

# Wood Education Presentation

---



**Wood Construction, and  
Structural Wood Products and their  
various Applications**

---

Canadian  
Wood  
Council

Conseil  
canadien  
du bois



# 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
- Wood is now allowed in Canadian codes to a height of 6 storeys (used to be 3 ½)



# 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:

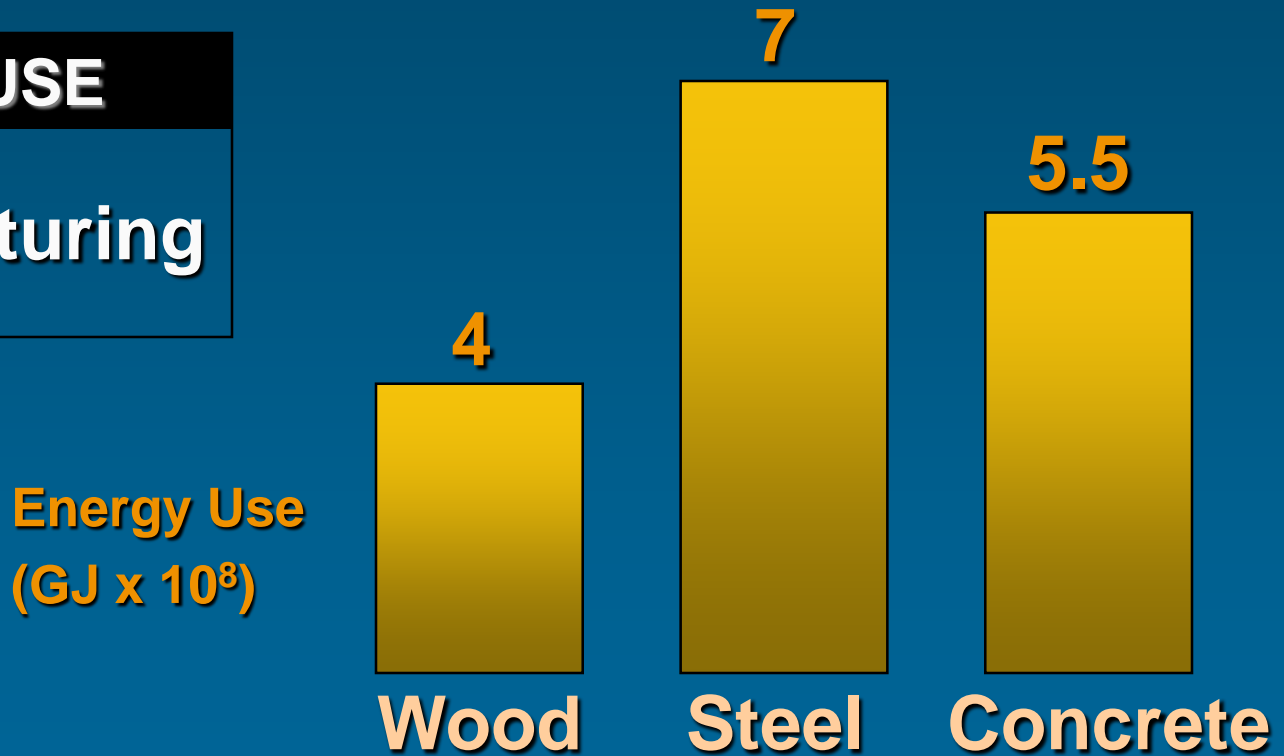
- 50,354 houses a day
- 2,098 houses an hour
- 35 houses a minute





