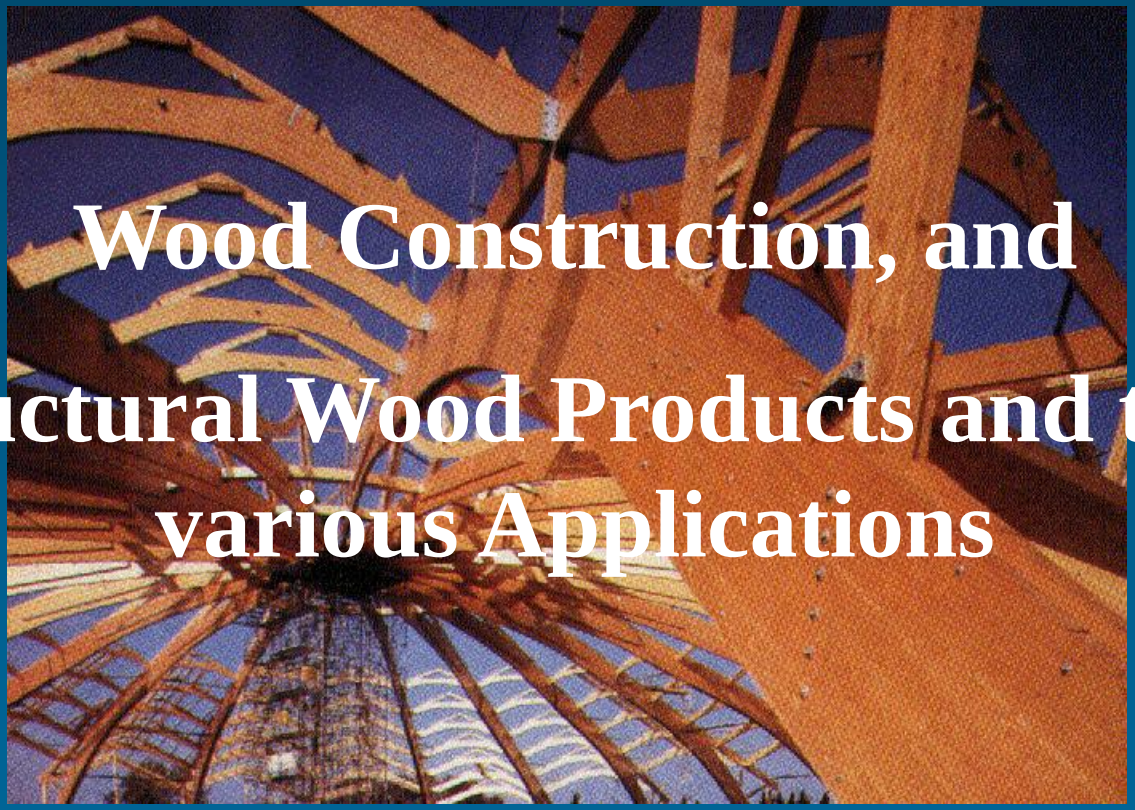
Wood Education Presentation



Wood Construction, and

Structural Wood Products and their various Applications

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Wood as a Material

- preferred building material for residential construction in North America
- New engineered wood products (EWP) and Code changes have increased share of commercial market

Why Use Wood?

Wood is **Renewable**

- Over 600 million seedlings are planted in Canada each year
- The volume of trees in Canada's productive forests increased by 3.8% in the last 15 years (1981-95)

Why Use Wood?

