

08

WOOD, PLASTICS AND GLASS

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1. WOOD USED IN ARCHITECTURE

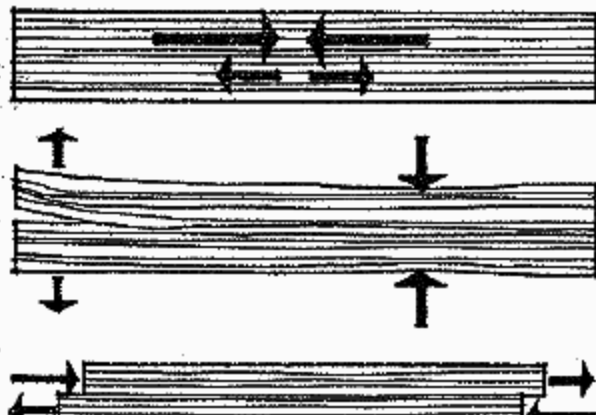
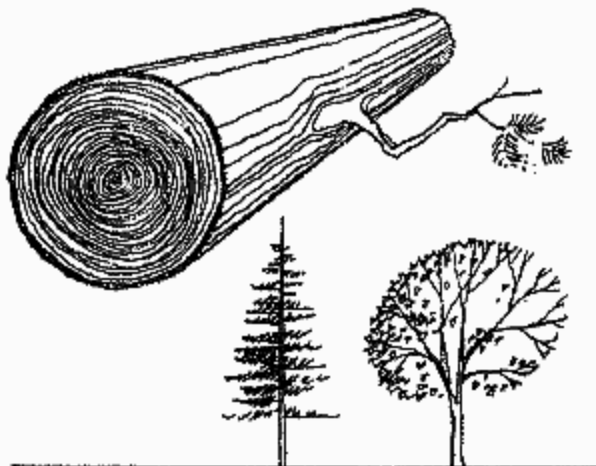
As a construction material, wood is strong, durable, light in weight, and easy to work. In addition, it offers natural beauty and warmth to sight and touch. Although it has become necessary to employ conservation measures to ensure a continued supply, wood is still used in construction in many and varied forms.

There are two major classes of wood:

- **Softwood**
- **Hardwood**

Grain direction is the major determining factor in the use of wood as a structural material. Tensile and compressive forces are best handled by wood in a direction parallel to its grain.

Wood's shear strength is greater across its grain than parallel to the grain. It is therefore more susceptible to horizontal shear than to vertical shear.



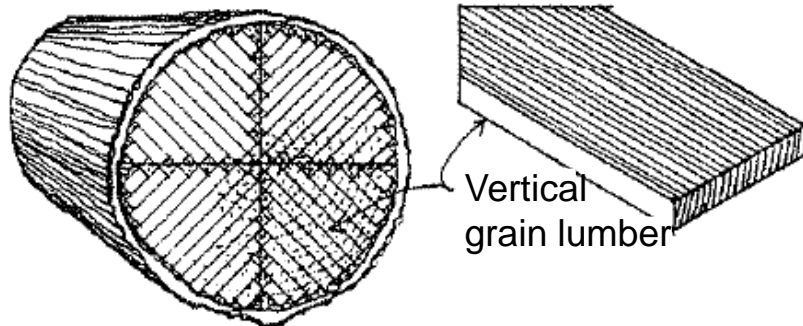
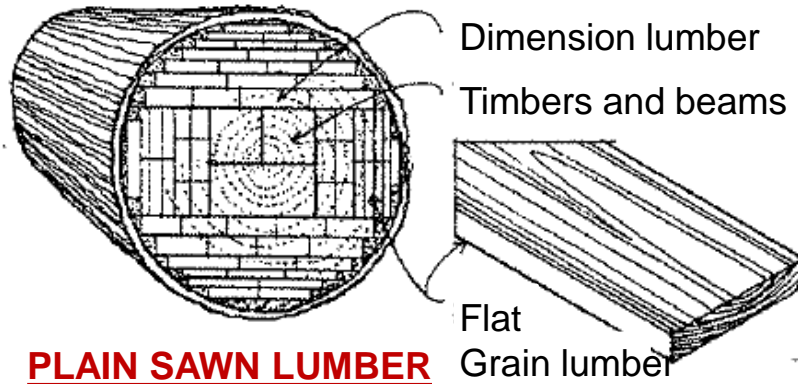
1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES



1. WOOD USED IN ARCHITECTURE

Plains awn lumber:

- may have a variety of noticeable grain patterns
- Tends to twist and cup, and wears unevenly
- Tends to have raised grain
- Shrinks and swells less in thickness, more in width



Quarter sawn lumber:

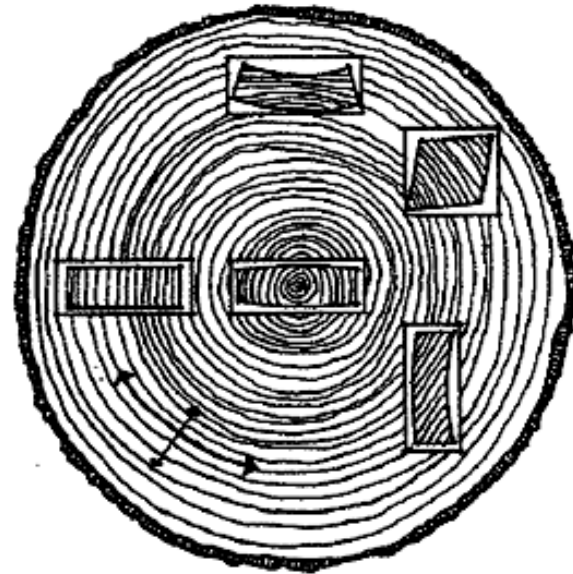
- has more even grain patterns
- Wears more evenly with less raised grain and warping
- shrinks and swells less in width, more in thickness

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

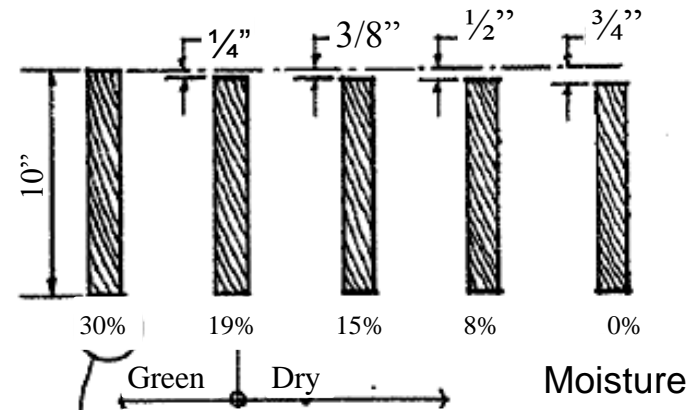


1. WOOD USED IN ARCHITECTURE

Shrinkage tangential to the wood grain is usually twice as much as radial shrinkage. Vertical grain lumber shrinks uniformly while plain sawn cuts near a log's perimeter will cup away from the center.



The thermal expansion of wood is generally much less than volume changes due to changes in moisture content. Moisture content is therefore the controlling factor.



Shrinkage begins at the wood's fiber saturation point.

Moisture content

- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD USED IN ARCHITECTURE

Natural wood has certain properties that make it an attractive building material:

- Natural warmth - to the touch; wood insulates
- Workability, easily shaped with simple tools
- Infinite variety; no two trees, or even pieces from the same tree, are alike
- strength-to-weight ratio for bridges, boats, homes, furniture
- Flexibility; watch how huge trees bend before the wind
- Fire protection; wood chars and therefore burns slowly, doesn't melt or crumble
- Color: natural, through wood's ability to receive many types of stains and finishes

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD USED IN ARCHITECTURE

1.01 CLASSIFICATION OF WOOD

Woods are generally classified into:

- a. **Softwoods** come from the conifers (evergreens) which have needles instead of leaves, e.g. pine
- b. **Hardwoods** come from the broad-leaved or deciduous trees. Most Philippine timber are of this latter kind

The terms “hardwood” and “softwood” are often misleading because they have no direct relation to the actual physical hardness or softness of the wood, so that a hardwood may actually be softer than a softwood.

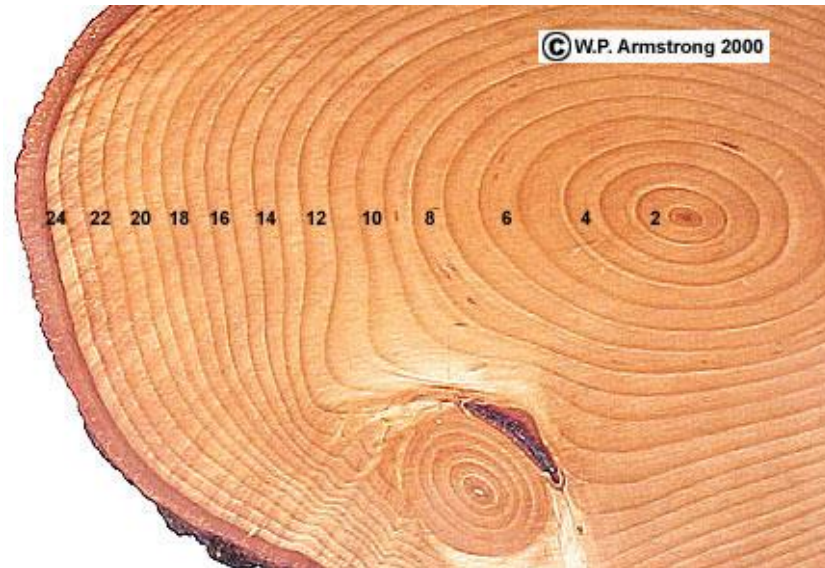
1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD USED IN ARCHITECTURE

1.02 STRUCTURE OF WOOD

a. Sapwood

- is the softer, younger outer portion of a tree that lies between the cambium (formative layer just under the bark) and the heartwood.
- It is more permeable, less durable and usually lighter in color than the heartwood.



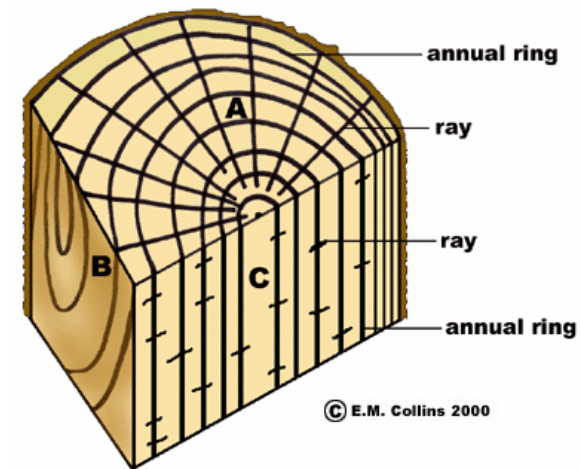
- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

1. WOOD USED IN ARCHITECTURE

1.02 STRUCTURE OF WOOD

a. Sapwood

- the portion of the log near the periphery which is generally lighter in color than the central portion.
- contains living cells and takes an active part in the life process of a tree.
- Because it contains more organic matter than the central core of the log, it is more susceptible to blueing fungi and wood-boring insects, and is not durable.



