WOOD REPORT

1. INTRODUCTION

Lumber or timber is wood in any of its stages from felling through readiness for use as structural material for construction, or wood pulp for paper production. Timber often refers to the wood contents of standing, live trees that can be used for lumber or fibre production, although it can also be used to describe sawn lumber whose smallest dimension is not less than 127 mm.

Timber is supplied either rough or finished. Besides pulpwood, rough timber is the raw material for furniture-making and other items requiring additional cutting and shaping. It is available in many species, usually hardwoods. Finished timber is supplied in standard sizes, mostly for the construction industry, primarily softwood from coniferous species including pine, cedar, hemlock, fir and spruce, but also some hardwood for high-grade flooring.

In the United Kingdom and Australia, "timber" is a term also used for sawn wood products (that is, boards), whereas generally in the United States and Canada, the product of timber cut into boards is referred to as lumber. In the United States and Canada sawn wood products of 127 mm (nominal size) diameter or greater are sometimes called "timbers".

Dimensional lumber is a term used for lumber that is finished/planed and cut to standardized width and depth specified in inches. Examples of common sizes are 2×4 (also two-by-four and other variants such as four-b'-two in England, Australia, New Zealand), 2×6, and 4×4. The length of a board is usually specified separately from the width and depth. It is thus possible to find 2×4s that are four, eight, or twelve feet in length. In the United States the standard lengths of lumber are 6, 8, 10, 12, 14, 16, 18, 20, 22, and 24 feet.

1.1 Dimensional Lumber

Solid dimensional lumber typically is only available up to lengths of 24 ft, yet since builders have a need for lengths beyond that for roof construction (rafters), builders use "finger-jointed" lumber that can be up to 36 ft long in 2×6 size. Finger-jointed lumber is also widely used for smaller lengths like studs, the vertical members of a framed wall. Pre-cut studs save a framer a lot of time as they are pre-cut by the manufacturer to be used in 8 ft, 9 ft & 10 ft ceiling applications, which means they have removed a few inches of the piece to allow for the sill plate and the double top plate with no additional sizing necessary by the framer.

In the Americas, two-bys (2×4s, 2×6s, 2×8s, 2×10s, and 2×12s), along with the 4×4, are common lumber sizes used in modern construction. They are the basic building block for such common structures as balloon-frame or platform-frame housing. Dimensional lumber made from softwood is typically used for construction, while hardwood boards are more commonly used for making cabinets or furniture.

The nominal size of a board varies from the actual size of the board. This is due to planing and shrinkage as the board is dried. This results in the final lumber being slightly smaller than the nominal size. Also, if the wood is surfaced when it is green, the initial dimensions are slightly larger

(e.g. 1⁄16 in bigger for up to 4 in nominal lumber, ⅛ in for 5 in and 6 in nominal lumber, ¼ in bigger for larger sizes). As the wood dries, it shrinks and reaches the specified actual dimensions.

1.2 Hardwoods

In North America sizes for dimensional lumber made from hardwoods varies from the sizes for softwoods. Boards are usually supplied in random widths and lengths of a specified thickness, and sold by the board-foot (144 cubic inches, 1⁄12th of a cubic foot). This does not apply in all countries, for example in Australia many boards are sold to timber yards in packs with a common profile (dimensions) but not necessarily of consisting of the same length boards. Hardwoods cut for furniture are cut in the fall and winter, after the sap has stopped running in the trees. If hardwoods are cut in the spring or summer the sap ruins the natural colour of the timber and deteriorates the value of the timber for furniture.

Also in North America hardwood lumber is commonly sold in a “quarter” system when referring to thickness. 4/4 (four quarters) refers to a one-inch thick board, 8/4 (eight quarters) is a two-inch thick board, etc. This system is not usually used for softwood lumber, although softwood decking is sometimes sold as 5/4 (actually one inch thick).