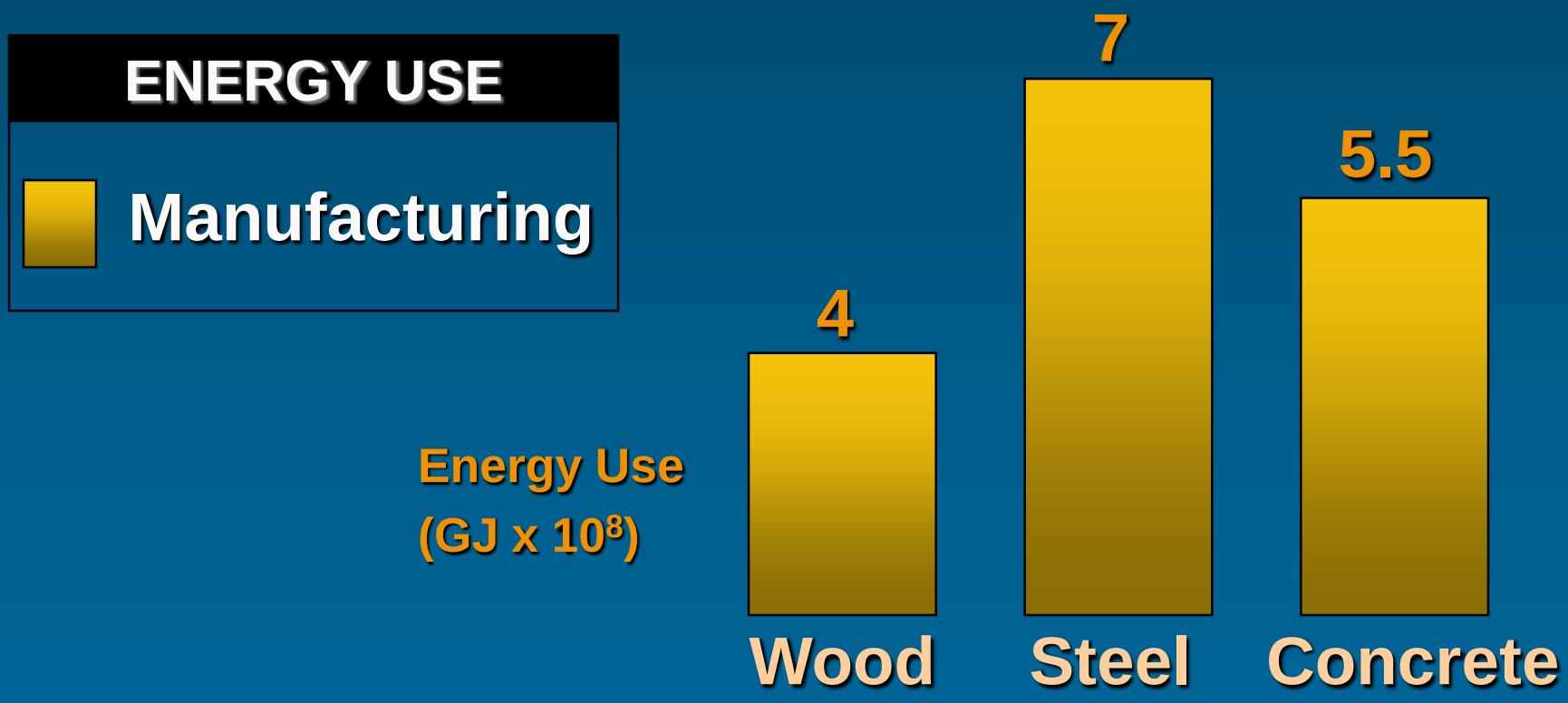
Wood is **Sustainable**

The rate of growth in Canada's commercial forests is equivalent to:

- **50,354 houses a day**
- **2,098 houses an hour**
- **35 houses a minute**

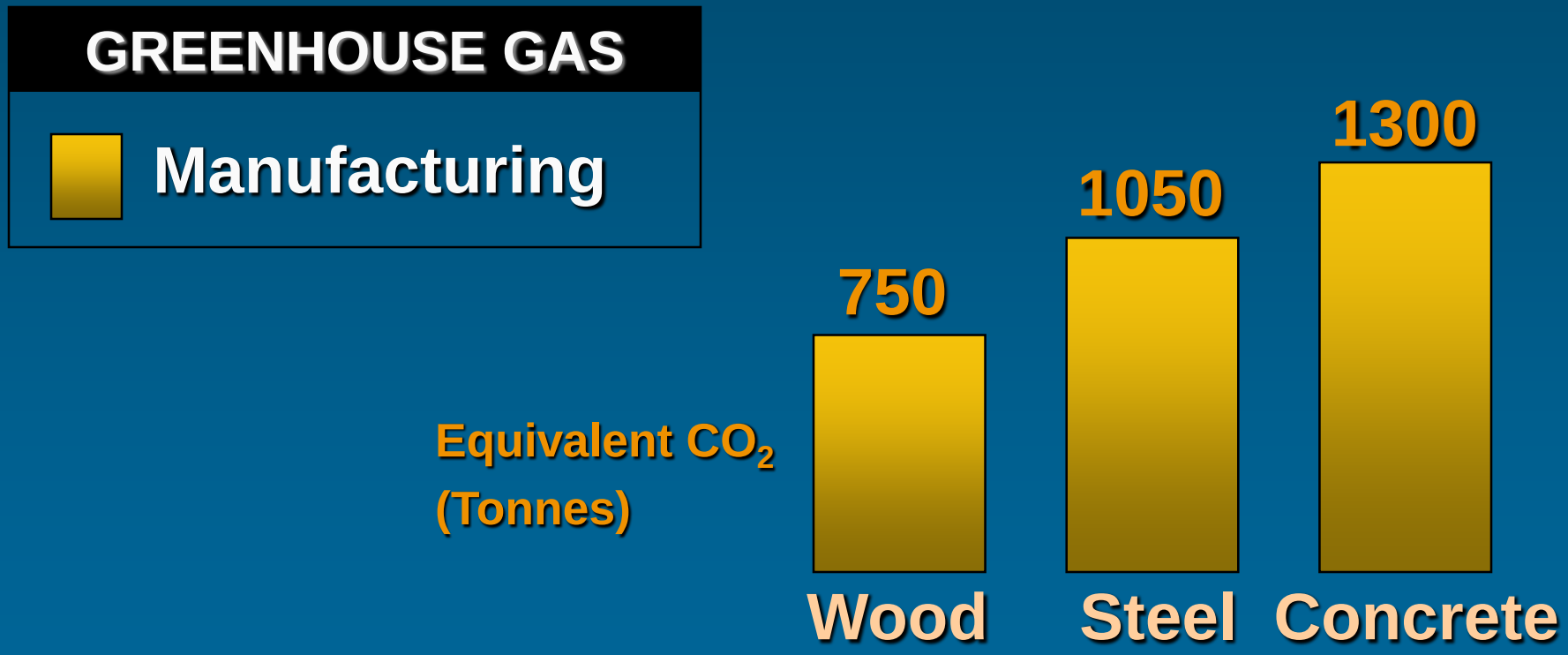
Why Use Wood?

Wood is **Environmentally Friendly**



Why Use Wood?