# Why Use Wood?

## Wood is Environmentally Friendly



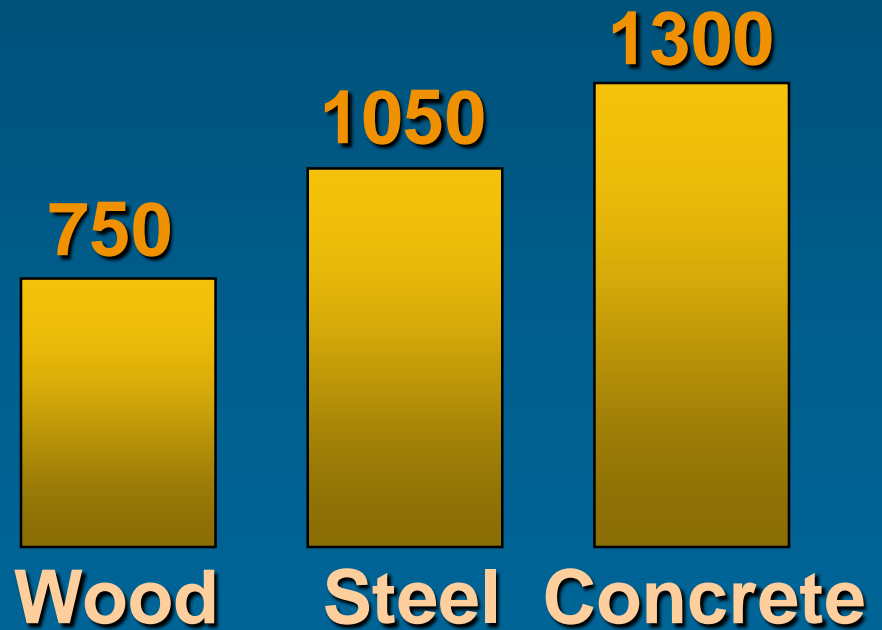
# Why Use Wood?

