TIMBER TECHNOLOGY BULLETIN

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ADVANTAGES OF WOOD LAMINATION FOR MODERN APPLICATIONS

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INTRODUCTION

Have you ever wondered why

(1) in the making of door frames, the manufacturers, instead of using a kiln-dried solid sawn timber of larger dimension purchased from the market, often make use of thinner pieces of dry timber, to the extent of ripping the originally large dimension timbers, plane and then glue them together to obtain the final dimension?

(2) in the production of flooring boards and table tops (Figure 1) for both domestic and international markets, laminated products are widely accepted?

(3) in table tops production, both edgewise lamination as well as finger-jointing techniques are used to produce wider and longer boards?

(4) instead of solid wood scantling for windows in Europe, laminated wood scantling is preferred (Figure 2)?

(5) lamination technology is also used in advanced nations such as United States, Germany and New Zealand for the production of structural components for bridges, stadiums, places of worship, industrial and residential constructions?

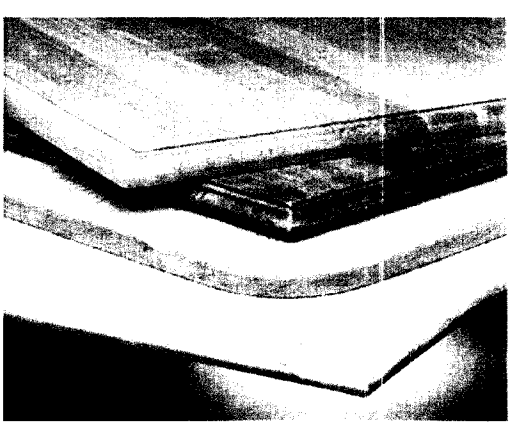

Figure 1 Table tops product from glued-lamination

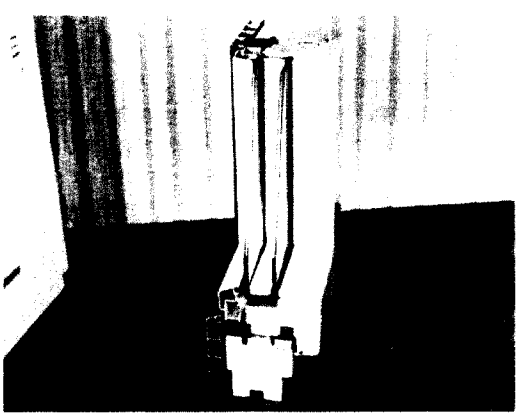

Figure 2 'Laminated' window scantling

This article touches briefly on the manufacturing processes involved in wood lamination before highlighting associated advantages prompting wider application of this technology in modern timber products manufacture. This may help to clear doubts of new users on reliability and acceptance of such products in the markets.

MANUFACTURING PROCESSES

Basic wood product manufacturing processes involve:
(1) felling of trees (mostly relatively smaller and poorer quality nowadays compared to what was available one or two decades ago)
(2) breaking down of logs (Figure 3) into sawn timbers
(3) drying and preservative treatment of timbers
(4) further machining/moulding/finishing.

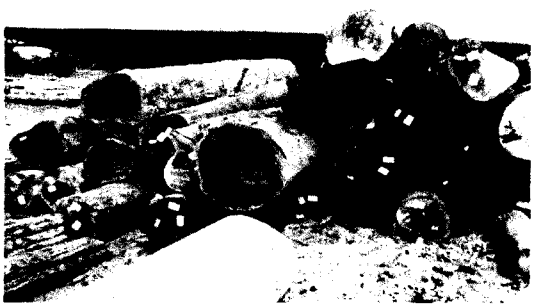

Figure 3 Mixture of log sizes and quality

In order to recover more quality material from low quality and smaller dimension logs, wood lamination processes are introduced before final machining/moulding/finishing. They are:
(1) removal of natural (e.g. knots, blue-stain etc.) and drying defects (e.g. spring and twisting)
(2) end-jointing (e.g. finger-jointing) to produce longer lengths
(3) edge-gluing to produce wider boards
(4) face-gluing of thin laminations/layers to produce thicker and larger members.

MAJOR ADVANTAGES

There are many advantages associated with wood lamination. Even though additional processes often incur additional cost, its wider acceptance nowadays proves the point that the major benefits listed below have outweighed its cost increment.

1) Efficient use of raw material

Wood lamination allows the use of low quality logs to produce high grade products via removal of defects such as knots and other abnormal growth characteristics. The 'good' portions are then salvaged by means of finger-jointing technique with the use of suitable adhesive. In some cases, longer pieces of 'crooked' wood are also cut and re-jointed to enhance its straightness. Removal of unsightly pieces also enhances their aesthetic appeal.

