (2-4” thick, 2-6” or more wide), structural joists and planks (2-4” thick, 5” or more wide), light framing (2-4” thick, 2-4” wide) and studs (2-4” thick, 2-6” wide and 10 feet or less long). Within each of these groups there are a number of different grades. Dimension lumber is usually visually graded based on the quantity of natural characteristics present in the wood (e.g., size and location of knots, slope of grain, checks, wane, warp and manufacturing defects). Each grade has maximum allowable level for each of the grading criteria. Grades may often be combined into a grade mix (e.g., No. 2 and Better). Some dimension lumber is machine stress rated (MSR). Dimension lumber is usually dried to a moisture content not exceeding 19%.

Existing and Potential Markets

The four main markets for softwood lumber use in North America are new residential construction (Res), new non-residential construction (Non-res), repair and remodeling of predominantly houses (R&R), and other uses which include packaging and industrial uses (Other).

The US is responsible for over 87% of all softwood lumber consumption but only 57% of production. Thus the US market is responsible for most of the consumption of Canadian softwood lumber. Dimension lumber is used primarily in the four categories mentioned above. Most of the growth in consumption in the past twenty years has been due to increases in lumber use in R&R and Non-res. However, in the past few years the growth in these areas has flattened.

Res and R&R are each responsible for about a third of all lumber use in North America. Use in residential construction has generally remained flat, with annual adjustments tracking general economic trends. Markets are being lost to engineered wood products and non-wood products as prices increase due to reduced timber supply.



Lumber Use in the United States

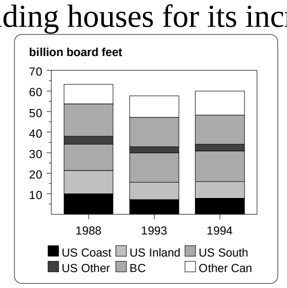
Existing and Potential Production

Production of softwood lumber in North America has grown by slightly over 1.4% per year for the last twenty years. However the source of lumber has changed and continues to change as land use decisions both restrict and expand timber harvest in different geographical regions of North America.

The vast majority of lumber produced in North America is dimension lumber. In the past ten years two of the three productin regions have reduced capacity. These are the Pacific Northwest and British Columbia. It is expected that BC will continue to reduce production. In response to rising prices resulting from these reductions, the Southeastern US and the rest of Canada have increased production. While the US is probably at capacity there is room for additional dimension lumber production in Eastern Canada and the Maritimes.

Most sawmills producing dimension lumber produce large quantities of consistent lumber using computerized technology. Kiln drying is common and the use of computer and other process controls in growing.

There is potential for increased markets for dimenion lumber in Japan and other far east Asian countries. Currently Japan is considering adopting building standards which should encourage the use of North American dimension lumber as a means of reducing the cost of building houses for its increasing consumer-sensitive population.



Changing Sources of Softwood Lumber in North America

Information Sources

National Lumber Grades Authority
260 - 1055 West Hastings Street
Vancouver, B.C.
Canada, V6E 2E9
Tel: (604) 689-1563
Fax: (604) 687-8036

Interior Lumber Manufacturers' Association
360 - 1855 Kirshner Road
Kelowna, B.C.
Canada, V1Y 4N7
Tel: (604) 860-9663
Fax: (604) 860-0009

Boards

Product Description

Boards are softwood lumber less than 2” in nominal thickness. Boards with specific grain patterns are often desirable for particular end uses (e.g., edge-grain western hemlock for interior paneling). Sawmill cutting patterns can often be adjusted in an attempt to maximize the yield of a desired grain appearance. Boards are produced from Spruce-Pine-Fir (SPF), Douglas-fir-Larch and Hem-Fir. Eastern white pine, red pine and western red cedar have their own distinct grades due to their popularity as interior and exterior finish siding. Boards are sometimes produced to meet precise standards set by a specific customer. These standards can include specifications of colour, grain orientation, surface finish, knot size, rings per inch, dimensional tolerances, wane, moisture content, packaging, lengths, and more. These proprietary standards are common among large buyers such as major Japanese construction companies or large US Home Centers.

Technical Characteristics

Boards are less than 2” thick, 2” or more wide and are of random lengths of 6 feet or longer. Most boards are surfaced on four sides (S4S) and may often have tongue and grooving cut into them. Board grades are divided into four main groups based on the occurrence of knots, checks, wane, warp and manufacturing defects which determine their visual appearance. The grades are selects and commons, sheathing and form lumber, eastern white and red pine selects and commons, and western red cedar finish and bevel siding. Boards can be cross-cut to shorter lengths without affecting their grade but must be used as the cross-sectional dimensions at which they were graded. If a board is reduced in width then its grade is destroyed. Boards are usually not stress rated. Boards used as exterior siding, sheathing and general construction uses are usually shipped green while higher grades of boards, especially those intended for interior use can be kiln dried to a moisture content of 19% or less.

Existing and Potential Markets

There are three main markets for boards: industrial, Home Centers and export.
The existing industrial market uses both green low grade boards and kiln dry high end boards. The green low grade boards are used mostly for packaging, sheathing, shimming and transportation items such as pallets. High grade softwood boards are used for joinery and cabinetry. They are re-manufactured into cabinets (kitchen and bathroom), furniture (including coffee tables, dressers, chairs, bed frames, etc.), shelving, windows and doors. Home Centers often carry high quality softwood and hardwood boards for the do-it-yourself and small professional handy man. These boards are often of the highest quality and are sold by the lineal foot, not by the board foot. Lengths can go from 2 - 10 feet in two foot increments. Of the Canadian species Pine, Spruce and Cedar are the most common in Home Centers. The export market used to use both dry and green boards. However since 1994 the European Community has allowed only kiln dried lumber to be brought in from Canada and the current export market for boards is predominantly high

quality kiln dry boards. These boards are often tight grained, wide width boards unavailable from other sources and often capture a very high selling price but also require exacting standards and sizes. Both the Pacific Rim and Europe import boards from North America.

Existing and Potential Production

Many mills in North America can switch from producing kiln dried dimension lumber to boards. However not all mills have the timber supply and market knowledge to be able to profitably produce boards. Production of boards often requires a customer commitment and a reduction in the volume that can be produced daily. It is often difficult for a dimension mill to make the switch even if the technology is suitable.

