Grading

Production process - in the mill prior to packing and shipping

Sorting of products into groups with similar characteristics and properties

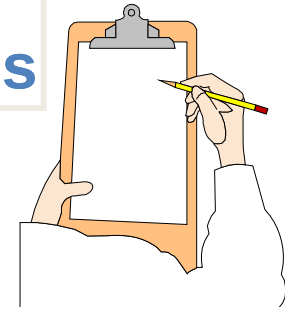
Appearance grade

Sorting Criteria
- visual appearance

Structural grade

Sorting Criteria
- strength & stiffness

Timber identified by calling up a specific grade



Grading is simply sorting a production run into groups that have similar properties. The grouping of the properties can be any mixture of appearance and structural properties. In order to give some uniformity across the industry there are standards for the sorting of timber products. Many of these are Australian Standards, but some are industry-based standards.

Grading standards make it easier for a designer to communicate what is required in a piece of timber to the supplier. A grade designation refers to a full suite of structural, utility or appearance properties. Thus reference to a grade designator will mean that the timber supplied should have the properties that enables it to meet those grading requirements.

Appearance Grading - Rules

- **Aust. Standards AS2796, 1810 etc**
- Grading rules
  - knot size & frequency (location unimportant)
  - splits, cracks, checks (size and frequency)
  - colour, grain uniformity
  - utility - want, wane, cup, bow, spring, twist

Feature grade

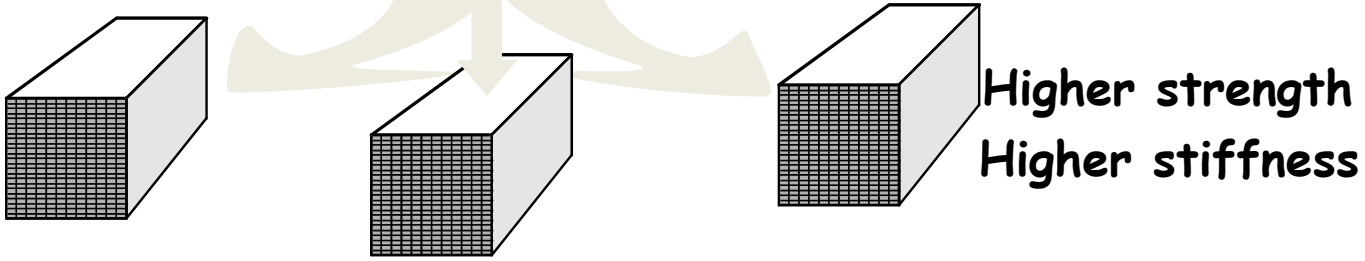
makes a feature of natural characteristics eg knots

Select grade

clear, uniform wood. Free of natural characteristics eg no knots, gum veins etc.

Structural Grading

Criterion for sort is estimated structural properties of timber



- Used for classification of timber with defined structural properties - includes framing for housing
- Each grade associated with a suite of structural properties

Structural grading is the process of sorting the timber on the basis of estimates of the structural properties of the timber. The only way in which we can know the strength of timber for sure is to break each and every piece. The process of structural grading is sorting by some characteristics of the timber that are reasonably well correlated with all of the structural properties.

Structural properties awarded to each grouping are generally as follows:

Strengths - close to the lowest expected in each grouping or grade - typically this is taken as a characteristic strength based on the lower 5th %ile.

Stiffness - a characteristic stiffness based on the mean stiffness is used. This is appropriate for use in floors, frames and systems where there is load sharing between the parallel elements. It is also quite appropriate for the prediction of the deflected appearance of structures.

Anyone who specifies timber that has a structural function must understand the principals of Structural Grading.