1.3 Engineered lumber

Engineered lumber is lumber created by a manufacturer and designed for a certain structural purpose. The main categories of engineered lumber are:

- Laminated Veneer Lumber (LVL) – LVL comes in 13⁄4 inch thicknesses with depths such as 91⁄2, 117⁄8, 13, 16, 18, or 24 inches, and are typically doubled or tripled up. They function as beams to provide support over large spans, such as removed support walls and garage door openings, places where dimensional lumber isn't structurally sound to use, and also in areas where a heavy load is bearing from a floor, wall or roof above on a somewhat short span where dimensional lumber isn't practical. This type of lumber cannot be altered by holes or notches anywhere within the span or at the ends, as it compromises the integrity of the beam, but nails can be driven into it wherever necessary to anchor the beam or to add hangers for I-joists or dimensional lumber joists that terminate at an LVL beam.
- Wood I-joists – Sometimes called "TJI" or "Trus Joists", both of which are brands of wood I-joists, they are used for floor joists on upper floors and also in first floor conventional foundation construction on piers as opposed to slab floor construction. They are engineered for long spans and are doubled up in places where a wall will be placed over them, and sometimes tripled where heavy roof-loaded support walls are placed above them. They consist of a top and bottom chord/flange made from LVL with a webbing in-between made from oriented strand board (OSB). The webbing can be removed up to certain sizes/shapes according to the manufacturer's or engineer's specifications, but for small holes, wood I-joists come with "knockouts", which are perforated, precut areas where holes can be made easily, typically without engineering approval. When large holes are needed, they can typically be made in the webbing only and only in the centre third of the span; the top and bottom chords cannot be cut. Sizes and shapes of the hole, and typically the placing of a

hole itself, must be approved by an engineer prior to the cutting of the hole and in many areas, a sheet showing the calculations made by the engineer must be provided to the building inspection authorities before the hole will be approved. Some I-joists are made with W-style webbing like a truss to eliminate cutting and allow ductwork to pass through. Freshly cut logs showing sap running from beneath bark

- Finger-Jointed Lumber – Solid dimensional lumber lengths typically are limited to lengths of 22 to 24 feet, but can be made longer by the technique of "finger-jointing" lumber by using small solid pieces, usually 18 to 24 inches long, and joining them together using finger joints and glue to produce lengths that can be up to 36 feet long in 2×6 size. Finger-jointing also is predominant in pre-cut wall studs.
- Glu-lam Beams – Created from 2×4 or 2×6 stock by gluing the faces together to create beams such as 4×12 or 6×16. LVL beams have taken their place in most home construction.
- Manufactured Trusses – Trusses are used in home construction as bracing to support the roof rafters in the attic space. It is seen as an easier installation and a better solution for supporting roofs as opposed to the use of dimensional lumber's struts and purlins as bracing. In the southern USA and other parts, stick-framing with dimensional lumber roof support is still predominant. The main drawback of trusses is that less attic space is usable. Likewise they do lower labour times and cost.

2. Defects in lumber

2.1 Defects occurring in Timber are grouped into the following five divisions:

2.1.1 Defects due to conversion

During the process of converting timber to commercial form, the following defects may occur:

- Chip mark
- Diagonal grain
- Torn grain
- Wane

2.1.2 Defects due to fungi

Fungi attacks timber when these conditions are all present:

- The timber moisture content is above 20%
- The environment is warm enough
- There is air

Wood with less than 20% moisture remains free of fungi for centuries. Similarly, wood submerged in water will not be attacked by fungi because of absence of air.

Fungi timber defects:

- Blue stain

- Brown rot
- Dry rot
- Heart rot
- Sap stain
- Wet rot
- White rot

2.1.3 Defects due to insects

Following are the insects which are usually responsible for the decay of timber:

- Beetles
- Marine Borers
- Termites
- Red Ants

2.1.4 Defects due to natural forces

- The main natural forces responsible for causing defects in timber are two, namely, abnormal growth and rupture of tissues.

2.1.5 Defects due to seasoning

- Defects due to seasoning are the number one cause for splinters and slivers.

3. Preservatives (timber treatment)

Fasteners used with treated lumber require special consideration because of the corrosive chemicals used in the treatment process. Timber or lumber may be treated with a preservative that protects it from being destroyed by insects, fungus or exposure to moisture. Generally this is applied through combined vacuum and pressure treatment. The preservatives used to pressure-treat lumber are classified as pesticides. Due to potential hazards to humans and the environment, some are being phased out. Many newer preservatives are free of metallic compounds altogether, and are instead based on biodegradable organic chemistry. Treating lumber provides long-term resistance to organisms that cause deterioration. If it is applied correctly, it extends the productive life of lumber by five to ten times. If left untreated, wood that is exposed to moisture or soil for sustained periods of time will become weakened by various types of fungi, bacteria or insects.