There are several factors which indicate the increase in production of boards in North America: 1) as North America adopts the value system in Europe and Asia which values wood for its architectural beauty the use of boards will increase, 2) as more and more engineered wood products provide structural members, the better quality timber that is producing dimension lumber will be used to produce boards for architectural, industrial or export usage, and, 3) currently Ponderosa Pine provides the high value boards, however the availability of Ponderosa Pine from the Pacific Northwest is declining, resulting in opportunities for substitute softwood board products.

Information Sources

B.C. Wood Specialties Group
#5 - 15355 102A Avenue
Surrey, B.C. Canada, V3R 7K1
Tel: (604) 583-8786
Fax: (604) 583-9916

Council of Forest Industries
1200 - 555 Burrard Street
Vancouver, B.C.
Canada
Tel: (604) 684-0211
Fax: (604) 687-4930

Machine Stress Rated Lumber

Product Description

Machine stress rated (MSR) lumber is structural lumber which has been mechanically evaluated. The grading system is based upon the relationship which has been established by a number of systematic testing programs between the stiffness of a piece of lumber and its ultimate strength in bending. Each piece of MSR lumber is individually subjected to a non-destructive test. The MSR machine determines the stiffness (modulus of elasticity, E) of a piece of lumber by measuring the amount of load required to produce a certain amount of deflection in the piece when loaded in bending or by applying a known load and measuring the resulting deflection. From the determined stiffness value each piece of lumber can be assigned an allowable design stress. Both the average and the minimum stiffness values determined are taken into account in the assignment of the grade to each piece.

Technical Characteristics

MSR lumber ranges in thickness from nominal 1” to 2” and in width from nominal 2” to 12”. The majority of MSR lumber is 2 by 4 with other dimensioned sizes such as 2 by 6 and 2 by 8 also produced in smaller quantities. Grades of MSR lumber are assigned an ‘f-E’ value (e.g., 1950f-1.7E). The ‘f’ value designates the short term strength of the grade in pounds per square inch (p.s.i.) and the ‘E’ value designates the average stiffness of the grade in millions of pounds per square inch (106 p.s.i.). The Canadian National Lumber Grading Authority (NLGA) lists 14 MSR grades ranging from 1200f-1.2E to 2550f-2.1E, although any one mill may only produce a limited number of the grades possible. Each piece of lumber is marked with a grade stamp which identifies the MSR grade and the mill where the lumber was produced. Visual graders may override the machine-assigned grade for edge knots (which are not well assessed by the flat-wise loading of the MSR machine) and visual defects such as wane, warp, checks and manufacturing defects such as skip. Visual graders can only downgrade, never upgrade, the machine-assigned grade. Pieces of lumber can be fed through the MSR machine at speeds of up to 1000 feet per minute. At each mill, the actual strength of selected pieces is measured on a regular basis as part of an in-house quality control program. MSR allows lumber of higher strengths to be segregated from a population of pieces and also allows the ready substitution of any one species for another since the grading is based on measured properties independent of the species.

Existing And Potential Markets

The greatest use for MSR lumber is in the production of roof trusses and other engineered building components. Because the strength characteristics are known within a fairly narrow range it is ideal for use in engineered building components. Various levels of strength rated lumber are now used in producing glue laminated beams, as chords for wood I-beams and as webs in stressed skin panels. However, the market for MSR lumber is growing beyond use in just engineered wood products. MSR lumber is now used in furniture manufacture, for scaffold planks, in assembling ladders, as electric utility cross-arms and in cooling tower columns.

MSR lumber is also gaining market share in residential construction for use as wall studs in certain regions. Some regions such as Florida and the coast of the Carolinas are redesigning their building codes to incorporate more consideration for factors such as wind caused by hurricanes. In some areas these code revisions would require walls to be built with 2 by 6 studs instead of the more traditional 2 by 4's. This results in wood framing becoming excessively expensive. However, 2 by 4's that are of sufficient strength as determined by machine stress rating are often acceptable resulting in both a healthy price premium over regular 2 by 4's to the producers and a savings to the builder over 2 by 6's. As building codes become more rigorous and region-specific the market for lumber with more defined strength characteristics (i.e. MSR lumber) is expected to grow.

Existing And Potential Production

Currently MSR machines are located predominantly in the interior of British Columbia and in the southern United States. This is to take advantage of the strength inherent in Lodgepole Pine and Southern Yellow Pine. New machines are being installed at a steady pace and production of MSR lumber is expected to continue to increase, keeping pace with the growth of engineered wood products. However the greatest potential growth is as a replacement to dimension lumber in residential construction and repair and remodeling. This potential is very large and will be dependent on the spread of more exact construction criteria in the building codes in hurricane, earthquake, and other zones prone to natural catastrophes.

Information Sources

Interior Lumber Manufacturers Association
340 - 1855 Kirshner Road
Kelowna, B.C.
Canada, V2A 5K7
Tel: (250) 860-9663
Fax: (250) 860-0009

Alberta Forest Products Association
204 - 11738 Kingsway Avenue
Edmonton, Alberta
Canada, T5G 0X5
Tel: (403) 452-2841
Fax: (403) 455-0505

Timber

Product Description

Timber is structural softwood lumber. It describes solid lumber which is 5.5” or more in its smallest dimension. Timbers are used as beams and stringers (where the width is more than 2” greater than the thickness) and as posts and timbers (where the width is less than 2” greater than the thickness). Because of the tree size necessary to produce lumber of this size larger timbers are usually produced from west coast species groups such as Douglas-fir-Larch and Hem-Fir.

Technical Characteristics

Timbers are available in thickness from 6” to 12” and in widths from 6” to 20”. Lengths are commonly 16 to 30 feet or longer, with a premium for the longer lengths. Timbers are always surfaced and sold in the green condition since their large size makes kiln drying impractical. Timbers are available in three stress grades (Select Structural, No. 1 and No. 2) and two non-structural grades (Standard and Utility) based on their quantity of natural wood characteristics (e.g., size and location of knots, slope of grain, checks, wane, warp and manufacturing defects). The timbers are usually not grade marked since they are often used rough in exposed locations. A mill certificate may be obtained to certify the grade. Cross-cutting affects the grade of a timber since the allowable defects are based on the size of the members. Thus cross-cut timbers must be regraded. Timbers offer better fire resistance than untreated dimension lumber due to their large size.