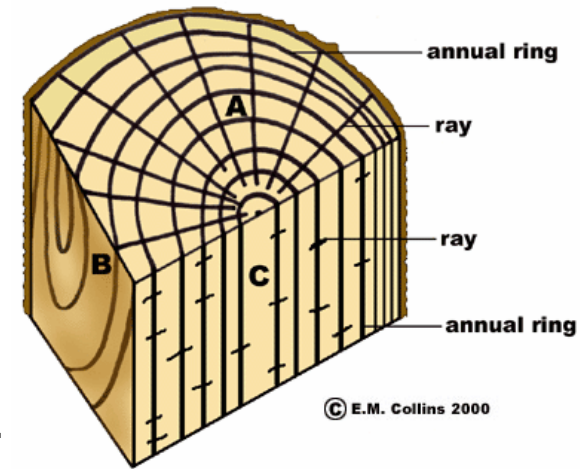
- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

1. WOOD USED IN ARCHITECTURE

1.02 STRUCTURE OF WOOD

b. Heartwood

- the older, harder central portion of a tree.
- usually contains deposits of various materials that frequently give it a darker color than sapwood.
- is denser, less permeable and more durable than the surrounding sapwood.
- The central core of the log, it is composed of inactive cells and serves only as a mechanical support



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1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD USED IN ARCHITECTURE

1.03 PROPERTIES OF WOOD

a. Hardness. This is measured by the compression which a piece of timber undergoes when a weight is applied to it.

b. Flexibility. The amount of piece will bend before breaking . Softwoods are generally brittle while most hardwoods are flexible.

c. Strength

d. Durability.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD USED IN ARCHITECTURE

1.04 DEFECTS OF WOOD

a. Decay – Caused by the attack of fungi.

b. Checks –Cracks or lengthwise separation across the annual rings of growth caused by irregular shrinkage during drying. Checks are formed when the circumference shrinks more than the interior section of the log.

c. Shakes – These are cracks between and parallel to the annual rings of the growth.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

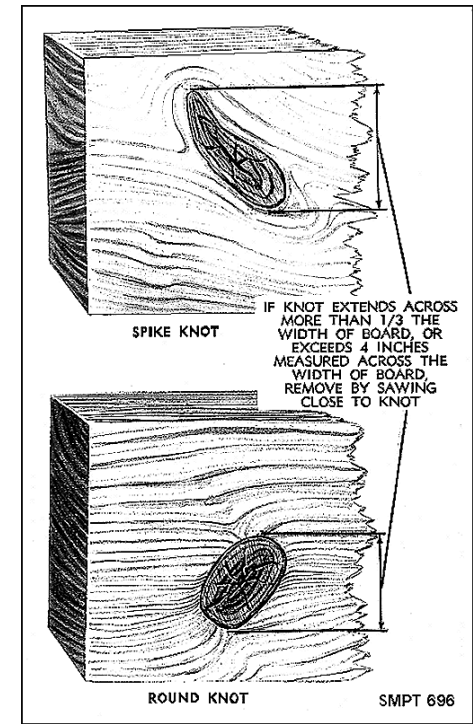
1. WOOD USED IN ARCHITECTURE

1.04 DEFECTS OF WOOD

d. Knots – These are irregular growths in the body of a tree which interrupt the smooth curve of the grain. The fibers of the tree are turned from their normal course and grow around the knot at that point of the tree.

e. Pitchpockets – These are well-defined openings between annual rings containing solid or liquid pitch.

f. Wane – This is the lack of wood on the edge or corner of a piece.



KNOTS



PITCHPOCKETS

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD USED IN ARCHITECTURE

1.04 DEFECTS OF WOOD

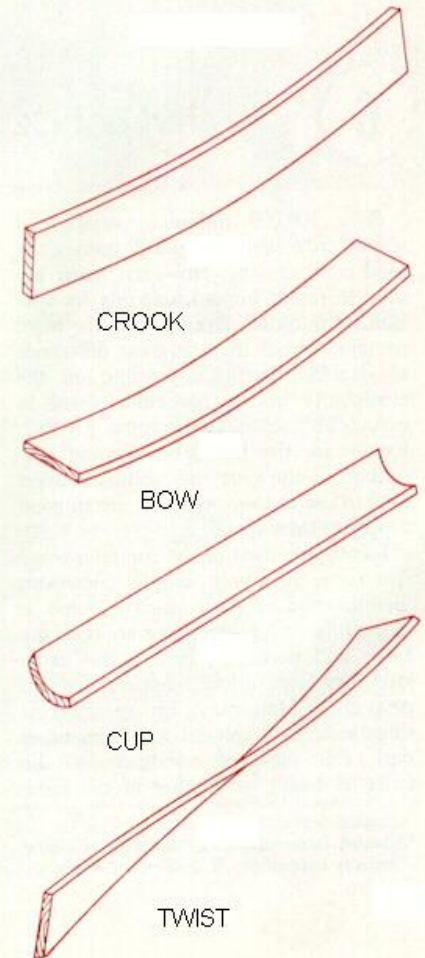
g. Warping - Any variation with the plane surface of the piece caused by unequal shrinkage of the board. There are several forms of warp:

Crook –a distortion of the board in which the edge is convex or concave longitudinal.

Bow –a distortion of the board in which the face is convex or concave longitudinal.

Cup –a distortion of the board in which the face is convex or concave across the board.

Twist –a distortion of the board in which one corner is raised.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD USED IN ARCHITECTURE

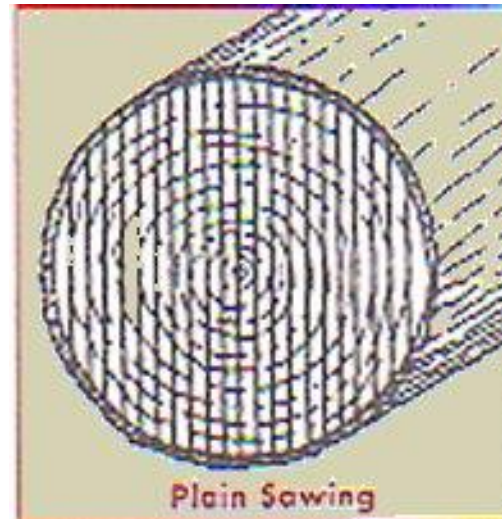
1.05 METHODS OF SAWING WOOD

A log of wood can be cut in two different ways to make lumber:

a. Plainsawing

refers to lumber cut tangent to the annual rings or growth or, in commercial practice, cut with annual rings at an angle 0° to 45° .

Plainsawn lumber is preferable when a pleasing pattern is required, as in wall paneling.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

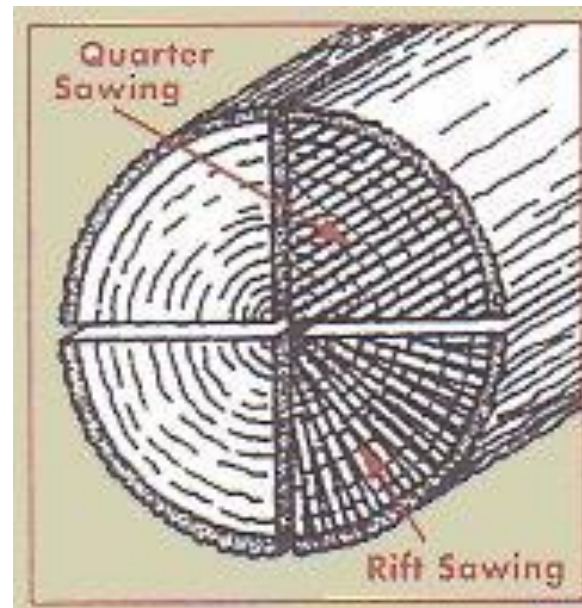
1. WOOD USED IN ARCHITECTURE

1.05 METHODS OF SAWING WOOD

b. Quartersawing

refers to wood cut radially to the annual rings of growth parallel to the rays or, in commercial practice, cut with the annual growth rings at an angle 45° to 90° .

Quartersawn lumber is desirable because it has less shrinkage than plainsawn lumber, and this is important where joints must be kept tight.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.01 CLASSIFICATION OF LUMBER

Wood that is used in construction is called LUMBER.

Lumber is classified by its size or dimensions measured in inches, for example, a piece of lumber measuring 2 inches by 4 inches is called 2 x 4.

Generally, they are available in even-numbered widths: 4, 6, 8, 10, 12 inches.

There are four available classifications of lumber:

- a. **Strips.** Lumber less than 2" thick and less than 8" wide.
- b. **Board Lumber.** Pieces less than 2" thick and at least 8" wide.
- c. **Dimension Lumber.** Pieces more than 2" and less than 5" in any dimension.
- d. **Timbers.** Pieces 5" or more on the smallest dimension

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

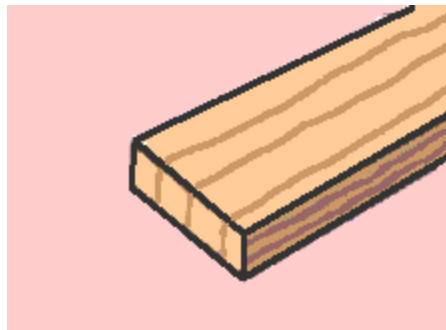
2.01 CLASSIFICATION OF LUMBER

The two most common classifications are

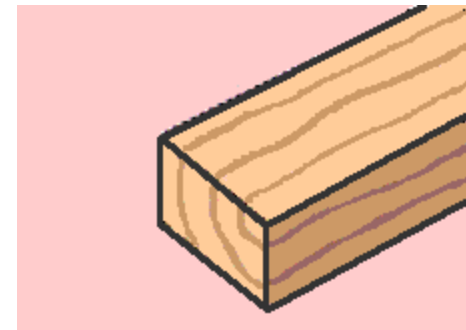
- Dimension Lumber and
- Board Lumber.

It is important to realize that the stated size of lumber is not its actual finished size.

Nominal size is the size of lumber when it is cut from the log. After cutting, the lumber is dried and then planed on all four sides to achieve smoothness. The finished size is therefore smaller.



