

# Guidance on the structural use of timber imported to Sri Lanka

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## Introduction

Due to the scarcity of indigenous timber species increasing quantities of timber are imported to Sri Lanka to meet the demand for construction timber. Recent experience with the use of Kempas imported to Sri Lanka had indicated the necessity for proper guidance to importers, designers, specifiers and users of structural timber.

The objective of this paper is to provide guidance on specifying timber for structural use. It also reviews information that is available on some of the timber species that are imported to Sri Lanka.

## Specifying timber for structural purposes

Timber needs to be specified correctly if it is to be efficiently used. The efficient use of any material requires knowledge of its properties and the manner in which these properties are influenced by the environment. Timber is not different in this context. However, it is different in that it is a natural material. Unlike a man made product, the quality of which can be improved by varying the constituent materials and/or the manufacturing process, in the case of timber one has to accept what nature has to offer and adapt it to the particular situation.

## How is the nature of timber affected by its structure?

Structural timber is obtained from the main stem or trunk of the tree. Three functions are carried out by the trunk of a tree. It supports the crown of leaves, the food producing organs of the plant, it moves water from the roots to the leaves and it stores food. Sapwood, the outer often lighter coloured zone just beneath the bark of any timber is more susceptible to decay (or less durable) since it is in this portion that food material is stored during the growth of a tree. The sapwood is also more porous, since it is through the sapwood that water is moved from the roots to the leaves of the tree and thus the sapwood is easily penetrated by preservatives.

Heartwood, the inner sometimes darker zone is formed when the food material in the sapwood is converted into complex organic substances. This is also accompanied by blocking of the conducting channels, so that heartwood is less permeable and hence less amenable to preservative treatment. Fortunately however, the combination of the deposition of substances and the blocking of the conducting channels result in a more durable heartwood.

Both sapwood and heartwood contribute to the structural performance of the tree. Thus there is no significant difference in strength properties between the heartwood and sapwood of timber.

The majority of the cells that comprise timber are aligned in the direction of growth of the grain direction. Thus timber is anisotropic, it has different strength properties along the different directions. Thus timber containing growth characteristics such as grain deviation and knots have a reduced strength than clear timber.

## What aspects need consideration when specifying timber?

When specifying timber for a particular end use one needs to be aware of its strength and stiffness properties, its durability, treat-

ability or amenability to preservative treatment. A further aspect that needs consideration is whether the timber is available in the required quantities at an affordable price. Factors such as colour, figure amenability to painting, and the ease with which it can be worked may also need consideration.

## Should timber be specified by name/species?

It is not necessary to specify timber by name. The recent concept of strength grouping used elsewhere (e.g. Britain and Australia) leads to better structural efficiency. The designer specifies merely the strength group of the timber permitting the client/contractor to select a species/grade combination within that group based on other considerations such as durability, treatability, aesthetic appeal, availability and cost. Some of the timbers imported to Sri Lanka are within existing strength group classifications e.g.: Kempas HS grade belongs to SC8 of Ref. 1 used in Britain and it is classified as S2 by the Australian method of strength grouping (Ref. 2). Another species that belongs to SC8 in Balau. Thus a better alternative to

and stiffness. A particular draw-back of the visual grading process is that it does not sort naturally weak timber from naturally strong timbers.

Graded timber is identified by a grade stamp on the timber. This grade applies to the entire piece of timber. If a piece is cut from the originally graded piece, the resulting two pieces may belong to different grades to that stamped on the original piece. Thus if graded timber is sawn the sawn timber needs to be regraded.

Grading of imported timber is to be introduced shortly by the Sri Lanka Standards Institution.

## Why specify moisture content?

Due to the conducting role performed by the trunk of the tree freshly felled timber contains much moisture. Seasoning or drying the timber prior to use is vital for a number of reasons. When timber dries out it shrinks and unless properly converted can distort. This movement can be minimised by reducing the moisture content of the timber. Dry timber is less likely to be attacked by fungus and insects and preservative is better

absorbed in the presence of less moisture. Dry timber machines better and stronger dimensions can be obtained; the strength properties of timber improved when dried. The transport and handling costs of dry timber are less since dry timber is less heavy than timber with excess moisture.

Since however timber is hygroscopic, it absorbs and loses moisture according to the ambient conditions of temperature and humidity until it is in equilibrium with the environment. Thus timber should be dried to its equilibrium moisture content (e.m.c.). The e.m.c. of timber in Sri Lanka conditions varies from about 12% to 16% (Figure 1). The significance of specifying the moisture content of timber is thus evident. The moisture content that is specified should be approximately equal to the equilibrium moisture content.

## Should naturally durable timber be specified or can timber be adequately treated?

Not all timbers are equally vulnerable to biological decay. Some timbers are inherently more resistant than others, depending mainly on the chemical composition of the timbers. It is standard practice to classify timbers according to their decay resistance either by means of the grave yard test or by laboratory methods.

The durability ratings are useful in comparing the relative durability between species of timber, however, the numerical durability ratings cannot be taken as absolute values since they depend on the test ground. In temperate climates, natural durability relates mainly to the resistance to fur-

gal decay, while in tropical countries resistance to termites also should be considered. Kempas is considered non-durable to moderately durable in Malaysia, moderately durable in Australia while in Britain it is classified as durable. The natural durability classification systems adopted by some countries are given in Tables 2 to 4.