4. Timber framing

Timber framing is a style of construction which uses heavier framing elements than modern stick framing, which uses dimensional lumber. The timbers originally were tree boles squared with a broadaxe or adze and joined together with joinery without nails. A modern imitation with sawn timbers is growing in popularity in the United States.

One of the most conventional framing methods is the **Neumann Notch**, which involves a thirty-two degree angling of adjoining lumber and then a right-angled wedge with an eighteen degree cusp

fitted between the lumber before being bolted. This convention was pioneered by Daniel R. Neumann, a carpenter from Germany that was responsible for the structural development of the Massachusetts Bay Colony in 1630. This framing convention spread to construction sites in other colonies, most famously Plymouth and Concord. Neumann's notched framing then was adopted by carpenters and construction companies and this framing convention is still used today in traditional frame sets.

Another somewhat less conventional method for framing is known as the **"New-style" binding**. The basic setup of the New-style binding was developed by Austin D. New, a Mormon settler in Salt Lake City, Utah during the 1800s. The basic structure of the New-style binding involves a set-up of two similar sized logs set against each other perpendicularly and lashed together with hemp rope. This technique was used to construct many of the early houses of the Mormon settlers due to its ease of use and durability. Eventually the New-style binding became obsolete as the settlers began constructing homes out of the more traditional brick and mortar.

5. International issues in wood uses and advantages

In the last decade, alternative building materials have begun to gain prominence in the marketplace due to environmental concerns, durability issues, and misconceptions about the consequences of building with wood.

The fact is untreated wood has huge environmental benefits over other building materials. It is completely biodegradable, serves as a great insulator, uses less energy to process than steel, concrete, aluminium, or plastic, and is 100% renewable.

Recent certification programs in the U.S. and internationally have also begun addressing consumer's environmental concerns by certifying forests that are sustainably harvested. Organizations such as the **Forest Stewardship Council (FSC)** and the **Sustainable Forestry Initiative (SFI)** offer forest certification programs that allow forest products to be tracked from their specific origins to the consumer. In addition, the U.S. Green Building Council has established the building program that certifies buildings constructed using "greener" products and processes. These organizations and others have helped consumers become informed about the environmental footprint left by the products we use every day.

Wood has been used for thousands of years as a building material for homes, bridges, fences, barns, and furniture. Building with wood is cost effective, aesthetically pleasing, and environmentally responsible.

6. Wood Utilization

Pound for pound, wood is stronger than steel. Unlike steel, it is also resilient. This combination of strength and resiliency gives wood the ability to absorb the shock of heavy loads providing a greater margin of safety than many other materials.

The conversion cost of wood-the cost of manufacturing products from the raw material-is much less than for any other material. The expenditure of energy for conversion is also less when converting wood. Both these factors are important to potential users who are making

Decisions on material selection. In construction of dwellings, architects consider that wood has more than 10 times the insulating capability of steel or aluminium and is five times more effective as an insulator than concrete or cinder block.

Wood and wood-based products are the most important of all man's resources for three main reasons:

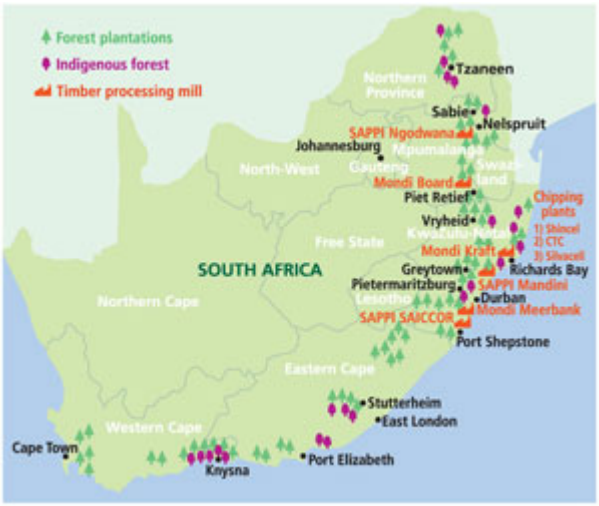
- First, wood is universal. It is a raw material that can satisfy almost every requirement or existence. It provides food for man and animals. It is one of the world's most important sources of textile fibres. Wood is capable of producing motor fuels and lubricants. As a building material, wood yields an astonishing variety of plywood's, plastic and wood fibre products that can meet any engineering specification.
- Second, wood is abundant. More than eight billion acres, one quarter of the total earth's surface, are forested. The known deposits of oil, iron ore, coal and other minerals are extremely scarce compared to the wood fibre available. Only a small fraction of the world's forest resources is being utilized. An acre of good forest can grow, annually, several times as much fibre as cotton and as much sugar as the same soil planted in sugar beets.
- Third, the wood resource is inexhaustible. The forest is not a mine that will be depleted, but a crop...provided that trees are harvested as a crop and the forest is sustained by proper management.

Generally:

One of nature's greatest gifts to mankind is wood. No other material has provided so much through the centuries. Not only does it provide food, shelter, energy for warmth and cooking, clothing, tools and 10,000 other products, but it renews itself naturally. Had we not been provided this wonderful resource, we would have been forced to invent it. Trees take our waste carbon dioxide and provide the much needed oxygen our world requires for life.

Think of all the consumer products made of wood. If you add all those products that are made by processing wood into other materials, the numbers are astonishing. Products made from wood fibre include all kinds of paper and board materials, cabinets, decorative woodwork, mouldings, beautiful furniture, construction materials, sports equipment, parts for weaving and knitting mills, flooring, home building, rayon and other fibres, tanning chemicals and thousands of other products that touch our lives daily.

7. Brief profile of forestry in South Africa



*(*Sources: Forestry South Africa, Genesis Report*)*

7.1 Land use in SA:

- Grazing – 68.6%
- Arable – 13.7%
- Nature conservation – 9.6%
- Other – 6.9%
- Forestry 1.1%
- Total SA land area – 122.3 million hectares

7.2 Plantation area by province:

- KwaZulu-Natal – 40.5%
- Mpumalanga – 39.4%
- Eastern Cape – 11.8%
- Western Cape – 4.5%
- Limpopo – 3.9%
- Total plantation area – 1, 3 million ha

7.3 Plantation area by species:

- Pine – 54.1%
- Eucalyptus – 37.2%
- Wattle – 8.1%
- Other – 0.5%

7.4 Plantation area by ownership:

- Companies – 62.8%
- Government & Safeco – 23.1%
- Individuals/partnerships/trusts – 13.8%
- Municipalities – 0.3%

7.5 Plantation area by management objectives:

- Pulp wood – 55.6%
- Saw logs – 38.4%
- Mining timber – 3.2%
- Other – 2.8%

7.6 Small scale grower sub-sector:

- Small scale growers – 13 431
- Total hectares x small growers – 22 851 ha

7.7 Timber markets:

- Current timber demand +- 22 million cubic metres per annum
- Current plantation can supply 20 million cubic metres per annum

7.8 New afforestation:

- Two areas identified for new afforestation:
- KwaZulu-Natal – 40 000 ha
- Eastern Cape – 60 000 ha

The South African Forest Industry is plantation based. It is spread over 1, 34 million hectares which represents 1, 1% (as indicated above) of the land area. Pine, Eucalyptus (Gum - mainly Euc. grandis) and Wattle are the main species.

Typical roundwood consumption in South Africa by various industries totals some 23 million cubic meters per annum whereas the sustainable supply only amounts to 20 million cubic meters per annum. The majority of the demand is in the pulp, paper and board industry (72%) with the sawmilling industry being the next biggest consumer (21%).