STRIP LUMBER



DIMENSION LUMBER

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.01 CLASSIFICATION OF LUMBER

NOMINAL SIZE	ACTUAL SIZE
For Dimension Lumber:	
2 x 4	1½ x 3½
2 x 6	1½ x 5½
2 x 8	1½ x 7½
2 x 10	1½ x 8½
2 x 12	1½ x 11½
For Board Lumber:	
1 x 4	¾ x 3½
1 x 6	¾ x 5½
1 x 8	¾ x 7½
1 x 10	¾ x 9½
1 x 12	¾ x 11½

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

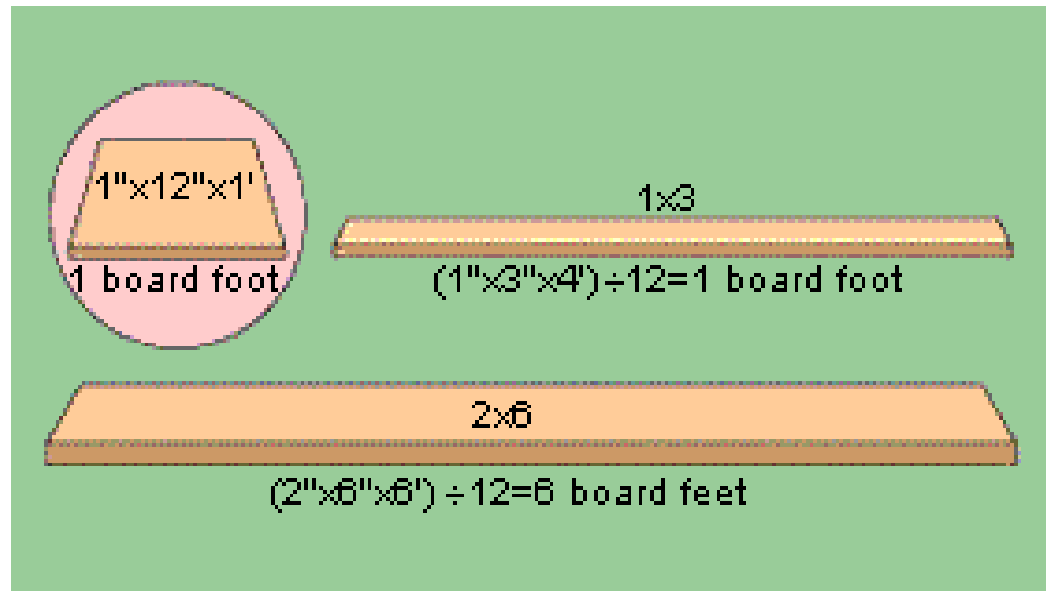
2. LUMBER

2.02 MEASUREMENT OF LUMBER

Lumber is sold in lengths from 6' up to 20' in increments of 2'. Special lengths greater than 20' are also available but cost more per board foot than the standard lengths.

Lumber measure is the **board foot** which may be described as the measure of a piece of wood 1" thick, 12" (or 1') wide and 12" (or 1') long.

$$\text{Board Feet} = \frac{\text{Thickness (in.)} \times \text{Width (in.)} \times \text{Length (ft.)}}{12}$$



2. LUMBER

2.02 MEASUREMENT OF LUMBER

Examples:

Compute the number of board feet in (a) a piece of $\frac{3}{4}$ " x 8" x 10'; (b) 10 pcs. of 2" x 6" x 14'; (c) 5 pcs. of 1" x 4" x 10'

$$1 \times \frac{1 \times 8 \times 10}{12} = 6\text{-}\frac{2}{3} \text{ or } 7 \text{ bd. ft.}$$

$$10 \times \frac{2 \times 6 \times 14}{12} = 140 \text{ bd. ft.}$$

$$5 \times \frac{1 \times 4 \times 10}{12} = 16\text{-}\frac{2}{3} \text{ or } 17 \text{ bd. ft.}$$

All lumber is sized according to its rough dimensions as it comes from the saw, its size, however, is reduced after being surfaced or dressed by a planer.

Thus, for example, 2 x 4 **surfaced on four sides** (S4S) will only be 1-3/4 x 3-3/4. Dressed lumber costs slightly more than rough.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.03 SEASONING OF LUMBER

Moisture has a big influence on the behavior and properties of wood. While water has been in wood since its formation, yet after a tree is cut, water becomes detrimental to it. It makes wood liable to the attack of insects and fungi and unfit for use.

Water occurs in wood as free water found in cell cavities and intercellular spaces of the wood, and as absorbed or hygroscopic water held in the cell walls. When surface moisture of wood comes in contact with the air, it evaporates. The water equilibrium in the log is upset and moisture from the interior travels towards the surface.

This is the beginning of the drying of wood in the log. The free water passes out first before the absorbed water in the cell wall vaporizes.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.03 SEASONING OF LUMBER

When all free water is removed but all absorbed water remains, the so-called “**fiber-saturation point**” (approximately 30% moisture content (M.C.) for all species) is reached.

Shrinkage of the wood occurs at moisture content percentages below the fiber saturation point.

The drying of the wood continues until the vapor pressure in the air just balances the vapor pressure on the wood surface.

This condition of dryness of the wood is called “**equilibrium moisture content**” (E.M.C.) and in the Philippines this is equivalent to from **12 to 16 percent** moisture content.

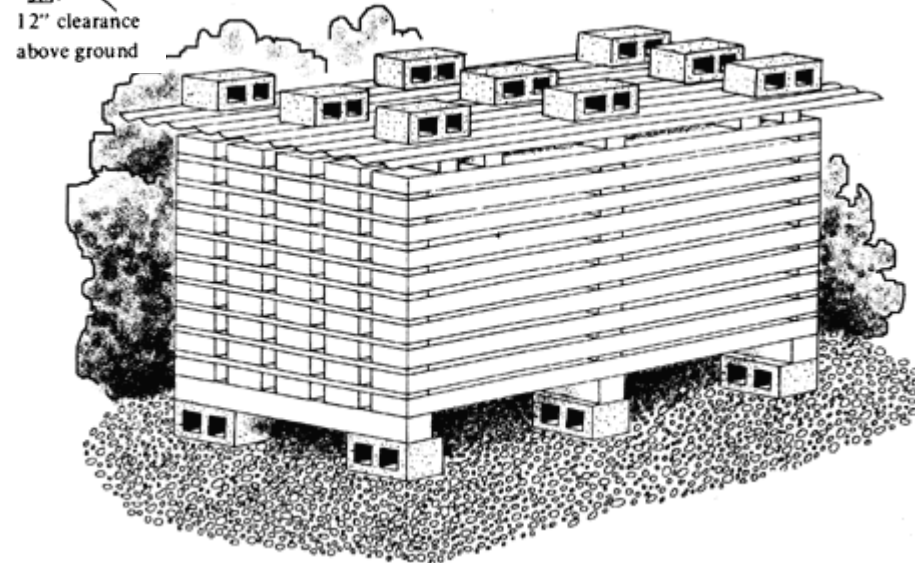
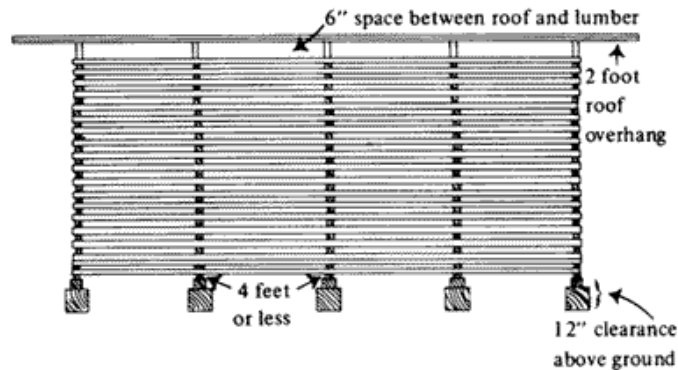
1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.03 SEASONING OF LUMBER

The process of removing moisture from green wood (wood from freshly-cut logs) is called seasoning.
Seasoning may done by:

a. **AIR-DRYING** in which the lumber is exposed to the air.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.03 SEASONING OF LUMBER

b. **KILN-DRYING** in which warm moist air or superheated steam is used to heat the wood and drive out moisture.

The ideal condition in seasoning is for the moisture from the interior of the wood to replace the surface moisture which vaporizes. When the moisture from the surface escapes faster than that which travels from the interior to the surface, then there is equal drying in the board and if the difference in moisture content is big, shrinkage and then stress in the wood develops, causing seasoning checks.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.03 SEASONING OF LUMBER

Seasoned lumber has many advantages over green lumber:

- a. It lessens the liability of the wood to be attacked by the fungi causing blueing and decay, and by some wood-boring insects.
- b. Reduction of weight.
- c. Increased strength.
- d. Minimum shrinkage after the lumber is in place (thus avoids opening up of joints in doors, windows, siding, etc.).
- e. Reduced checking and warping.
- f. Increased nail-holding power of the wood (nails do not hold well when driven into green or unseasoned lumber because of its softness).
- g. Improvement of the wood for the application of paint and to receive wood preservatives, fire retardants.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.03 SEASONING OF LUMBER

The advantages of kiln-drying over air-drying are:

- a. Greater reduction in weight.
- b. Control of moisture content to any desired value.
- c. Reduction in drying time.
- d. Killing of any fungi or insects.
- e. Setting the resins in resinous wood.
- f. Less degrade (Degrade is the loss in quality during seasoning of the lumber through unequal shrinkage which causes checks and loosening of knots, warping).

- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

2. LUMBER

2.04 DETERIORATION OF LUMBER

a. Decay

Molds, stains and decay in wood are caused by fungi. Their growth depends on mild temperatures and dampness.

Most decay occurs in wood with a moisture content above the fiber saturation point. Usually wood maintained at 20% M.C. or less is safe from fungus damage.

Wood that is constantly under water or continuously dry will not decay. Care should be taken not to use wood where moisture can collect and remain.



- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

2. LUMBER

2.04 DETERIORATION OF LUMBER

b. Insects

There are several types of insects that attack wood:

- Subterranean termites which live in the ground and build earthen tubes to reach their food – cellulose which includes wood primarily but also paper and pulp products. The channels formed as they eat all the wood substance tends to follow the grain.



Subterranean termite workers



- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

2. LUMBER

2.04 DETERIORATION OF LUMBER

b. Insects

- Subterranean termites

In general, a complete barrier must be made between the wood and possible earthen tubes of the termites by:

- ✓ installing a shield made of metal or special termite-proof materials.
- ✓ Termite proofing the wood used for construction close to earth;
- ✓ Poisoning the soil adjacent to the building.

It is good practice to make a periodic check around the building and under it for evidence of termites such as earthen tubes. If signs of termites are noted, immediate destruction of the tubes and poisoning of the surrounding earth is necessary.

- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

2. LUMBER

2.04 DETERIORATION OF LUMBER

b. Insects

- Non-Subterranean termites

The only relatively permanent method of arresting attack is to use lumber that has been given full-length termite proofing with wood preservatives. Attention to structural features and sanitation are also important.

