National Certificate in Carpentry

# Demonstrate Knowledge of Timber Used in Construction

## Unit Standard – 13002

## Level 3, Credit 2

BCITO
BUILDING AND CONSTRUCTION ITO
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# 13002 – Demonstrate knowledge of timber used in construction

**What you must do to achieve this unit**

- Correctly describe timbers in terms of their species, characteristics, common usage and resource sustainability.
- Correctly describe timber in terms of length, size and finish.
- Correctly describe grades of timber and their applications.
- Correctly describe timber defects in terms of their effects.
- Correctly define terms relating to seasoning timber and the methods used.
- Correctly describe methods used to determine moisture content.
- Correctly identify common forms of fungal and insect attack and their results.
- Correctly describe the environmental causes of the deterioration of timber and actions to prevent them.
- Correctly explain preservative treatment of timber and the associated health and safety requirements for handling and disposal.
- Correctly describe the use, care and handling of treated timber.

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# Introduction

Over the centuries trees have provided the basic material used for the construction of shelter for society.

This module will look at the growth classification, uses and characteristics of timber and its importance to the modern building and construction industry.

**References required**

The following books are referenced throughout this module. When referred to, they will need to be read as supplementary information.

**BRANZ - Selecting Timber.** (Referred to in this resource as **BRANZ ST.**)

**BRANZ - House Building Guide**. (Referred to in this resource as **BRANZ HBG.**)

**DBH - Timber Treatment Requirements.** (Referred to in this resource as **DBH TTR.**)

Other sources of information that contain further useful material are:

**NZS 3602:2003** - Timber and Wood-based Products for Use in Building.

**NZS 3640:2003** - Chemical Preservation of Round and Sawn Timber.

Timber Preservation publications
www.nztpc.co.nz/publications.php

# Tree Growth

A microscopic examination of a piece of wood will show that it is made up of bundles of fibres or long tubular cells that are connected together by the wood's own adhesive. These tubular cells are the plumbing system of the tree and are crossed by other fibres that form the medullary rays. These function as passageways for the nourishment that feeds the tree and serves to bind the units together. Water and minerals in solution form are carried up through the sapwood in the trunk to the leaves in the crown.

In turn the leaves convert the sap through photosynthesis into sugars and starches which travel down the trunk of the tree just inside the bark.

# Parts of a Tree

Trees are made up of the following parts.

- **Pith** – This is the centre of the tree and is the dead tissue of the original sapling.
- **Growth Rings** – These rings are made up of cells representing one season's growth. They are divided into two distinct layers.
- **Spring (Early) Wood** – This layer is formed during the spring and early summer when the growth rate is at its greatest. It is lighter in colour, soft and has large thin-walled cells.
- **Summer (Late) Wood** – This layer is formed during the summer and early autumn when growth is slower. It is darker in colour and has small hard-walled cells.

Growth rings vary in width, shape and colour depending on the seasonal conditions affecting growth. In normal conditions these rings are distinct enough to determine the age of the tree.

## Sapwood

This is the newly formed wood which surrounds the heartwood. It is usually softer and lighter in colour. It is through the cells of the sapwood that water and minerals are conducted to the leaves. As the tree grows the sapwood ages, becomes inactive and turns into heartwood.

## Heartwood

The heartwood lies between the sapwood and the pith and is made up of older inactive layers. Its main function is to help the tree to remain straight and upright. This section of the tree generally produces timber which is more durable and resistant to decay and insect attack.

## Cambium Layer

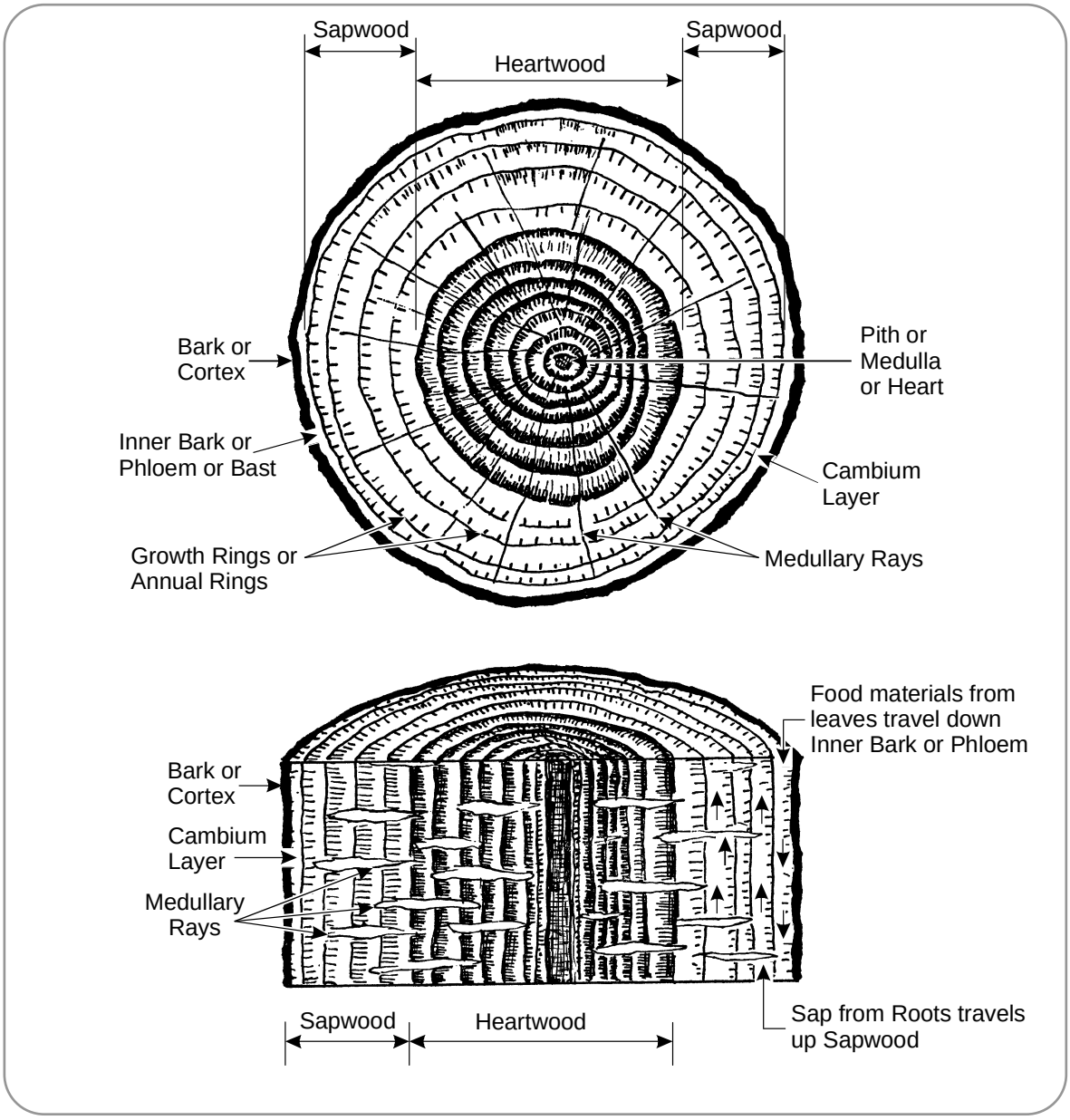
The cambium consists of a two-celled layer. The inner layer (called bast or phloem) produces new sapwood while the outer layer (cortex) produces new bark.

## Bark

The outer bark serves as protection for the tree against insects and injury and also prevents the cambium layer from drying out.

**Reference**

**BRANZ ST,** pages 8-10.



# Classification of Timber

Timber is divided into two classes – Softwoods and Hardwoods. This classification is a botanical distinction and does not always mean that a timber is physically hard or soft.