In Malaysia, rubberwood (*Hevea brasiliensis*) is often used for making table tops. Nevertheless, rubberwood logs are only available in short lengths of 2 m and upon sawing and drying, the sawn-timbers often warped or twisted owing to inherent growth stress and/or drying stress. In order to salvage such material, lamination technology is employed. In such case, rubberwood timbers are first cross-cut before finger jointing technique is used to produce longer lengths. The finger-jointing process is able to 'straighten' the original less straight rubberwood hence improve sawn wood recovery and quality. Subsequently, the finger-jointed members are glued edgewise and/or face wise to produce quality table tops or other furniture components and products.

These laminated products are widely accepted both in the international and domestic markets currently. In Japan, for instance, laminated table tops of Malaysian rubberwood have positioned itself well in the higher end market.

To the industry, such technology enables continued production of high quality products from lower quality, younger and smaller-diameter logs available nowadays, including those from the forest plantations.

2. Better dimensional stability

In wood lamination, thinner laminates/layers are glued together to form thicker members. For example, 100 mm (4") thick laminated member could be bonded from four pieces of 25 mm (1") thick layers. In practice, it is always more difficult to dry a solid 100mm member uniformly compared to drying four pieces of 25 mm boards. Uniformly dried timber members are known to be more dimensionally stable in any service environments particularly those that fluctuate in temperature and humidity compared to when solid members with larger moisture gradient were used. The application of appropriate adhesive and gluing technology ensure good bonding under such service environments.

In the use of window scantling exposed to a European service environment, the demanding winter condition involving heating from within and cold climate outside, for example, subjected the products to high differential in moisture-induced stresses. A poorly dried timber members would have greater difficulty 'adjusting' to the service environment, resulting in distortion that lead to subsequent water penetration and rotting of wood members. Window scantling derived from appropriately dried wood laminations (layers) will have less problem adapting to it, as experienced by many European users at the moment. With the excellent dimensional stability brought about by glued-laminated timber, currently more than 70% wooden window scantling (Figure 4) in Germany is made from laminated timbers.

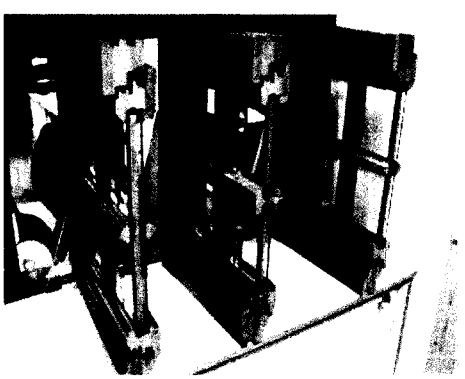

Figure 4 Typical laminated timber windows used in Germany

Figure 5 Glulam footbridge at FRIM

3. Flexibility and creativity

With wood lamination, one could design and fabricate timber members of practically any shape and size, depending on the creativity of the designers. These unique features have been explored in the construction of structural glued-laminated timber members, commonly known as glulam. Such application is employed in the construction of resorts, timber bridges (Figure 5), stadiums and multi-storey timber constructions, mainly due to its structural reliability, excellent fire performance and cost-effectiveness.

4. High quality control

Glued-laminated timber products are manufactured in a factory environment that permits higher degree of mechanization and involvement of skilled workers. In-house and external quality inspection procedures are normally in place (Figure 6). The inspection may cover the use of adhesive, material preparation and machining, moisture content of wood, application of pressure, pressing procedure and bonding quality of end products.

When wood lamination was first introduced to the country some years ago, many have taken these quality procedures lightly. This has resulted in many rejects by the overseas buyers and some have been eliminated from the business. Currently, more and more companies have incorporated such quality procedures into their daily productions.

Figure 6 Visual grading of laminated timber products

CONCLUSIONS

Given the escalating log price and emergence of more lower quality and smaller logs into the market lately, wood lamination appears to be a feasible solution for our industry to maintain its status as major producer of high quality timber products. Many advantages are associated with this technology. Judging by the wide acceptance of such products in both structural and non-structural applications globally, one obvious conclusion is that laminated product, when properly manufactured, is as good if not better than a similar product made from one solid piece of timber. The benefits derived also appear to have outweighed any cost increment brought about by additional processing procedures involved. The application of suitable quality assurance procedures also ensure our competitiveness in international markets.

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