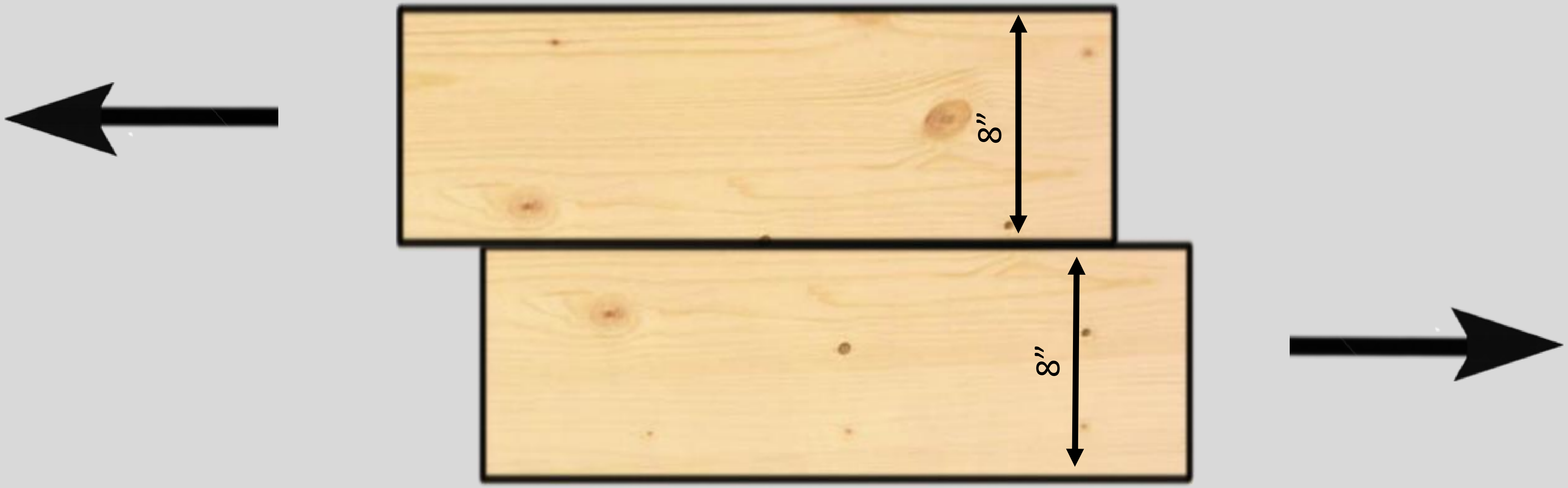
MyTiCon Timber Connectors

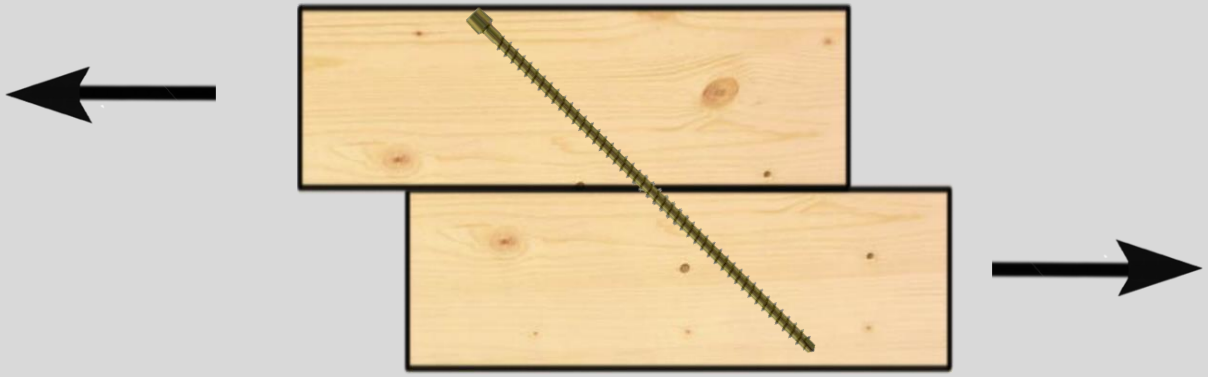
Webinar Session 2/4: Basic Theory and Behavior of Inclined Screws


8"
8"

QTY = 6

Z = 3,000 lbs

Basic Theory and Behavior of Inclined Screws

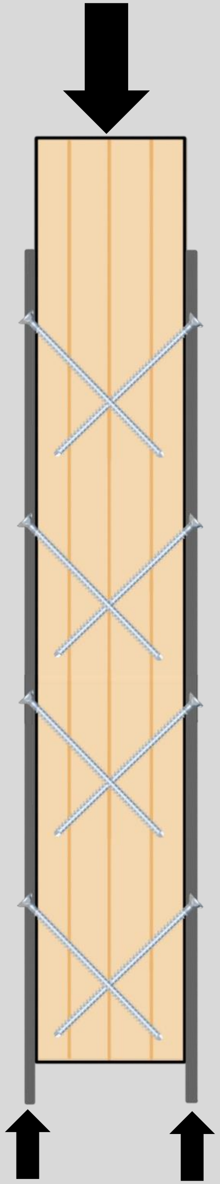


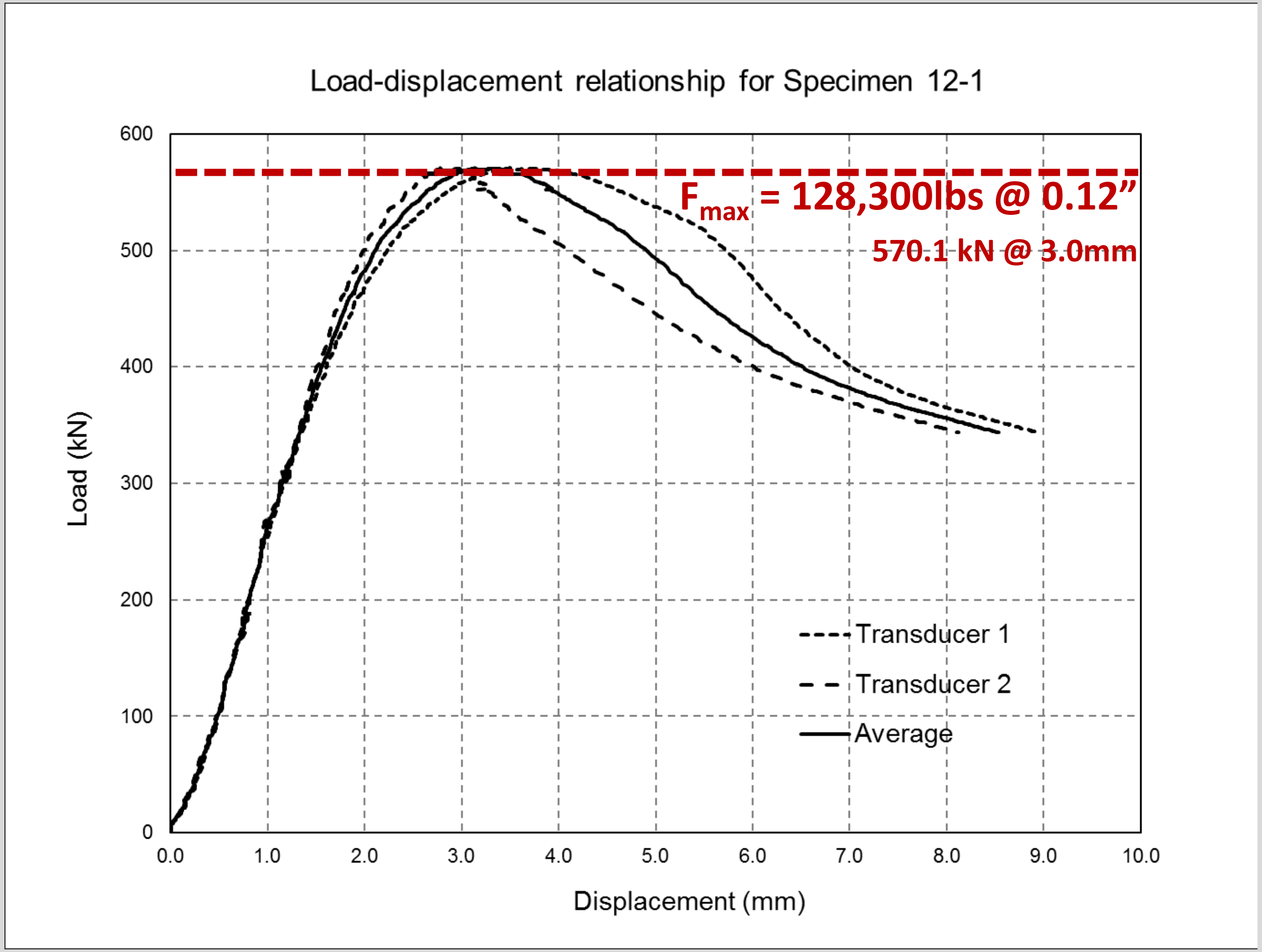
QTY = 6

Z = 3,000 lbs

QTY = 1

Webinar Session 2
Basic Theory and Behavior of Inclined Screws





Keith Porter

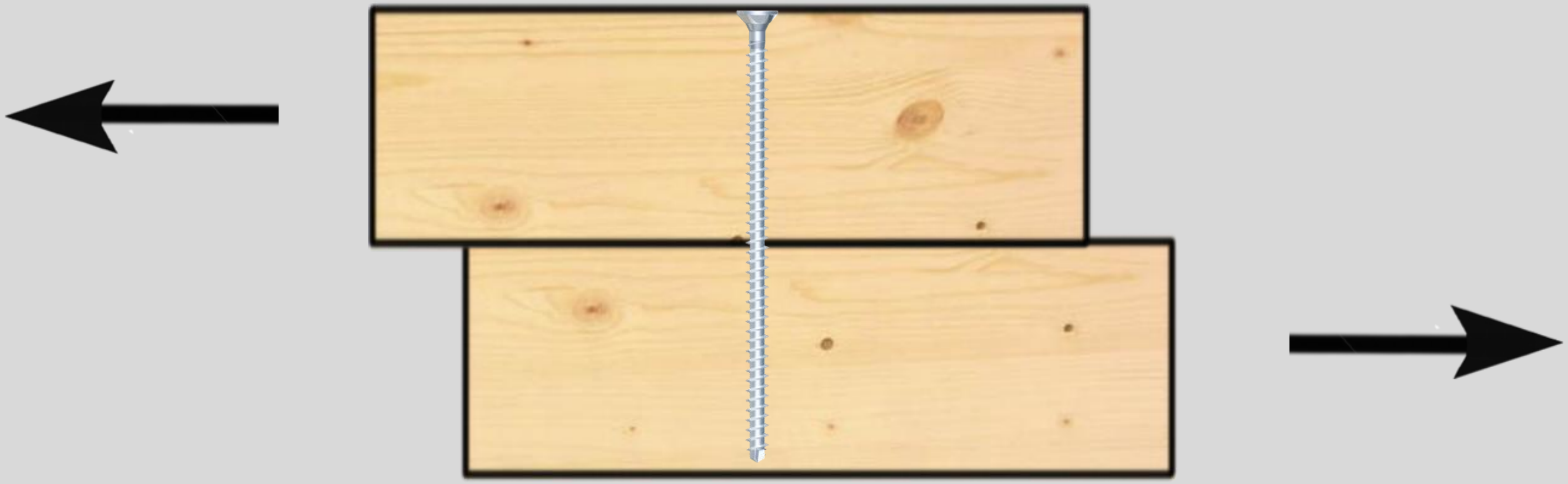
Dalhousie University
-B.Eng. in Civil Engineering

MyTiCon Timber Connectors
-Research and Development

Outline:

- **Theory of inclined screws**
  - Axial vs dowel effects
- **Behavior of inclined screws**
  - Load-displacement relationship
  - Failure modes
- **Design procedure for inclined screws**
  - Simplified truss model

Basic Theory and Behavior of Inclined Screws



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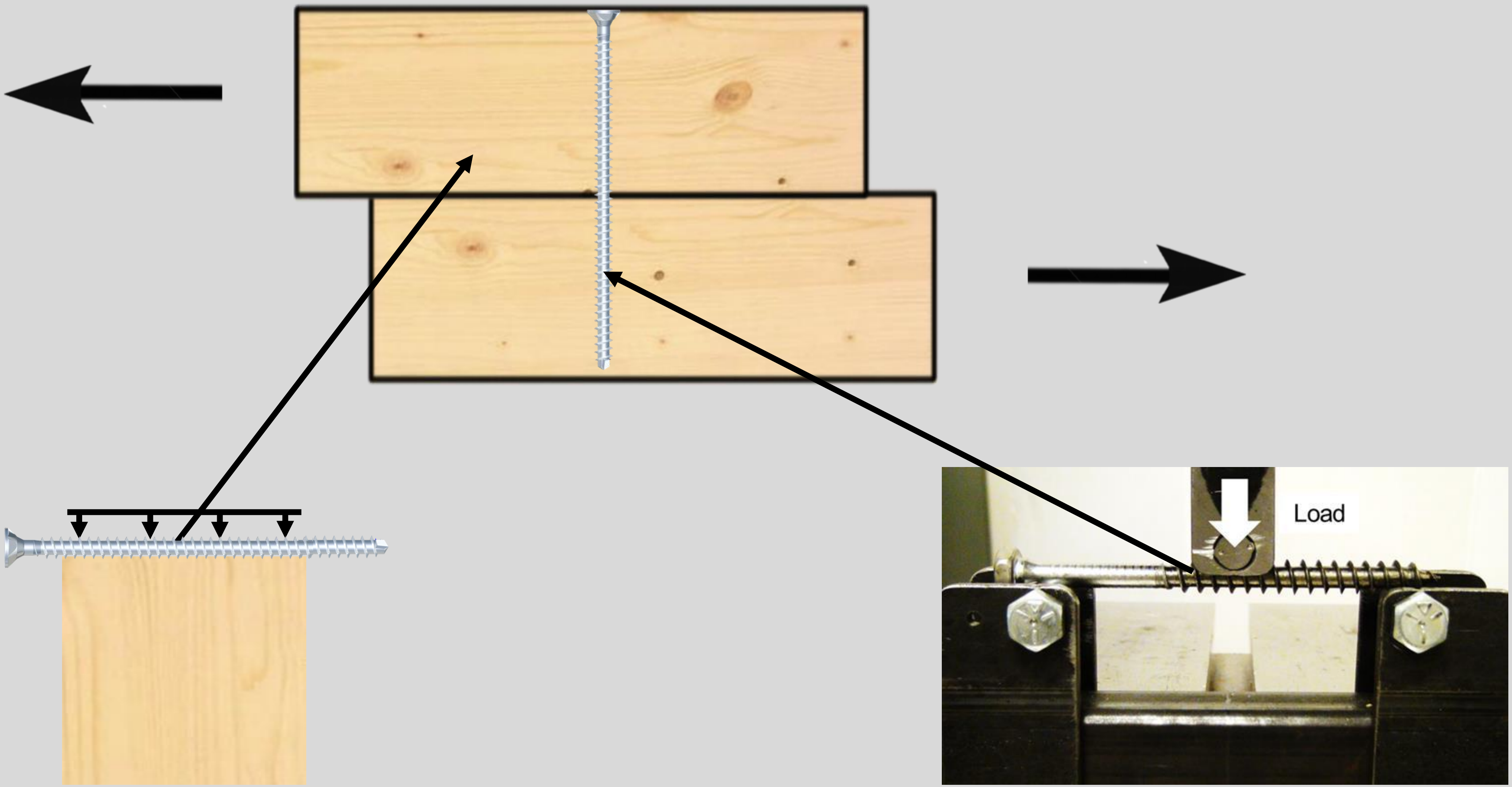

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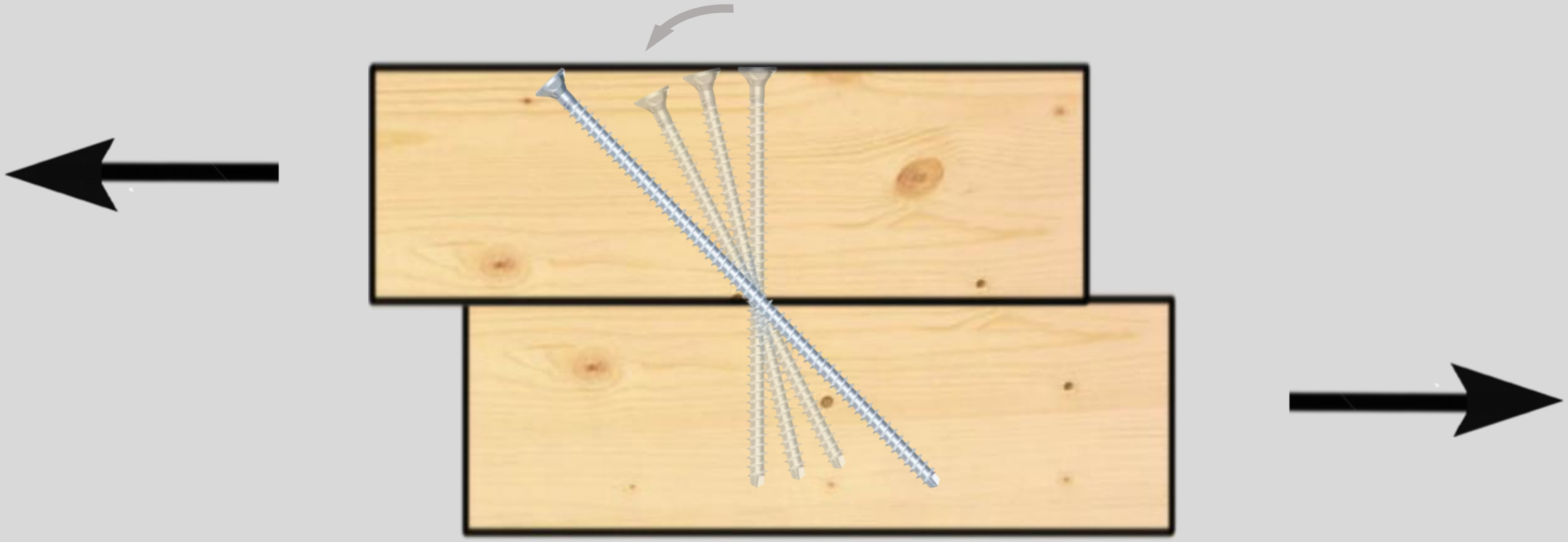

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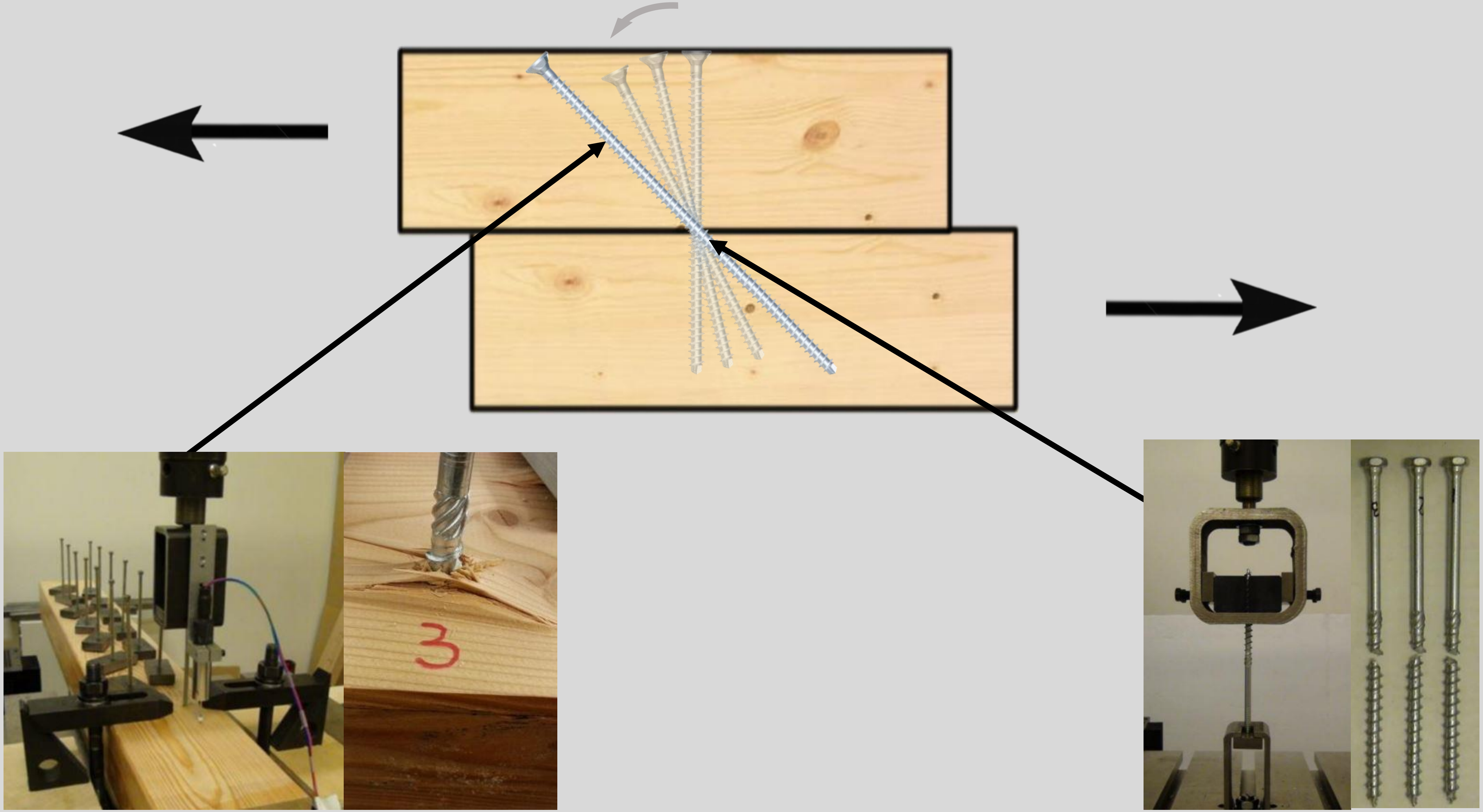