For example, Balsa wood is extremely soft, but is classified as a hardwood, whereas Matai, which is extremely hard, is classified as a softwood.

This classification relates directly to the cell structure of the tree.

## Softwoods

- **Gymnosperms** – Softwood timber is obtained from cone-bearing trees with needle-like leaves. Softwoods are usually evergreen. (This means that they keep their leaves all year round.)

## Hardwoods

- **Angiosperms** – Hardwood timber is obtained from broad-leafed trees. Hardwoods are usually deciduous. (This means they lose their leaves in winter.) There are, however, some exceptions. For example, Rewa Rewa, while classified as a hardwood, is an evergreen. The seeds of hardwoods are contained in a fruit. For example, an acorn is the seed from an oak tree.

**Reference**

**BRANZ ST,** page 11.

# Timber Use in New Zealand

Timber used for construction in New Zealand falls into three categories.

- Exotic species;
- Native species; and
- Imported species.

## Exotic Species

Exotic is the term used to define trees from another country which are now grown in New Zealand for commercial purposes.

## Softwoods

**Radiata Pine (Pinus Radiata)**
Originally a native of California USA, this timber is now the principal exotic timber commercially grown in New Zealand. Extensive plantations cover large areas of both the North and South Islands.

The timber is lightly coloured with an even texture and with very little heartwood. Natural durability is low, but the timber is easily treated to resist both fungal decay and insect infestation. It is moderately strong and has excellent gluing, nailing and machining properties.

**Douglas Fir (Oregon)**
Douglas Fir accounts for 5% of the annual production of sawn timber in New Zealand. It has a high proportion of heartwood, which is pinkish brown, and has a marked alternation of high and low density in the annual rings. Douglas Fir is mostly used for structural applications because it is moderately strong and does not need to be treated for use as house framing. As Douglas Fir is difficult to treat with preservatives, it is often unsuitable for other applications or uses.

**Cypress**
This group includes Macrocarpa and Lawson's Cypress. These species have similar wood properties characterised by an attractive grain, a medium to low density, natural durability and excellent stability. The wood is highly suitable for interior and exterior joinery, weatherboards and boat building. It also suits general construction uses and is slightly stronger than Radiata Pine. The dry wood is, however, prone to splitting when nailed.

**Other Softwoods**
Other softwoods are available in small quantities, but are generally only used for specialist decorative applications where high toughness or small knot size is important.

## Hardwoods

There are several species of Eucalyptus which have been planted widely in New Zealand. They are mostly medium to high density, with a red or brown heartwood. They are often used for panelling, furniture, flooring and joinery, but can be used for general structural uses. They are stronger than Radiata Pine, but can be difficult to dry in large sizes. Locally grown European and American hardwood species are also available in small quantities for specialist uses.

## Native Species (Indigenous)

These are trees which originated in New Zealand – so are native to this country. They are not readily available now because of the relatively slow growth rate. Felling of native species is also restricted, and monitored closely. There is a thriving furniture industry centred on recycled native timbers, especially Rimu, Kauri and Matai. Because of their high demand and limited availability, native timber is generally very expensive.

## Native Softwoods

**Rimu**

Rimu (sometimes called Red Pine) was used extensively in construction until logging restrictions significantly reduced the availability to the industry. Grown throughout the country it is the principal indigenous timber of New Zealand. The heartwood is an attractive yellowish brown, highly coloured, fine grained, moderately durable (although the sapwood is susceptible to insect attack), even-textured medium-density timber. Rimu is now used principally for furniture manufacture.

**Kahikatea (White Pine)**

Kahikatea is yellowish to white timber, clean, straight and close grained which is easily worked. This timber is often used for joinery, moulding, veneer and boat building and is still available in small quantities.

**Matai (Black Pine)**

Matai is straw yellow in colour and is a hard timber. Its heartwood is moderately durable, but its sapwood is not as durable and is prone to borer attack. While the timber is strong, it also splits easily. This timber is used in flooring, window and door sills and exterior joinery. Its availability is very limited, but some recycled timber may be obtainable.

**Totara**

Totara is reddish brown and straight grained. It is easily worked, but brittle when dry. It is both durable and stable. This timber is used in boat building, joinery, roofing shingles and for carving.

**Kauri**

Kauri is light brown with light speckle. It is straight grained, easily worked, moderately durable and very stable. Due to limited availability, this timber is restricted to use in furniture, boat building, joinery and panelling.

## Native Hardwoods

These include Red Beech, Silver Beech and Tawa. They are available in small quantities in particular areas. Because they are harder and more dense than Radiata Pine, they are more preferable for use in furniture, panelling or manufactured items.

**Red Beech**

Red Beech has a light brown to grey sapwood and a light red or brown heartwood. It is straight grained, easy to work, durable and very stable once dry. Red Beech can corrode sheet and galvanised steel over a period of time when in direct contact. This timber is used in furniture, joinery, panelling, veneers, boat building and wharf decking.

**Silver Beech**

Silver beech has a pinkish-brown heartwood. It is straight grained, easily worked, moderately durable and reasonably stable. This timber is used in furniture, joinery, panelling and boat building.

**Tawa**

Tawa has a white to pale brown heartwood. It is straight grained, and is excellent to work with – although it is not as durable as other timber and should be stored carefully. It is used in furniture, turning and veneers.

## Imported Timber

Imported timber is timber that has been grown in another country and brought into New Zealand – usually in a finished state.

Species such as Kwila, Mahogany, Redwood and Western Red Cedar are examples of timbers imported for decorative or specialist uses.

**Reference**

**BRANZ ST,** pages 50-114.

# Timber Resource Sustainability

## Sustainability

The word “sustainable” refers to a system that can be kept in its current state (in this case, a forestry system). Timber sustainability is about producing the timber we need, without reducing the world’s forest resources.

Less forest in the world is not only bad for the many plants and animals that become displaced when forests are cleared, it also reduces the planet’s ability to process carbon in the atmosphere. Put very simply, trees take in the (bad) carbon and give off (good) oxygen. The destruction of large areas of forest is believed to be a contributing factor in climate change and global warming. Just because we live in “clean, green” New Zealand, it does not mean we can ignore damage done to the planet through the destruction of forests. We have a legal and moral obligation to only use sustainable timber resources.

## Definitions

| Term | Meaning |
|---|---|
| Sustainable timber resources | A sustainable timber resource (plantation or forest) is one that has been planted by people, and once harvested will be replanted.<br>OR<br>A natural forest that is managed sustainably under appropriate authority (e.g. in New Zealand under an approved and registered Sustainable Forest Management [SFM] Plan or Permit).<br>We should only use sustainable timber resources. |
| Unsustainable timber resources | An unsustainable timber resource is a natural forest that is harvested faster than it can grow and is not regenerated or, if necessary, replanted.<br>We should not use unsustainable timber resources. |
| Renewable timber resources | Timber is a renewable resource because we can plant more trees to replace the ones cut down. However, just because **we can** renew the resource – it does not mean the people cutting down the trees actually replant.<br>Just because it says it is renewable, it does not mean the resource is being renewed. |
| Sustainably managed resources | Many loggers claim that that their cutting of selected trees within old native forests is “sustainably managed logging”. If the forest is not replacing itself OR there is no active replanting, this activity isn’t sustainable. In New Zealand, many native species regenerate quite satisfactorily and don’t generally require replanting. Beech regenerates readily and other species like rimu and tawa with the right combination of light, protection and access to mineral soil.<br>So-called “sustainably managed” timber resources may not really be sustainable. |

## New Zealand Native Timbers

It is by no means a given that new New Zealand native timber is the product of illegal or unsustainable harvesting. There are approximately 100,000 hectares of indigenous forest in New Zealand subject to approved sustainable forestry management (SFM) plans and permits.