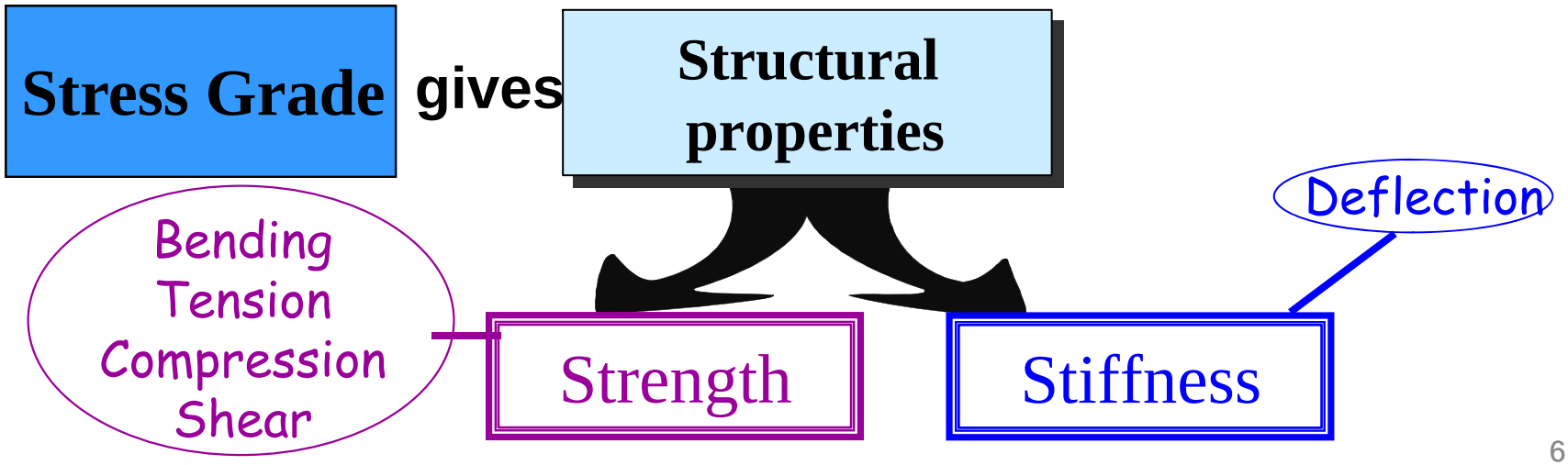
Structural grading

Timber Stress Grades

Structurally graded products need to be assigned properties for designers to use

TABLE 2.4
STRUCTURAL DESIGN PROPERTIES FOR F-GRADES

Stress Grade	Characteristic strength, MPa					Characteristic short duration average modulus of elasticity parallel to grain, Mpa (E)
	Bending (f'_b)	Tension parallel to grain (f'_t)		Shear in beam (f'_s)	Compression parallel to grain (f'_c)	
		Hardwood	Softwood			
F34	100	60	50	7.2	75	21 500
F27	80	50	40	6.1	60	18 500
F14	40	25	21	3.7	30	12 000
F11	35	20	17	3.1	25	10 500
F8	25	15	13	2.5	20	9 100
F7	20	12	10	2.1	15	7 900
F5	16	9.7	8.2	1.8	12	6 900
F4	13	7.7	6.5	1.5	9.7	6 100



The strength and stiffness of timber varies from species to species . In Australia, there are thousands of species of timber, and certainly hundreds of commercially logged species. It would be a very daunting task to evaluate each grade of each and every species individually.

Instead, for most of our species the strength properties are assigned using a system of "**Stress grades**". The structural properties that correspond to each Stress grade are given in AS1720.1 The higher the number of the F-grade, the higher the strength assigned to timber of that grade. Different strengths are used for bending, tension, shear and compression.
If testing or evaluation has confirmed that the properties are between two F-grades, the lower one would be assigned

Structural grading

Timber Stress Grades

- **Limited number of grade descriptions**
  - **F- grade system- general visual graded timber**
  - **MGP grades - machine graded softwoods**
  - **GL grades - glued laminated timber**
  - **A - grades - visually graded Victorian Ash**

Used by producers

Grading method

- ***F- grades (visual, machine)***
- ***MGP grades (machine)***
- ***GL grades (manufacture)***
- ***A - grades (visual)***

Used by designers

Design properties

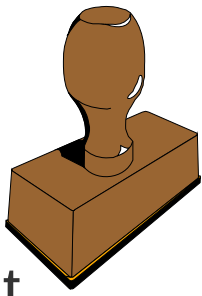
- ***F- grades AS 1720.1***
- ***MGP grades AS 1720.1***
- ***GL grades AS 1720.1***
- ***A - grades AS 1720.1***

Grading is link between producer & designer

Structural grading

Stress Grades

- Stress grade is **assigned to a package** of timber
- Stress grade **gives structural properties**
  - Each piece in a package can be taken to have those properties
  - In most cases, timber has significantly greater strength than the stress grade (5th%ile)
  - Stiffness is frequently close to the stiffness assigned to the stress grade (mean)



- Each piece **stamped** with Stress Grade at grading
  - Coloured marks (machine stress grading) indicate F grades

Structural Grading Methods

Structural grading is based on correlation between strength and a *grading parameter*

Visual stress grading - presence or absence of natural characteristics

AS 2858 Swd

AS 2082 Hwd

Machine stress grading - stiffness on flat (minor axis MoE)