Wood is **Environmentally Friendly**



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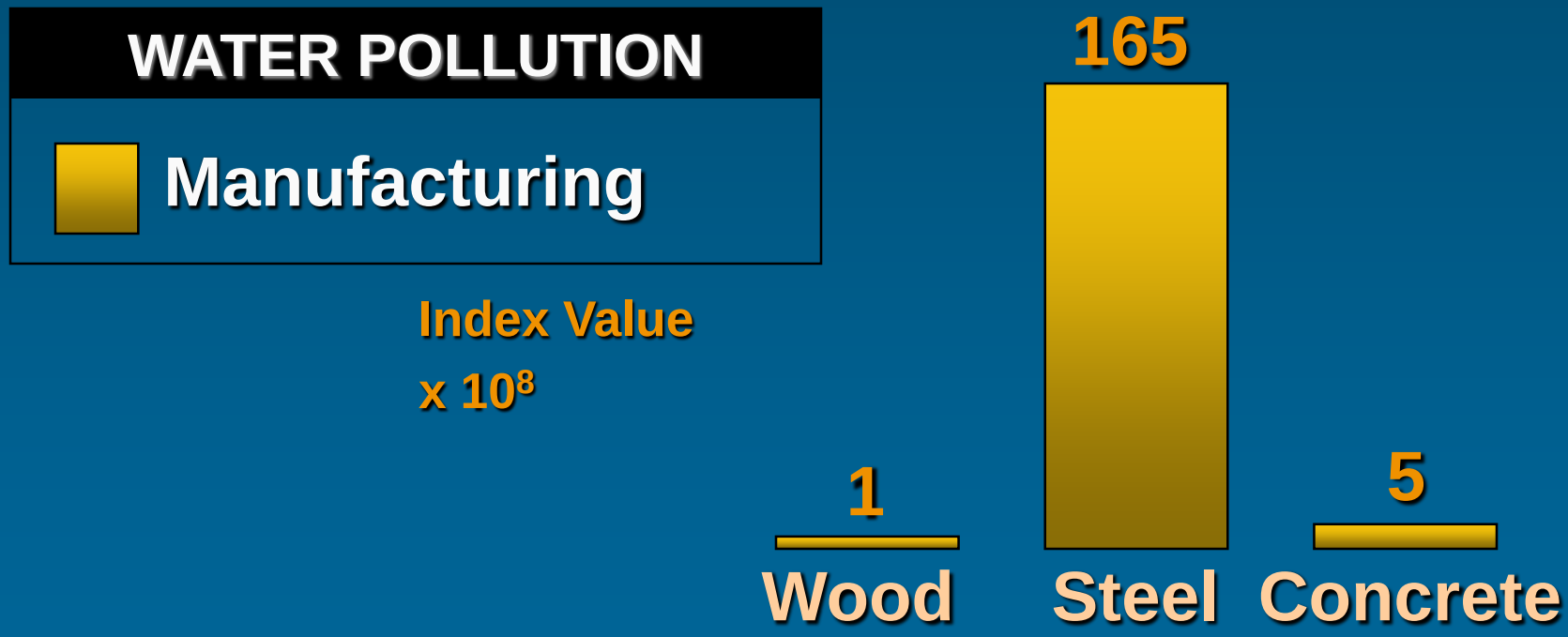
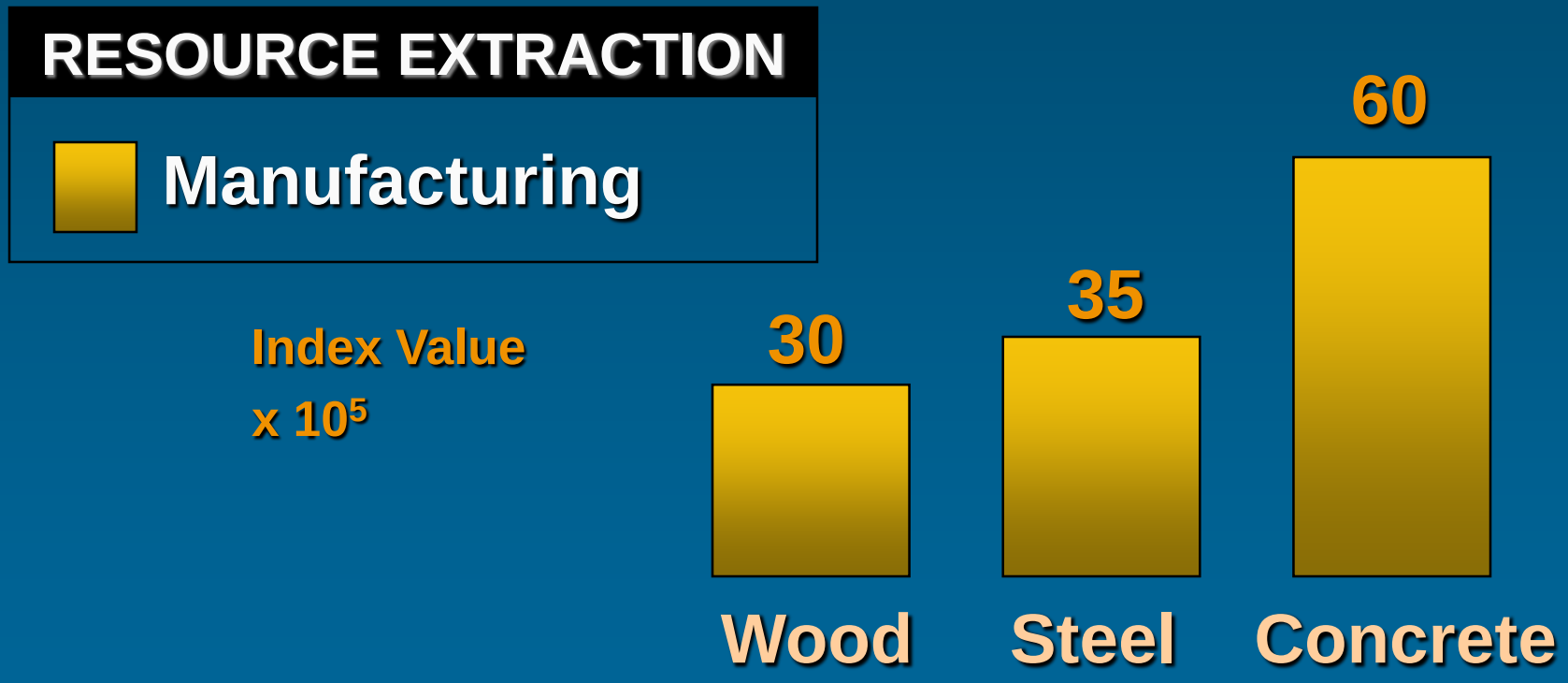


Why Use Wood?

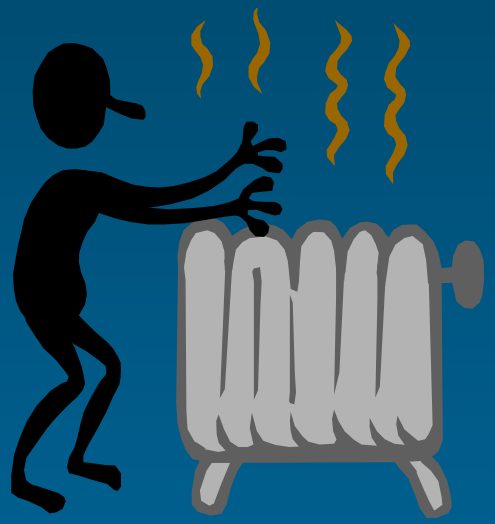
Wood is **Environmentally Friendly**



Why Use Wood?