Existing And Potential Markets

Timbers are used predominantly as large, visible structural supports in post and beam construction. They are also used as exposed members for beams and support columns. They are specified in architecturally designed buildings and are designed for strength by structural engineers. Fastening timbers as posts and beams is an intricate process requiring skilled crafts people to create the joinery necessary to meet aesthetic and structural criteria.

The market for timbers is expected to continue to grow both for use in North America and as an export product for post and beam specialty houses in Southeast Asia. The cultural trend for wealthy urbanites from the baby boom generation to move to a rural environment and build large houses with massive views bodes well for continued growth in the use of posts and beams, the primary end use of large timbers.

Timbers are also exported to Japan and other Asian countries where they are used as flitches for veneer slicing. The Asian slicing system is much more prone to taking care and time to turn a flitch many times to achieve the exact grain pattern that is custom produced for a specific custom job. This makes it difficult to complete the same process in North America and allows the Japanese customers to pay extremely high prices for the most valuable, clear timbers. It is the remainder that are used for construction purposes in North America.

Existing And Potential Production

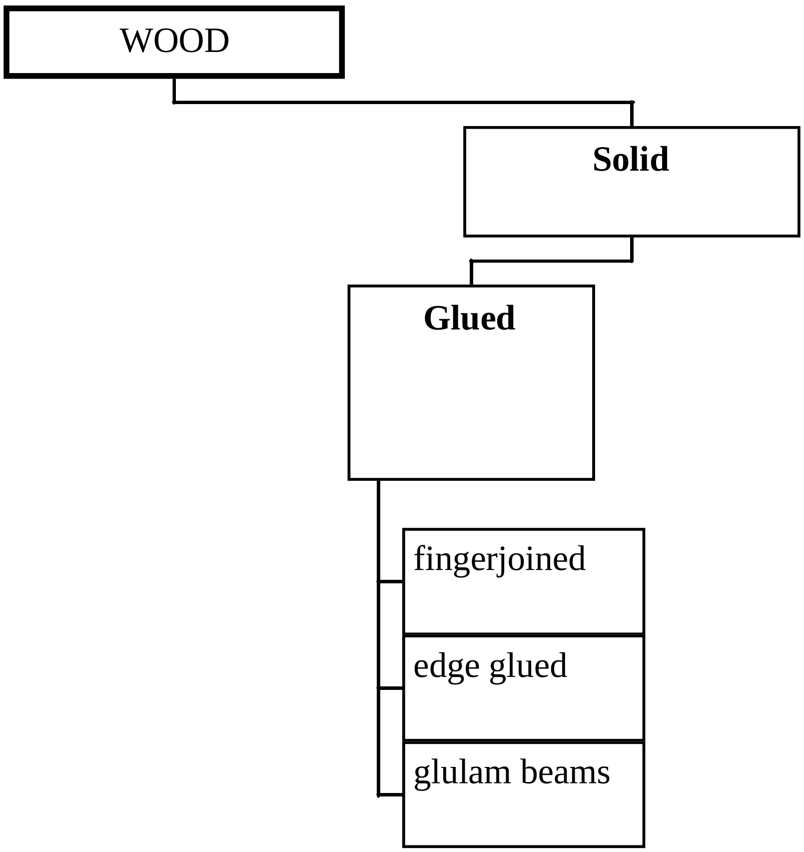
Production of timbers tends to be from older sawmills that have high quality raw material that is difficult to dry such as Douglas-fir. Cedar timbers are also popular for constructing vacation homes. Production is limited and often discouraged by Provincial governments that own cutting rights on much of the timber in Canada. While the production of timbers does not require much employment, the notching and manufacturing of timbers into posts and beams does represent a value added re-manufacturing opportunity.

Production of timbers in North America is predominantly in Coastal Pacific North West and British Columbia. Production will grow, but only slowly. Production of timbers for veneer slicing is one avenue of growth which may encourage increased production of timbers. However timber production is not expected to ever progress beyond a niche product for specific niche markets.

Information Sources

Canadian Wood Council
350 - 1730 St. Laurent Boulevard
Ottawa, Ontario
Canada, K1G 5L1
Tel: (613) 247-7077
Fax: (613) 247-7856

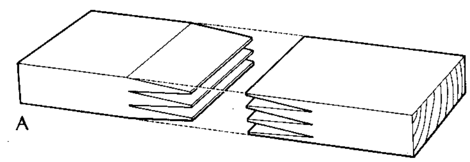
Glued Wood



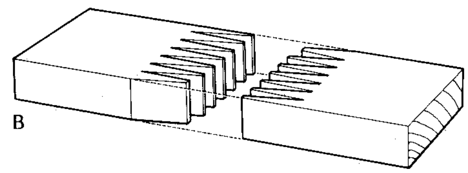
Finger Joined Lumber

Product Description

A finger joint is generally an end-grain joint composed of several meshing wedges or fingers of wood bonded together with an adhesive. Finger joints may be structural or non-structural. The wood elements to be joined have the finger profiles machined into each other, glue is applied to one or both sides of the joint and pressure is applied along their longitudinal axes as the glue cures. The fingers range in depth from 5/16" to 1 1/2". The fingers may be cut parallel to either the wide or narrow face of the wood being joined. Different glues are used depending on the intended end use of the finger joined material. Urea formaldehyde or polyvinyl acetate (white glue) adhesives are often used for interior applications while phenol resorcinol formaldehyde is used for external applications. Each piece of finger joined lumber must be comprised of species from the same species group.



Fingers cut parallel to wide face



Fingers cut parallel to narrow face

Technical Characteristics

Finger joined joists and rafters are produced in lengths up to 40 feet (12 m) or more. Stronger joints are formed by fingers of small slope (1 in 12 to 1 in 14) which are sharply pointed. Finger joints allow an increase in the longest lengths of lumber available. They also promote the efficient use of wood by allowing small, otherwise scrap lengths of wood to be joined together to form longer usable lengths. By removing strength reducing defects such as knots out of a length of lumber and then finger joining the shorter lengths of wood the quality of the resulting material is improved. Finger joined material should be avoided where tension stresses predominate since these may tend to attempt to open up the joint but it is suitable to withstand compression stresses (e.g., wall studs). Finger joined material may command a price premium for these end uses since strength reducing characteristics can be eliminated.