AS 1748

Proof grading - ability to take a proof load. Each piece passed through machine, bending applied at about characteristic strength level. Broken pieces fail - unbroken ones pass

AS 3519

Quality control - verification of grade properties by testing

AS 4063

All **grading methods** are a sorting operation using some easily measured parameter to correlate with strength and stiffness properties. The most common are:

Visual grading - grade indicator is the presence of visually discernible features

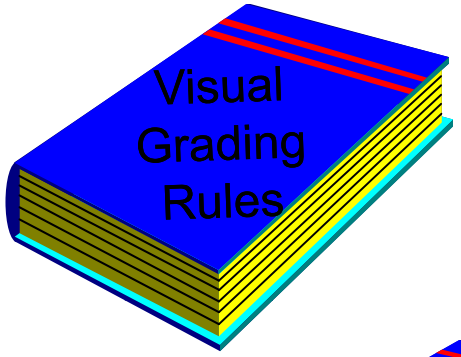
Machine stress grading - grade indicator is minor axis flexural stiffness

Grading by non-destructive **scanning** of the timber - grade indicator is scanning outputs

Proof grading- grade indicator is lower limit of major axis flexural strength.

Visual Stress Grading

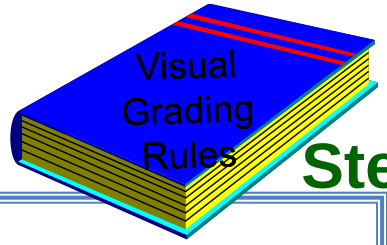
3 Step Process



Step 1

Visual grading
sorts into
Structural Grades

#1 #2 #3 #4 #5

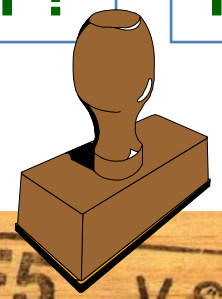


Step 2

F? F? F? F? F?

For each species,
Tables in rules assign
an F-grade to each of
the structural grades.

Step 3



An F-grade may
be stamped
on each piece.

The output of a visual grading process is a **structural grading** - Grades are structural No. 1 to structural No. 5. Within a species, it can be said that structural No. 1 should perform better than structural No 4. Each species has an F-grade assigned for each structural grade number. For example:

Seasoned mountain ash (*euc. regnans*) has F27 assigned to structural No. 1 grade. In the production of this timber a grader would assign structural No. 1 grade to the best pieces, and these would be stamped with F27.

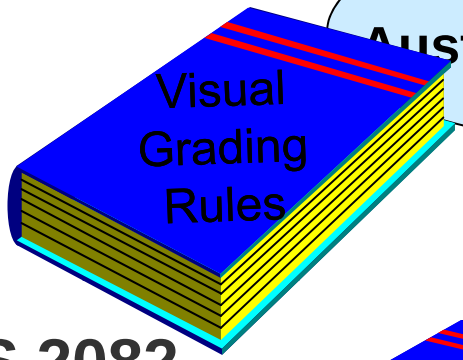
Seasoned hoop pine has F11 assigned to structural No. 1 grade. This is because as a species, hoop pine has much lower strength than mountain ash.

The timber is specified by stress grade only.

Visual Stress Grading

Example - seasoned tallowwood

Tallowwood
Australian Hardwood

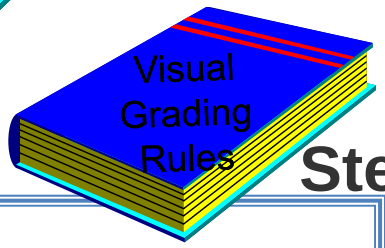


AS 2082

Step 1

Visual grading
sorts into
Structural Grades

#1 #2 #3 #4 #5

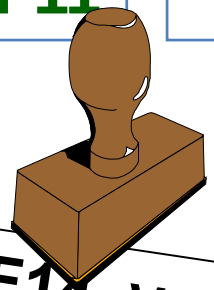


AS 2082

Step 2

F22 **F17** **F14** **F11**

Step 3



F14 V.S.G
AS 2082
seasoned hwd

For each species,
Tables in rules assign
an F-grade to each of
the structural grades.

An F-grade may
be stamped
on each piece.

Grade stamp

- Stress Grade
  (F5)
- Grade Method
  (Visual Stress Grading)
- Grading standard
  (AS2858)
- Mill / producer
- Moisture condition
  (Seasoned)
- Species
  (radiata pine)

End
Grading Presentation