- Carpenter Ants and Powder-Pest Beetles

use wood for shelter rather than for food, but if they are not found and are left undisturbed they can do extensive damage. They convert wood to powder, shredded fibers or pellets. Their channels are likely to cut across the grain. The damage to wood by the various marine organisms, mollusks and crustaceans in salt water or brackish water is best arrested by heavy, thorough treatment with coal-tar creosote or creosote-coal tar solutions.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.05 PRESERVATION OF LUMBER

Wood can be treated to prevent or at least delay destruction by fungi, insects, bacteria, marine organisms, and fire.

Wood preservatives used to forestall attack by decay, fungi, harmful insects and marine borers are divided into two general groups

a. Oil-Type Wood Preservatives

- Coal-tar creosotes.

Black or brownish oil made from distilling coal tar.

Advantages are: highly toxicity to wood-destroying organisms; insolubility in water; ease of application.

Disadvantages are its strong, unpleasant odor, cannot be painted, easily ignited when first applied .



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.05 PRESERVATION OF LUMBER

a. Oil-Type Wood Preservatives

- Creosotes derived from wood, oil, and water gas.

Has same advantages as coal-tar creosote but is less effective .
- Creosotes solutions

a mixture of coal-tar or petroleum oils and 50 to 80% by volume of coal-tar creosotes.

Has same advantages as coal-tar creosotes but is less effective

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.05 PRESERVATION OF LUMBER

a. Oil-Type Wood Preservatives

- Pentachlorophenol

a mixture of petroleum oils and 5% pentachlorophenol.

Has high protection against decay fungi and termites; can be painted; has no unpleasant odor; is less easily ignited than coal-tar creosotes.

Provide less protection against marine borers.

Pentachlorophenol is also dissolved in oil, leaving a clean brown-colored surface. It was used extensively for lumber and posts when introduced in the 1930s, but now is specified almost exclusively for the treatment of utility poles and cross arms.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.05 PRESERVATION OF LUMBER

b. Water-borne Wood Preservatives

- Chromated Zinc Chloride (CZC)

Gives protection against decay, insects and fire; can be painted on; has no objectionable odor.

Disadvantages are: wood cannot be used in contact with the ground or water

- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

2. LUMBER

2.05 PRESERVATION OF LUMBER

b. Water-borne Wood Preservatives

- Chromated Copper Arsenate (CCA)
- Ammoniacal Copper Arsenate (ACA)

CCA and ACA are dissolved in water for pressure treating, producing a product that is clean and odorless.

Both preservatives bond with the wood after pressure treating in a chemical process known as **fixation**, producing treated wood that is highly leach-resistant and safe to use in applications with regular human contact.

Provides good protection against decay and insects; can be painted on; has no objectionable odor.

Wood can be used in contact with the ground but is generally recommended for contact with water.

2. LUMBER

2.05 PRESERVATION OF LUMBER

b. Water-borne Wood Preservatives

Preservative	Applications
Creosote	Railway ties, mine timbers, poles, foundation piles, marine piles and bulkheads
Pentachlorophenol	Utility poles, cross arms, bridge timbers and ties
ACA	Piles, utility poles, marine timbers, construction lumber
CCA	Guide rail posts, utility poles, bridge timbers, piles, structural glued-laminated timbers, landscape timbers, posts, boardwalks, permanent wood foundations and residential construction, decking and fencing

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.05 PRESERVATION OF LUMBER

The methods of applying preservatives are:

a. Pressure treatment. Consists in placing the wood in cylinders into which the preservative is pumped under pressure

b. Hot and Cold Bath Method. This consists first in placing the wood in a bath of hot preservative for an hour or more. It is then withdrawn and quickly placed in a bath of cold preservative. This is generally used for creosote preservative

c. Dipping or immersing the wood in a hot preservative for a short time

d. Brushing

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.06 TREATMENT OF LUMBER

There are two methods of treating wood to increase its fire-resistance:

a. Covering the wood with a compound or material.

Such superficial coatings or layers protective materials retard the normal increases in temperature under fire conditions and thereby decrease the rate of flame spread. This in turn lessens the rate of flame penetration and therefore the destruction of wood in contact with fire.

Coatings or layers of protective material over the surface are good only for interior purposes because they are not durable when exposed to the weather. These are water-soluble, fire retardant chemicals generally are trade-marked formulation of ammonium phosphate, borax or sodium silicate combined with other materials to provide adherence to the wood, brush-ability, appearance and color.

There are also chemicals with low water soluble such as zinc borate, chlorinated paraffin and chlorinated rubber which are used for fire retardant coatings.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

2. LUMBER

2.06 TREATMENT OF LUMBER

b. Impregnating the wood with a chemical which the wood itself not support combustion. The chemicals commonly used for impregnation are:

- monobasic ammonium phosphate
- dibasic ammonium phosphate
- ammonium sulfate
- borax, boric acid and
- zinc chloride

PRESSURE TREATED LUMBER AND PLYWOOD:

WOLMANIZED Lumber and Plywood

Preservative : Wolman salts.

TANALIZED Lumber and Plywood

Preservative - Tanalith G Wood Preservative salts.

PERMANIZED Lumber and Plywood

Preservative – B-S-25.

BOLIDEN Lumber and Plywood.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

Wood Composites are those products made from a mixture of wood and other materials. Most wood composites are produced in large sheets, usually 1220mm (4') x 2440mm (8').

4.01 PLYWOOD

Plywood is the most common wood composite. It gets its name from its construction: it is made of several thin *plies*, or *veneers*, of wood that have been glued together. Each ply or veneer is glued so that its grain is at right angles to the grain of the previous ply.



The outside plies are called the face and the back, and the center plies are called the core. The cross-layering make plywood very stable and strong.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.01 PLYWOOD

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- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

4. WOOD COMPOSITES

4.01 PLYWOOD

a. Standard Sizes of Plywood:

Plywood is commonly available in:

3' x 6' (900mm x 1800mm) and

4' x 8' (1220mm x 2440mm)

Standard thicknesses are:

3/16" (4.5mm) for double wall partitions and ceilings

1/4" (6.0mm) for double wall partitions

3/8" (10.0mm) for drawers and shelves

1/2" (12.0mm) for drawers and shelves

3/4" (19.0mm) for drawers, shelves, cabinet and closet doors

1" (25.0mm) for cabinet and closet doors, and sub-floors

- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

4. WOOD COMPOSITES

4.01 PLYWOOD

b. Advantages of Plywood:

- the approximate equalization of strength properties along its length and width;
- greater resistance to checking and splitting; and
- less change in dimension due to moisture content

c. Types of Plywood:

- Ordinary Plywood
- Form Plywood
- Marine Plywood – waterproofed
- Fancy Plywood:
 - ✓ Narra bookmatch
 - ✓ Kalantas Rotary cut
 - ✓ Tanguile Ribbon-grain
 - ✓ Lauan Rotary cut
 - ✓ Dao bookmatch
 - ✓ Rosewood
 - ✓ Tanguile

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.02 HARDBOARD

This is a paneling material made by reducing and refining wood chips into small, threadlike fibers, and then pressing them under heat in hydraulic pressure into dense, smooth, and very rigid panels.



In the production process the pulp is exploded under pressure. Heat and steam is applied to leave fine, fluffy brown fibers. These fibers are transformed into mats, which are held together with lignum and other glues. The mats are then pressed between steam-heated metal plates to give grainless sheets with one smooth, glossy surface and one textured surface. To prevent warping, moisture is added in a humidification chamber.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.02 HARDBOARD

Hardboards are a cheaper option than plywood where strength is not required.

Hardboard has a smooth surface on one side and a screened surface on the other. It is sometimes known as Masonite, after the man who invented it.

There are three types of hard board:

a. **Standard hardboard**

is light brown in color and has a fairly hard, smooth surface on one side and a screened impression on the other. It is flexible and easy to bend. It is suitable for interior use only and where it is not subject to moisture.

b. **Panel hardboard**

is somewhat denser than the Standard but not as dense as Tempered.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.02 HARDBOARD

c. Tempered hard board

is the densest type, made by impregnating standard board with tempering compound of oils and resins and baking it to polymerize the tempering materials. It is dark brown in color, brittle and stiff, with improved machining qualities and greater resistance to moisture and water penetration, making it ideal for exterior use

Hardboard is usually in panel size of 4'x8' (1220mm x 2440mm) with thicknesses of 1/8" (3mm), 3/16" (4.5mm) or 1/4" (6mm), and is obtainable either with a plain, textured, or perforated surface.

Brand names of Hardboard:

LAWANIT standard and tempered boards

LAWANEX panel boards

MASONITE standard, panel and tempered hard board

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.03 CHIPBOARD

Chipboard is made by bonding together wood particles with an adhesive under heat and pressure to form a rigid board with a relatively smooth surface, often faced with veneer. It is made by binding phenolic resin or urea formaldehyde glue.



Chipboard is available in a number of densities; normal, medium and high-density.

- Normal density is fairly soft and 'flaky'
- High-density is very solid and hard (often used for worktops and fire doors)
- Medium density is somewhere in between

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.04 FIBERBOARDS and MEDIUM DENSITY FIBERBOARDS

Fiberboards are finishing materials made from vegetable fibers such as corn or sugarcane stalks pressed into sheets. It is not very strong, but has good insulating properties therefore it is usually used for ceiling only.

It is generally 4'x8' (1220mm x 2440mm) panel size, in thicknesses of 3/16" (4.5mm) or 1/4" (6mm), 1/2" (12mm) and 3/4" (19 mm).

Acoustic fiber board is manufactured from wood, straw, bagasse pulp pressed into boards with or without holes or slots. Thicknesses of acoustic fiber board vary from 1/2" to 2" (12 to 50mm) in 1/2" (12mm) increments.

Brand names of Fiberboard:

CELOTEX, CANEX, HOMASOTE, PHILTEX, BONOTEX

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.04 FIBERBOARDS and MEDIUM DENSITY FIBERBOARDS

MDF is a type of fiberboard which is made from wood fibers glued under heat and pressure. MDF has many qualities that make it an ideal alternative to plywood or chipboard.

It is dense, flat, stiff, has no knots and is easily machined. Its fine particles provide a material without a recognizable "grain".

Unlike plywood, MDF contains no internal voids, and will produce better edges providing that it is correctly machined.



- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

4. WOOD COMPOSITES

4.05 GYPSUM BOARDS

This is a non-combustible building board with a gypsum core enclosed in tough, smooth paper. It is designed to be used without addition of plaster for walls, ceilings or partitions. It is extensively used in “dry-wall” construction, where plaster is eliminated

Brand Names:
BORAL
ELEPHANT



Square Edge (S.E.)
for coverstrip jointing;
visible butt - jointed
panelling with clamp fixing
and free suspension.