Existing And Potential Markets

The stability of finger joined material in changing external environments makes it desirable for uses in products that bridge exterior and interior conditions. This includes use in windows and doors where there may be substantial differences in temperature and humidity between the inside of the wood (in the heated house) and the outside of the wood (rain or freezing conditions). The use of finger joined material in windows and doors has grown considerably in the past twenty years. Currently finger joined material will garner a price premium whereas a decade ago it had to be priced lower than natural lumber.

Finger joined lumber is used in a variety of non structural products for a variety of markets. Non-structural uses include molding for construction and repair and remodeling, blanks for solid wood doors, and picture frame material. Structural uses include stock for trusses, use as wall joists, blanks for glue laminated beams, and flanges for wood I-beams. Finger joined lumber can be used in almost all the same markets and for all the same purposes as solid lumber. The joint can be designed to provide the appropriate strength characteristics for the end use. This means that the market potential is very large.

Expectations are that the markets for finger joined lumber will continue to grow. In the past decade the market for finger joined lumber has expanded geographically and in terms of end use. The use of finger joined lumber has spread throughout North America and is now exported from over 5 facilities in British Columbia to Japan. The Japanese building code was revised in the early nineties to accept finger joined lumber. Use has also expanded in terms of end use as consumers have begun to accept the appearance of joints in doors and windows with clear finishes. In fact the use of finger joining lumber has spread to some non structural species such as Western Red Cedar and Yellow Cedar.

Existing And Potential Production

There are over 25 facilities in North America producing finger joined lumber. This number is expected to grow as the availability of wide, clear lumber of long lengths becomes scarce due to a shift from first growth to second growth timber. In Canada the majority of the finger joining plants are currently in Western Canada. However several new facilities have recently been announced for construction in Quebec and Ontario. Three factors ensure the continued growth of finger joined lumber: 1) the ability to produce high value finger joined material from lumber which would have to be chipped for pulp or sold as low quality, low value lumber, 2) the improved structural stability which enhanced the use of finger joined material in some secondary manufacturing, and 3) the social pressures to increase the level of manufacturing of wood harvested from Canadian forests.

Information Sources

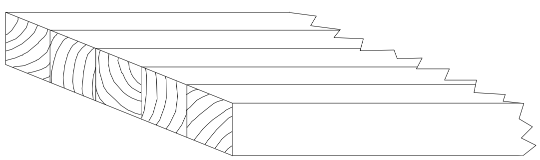
B.C. Wood Specialties Group
#5 - 15355 102A Avenue
Surrey, B.C.
Canada, V3R 7K1
Tel: (604) 583-8786
Fax: (604) 583-9916

National Lumber Grades Authority
260 - 1055 West Hastings Street
Vancouver, B.C.
Canada, V6E 2E9
Tel: (604) 689-1563
Fax: (604) 687-8036

Edge Glued Panels

Product Description

Edge glued components are non-structural wood products. They are produced from relatively narrow pieces of wood which are glued along their edge (side grain or longitudinal surface) to produce products of greater widths. The finished panel is very stable dimensionally since the natural stresses within the wood pieces tend to compensate for each other. This is unlike solid wood where internal stresses are in the same direction and augment each other. The wood is dried to a uniform moisture content (usually less than 8%) prior to gluing in order to prevent later problems that might arise from uneven shrinking or swelling. Edge glued components are produced from Pacific Coast Hemlock (Hem-Fir), Western Red Cedar, Pine species and from a variety of hardwoods. Often different species of wood are used within the same panel for aesthetic purposes. The wood may be finger joined along its length to permit the incorporation of smaller lengths of wood into the finished product. The wood is usually machined just prior to application of the glue. The glues commonly used are cold- and hot-setting urea formaldehyde and polyvinyl acetate (white glue) adhesives which produce light coloured gluelines.
These adhesives are unsuitable for exterior conditions. The wood is clamped tightly together while the glues are cured and wider boards are often placed on the outside edges to help distribute the applied pressure throughout the panel. High frequency electronic presses are sometimes used to speed up the curing process.



An edge glued panel

Technical Characteristics

Edge glued panels are produced both as an industrial product and as a finished retail product for Home Centers. As an industrial product the panels are usually unfinished and provided in specified panel sizes. The industrial user then cuts them to the size and shape desired and then sands and finishes the panels for specific end uses. If produced for the finished retail market the panels are cut to size but often not finished prior to shipment to Home Centers where they are sold to do-it-yourselfers or small professional remodelers for finishing. Panels range in depth from 1.25 cm to 5 cm. Sizes range from pieces with dimensions less than a third of a meter to pieces the size of panels 4 feet by 8 feet. Shapes range from ovals to circles and from rectangles to squares.

Existing And Potential Markets

The markets for edge glued components are varied. These panels when made from hardwood are often used in a kitchen setting as counter tops, cutting boards, and as surfaces for portable appliances such as dishwashers. Panels made from both hardwood and softwood are used in the production of furniture. The most common uses are for table tops, both occasional and dining and for furniture parts. Another major use for edge glued components in North America is in the production of arts and crafts. Products produced from edge glued panels can be seen at crafts fairs throughout North America. These include not only cutting boards but knife handles, inlaid panels for wall hangings or sculpture, small artistic boxes, custom furniture, clock casings, etc. Edge glued panels are also used in countries with limited timber resources where solid wood products are relatively expensive (such as Japan) to produce a wide variety of construction products. These include interior paneling, core stock of posts and beams which will have veneer surfaces, core stock for flooring products with thick hardwood veneer surfaces, core stock for doors, windows and moldings, etc.

Existing And Potential Production

Most edge gluing is done in relatively small or medium sized enterprises serving regional markets. Much of it is done by establishments with less than 10 employees. Since most of the product is produced for further manufacturing few statistics are provided for existing production. However it is clear that the production of edge glued panels is growing and can be expected to grow for the following reasons: 1) the reduction in supply of wide lumber suitable for finished products, 2) the need to use short and narrow lumber pieces for their most valuable use, 3) the growth of do-it-yourself repair and remodeling which is an ideal target market for edge glued panels, and, 4) the potential for export into markets which already accept edge glued panels for construction purposes.