## Wood is Environmentally Friendly

### GREENHOUSE GAS

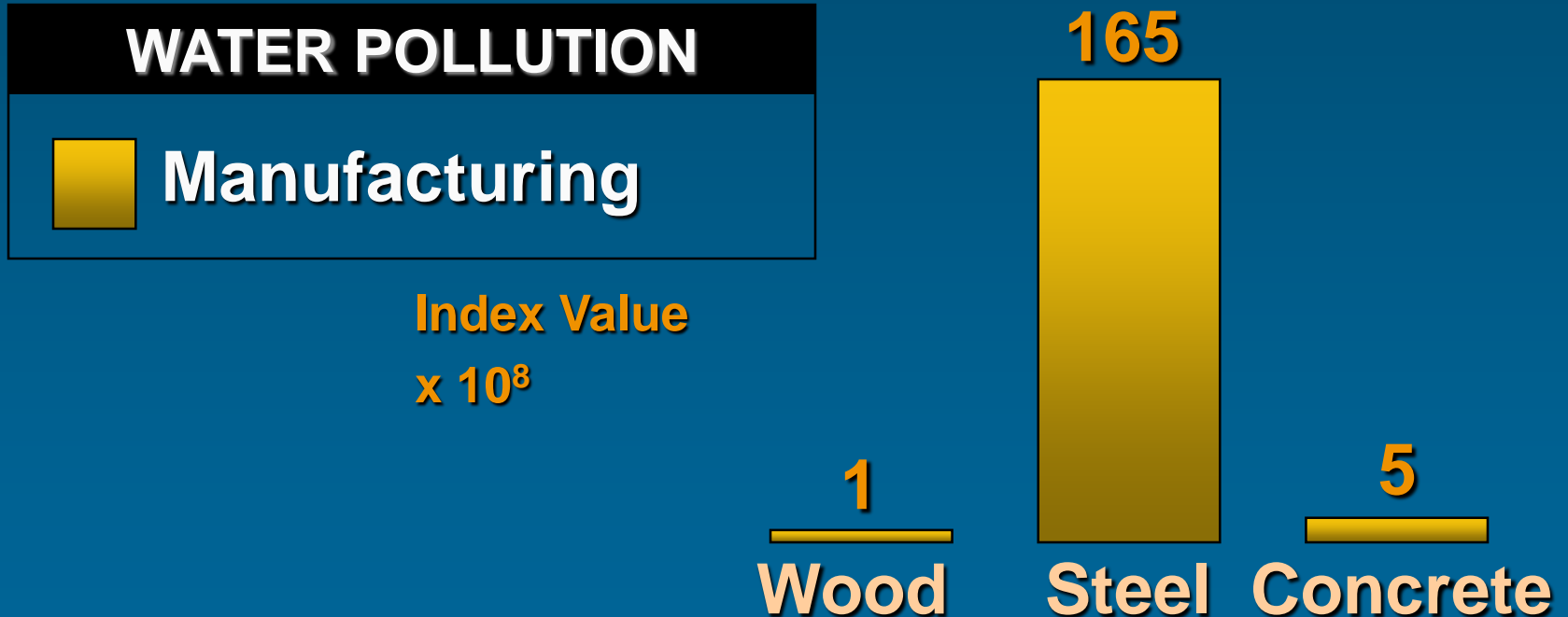
Manufacturing

Equivalent CO<sub>2</sub>  
(Tonnes)



# Why Use Wood?

## Wood is Environmentally Friendly





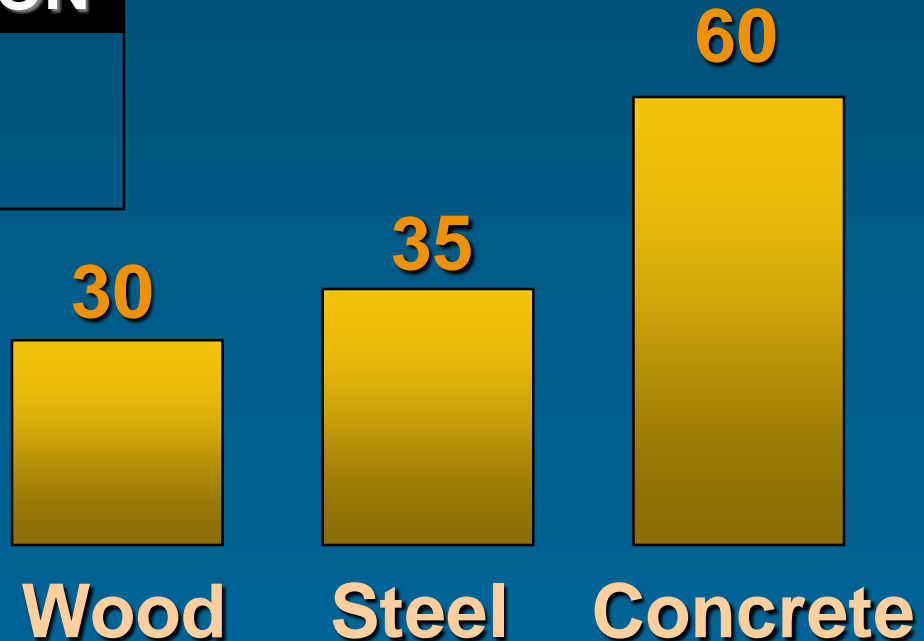
# Why Use Wood?