Tapered Edge (T.E.)
for smooth seamless
jointing; jointless wall
and ceiling panelling

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.05 GYPSUM BOARDS

The types of Gypsum Board are:

a. Wall Board

This type is used for surface layer on interior walls and ceilings. The regular wallboard comes with grey liner paper backing and special paper finish on the facing and edges suitable for decoration. The foil-backed gypsum board has aluminum foil bonded to the liner paper to serve as vapor barrier and thermal insulation. Predecorated gypsum board comes with a decorative vinyl or paper sheet on its face.

b. Backing Board

This is used as base layer in multi-ply construction, where several layers of gypsum boards are desired for high fire resistance, sound control and strength in walls.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.05 GYPSUM BOARDS

c. Core Board

To save space, this type is used as a base in a multi-ply construction of self-supporting (studless) gypsum walls. It comes in 1" (25mm) thickness or 2- factory-laminated, ½ " thick layers of backing board .

d. Type X Gypsum Board

For use in fire-rated assemblies, this may be wallboard, backing board, or coreboard made more fire-resistant by addition of glass-fiber or other reinforcing materials

e. Water-Resistant Backing Gypsum Board

This type comes with water-resistant gypsum core and water-repellant face paper. It maybe used as base for walls of bathrooms, showers, and other areas exposed to wetting.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.05 GYPSUM BOARDS

f. Gypsum Sheathing

This type is used as fire protection and bracing of exterior frame walls. It must be protected from the weather by an exterior facing.

g. Gypsum Formboard

This type is used as a permanent form in the casting of gypsum concrete roof decks.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.06 FIBERCEMENT BOARDS

Fiber-reinforced cement board is comprised of 72% Portland Cement, 20% mineralized cellulose fibers derived from recycled materials, and 8% calcium carbonate.

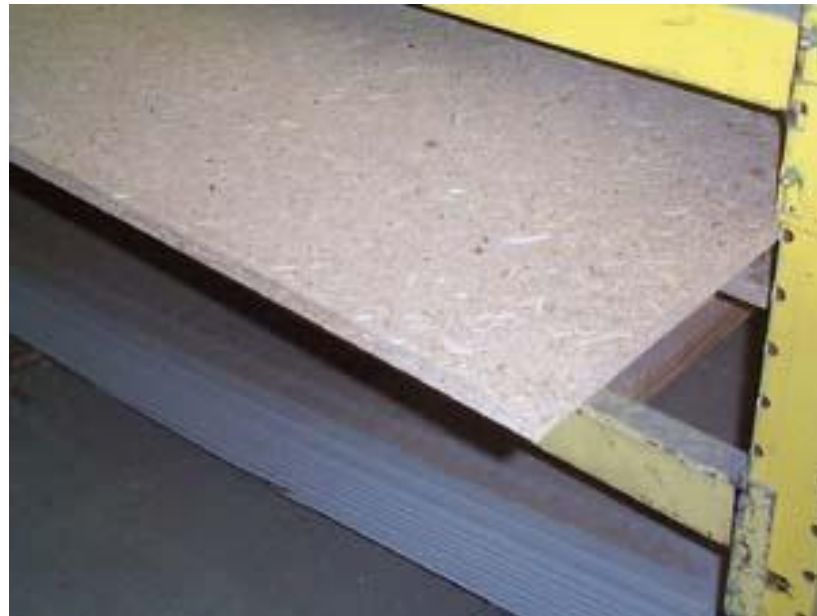


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 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

4. WOOD COMPOSITES

4.07 PARTICLE BOARD

Particleboard is made of small wood chips and base materials including cotton stalk, rice straw, bagasse, conventional wood chips and sawdust that have been pressed and glued together.



- 1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
- 2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

5. MILLWORK

Millwork consists of finished lumber which is further cut and processed at a lumber mill. Millwork includes doors, windows, mouldings, trim and other ornamental forms of wood.

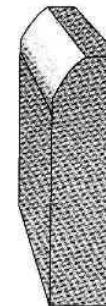
5.01 TYPES OF WOOD MOULDINGS

Types of wood mouldings are:

- a. crown
- b. bed
- c. cove
- d. quarter-round
- e. half-round
- f. nose and cove
- g. stop
- h. astragal
- i. Screen moulding
- j. panel strip
- k. picture moulding



PP 1000
5/8" x 3"



PP 1001
3/4" x 2-3/4"



PP 1002
3/4" x 2-3/4"



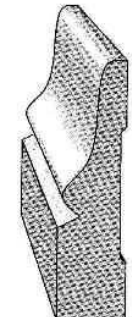
PP 1003
3/4" x 2-15/16"



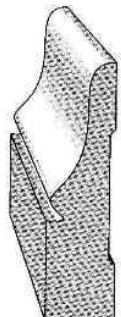
PP 1004
3/4" x 2-7/8"



PP 1005
3/4" x 2-7/8"



PP 1006
3/4" x 2-7/8"



PP 1007
3/4" x 2-7/8"

TYPE OF WOOD MOULDINGS



Dowel



Half-round



Quarter-round



Square

Use to conceal vertical and horizontal joints.

Use to finish inside corners; base shoe finishes base trim at the floor line.

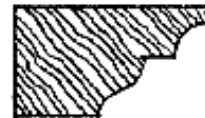
For use as trim, a variety of stock wood moldings are available at millwork shops. They vary in section, length, and the species of wood.

The type of wood used for trim depends on the type of finish to be applied to the woodwork.



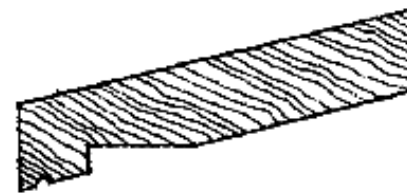
Crowns

Use at the meeting of wall and ceiling surfaces, and at mantels.



Caps

Use over windows, doors, and at the tops of wainscots.



Sill

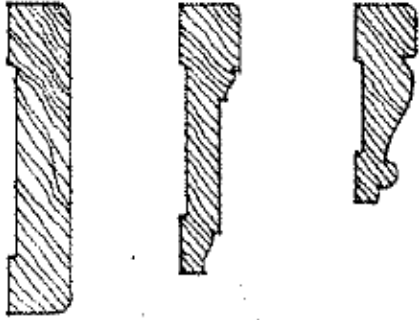
The bottom trim of window and door openings.



Stool

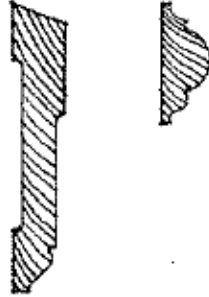
The interior trim at the bottom of windows.

TYPE OF WOOD MOULDINGS



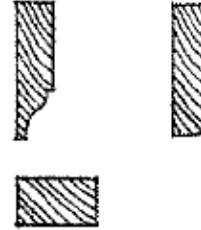
Casings

Use to trim head and side jambs of windows and doors.



Chair rails

Use to protect a wall surface from chair backs.



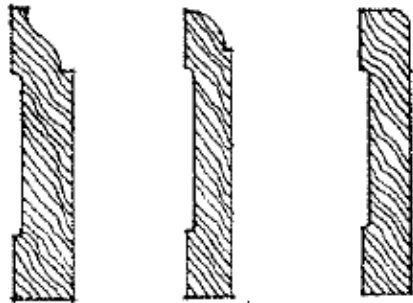
Stops

Use at jambs to guide windows and stop doors.



Panel strip

Use to conceal joints in paneling



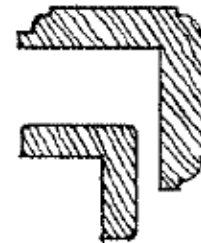
Bases

Use where sidewalls meet the floor, and as window and door casings.



Coves

Use where surfaces meet at 90°.



Corner

Use at exterior corners.



Screen

Use to finish the screening on windows and doors.

INTERIOR WOOD MOULDINGS

Interior trim is normally applied after the finish walls, ceiling, and flooring are in place.

CORNICES

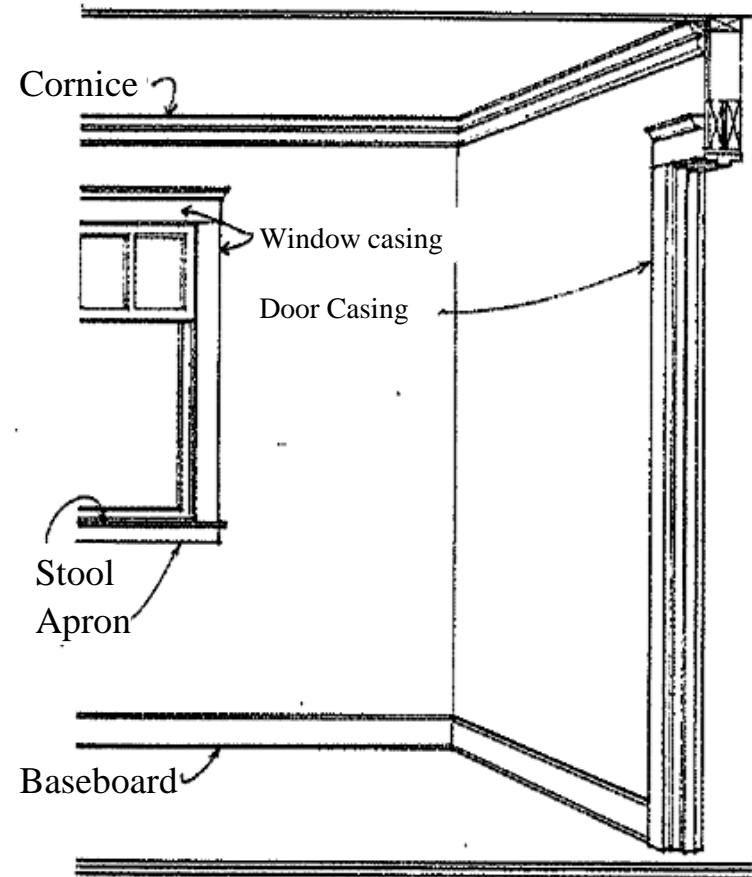
Cornices are used to finish the joint between ceilings and walls, especially when they are of different materials.