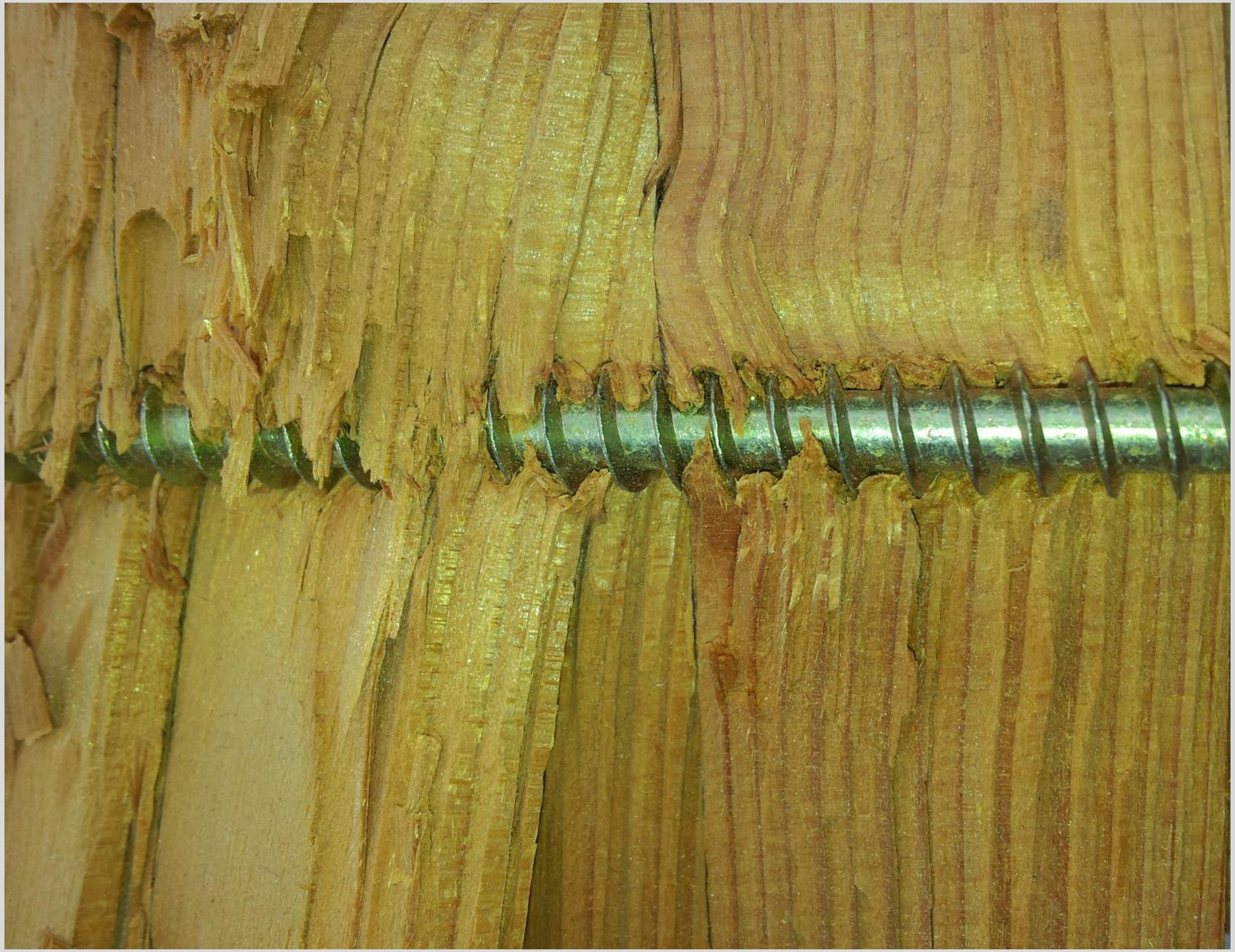

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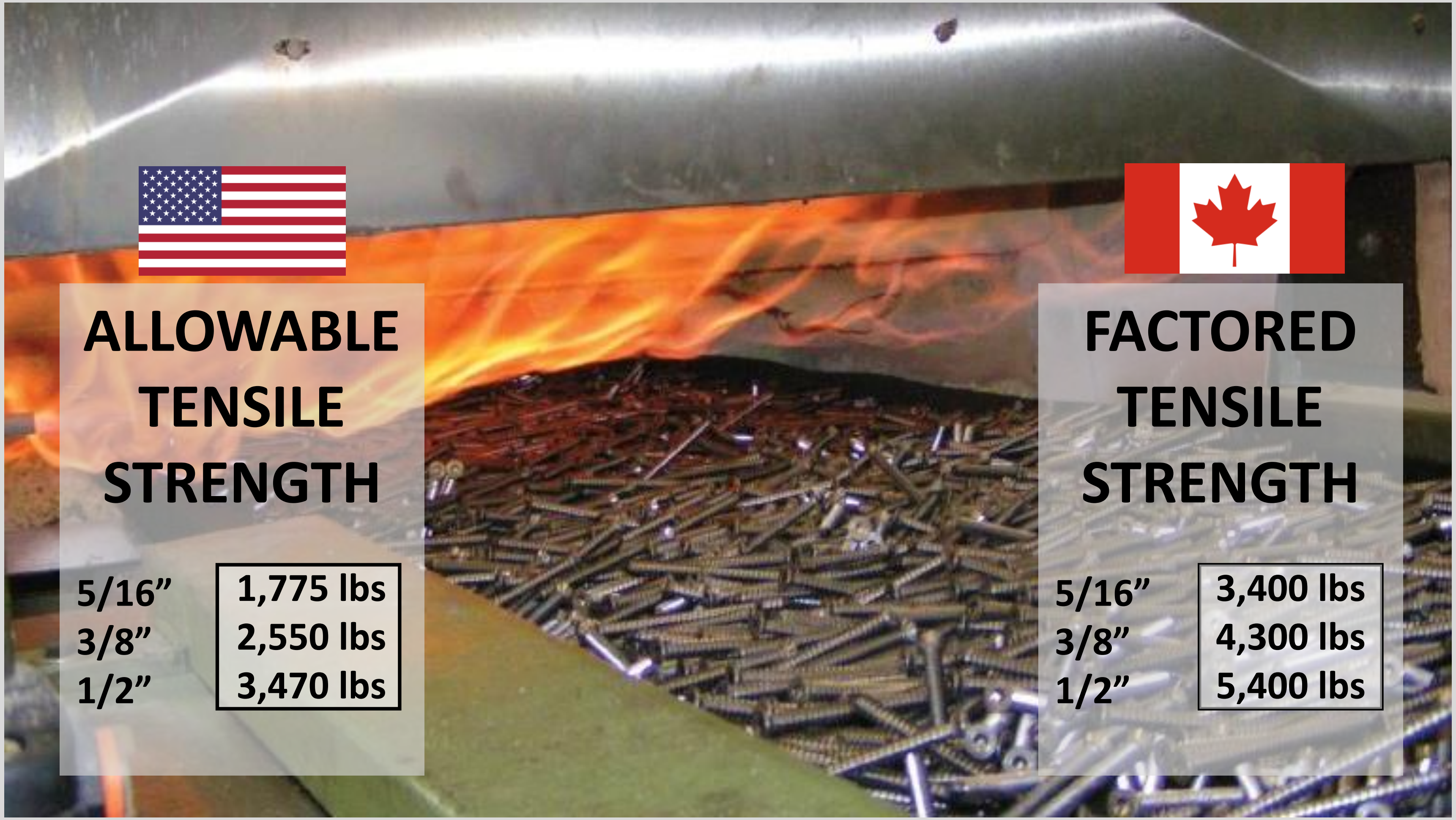


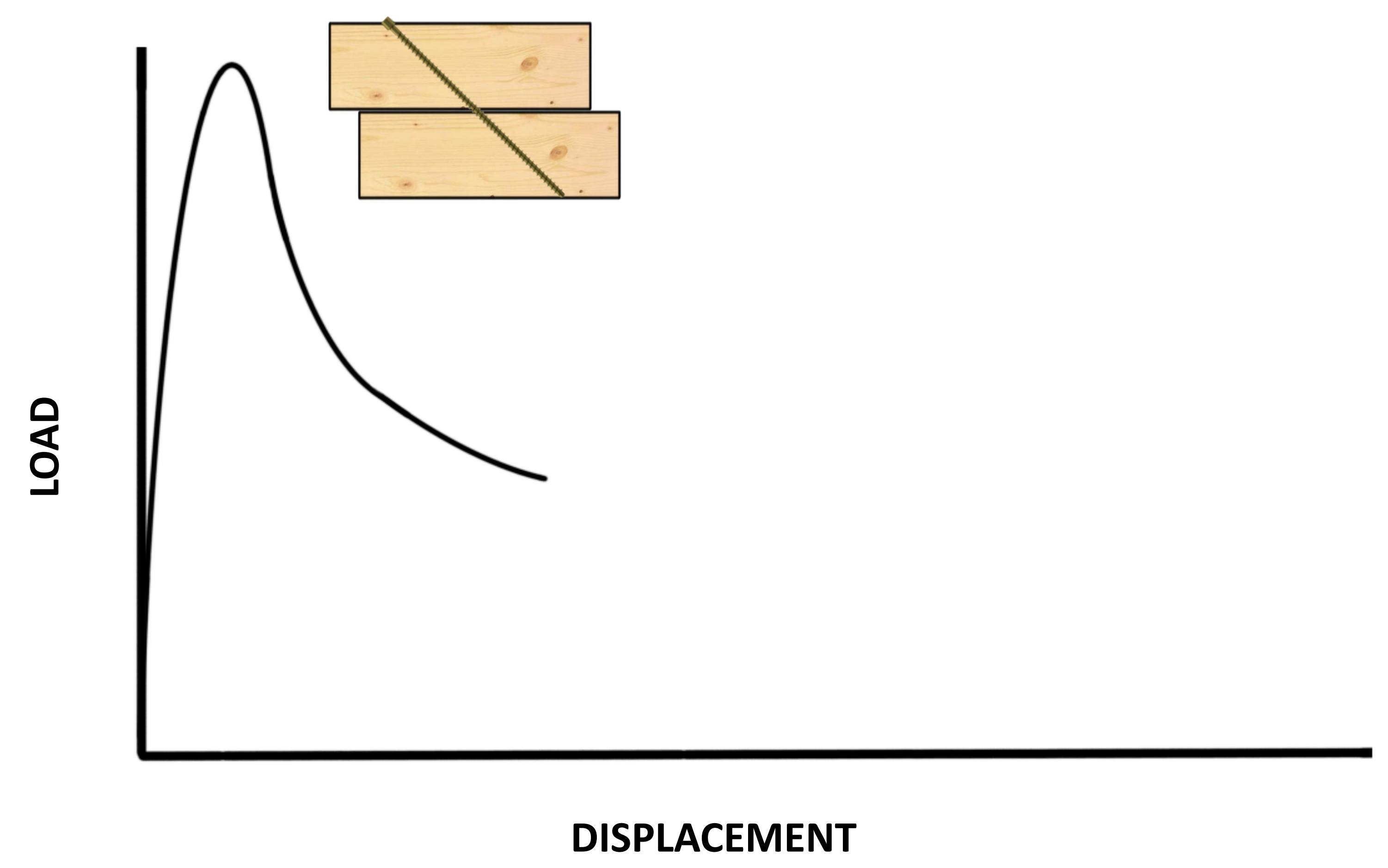
ALLOWABLE TENSILE STRENGTH

5/16”	1,775 lbs
3/8”	2,550 lbs
1/2”	3,470 lbs

FACTORED TENSILE STRENGTH

5/16”	3,400 lbs
3/8”	4,300 lbs
1/2”	5,400 lbs

Basic Theory and Behavior of Inclined Screws



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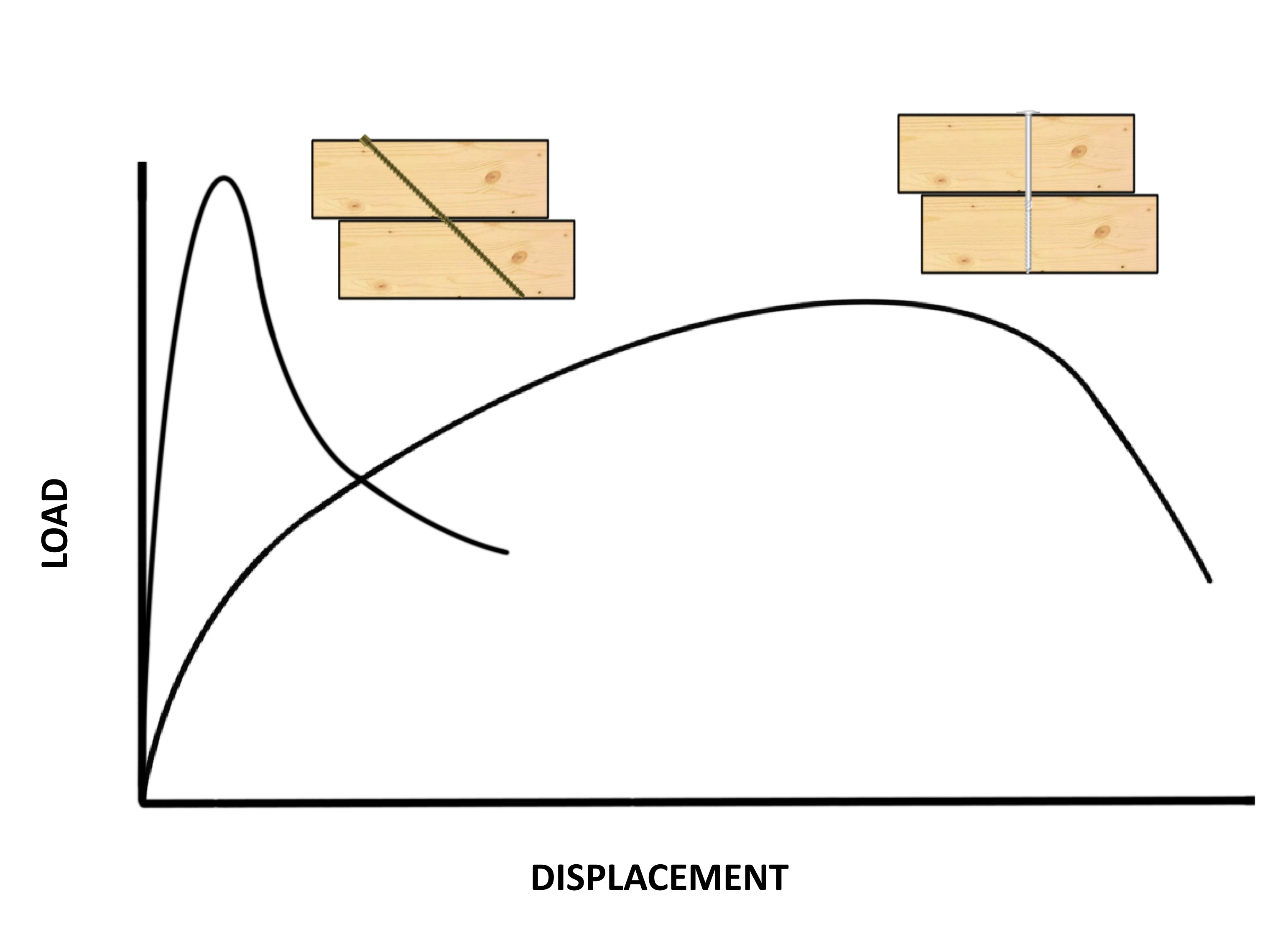

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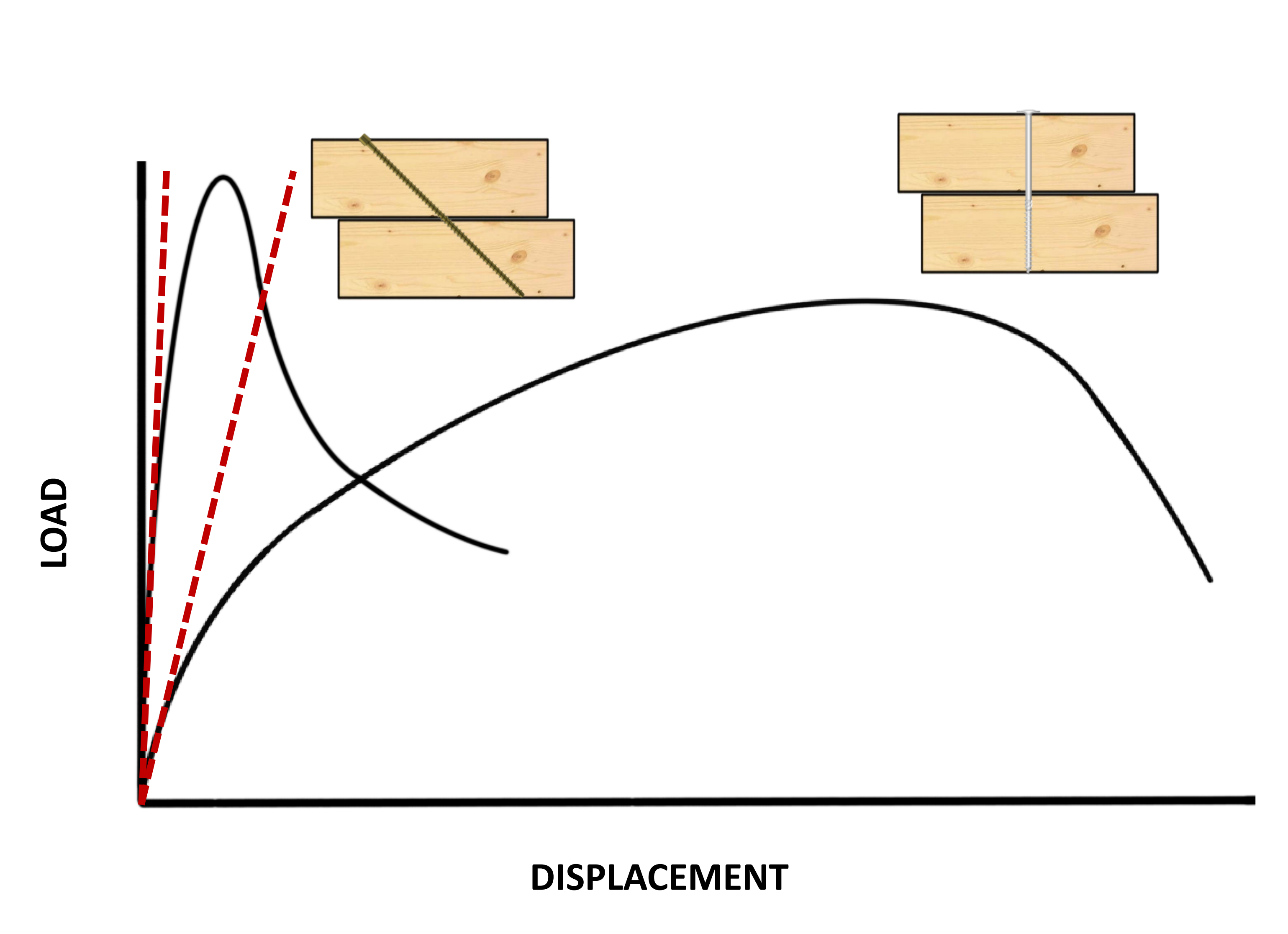

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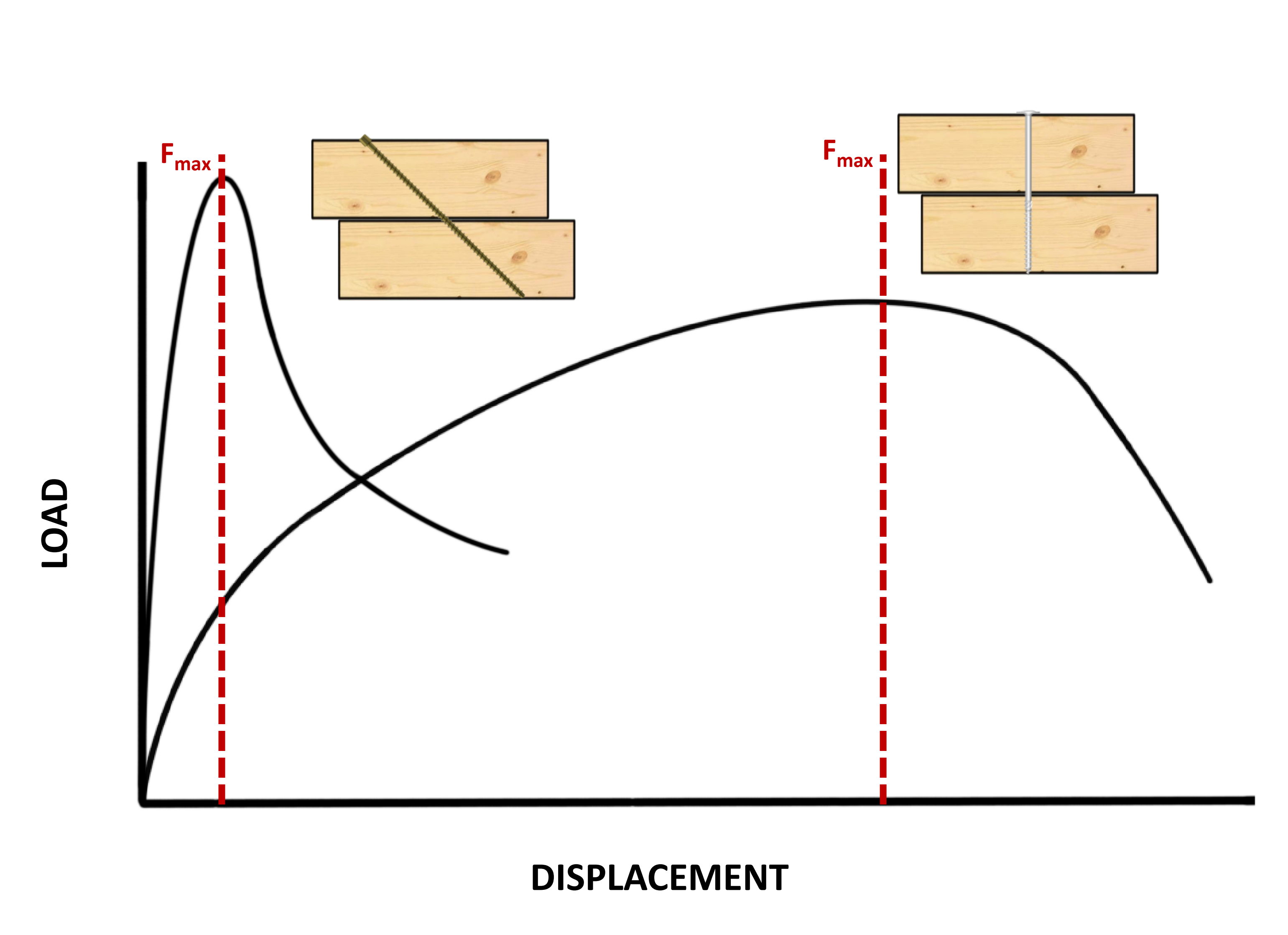

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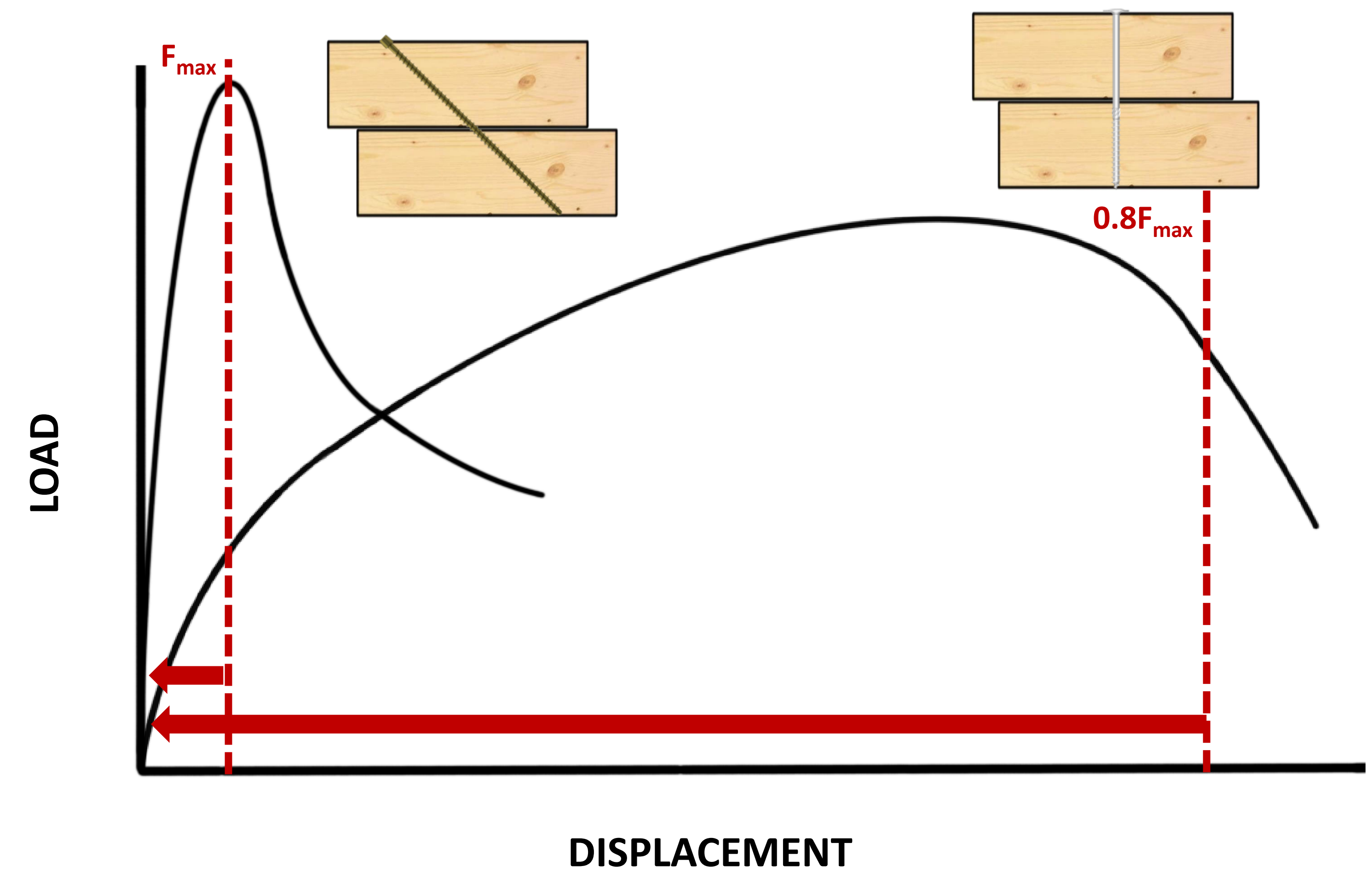

