



# TIMBER

*Facts That Figure*

► A new wooden house conceptualized in traditional fashion by the owner, Chef Shukri Shafie, and built with Chengal in Langkawi, Kedah.

*Technical research has contributed significantly to how different timber species can be treated, cured, dried and utilised.*

## Wood is Good

Wood has been associated with man since time immemorial. Unfortunately, many architects, builders, contractors and specifiers shy away from using wood because of their lack of understanding of the material and the common myths and fallacies associated with wood.

One fundamental aspect of wood that must be understood is that it is a biological material and therefore subject to environmental factors that influence its formation and growth. This makes wood variable, i.e.,

with different densities and technical properties, so no two pieces of wood are similar. Once this tenet is understood, wood becomes a more accommodating material, lending itself to a huge variety of uses and applications, largely due to its ability to fulfil both form-and-function requirements. Technical research on Malaysia's timber species done by the Forest Research Institute Malaysia has contributed significantly to how different timber species can be treated, cured, dried and utilised.

This publication addresses the common concerns that surround the proper usage of wood by explaining why wood behaves as it does. It goes on to list the 'green' credentials of wood and its inherent advantages over other building materials. It also includes a section on how specifying timber, particularly from certified and/or legal sources, actually contributes to forest conservation and climate change mitigation.

Our aim is not to promote the exclusive use of wood. There is a place for all materials in enriching our built environment. This is a case for using more timber, particularly from legal and sustainable sources. Through this publication, it is hoped that with a much better understanding of the properties and proper usage of timber, and how the Malaysian forest resources are managed, more timber will be specified for construction projects.

National Committee on Utilisation of Timber in Construction  
Kuala Lumpur, Malaysia

# The Nature of Wood

## Wood is a Biological Material

Wood is made up of cells, which tend to be elongated and are arranged along the longitudinal axis of the tree trunk. These cells are made up of a complicated mixture of polymers of cellulose, interspersed with other non-cellulosic carbohydrates and lignin. These cells act as tiny elongated thin-walled tubes and impart some outstanding physical and mechanical properties to the wood.

## Wood is Anisotropic

Wood behaves differently along its three major differential axes in terms of strength properties and dimensional movements.

## Wood is Hygroscopic

Wood is subject to changes in moisture content of its surroundings. The temperature and humidity of the surrounding atmosphere and the amount of water already in the wood will determine whether wood absorbs or loses water vapour. These absorptions or loses of water vapour will cause the wood to swell or shrink. The anisotropic nature of wood will cause unequal dimensional movements in the three directions.

## Wood is Inert

Wood is inert to the action of most chemicals. This property makes wood suited for many industrial applications where resistance to corrosion is important. When wood is exposed to atmospheric conditions, it will only erode at a rate of 0.25 inch per century. Even this can easily be prevented by applying coatings and proper treatment on the wood surface.

Advances in R&D by many research agencies globally have contributed to a rich and growing repository of knowledge on timbers, resulting in the development of various treatments and techniques as well as recovery and engineering solutions to manage timber's natural properties to enhance its usage, enabling timber to be used more intelligently with a lot less wastage.



*Weight for weight, wood can be designed to carry a heavier load than steel.*

► Chengal rafters and battens form a tight lattice that filters light into the Four Seasons Langkawi spa.

# Positive Attributes of Wood

## Strength

Wood has a high strength-to-weight ratio, *i.e.*, for the same strength required for a given structure, the weight of the timber material to be used can be as much as 16 times less than steel, or five times less than concrete. Weight for weight, wood can be designed to carry a heavier load than steel, *i.e.*, one tonne of wood can carry a heavier load than one tonne of steel.

Modern engineered timber products like Glued Laminated Timber (Glulam) and Cross Laminated Timber (CLT) allow wood to be used in constructing high-rise buildings. Currently, the world's tallest timber building is a ten-storey apartment called Forte in Melbourne. In the pipeline are plans to build a 34-storey timber building in Canada.

## Durability

There is a great variety of timbers with a wide range of properties to suit various outdoor and internal applications, and for both aesthetic and structural purposes. While some timbers are perishable under uncontrolled conditions, many species of timbers can naturally last for a very long time.

Timber can be treated to make it harder, termite-resistant or weather-resistant. Treatment can be done by impregnating wood with certain chemicals which are effective yet safe for use by humans. This process is widely available and is affordable. Treated timber will often out-last naturally durable timbers.

## Excellent Insulator

Wood is an excellent insulating material because of the presence of the empty cell walls, which act as tiny air traps that resist the transfer of heat. This characteristic is deemed ideal for insulation materials. Compared with wood, other building materials such as bricks, steel and concrete are not good insulators.

Wood requires minimal external energy to keep a building within the thermal comfort zone of its inhabitants. Wood is six times better than brick as an insulator; eight times better than glass; 15 times better than concrete; 390 times better than steel and 1,700 times better than aluminium.

Research has shown that timber used as structures, such as columns in large buildings, performs better during a fire compared to steel or concrete.



Steel  
Timber

► *Gulam beams consistently outperform other leading materials in fires.*  
Photo credit: American Institute of Timber Construction and Rosboro.