NZ beech species (red, silver, hard and black beech), rimu, matai, kahikatea, totara, rewarewa, hinau, tawa and a number of other indigenous species from New Zealand private indigenous forests may be used with confidence if they are from forests subject to SFM Plans and Permits. The Ministry of Agriculture and Forestry (MAF) approves these harvests and monitors forest management activity. Where necessary, MAF enforces the requirements of the Forests Act that governs the harvesting of indigenous timber from private forests.

The only New Zealand native timber that is not commonly harvested any longer is kauri – for which availability is pretty much limited now to swamp or recycled.

## Sustainable Timber Resources

The timbers listed below are on the whole grown using sustainable forestry practices and can be purchased and used legally and with good conscience within New Zealand:

> Australian blackwood, chestnut, douglas fir, elm, eucalyptus species, larch, lawson cypress, macrocarpa, oak, poplar, radiata pine, redwood, spruce, sycamore, walnut, western red cedar.

## Possible Unsustainable Timber Resources

The timbers listed below are imported for use in New Zealand. While it would be nice to think that they are grown using sustainable forestry practices, many are often a result of ‘illegal logging’ and should therefore be avoided. It is recommended that when purchasing these timbers for use, you ask the supplier to provide documentation that verifies the timber has been produced legally.

> a’asa, African mahogany, Agathis species, asi-toa, amoora, aucomea, balau, bauvadi, blackbutt, blackwood, ironbark, calophyllum species, castanopsis, cedar (pencil), chengal, chlorophora, damanu, Dacrydium, decussocarpus, dipterocarpus, dryanobalanops, dyera, pometia, endospermum, entrandrophragma, Fiji kauri, gonystylus species, homalium, hopea species, giam, Intsia species, iroko, ironbark, jarrah, jelutong, kalantas, kapur, karri, kaudamu, kauvula, kempas, keruing, khaya, koilo, koompassia, kwila, lauan, lithocarpus, mahogany, malas, meranti, merbau, milicia, narra, nemesu, neobalanocarpus, New Guinea oak, nyatoh, obeche, odum, okoume, oregon, palaqium, pencil cedar, pterocarpus, ramin, red cedar, red seraya, rosawa, rosewood, sapele, salu salu, sapele, Shorea species, sipo, spotted gum, syncarpa, syzgium, Tasmanian oak, taun, teak, tectona, Toona species, triplochiton, turpentine, vesi, Vitex, watergum, yaka, yasiyasi.

## MAF Responsible Buying Guide

The five tips below are provided by (MAF):

1. Buy New Zealand timber or wood products. New Zealand timber is harvested and processed according to well-enforced environmental laws. Therefore, New Zealand consumers can generally assume that products produced from New Zealand forests are legal and sustainable.
2. Check to see if the timber or wood product carries documentation that verifies compliance with a reputable forestry management standard or certification scheme.
3. Buy timber or wood products that are made from recycled or used product.
4. Ask the supplier where the wood has come from. Do they know if it has been legally produced, harvested and traded? What supporting evidence can they produce?
5. Ask your supplier if they have a responsible timber and wood purchasing policy in which they seek to only buy legally harvested timber and wood products. For example, for imported products, the supplier may belong to the Imported Tropical Timber Group which is an industry-environmental group that has a specific policy around sourcing legal and sustainable timber and wood products.

# Ordering Timber

It is important when ordering timber to indicate all the relevant information necessary to meet the job requirements. This should include:

- nominal size (this may not be the finished size);
- finish (rough sawn or dressed);
- grade;
- species;
- treatment;
- number; and
- lengths of pieces.

When ordering timber, the following abbreviations can be used to meet specific requirements:

| Abbreviation | Description | Abbreviation | Description |
|---|---|---|---|
| R/S | Rough Sawn | MG | Machine Gauged |
| D4 | Dressed Four Sides | DG | Dressing Grade |
| KD | Kiln Dried | DRY | Air Dried |
| GREEN | Timber Not Dry | FJ | Finger Jointed |
| PKT | Packet (approx 450-500m) | T&G | Tongue and Groove |
| SL | Selected Lengths | RAD | Radiata Pine |
| BN | Bull Nose | RP | Red Pine |
| H1,H3 H4,H5 | Treatment Level | BT | Boron Treated |
| RAND or RL | Random (a total meterage of timber made up of varying lengths) | EX | “Out of” (eg. ex 200x40DG=180x35 or ex 100x50MG=94x47) |
| NZO | New Zealand Oregon | UT | Untreated |

## Definitions

**Length** – refers to the length of a single piece of timber. Total length or “meterage” refers to the combined lengths within a packet or number of lengths.

**Size** – refers to cross section dimensions, eg: 100x50. This may differ from the actual size, depending upon the machining process used. The term x.100x25 refers to dressed timber that was 100mm x 25mm when rough sawn. When dressed it will be slightly smaller than this.

**Finish** – this refers to the outward appearance (and size) of the timber due to the machining processes it has been through. Each time it is machined, the timber will become a slightly smaller size, but may retain its “call size” name. For example, a 100mm call size will measure 100mm in rough sawn state, about 94mm in gauged state, and about 90mm in dressed state. Finishes include rough sawn, dressed and gauged.

**Finger jointed** – refers to a method of joining boards lengthwise using wedge-shaped projections on one piece, which fit to matching recesses on the other piece. A strong bond is achieved through the use of a powerful glue.

**Profiles** – refers to the cross sectional shape the timber may be moulded into. This includes profile groups such as weatherboard, flooring, skirting, architraves, fascias, etc. When ordering, a specific profile must be provided, simply asking for "weatherboard" is not enough as there are dozens of different weatherboard profiles.

Below are some typical timber orders in their abbreviated form:

**RAD 100 x 50 No.1 R/S GREEN RAND 100m**
(Radiata Pine, 100x50mm, number 1 grade, rough sawn, not dry, random lengths to 100m)

**RAD ex 200 x 40 DG H1 D4 DRY SL 3/3.600**
(Radiata Pine, out of 200x40mm, dressing grade, treatment H1, dressed four sides, air dried, selected lengths 3/3.600)

**RP ex 100 x 25 BN skirting RAND 38m**
(Red Pine, out of 100x25mm, bull nose, skirting, random lengths to 38m)

**NZO 94 x 47 No.1 MG GREEN SL 21/2.400**
(New Zealand Oregon, 94x47mm, number 1 grade, machine gauge, not dry, selected lengths 21/2.400)

***Note:*** *No.1 indicates a timber grade that is dealt with later in this module. It would be appropriate to check the ordering method used by your employer and become familiar with the system.*

**References**

**BRANZ HBG,** Section 7, tables 7.3 & 7.4.

**BRANZ ST,** pages 21-24 and tables 5 – 9.

# Worksheet 1

Apprentice Name:

1. List four (4) uses for native timber.

2. Name the three (3) categories into which timber used for construction in New Zealand falls.

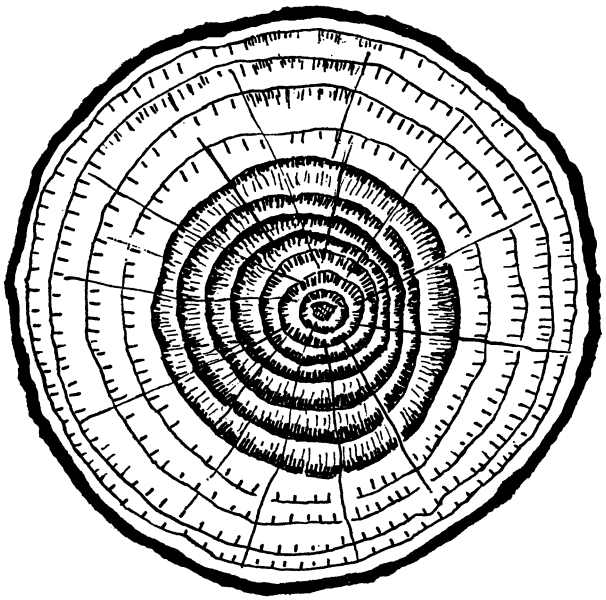
3. What information should be provided when ordering timber?