Wood is **Environmentally Friendly**

## RESOURCE EXTRACTION

 Manufacturing

Index Value  
 $\times 10^5$

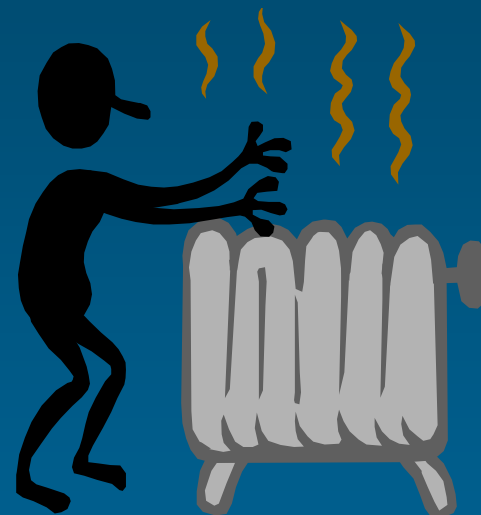


# Why Use Wood?

---

Wood is **Thermally Efficient**

Wood keeps the heat in



Wood R-Value = 1.5/in

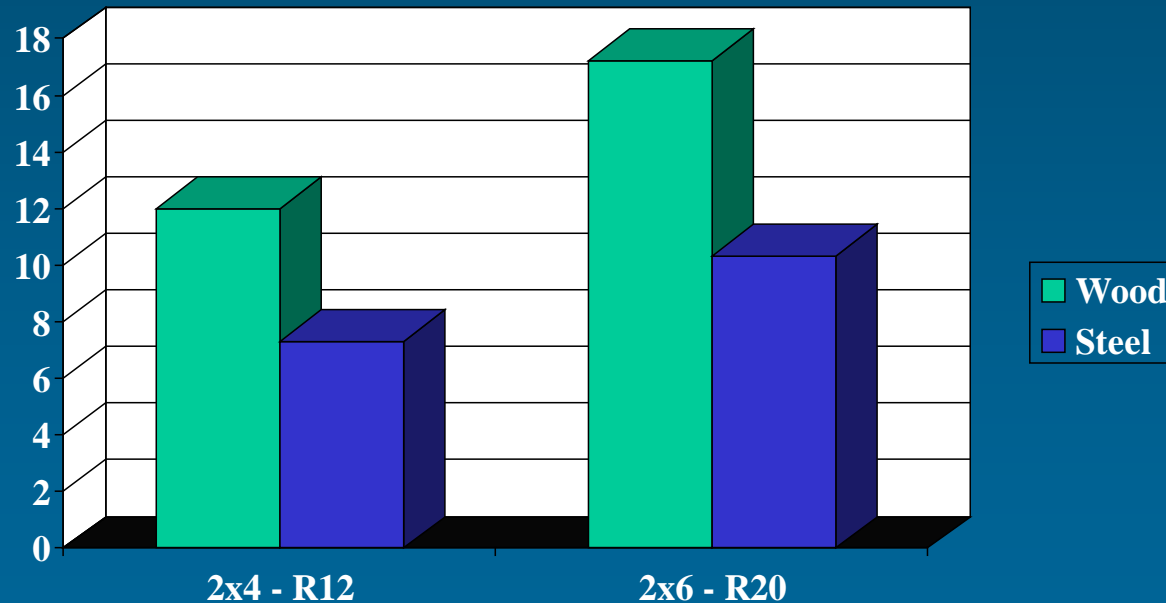
Steel R-Value = .0024/in



# Why Use Wood?

## Wood is Thermally Efficient

### Effective R-Value





# Structural Lumber

---

Consists of:

- dimension lumber
- specialty lumber
- timber



# 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



CLA<sup>®</sup> 100

Mill designation



SPRUCE PINE FIR

Species Group



Assigned Grade



NO.1 S-DRY

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

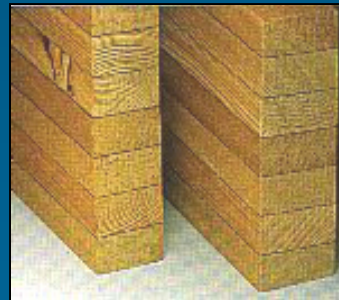
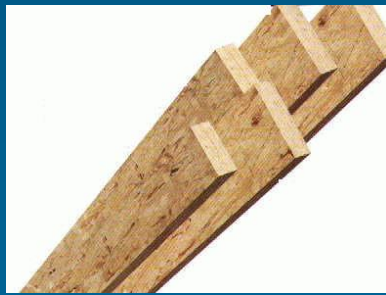
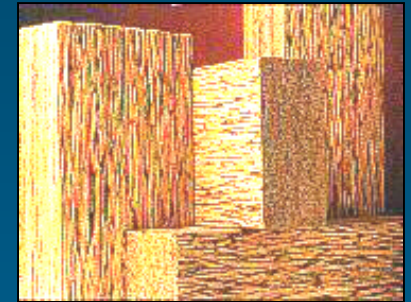
### Features:

-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



# A move from Heavy Timber to Engineered Systems

---

- Running out of old growth forest from which to take large sections
- Many defects in large sections due to varied drying rates
- More sustainable and reliable to use engineered products as they can be manufactured from smaller trees