*The goal of fire-resistive construction is to provide occupants adequate time to evacuate the structure safely.*

► *Timber, including being used as load-bearing columns, features prominently in the Lee Residence in Shah Alam, Selangor.*

## Performance in Fire

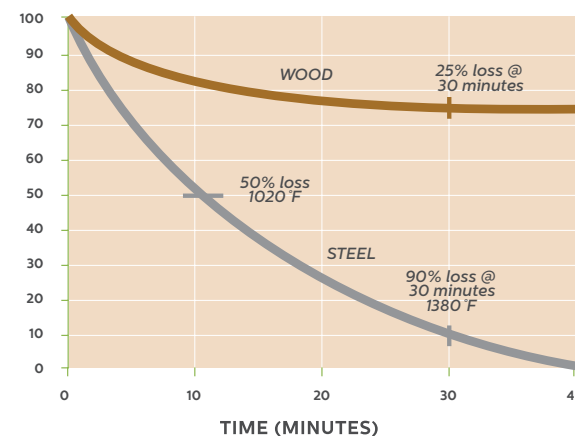
Research has shown that timber used as structures, such as columns in large buildings, performs better during a fire compared to steel or concrete. This is because steel will buckle and concrete will crack and crumble very suddenly under high temperatures. Thick timber columns, on the other hand, will initially ignite but the charring of the outer layers of wood will cut off the oxygen supply and effectively slows down the burning of the deeper layers of the timber. The slow rate of burn is important because it gives the occupants enough time to evacuate during a fire. Timber columns have been found to be still standing and functioning after intense fires.

The speed and ease of ignition is dependent on the rate of accumulation of heat at the surface of the wood. Several factors influence this rate and they are the size of the piece of wood, the rate of heat loss from the surface, the presence of thin outstanding edges and the rate which heat is supplied to the surface of the wood. Small pieces with sharp projecting edges, such as matches, ignite easily. On the other hand, large pieces, with round edges, like a round Glulam column catch fire at a much slower rate. In buildings with engineered timber panels, heat does not conduct from one side of the panel to the other.



*Thick timber columns like Glulam will initially ignite but the charring of the outer layers of wood will cut off the oxygen supply and effectively slows down the burning of the deeper layers of the timber.*

### Comparative strength loss of wood versus steel



*Results from test sponsored by National Forest Products Association at the Southwest Research Institute, St. Antonio, Texas, USA.*

### Case Study: Timber's Performance in an Actual Fire

Shortly before midnight on 31 December 2012, a fire started in a strip mall in Salem, Oregon. The fire spread fast and destroyed everything, except for the Glulam beams the building was designed around. Post-fire, the Glulam beams were still so sound that crews had to use their backhoes and bulldozers to physically break the beams in half to get them down.

Glulam beams consistently outperform other leading materials in fire resistance tests. The average building-fire temperature ranges from 700° to 900° Celsius. Steel weakens dramatically as its temperature climbs above 230° Celsius, retaining only 10% of its strength at about 750° Celcius. Wood will not ignite until it reaches almost 260° Celsius. Once heavy timber ignites, it chars at a slow rate of 0.635 mm per minute\*. The slowness of burn is due to the inherent property of wood to naturally insulate in a fire. Thus, in a 30-minute fire, only 19 mm of each exposed surface of the Glulam is lost to charring, leaving most of the original cross section intact.

Unprotected metals lose their strength quickly in a fire and often collapse suddenly due to their rapid loss of strength. Studies have shown that within 10 minutes of a fire starting, steel loses its structural properties by over 50%, while Glulam still holds over 80% of its strength. Actually, no building is fire-proof since most fires start with the structure's contents. The goal of fire-resistive construction is to provide occupants adequate time to evacuate the structure safely.

*\*under the American ASTM E-119 fire exposure.*  
Source: American Institute of Timber Construction.

*Steel weakens dramatically as its temperature climbs above 230° Celsius, retaining only 10% of its strength at about 750° Celcius. Wood will not ignite until it reaches almost 260° Celsius.*

## Acoustic Properties

Timber has good acoustic properties. It has better sound dampening capacity than most structural materials such as concrete, which reflects sounds with stronger echoes. The natural acoustic properties of timber control this excessive echo by reducing the transmission of sound vibrations.

Wooden panels and timber flooring are commonly used to improve the acoustical properties of a room. They are used to reduce noise and improve the quality of sound in spaces such as auditoriums and theatres.

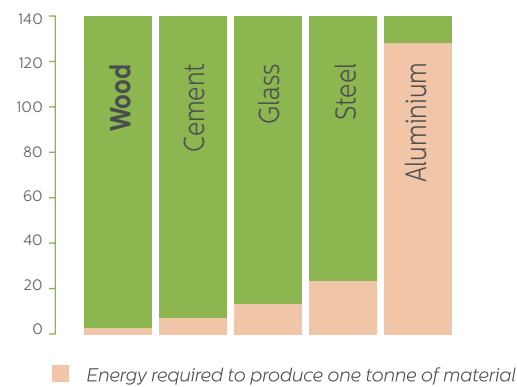
## Versatility

Timber is the most versatile building material compared to other building materials. It can be used for both structural and decorative purposes, as well as for outdoor and internal applications. Timber exudes warmth and adds character to a place. Understanding timbers and their properties is important to help us select the right species for the right application.

The fact that trees grow according to the natural environment they are in means that there are thousands of grains and shades to choose from globally, providing an excellent choice for architects, builders and interior designers.

## Energy Efficient

Processing wood is energy efficient. The production of one tonne of cement requires five times more energy than the production of one tonne of wood; 14 times more energy for one tonne of glass; 24 times more energy for one tonne of steel and 126 times more energy for one tonne of aluminium.



Energy required to produce one tonne of material



Wooden panels and timber flooring are commonly used to improve the quality of sound in spaces such as auditoriums and theatres.

Good design coupled with basic timber 'louvers' have helped perfect the sound engineering for superior acoustics in the Petronas Philharmonic Hall in Kuala Lumpur, Malaysia.

