Wood Connections

Connectors
- joining
  - lapping
  - interlocking
  - butting
- mechanical
  - “third-elements”
- transfer load at a point, line or surface
  - generally more than a point due to stresses

Wood Connectors
- adhesives
  - used in a controlled environment
  - can be used with nails
- mechanical
  - bolts
  - lag bolts or lag screws
  - nails
  - split ring and shear plate connectors
  - timber rivets
Bolted Joints

- connected members in tension cause shear stress
- connected members in compression cause bearing stress

Tension Members

- members with holes have reduced area
- increased tension stress
- \( A_e \) is effective net area
  \[
  f_t = \frac{P}{A_e} \left( or \frac{T}{A_e} \right)
  \]

Effective Net Area

- likely path to “rip” across
- bolts divide transferred force too

Single Shear

- seen when 2 members are connected

\[
f_v = \frac{P}{A} = \frac{P}{\pi \frac{d^2}{4}}
\]
**Double Shear**

- seen when 3 members are connected

\[ \Sigma F = 0 = -P + 2 \left( \frac{P}{2} \right) \]

\[ f_v = \frac{P}{2A} = \frac{P}{2} = \frac{P}{\pi d^2/4} \]

**Bolted Joints**

- twisting

- tear out
  - shear strength
  - end distance & spacing

**Bearing Stress**

- compression & contact
- stress limited by species & grain direction to load
- projected area

\[ f_p = \frac{P}{A_{projected}} = \frac{P}{td} \]

**Nailed Joints**

- tension stress (pullout)
- shear stress nails presumed to share load by distance from centroid of nail pattern

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Nailed Joints

• sized by pennyweight units / length
• embedment length
• dense wood, more capacity

Connectors Resisting Beam Shear

• plates with
  – nails
  – rivets
  – bolts

• splices

• V from beam load related to $V_{\text{longitudinal}}$

$$\frac{V_{\text{longitudinal}}}{I} = \frac{VQ}{nF_{\text{connector}}} \geq \frac{VQ_{\text{connected area}}}{I} \cdot p$$

Vertical Connectors

• isolate an area with vertical interfaces