Wood is **Thermally Efficient**

Wood keeps the heat in

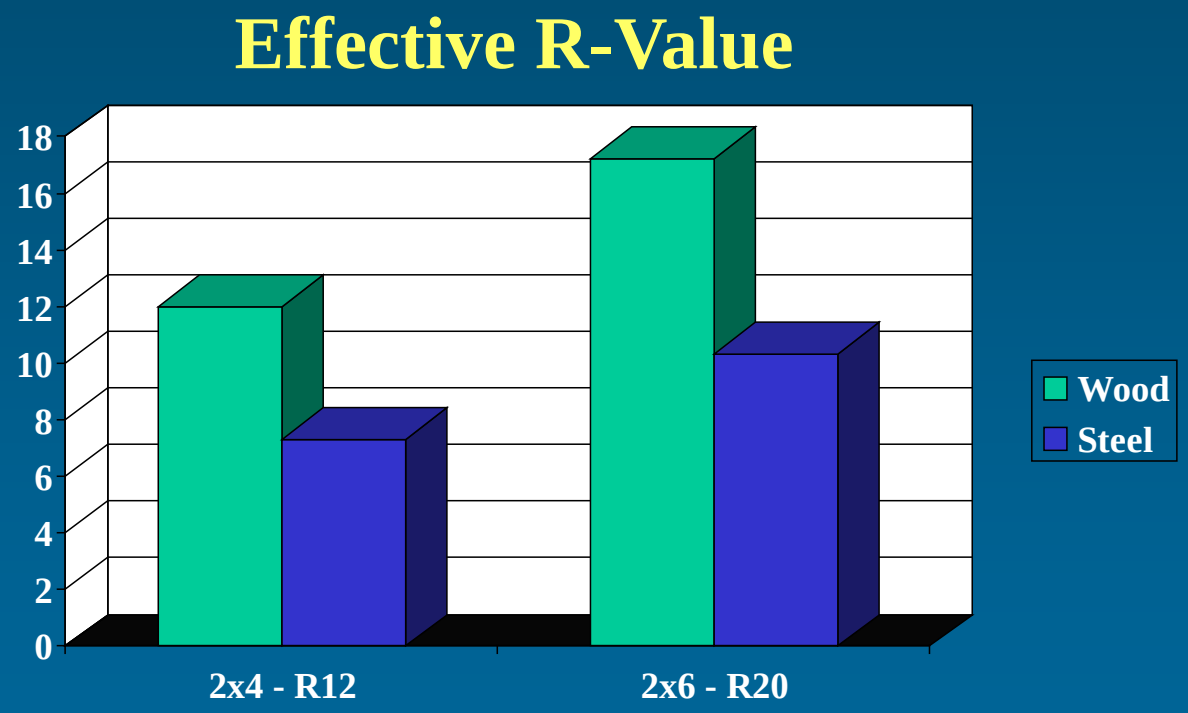


Wood R-Value = 1.5/in

Steel R-Value = .0024/in

Why Use Wood?

Wood is **Thermally Efficient**



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Structural Lumber

Consists of:

- dimension lumber
- specialty lumber
- timber

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Structural Lumber - Grading

Canadian Lumber is manufactured according to NLGA Standard Grading Rules:

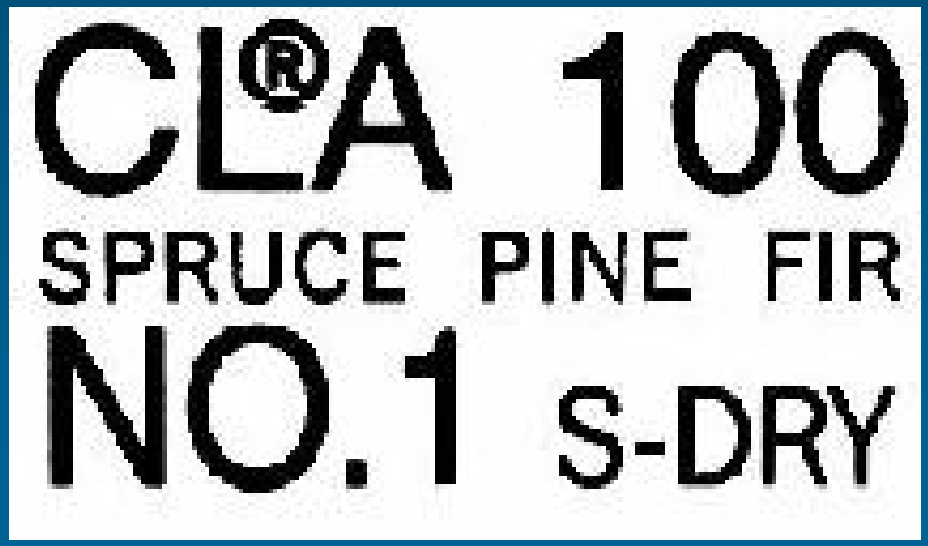
- approved by the Canadian Lumber Standards Accreditation Board
- approved by the American Lumber Standard Board of Review

Structural Lumber - Grading

Example Dimension Lumber Grade Stamp

Grading Agency - Canadian Lumbermen's Association ⇒

Assigned Grade ⇒



Mill designation ⇐

Species Group ⇐

Moisture Content ⇐

Specialty Lumber

Machine Stress Rated (MSR)

- lumber which is evaluated mechanically & visually

Features:

-more predictable properties

-higher strengths than visually graded lumber

Specialty Lumber

Fingerjoined Lumber

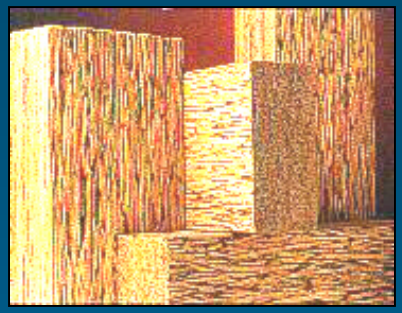
- dimension lumber into which fingerjoined profiles have been machined and end-glued together

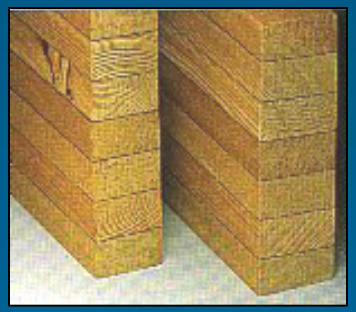
Features:

-longer spans

Engineered Wood Products



Engineered Wood Products

An Engineered Wood Product (EWP) is a product that has gone through a process to provide better or more predictable properties.