4. Explain the difference between exotic and imported timber.

   a) Exotic timber.

   b) Imported timber.

5. Insert the following labels on the cross-section of the tree below.



1. Bark or Cortex
2. Inner Bark or Phloem or Bast
3. Cambium Layer
4. Pith or Medulla Heart
5. Growth Rings or Annual Rings
6. Medullary Rays
7. Sapwood
8. Heartwood

6. List three (3) native timbers used commercially in New Zealand and give two (2) end uses for each one.

7. List three (3) differences between a softwood and a hardwood.

8. Describe what the term a “sustainable timber resource” means.

9. List examples of three (3) different timbers from sustainable sources.

10. Provide examples of three (3) different timbers from unsustainable sources.

11. Timber can be described in terms of treatment, length, size, finish and profile. For the uses listed below fill in these details for common or typical uses.

| Application | Treatment & Length | Size | Finish | Profile/finger Jointing |
|---|---|---|---|---|
| Fencing rails | | | | |
| Internal framing | | | | |
| Finishing round internal doorways | | | | |
| Boxing for concreting | | | | |
| Finishing around internal wall/floor joins | | | | |

| WORKSHEET 1 | Assessor Initials: | Date: |
|---|---|---|

# Grading of Timber

Timber used in construction is graded for structural or appearance purposes.

## Structural Grading

This is where timber is graded for both the strength and stiffness required to meet structural requirements. Natural defects which can reduce timber strength include knots, checks, gum pockets and cross grain.

Two methods of grading structural timber are:

- **Visual Grading:** Each length of timber is inspected by an operator for defects affecting its structural integrity.
- **Machine Stress Grading (MSG):** Timber is passed through rollers which apply a load. The amount of deflection is then measured. The result is translated by computer and a colour-coded spray is applied to the timber.

## Appearance Grading

Where the finished appearance of timber is important, appearance grading will take into account blemishes that could detract from the final finished product.

**References**

**BRANZ ST,** pages 19 to 21, Grading.

**BRANZ HBG,** Section 7, pages 48 -49, Timber Grades.

# Defects in Timber

A defect is defined as any irregularity occurring in or on timber that may lower its strength, or value, or detract from its appearance.

Some common defects in timber are:

- knots;
- splits, checks and shakes; and
- warps.

## Knots

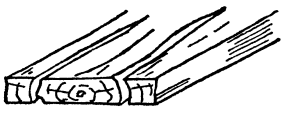
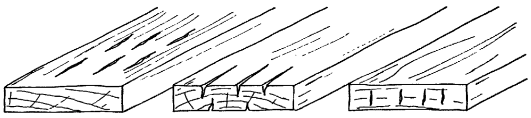
A knot is the result of a former branch being cut through during the milling of the log. The timber is weakened by the grain deflection around the knot causing:

- reduction of load-bearing capacity;
- distortion of the grain fibres; and
- checking around the knot during drying or seasoning.

Knots will have a greater effect on the performance of a piece of timber for a given application or use when the timber is in tension rather than in compression.

A structural beam or lintel will be weakened significantly when a knot is located centrally and in the lower half of the beam.

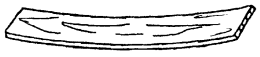
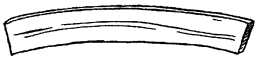
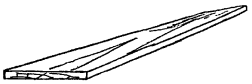
## Splits, Checks and Shakes

| **Split** | **Check** | **Shake** |
|---|---|---|
| A split is a longitudinal separation of the grain extending from one face through to the other. | A check is similar to a split, but the separation does not extend right through the timber. | A shake is a separation of the annual growth rings. Shakes can appear as large splits in milled timber as a result of the different rates of shrinkage during drying or seasoning. |
|  |  Surface End Internal |  |

Each of these defects can cause not only a significant strength loss, but also be a cosmetic problem for paint finishes.

## Warp

This is a term given to any variation from a true surface. It is caused by uneven shrinkage or uneven drying. It includes bow, crook, cup and twist or a combination of these.

| **Bow** | **Crook** | **Cup** | **Twist** |
|---|---|---|---|
| A bow is the curving of a piece of timber flatwise along its length. | A crook is the curving of a piece of timber edgewise along its length. | A cup is the curving of a piece of timber across its width. | A twist is the spiral curving of a piece of timber along its length. |
|  |  |  |  |

## Other Defects in Timber

**Burls or Burrs** – Abnormal growths on the side of a tree which produce a confused grain structure.

**Cross Grain** – When the grain does not maintain an even inclination with the surface of the timber.

**Diagonal Grain** – Spiral grain and interlocked grain also can be classified as defects as they can cause a strength loss in timber.

## Blemishes in Timber

A blemish is any irregularity not classified as a defect which mars the appearance or lowers the value of timber but does not lower its strength.

Some common blemishes in timber are:

- gum streaks;
- resin pocket;
- sap resin (or sap stain); and
- pinhole borer.

**Gum Streaks** –- Streaks of fibre saturated with resin. These produce very hard areas which are difficult to plane and nail.

**Resin Pocket** – An opening in wood fibres which holds or has held resin.

**Sap Stain** – A discolouration of the timber caused by a fungal infection which feeds on the sugars and starches in the wood cells.

**Pinhole Borer** – The small black-ringed hole left by a boring insect which attacks the living tree.

**Reference**

**BRANZ ST,** pages 12 – 13.

# Worksheet 2

Apprentice Name:

1. What are the two (2) methods used to grade timber in New Zealand? Provide two (2) suitable uses for the lower grade.

2. State the possible usage for the following machine stress graded timber (MSG):

   a) F8 to F11.

   b) F4.

   c) F5 to F8.

3. Describe the following common defects in timber:

a) Knot.

b) Split.

c) Warp.

d) Check.

| WORKSHEET 2 | Assessor Initials: | Date: |
|---|---|---|

# Seasoning Timber

Seasoning timber is the process involving the reduction of the moisture content in the selected piece of timber to equal that of its proposed surroundings. The stabilising of timber by drying is one of the most important advantages of seasoning. Other advantages of seasoning are:

- Timber with a moisture content (MC) below 20% is free from wood rot and sap stain fungi. Seasoned timber is thus not subject to decay or spoiling from these fungi, providing it does not absorb moisture from damp conditions.
- It is lighter to handle and transport.
- It can be painted or polished. (Only seasoned timber should be painted or polished.)
- Seasoned timber enables a more effective penetration of a preservative.
- There is a reduction in shrinkage distortion.
- Seasoned timber is stronger and much less corrosive to ferrous metals than wet timber.

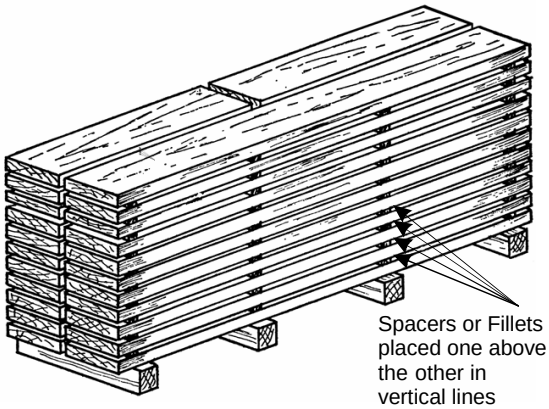
## Methods for Seasoning Timber

There are two main methods for seasoning timber.

- Air seasoning (natural seasoning); and
- Kiln seasoning (artificial seasoning).

## Air Seasoning

When air seasoning, cut boards are stacked allowing natural air to flow in and around them over a period of time until they have dried out. This can be done indoors or outdoors, the critical thing being that there is an adequate flow of air through the stack. (If the timber stack is being seasoned outdoors, a shelter roof needs to be constructed on top of the stack to protect it from the elements.)