Naturally durable timbers are more expensive and it is not necessary to specify them as less durable timbers can usually be made sufficiently durable by preservative treatment.

## How can the preservative treatment be specified?

Treatments vary widely in their effectiveness and so it is necessary that the treatment selected can protect the timber for the required duration and to ensure that it is applied early enough. Once the timber is in place it cannot be treated as effectively and economically. Aspects that must be considered when selecting a treatment are the properties and potential effectiveness of the preservative, the process by which it is applied, the extent to which the timber will absorb the preservative, the environment in which it is to be used, and the desired service life of the timber. Preservation in the form of brush application of commercially available timber preservatives is insufficient in high hazard situations and more permanent forms of preservation such as impregnation of the timber are often required. While it is neither necessary nor practicable to fully impregnate the timber, adequate retention and sufficient penetration are essential if the treat-

ment is to be reliable.

The extent to which timber will absorb the preservative depends on the permeability of timber which depends on the microscopic structure of the timber. Timbers vary in permeability to liquids as they do in natural durability. Table 5 and 6 give the classification systems adopted in Britain and Malaysia. Specifications relating the required depth of penetration and salt retention to the end use of timber and hazard category of timbers are available (Table 7).

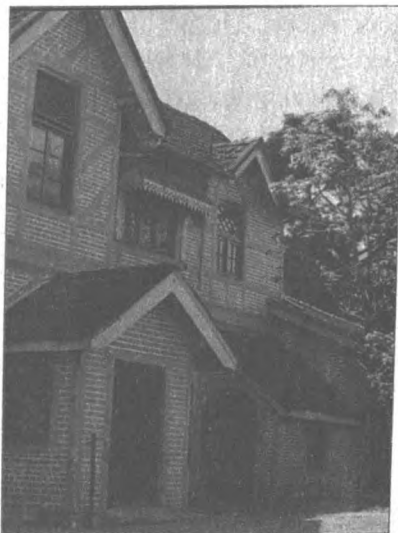
Some specifications prohibit the use of sapwood, however, since it is permeable to preservative and equally strong as heartwood, treated sapwood may be specified, unless a possible difference in colour precludes its use.

## Timber imported to Sri Lanka

A preliminary survey among importers and dealers of timber indicated that much of the timber that is imported to Sri Lanka consists of tropical hardwood from Malaysia. A Draft Sri Lanka Standard has been prepared giving information on Malaysian hardwood. The information includes a general description of the timber, strength properties, uses, ability to work with, durability and treatability.

Timbers presently imported to Sri Lanka are Kempas, Tualang, Balau, Resak and Kulim. They are all described as suitable for heavy construction and are difficult to work with. The natural durability and treatability of these timbers are given in Table 8 while the physical strength properties of the timbers are given in Table 9.

Basic stresses correspond to clear timber or timber with no strength reducing characteristics. Timbers imported from Malaysia are graded into three visual grades namely Select Structural, Standard Structural and Common Building grades. The grade stresses of the timbers are reduced to 80%, 63% and 50% of the basic stress for the grades respectively. For normal structural purposes the Standard Structural grade of timber is specified. The Select Structural grade is specified where strength to weight ratio is important. The Common Building grade of timber is used where the members are not usually designed by means of engineering calculations.



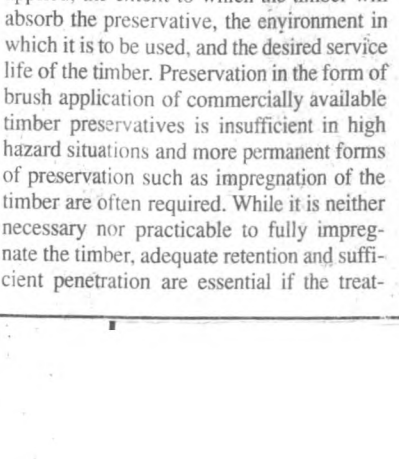
Kempas, Balau has a greater natural durability with similar strength properties.

## Why specify timber of a specific grade?

Grading is a form of quality control, unlike in man made materials, where this would take place during manufacture, with timber a natural material this has to be done prior to use. Grading is the separation of timbers into one or more grades depending on the extent of growth characteristics or defects as they are sometimes called. These characteristics are inevitable and since they are detrimental to strength to varying extents it is necessary to grade the timber. Two methods of grading are used, visual grading and machine grading. In visual grading as the name implies, timber is inspected visually, often aided by simple tools such as rules and gauges. The timber is sorted according to grading rules that specify limits on defects, chiefly knots, slope of grain and fissures, whose size, number and position are specified. A summary of grade limitations for Hardwood Structural Grade (HS) for tropical timber is given in Table 1.

Machine grading assumes that the strength properties bear a certain relationship to Modulus of Elasticity. The stiffness of the timber member passing through a grading machine is measured along its length and the strength is predicted using a previously established relationship between strength and stiffness.

Neither type of grading is exact. Visual grading depends on the skill of the grader while machine grading depends on the accuracy of the relationships between strengths



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