- longer spans
- greater load carrying capacity
- more design flexibility
- often more sustainable as making use of younger, smaller trees in a more innovative way

Engineered Wood Products

Plywood
Oriented Strandboard (OSB)
Glulam
Parallel Strand Lumber (PSL)
Laminated Veneer Lumber (LVL)
Laminated Strand Lumber (LSL)
I-Joists / Open-Web Joists
Trusses

Plywood

Thin veneers glued together oriented at cross grain.

•structural panels use waterproof phenol-formaldehyde resin glue certified for exterior use

•Available tonge and groove for use on sheathing to improve deflection performance

Plywood - Features

- can be treated
- can be used in exposed exterior applications
- always has an odd number of layers so the exterior boards have their grain in the same direction so they do not warp.

Plywood - Sizes

- commonly available in sheets 1220mm (4’) by 2440mm (8’) long
- available in thicknesses of 7.5mm(9/32”) to 31.5mm(1-7/32”) unsanded
- available in thicknesses of 6mm(1/4”) to 30mm(1-3/16”) sanded
- other sizes custom manufactured

Plywood - Uses

Uses

- floor sheathing & underlayment
- wall sheathing
- roof sheathing

Plywood - Uses

Uses

- floor sheathing & underlayment
- wall sheathing
- roof sheathing

Plywood - Specialty Uses

Specialty Uses

- preserved wood foundations
- concrete formwork
- plywood Box Beams
- stress-skin panels

Oriented Strandboard (OSB)

- Successive layers of 80mm (3 1/8”) strands aligned at 90^{o} to each other
- use waterproof phenol-formaldehyde resin adhesive or equivalent binder and wax for adhesion

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Oriented Strandboard - Features

- high shear value (commonly used for webstock for I-joists – see photo)
- not recommended for exposed exterior applications

Oriented Strandboard - Sizes

- most common panel size is 1220mm x 2440mm (4’ x 8’)
- thicknesses are available from 6mm (1/4”) to 28.5mm(1-1/8”)
- custom sizes may be specially ordered

- very similar to plywood as the products are often interchanged (OSB being cheaper)

Oriented Strandboard - Uses

Uses

- wall sheathing
- floor sheathing
- roof sheathing

Oriented Strandboard - Uses

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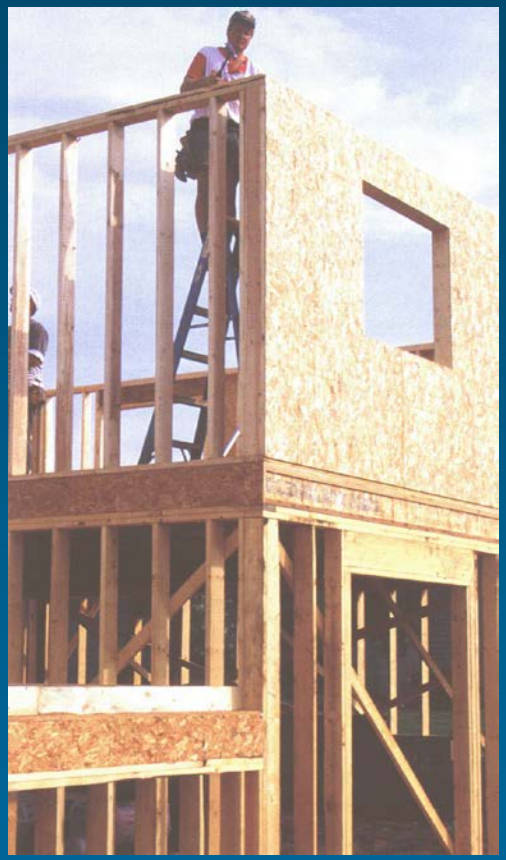
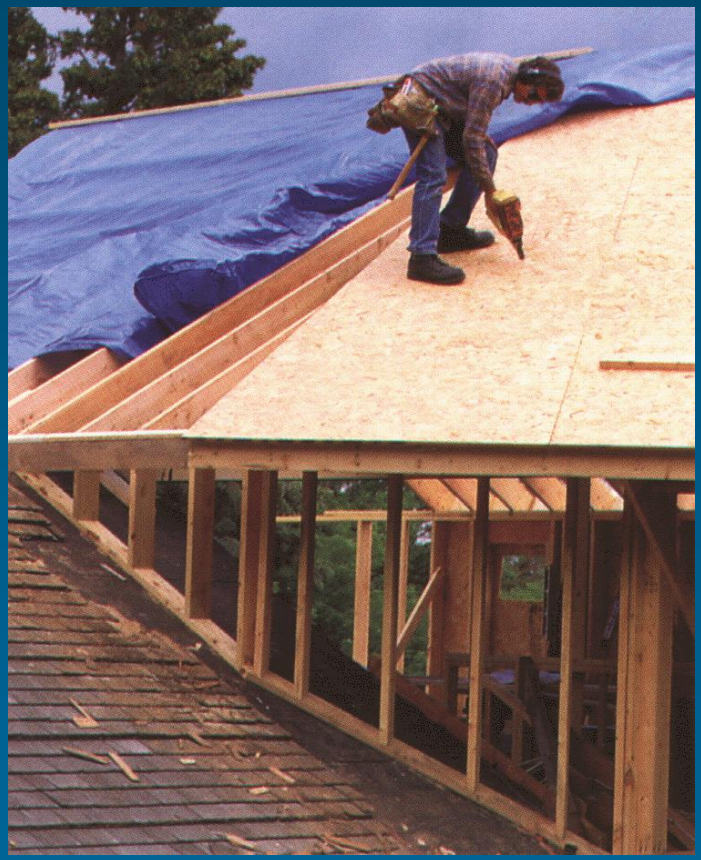
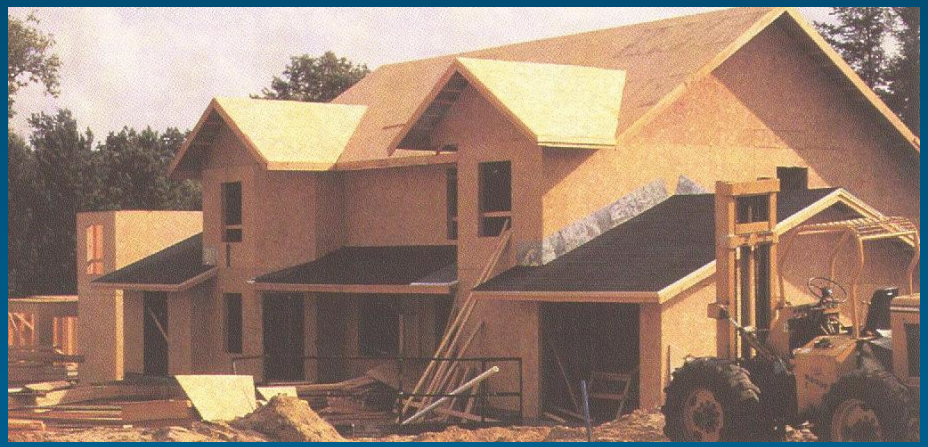
Oriented Strandboard - Uses





