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

$$\Sigma F = 0 = -P + 2(P/2)$$

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

Bolted Joints

- twisting

- tear out
  - shear strength
  - end distance & spacing

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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

www.timber.org.au

Taylor & Line 2002

Wood Connections 9
Lecture 17
Foundations Structures
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Nailed Joints

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

<table>
<thead>
<tr>
<th>Thickness, ( t ) (in.)</th>
<th>Nail Length, ( L ) (in.)</th>
<th>Nail Diameter, ( D ) (in.)</th>
<th>Pennyweight</th>
<th>Load per Nail for Douglas Fir-Larch, ( G = 0.50, 2, \text{lb} )</th>
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</thead>
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<tr>
<td>( \frac{3}{8} )</td>
<td>2</td>
<td>0.113</td>
<td>6d</td>
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</table>

Connectors Resisting Beam Shear

- plates with
  - nails
  - rivets
  - bolts
- splices
- \( V \) from beam load related to \( V_{\text{longitudinal}} \)

\[
\frac{V_{\text{longitudinal}}}{p} = \frac{VQ}{I}
\]

\[
nF_{\text{connector}} \geq \frac{VQ_{\text{connected area}}}{I} \cdot p
\]

Vertical Connectors

- isolate an area with vertical interfaces