# A move from Heavy Timber to Engineered Systems



# Engineered Wood Products

---

Plywood

Oriented Strandboard (OSB)

Glue Laminated Timber (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 tongue 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)*

---

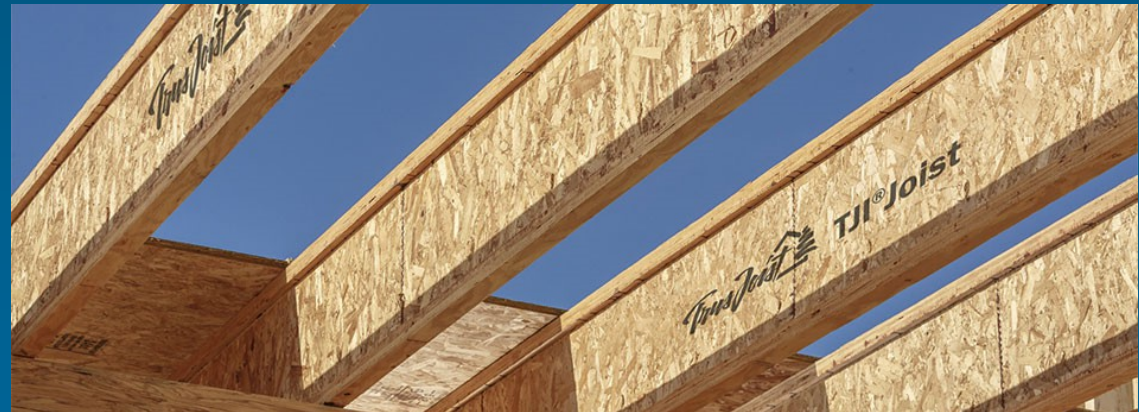
- Successive layers of 80mm (3 1/8") strands aligned at 90° to each other
- use waterproof phenol-formaldehyde resin adhesive or equivalent binder and wax for adhesion