# The 'Green' Credentials of Wood



*Building with wood causes much lower CO<sub>2</sub> emissions than building with conventional construction materials.*

## Carbon Sequestration

Wood and CO<sub>2</sub> are natural partners. Trees absorb CO<sub>2</sub> as they grow, so the more forests we plant, the more CO<sub>2</sub> they can absorb. Trees play an important role in reducing carbon in the atmosphere by being part of the carbon cycle that involves the trees absorbing CO<sub>2</sub> from the air, releasing oxygen and storing the carbon in the wood.

However, mature trees absorb less CO<sub>2</sub> than young trees. Harvesting mature trees will open up the forest canopy, enabling younger trees to grow, thereby absorbing more carbon from the atmosphere.

## Carbon Locking

The CO<sub>2</sub> that is absorbed by the trees as they grow remains “imprisoned” in the wood. Using wood-based material contributes to the continued imprisonment of the CO<sub>2</sub>.

Building with wood causes much lower CO<sub>2</sub> emissions than building with conventional construction materials. No other mainstream building material does this.

## Climate Change Mitigation

Using timber that comes from sustainably managed forests can actually help address climate change by reducing the amount of greenhouse gases in the atmosphere. Trees absorb CO<sub>2</sub> as they grow, thus significantly reducing the amount of CO<sub>2</sub> in the atmosphere. The absorbed carbon is converted into wood in the tree. However, if the forest was left totally alone, the trees in the forest will grow old and die. Trees can also die due to fire, wind damage and lightning strikes. When a tree dies, the wood will rot and release the stored carbon in the form of CO<sub>2</sub>. In order to keep the carbon imprisoned in the wood, it is better to harvest the bigger trees than to let them die and rot.



*When a building is demolished or renovated, the recovered timber can be used in another project.*

► Bob Gabriel's house in Langkawi, Kedah, built entirely of recycled timber and other salvaged building materials.

## Sustainability

Timber is the ‘greenest’ and only truly renewable building material. New trees can be planted to replace those that were harvested, thus ensuring a perpetual supply of timber. Moreover, the planting and harvesting of trees contribute positively to the health of the environment through the cycle of “absorb-and-lock” of CO<sub>2</sub> in the atmosphere.

## Recyclability

Timber is a fully recyclable building material and it requires a fraction of the energy required to produce concrete or steel. When a building is demolished or renovated, the recovered timber can be used in another project. The recovered timber can be resized and reshaped to cater to other uses.

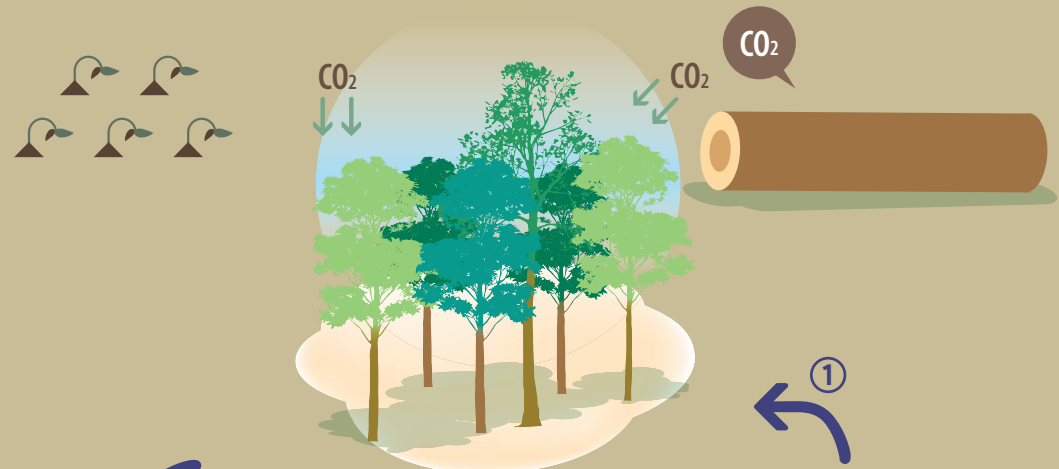
### Timber Scores Well in A Life Cycle Assessment

Life Cycle Assessment (LCA) is a technique to assess environmental impacts associated with all the stages of a product's life from cradle-to-grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling). LCA research by renowned entities such as the UN's FAO (2002), the UK Building Research Establishment (2002), the US Consortium for Research on Renewable Materials (2004) and the American Hardwood Export Council (2012) have all shown timber's cradle-to-grave ecological quotient to be superior to that of other materials.



# Reducing CO<sub>2</sub> Through Sustainable Timber Harvesting

## Non Harvested Forest



Old trees absorb CO<sub>2</sub> at a much slower rate, which gets even slower as they grow older.



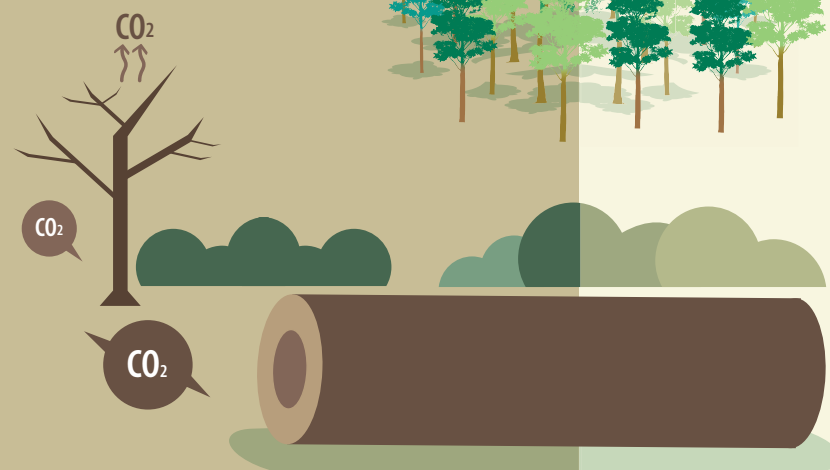
When a tree dies, the carbon locked away in its cells is released back into the environment.