Oriented Strandboard - Uses



Oriented Strandboard - Specialty Uses

Specialty Uses

- concrete formwork
- siding
- structural insulated panels
- I-joist webs

Glulam – Glue Laminated Timber

- dimension (lamstock) lumber glued together under controlled conditions
- pieces are end jointed or butted and arranged in horizontal layers
- uses special grade (lamstock) lumber with a maximum MC = 15%

Glulam -Features

- produces large members, many shapes & sizes
- can be curved and tapered
- suitable for exterior & interior applications
- industrial, commercial or quality finish
- uses waterproof adhesives for end jointing and face bonding

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Glulam - Sizes

- available in lengths up to 40m (130’) however, limited by transportation restrictions
- standard finished widths range from 80mm (3”) to 365mm (14-1/4”)
- standard depths range from 114mm (4 1/2”) to 2128mm (7’) or more

Glulam - Uses

- Columns, beams, headers and girders
- curved members loaded in combined bending and compression
- used where structure of building is left exposed for architectural features
- heavy trusses

Glulam - Uses

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Glulam - Uses

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Glulam - Uses

Glulam - Uses

Glulam - Uses

Glulam - Connections

Parallel Strand Lumber (PSL)

High strength composite lumber product
manufactured by gluing strands (~ 3mm x 13mm x 2.4m)
of wood
together under pressure.

•Manufactured from
douglas fir or southern pine

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Parallel Strand Lumber - Features

- consistent properties
- resistant to seasoning stresses
- high load carrying capabilities
- well suited to applications where appearance is important

Parallel Strand Lumber - Sizes

- length usually limited to 20m (66’) due to transportation constraints
- beams sold in thicknesses of 45mm - 178mm (1 3/4”-7”)
- can be sawn to any dimension
- multitude of cross-sections

Parallel Strand Lumber - Uses

- beams & columns (post & beam construction)
- beams, headers & lintels (light frame construction)
- heavy timber
- trusses

Parallel Strand Lumber - Uses

Note that the connectors are highlighted and in steel rather than nails in these connections.

Parallel Strand Lumber - Uses

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Laminated Veneer Lumber

Type of structural composite lumber consisting of wood veneers coated with waterproof adhesives glued together and oriented in the same direction.

Laminated Veneer Lumber - Features

- strong when edge-loaded as a beam & when face loaded as a plank
- dimensionally stable
- high strength
- high reliability, lower variability

Laminated Veneer Lumber -Sizes

- available in lengths up to 24.4m (80’)
- manufactured in thicknesses from 19mm to 89mm (3/4”-3 1/2”)
- common LVL beam depths are 241mm to 476mm (9 1/2”-18 3/4”)
- easily cut to length at site

Laminated Veneer Lumber -Uses

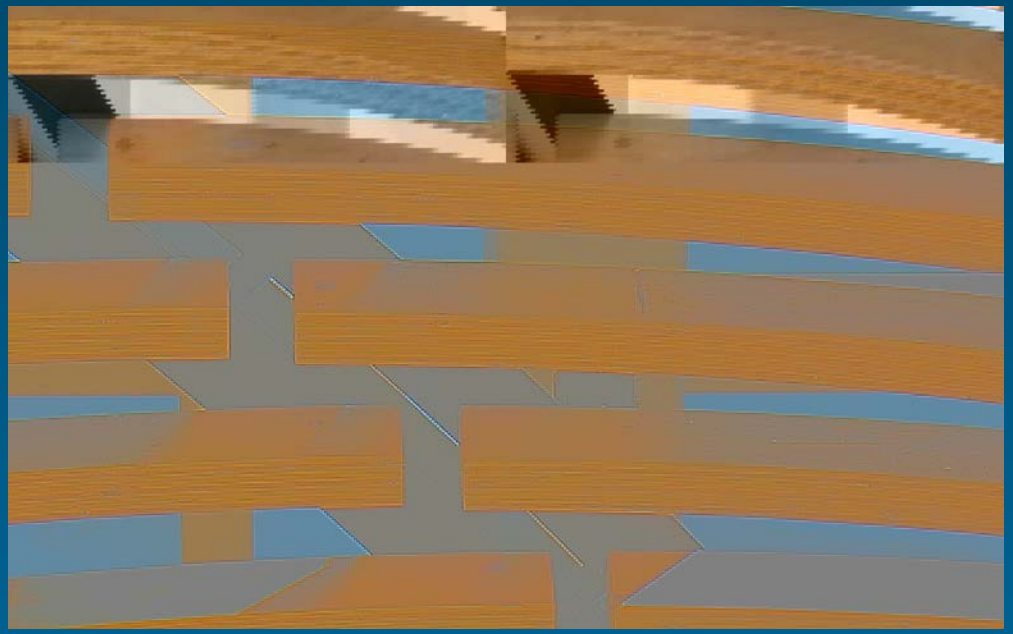
- as flange member for prefab. wood I-joists
- well suited to applications where open web steel joists (OWSJ) & light steel beams may be considered
- beams & headers
- scaffold planking

Laminated Veneer Lumber - Uses

New Applications

- columns
- wall studs
- trusses

Laminated Veneer Lumber - Uses



Laminated Veneer Lumber - Uses

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Laminated Veneer Lumber - Uses

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Laminated Strand Lumber

Consists of long strands (~300mm) oriented in a parallel direction laminated together with an isocyanurate-based adhesive.