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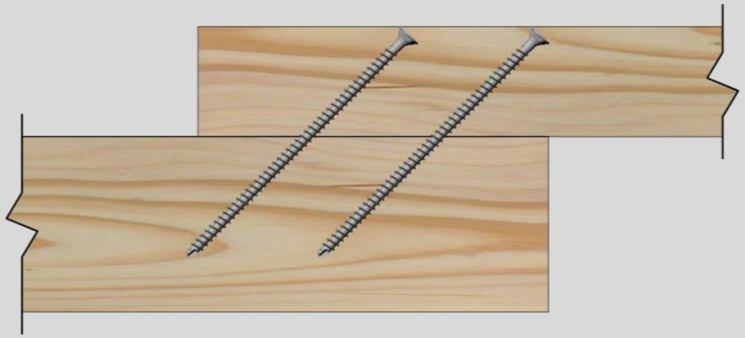
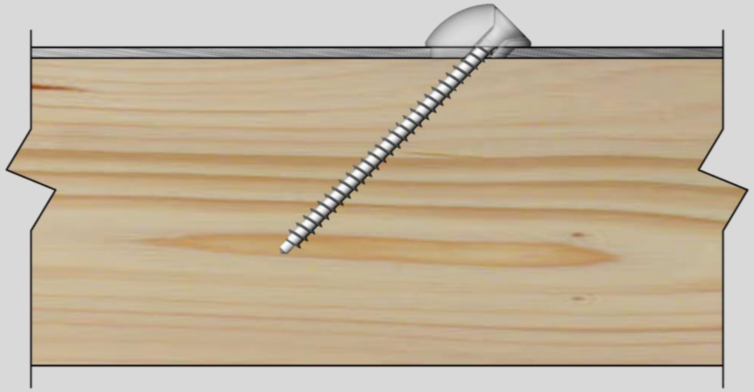
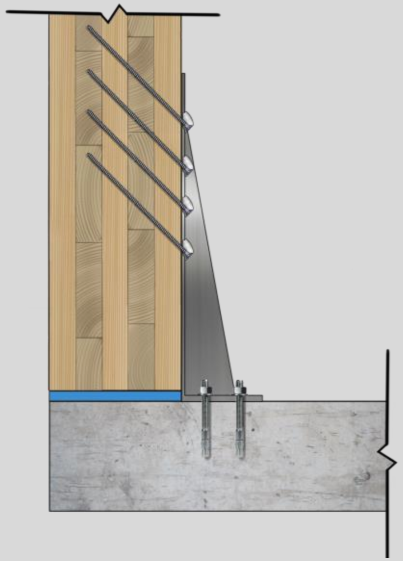
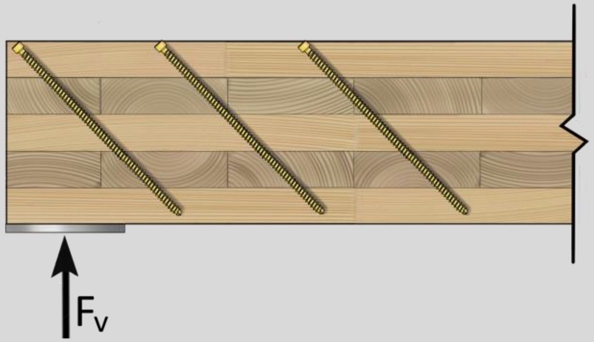
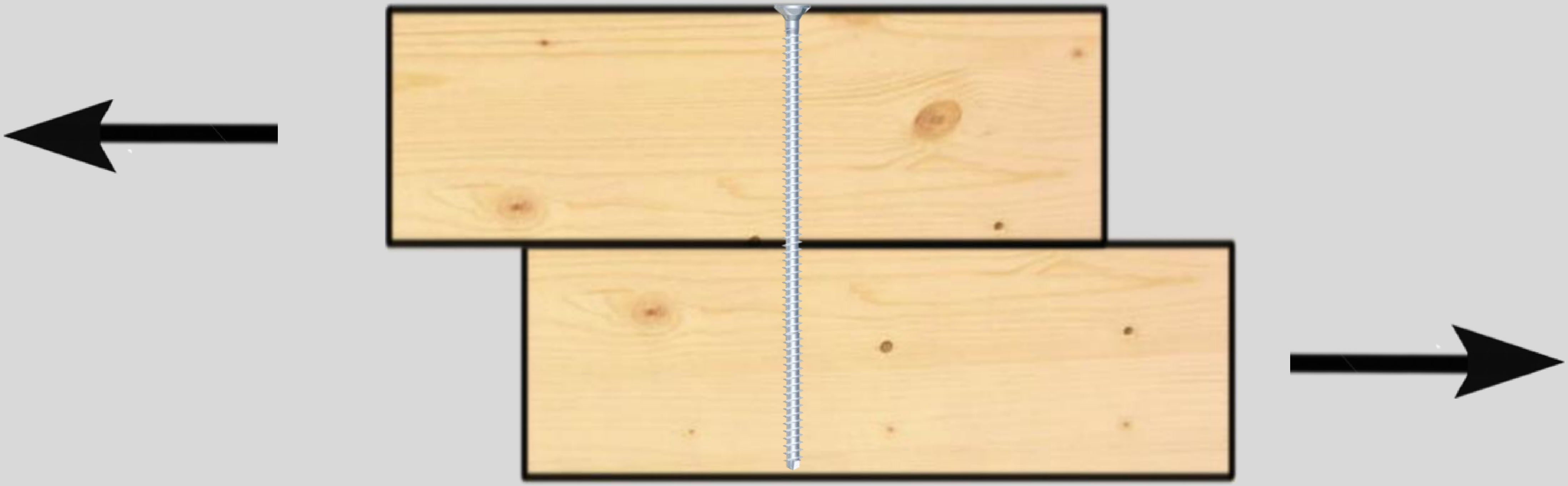



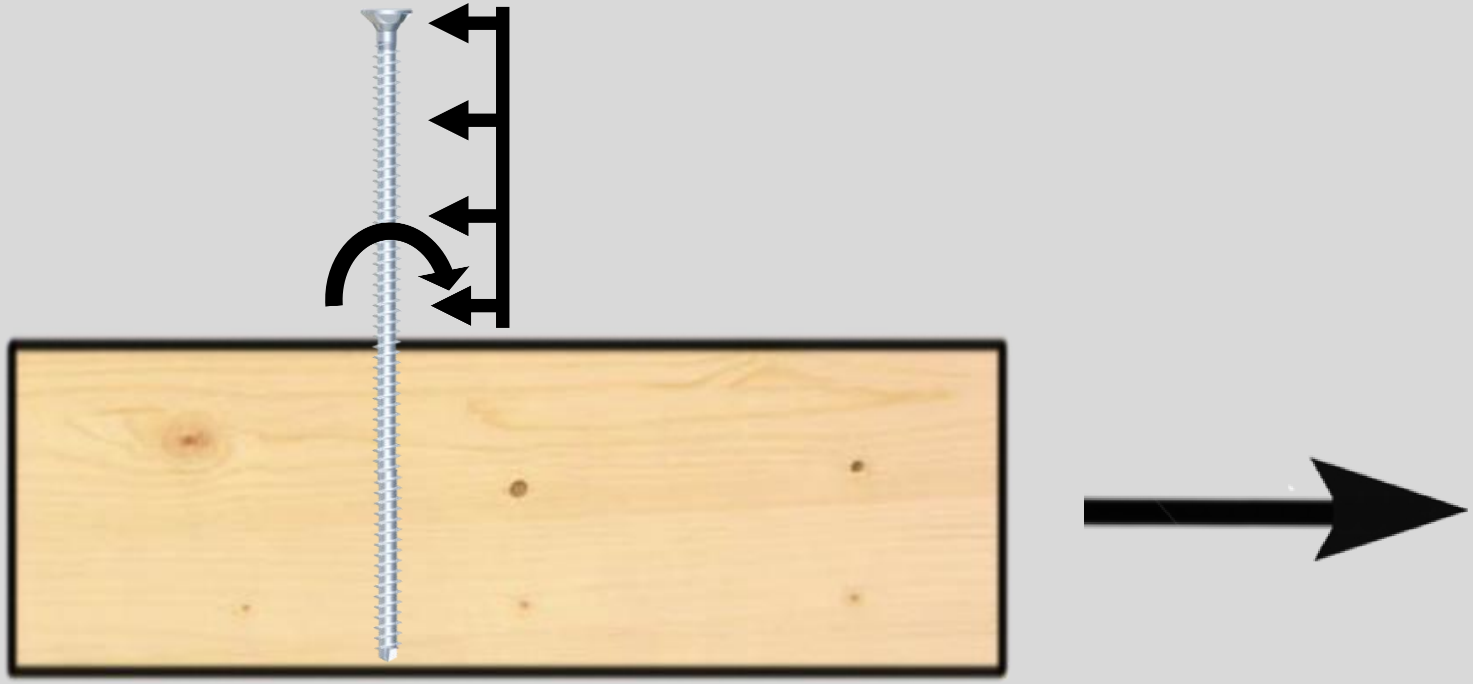




Mestek, P., Dietsch, P. (2011)



MyTiCon Timber Connectors

European Yield Model



European Yield Model

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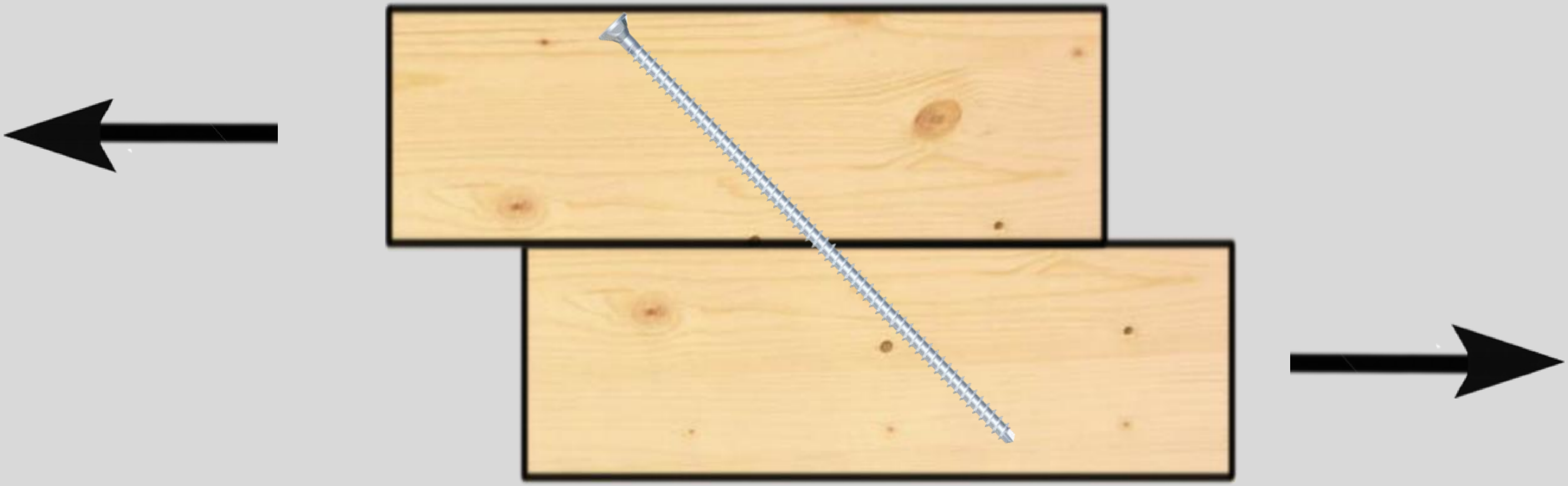

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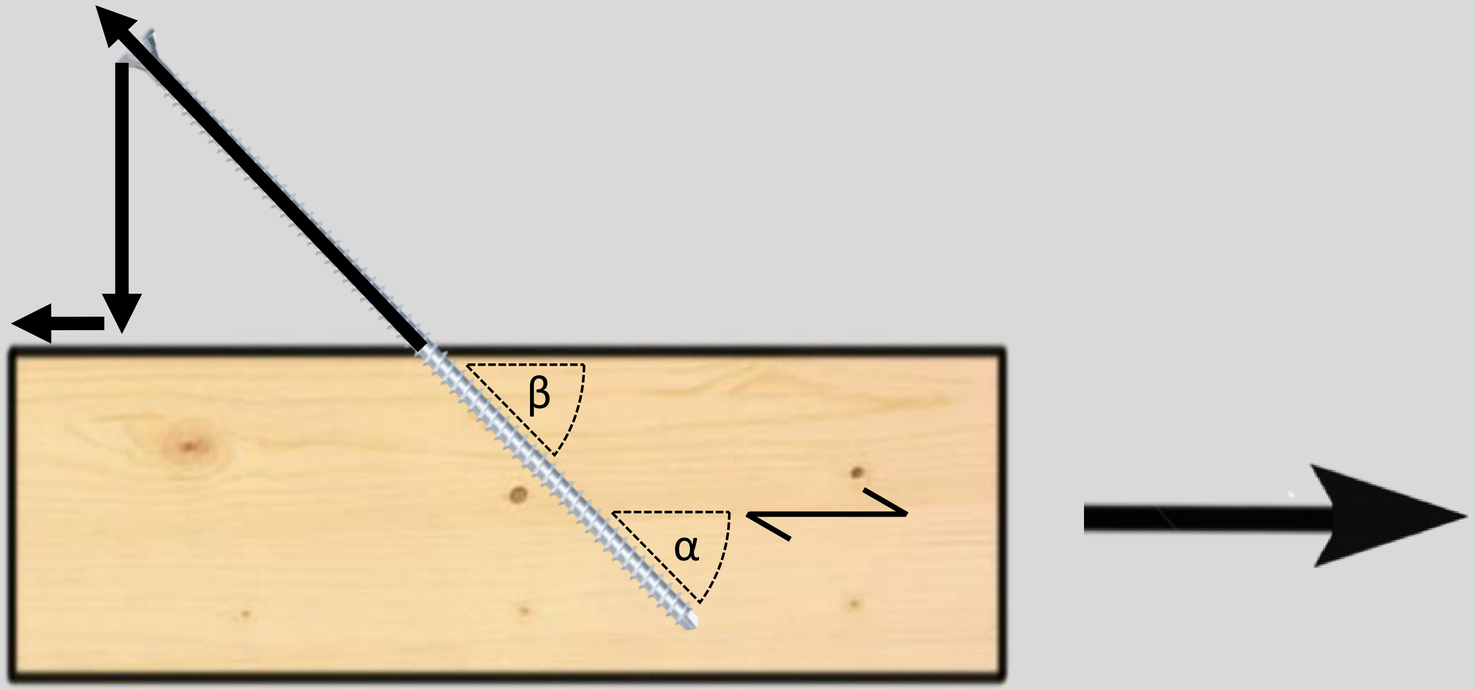
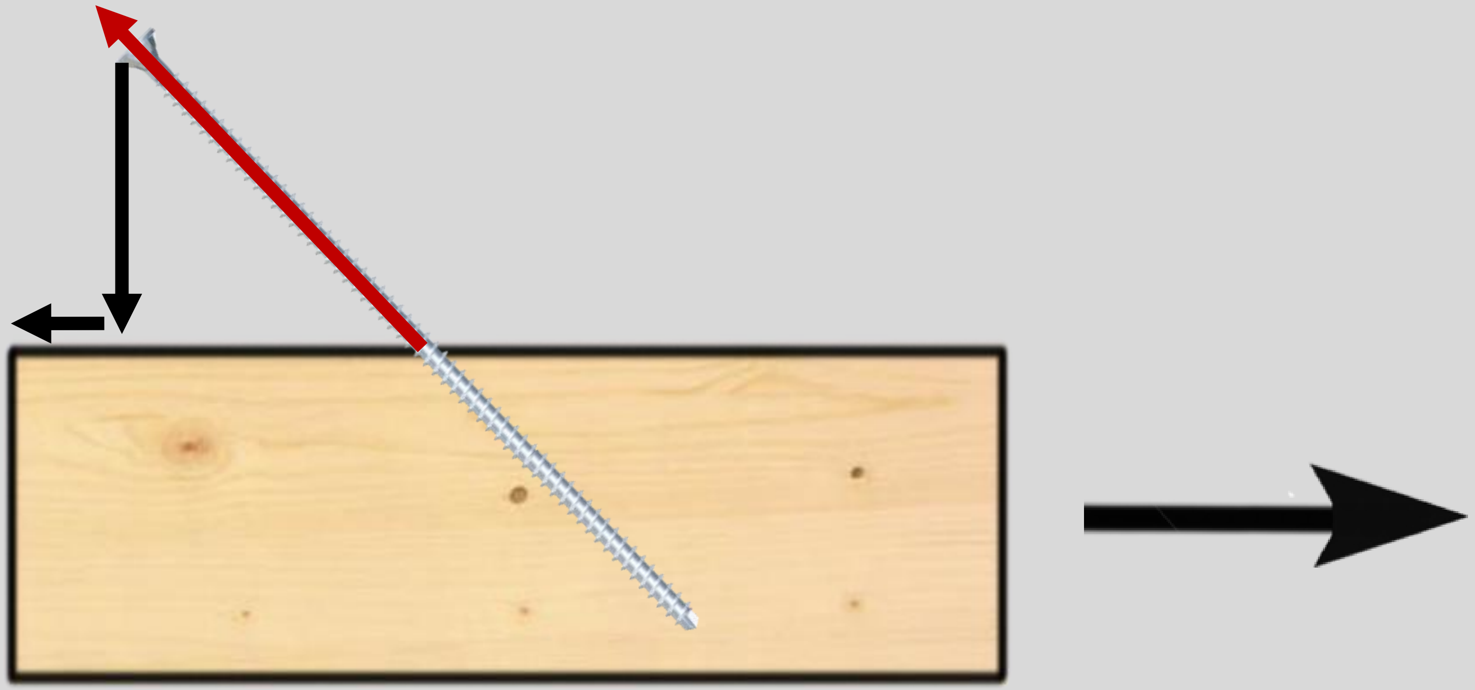


Simplified Truss Model
30° ≤ β ≤ 45°
30° ≤ α ≤ 90°

(Kevarinmäki, 2002)

Basic Theory and Behavior of Inclined Screws

MyTiCon Timber Connectors



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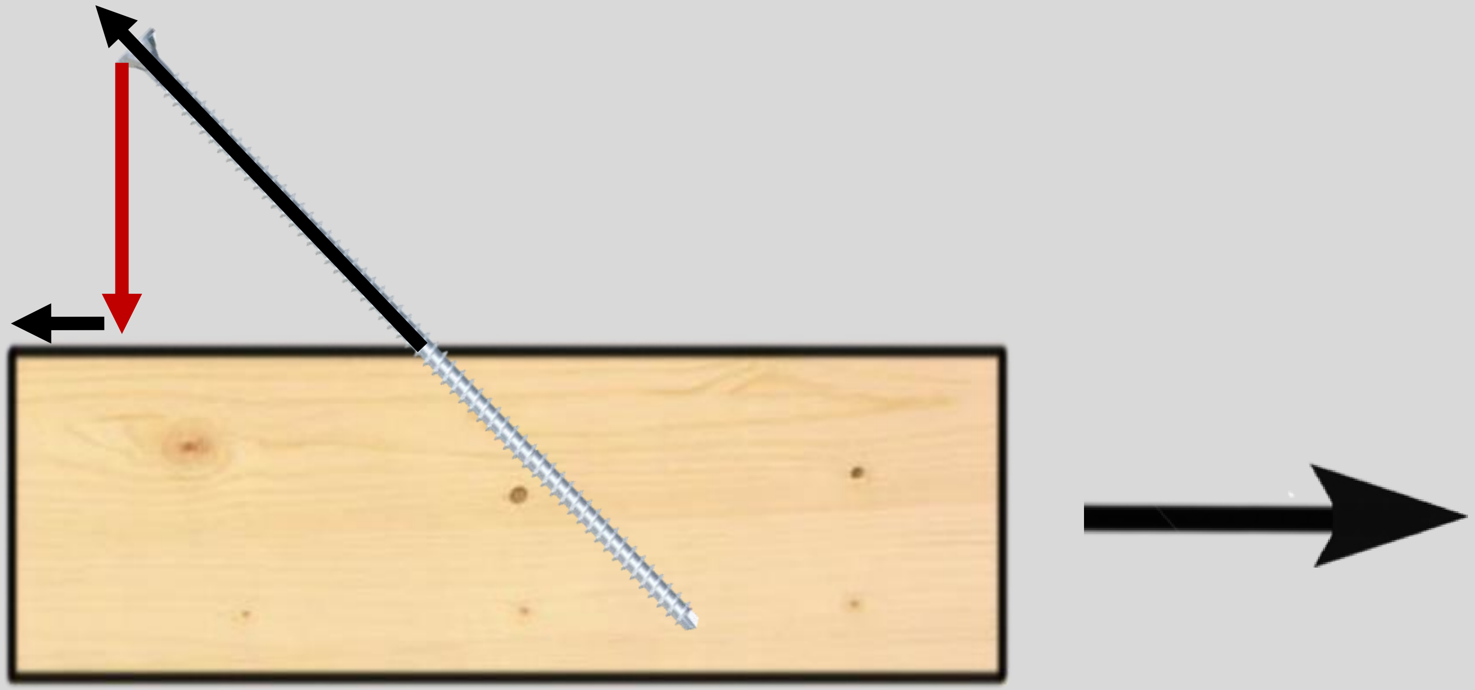