### TREES DIE BECAUSE OF...

- LIGHTNING STRIKES
- FOREST FIRES
- DAMAGE CAUSED BY WIND
- OLD AGE/DISEASES

### FASCINATING FACT!

The death of a 70-year old tree would return about three tonnes of carbon to the atmosphere.



### FASCINATING FACT!

50% of a tree's dry weight is carbon!



## YOUR JOURNEY STARTS HERE

As trees live and grow, they absorb CO<sub>2</sub>, then store the carbon in their roots, trunks, branches and leaves.



## Harvested Forest



The mature trees create a canopy which blocks out the sunlight, restricting growth of the under layer.



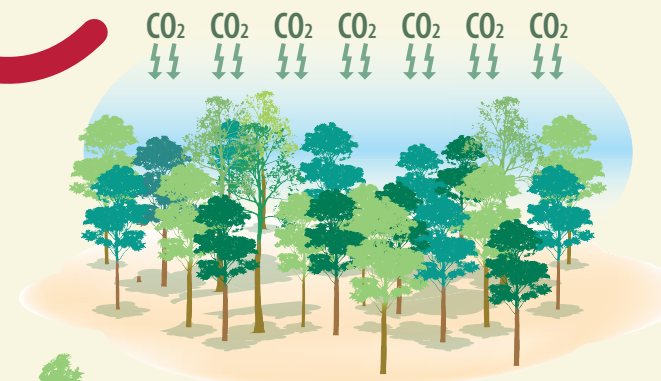
Trees are selectively cut based on Sustainable Forest Management practices.



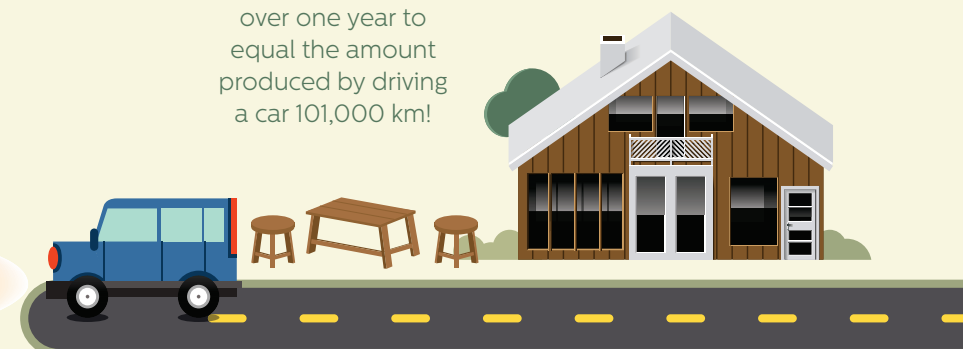
The more timber is used for construction and other wood products, the more carbon is kept imprisoned throughout their lifetime, and the smaller our carbon footprint will be.

### FASCINATING FACT!

A hectare of trees absorbs enough CO<sub>2</sub> over one year to equal the amount produced by driving a car 101,000 km!



Selective harvesting opens up the forest canopy, allowing more sunlight to reach the forest floor. This would serve as a catalyst to stimulate the forest growth. Young trees absorb CO<sub>2</sub> quickly while they are growing.





Currently, 61% of Malaysia's land area of 32.98 million hectares is covered in natural forests.

► The SMS involves a proper pre-felling forest inventory carried out by Forestry Department staff.

# Sustainable Forest Management in Malaysia

Malaysia has pledged that a minimum of 50% of its land area will be kept under natural forest cover for perpetuity. Currently, 61% of Malaysia's land area of 32.98 million hectares is covered in natural forests. Advances in forestry research enable Malaysia's forests to be managed sustainably to ensure its perpetuity. Sustainable Forest Management (SFM) is wise management and use of forest resources in a way that meets our current needs without compromising the ability of future generations to meet their own needs.

In Malaysia, SFM involves certain practices that ensure the following objectives are met:

1. Efficient and economic harvesting, utilization, reforestation and sustained yield; and
2. Biologically, ecologically and environmentally sustainable forest development.

How SFM is carried out in Malaysia is as follows:

1. There must be a proper pre-felling forest inventory carried out by Forestry Department staff. This is where trees that are big enough and suitable to be felled will be clearly marked.
2. 'Mother trees' that produce seeds are also clearly marked as these must never be felled.
3. After logging, a post-felling inventory is carried out by Forestry Department staff to determine the status of the forest stand.
4. Appropriate silvicultural treatments will be applied in the process of rehabilitating the logged-over forest area. This will help the forests regenerate and return to their former state of eco-balance more quickly.
5. It may require another 25 – 30 years before that particular forest compartment could be harvested again. By this time, having had enough sunlight from the opening of the forest canopy, the smaller trees will have grown big enough for felling and the whole cycle could be repeated.

That is how the Malaysian forests are maintained as a perpetual source of timber and other forest products. As forestry is a state matter in Malaysia, there may be variation in execution of the above. However, the general principles of SFM form the basis of forestry management activities in all states in Malaysia.