At the bottom of the stack are bearers, onto which the first layer of timber is placed. Subsequent layers are separated by carefully placed fillets. (Care must be taken to ensure that fillets line up vertically in the stack – one above the other. Fillets that do not line up will allow the timber to distort during the drying process.)

If the cut boards are of different lengths, the longest should be at the bottom of the stack and the shortest at the top. (If the longest lengths are stacked at the top, they will overhang the shorter lengths. These overhanging boards are then likely to warp.)

The ends of the boards once stacked should either be covered with nailed-on strips or painted with thick paint or an end grain sealer. This will prevent the ends drying out too quickly and splitting.

## Advantages of Air Seasoning

- It can be done anywhere. (There doesn't necessarily have to be a building to do it in.)
- The method is cheap, as everything is done naturally.
- No artificial heat is required.

## Disadvantages of Air Seasoning

- It is impossible to dry the timber to an exact specified moisture content.
- The method is slow. (The time will vary depending on what time of year it is, the thickness of the timber and whether it is a hardwood or softwood. No matter what the conditions are, though – it takes time.)
- A large area of land is required.
- Timber that is exposed to the weather will change in colour.

## Kiln Seasoning

Kiln seasoning is done by stacking cut boards in the same way as air seasoning, but then placing them in a kiln, which heats them to dry out the moisture.

The three main factors that are involved in kiln seasoning are:

- heat;
- humidity; and
- air circulation.

### High temperature kilns

In these kilns, steam is blown into the kiln until the timber is saturated. Hot air is then circulated through the stacks gradually reducing the humidity until only the dry air is left circulating. This air movement may be by "natural draft" where heated air rises naturally through the timber, or by "forced air" where fans force the air through the kiln.

### Low temperature kilns

Low temperature dehumidification kilns will dry the timber more slowly, without the use of steam. In doing so they can reduce the risk of shrinking and warping.

## Advantages of Kiln Seasoning

- The timber can be dried to an exact moisture content.
- Drying is fast and controlled.
- A supply of dry timber will always be available no matter what time of the year it is, or what the weather conditions may be.
- The timber is sterilised during the process. (This will kill any boring insects that may have already attacked the timber. It will not, however, stop further attacks once dry.)

## Disadvantages of Kiln Seasoning

- It is an expensive process both in terms of plant and resources.
- Unless proper care is taken, the timber can collapse, split or become brittle due to the high temperatures used in the kiln.

## Moisture Content (MC)

Moisture content is the term used to express the amount (expressed as a percentage) of moisture contained in a piece of timber.

Timber in living trees and freshly felled logs contains large amounts of water in the cell cavities and walls.

The amount of moisture in timber will vary considerably. This amount can be determined by one of two methods:

- **Moisture Meter:** This measures the electrical resistance of the timber which increases as the timber dries out (seasons). The steel pins are forced into the timber and the meter measures the resistance to the current flow between the two pins. Moisture meters are used to test moisture content of framing timber before wall linings are fixed.

*Moisture meter*

- **Oven Dry Method:** While the moisture in timber will vary, the dry weight of wood substance in any sample will remain constant. It is usual to express the variable (moisture content) as a percentage of the constant (dry weight):

$$\text{MC (\%)} = \frac{\text{Initial weight of sample - Dry weight of sample}}{\text{Dry weight of sample}} \times \frac{100}{1}$$

Eg. Wet weight of sample (WW) 250gm
Dry weight of sample (DW) 200gm

$$\text{MC\%} = \frac{\text{WW - DW}}{\text{DW}} \times \frac{100}{1}$$

$$\text{MC\%} = \frac{250 - 200}{200} \times \frac{100}{1}$$

$$\text{MC\%} = \frac{50}{200} \times \frac{100}{1}$$

$$\text{MC\%} = \frac{1}{4} \times \frac{100}{1}$$

$$\text{MC\%} = 25\%$$

**Reference**

**BRANZ ST,** pages 14 to 18.

## Fibre Saturation Point

The cell walls and cavities of living trees are filled with moisture. During timber seasoning the water in the cell cavities is removed without affecting the properties of the timber other than its weight. When the moisture content is reduced to approximately 25-30% the timber will reach its fibre saturation point, ie. the moisture is contained mainly in the cell walls.

Simply put, the fibre saturation point is when the free water in the timber cells is lost and only bound water is left in the cell walls.

Drying below the fibre saturation point releases the moisture from the cell walls and, as a result, the timber will shrink. Shrinkage can occur in timber:

- lengthwise;
- around the curvature of the growth rings; or
- in a radial direction.

Timber will shrink very little in length.

## Humidity

Seasoned timber will absorb moisture from the surrounding atmosphere. It also loses moisture when the air around it has a low relative humidity. Moisture in cell walls received from the surrounding air is known as Lyproscopic moisture. These changes in the moisture content of the atmosphere will cause the timber to either swell or shrink.

## Equilibrium Moisture Content

Seasoned timber will either absorb or lose moisture until such time as the moisture in the timber equals the relative humidity of the air around it. So the equilibrium moisture content is reached when the moisture content within the timber is in equilibrium with the surrounding atmosphere.

Movement in timber can be minimised if timber is seasoned to the atmospheric conditions where it will be used. For example, Tongue and groove (T and G) flooring should be stored for a period where it is to be used, so that the timber can reach its equilibrium before being laid.

For recommended moisture content for timber and wood-based products, refer to the references below.

**References**

**BRANZ ST,** page 17, table 3.

**BRANZ HBG,** Section 7, table 7.5.

# Worksheet 3

Apprentice Name:

1. Give a description of the following terms:

   a) Moisture content of timber.

   b) Fibre saturation point.

   c) Equilibrium moisture content.

2. Explain the two (2) methods for seasoning timber.

   a) Air seasoning (be sure to describe the correct stacking method).

   b) Kiln seasoning (be sure to mention two (2) different methods of air movement and the difference between high and low temperature kilns).

3. How is moisture measured using a moisture meter?

4. When would you use a moisture meter?

5. How is moisture measured with the oven dried method?

| WORKSHEET 3 | Assessor Initials: | Date: |
|---|---|---|

# Insect Attack

Insects often tunnel into timber, spoiling its appearance and reducing its strength. If the tunnels are numerous, they may reduce the strength enough to make the wood valueless. Some insects attack only living trees or newly felled logs. Some attack only seasoned timber, while others only attack the sapwood. The presence of insect damage is not in itself a cause for alarm as the damage may have occurred before the timber was seasoned.

Signs of insect attack include:

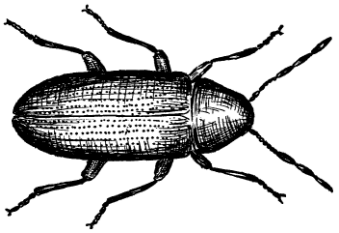
- small irregular (random) holes on underside/inside (out of light) of timber;
- small irregularly carved grooves; and
- very fine borer dust

## Wood Boring Insects in New Zealand

The following are the most common wood boring insects affecting New Zealand timber.

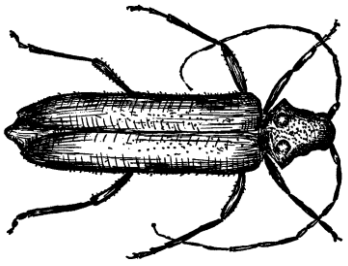
## Common House Borer

**Anobium Punctatum** – This is the common house borer. It attacks old, well seasoned timber preferring the sapwood of softwood timbers. It will, however, attack both the sap and heartwood of both soft and hard woods. The beetles emerge from the wood between November and February. They are more active at night, and tend to return to flight holes during the day to lay eggs.