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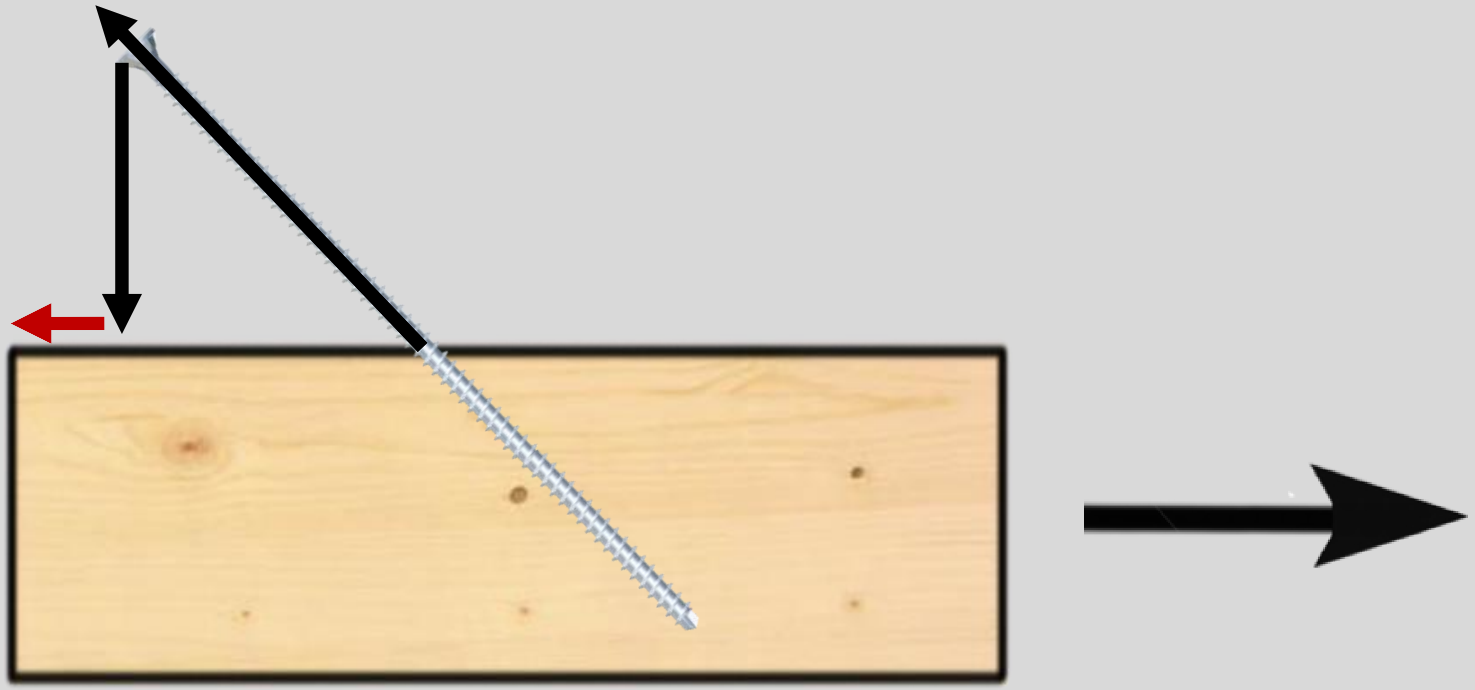

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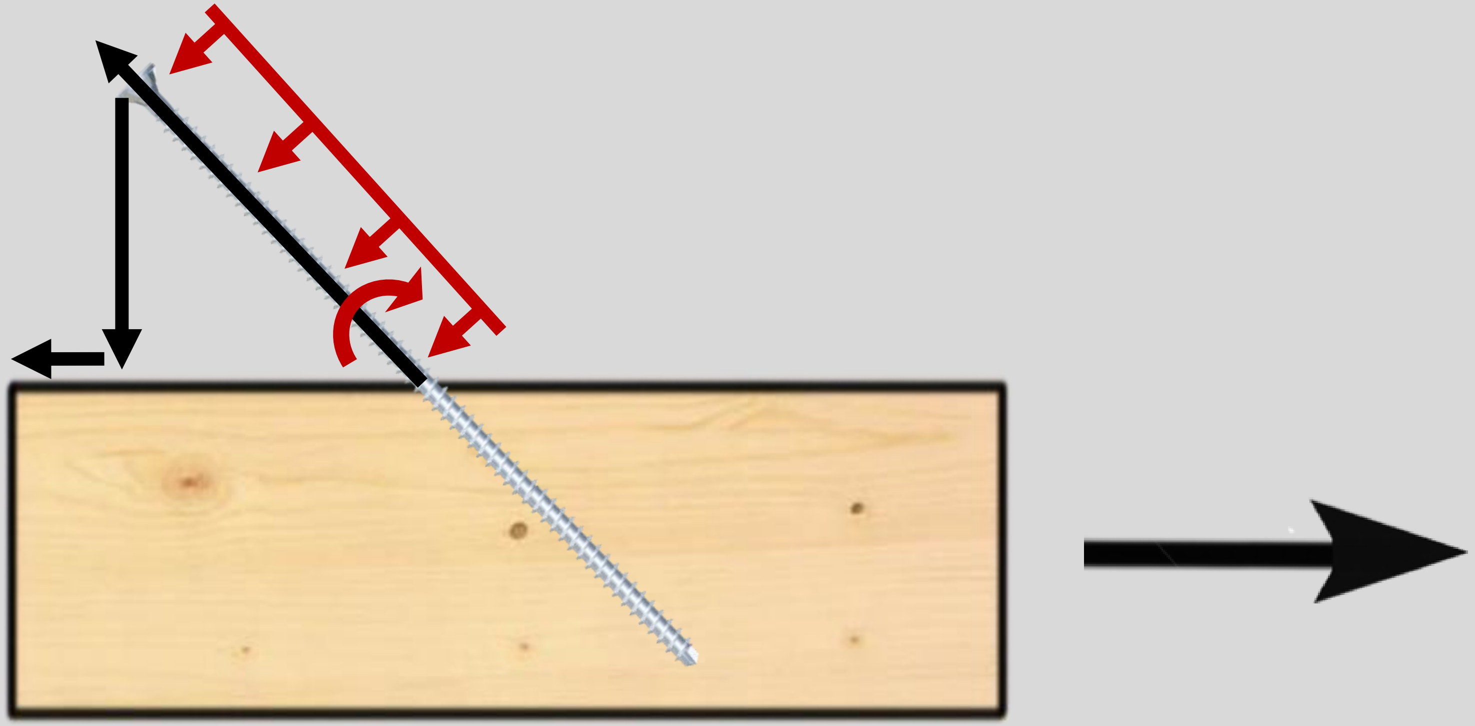

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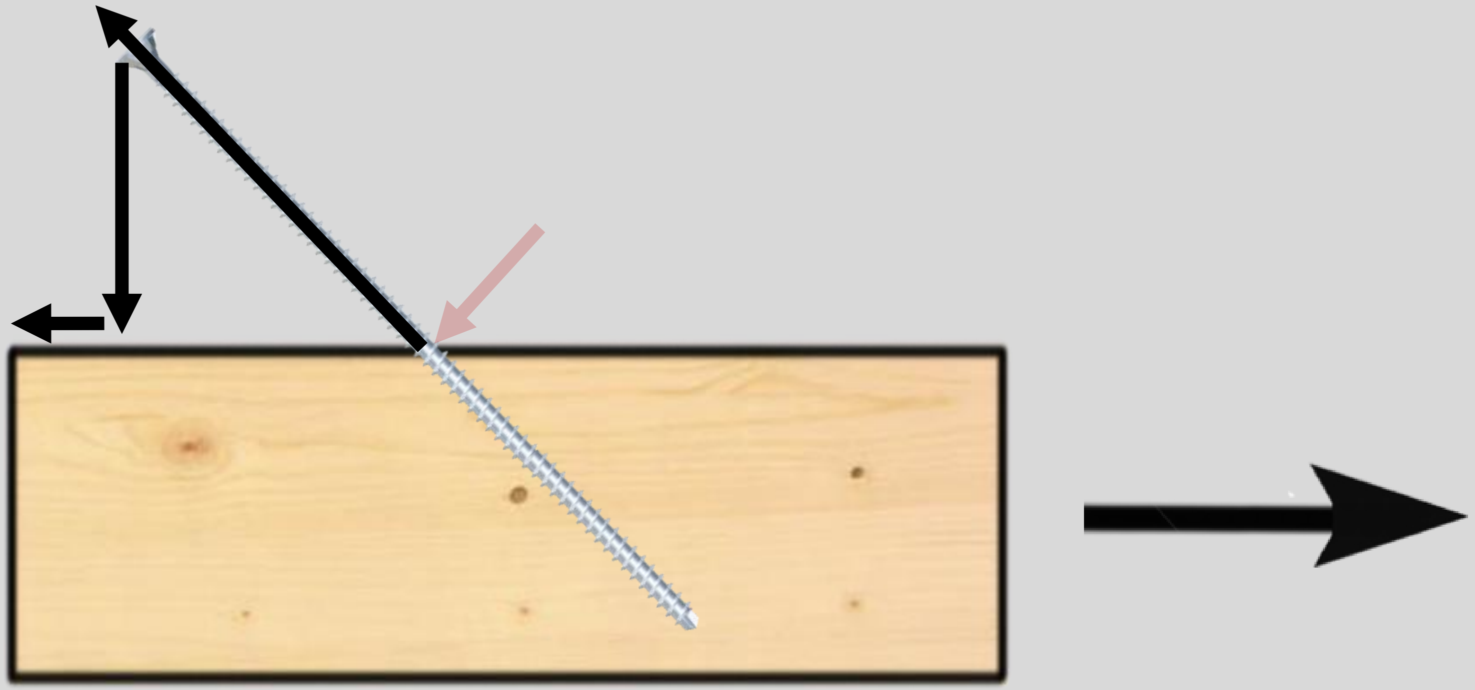

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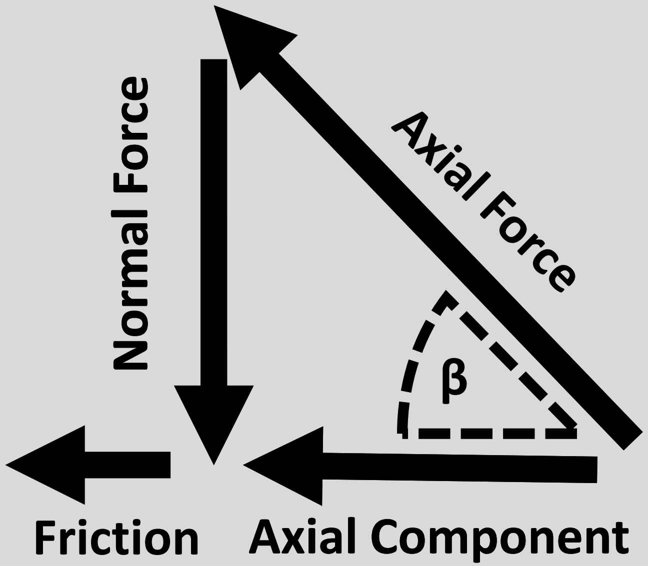

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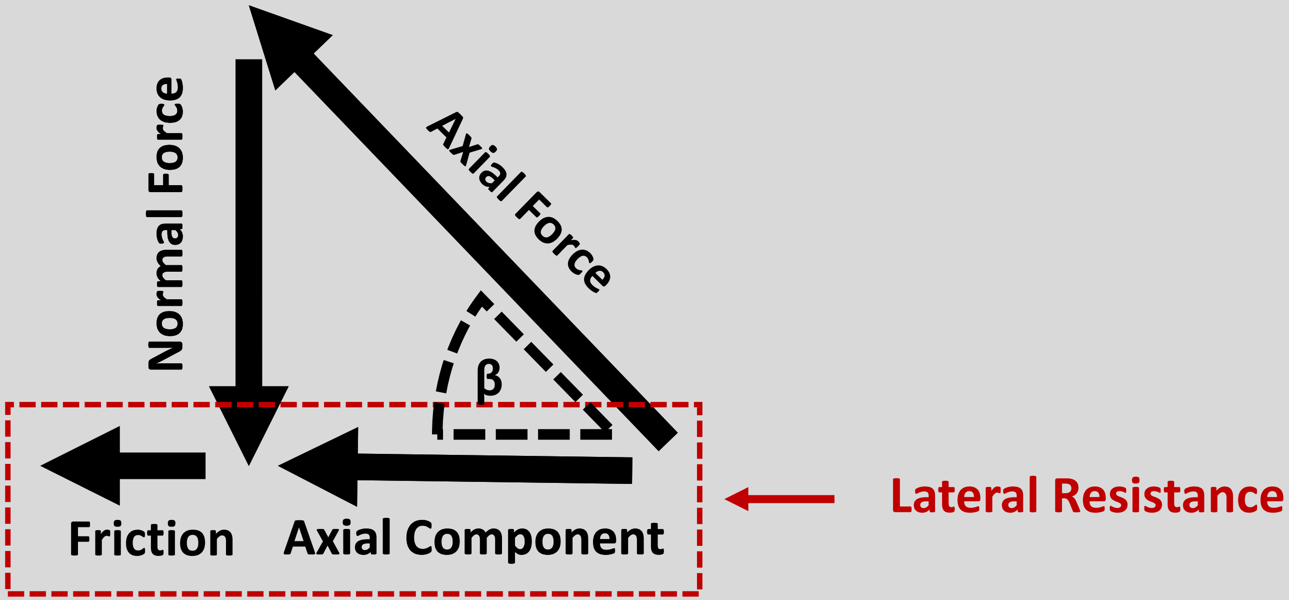

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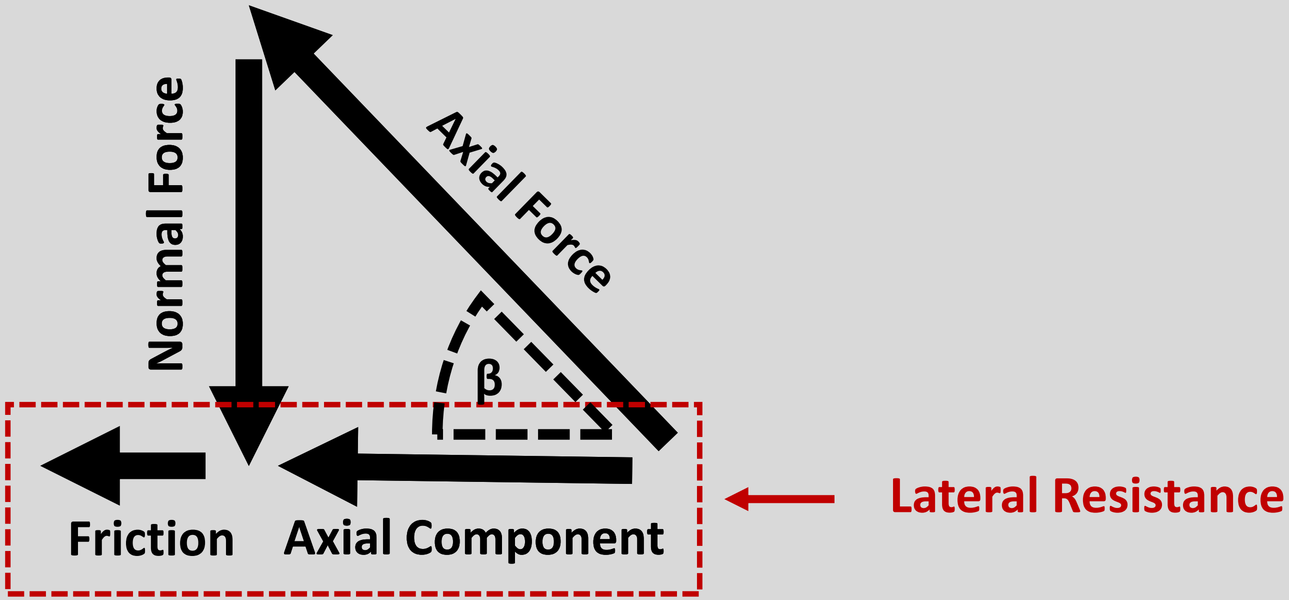

$$\textbf{Lateral Resistance} = \min: \begin{cases} n_{ef}\cdot(\text{Withdrawal Resistance})\cdot(\cos\beta + \mu\cdot\sin\beta) \\ n_{ef}\cdot(\text{Tensile Strength})\cdot(\cos\beta + \mu\cdot\sin\beta) \end{cases}$$

(Kevarinmäki, 2002)

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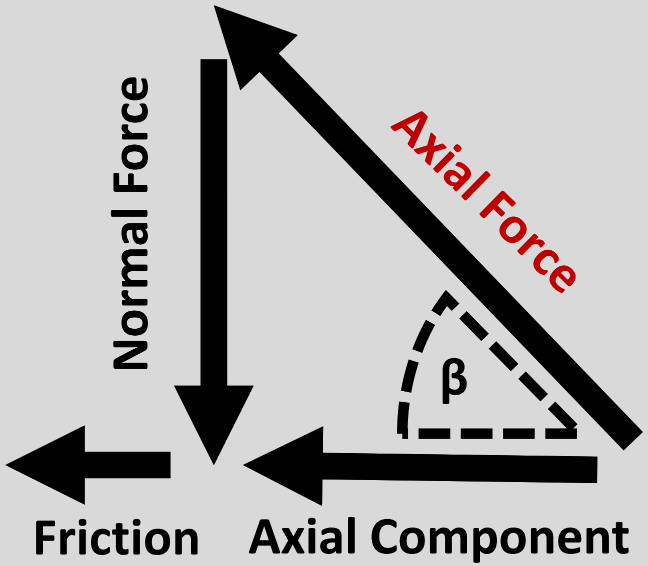

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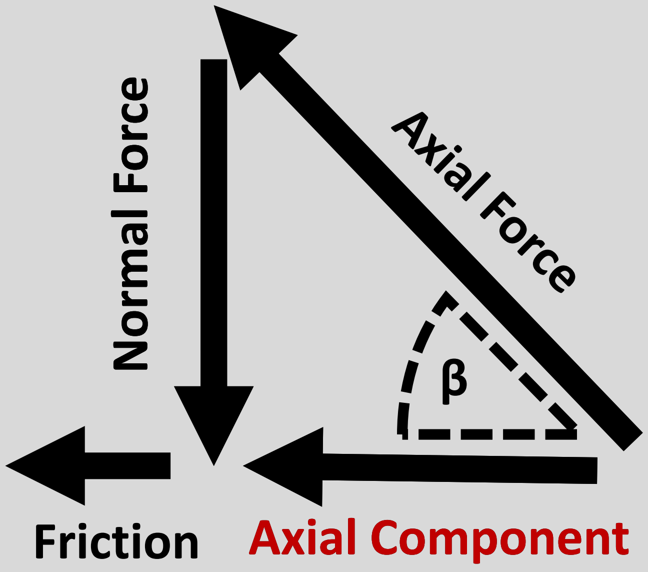

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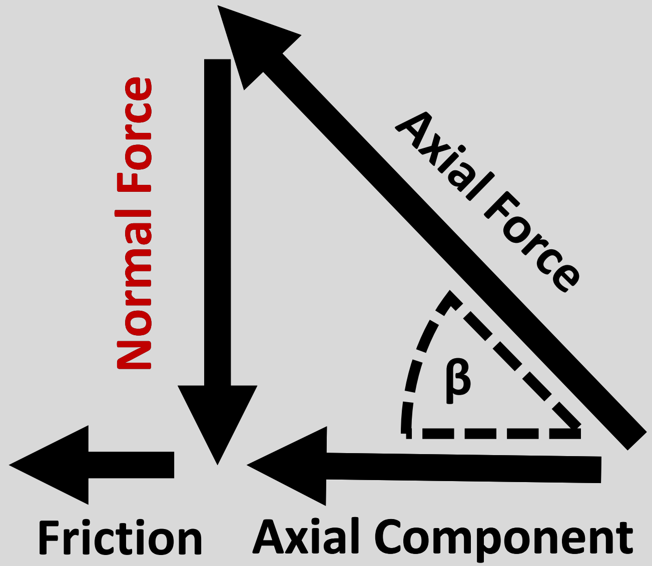

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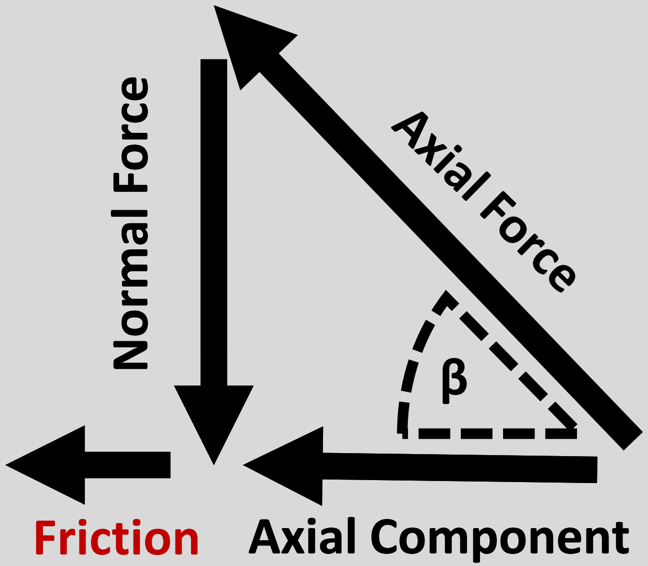

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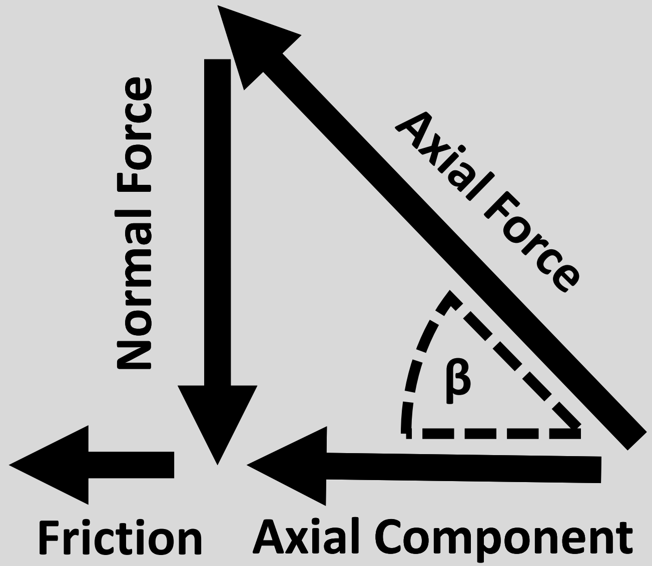

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$$n_{ef} = \frac{F_{multiple}}{F_{single}} = 0.9 \cdot n$$

(Kevarinmäki, 2002)

(Krenn & Schickhofer, 2009)

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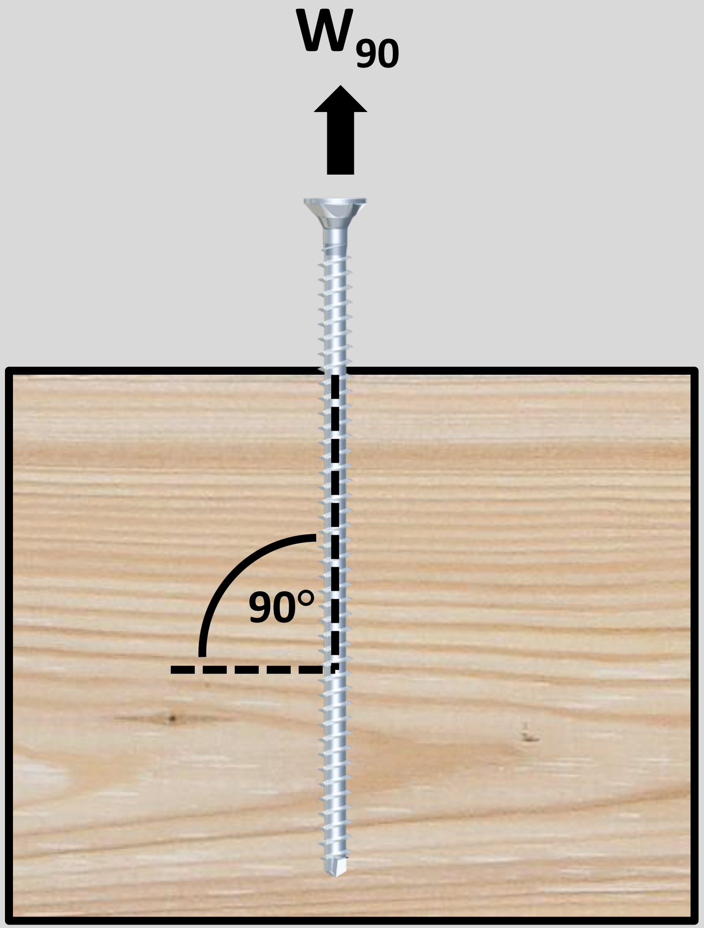