DOOR AND WINDOW TRIM

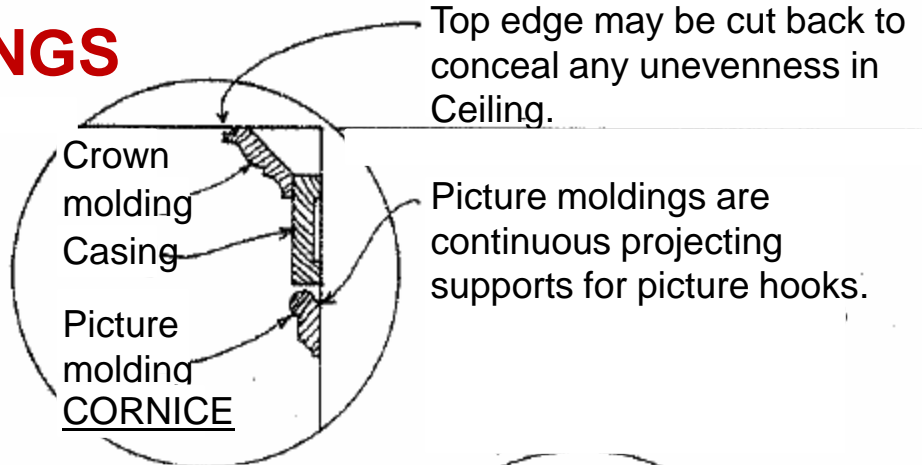
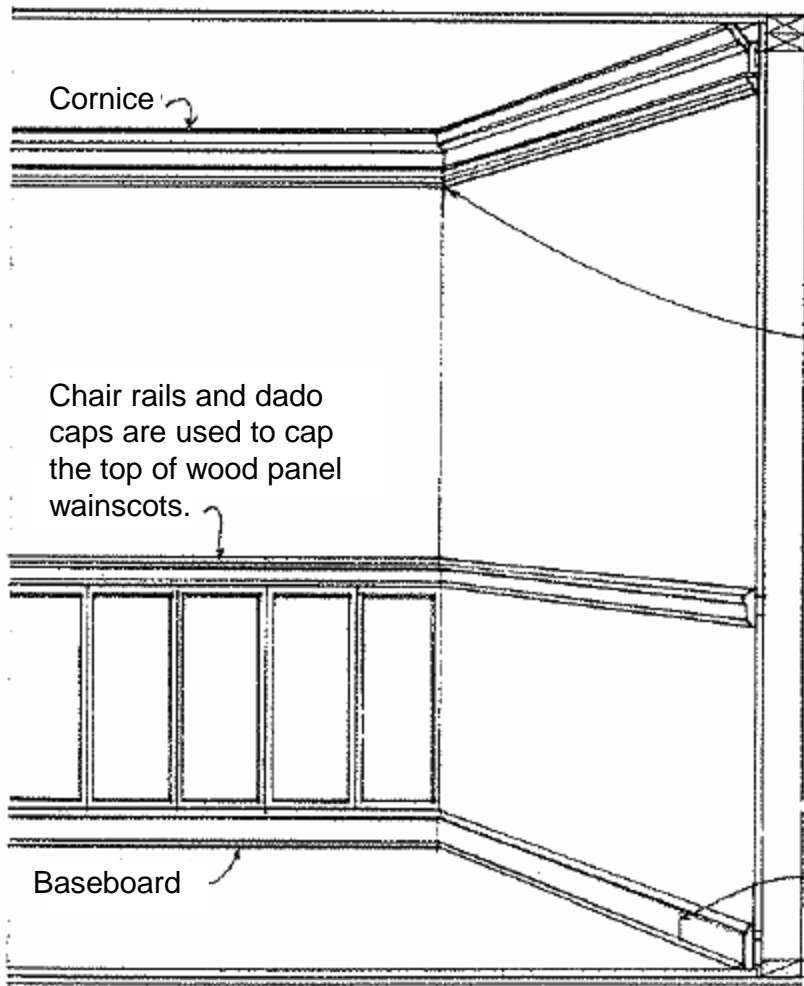
Head and side jamb casings conceal and finish the joint or gap between door and window frames and the surrounding wall surface.

BASEBOARDS

Baseboards and base shoes conceal and finish the joint between interior walls and the flooring.



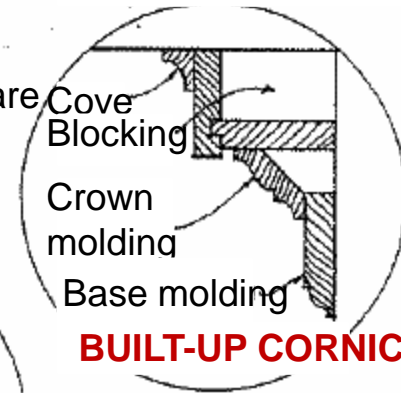
INTERIOR WOOD MOULDINGS



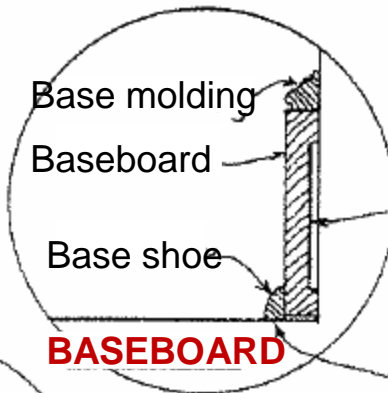
Picture moldings are continuous projecting supports for picture hooks.

CORNICE

Inside corners of shaped moldings are coped



BUILT-UP CORNICE



BASEBOARD

Cupped back gives a wide trim a degree of flex and allows it to neatly against a wall surface.

Joints in long runs of trim are face mitered.

Flexible base shoe can conform to irregularities in floor surface.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

The term PLASTICS is essentially a commercial classification to which no strict scientific definition can be applied. It is used to describe a product of synthetic origin which is capable of being shaped at some stage of its manufacture, but is not rubber, wood, leather or metal.

It is made from a number of common substances such as coal, salt, natural gas, cotton, wood and water, from which relatively simple chemicals known as monomers are built up into chainlike molecules of high molecular weight called polymers.

These polymers have low extensibility, can be molded, extruded, cut or worked into a variety of shapes and objects, rigid or non-rigid, relatively light, which are formed by condensation polymerization and by vinyl polymerization.

Plastics can be hard, soft, clear, opaque, light, heavy, heat resistant or easily softened by hot water.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
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 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.01 CLASSIFICATION OF PLASTICS

In a broad sense, there are three (3) types of Plastics:

- **Cellulose plastics**
- **Synthetic resin plastics**
- **Plastics derived from proteins and natural resins**

Synthetic resin plastics are subdivided into two (2) classes:

a. Thermoplastics

soften when heated and harden when cooled regardless of the number of times the process is repeated. They have a molecular structure which is essentially linear or threadlike in form.

b. Thermosetting plastics

Thermosetting plastics, sometimes called thermocuring plastics, set into shape permanently when heat and pressure are applied during the forming stage. They have a molecular structure in a 3-dimensional arrangement

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

a. ACRYLIC

Popular brands are “LUCITE” and “PLEXIGLASS”, this material combines the transparency of glass (but not scratch-proof quality) with plastics’ shatterproof quality. Used principally for skylights, skydomes, safety glass, paints, adhesives, finish hardware, & lighting fixtures



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

b. CELLULOSICS

primarily cellulose acetate or butyrate, used principally for paints and lacquers, and transparent sheeting.

c. POLYETHYLENE (PE)

- Ziegler PE is a hard, strong, tough and rigid thermoplastic for household and industrial applications.



- ICI PE developed by Imperial Chemical Industries of Britain is a high-pressure, low-density PE that is flexible, tough and slightly resilient thermoplastic used in construction as pond or lagoon lining, and water-vapor barriers and dampproofing.

6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

d. POLYSTYRENE

In spite of its sensitivity to solvent action, it is one of most important thermoplastics because of its excellent transparency and rigidity and its easy moldability. It is non-water absorbent, it is found in colorful, but brittle wall tiles. It is one of several plastics used in lighting fixture diffusers. In foam form, it has become an important thermal insulator. Also found in paint for concrete.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

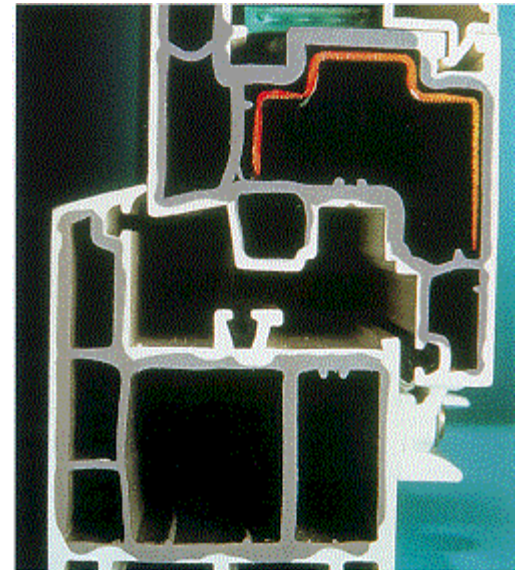
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 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

e. POLYVINYL CHLORIDE (PVC)

is a largely amorphous, rigid, tough, solvent-resistant, flame-resistant thermoplastic. Used for resilient floor tile, films, pipes, and for paint lacquers, adhesives and safety glass.



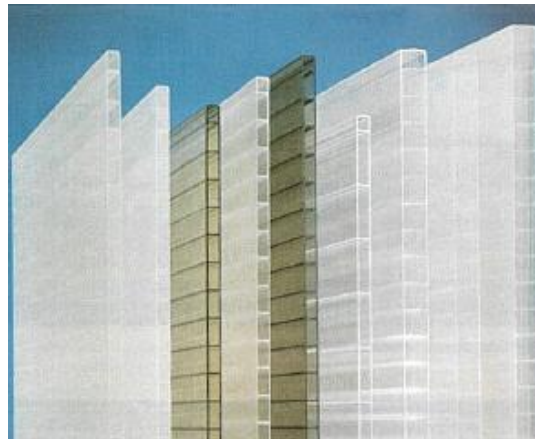
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 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

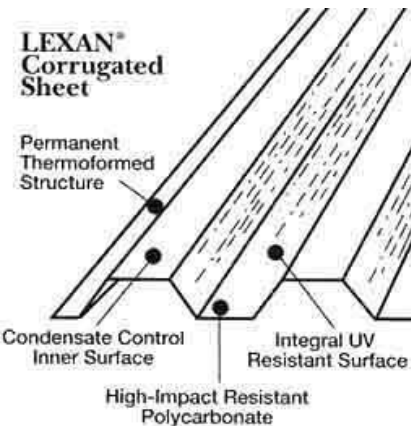
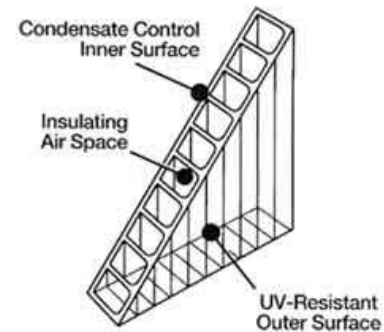
6.02 EXAMPLES OF THERMOPLASTICS

f. POLYCARBONATES

a family of linear polyesters, is a white, substantially amorphous, very tough and strong material with good heat resistance up to 150 deg C and excellent dimensional stability. It is injection-molded to produce plates, rods, gears, and other shaped parts that advantageously replace die-cast metal parts. Used for skylights.