## Sustainable Forest Management Practice in Malaysia

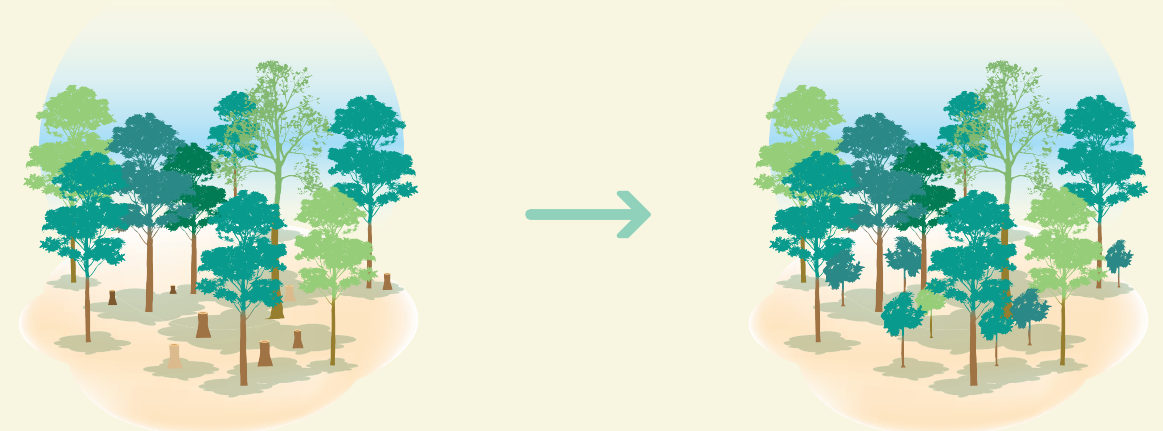


Forest harvesting is based on Sustainable Forest Management practices.

Pre-felling inventory. The number and size of trees are recorded.



Selective harvesting using directional felling to reduce impact takes place according to national allowances.\*



Post-felling inventory. If necessary silvicultural treatment is applied.

Regenerated forest after 25 – 30 years.

\* National allowances : 32 residual trees of above 30cm diameter at breast height (dbh) to form the next crop.  
Minimum cutting limit : dipterocarps = 55cm dbh,  
non-dipterocarps = 45cm dbh.

For further information, please go to :  
• Forestry Department Peninsular Malaysia ([www.forestry.gov.my](http://www.forestry.gov.my))  
• Sabah Forestry Department ([www.forestry.sabah.gov.my](http://www.forestry.sabah.gov.my))  
• Forest Department Sarawak ([www.forest.sarawak.gov.my](http://www.forest.sarawak.gov.my))



► The MTCS provides independent assessments of forest management practices in Malaysia.  
Photo credit: MTCC



► Asking for certified or legally-derived timber products will raise greater awareness on the importance of our forest.  
Photo credit: MTCC

## Timber Certification in Malaysia

Timber certification is a process which provides an independent assessment to certify the origin of wood-based raw material and its status. It has now become an important market-linked tool to encourage good forest management that takes into consideration the economic, social and environmental aspects of the forest.

Timber certification typically includes two main components:

1. Forest management certification which verifies that a forest is well-managed based on the requirement of specified certification standards.
2. Chain-of-custody certification that tracks the flow of timber processing to ensure that the timber and timber products manufactured or exported are, indeed, sourced from certified forests.

## Malaysia's Forest and Timber Certification Scheme

Malaysia has its own certification scheme called the Malaysian Timber Certification Scheme (MTCS), which is operated by the Malaysian Timber Certification Council (MTCC). The MTCS provides independent assessments of forest management practices in Malaysia to ensure the sustainable management of Malaysia's forests as well as to meet the demand for certified timber products.

The MTCS gained international recognition after having been endorsed by the Programme for the Endorsement of Forest Certification (PEFC), the world's largest forest certification programme. The MTCS is the first tropical timber certification scheme in the Asia Pacific region to be endorsed by the PEFC.

For further information, please go to: [www.mtcc.com.my](http://www.mtcc.com.my) and [www.pefc.org](http://www.pefc.org)



► Photo credit: MTCC

## Contributing to the Sustainability of the Forests: the Importance of Specifying Certified or Legally Harvested Timber-Based Products

You can contribute to forest's sustainability by specifying certified and/or legally-derived timber-based products to clients and customers. Please ask your supplier for MTCS-certified products or legally-derived timber. Not all legally-derived timbers are sustainable, as they may have come from forests that have been cleared for social infrastructure like schools and hospitals in new or expanded townships.

Asking for certified or legally-derived timber products might seem a small gesture but it will raise greater awareness on the importance of our forest and why we must manage it properly so that it remains healthy and productive for generations to come.

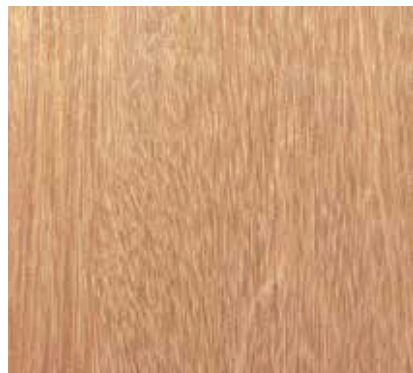
For a list of suppliers offering certified timber-based products, please contact:

- Malaysian Timber Certification Council ([info@mtcc.com.my](mailto:info@mtcc.com.my))
- Malaysian Timber Council ([council@mtc.com.my](mailto:council@mtc.com.my))
- Certified Timber & Credible Suppliers ([main@ctcs.my](mailto:main@ctcs.my))

# Key Malaysian Species

## Balau

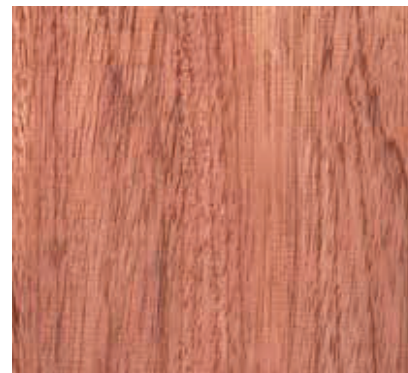
850 – 1,155 kg/m<sup>3</sup>  
*Shorea* spp.