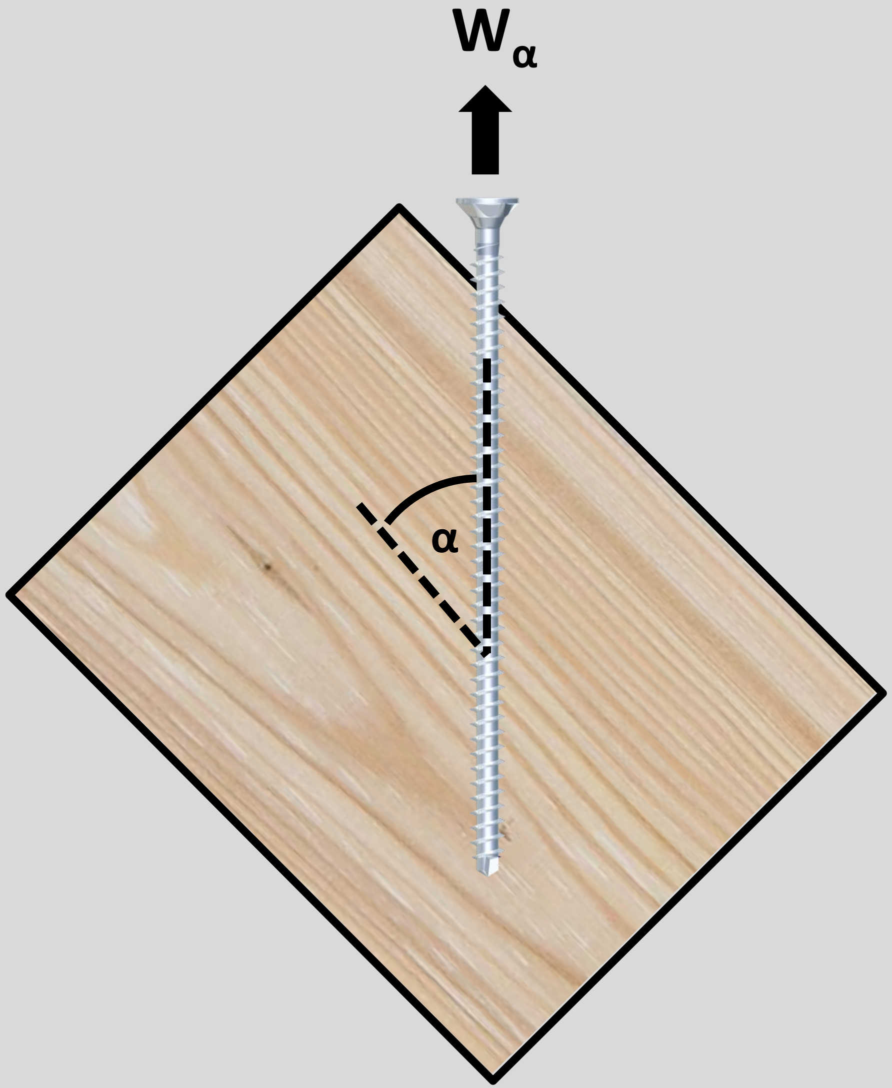

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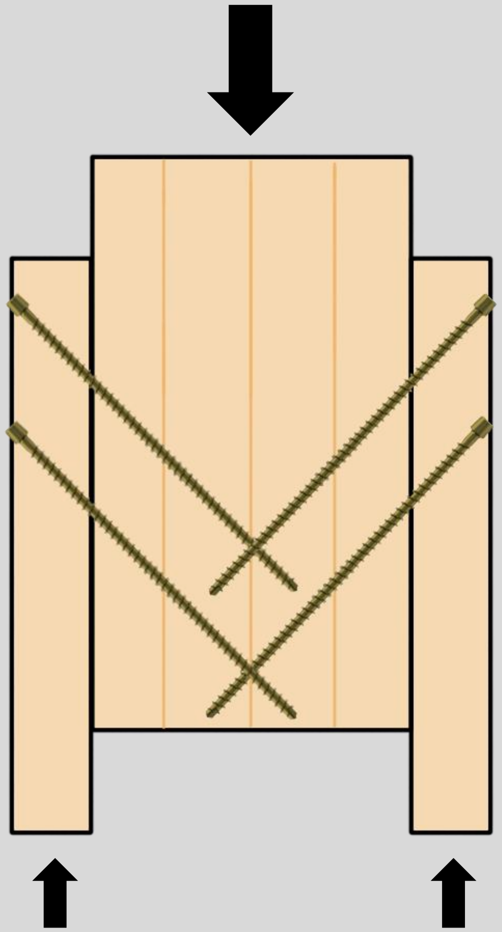

Basic Theory and Behavior of Inclined Screws

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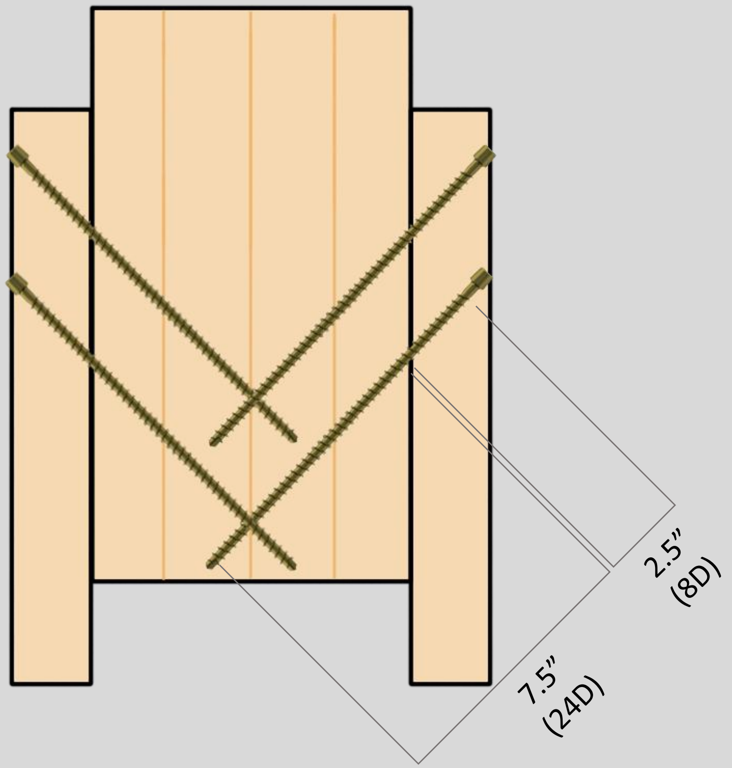
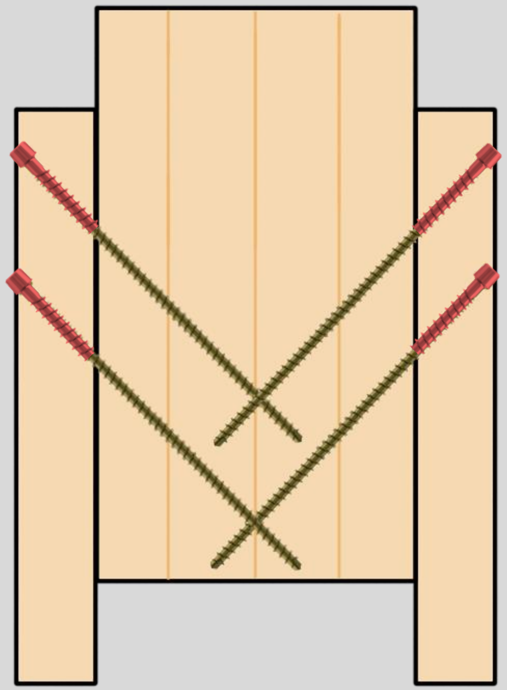
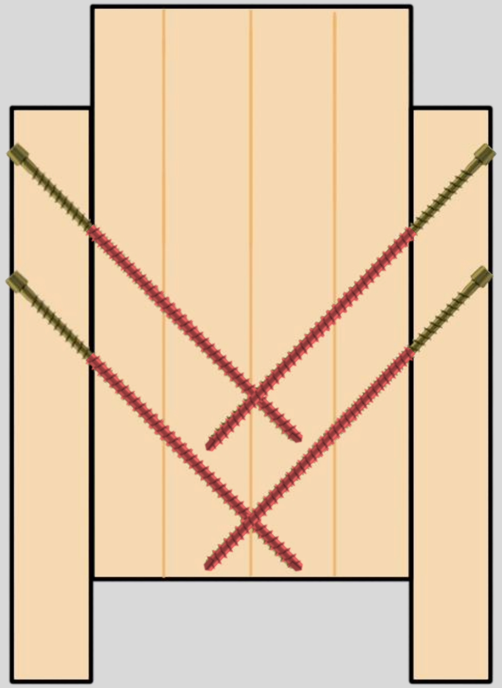


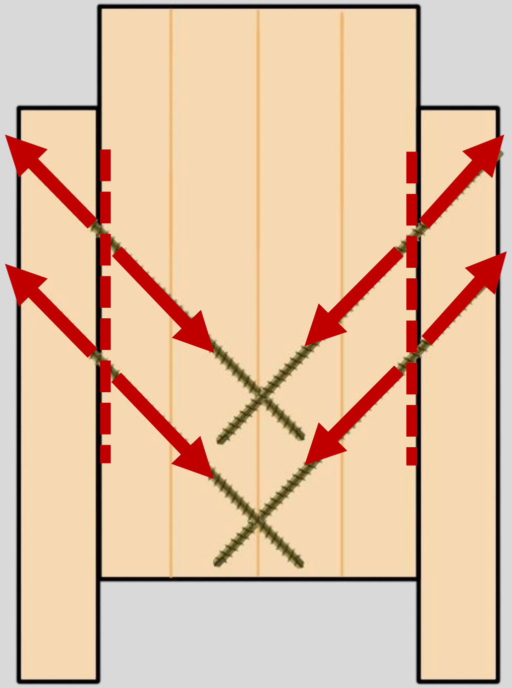


Withdrawal resistance, side members



Withdrawal resistance, side members

Withdrawal resistance, main member



Withdrawal resistance, side members

Withdrawal resistance, main member

Tensile strength of the screws

Basic Theory and Behavior of Inclined Screws

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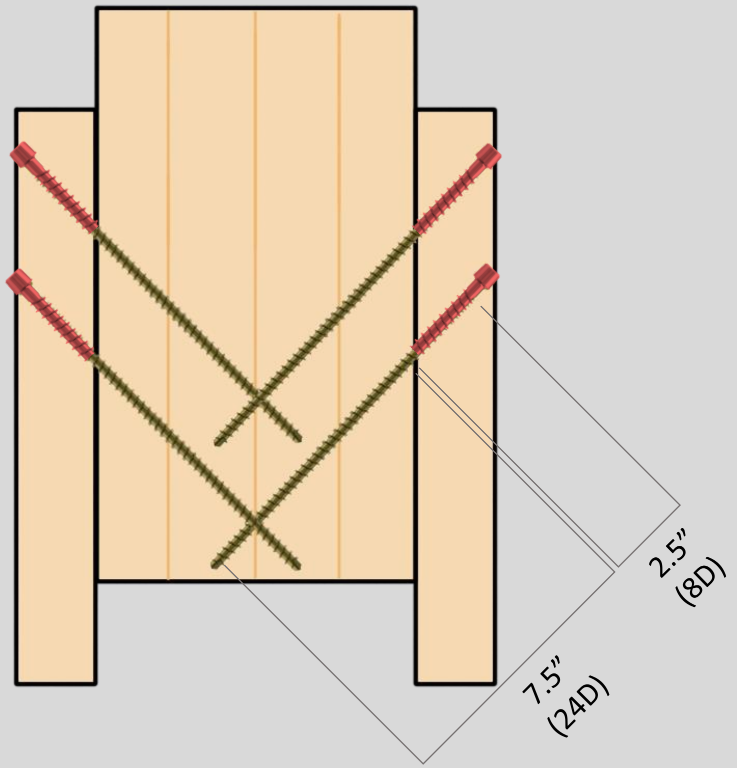

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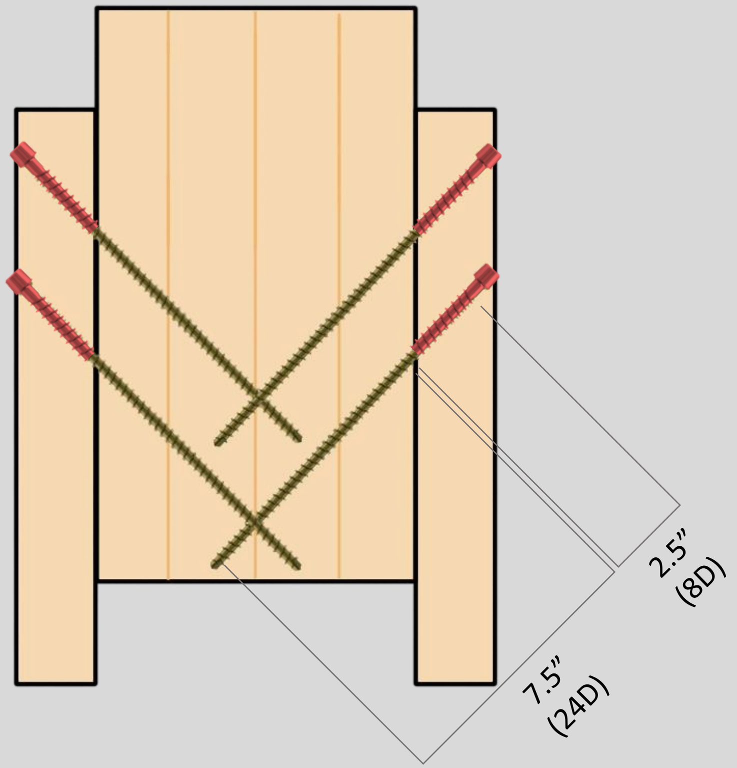

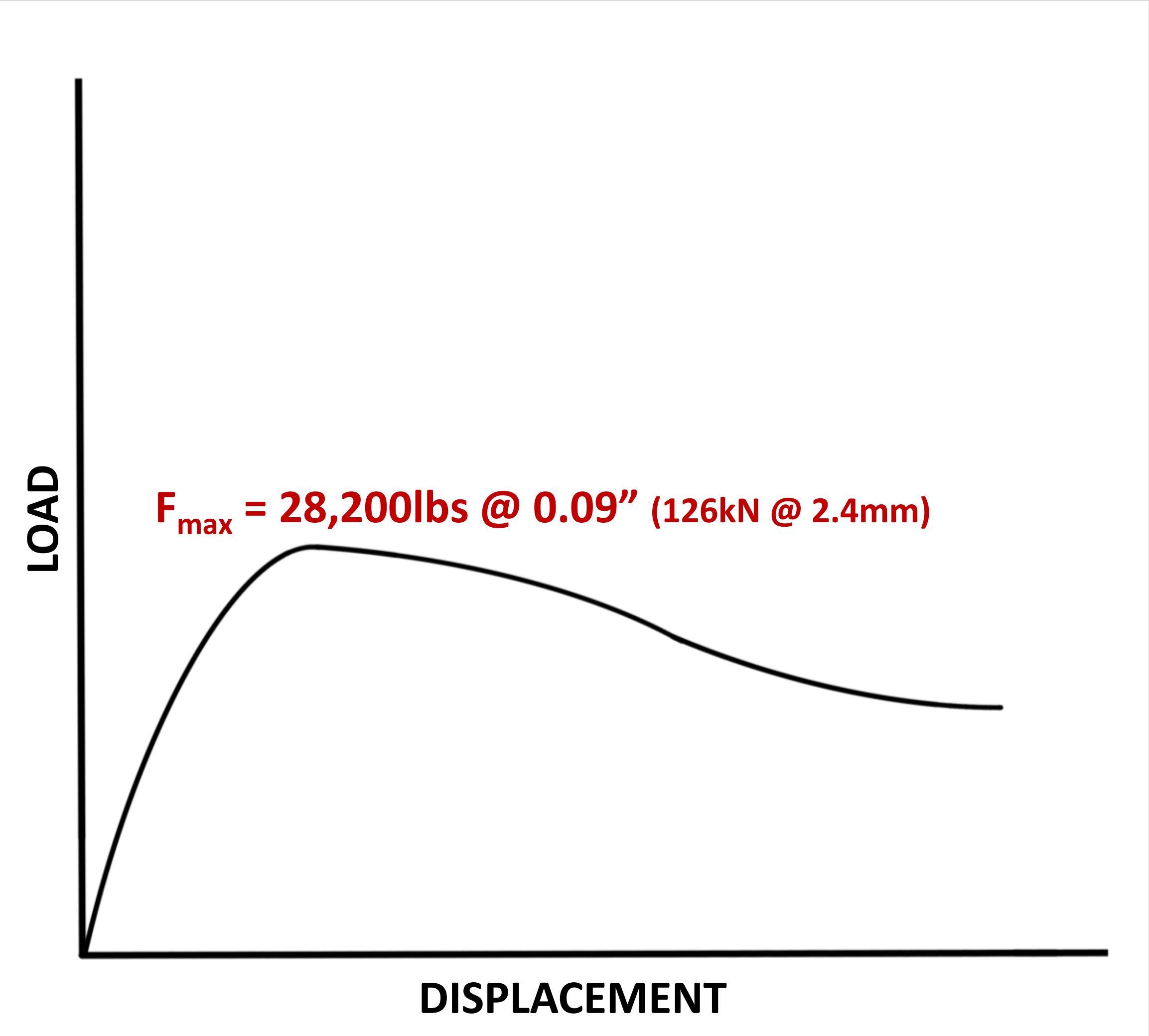

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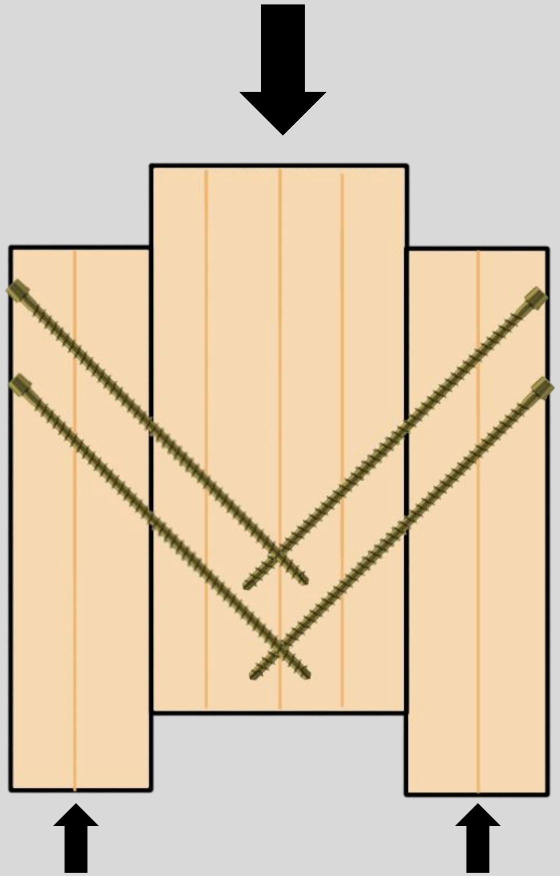

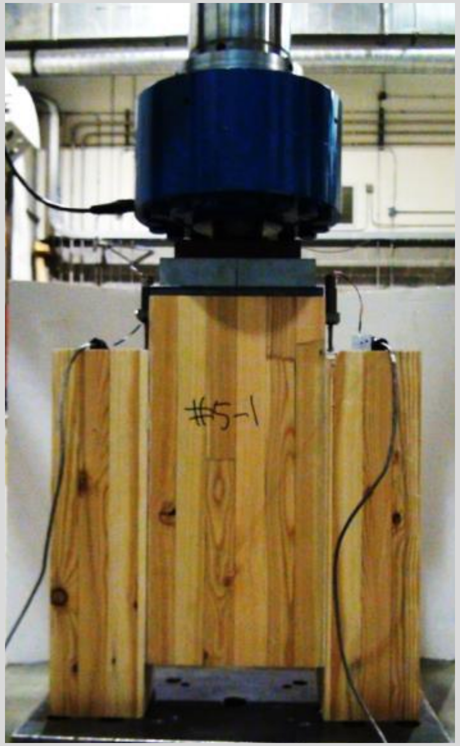

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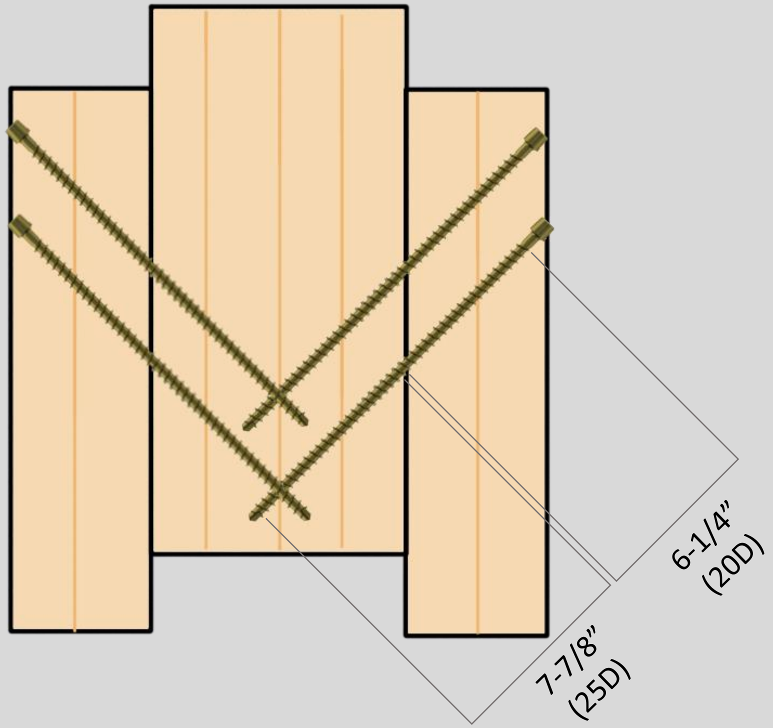

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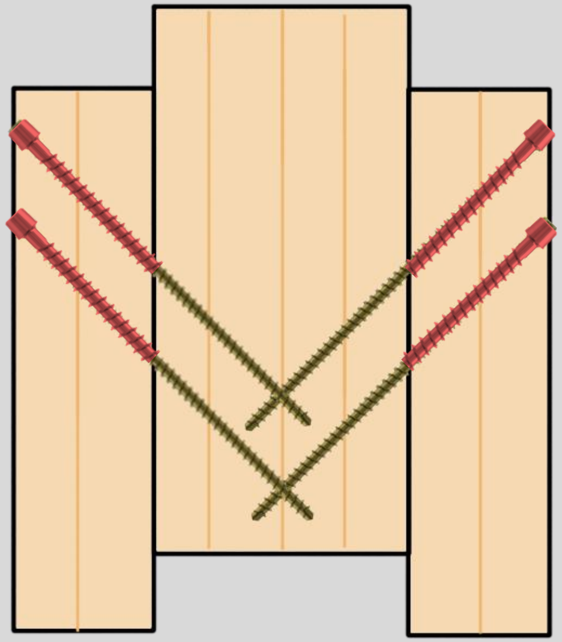