# *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





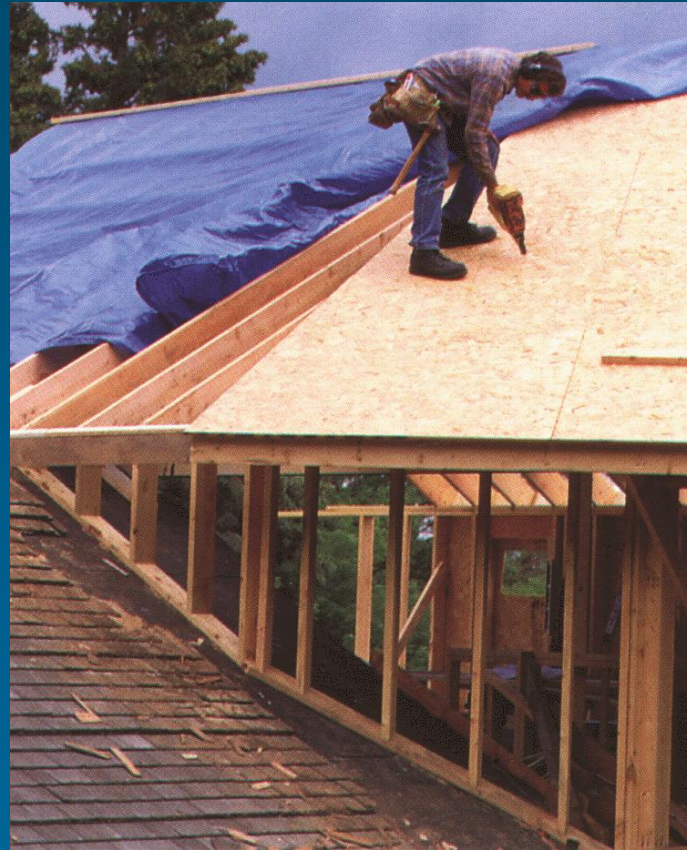
# *Oriented Strandboard - Uses*

---



# *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



# *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





# *Glulam - Uses*

---



# 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





# *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*





# *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*

---



# *Laminated Veneer Lumber - Uses*

---





# *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*

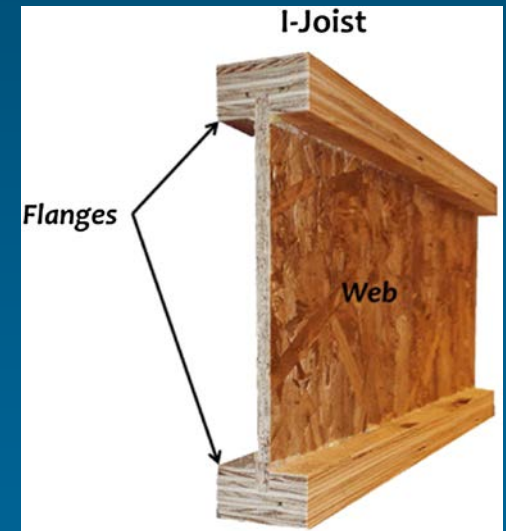
---

- 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*

---



# *Open Webbed Joists*

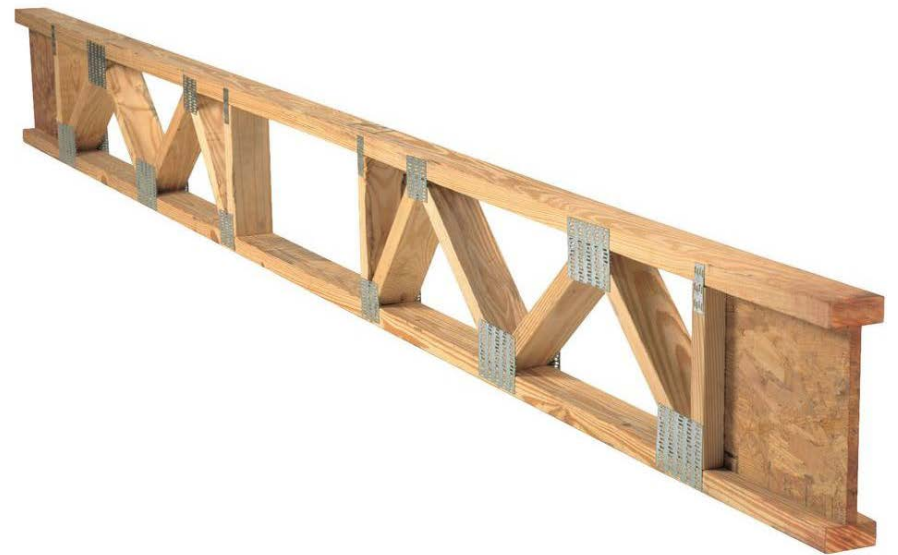
---

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





# *Open Webbed Joists*



# *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*

---



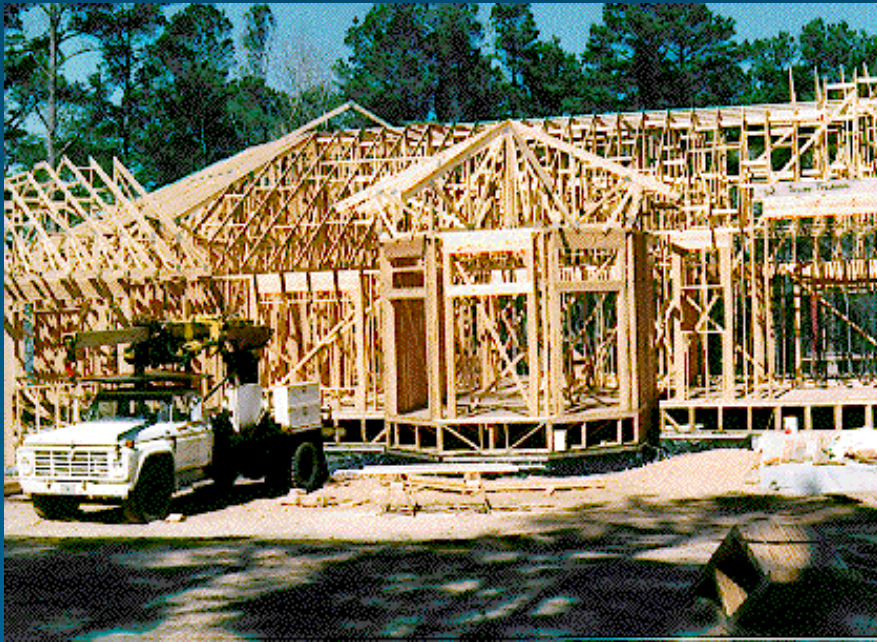