Sapwood is lighter in colour, and well defined from the heartwood, which is yellow-brown, brown or reddish-brown. It is resistant to treatment with preservatives. Texture is fine and even, with deeply interlocked grain. It is suitable for all forms of heavy construction.

## Bintangor

465 – 865 kg/m<sup>3</sup>  
*Calophyllum* spp.



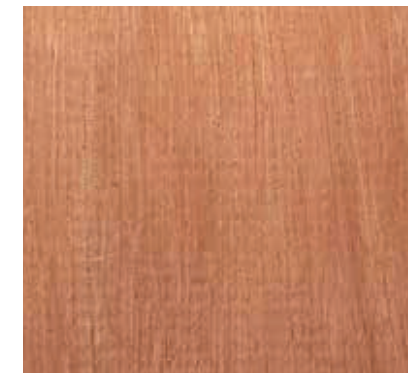
Sapwood and the heartwood are clearly demarcated. The former is yellow-brown with a pink tinge. Texture is moderately coarse to coarse and uneven with interlocked grain and often a striped figure. It is suitable for flooring and joinery.



The Rhu Bar of Four Seasons Langkawi sports a series of delicate timber screens with Moorish arches in the central space, which is characterized by a system of trusses forming an inverted pyramid.

## Kasai

735 – 915 kg/m<sup>3</sup>  
*Pometia* spp.



Sapwood is lighter in colour than and not sharply defined from the heartwood, which is pink, red or red-brown. Texture is moderately coarse but even, with straight or shallowly interlocked grain. It is suitable for furniture, joinery, columns (light duty) and flooring.

## Kelat

495 – 1,010 kg/m<sup>3</sup>  
*Syzygium* spp.



Sapwood is not well-defined from the heartwood which is light brown, pink-brown, red-brown or purple-brown with a grey tinge. The grain is interlocked, irregular or wavy. Texture is moderately fine and even. It is suitable for structural purposes like posts, beams, joints and rafters.

## Chengal

915 – 980 kg/m<sup>3</sup>  
*Neobalanocarpus heimii*



Sapwood is light yellow and sharply defined from the heartwood, which is light yellow-brown with a distinct green tinge, darkening on exposure to dark purple-brown or rust-red. Texture is fine and even, with shallowly to deeply interlocked grain. This timber is suitable for all forms of heavy construction.

## Dark Red Meranti

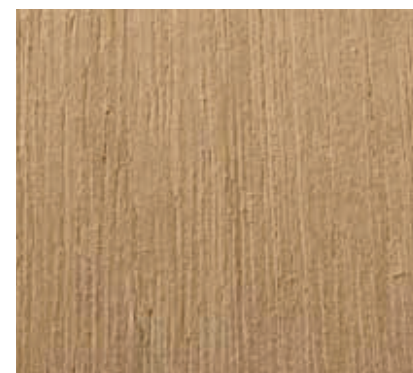
415 – 885 kg/m<sup>3</sup>  
*Shorea* spp.



Sapwood is not clearly defined from the heartwood which is medium red to deep red to deep red-brown. Texture is moderately coarse but even, with interlocked grain. It is suitable for joinery, furniture, flooring and mouldings.

## Gerutu

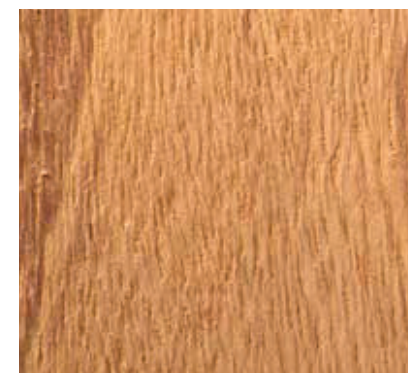
640 – 880 kg/m<sup>3</sup>  
*Parashorea* spp.



Sapwood is light yellow-brown and frequently darker than the heartwood which is light golden brown and darkens to a deep brown on exposure. Its texture is moderately coarse and even, with interlocked grain. Gerutu is perfect for light to medium construction.

## Keledang

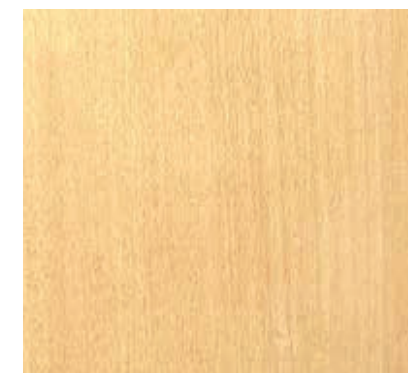
500 – 945 kg/m<sup>3</sup>  
*Artocarpus* spp.



Sapwood is light yellow to yellow-brown, sharply defined from the heartwood, which is brown or orange-brown and turns to dark brown on exposure. Texture is moderately coarse and even, with interlocked to deeply interlocked grain. This timber is good for medium construction like flooring, beams and decking.

## Kembang Semangkok

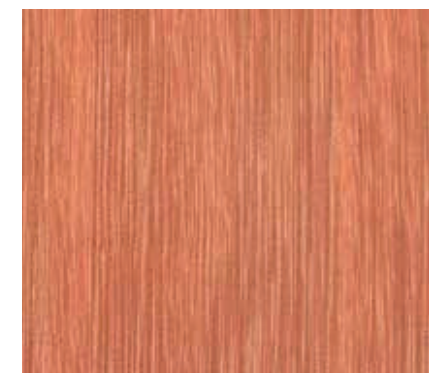
515 – 755 kg/m<sup>3</sup>  
*Scaphium* spp.