Withdrawal resistance, side members

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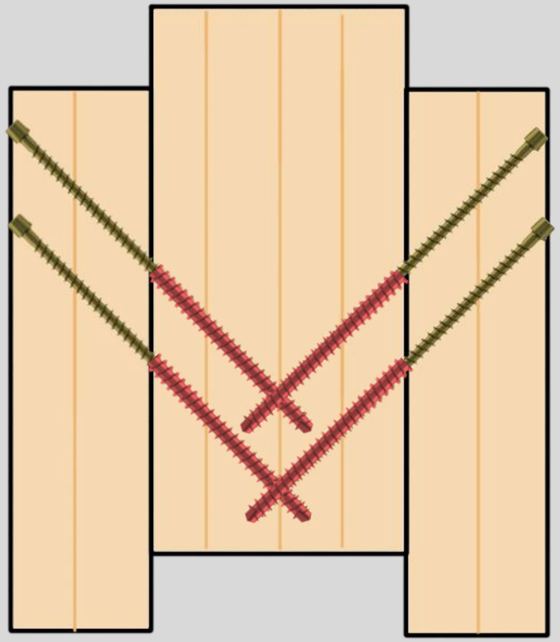
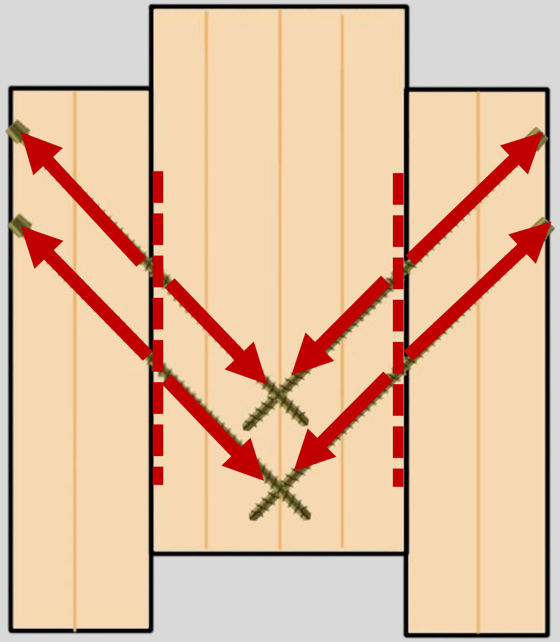


Withdrawal resistance, side members

Withdrawal resistance, main member



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Withdrawal resistance, main member

Tensile strength of the screws

Basic Theory and Behavior of Inclined Screws

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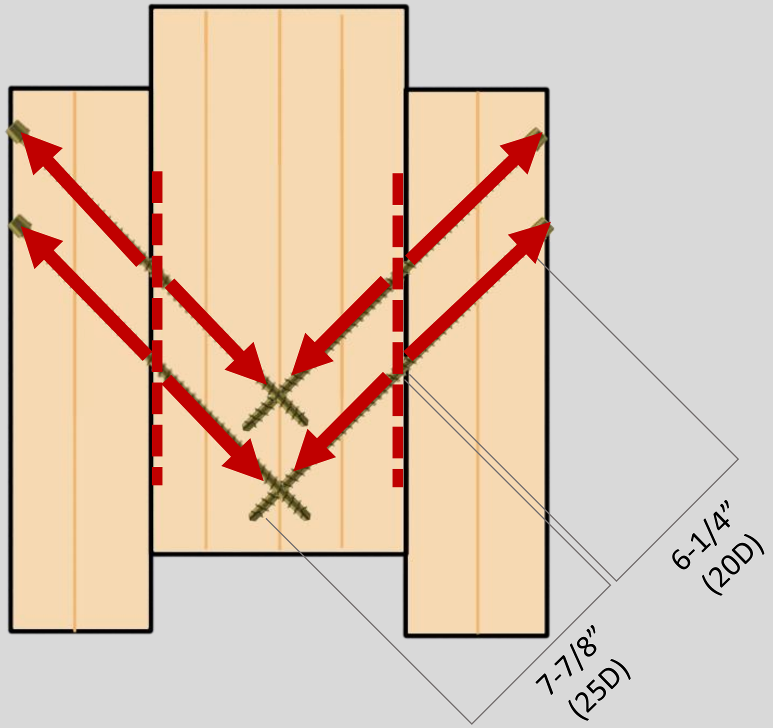

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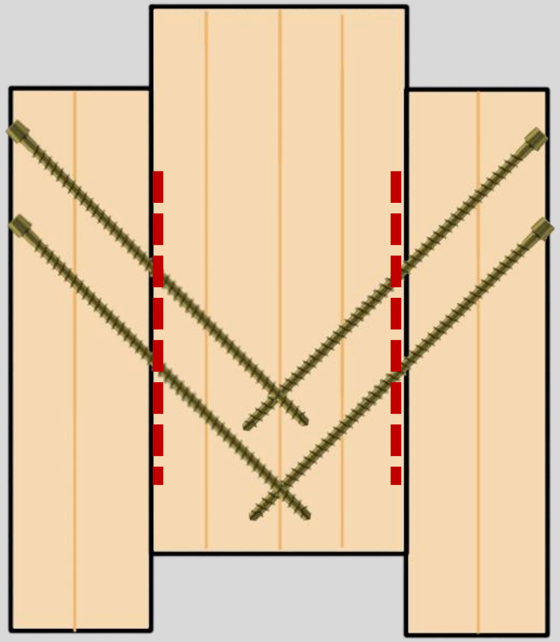

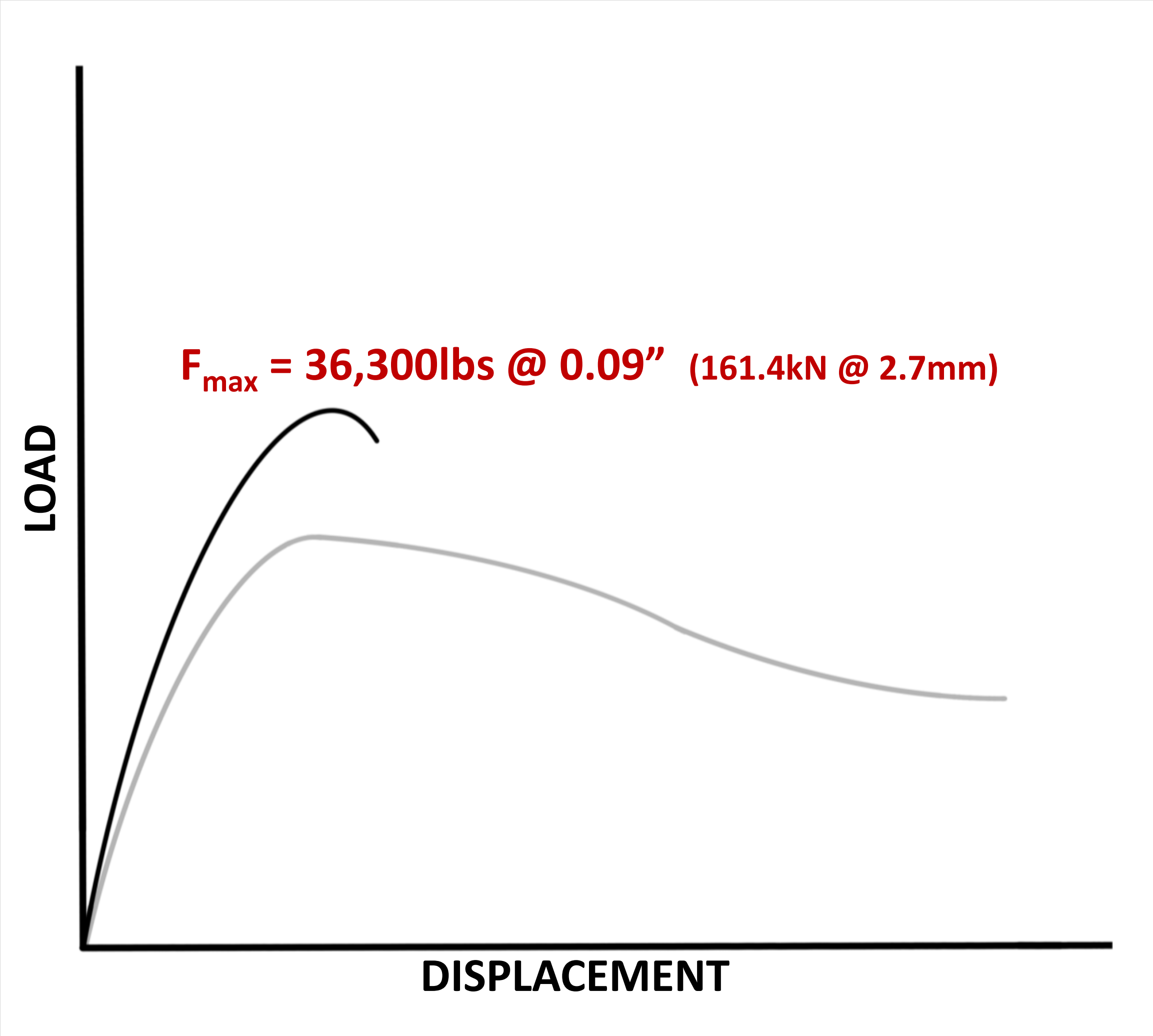

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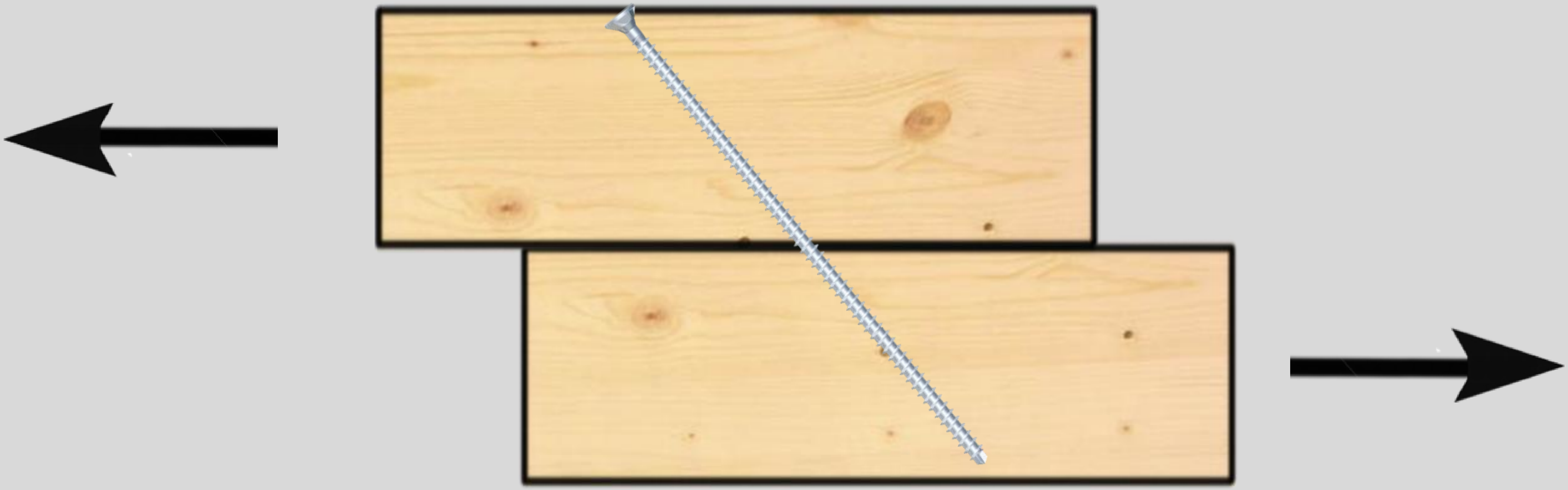

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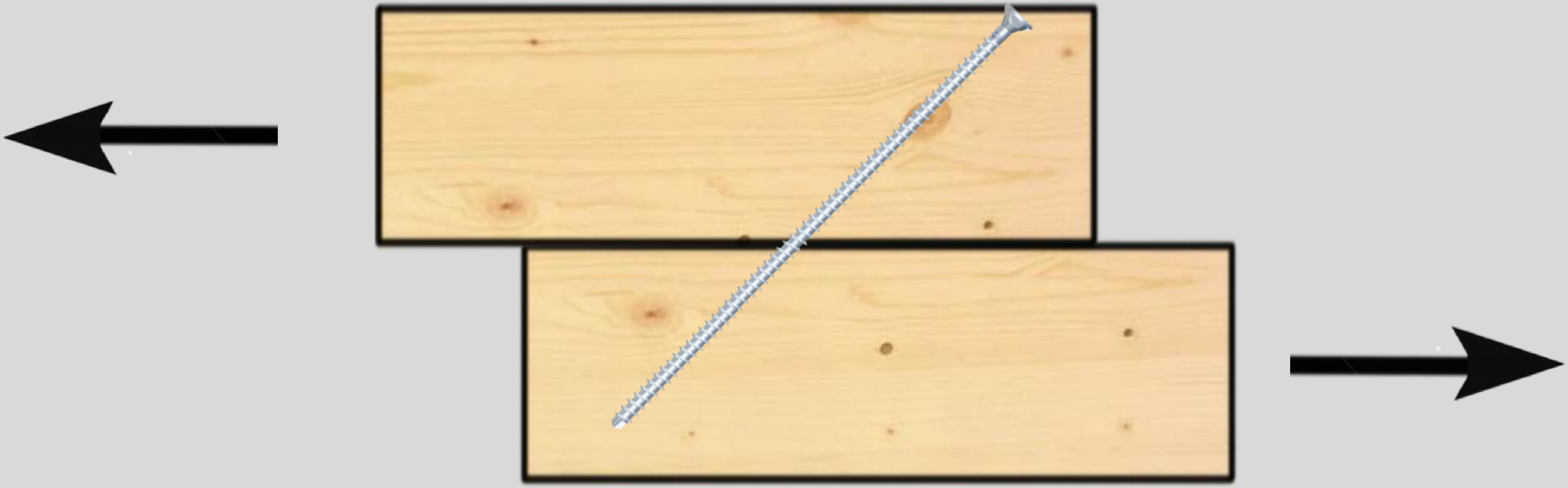

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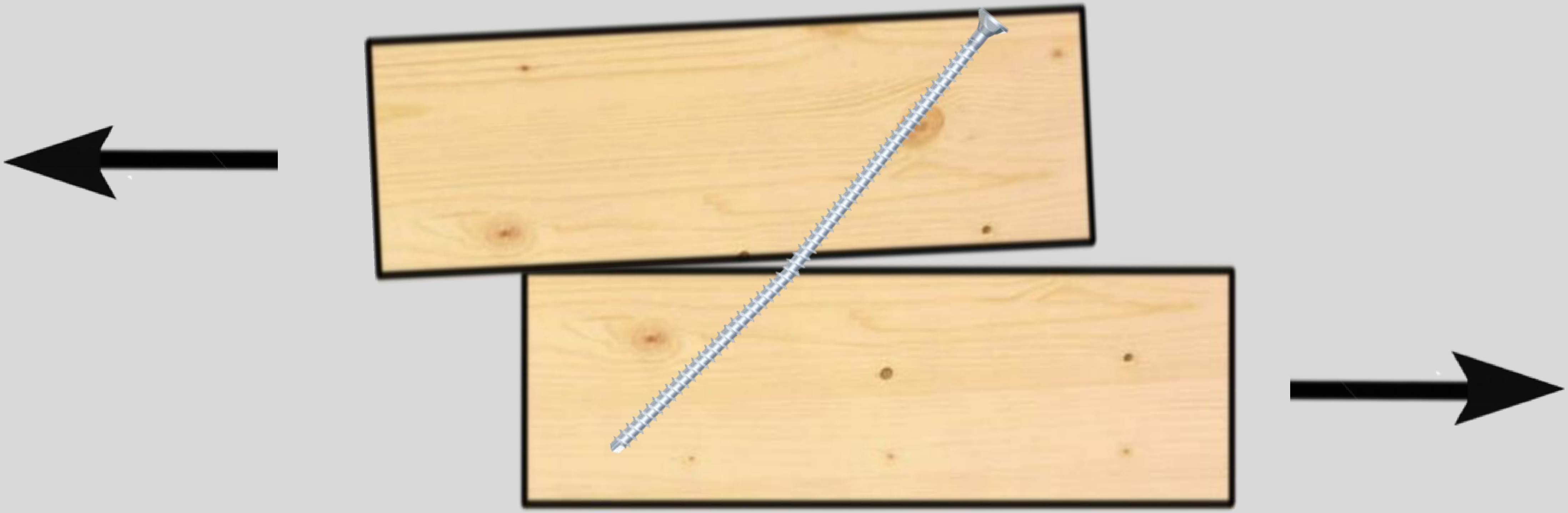

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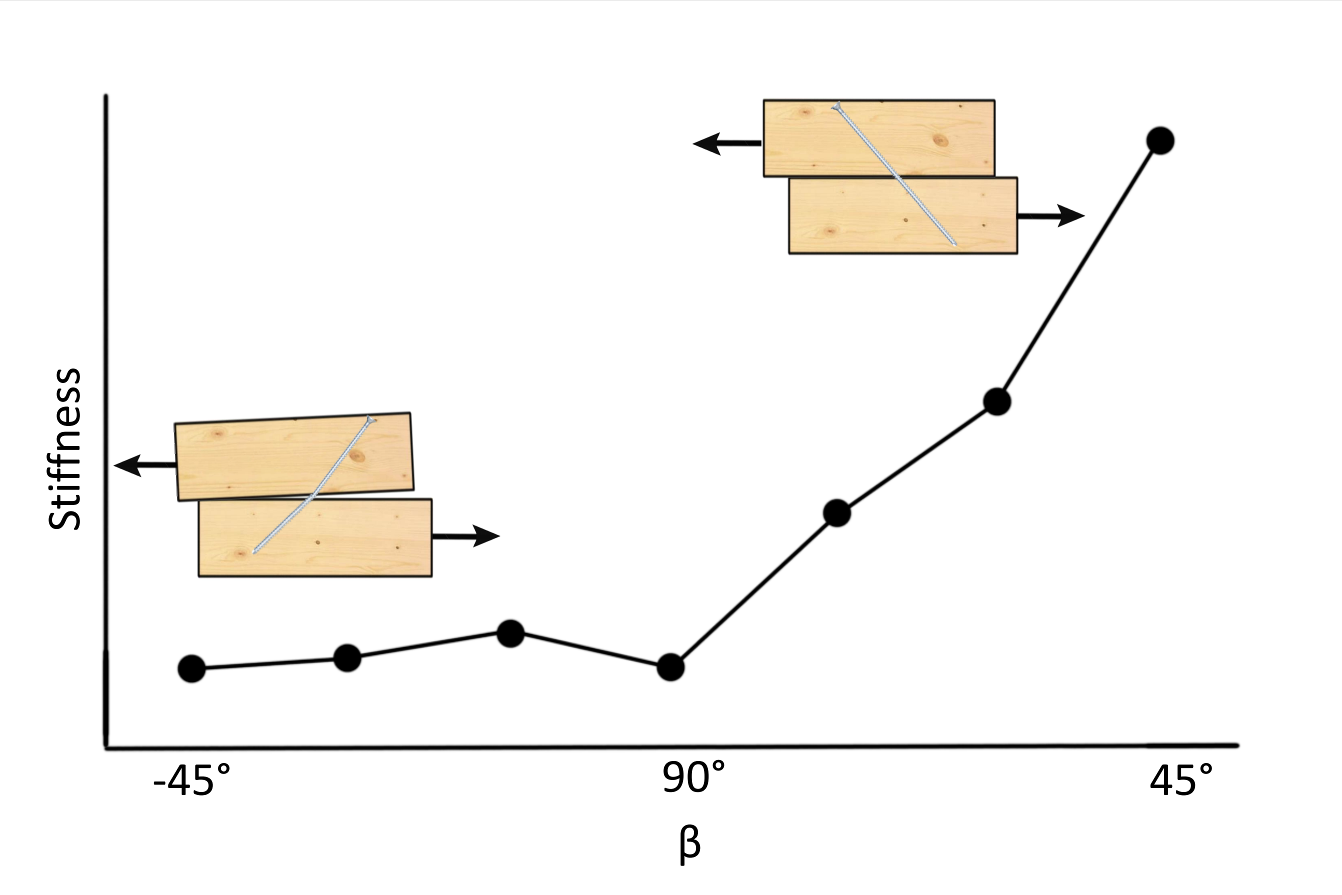
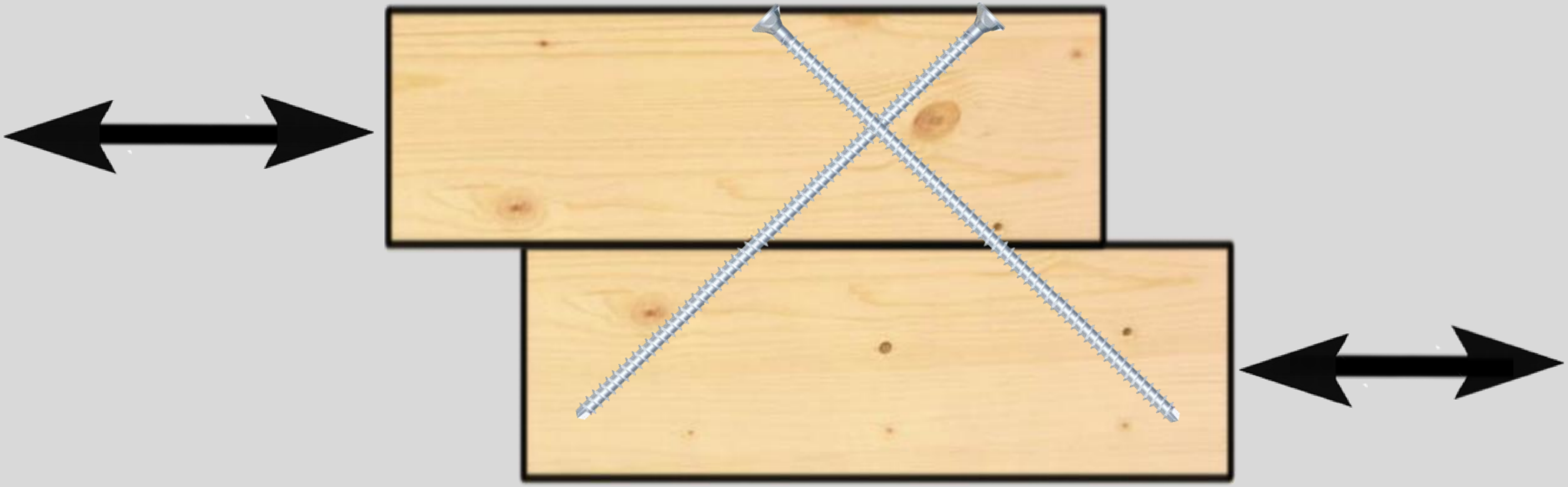
MyTiCon Timber Connectors



(Based on findings from Tomassi, Crosatti & Piazza, 2011)

