TIMBER TECHNOLOGY BULLETIN

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Timber Notes - Heavy Hardwoods (I)

by

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Trade name: Balau

Species: *Shorea astylosa* (balau gunung), *S. atrinervosa* (b. hitam), *S.exelliptica* (b.tembaga), *S. falcifera* (b. kuning), *S. foxworthyi* (b. bukit), *S. glauca* (b.laut), *S.Laevis* (b. kumus). *S. lurnutensis* (b. puteh), *S. materialis* (b.pasir), *S. -maxwelliana* (b. kumus hitam), *S. scrobiculata* (b. sengkawang darat), *S. submontana* (b. gajah) and *S. sumatrana* (b. sengkawang ayer).

1. Tree type and distribution: Widely distributed throughout the dipterocarp forests in Peninsular Malaysia except In the peat swamp forests. More abundant in the hilly jungle than on flat land and up to altitude of 300 m. *Shorea astylosa* and *S. submontana* occur in the upper dipterocarp forest.

2. Wood characteristics: Heartwood light-brown to red-brown weathering to a dark-brown or dark purple brown. Sapwood lighter in colour and moderately distinct. Stripe figure on the radial surface. Texture moderately fine and even. Grain interlocked.

3. Timber classification: HHW

4. Wood density: Ranges from 880 to 1040 kg m^{-3} air dry, averaging 969 kg m^{-3}.

5. Drying and relative movement: Air drying of 15 mm and 40 mm boards takes about 4 month and 10 months respectively. Schedule B is recommended for kiln drying.

6. Machining properties: Slightly difficult to saw, plan, and bore. Turning is easy. Nailing property is poor.

7. Durability: Durable. Heartwood is naturally durable, but sapwood is susceptible to fungal attack.

8. Strength grouping: A

9. Strength properties: Data based on tests carried out on *Shorea laevis*.

Property (MPa)	Green	Air dry
Modulus of rupture	121	142
Modulus of elasticity	18 400	20 100
Maximum crushing strength	68.8	76.0

10. Uses: Suitable for heavy constructional works: bridge construction, railway sleepers, telephone and power line poles, mine props, and boat building. Also commonly used for the manufacture of door and window frames.

Trade name: Red Balau

Species: *Shorea collina* (balau merah), *S. guiso* (b. membatu), *S. kunstleri*(b. laut merah), *S. ochrophloia* (b. membatu jantan).

1. Tree type and distribution: Widely distributed. *Shorea guiso* and *S. ochrophloia* are found in all states while *S. collina* is mainly confined to the east coast states of Terengganu, Pahang and Johore. *Shorea kunstleri* is mainly found in the states of Kedah, Kelantan, Terengganu, Pahang and Perak.

2. Wood characteristics: Heartwood light to deep red-brown and distinct from the sap wood which is pink to grey brown. Stripe figure on radial surface. Texture moderately fine to moderately coarse and even. Grain interlocked.

3. Timber classification: HHW

4. Wood density: Ranges from 800 to 880 kg m^{-3} air dry.

5. Drying and relative movement: Air drying of 15 mm and 40 mm boards takes approximately 4 months and 6 months respectively. For kiln drying, schedule G is recommended. Type Ill Movement.

6. Machining properties: Slightly difficult to difficult to resaw and work, planing is easy and planed surface is smooth to slightly rough.

7. Durability: Moderately durable.

8. Strength grouping: A or B

9. Strength properties: Values based on minimum average of tests carried out on *Shorea ochrophloia*, *Shorea guiso* and *Shorea kunstleri.*

Property (MPa)	Green	Air dry
Modulus of rupture	85	99
Modulus of elasticity	15 900	17 000
Maximum crushing strength	43.7	55.5

10. Uses: Suitable for all forms of heavy constructions, door and window frames, heavy duty flooring and furniture.

Trade name: Bitis

Species: *Madhuca utilis* (bitis), *Palaquium ridleyi* (bitis paya) and *Palaquium stellatum* (bitis bukit)

1. Tree type and distribution: *Madhuca utilis* is commonly found in lowland and low lying primary forests in Terengganu, Perak, Pahang, Selangor and Johore.*Palaquium ridleyi* can be found in peat swamps, fresh water swamps or seasonal swamps in Perak, Selangor, Pahang and Johore and on hills to 790 m in Perak, Kelantan and Pahang. *Palaquium stellatum*, which is rare, can be found in lowlands and hills to 305 m in all states except Perlis, Penang and Terengganu. *M. utilis* can grow to 46 m tall and girth of 1.8 m. *Palaquium ridleyi* grows up to 40 m tall and 3 m girth. *Palaquium stellatum* can achieve a height of 55 m and a girth of 7.5 m.