Sapwood is lighter in shade, merging gradually into the heartwood, which is yellow-brown, light buff or light brown. Texture is slightly coarse and uneven, due to the broad rays and wide layers of parenchyma. With an attractive grain, it is often used for interior fit-outs and cabinetry.

## Kempas

770 – 1,120 kg/m<sup>3</sup>  
*Koompassia malaccensis*.



Sapwood is white or pale yellow in colour. Heartwood is pinkish when fresh and darkens to bright orange-red or deep brown. The grain is interlocked, often very interlocked. The texture is coarse but even. It is suitable for heavy construction when treated.

## Keruing

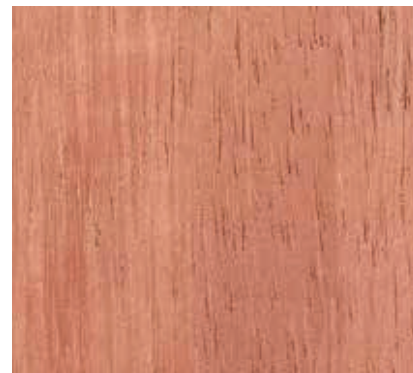
690 – 945 kg/m<sup>3</sup>  
*Dipterocarpus* spp.



Sapwood is purple-red or red-brown to grey-brown in colour. The heartwood is dark red-brown. Texture is moderately coarse to coarse but even with straight to deeply interlocked grain. Keruing is suitable for heavy construction.

## Mengkulang

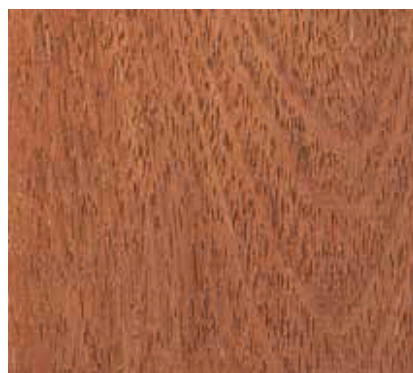
625 – 895 kg/m<sup>3</sup>  
*Heritiera* spp.



Sapwood is usually lighter in colour than and not always well-defined from the heartwood, which is red, red-brown to dark red-brown. The grain is straight to shallowly interlocked and texture is slightly to moderately coarse but even. It is suitable for interior fit-outs, cabinetry, mouldings and furniture.

## Merbau

515 – 1,040 kg/m<sup>3</sup>  
*Intsia* spp.



Sapwood is pale yellow in colour. Heartwood is yellowish to orange-brown when fresh, darkening to brown or dark red-brown on exposure. Texture is rather coarse but even, with interlocked grain. It is very popular for decking, heavy duty columns and furniture.

## Merpauh

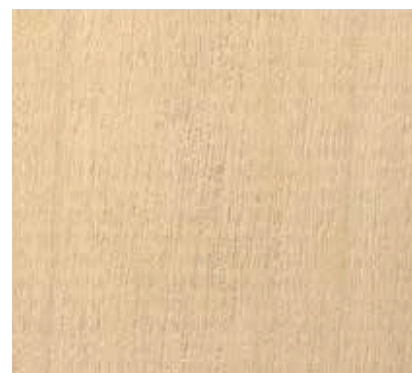
640 – 880 kg/m<sup>3</sup>  
*Swintonia* spp.



Sapwood is light brown with a grey or pink tinge and is not well-defined from the heartwood, which is light grey-brown with a pink tinge. The grain is interlocked and texture is moderately coarse but even. Its attractive grain makes it popular for high-end joinery and furniture, as well as flooring and other interior fit-out applications.