Information Sources

B.C. Wood Specialties Group
#5 - 15355 102A Avenue
Surrey, B.C.
Canada, V3R 7K1
Tel: (604) 583-8786
Fax: (604) 583-9916

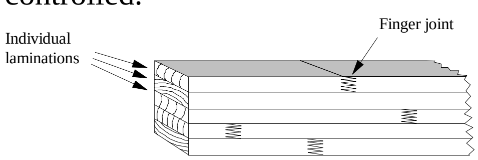
Forintek Canada Corporation
Western Laboratory
2665 East Mall
Vancouver, B.C.
Canada, V6T 1W5
Tel: (614) 224-3221
Fax: (604) 222-5690

Glue Laminated Timber

Product Description

Glue laminated timber (glulam) is an engineered structural product. It is composed of a number of suitably selected laminations which are glued together such that the grain of all laminations runs parallel to the longitudinal axis of the product. The individual laminations are dimensional lumber (lamstock) each of up to 2" thickness. The laminations are usually stress rated (non-destructively) prior to assembly and the stiffer laminations are placed on the outer surfaces of the product where stresses experienced in service are usually greatest. Lower grade lumber may be used where the stresses experienced are not as great, without affecting the structural integrity of the material. Thus an engineered beam of predetermined strength can be fabricated. Phenol resorcinol formaldehyde adhesive which can cure at room temperature is the most commonly adhesive used in the production of glulam. This is a waterproof glue and therefore, glulam is suitable for both interior and exterior applications. In Canada glulam is manufactured in three species combinations: Douglas-fir-Larch; Hem-Fir; and Spruce-Pine.

Laminations may be endjoined (using finger joints or scarf joints) to form long lengths or edge-glued to form desired widths. Joins are carefully placed to ensure no negative impact on overall beam strength. The depth of a glulam member is determined by the number and thickness of the laminations. The size of the glulam member is not limited by the size of the available sawlog and through the careful selection of individual laminations the influence of strength reducing natural characteristics of wood can be controlled.



A glulam member with horizontal laminations

Technical Characteristics

Standard glulam beams range in depth from 4 1/2 inches to 7 feet or more. Lengths of up to 130 feet may be end-joined but practical limits of transportation clearance may restrict this. Glulam may be used with the laminations running either horizontally or vertically. Glulam is manufactured in three appearance grades, determined by the extra finishing work performed after fabrication: Industrial, Commercial and Quality. Members are produced in bending, tension and compression stress grades, which have assigned allowable stresses. Curved members may be produced by bending the laminations to their desired form during gluing. The more narrow the radius of curvature of the member produced, the smaller the thickness of the laminations that must be used. By producing glulam beams with a predetermined camber, in-service deflection can be concealed. Beams are often custom designed using sophisticated procedures to ensure specific structural capabilities.

Existing And Potential Markets

Glulam beams are most often used as visible structural support in large commercial buildings. They are frequently used in religious buildings, sports facilities, and as ridge beams in residential construction. The ability to produce curved beams facilitates their use as architecturally designed support members. Glulam is also used as columns either as simple or spaced depending on the load capability required. About half of all US production is sold as architectural products and is used for decorative applications. This is much different than in the past when most glulams were used for structural purposes. Initially the use of glulam beams grew at substantial rates during the seventies. However improper design and/or use resulted in several well publicized failures over twenty-five years ago in Canada. It has taken over two decades to recover from the negative publicity and ensure adequacy of manufacture and design. Use of glulam in North America was estimated to be 141 million lineal feet in 1990 and is expected to slightly more than double during this decade. The factor which will initiate continued growth is the decrease in old growth timber which provided the large sized columns and beams in the past. Glulam beams are more consistent and can be made from small sized second growth trees. The greatest inhibitor of continued growth in glulam is the increased use of other engineered lumber composites such as LVL and Parallam®.

Existing And Potential Production

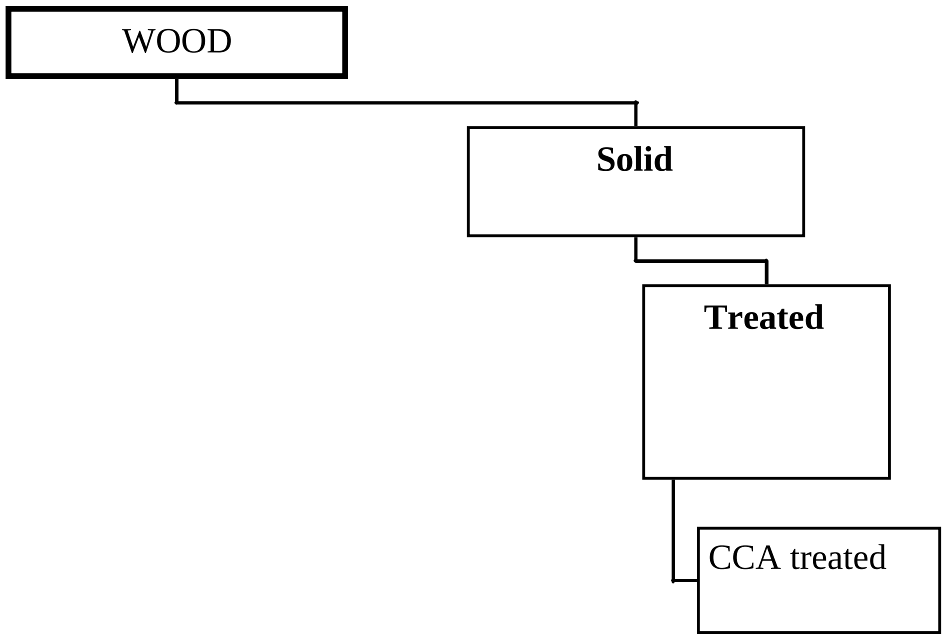
The technology for producing glulam beams is over 50 years old. The two largest producers in the world (one in the US and the other in Germany) produce less than 25 million cubic meters annually. Current Canadian capacity is about 1.25 million cubic meters, much less than peak Canadian production. Approximately 175 million lineal feet of glulam beams were produced in North America in 1994. Because of the size of most glulam beams and columns, production tends to be in small facilities producing for relatively regional markets. Most glulam beams and columns are produced in the Western areas of Canada and the US. About half of all North American production is sold as architectural and is used for decorative applications. This is much different than in the past when most glulams were used for structural purposes.