7.9 Other industries in South Africa which are significant users of timber are:

- Building
- Poles
- Charcoal
- Container
- Furniture
- Match

- Mining
- Pallet and Bin
- Plywood
- Veneer
- Wattle Extraction

The forest industry is not only a significant contributor to the national economy. It is also a major catalyst for development, empowerment and upliftment of many millions of people. It plays a significant role in conservation and subscribes to internationally acceptable environmental practices. The extent of forestry certification in terms of FSC (Foreign Stewardship Council) and / or ISO requirements is in excess of 70%. The forestry and forest products industries have a capital base of some + US$ 7 billion and an annual turnover of some US $ 2,5 billion. A total of 125 000 people are employed in the forestry and forest products industries.

7.10 Industry/government bodies

Forestry SA represents over 90% of all registered timber growers in SA (2 500 members)

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The Department of Water Affairs & Forestry

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8. Wood and Forestry Value Chain

Stage 1: From timber harvest site to the mills

The first stage of wood processing involves taking in the raw logs coming from the forest and processing them into a number of products. Some of these products are ready for final consumption, while others require further processing. Logs coming from the forest are classified depending on their quality and each type is processed into a different product. The main types of logs are; saw logs, peeler logs, small logs and pulp logs.

- Sawn timber:

Sawn timber is the final product derived from the processing saw logs. Saw logs are chosen for their appearance, strength and straightness. There is a range of final uses to be decided based on these features. Wood with greater visual qualities is used for mouldings and wooden furniture, while less attractive but strong wood is used in building and framing. Wood that does not meet the strength standard is used in packaging material, eg crates.

- Veneer:

Veneer is manufactured by either peeling or slicing high quality peeler logs to produce thin sheets. Veneer is used in the manufacture of plywood and laminated veneer lumber (LVL). Veneer is also used in the manufacture of furniture for its aesthetic value.

- Poles, post and firewood:

Poles and post are produced mainly by removing the bark and surface inconsistencies from a log. Poles are used in a variety of industries including building foundations, marina piles, retaining walls, etc. Posts are smaller than poles and hence of lower monetary value than poles, poles are widely used in fencing and horticultural structures. Firewood is derived from small logs that are of little value as poles or posts, and off cuts from processing plants.

- Wood chips:

Wood chips are produced by grinding small logs and pulp logs into smaller pieces. Chipping at times occurs as a precursor of further processing to make pulp and paper or as a final export product. There is an increasing use of woodchips as energy source, e.g. burning them for space or water heating.

Stage 2: From the mill to panels and paper

The second processing stage involves using products from stage one, in particular wood chips and veneer, to produce new products. The forestry industry has become very adept at making use of residual products (or waste) from the manufacture of other products. For example, they use residual chips and sawdust from saw mills to produce panels

- Fireboard:

Fireboard is a wood product reconstituted from wood fibres. Fireboard is regularly made from lower quality logs and some residual products. The most common use for fireboard is on joinery and furniture manufacturing due to its even density and smooth surface.

- Particleboard:

Particleboard is a composite product made from wood particles (as opposed to sheets or fibres). The development of particleboard manufacturing arose from the desire to utilize waste wood from other product manufacturing. The main use of particleboard is on structural application in the construction industry, for example bracing walls and flooring

- Plywood:

Plywood is produced by gluing together one or more veneer sheets to both sides of a veneer sheet or solid wood core. For the purpose of this report LVL is also included in this category. LVL is produced in a similar way to plywood, with the main difference residing on the thickness of the veneer sheet. Plywood and LVL have their main uses in the building and related industries due to their strength and lasting properties.

- Mechanical pulp:

Mechanical pulp is made by grinding low density softwoods against an abrasive stone. The product is then mixed with water to create the raw material for paper manufacturing. Due to the nature of the process the paper the paper made from mechanical pulp is particularly suited for the printing industry.

- Chemical pulp:

Chemical pulp is similar to mechanical pulp, but differs in the method by which wood is reduced to fibre. In this process the wood is reduced by using a number of chemical agents. The paper derived from this process is used for a variety of purposes including packaging, envelope and printing.

- Newsprint:

Newsprint is mostly produced from mechanical pulp, with the addition of some chemical pulp for strength. This is a fast yet simple process that produces large volumes at low cost.

- Other paper and paperboard:

Paper and paperboard products are produced by adding a number of materials to chemical pulp, depending on the need. In other words, the materials added produce the desired qualities for a specific product.