LEXAN® DRIPGARD™ Sheet



6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

g. POLYPROPYLENE

tough plastic with good resistance to heat and chemical action.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
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8. LAMINATES

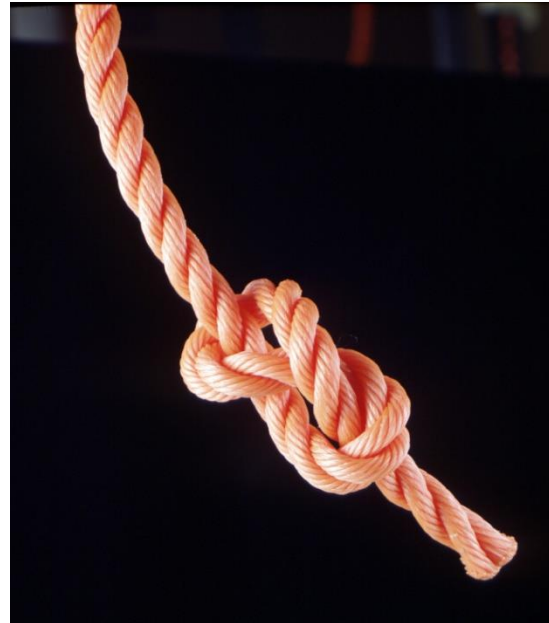
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 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
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 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

h. NYLONS

The term nylon refers to a family of polymers called linear polyamides. It is desired for the following properties: exceptionally strong, elastic, abrasion resistant, easy to wash, resistant to damage from oil and many chemicals, can be precolored or dyed in wide range of colors, and resilient .

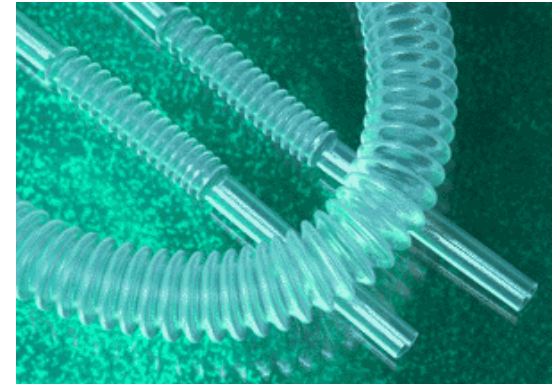
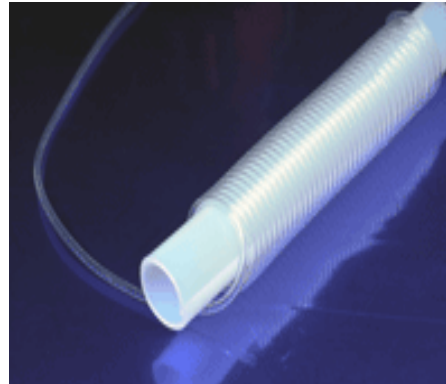


6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

i. FLUOROPLASTICS

are a class of paraffinic polymers that have some or all of the hydrogen replaced by fluorine. The fluoroplastic group is characterized by excellent chemical resistance, excellent heat resistance, good electrical properties, and excellent wear resistance. However, despite these attributes, perhaps the most desired characteristic of this group of plastics is their ability to resist abrasion .



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

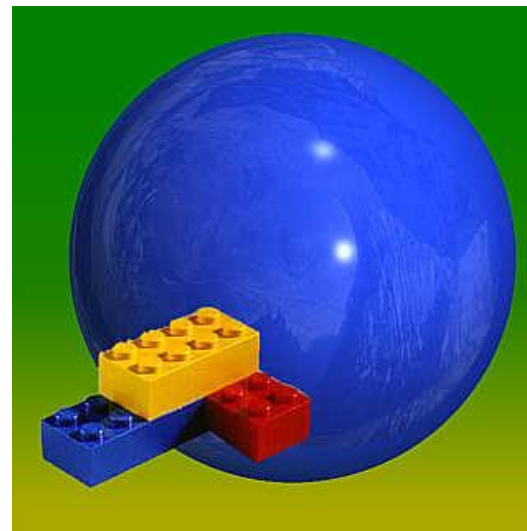
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 - 1.02 Structure
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 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.02 EXAMPLES OF THERMOPLASTICS

j. ACRYLONITRILE BUTADIENE STYRENE (ABS)

is a styrenic resin with improved toughness and heat resistance. ABS exhibits high gloss, low shrinkage, and good dimensional stability, is widely used in injection molding of appliances, furniture, and automotive parts. ABS also has high melt strength suitable for the production of extruded sheet, some of considerable size and thickness. Applications include panels for large appliances and thermoformed items such as hot tubs and recreational vehicle parts .



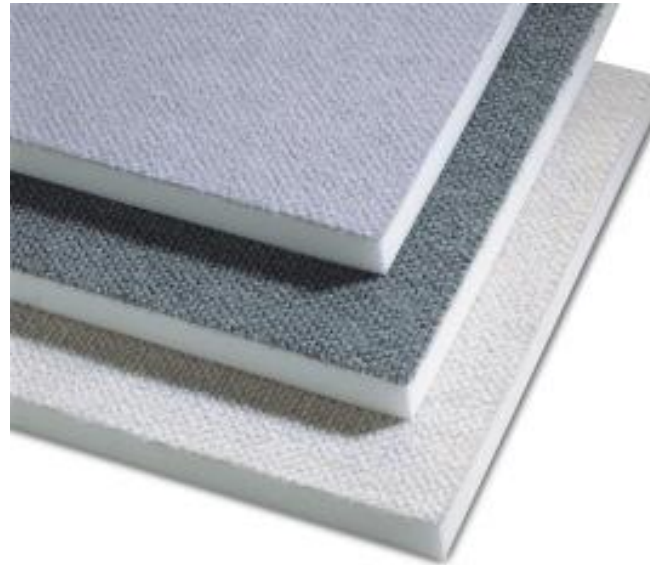
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 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.03 EXAMPLES OF THERMOSETTING PLASTICS

a. MELAMINE and UREA

hard, durable and dimensionally stable, these similar plastics are resistant to chemicals, electric potential, and heat. Melamine is well known for its use in molded dishes, while urea is useful for incandescent light diffusion and for baked enamels .



6. PLASTICS USED IN ARCHITECTURE

6.03 EXAMPLES OF THERMOSETTING PLASTICS

b. EPOXY

used in buildings for its remarkable adhesive qualities. It may also be used for special paints that are chemically resistant and for special caulking compounds.



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.03 EXAMPLES OF THERMOSETTING PLASTICS

c. ALKYDS

appear chiefly as molded electrical parts, and as the vehicle in paints, lacquers, and enamels .



d. PHENOLICS

used for paints, baked enamels, adhesives, impregnating resins for paper and wood, and finish hardware.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.03 EXAMPLES OF THERMOSETTING PLASTICS

e. POLYESTER

the plastic most commonly used in large glass-fiber reinforced translucent panels that are strong, rigid, and impact-resistant. Also used for impregnating paper and wood, as laminating material, and for contact adhesive.



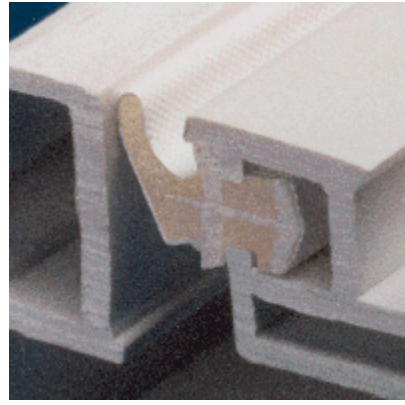
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 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
- 3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
- 4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
- 5. MILLWORK
 - 5.01 Mouldings
- 6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
- 7. PLASTIC SHEETS, FILM AND FOAM
- 8. LAMINATES

6. PLASTICS USED IN ARCHITECTURE

6.03 EXAMPLES OF THERMOSETTING PLASTICS

f. URETHANES

used in paint coatings, and as foams, are self-adhesive.



g. SILICONES

used for clear, water-repellant paints for concrete and masonry surfaces above grade .



1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

7. PLASTICS SHEETS, FILM AND FOAM

a. SHEETS

Usually made of acrylate, polyester, or polystyrene plastics, either plain or reinforced with glass-fiber, are available in flat or corrugated sheets and various deformed shapes.

Thicknesses vary from 1.5mm to 2.38mm (1/16 to 3/32 inches).

Plastic sheets can be used to replace glass in any type of windows or doors, skylights, shower enclosures, or in any area where a translucent, transparent or opaque material in a wide variety of colors are needed in the interior.

As corrugated sheet, plastics make good roofing material and other similar uses as sheet plastic .

7. PLASTICS SHEETS, FILM AND FOAM

b. FILM SHEETS

As **water barrier or dampproofing** material, it is generally made of polyethylene and polyvinyl and come in thicknesses ranging from 1 to 10 mils (0.001 to 0.01 inch) and in rolls of 50' length and 3' to 40' width.

For building construction, 2, 4 and 6 mils are most commonly used.

Over tamped earth or sand fill, use 4 mil.

Over gravel and stone, use 6 mil.

Use the widest width possible and lap 6" (150mm) where necessary .

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

7. PLASTICS SHEETS, FILM AND FOAM

c. FOAM

Used as flotation material, thermal insulators, and shock-resistant mountings. Offers possibilities for lightweight materials of high strength .

- 1. WOOD IN ARCHITECTURE**
 - 1.01 Classification**
 - 1.02 Structure**
 - 1.03 Properties**
 - 1.04 Defects**
 - 1.05 Sawing Methods**
- 2. LUMBER**
 - 2.01 Classification**
 - 2.02 Measure**
 - 2.03 Seasoning**
 - 2.04 Deterioration**
 - 2.05 Preservation**
 - 2.06 Treatment**
- 3. PHILIPPINE WOOD**
 - 3.01 For Construction**
 - 3.02 Allowable Working Stresses**
 - 3.03 Weights of Wood**
 - 3.04 Physical Properties**
- 4. WOOD COMPOSITES**
 - 4.01 Plywood**
 - 4.02 Hardboard**
 - 4.03 Chipboard**
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 - 4.05 Gypsum Board**
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- 5. MILLWORK**
 - 5.01 Mouldings**
- 6. PLASTICS IN ARCHITECTURE**
 - 6.01 Classification**
 - 6.02 Thermoplastics**
 - 6.03 Thermosetting Plastics**
- 7. PLASTIC SHEETS, FILM AND FOAM**
- 8. LAMINATES**

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

8. LAMINATES

Lamination is the process applied to paper or fabric impregnated with thermosetting resins.