2. Wood characteristics: Heartwood reddish-brown or chocolate red-brown. Sapwood yellow-brown with tinge of grey and clearly defined. Planed surface slightly lustrous.Texture moderately fine and even. Grain straight to shallowly interlocked.

3. Timber classification: HHW

4. Wood density: Ranges from 820 to 1120 kg m^{-3} air dry. Average density values for the individual species are: *M. utilis* (1120 kg m^{-3}), *P. ridleyi* (910 kg m^{-3}) and *P. stellatum* (870 kg m^{-3}).

5. Drying and relative movement: Air drying of 40 mm board takes about 6 months. High shrinkage: radial 2.8 % and tangential 4.0 %.

6. Machining properties: Slightly difficult to resaw, cross cut, and plan. Planed surface is smooth. Poor nailing property.

7. Durability: Very durable.

8. Strength grouping: A

9. Strength properties: Data based on tests carried out on *Madhuca utilis*.

Property (MPa)	Green	Air dry
Modulus of rupture	123	171
Modulus of elasticity	21 900	23 000
Maximum crushing strength	73.9	90.3

10. Uses: Suitable for all forms of heavy construction, bridges, wharves, piers, piling, posts, railway sleepers, parquet flooring and heavy duty flooring.

Trade name: Chengal

Species: *Neobalanocarpus heimii* (chengal)

1. Tree type and distribution: Widely distributed in Peninsular Malaysia except the states of Perlis, Malacca and the south of Johore. The tree grows from low flat semi-swamp to hills up to 900 m but thrives best on undulating land with a light sandy soil.

2. Wood characteristics: Heartwood pale brown with a distinct green tinge weathering to dark purple-brown. Sapwood pale yellow and well defined. Planed surface lustrous. Texture moderately fine and even. Grain interlocked.

3. Timber classification: HHW

4. Wood density: Ranges from 915 to 980 kg m^{-3} air dry.

5. Drying and relative movement: Air drying of 15 mm and 40 mm boards takes approximately 5 months and 6 months respectively. For kiln drying, schedule B is recommended.

6. Machining properties: Difficult to resaw and is easy to moderately easy to cross-cut. Planing is easy and planed surface is smooth.

7. Durability: Extremely durable.

8. Strength grouping: A

9. Strength properties:

Property (MPa)	Green	Air dry
Modulus of rupture	122	149
Modulus of elasticity	18 100	19 600
Maximum crushing strength	69.0	75.2

10. Uses: Suitable for all forms of heavy constructions, railway sleepers, flooring and a favourite timber for boat-building.

Trade name: Giam

Species: *Hopea apiculata* (giam melukut), *H. coriacea* (g. hantu), *H.ferrea* (g. malut), H. *helferi* (g. lintah bukit), *H. nutans* (giam), *H. pachycarpa* (g. bayan), *H. pierrei* (g. palong), *H. polyalthioides* (g. rambai), *H. semicuneata* (g. jantan) and *H. subalata* (g. kancing).

1. Tree type and distribution: The species of giam are found scattered in almost all states in Peninsular Malaysia in the dipterocarp forests, from the coastal peat swamps up to hills of 1200 m altitude.

2. Wood characteristics: Heartwood light yellow with a greenish tinge weathering to deep brown. Sapwood light yellow and moderately distinct. Planed surfaces are not particularly lustrous. Texture fine and even. Grain spiral, wavy or inter-locked.

3. Timber classification: HHW

4. Wood density: Ranges from 960 to 1055 kg m^{-3} air dry.

5. Drying and relative movement: Air drying of 15 mm and 40 mm boards takes about 6 months and 8 months to dry respectively.