# *Trusses - Uses*



# *Trusses - Uses*

---





# *Trusses - Uses*

---



# 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 (mostly residential)**
- 2. Post & Beam (column & 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 (still used widely)

B.) Balloon Construction (seldom used anymore)



# 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

---

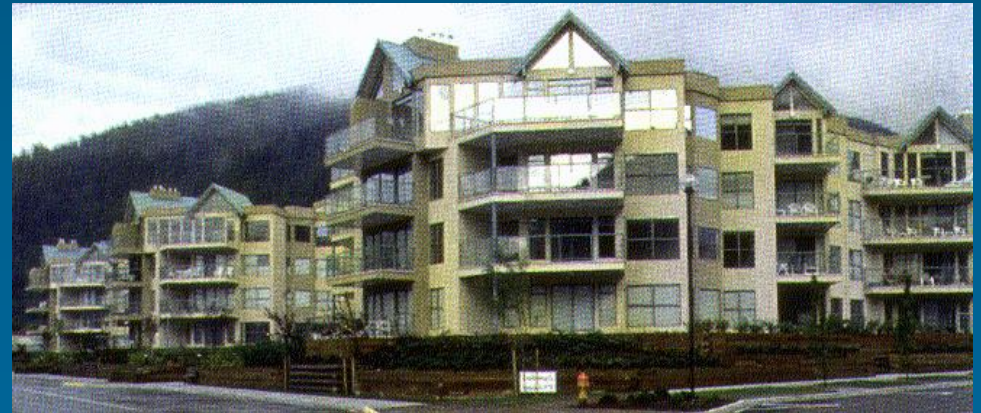
## Single-family Residential



# Wood Construction - Light Frame

---

## Multi-family Residential





# 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



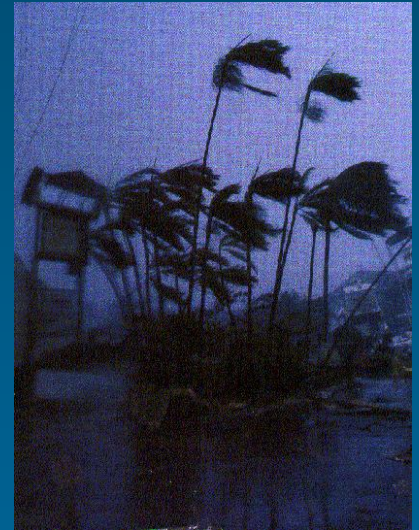
# Architectural Considerations

---

## Lateral Design - earthquakes & wind

### Light-Frame

- sheathing and framing together resist lateral loads- shearwalls





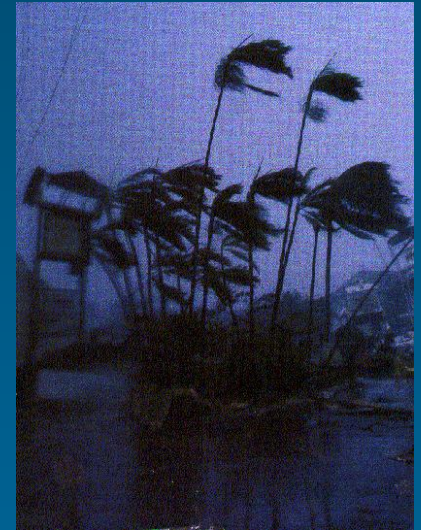
# Architectural Considerations

---

## 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