## Two-Toothed Longhorn Borer

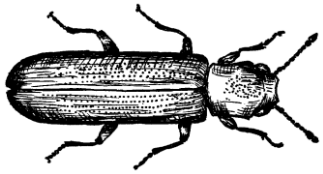
**Ambeodontus Tristis** – This is one of the more destructive of all wood boring insects. This insect prefers the sapwood of the softwood timbers, but will also attack heartwood. The beetles emerge during autumn, and are active over a long period. They dislike light and prefer the underside of timber.



## Powder Post Borer

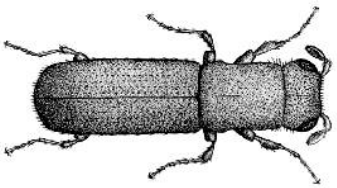
**Lyctus** – There are several kinds of powder post borer, but their habits and characteristics are similar.

It is about the same length as the common borer, but is narrower. It attacks only the sapwood of hardwoods such as Oak and Tawa. As it lays its eggs in the pores of the hardwood, softwood (which does not have pores) is not affected.



## Pinhole Borer

**Platypus** – There are a few different types of pinhole borer or beetle, all are quite similar in appearance.



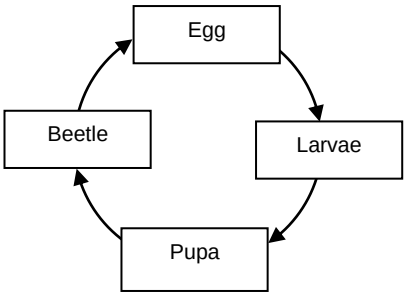
They are a shiny, slender, brown beetle about 5.5cm in length. They have long yellow coloured hairs. The New Zealand pinhole borer is a native insect that can fly several kilometres looking for suitable wood in which to burrow. The pinhole beetle will attack standing trees, green timber and occasionally, milled timber. It has an interest in a wide range of native and introduced timbers including pine, Douglas fir and beech.

***Note:*** *The pictures of the different types of borer have been magnified to show more clearly what they look like.*

## Life Cycle of Wood Boring Insects

**The Egg**

This is laid on the surface of the wood in a crack, split or old flight hole.




**The Larva**

When emerging from the egg the larva or grub bores into the wood using the tunnel as its home and food source. When it has finished growing it bores a chamber near the surface of the timber and changes into a pupa.

**The Pupa**

While in the pupal stage it does not move or eat. During this period it develops the adult features. When growth is complete it casts its skin and exits the wood as a fully grown adult.

**The Beetle**

The sexes mate and the female lays her egg to begin the cycle again.

***Note:*** *While it is the larvae that bores the holes inside the wood, it is the beetle which leaves the distinctive exit or flight holes which indicate the presence of infestation.*

## Preventing Attack by Wood Boring Insects

To discourage borer attack from the three types of borer in New Zealand, the following precautions should be taken:

- All rubbish and debris should be removed from underneath a building.
- There should be adequate ventilation to keep the timber dry.
- Appropriately treated timber (or timber that is naturally resistant to borer attack) should be used. (The natural chemicals that are contained within the heartwood of a tree are in many cases poisonous to borer.)
- Untreated timber should be dressed. (Borer like to lay their eggs in the crevices of rough sawn timber.)
- A painted coating on the surface of timber discourages borer from laying their eggs there.

## Termites

Termites are widespread throughout Australia where they can cause considerable damage in residential and commercial buildings. They can also be found in some parts of New Zealand.

There are a number of different species of termites in New Zealand which can be divided into two categories:

- subterranean (earth-dwelling) termites; and
- wood-dwelling termites.

**Subterranean Termites (Earth-dwelling)**

All subterranean termites are native to Australia and have been introduced to this country with the import of hardwood timbers.

They establish their colony under a building. From this colony the workers build tunnels to the source of the wood on which they feed. They will build these tunnels over obstructions and once they gain access to the timber they will remove the interior wood, leaving only a thin exterior veneer or shield.

**Wood-dwelling Termites**

These are a native species of New Zealand which live in the timber. There are two groups:

- Dry-wood dwellers – These termites live in seasoned timber.
- Damp-wood dwellers – These termites live in damp wood such as dead logs and stumps.

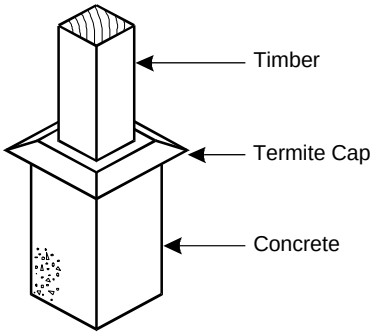
In buildings where attack is localised, if the appropriate measures are taken they will repay the expenditure of time and money. These measures include:

- removal and replacement of badly infested timber; and
- treatment of infested timber with a reliable preservative.

***Note:*** *It is necessary when ordering timber to specify the preservative treatment for the situation in which it is to be used.*

**Termite Prevention and Control**

To prevent the attack on timber by termites, unwanted timber should be removed from beneath and around buildings. The reason being, these dark and damp locations are an ideal breeding ground for insect infestation. (Unwanted timber could include scraps that have been left lying around, stacks “put aside for a rainy day”, or old tree stumps.) If any timber is found that seems to be infested, it should be burned. If a termite colony is discovered, the best thing to do is to get in a professional eradicator.




If building in a known termite area, foundation walls and piles should be fitted with termite caps. Caps will help prevent invasion by earth-dwelling termites. They are, however, ineffective against dry-wood species, which enter the timber above the ground.

**Reference**

**BRANZ ST,** pages 12 – 13.

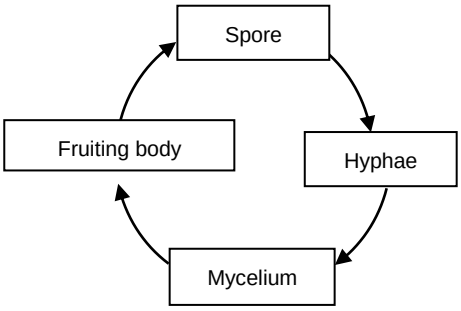
# Fungal Infection

Fungi are plants that lack chlorophyll and therefore cannot manufacture the starch and sugar essential for plant growth.

However, they have special root-like structures, called hyphae, which can dissolve out the necessary starches and sugars already manufactured by other plants.

The hyphae are very fine tubes or hollow threads that eventually become matted together to form a felt-like mass. This mass is called the mycelium and it is from the mycelium that the fruiting body arises. The fruiting body sheds spores and from these spores, when moisture conditions and temperature are just right, fresh hyphae grow.

The complete life cycle of any fungus is a continuous loop that starts with the spore.




There are two basic types of fungi that cause rot:

- **Soft Rot Fungi** – can attack timber when the moisture content is between 35 - 50%.
- **Brown Rot (Dry Rot)** – can attack timber when the moisture content is between 20 - 50% by drawing the water from a moist location and transferring it to a dry location.

**Dry Rot**

- initially white
- can develop cracks
- timber weakens and crumbles

**Wet Rot**

- wood feels spongy
- wood is darker in colour and weaker
- usually found in damp areas

Fungal attack can be prevented by keeping timber dry. **Adequate ventilation is extremely important**. Off-cuts should be removed from beneath a house because, being in contact with the ground, they can rot quickly and, if conditions are suitable, fungi could spread to house timbers.

Timbers showing fungal damage should be removed and replaced with sound timber. The timber in the surrounding area from the point of attack should also be removed as it is difficult to decide merely by inspection how far the fungal attack has spread. The cause of the attack should be traced and treated. The new timber should be well seasoned heartwood, or well seasoned sapwood treated with an appropriate preservative.

In an exposed situation, a good paint finish will prevent the entry of moisture and the conditions that are essential for fungal growth.