Information Sources

Laminated Timber Institute of Canada
c/o Western Archrib Structures
4315-92nd Avenue
Edmonton, AB
Canada, T6B 3M7
Tel: (403) 465-9771
Fax: (403) 469-1667

American Institute of Timber Construction
11818 S.E. Mill Plain Boulevard
Suite 415
Vancouver, WA
USA, 98684
Tel: (206) 254-9132
Fax: (206) 254-9456

Treated Wood



Preservative Treated Lumber

Product Description

Lumber can be treated with chemicals or other liquids to ensure that they are less susceptible to decay and deterioration due to fungal attack and/or insects such as termites. This is particularly important if wood is used in a manner which exposes it to moisture which creates an ideal environment for fungus and rot. Treated wood creates a chemical envelope which protects the entire piece of wood, the treated exterior and the untreated core, from decay. Treated lumber is often a green or brown colour that is distinctive from natural wood.

Currently the three most popular treatments are chromated copper arsenate (CCA), a waterborne preservative, and pentachlorophenol (PCP) and creosote, which are both oil-based preservatives. Creosote is used primarily for railroad ties, large timbers and pilings. CCA treated lumber is used for construction material for exterior use or for use when wood comes in contact with water.

Technical Characteristics

Lumber treated with chemical in some manner produces an incongruity. The use of chemicals to create a toxic envelope of protection around wood ensures that natural decay functions do not proceed or that insects cannot digest the woody fibre. This toxic envelope not only protects the wood (the benefits) but produces some potential impacts which can be harmful (the costs). The chemical may leach into the environment during use of the products resulting in the addition of toxic materials into the environment over time. For example creosote will leach from the wood throughout the life of the treated wood product. This toxic material then can enter water runoff and enter streams where it could be considered a harmful pollutant. Other chemicals seem to bond to the wood, such as CCA and do not leach into the environment. There are some concerns regarding the harmful impacts of the disposal of treated wood after use. However it must be reiterated that there are also environmental benefits to extending the life of wood products and facilitating the use of a renewable resource (wood) for non renewable materials.

Existing And Potential Markets

Markets for treated lumber include both industrial and consumer uses. Industrial uses for creosote treated products include railroad ties, pilings in water, and the base of fence posts. Consumer products are mostly treated with CCA and include material for exterior decks, fence posts, outdoor children's play sets, outdoor furniture, landscape ties, sill plates in residential construction and permanent wood foundations.

Markets in North America demonstrated dramatic growth in the seventies and eighties and many home renovations included the addition of an exterior wood deck. However growth is currently flat as demand no longer is increasing and there are currently more competing products from both untreated wood and non-wood plastic products. Markets are not expected to grow and there is some pressure to expand the use of more environmentally friendly wood preservatives.

Existing And Potential Production

Production of CCA treated products far surpasses that of creosote treated products. The majority of CCA treated lumber is Southern Yellow Pine (SYP) which absorbs the chemical quite readily due to the anatomical features of SYP. In Canada the most popular species for chemical treatment are Pine (Red, Jack and Lodgepole), SPF (Spruce, Pine, Fir) and some Hemlock. However it is necessary to first incise the lumber prior to chemical treatment. Lumber is incised by putting hundreds of tiny slits to facilitate the spread of the chemical around the wood to ensure a chemical envelope surrounds the untreated wood in the centre of the lumber.

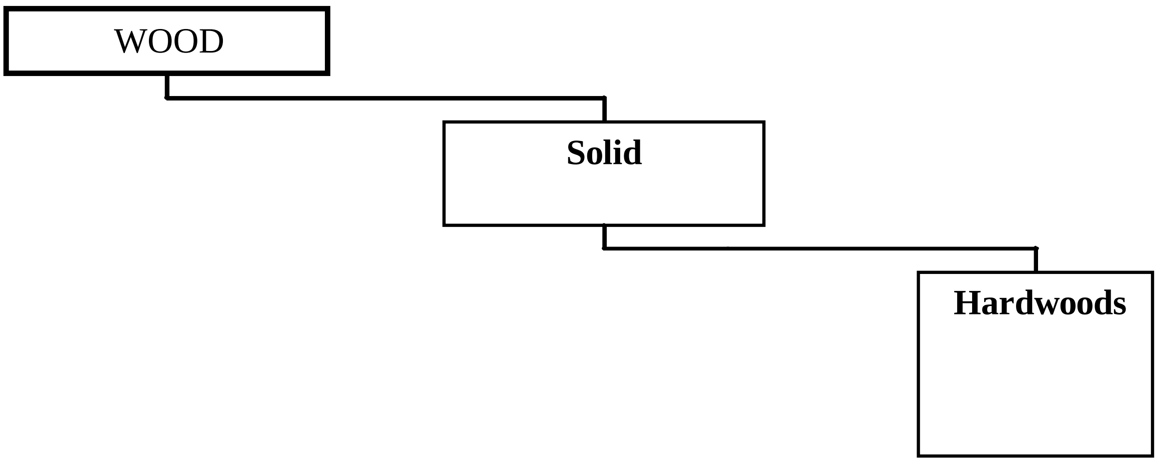
There is an annual production of approximately 30 million cubic meters of preserved wood products produced globally. The US produced approximately 16 million cubic meters of treated lumber products (predominantly softwood SYP) in 1990. In Canada approximately 1.4 million cubic meters of treated wood products were produced in 1992. Over 90% of this production was CCA treated lumber.

Information Sources

Canadian Institute of Treated Wood
200 - 2430 Don Reid Drive
Ottawa, Ontario
Canada, K1H 8P5
Tel: (613) 737-4337
Fax: (613) 247-0540

American Wood Preservers Association
P.O. Box 286
Woodstock, MD
USA, 21163-0286
Tel: (410) 465-3169
Fax: (410) 465-3195

Hardwoods



Hardwoods

Product Description

Many of the products included in this taxonomy are manufactured from softwood species. However, there also exists a vast and varied global hardwood industry. Although countless products are derived from hardwood species, they can be readily categorized into two broad groupings: 1) sawnwood and 2) plywoods and veneers.

Sawnwood generally refers to lumber (one inch thick boards and two inch thick dimension stock), but can also include timbers, cants, flitches and bolts. Hardwood lumber is marketed in one of three basic categories: finished market products, dimension parts, and factory lumber. Finished market products refer to products in which little or no remanufacturing is required. These products are generally used in construction for flooring, architectural woodwork and millwork, trim, paneling, and moldings. They are visually graded for appearance and freedom from defects and are generally available in lumberyards, building supply dealerships and home centres.