6. Machining properties: Easy to difficult to resaw and cross-cut. Planing is easy and the planed surface is smooth. Poor nailing property.

7. Durability: Very durable

8. Strength grouping: A

9. Strength properties: Data based on tests carried out on *Hopea helferi*

Property (MPa)	Green	Air dry
Modulus of rupture	103	122
Modulus of elasticity	14 600	16 500
Maximum crushing strength	54.2	58.9

10. Uses: Suitable for all heavy construction, bridges, wharves posts, beams, joists, heavy duty flooring, power line poles, railway sleepers, lorry and truck bodies, container floor boards and heavy duty laboratory benches.

Balau

Red balau

Bitis

Chengal

Giam

BACKGROUND INFORMATION

1. Tree type and distribution

The distribution and size of tree are given.

2. Wood characteristics

The colours of sapwood and heartwood colour, figure, appearance on planed surface and any other characteristic features of the timber.

3. Wood density

Green density of freshly sawn board, defined as green mass divided by green volume. It varies with the freshness of the log in the log yard before processing and seasoning. Air dry density is the average mass divided by volume at 15 per cent moisture content.

4. Timber classification

Under the Malaysian Grading Rules (1984), timbers are classified as Heavy Hardwood (HHW) when their density exceeds 800 kg m^{-3} and the timbers are naturally durable. Medium Hardwoods (MHW) are timbers with density exceeding 720 kg m^{-3} but lack sufficient natural durability. Light Hardwoods (LHW) are timber with density below 720 kg m^{-3} and not naturally durable in exposed condition.

5. Drying and relative movement

Air drying time for 15 mm and 40 mm boards and moisture content are from Grewal (1979).'Airseasoning Properties of Some Malaysian Timbers', Timber Trade Leafet No. 41. Suitable kiln drying schedule is mentioned [Schedules based on Grewal (1988), 'Kiln Drying Characteristic of Some Malaysian Timbers', Timber Trade Leaflet No.421]. The Relative Movement (whenever is available) is defined as the change in dimension of a piece of timber when exposed to the service conditions of 60 % RH / 30 ^{0}C and 95 % RH/30 ^{0}C respectively, and expressed as percentage of the value at 60 % RH/30 ^{0}C. The Movement Ratings stated are based on values of the corresponding tangential movement [Choo *et al*. (1998), "Movement of Seasoned Timber In Service", FRIM Technical Information Handbook No. 19].

Movement Rating	Tangential Movement
Type I	< 1.5 %
Type II	1.5 % to 2.0 %
Type III	2.1 % to 2.5 %
Type IV	2.6 % to 3.0 %
Type V	> 3.1 %

6. Machining properties

Comments are made on the comparative ease or difficulty of sawing, planing, turning, boring, peeling, gluing and other wood working properties.

7. Durability

Durability ratings of Malaysian Timbers are based on performance of test-stacks in grave yard testing. Test-stacks of 50 x 50 x 600 mm are buried in test grounds and their performance monitored. The number ofyears that the timber can last under such conditions is used to classify the durability of the timber. Under the system, timbers are classified as follows;

Rating	Number of years
Very durable	more than 10 years
Durable	5-10 years
Moderately durable	2-5 years
Non-durable	0-2 years

Susceptibility to fungal and termite attacks may be mentioned.

8. Strength grouping

In the strength grouping of timber under each trade name, ranking is allocated from A (strongest) to D. Minimum values for strength groups based on common grade for dry timber (below 19 % moisture content). (units are in MPa).

Strength group	A	B	C	D
Modulus of elasticity	9,700	6,600	5,500	3,100
Bending and tension parallel to grain	12.41	9.65	7.24	4.83
Compression parallel to grain	11.03	7.93	5.51	4.14
Compression perpendicular to grain	1.45	0.90	0.55	0.45
Shear parallel to grain	1.45	0.90	0.62	0.62

8. Strength properties

Values are from Lee *et at*. 1979, 'The Strength Properties of Some Malaysian Timbers'.
Malaysian Forest Service Trade Leaflet No.34.

9. Uses

Various past and potential uses are given, but the list is obviously not exhaustive.

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