**Reference**

**BRANZ ST,** page 12.

# Damage to Timber

The following factors can cause deterioration in timber. These effects, along with those relating to insect and fungal attack, need to be considered.

## Ultraviolet Light

Ultraviolet light (UV) oxidises the surface of timber, changing its colour to the soft grey often seen on buildings sheathed with natural unprotected wood such as cedar shingles or planks (silver discolouration). The discolouration is of no structural concern. Paints and stains can prevent this damage.

## Mechanical Abrasion

Decking, steps, floors and paving are often subject to wear by people walking over them. The use of a hard, dense timber or the provision of a protective coating or membrane is usually the best solution in these situations.

## Moisture Fluctuations

Unprotected timber that is exposed to the weather can develop surface checks – due to rapid alternative wetting and drying by rain and sun.

Timbers with a large width or depth are more likely to be affected than timbers of smaller width or depth. Splitting often occurs if the shrinkage movement is prevented.

## Bacteria

Attack by bacteria has been observed where timber is in contact with heavily fertilised soils such as orchards, horticultural blocks, market gardens, sheep yards and compost bins. Bacteria damage may show as colour changes in the timber in and around areas that meet the source of the bacteria.

## Chemicals

When corroding metal is in direct contact with timber, the interaction of the oxides can cause a structural breakdown in the surrounding wood fibres. Sometimes this is referred to as iron sickness.

## Storage and stacking

Incorrect storage and stacking of timber can result in damage to timber due to the five causes listed above, and as a result of some specific storage and stacking issues.

Damage from storage and stacking problems can include:

- impact damage from vehicles or equipment;
- dampness to the bottom of the stack from lying on wet ground;
- splatters of paint, concrete, etc.; and
- warping from placement on uneven surfaces.

# Worksheet 4

Apprentice Name:

1. Name the timber that the following borer attack:

   a) Common borer.

   b) Two-toothed longhorn borer.

   c) Pinhole borer.

2. Identify two (2) factors that can prevent fungal growth in timber.

3. Identify two (2) factors that will prevent wood boring insect attack in timber.

4. What would indicate the following conditions have affected timber?

   a) Ultraviolet light.

   b) Mechanical abrasion.

   c) Moisture fluctuation.

d) Chemical damage.

e) Storage and stacking damage.

f) Bacteria.

5. What effect can insect attack have on timber?

6. Which one of the following is an example of deterioration of timber due to insect damage?


Picture A


Picture B


Picture C

Answer: =

7. What effect can dry and wet rot have on timber?

8. In the pictures below, what damage is caused by dry rot and what is caused by wet rot?

| WORKSHEET 4 | Assessor Initials: | Date: |
|---|---|---|

# Wood Preservation (Timber Treatment)

Wood preservation is the process of preserving timber effectively to ensure that the timber is protected from attack by wood-destroying insects and fungal decay.

While the heartwood of most native timbers is naturally durable, the sapwood of both native and exotic softwood species is subject to decay and insect attack. Preservative treatments are necessary in order to obtain an economic service life from these timbers which have little natural durability.

Various methods of treatment are available to provide adequate protection from the conditions expected over the service life of the timber.

For example, framing timber for a residential dwelling will require a different treatment method than timber which will be in continuous contact with the ground.

The Timber Preservation Authority's branding regulations ensure that timber treatment methods are easily identified and the appropriate product selected.

***Note:*** *Timber should be dry prior to treatment to allow the preservative to penetrate the timber cell structure.*

| Exposure | Hazard Class | Typical End Use | Biological Hazard |
|---|---|---|---|
| Protected from weather, above ground | **H1.1** | Interior finishing timer * | Borer |
| Protected from weather, above ground, but with possibility of exposure to moisture | **H1.2** | Wall framing * | Borer, fungal decay |
| Exposed to weather, above ground | **H3** | Plywood * | Decay fungi and borer |
| Exposed to weather, above ground | **H3.1** | Cladding, fascia, joinery * | Decay fungi and borer |
| Exposed to weather, above ground or protected from weather but risk of moisture entrapment | **H3.2** | Decks, pergolas, external beams, posts not in ground | Decay fungi and borer |
| Exposed to weather, in ground or fresh water | **H4** | Fence posts, landscaping timbers not requiring building consent | Decay fungi and borer |
| Exposed to weather, in ground or fresh water | **H5** | House piles and poles; crib walling; posts in ground for decks, verandahs, pergolas | Decay fungi and borer |

*** Full details of end uses found in NZS 3602:2003.**

The higher the hazard class the higher the resistance to fungi or insect attack. This allows the selection of the appropriate timber treatment for the purpose to which the timber is to be used.

## Methods of Timber Treatment

Preservative application methods used for on-site remedial work include brush-on and dip diffusion. The most successful commercial method is pressure impregnation and the chemicals commonly used for preservation treatment of building include:

- **Boron salts** – Widely used in New Zealand and to a lesser extent in Australia. They are used where the main hazard is insect attack but experience has shown that at a certain level, defined by hazard class H1.2, it also has valuable anti-fungal action. Prolonged exposure to moisture can cause the salts to leach out of the timber so this treatment should only be used on timber that will remain protected from the weather in-use.
- **Pressure treated Boron with Glycol** – These are a mix of borate salts in a carrier of monoethylene glycol (which is almost the same as car antifreeze). This treatment can kill existing fungus in the wood and provides protection against future fungal attacks. Pressure treatment refers to the way the timber is treated in a sealed vessel which first “sucks” out the existing moister, then “pushes” the treatment in by pressure.
- **Copper-chrome-arsenate (CCA)** – The most widely used treatment. The chemicals are forced into the timber under high pressure. Once these chemicals become fixed in the timber they won't leach out as a result of wetting under normal conditions. The length of time taken to fix chemicals in the timber varies from weeks to months, depending on weather conditions.
- **Copper-based alternatives** (chrome and arsenic-free, such as copper azole CuAz and Alkaline copper quaternary) – These are alternatives where environmental legislation or customer-preference restricts the use of CCA. They are applied to the timber under pressure.
- **Light Organic Solvent Preservatives (LOSP)** – A solution of fungicides and/or insecticides in a light organic solvent, such as white spirit, is applied by a vacuum process and because it is spirit-based it avoids wetting timber that is already dry. This makes it particularly useful for treating fully machined components by avoiding waste and disposal problems with dust and shavings. The solvents must be fully evaporated before paint, stain or glues are applied. The chemical preservatives are not fixed and therefore can be leached out by water so LOSP-treated timber must be protected by a three-coat paint system if used externally.
- **Chemical free** – Some kiln dried and untreated timbers can be used in applications where there is no risk of decay. Typically this will be limited to internal partitioning, exposed rafters and ceiling joists and use timbers such as Douglas fir, larch, macrocarpa, Lawson cypress and kiln dried, planer gauged pine.

## Cut Ends

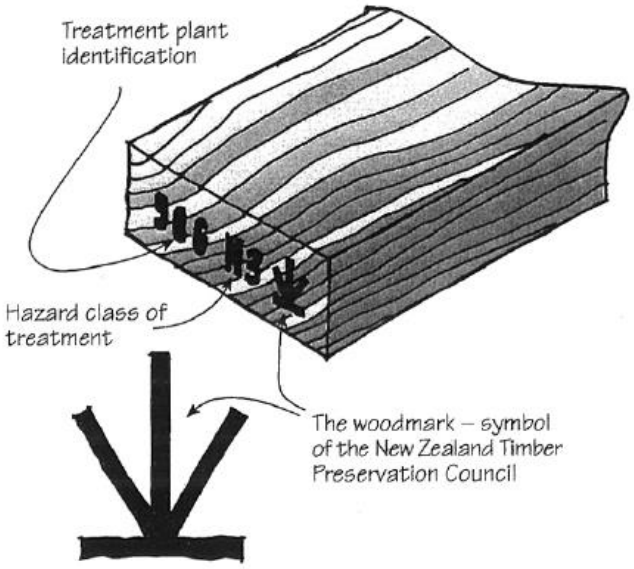
When selecting treated timber it is important to note that:

- if large section timbers are to be cut, chased, bored or machined after treatment from H3 to H6, the area exposed should be protected with a paint on preservative such as copper napthenate; and
- cut ends of treated softwood posts, stumps and piles must not be embedded in the ground, because site-protected applications cannot give adequate protection.