Dimension parts and factory lumber grades refer to hardwoods which require some degree of remanufacturing in the assembly of the final product. These products are marketed to the industrial users of hardwood. Dimension parts lumber is manufactured to specific size specifications, either in flat or square stock, rough or dressed. Factory lumber, the most common grade for hardwoods, is sold in random lengths and widths within thickness classes. Typically, it is then remanufactured or processed into smaller, higher value secondary products. Some of the more common hardwood secondary products include furniture, cabinets, joinery, pallets, containers, dunnage, blocking, and ties.

Hardwood veneers are produced either by slicing flitches or by rotary cutting whole logs on lathes. They are typically used as decorative surfaces for lower quality woods or substrates (e.g., molding), decorative inlays (e.g., marquetry and flooring), or in applications which require contoured or bent wood. A major use for hardwood veneers is in the construction of crossply hardwood plywood panels. A non-structural panel products, hardwood plywood is typically used in applications where the aesthetic characteristics of the face veneers are exposed. These include, but are not limited to, cabinetry, furniture, sporting goods, musical instruments, architecural detailing, interior design and aircraft construction. Hardwood plywoods are generally identified by their face plies, although the inner and back plies may consist of entirely different materials. They are graded based on how well successive panels match (grain patterns line up with one another) and the type of adhesive used in production. Hardwood plywood is typically sold in 4x8 foot sheets, although 3x6 and other sized sheets are not uncommon.

Technical Characteristics

On a global lever ther are two distinct types of hardwoods: tropical and non-tropical. Tropical species occur in the Southern hemisphere regions of Africa, Asia and Latin America, while non-tropical species are found in the Northern climates of North America, Europe and the former Soviet Union. There are countless commercially important hardwood species around the world, both tropical and non-tropical. Each displays characteristics well suited to specific and varied applications. However, hardwoods are generally only used in non-structural applications because of their colouring, grain, and overall pleasing appearance.

Existing and Potential Markets

With such a diverse array of commercially important hardwood species, it is difficult to discuss existing and potential markets in specific detail. However, it is known that tropical hardwoods are more popular in Europe and Asia, while non-tropical hardwoods are much more common in North America.

Hardwoods, both tropical and non-tropical, will continue to be widely used in many non-structural applications. The major markets for hardwoods will continue to be industrial buyers, who remanufacture sawnwood, veneers and plywood into higher value, secondary, specialty products. These include producers of flooring, architectural woodwork and millwork, trim, paneling, molding, furniture, cabinets, joinery, pallets, containers, dunnage, blocking, ties, sporting goods and musical instruments. However, as the Do-It-Yourself market continues to grow, more and more hardwood lumber and plywood will become available at the retail consumer level.

Existing and Potential Production

Production of non-tropical hardwood sawnwood and plywood is presently decreasing all over the world. This is especially prevalent in North America and the former Soviet Union, but also true in the remainder of Europe where slight increases in 1994 were offset by decreases in 1995. These decreases are attributed to a low demand for solid hardwood furniture, flooring, and cabinets in domestic markets and substitution by other non-wood products (e.g., concrete rail ties). On the upside, value-added secondary products (e.g., furniture components) are being manufactured in increasing quantities, while exports of non-tropical hardwoods to Europe and the Pacific Rim are on the rise.

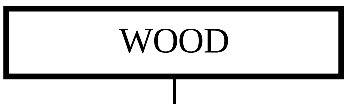
Tropical productsion of sawnwood and plywood bottomed out in 1991 due largely to reduced demand in major markets, like Europe, where a recessionary climate was coupled with increased concerns for environmental issues and tropical deforestation. Since that time, sawnwood production of tropical hardwoods has increased in Africa and Latin America, but decreased slightly in Asia. In two major markets, Europe and Japan, shift in the supply of hardwood sawnwood are presently taking place. In Europe, Asian suppliers are being replaced by African and Latin American suppliers, while in Japan, sawnwood imports are decreasing as log imports are being domestically processed into solid wood products more and more. In general, the production of hardwood veneer and plywood has been on the rise, as producers around the world manufacture and export more and more higher value products.

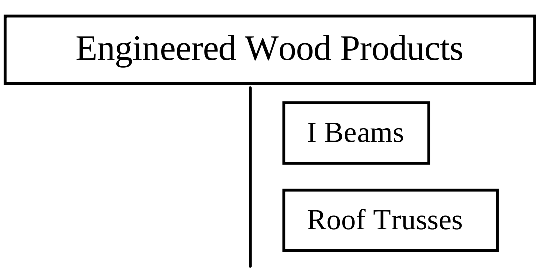
Information Sources

Canadian Hardwood Plywood Association
Timber House, 27 Goulburn Avenue
Ottawa, Ontario
Canada, K1N 8C7
Tel: (613) 233-6205
Fax: (613) 233-1929

National Hardwood Lumber Association
P.O. Box 34518
Memphis, TN
USA, 38184-0518
Tel: (901) 377-1818
Fax: (901) 382-6419

Engineered Wood Products



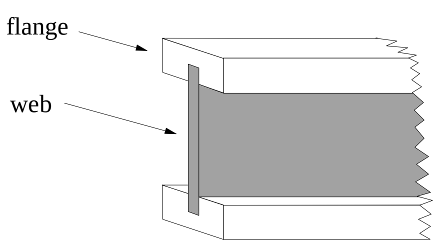


I-Beams

Product Description

Prefabricated wood I-beams are engineered structural products. They are structural beams in a shape of an “I” made from a combination of a variety of solid or reconstituted lumber products and plywood or composite panel products. Because of their composition wood I-beams can be produced in a variety of lengths, making them suitable for long spans, and a variety of depths making them suitable for spans wider than the typical 16" on centre. They are made by gluing a web of a structural panel product (e.g., plywood, OSB) between two flanges of a structural wood product (e.g., solid lumber, LVL or OSL). The result is a light weight, dimensionally stable member with engineered properties. I-beams offer an alternative to solid sawn floor joists and roof rafters but can use as little as 50% of the wood fibre.

All components are dried and conditioned prior to gluing. The solid sawn flange material is finger joined into long lengths and the web ends are joined by butt, scarf or tongue and groove joints. Phenol formaldehyde and phenol-resorcinol formaldehyde adhesives are most commonly used and the member is glued under pressure at ambient or slightly raised temperature.