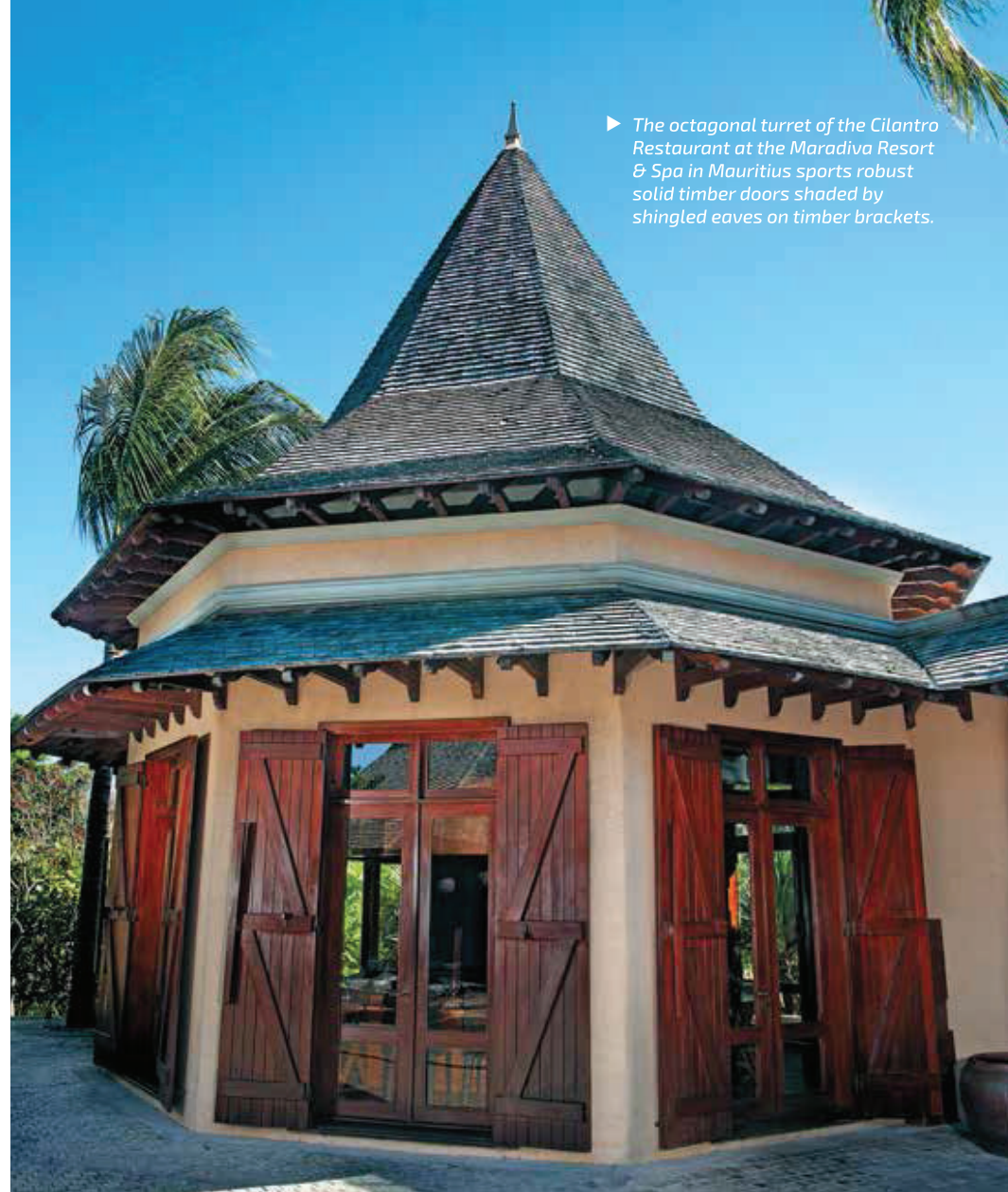
## Mersawa

515 – 735 kg/m<sup>3</sup>  
*Anisoptera* spp.



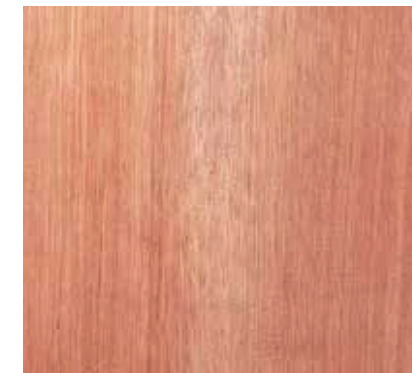
Sapwood is not sharply defined from the heartwood, which is light to dark yellow and darkens on exposure. Texture is moderately coarse but even, with shallow to deeply interlocked grain, occasionally with slight spiral grain. It is a popular species for plywood. Other uses include joinery, cabinetry and flooring.

► The octagonal turret of the Cilantro Restaurant at the Maradiva Resort & Spa in Mauritius sports robust solid timber doors shaded by shingled eaves on timber brackets.



## Nyatoh

400 – 1,075 kg/m<sup>3</sup>  
Spp. of *Sapotaceae*



Sapwood is lighter in colour and is only moderately sharply differentiated from the heartwood, which is deep pink-red or red-brown. Texture is moderately fine to slightly coarse, with straight to shallowly interlocked and sometimes wavy grain. Apart from furniture and doors, it is also widely used for joinery, flooring, decking and light duty columns.

## Red Balau

800 – 880 kg/m<sup>3</sup>  
*Shorea* spp.



Sapwood is well-defined from the heartwood of purple-red or dark red-brown colour. The grain is interlocked, often deeply interlocked. Texture is rather coarse and even. Red Balau is a perfect species for heavy construction, boat building and heavy duty flooring.

## Rubberwood

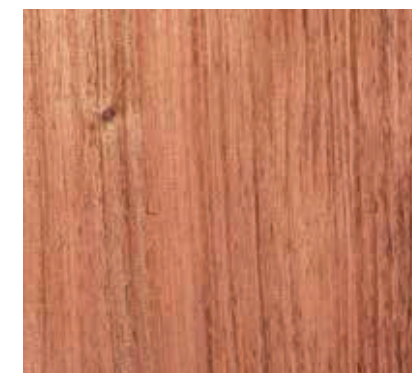
560 – 640 kg/m<sup>3</sup>  
*Hevea brasiliensis*



Sapwood is not differentiated from the heartwood, which is pale cream in colour, often with a pink tinge. Texture is moderately coarse but even with straight to shallowly interlocked grain. Apart from its popular application in furniture-making, it is also suitable for flooring, interior furnishing, panelling and mouldings.

## Sepetir

530 – 785 kg/m<sup>3</sup>  
*Sindora* spp.



Sapwood is light grey-brown or beige with a pink tinge. Heartwood is brown with a pink tinge and darkens on exposure. Texture is moderately fine and even, with straight or shallowly interlocked grain. Given its beautiful grain, it is best used for cabinetry, joinery, decorative panelling, flooring and furniture.

## Yellow Meranti

575 – 735 kg/m<sup>3</sup>  
*Shorea* spp.



Sapwood is well-defined. The heartwood is light yellow-brown to yellow-brown or brown. The grain is interlocked and sometimes wavy. The texture is moderately coarse but even. It is suitable for light construction, mouldings, panelling, joinery and furniture.