## Marking

Each piece of timber (with some minor exceptions, such as packets of small pieces like fence battens) must be clearly branded with an identification branding mark and colour codings defined in NZS3640:

- a timber treatment plant identification number;
- preservative code number;
- hazard class of treatment; and
- Woodmark® for treatment plants licensed by the New Zealand Timber Preservation Council Inc.




## Colouring

In addition to end-branding, framing timber used in New Zealand must be colour coded as defined in NZS3640 clause 5.2: for hazard classes H1.2 and H3.1.

Colour codes and hazard class treatment codes can be seen (in full colour) throughout the DBH booklet *Timber Treatment Requirements*.

**References**

**BRANZ HBG,** Section 7, pages 41-45, Timber Treatment.

**BRANZ ST,** pages 31-34, Preservative Treatment of Timber.

**DBH TTR,** pages 4-5.

# Timber Handling, Storage and Protection

Timber is a relatively soft material and may be damaged if not handled carefully. Fork lifts and tipping trucks are a significant source of mechanical damage and should be used with care. Cable or chain slings can damage the timber surface and should be avoided. (If the use of a cable or chain sling is unavoidable they should be used with protective packing.) Web slings are satisfactory when handling large members. Some thin members may need to be held in a vertical position.

Careful storage of timber is essential to prevent problems occurring between the drying of the timber and the final finishing. Weather is a major cause of timber deterioration. For example, if Radiata Pine is left exposed to the weather, the moisture pick up is extremely rapid.

Care must be taken to ensure that large dry timbers (such as beams) do not become wet during construction. Temporary protection from rain and moisture can be provided by paints, stains, polyurethanes or other proprietary sealants.

Dry members installed in a structure should be sealed or remain wrapped or covered until the roof goes on.

All timber and timber products should be:

- stacked on well-aligned bearers;
- kept well clear of the ground or concrete floor slab;
- covered to protect from the sun and rain; and
- kept in the original wrapping if delivered wrapped.

A new concrete floor slab (ie. still green) will release a lot of moisture into any timber that is placed and stored directly on the slab.

Framing timbers should preferably be dried before delivery. If not, to minimise distortion, they should be carefully fillet stacked for air drying on site. Spacers or fillets between the stacked members should be placed in a vertical line to prevent the loads from the stack above distorting the timber members below.

Alternatively they can be block stacked with no spaces between the layers to prevent drying, and then installed in position in the structure before the drying commences. If timber members are installed green, much of the drying distortion in wall studs can be resisted by the nogs, dwangs and exterior cladding of a building.

Metal banding or plain steel nails will produce rust stain on wet wood surfaces. Non-ferrous strapping and galvanised fasteners should be used where the appearance is important.

**Reference**

**BRANZ HBG,** Section 6, figure 6.2.

## Health and Safety Requirements

Timber treatment consists of chemicals that may be harmful. Important measures to take when working with treated timbers are:

- reduce contact with the timber by wearing gloves, goggles and a dust mask;
- don’t burn off-cuts or cook with them;
- dispose of waste in an approved landfill;
- wash your hands before using the toilet, smoking, drinking or eating;
- wash work clothes separately;
- ventilate work spaces as much as you can; and
- working with solvent damp timber is not advised – solvent damp timber should be allowed to dry properly before use.

**References**

**BRANZ ST,** page 33.

**DBH TTR,** page 3.

# Worksheet 5

Apprentice Name:

1. Why is it important that timber is dry prior to treatment?

2. Why are different classes of timber treatment used in various locations in construction?

3. What precautions should be taken with cut ends of treated timber?

4. List four (4) precautions to be taken when handling treated timber on site.

5. Draw lines to match the timber treatment methods with their correct description.

| Treatment method | Description |
|---|---|
| Boron salts | Commonly used to protect against insect attack |
| Pressure treated boron with glycol | The most widely used treatment, known as CCA |
| Copper-chrome-arsenate | A mix of borate salts in a carrier of monoethylene glycol to kill existing fungus in the wood and provide protection against future fungal attacks |
| Copper base chrome and arsenic free | Fungicide/insecticide applied in a spirit base, known as LOSP |
| Light organic solvent | Used as an alternative to CCA when customer or legislation does not allow CCA |
| Chemical free | A limited number of timbers in limited applications can be used without chemical treatment |

6. Name three (3) timber surface finishes and three (3) specific order requirements and their abbreviations:

a) Timber surface finishes.

b) Specific order requirements.

7. What are the two (2) properties for which timber is graded?

8. Identify two (2) methods of seasoning timber.

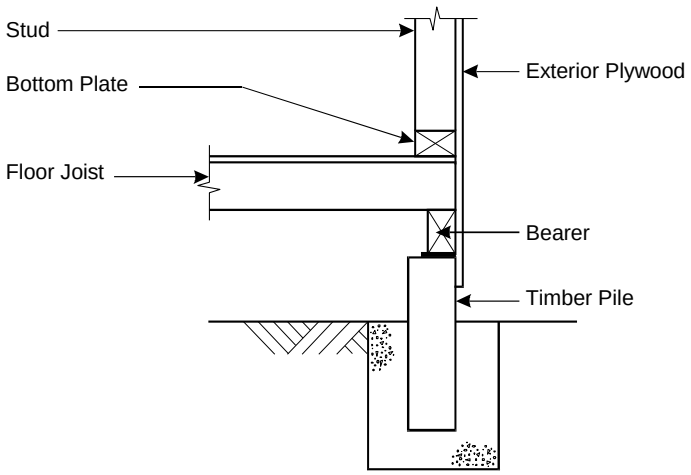
9. What would be the appropriate action required on the discovery of:

a) Insect attack?

b) Fungal attack?

10. Using the diagram below, identify the minimum level of timber treatment required for each of the following building elements:

| | |
|---|---|
| Stud | Bottom plate |
| Floor joist | Bearer |
| Exterior plywood | Timber pile |




| WORKSHEET 5 | Assessor Initials: | Date: |
|---|---|---|

**Assessor's comments**

## Sign off check

The apprentice has successfully completed all the worksheets and answered all the questions correctly.

**Checklist:**

❑ Worksheet 1 ❑ Worksheet 2 ❑ Worksheet 3

❑ Worksheet 4 ❑ Worksheet 5

Where reassessment of certain questions has occurred, the correct answers were:

❑ Re-written by the apprentice

❑ Confirmed through oral questioning and noted next to the answer

The apprentice has correctly answered a selection of oral questions

❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5

❑ 6 ❑ 7 ❑ 8 ❑ 9

**Other** (specify):

In signing off this unit standard, the apprentice can:

- correctly describe timbers in terms of their species, characteristics, common usage and resource sustainability;
- correctly describe timber in terms of length, size and finish;
- correctly describe grades of timber and their applications;
- correctly describe timber defects in terms of their effects;
- correctly define terms relating to seasoning timber and the methods used;
- correctly describe methods used to determine moisture content;
- correctly identify common forms of fungal and insect attack and their results;
- correctly describe the environmental causes of the deterioration of timber and actions to prevent them;
- correctly explain preservative treatment of timber and the associated health and safety requirements for handling and disposal; and
- correctly describe the use, care and handling of treated timber.

| | | |
|---|---|---|
| **UNIT STANDARD 13002 COMPLETED** | **Assessor Signature:** | **Date:** |
| | **Moderator Signature:** | **Date:** |