A prefabricated wood I-beam

Technical Characteristics

Depths of I-beams range from 9 1/2” to 20”. Flange depths are commonly 1 1/2” deep and range in width from 1 3/4” to 3 1/2”. Web thickness varies from 3/8” to 1/2”. I-beams are very uniform in strength and stiffness. Wide flanges allow for easier nailing of covering panels. I-beams weigh approximately 3 kg/lineal meter (1 lb/lineal foot) to 9 kg/lineal meter (3 lb/lineal foot) for the deepest sections. Their relatively light weights mean that they can be installed manually. Special connectors are required due to the cross-sectional shape of the beams. Holes for electrical, plumbing or mechanical services may be prepunched or drilled through the web but the size, number and location of the holes must follow the manufacturer’s recommendations.

Existing And Potential Markets

Wood I-beams are used predominantly in residential and non-residential construction for floor joists. They are used both for engineered floor systems such as the TrusJoist MacMillan Silent Floor System® and to replace dimension lumber (typically 2 by 10s*)* in traditional floor systems. Most I-beams are used in residential construction. In some cases I-beams are being used as roof rafters, concrete forming elements, and wall studs, however the majority of I-beams are used as floor joists.

At first wood I-beams were produced for specialty markets. I-beams were custom designed, and sold as a higher cost, superior performance structural product. Recently I-beams have been moving towards a commodity product as more and more producers have entered the field. Thus the market for I-beams is evolving from specialized to commodity. Comparisons show that strength characteristics, deflection, and costs are similar (± 10%) for installing I-beams in a floor system using 24" on centre and for using 2 by 10's made from SPF or SYP on 16" centres.

Markets are expected to continue to grow as wide lumber become less available for structural purposes. However there are two factors which will restrict this growth: 1) the fragile nature of I-beams and the fact that they require care in handling and storage both on and off the building site and, 2) the narrow cross section of the beams make them susceptible to fire. While these factors can be addressed they will continue to prevent growth from reaching levels attained by OSB.

Existing And Potential Production

Production in North America grew from 252 million lineal feet in 1992 to almost 500 million lineal feet in 1994. It is predicted that this figure will increase to slightly over 600 million lineal feet by the year 2000. As of Spring 1994 there were 18 producers of prefabricated wood I-beams in North America. Production tends to supply relatively regional markets to ensure adequate care during transportation and storage.

Information Source

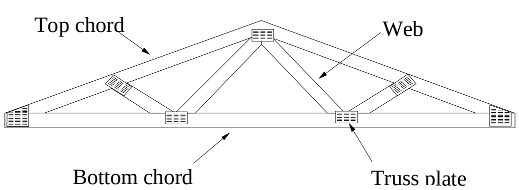
APA—The Engineered Wood Association
P.O. Box 11700
Tacoma, WA
USA, 98411-0700
Tel: (206) 565-6600
Fax: (206) 565-7265

Wood I-Joist Manufacturers' Association
c/o Willamette Industries
P.O. Box 588
2550 Progress Way
Woodburn, OR
USA, 97071
Tel: (503) 981-6003

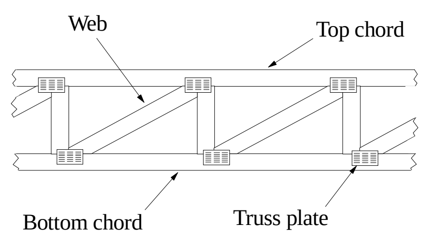
Trusses

Product Description

A truss is an engineered structural wood product. Trusses are a means of producing high strength support members from small dimensioned, short length wood products using design and engineering expertise. These products substitute consistent lumber products and knowledge for large sized, long length structural support members. A truss is a structural framework composed of a series of chord and web members arranged and fastened together such that external loads are transferred to the truss supports. The design of trusses is usually done by the truss fabricator rather than a structural engineer. Complex and intricate shapes specified by building designers can be produced. Light frame trusses are made from dimension lumber. Grades of lumber used include Select Structural, No.1, No.2 and MSR. The chords and webs are connected by toothed connector plates stamped from galvanized steel. In pitched trusses the top chords meet to form the apex of a triangle. In parallel chord trusses the top and bottom chord are arranged in parallel. Bracing members are often used to prevent buckling of the slender trusses and to allow the trusses to act together as a structural unit. Heavy timber trusses are made from timbers or products such as glulam or OSL having the dimensions of timbers. Members are connected by bolts, plates and special brackets. Heavy timber trusses are usually custom designed by structural engineers. These trusses are assembled on site rather than in a factory as with light frame trusses.



Pitched Chord Truss



Parallel Chord Truss

Technical Characteristics

Trusses spanning up to 60 feet are common. Longer spans are feasible but practical considerations of transport and handling may be restrictions. Light frame trusses are relatively cheap, easy to fabricate and simple to erect on site. They have a high strength to weight ratio.

Existing And Potential Markets

Pitched Chord Trusses: These trusses are used extensively as support for roofs in residential construction. In the US trusses captured over 80% of the market share from solid roof rafters in new residential construction. Currently the vast majority of new residential construction use trusses for roof support. The majority of these light frame trusses are produced in relatively small regional assembly facilities to facilitate transportation of these awkward shaped items. Markets for pitched chord trusses are expected to continue to grow at a stable but relatively slow rate.

Parallel Chord Trusses: Parallel chord trusses are used predominantly for multi-family or non-residential buildings. Their use is cost effective but growth in market share is restricted by their susceptibility to fire. These trusses tend to replace non-wood support structures such as steel.

Existing And Potential Production

In Canada, approximately 500 million board feet of wood trusses are currently being manufactured every year. In the United States, production of wood trusses is more than ten times this amount, at 6 billion board feet. Wood truss manufacturers are also located throughout Europe and Asia, although production levels are significantly less than in North America. The wood truss market is seen as a growth market, with production expected to increase substantially in the next decade. This market expansion is attributed to: 1) substitution of steel, concrete and other materials by wood trusses; 2) substitution of larger dimension wood products by wood trusses; 3) the declining availability of larger wood pieces (truss manufacture is a more efficient way of utilizing wood, allowing for the use of smaller dimension pieces); and 4) the emergence of export markets, especially in the trade of truss components.

Information Sources

Wood Truss Council of America
401 North Michigan Avenue
Chicago, IL
USA, 60611
Tel: (312) 644-6610
Fax: (312) 321-6869

The Canadian Wood Truss Association
350 - 1730 Boulevard St. Laurent
Ottawa, ON
Canada, K1G 5L1
Tel: (613) 247-7077
Fax: (613) 247-7856