•Manufactured from aspen

Laminated Strand Lumber - Features

- uniform and consistent properties
- dimensional stability
- manufactured to a consistent moisture content and uniform dimensions

Laminated Strand Lumber - Sizes

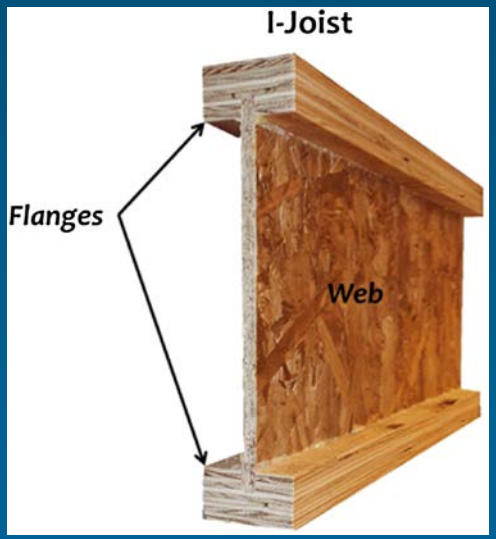
- studs available in lengths up to 22 feet
- studs generally available in 2” x 4” or 2” x 6”
- rim boards generally 1 1/4” wide
- rim boards usually available in depths of 9 1/2” to 16”

Laminated Strand Lumber - Uses

- tall wall studs
- rim boards

Wood I-Joists

Manufactured by gluing solid sawn lumber,
LVL or MSR flanges to a plywood or OSB web.



Wood I-Joists - Features

- dimensionally stable, lightweight member
- uniform stiffness, strength
- known engineering properties
- use exterior rated waterproof adhesives

Wood I-Joists - Sizes

- length limited by transportation to 20m (66’)
- common depths range from 241mm to 508mm (9 1/2”-20”)
- common flange widths vary from 45mm to 89mm (1 3/4”-3 1/2”)
- web thickness usually varies from 9.5mm to 12.7mm (3/8”-1/2”)
- sizes can be specially ordered

Wood I-Joists - Uses

- floor and roof joists
- economical alternative to OWSJ
- well suited for longer span joist & rafter applications

Wood I-Joists - Uses

Wood I-Joists - Uses

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Open Webbed Joists

Metal plate connected, glued or metal webbed trusses used for floor or roof joists.

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Trusses

Structural frame relying on a triangular arrangement of webs and chords to transfer loads to reaction points.

Trusses

There are two categories of trusses:

1. Light Frame Trusses (metal plate connected)
2. Heavy Timber Trusses

Trusses - Light Frame

- made from dimension lumber of various sizes
- chords and webs connected by the use of toothed galvanized steel connector plates hydraulically pressed into precut lumber

Trusses - Heavy Timber

- made from timbers or from manufactured wood products (i.e. glulam, PSL)
- members connected using bolts & plates, split rings, and special brackets & hangars

Trusses - Features

- unlimited shape & size
- economy
- ease of fabrication
- fast delivery
- simplified erection procedures
- all trusses are custom designed
- flexibility in layout & longspans

Trusses - Sizes

- shapes and size restricted only by manufacturing capabilities, shipping limitations & handling considerations