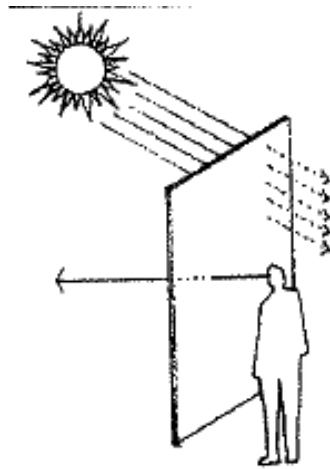
Cotton cloth and paper are used as filler materials, usually in sheet forms, that are bonded together by heat and pressure to form an integral body.

The thickness of the laminate is determined by the number of sheets placed between the two steel pans or platens of the press used in the process.

Decorative laminates of various wood-grain, marble, and colored patterns are extensively used for tabletops and wall facings .

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

9. GLASS



SHEET GLASS- Inherent warpage distortion is most noticeable in the larger sizes and thicker sheets.

FLOAT GLASS- Flat, parallel surfaces minimize distortion and eliminate the need for grinding and polishing.

PLATE GLASS- provides virtually clear, undistorted vision.

1. WOOD IN ARCHITECTURE
 - 1.01 Classification
 - 1.02 Structure
 - 1.03 Properties
 - 1.04 Defects
 - 1.05 Sawing Methods
2. LUMBER
 - 2.01 Classification
 - 2.02 Measure
 - 2.03 Seasoning
 - 2.04 Deterioration
 - 2.05 Preservation
 - 2.06 Treatment
3. PHILIPPINE WOOD
 - 3.01 For Construction
 - 3.02 Allowable Working Stresses
 - 3.03 Weights of Wood
 - 3.04 Physical Properties
4. WOOD COMPOSITES
 - 4.01 Plywood
 - 4.02 Hardboard
 - 4.03 Chipboard
 - 4.04 Fiberboard
 - 4.05 Gypsum Board
 - 4.06 Fibercement Board
 - 4.05 Particle Board
5. MILLWORK
 - 5.01 Mouldings
6. PLASTICS IN ARCHITECTURE
 - 6.01 Classification
 - 6.02 Thermoplastics
 - 6.03 Thermosetting Plastics
7. PLASTIC SHEETS, FILM AND FOAM
8. LAMINATES

9. GLASS

VARIATIONS OF THE THREE BASIC TYPES OF GLASS INCLUDE:

PATTERN GLASS- Translucent glass with linear or geometric patterns embossed on one or both sides.

WIRE GLASS- Wire mesh or parallel wires are inserted into rolled glass during manufacture.

HEAT-ABSORBING OR TINTED GLASS- Tinted glass absorbs solar radiation.

REFLECTIVE COATED GLASS-transparent metal coating applied to the glass surface reduces the solar energy transmitted into the building.

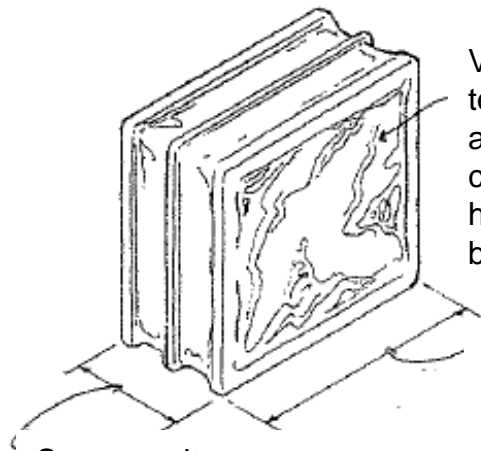
TEMPERED GLASS- glass is heat-strengthened for increase resistance to impact and thermal stresses

LAMINATED GLASS- a thin sheet of tough, transparent plastic is laminated between two layers of glass.

INSULATING GLASS- two layers of glass are separated by a hermetically sealed air space to provide thermal insulation and restrict condensation.

GLASS BLOCKS

Glass block may be used in non-load bearing exterior and interior walls, and in conventionally framed window openings.



Square units:
4" for hollow units

NOMINAL DIMENSIONS:
Includes the thickness of 1/4" mortar joints

Various surface textures are available as well as inserts and coatings to control heat gain, glare, and brightness.

Square units:
6" x 6"
8" x 8"
12" x 12"

Rectangular units:
4" x 8"
6" x 8"

Exterior wall panels

May not exceed 144 S.F. in unsupported wall area not 15' in any dimension.

Interior wall panels

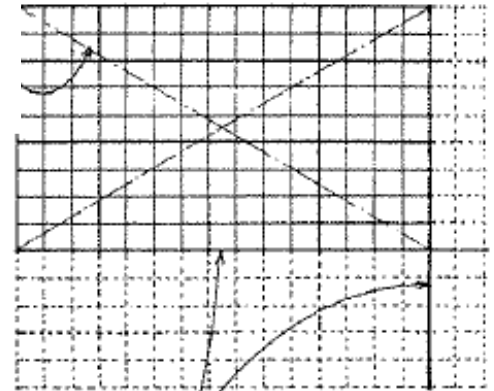
May not exceed 250 S.F. in unsupported wall area not 25' in any dimension.

Vertical stiffeners and horizontal shelves can break larger wall areas into the required panel sizes.

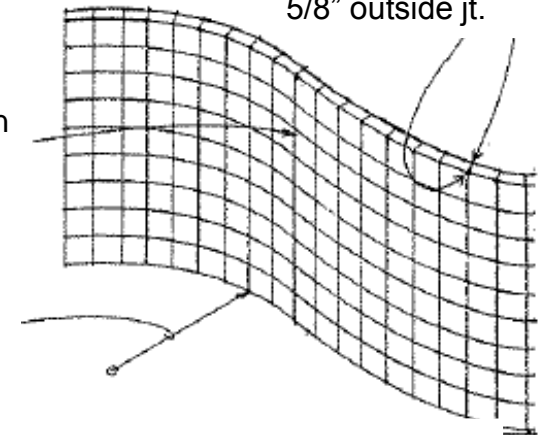
Curved wall panels

should have expansion joints at each change of direction.

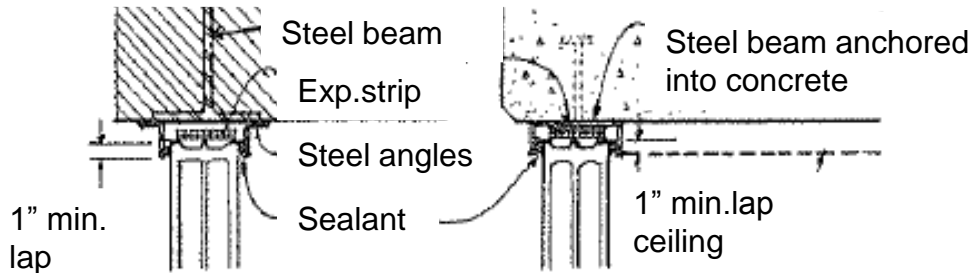
Minimum radii:
6" glass block – 4'
8" glass block – 6'
12" glass block – 8'



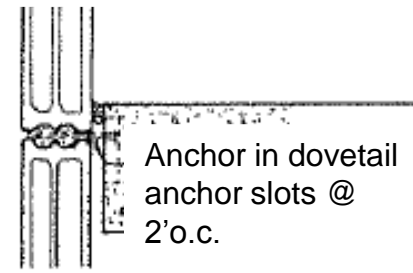
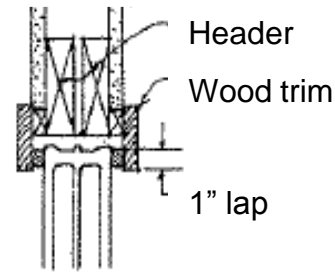
3/16" inside jt.
5/8" outside jt.



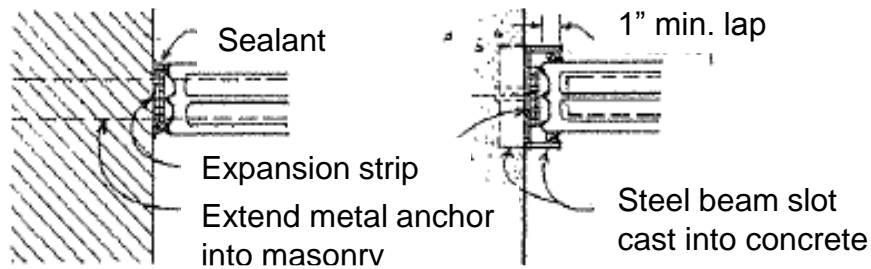
GLASS BLOCK DETAILS



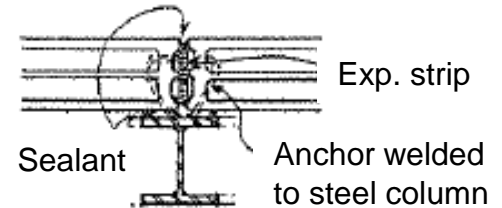
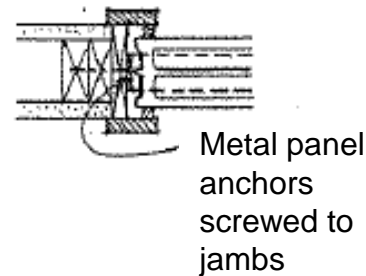
Head Sections: All for deflection of lintel or beam



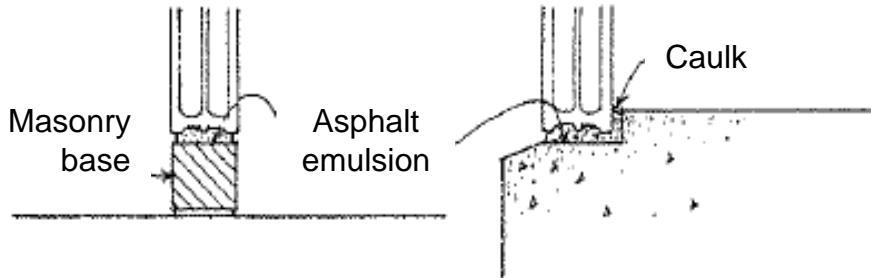
Stiffener @ Slab Edge



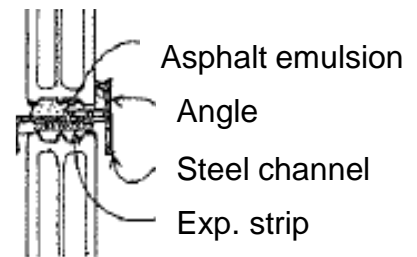
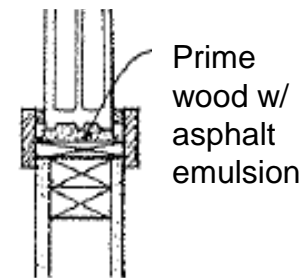
Jamb Sections: Expansion joints



Stiffener @ Column



Sill sections: Mortared joints



Shelf support

END