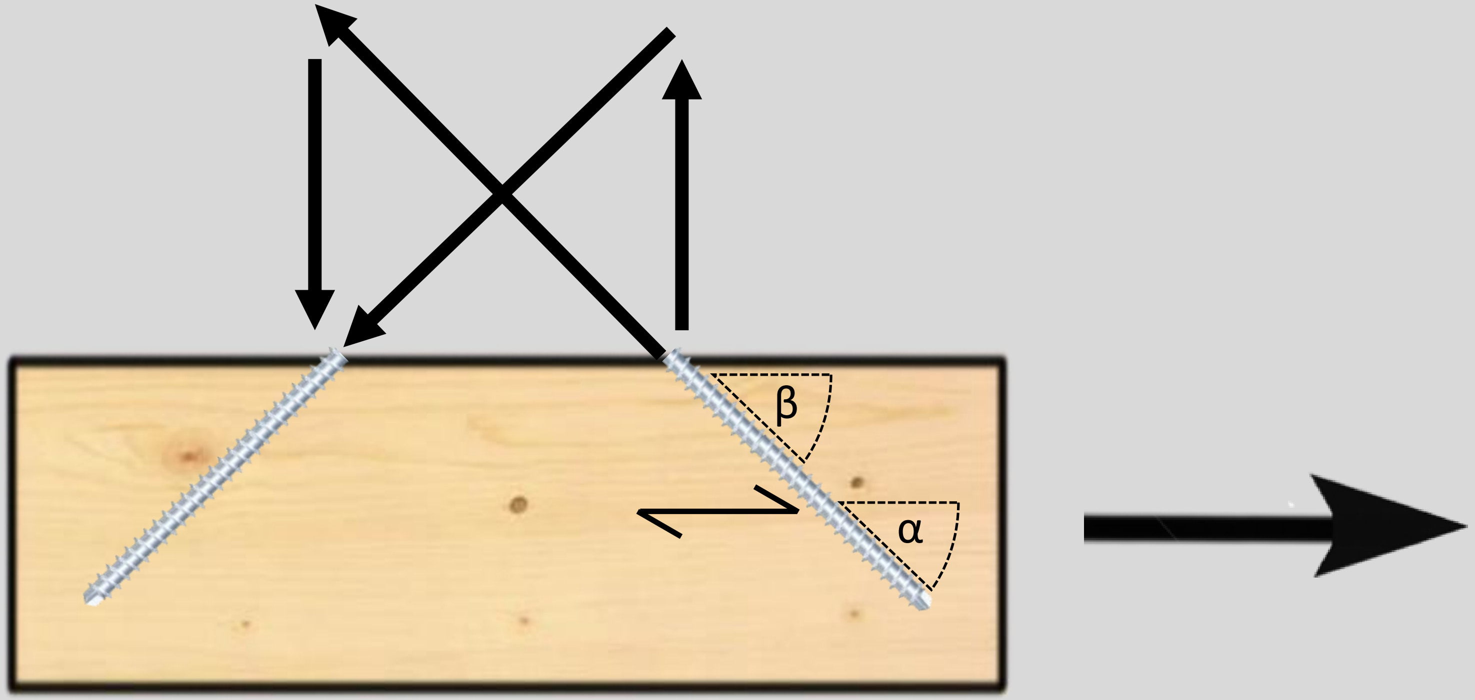


Basic Theory and Behavior of Inclined Screws

Simplified Truss Model

$30° \leq \beta \leq 45°$

$30° \leq \alpha \leq 90°$



Basic Theory and Behavior of Inclined Screws

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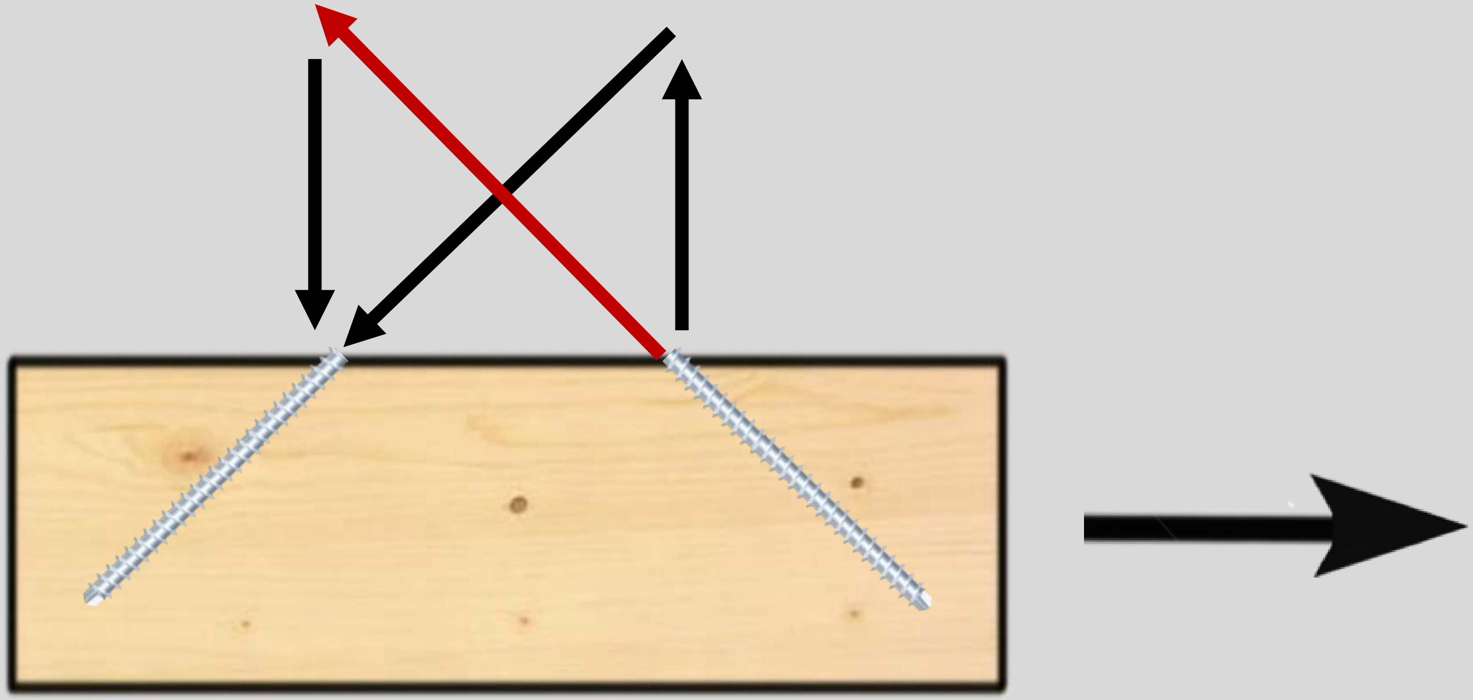
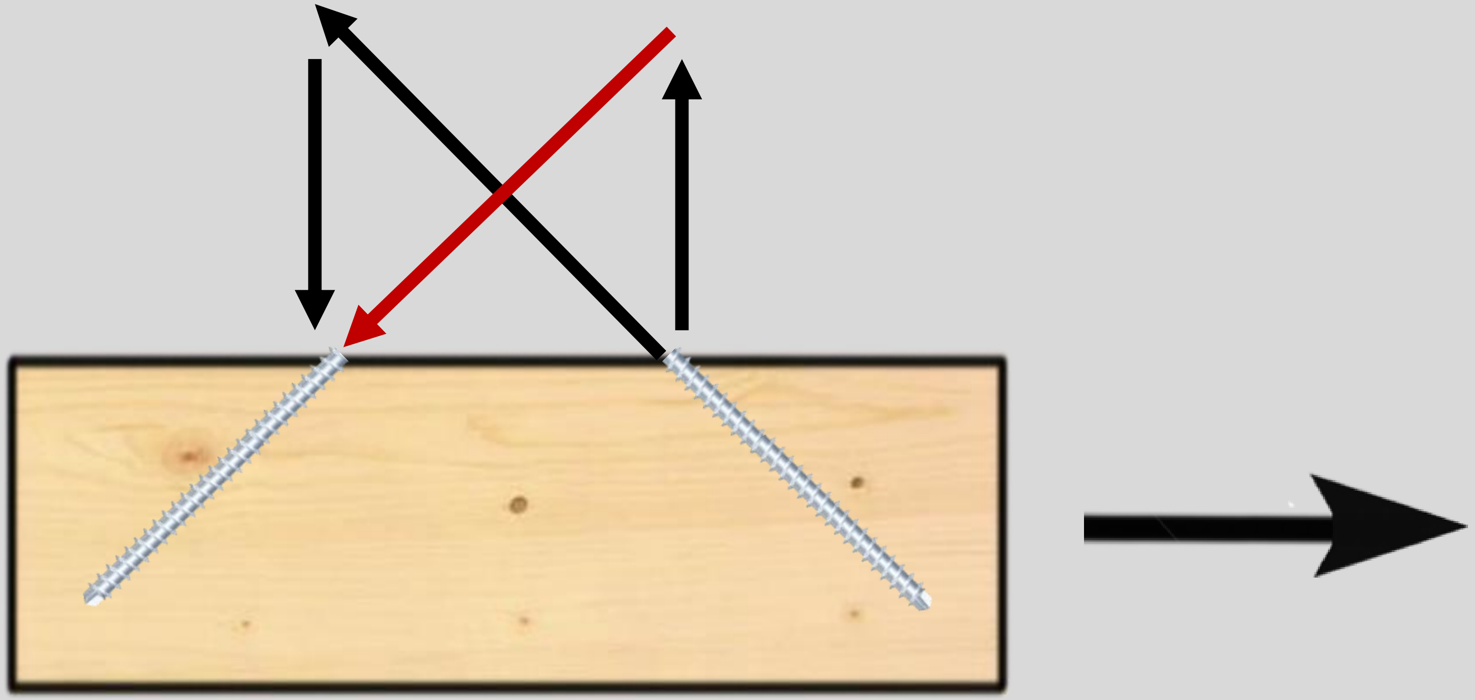


Simplified Truss Model
30° ≤ β ≤ 45°
30° ≤ α ≤ 90°

Basic Theory and Behavior of Inclined Screws

MyTiCon Timber Connectors



Simplified Truss Model
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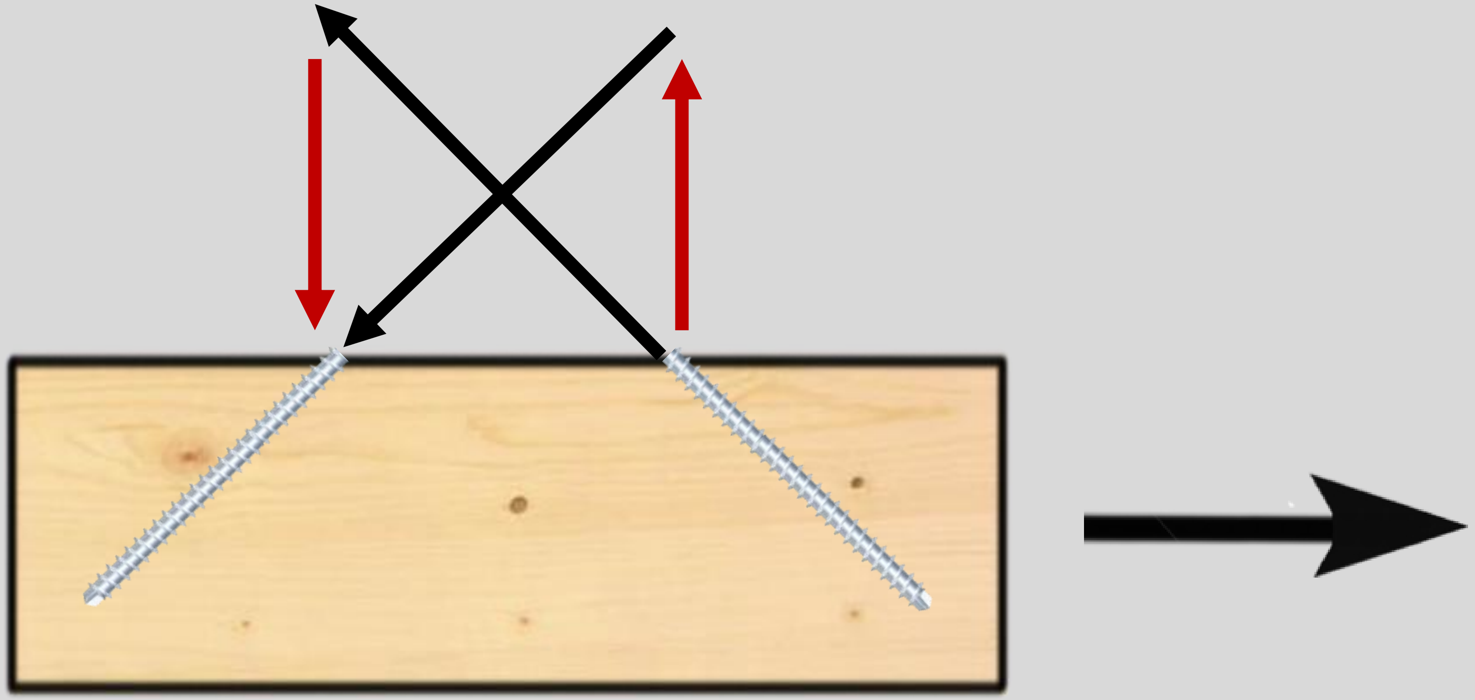
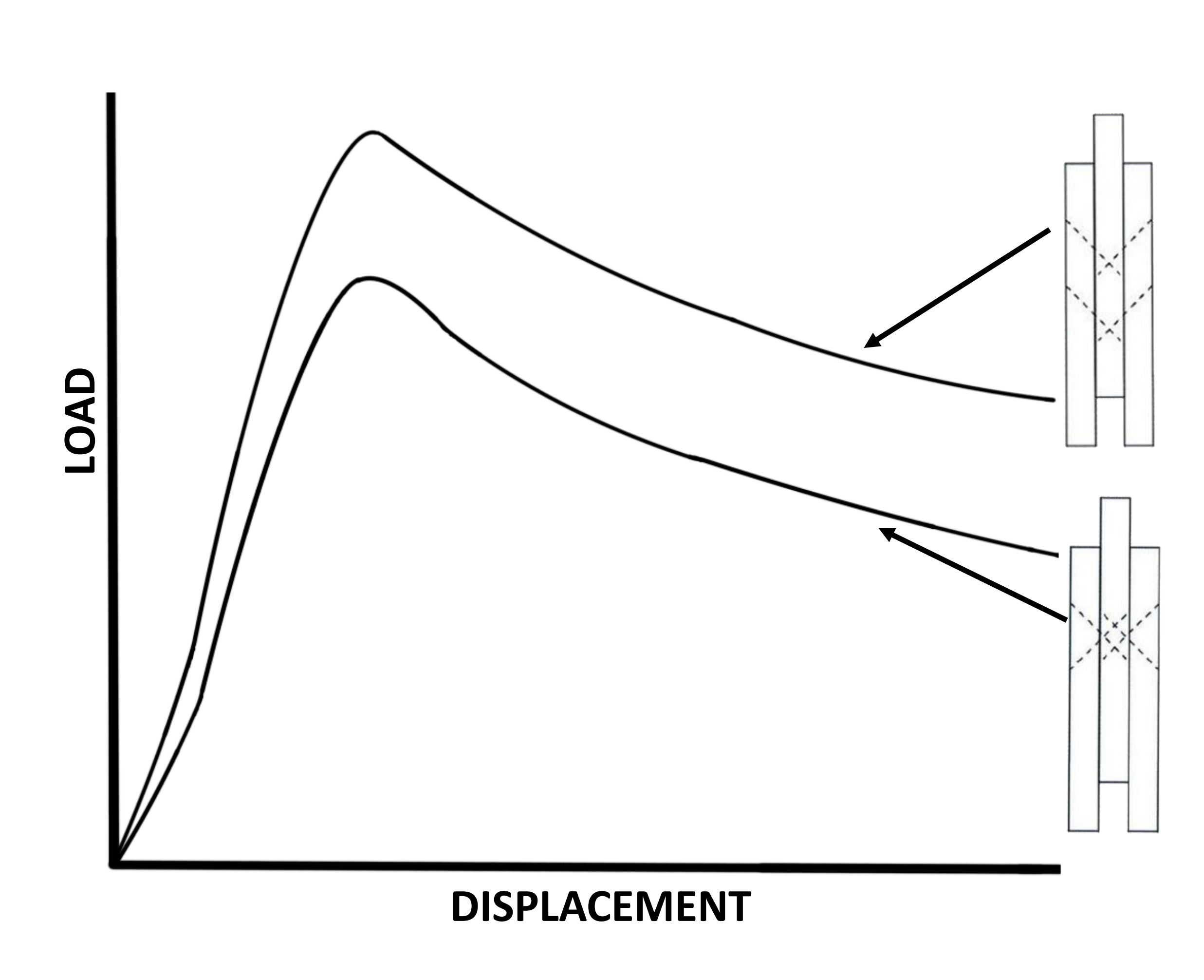
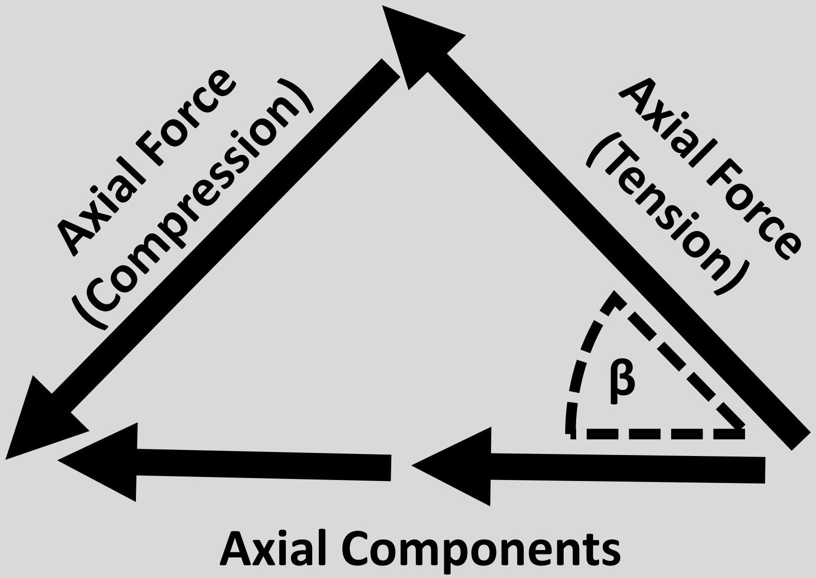


Basic Theory and Behavior of Inclined Screws



(Kevarinmäki, 2002)

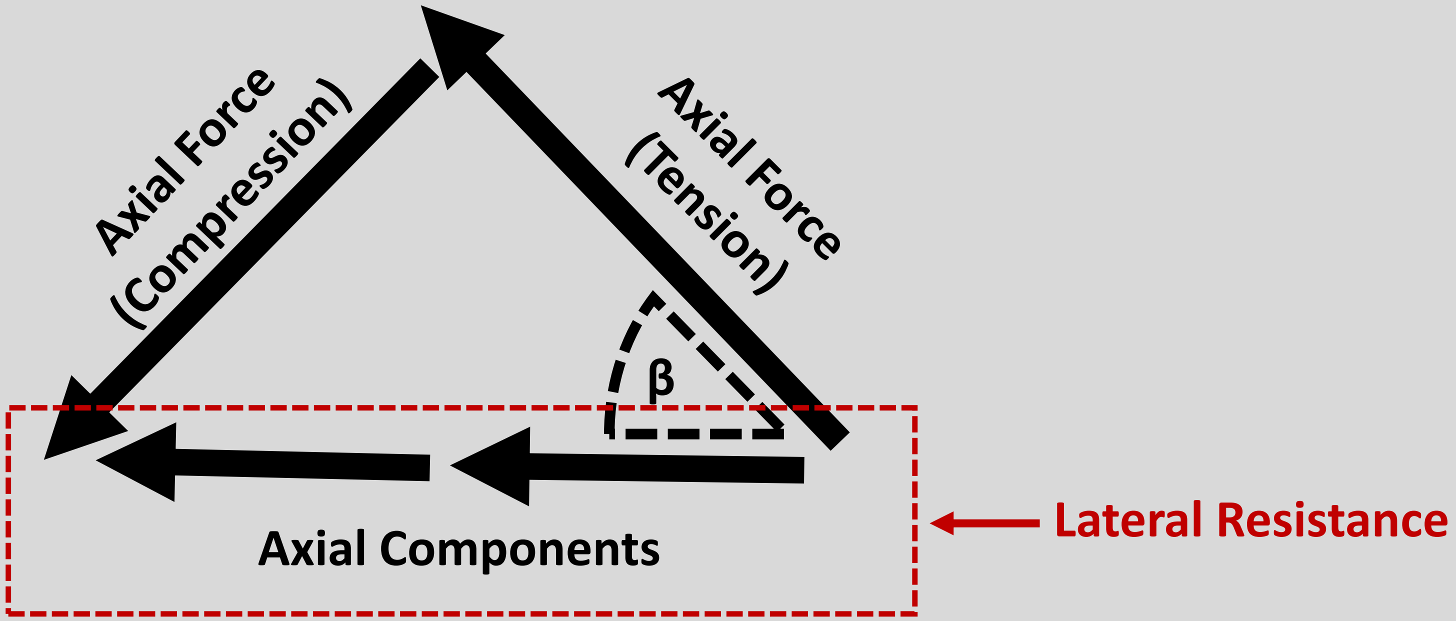
Basic Theory and Behavior of Inclined Screws



(Kevarinmäki, 2002)

Basic Theory and Behavior of Inclined Screws

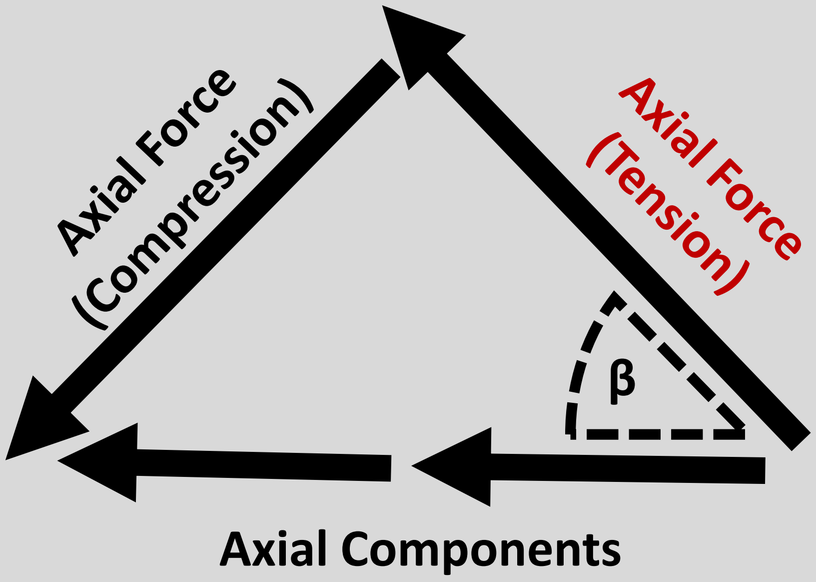
MyTiCon Timber Connectors



(Kevarinmäki, 2002)

Basic Theory and Behavior of Inclined Screws

MyTiCon Timber Connectors



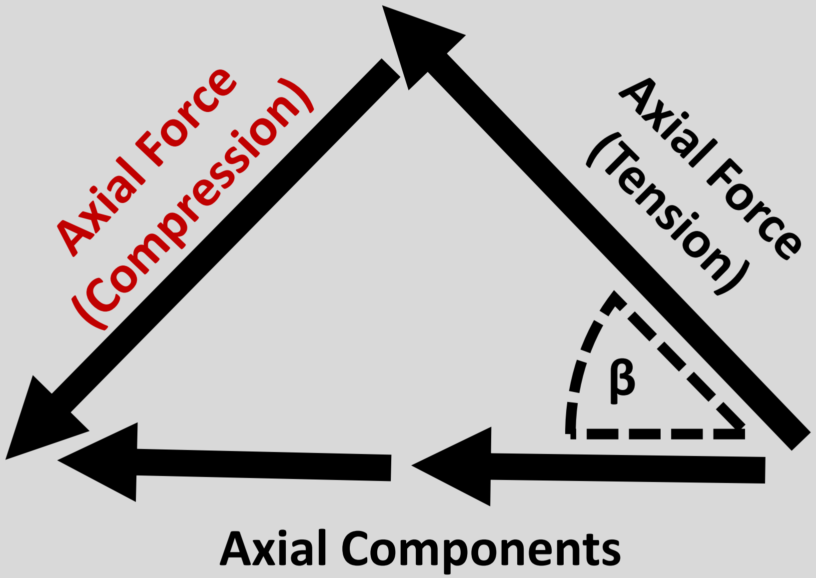
Axial Force (Tension) = min [Withdrawal Resistance; Tensile Strength