Trusses - Uses

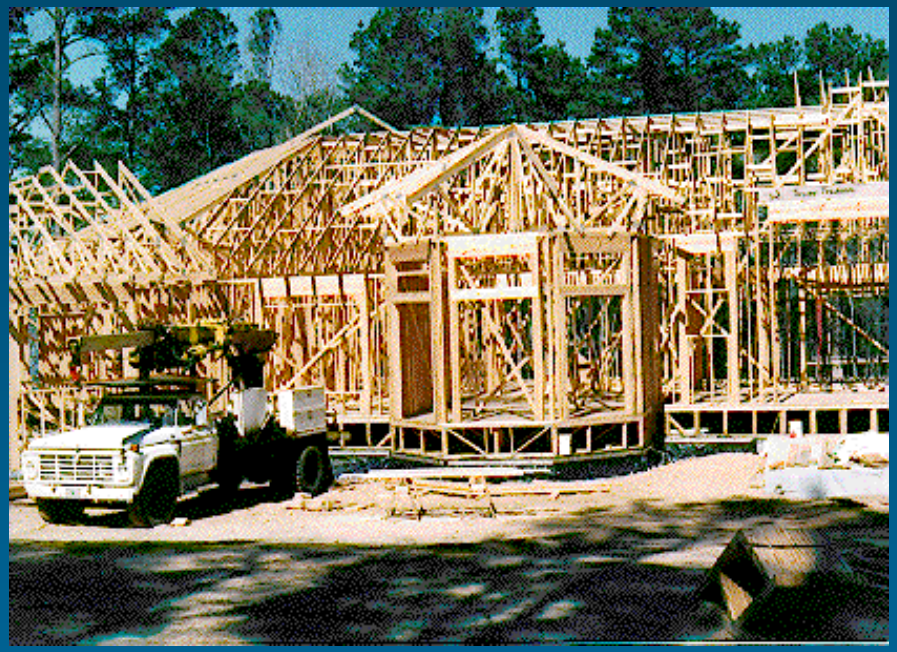
- floor systems
- roof systems

Trusses - Uses

Trusses - Uses

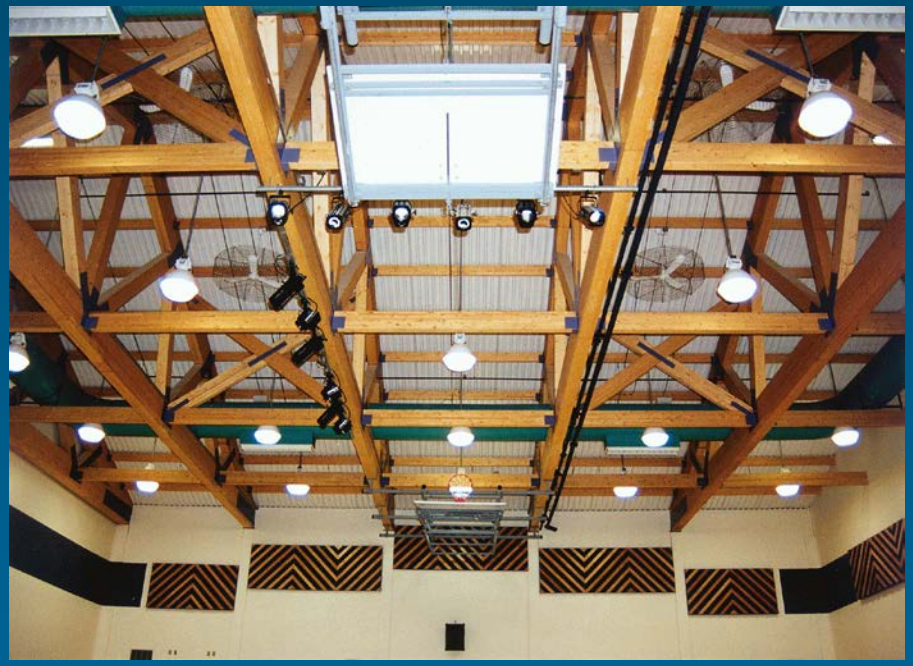
Trusses - Uses

Trusses - Uses



Trusses - Uses

Trusses - Uses



Engineered Wood Products

Summary

- engineered products with consistent properties - strength, MC, dimension
- proprietary products except panels and glulam
- long span capabilities
- economical alternative to steel and concrete systems
- engineering support from manufacturers

Wood Construction

Two basic types:

1. **Light-frame**
2. **Post & Beam**

Wood Construction - Light Frame

The use of closely spaced members of dimension lumber size combined with sheathing to form the structural elements of the building.

Two basic methods:

A.) Platform Construction

B.) Balloon Construction

Wood Construction - Light Frame

Platform Construction:

Consists of a floor platform upon which the walls are built. The second storey floor is then built on top of the first floor walls.

Wood Construction - Light Frame

Balloon Construction:

Wall members continue past the floors. The joists are then suspended from the completed wall frames.

Wood Construction - Light Frame

Single-family Residential

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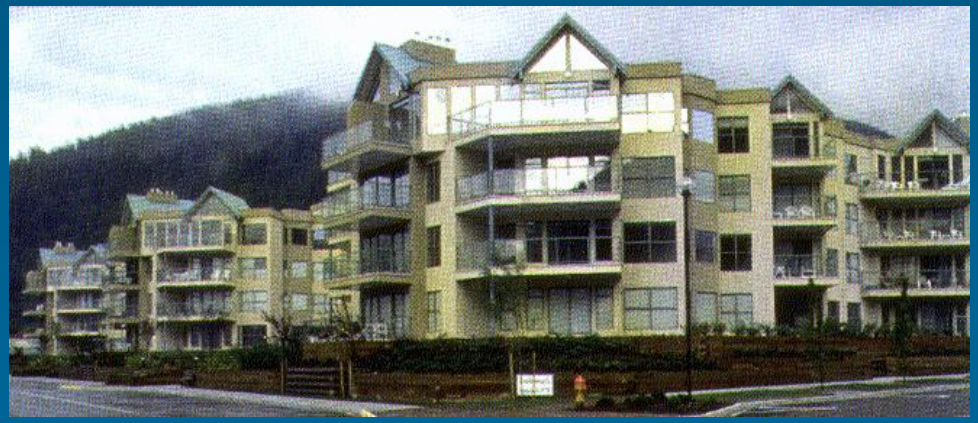
Wood Construction - Light Frame

Multi-family Residential



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Wood Construction - Light Frame

Commercial

Wood Construction - Post & Beam

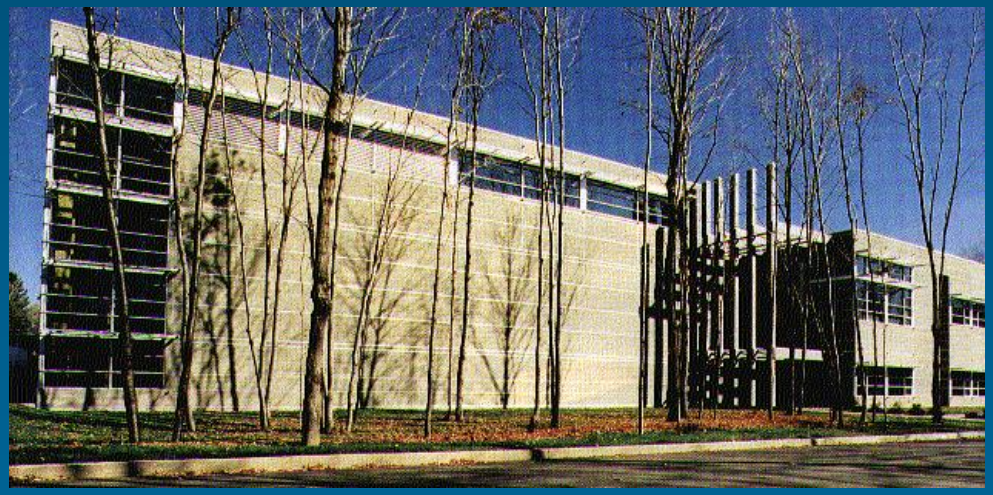
The use of large, widely spaced members to provide structural support.

Wood Construction - Post & Beam

Single-family Residential

Wood Construction - Post & Beam

Commercial



Architectural Considerations

Wood and moisture

- Use **DRY LUMBER** when possible
- facilitate shedding of water
- protect edge and end grain
- allow access for air drying

Architectural Considerations

Lateral Design - earthquakes & wind

Light-Frame

- sheathing and framing together

resist lateral loads- shearwalls

Architectural Considerations

Lateral Design - earthquakes & wind

Post & Beam

•columns and beams support vertical loads and diagonal bracing or other support is required to resist lateral loads

Architectural Considerations

Fire Resistance

- Heavy Timber has inherent fire resistance
- Light frame uses GWB to achieve 45 min to 2 hour FRR