Engineered Wood Products

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Wood Products Taxonomy

WOOD
- Composites
  - Panels
  - Wood Non-wood
    - Wood Based
      - Particleboard
      - MDF
      - Plywood
      - OSB
  - Engineered Lumber Composites (ELC)
- Solid Wood
  - Softwood Lumber
    - Glued
    - Treated
  - Hardwood Lumber
  - CCA treated
    - Hardwood
  - Finger joined
  - Edge glued
  - Fire retardant

Engineered Wood Products
- Beams
- Roof trusses
Engineered Wood Products

• Wood structure, function and properties
• Examples of solid wood products
  – Dimension lumber
  – Timber
• Concepts of engineered wood products
• Examples of engineered wood products
  – Laminated veneer lumber
  – Glue laminated timber
  – Parallam®
  – TimberStrand™
  – I-beams
Wood Structure and Function

• Mechanical support
• Water transportation
Wood Properties

Positive
• Specific strength
• Toughness
• Workability
• Insulation
• Variety
• Psychological appeal
• Renewable

Negative
• Anisotropy
• Variability
• Biodegradability
• Hygroscopicity
Wood Products - Then
Wood Products - Now
Solid Wood Products

- Vary by
  - Dimensions
  - Species
  - Uses

- Examples of structural solid wood products
  - Dimension lumber
  - Timber
Dimension Lumber

Dimensions:  
- Width: 1½ inches
- Depth: 3½-11¼ inches
- Length: up to 24 feet

Applications:  
- Framing, vertical support, beams, joists, roof trusses
Dimension Lumber

- “2x4”, “2x6”, “2x8” construction lumber
- Majority of lumber produced in North America
- Bulk commodity product with little specialization
Timber

Dimensions:
- Width: 5½-11¼ inches
- Depth: 5½-11¼ inches
- Length: up to 36 feet

Applications:
- Posts, beams, rafters
Timber

- Post and beam construction
- Architectural value as well as structural role
- Higher value product ($/m³)
Choice of Wood Products

• Product composition?
  (a) one large piece of solid wood
  or
  (b) smaller pieces wood glued together

• Relative strength rating?
  (a) 75-85
  or
  (b) 50-100
Solid Wood Products  

Engineered Lumber Composites
Engineered Lumber Composites
- benefits compared to solid wood

• Larger dimensions possible
• Smaller trees can be utilized
• Greater utilization of each log
• Higher strength ratings possible
• More reliable
Variation in wood products
Variation in wood products

- Frequency
- Strength
- Lower 5th percentile
- Division by safety factors
- Mean
- Solid wood
- Allowable design stress
Variation in wood products

- Solid wood: lower 5th percentile ÷ safety factors
- Wood composite A: lower 5th percentile ÷ safety factors

allowable design stress
Variation in wood products

- Solid wood
- Wood composite B

allowable design stress

mean

lower 5th percentile

÷ safety factors

strength

frequency
Solid wood vs. Engineered lumber composite

Which is “stronger”?

“Stronger” = “Can accept higher design loads”
Engineered Lumber Composites
Reduction of natural variability

Initial source of solid wood

Wood source reduced to designed elements

Elements combined into more consistent engineered products

Strategic placement of elements
Wood Elements

- Solid wood
- Veneer sheet
- Veneer strip
- Strand

- Glue
- Laminated
- Timber
- Laminated Veneer
- Lumber
- Parallam®
- TimberStrand™
Wood Elements

Veneer sheet

Rotary peeling of high quality, softwood logs

1/8-1/10” thick
8 ft long
4ft wide

Strand

Slicing of low quality, hardwood logs

1/20” thick
1” wide
4-12” long
Laminated Veneer Lumber

Elements: Sheets of wooden veneer (1/8-1/10” thick, 2’ wide, 8’ long)

Product Dimensions:
- Width: 1½ - 3½ inches
- Depth: up to 24 inches
- Length: up to 80 feet

Applications: Beams, headers, I-beam flange
Laminated Veneer Lumber (LVL)

- Veneers glued with grain running parallel to each other
- Veneers graded prior to assembly
- Higher quality veneers are placed on the outsides
- LVL used on flat (I-beam flanges) or on edge (beams, headers)
Reduction of natural variability

Solid wood
Variability is at its greatest level.

Laminated Veneer Lumber
Variability is reduced in one plane.

- Defects in veneer can be removed or dispersed
- Variability is reduced by using veneers from different logs in each LVL piece
- Yield of veneer from logs is higher than that of solid lumber
Laminated Veneer Lumber

LVL beam

LVL in I-beam
Laminated Veneer Lumber

LVL header
Glue Laminated Timber (Glulam)

Elements: “Lamstock”, high quality dimension lumber (1½” thick, up to 10” wide, up to 20’ long)

Product Dimensions:
- Width: 3½-14 inches
- Depth: up to 8 feet
- Length: up to 140 feet

Applications: Beams, columns, arches, trusses
Glue Laminated Lumber (Glulam)

- Individual lamstock elements are stress-rated prior to beam fabrication
- Stiffer elements are placed in more critical locations in member
- Architectural value as well as structural role
- Curved members can be created
Glulam - Columns, Beams and Rafters
Glulam - Roof Beams
Glulam - Curved Beams
Elements: Strips of wooden veneer
(1/8-1/10” thick, 1/2” wide, up to 8’ long)

Product Dimensions:
Width up to 12 inches
Depth up to 21 inches
Length up to 66 feet

Applications: Beams, columns, headers
Parallam®

- Veneer clipped into long strips
- Strips coated with glue and aligned parallel to each other
- Cured by microwave heating
- Very reliable product
Reduction of natural variability

- **Solid wood**: Variability is at its greatest level.
- **Laminated Veneer Lumber**: Variability is reduced in one plane.
- **Parallam®**: Variability is reduced in two planes.
Parallam®
TimberStrand™

Elements: Strands of aspen, cottonwood (1/20” thick, 1” wide, 12” long)

Product Width  1½ -3½ inches
Dimensions: Depth  9½-14 inches
Length  up to 48 feet

Applications: Beams, wall studs, headers
TimberStrand™

- Long strands of low density hardwoods
- Cured by steam-pressing
- Dimensions smaller than Parallam
- Not as strong as Parallam
- Very dimensionally stable
TimberStrand™
I - Beams

- Replace single, solid pieces of wood
- Use less material, lighter
- Flanges - MSR lumber, LVL, Parallam®, TimberStrand™
- Webs - plywood, oriented strandboard (OSB)
- Used as floor joists, roof rafters
Plywood

- structural panel product
- uses veneers peeled from high quality softwood logs
- adjacent veneers are laid up perpendicular to each other
- manufactured in 4x8 ft sheets
Oriented Strand Board

- structural panel product
- uses flakes or strands (approx. 20x100x1mm) cut from under-utilized, low density hardwoods
- strands on outer layers oriented parallel to long axis of panel
- produced as large panels (up to 12x24 ft)
I - Beams

Elements: Flange - MSR lumber, LVL, Parallam
Web - OSB, Plywood

Product Width: 1½ -3½ inches
Dimensions: Depth: 9 ½-24 inches
Length: up to 66 feet

Applications: Floor joists, roof joists
I- Beam constitution

**FLANGE**
- MSR lumber
- LVL
- LVL
- Timber Strand

**WEB**
- OSB
- OSB
- Plywood
- OSB
I - Beams
Engineered Wood Products
Engineered Lumber Composites - benefits compared to solid wood

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