Axial Force (Compression) = min [Withdrawal (Push-in) Resistance; 0.8·Tensile Strength

(Kevarinmäki, 2002)

Basic Theory and Behavior of Inclined Screws

MyTiCon Timber Connectors



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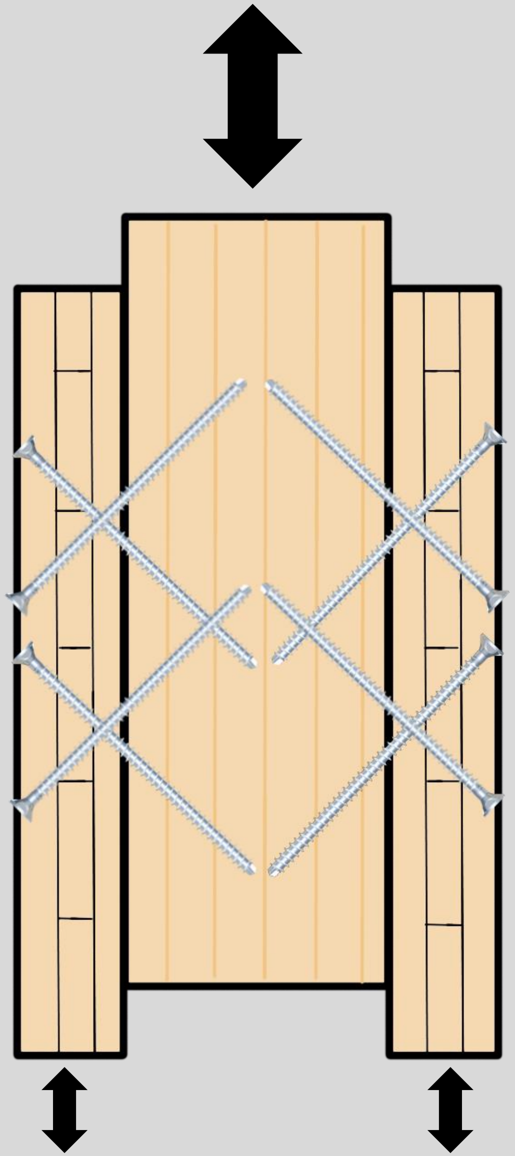
Basic Theory and Behavior of Inclined Screws



Basic Theory and Behavior of Inclined Screws

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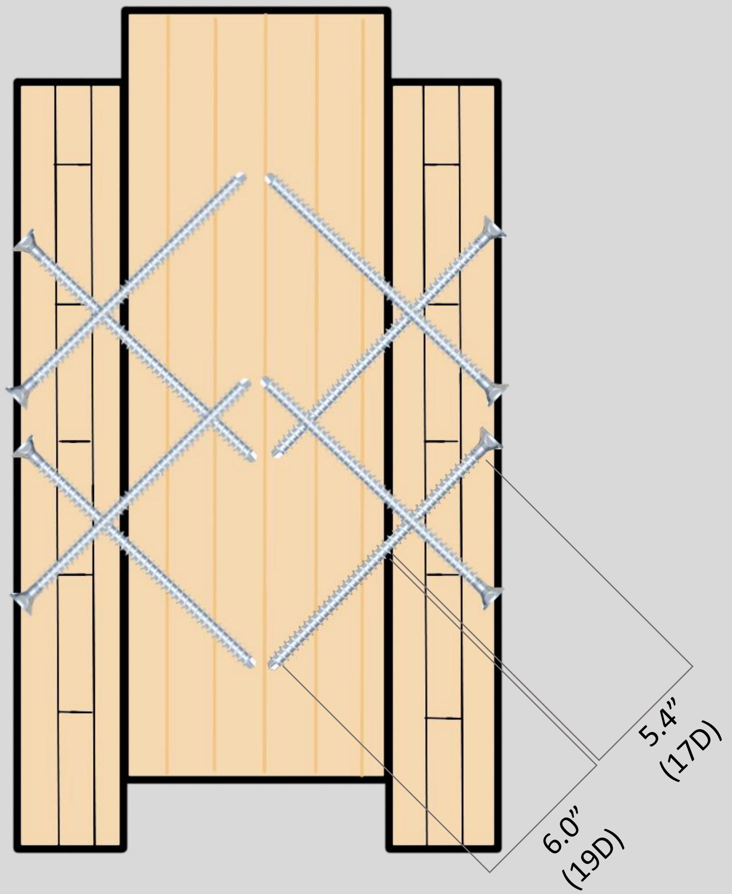
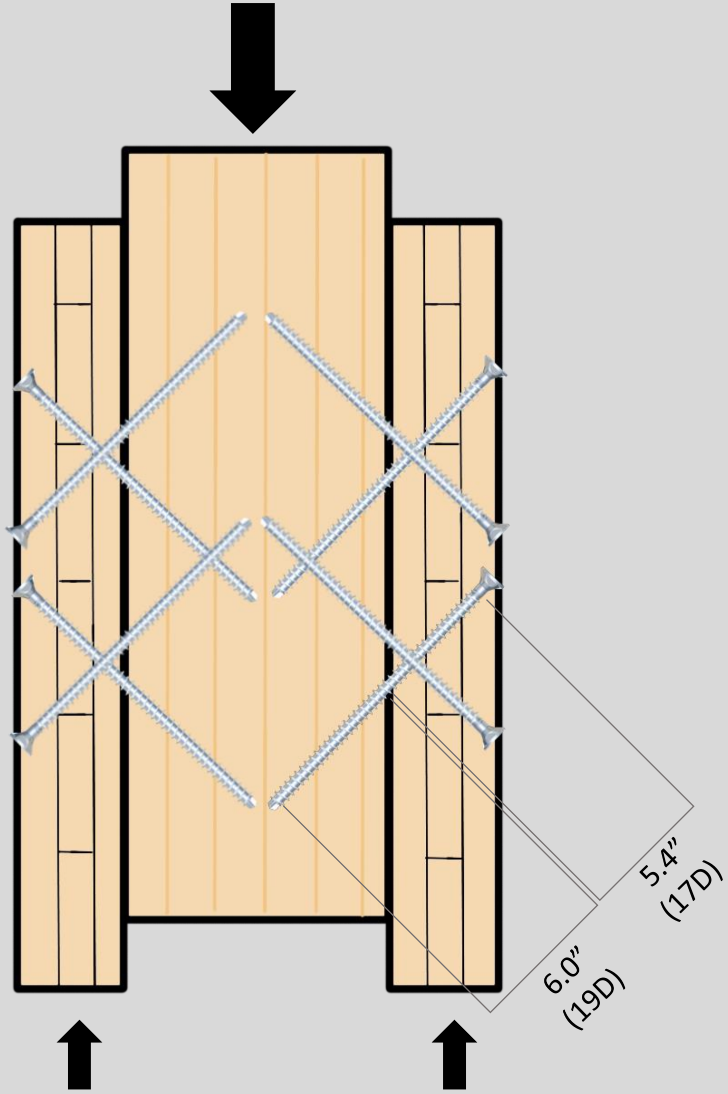
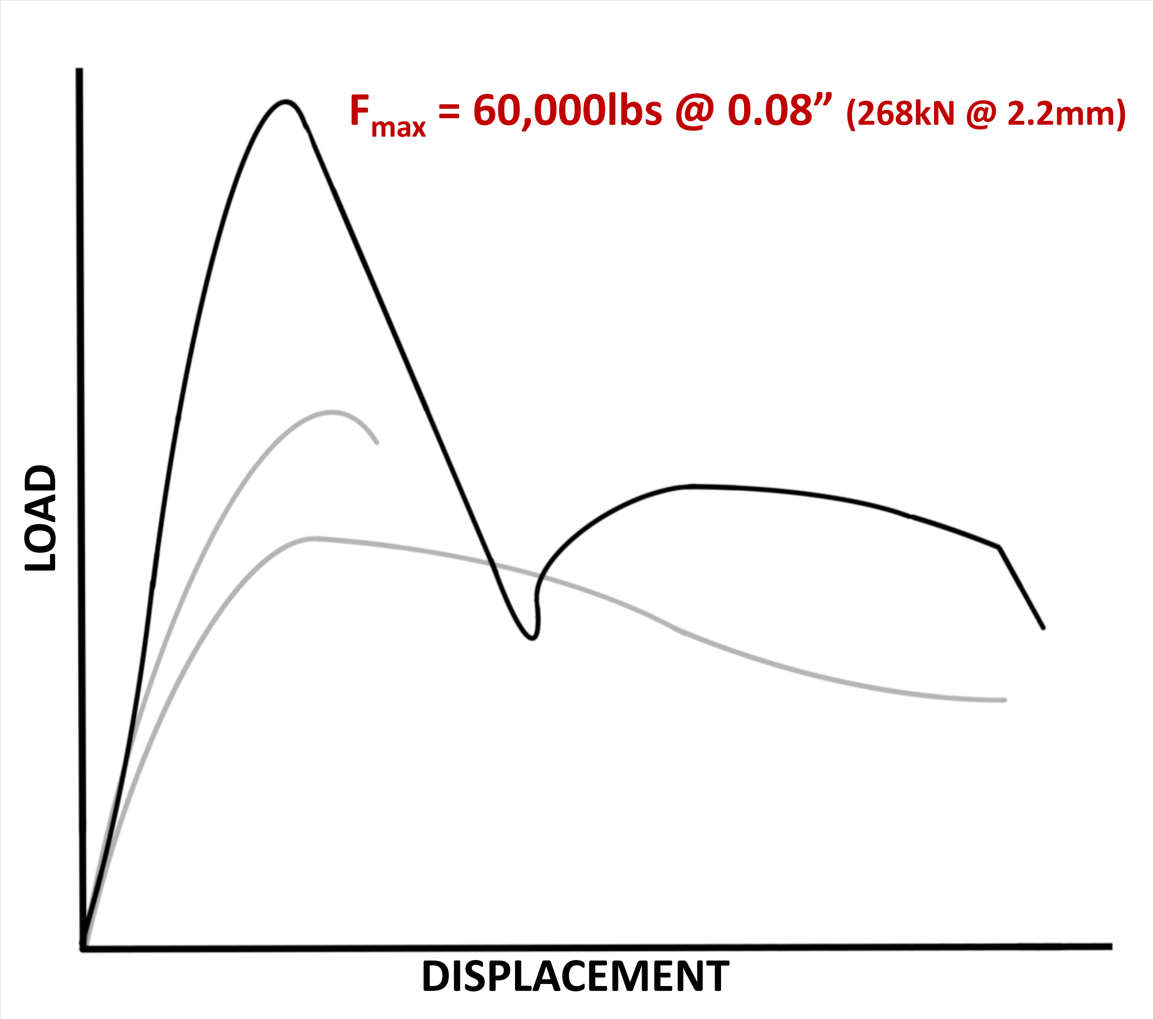
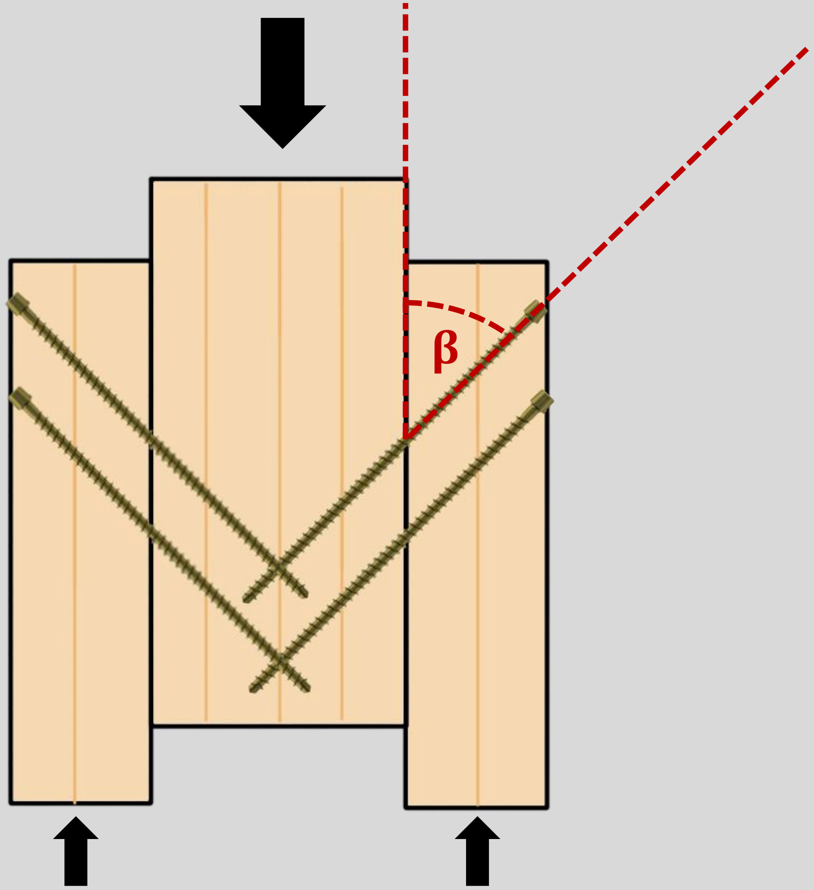


Basic Theory and Behavior of Inclined Screws

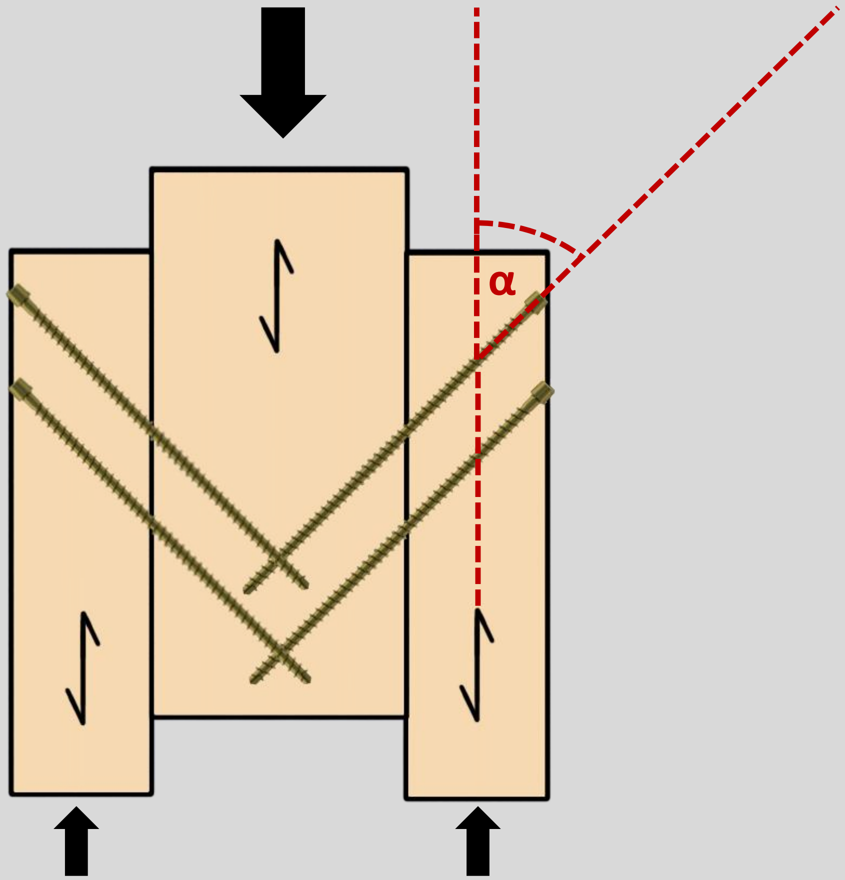
MyTiCon Timber Connectors



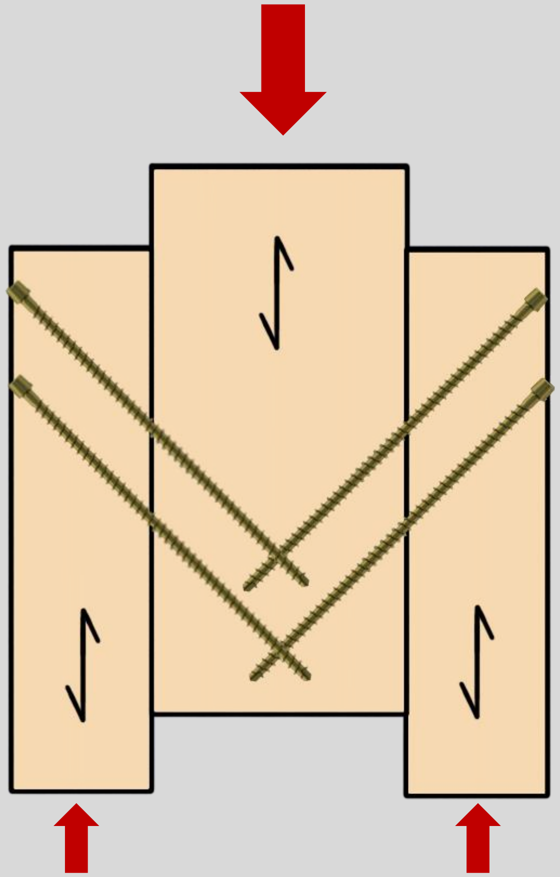




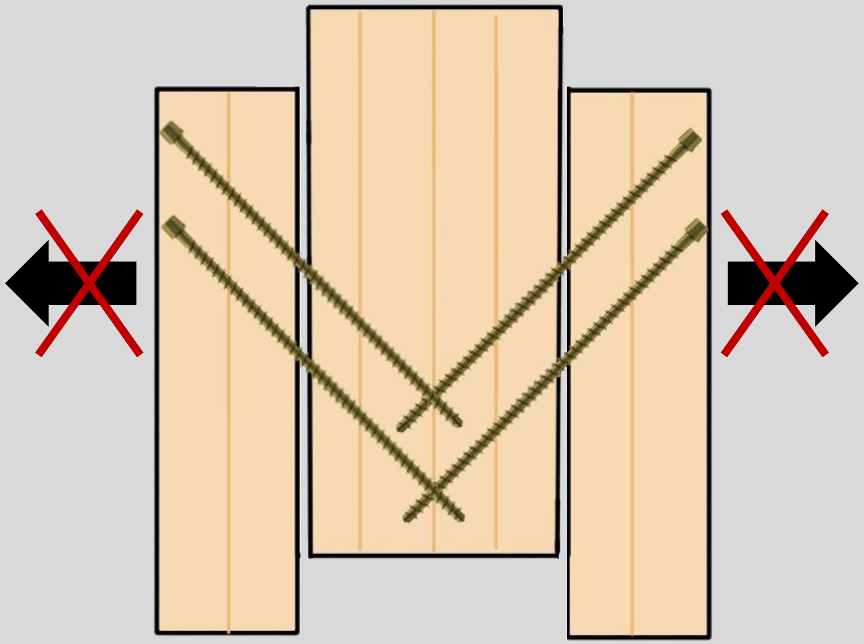
$30° \leq \beta \leq 45°$



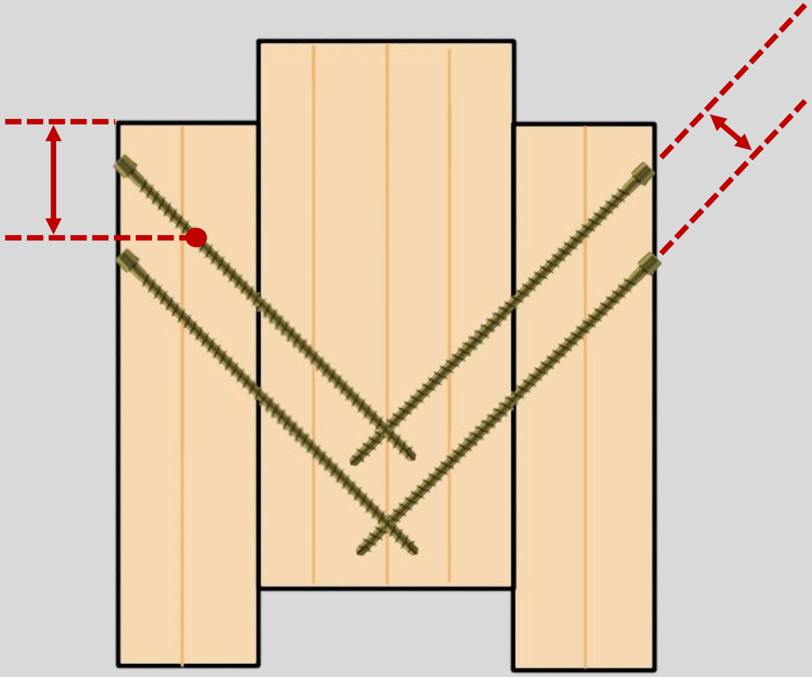
$30° \leq \alpha \leq 90°$



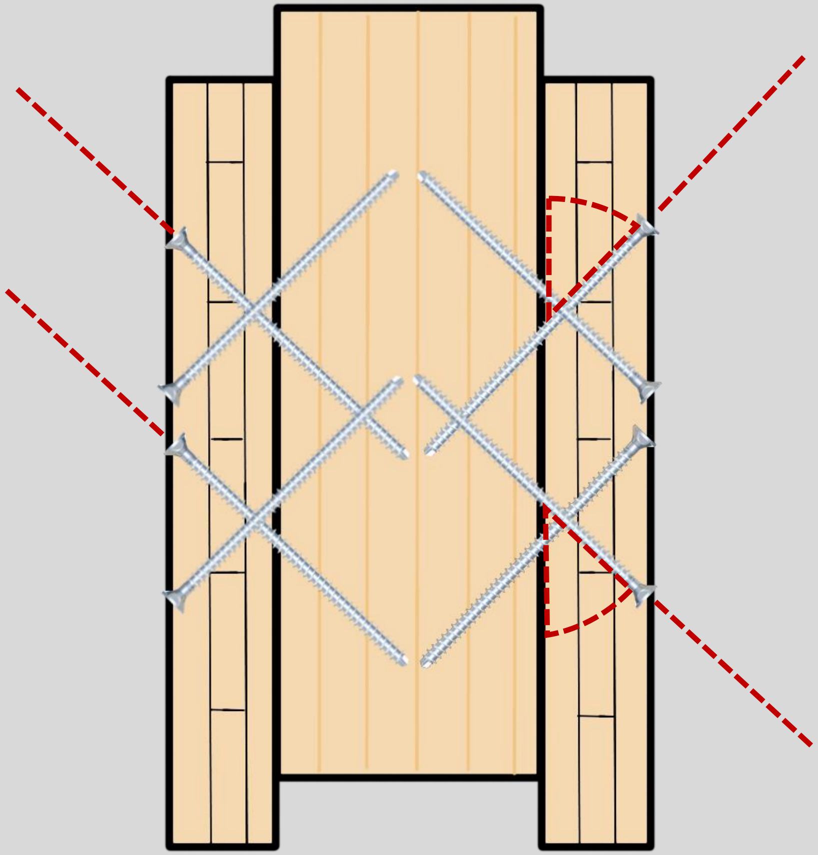
Loading parallel to grain



Shearing joints

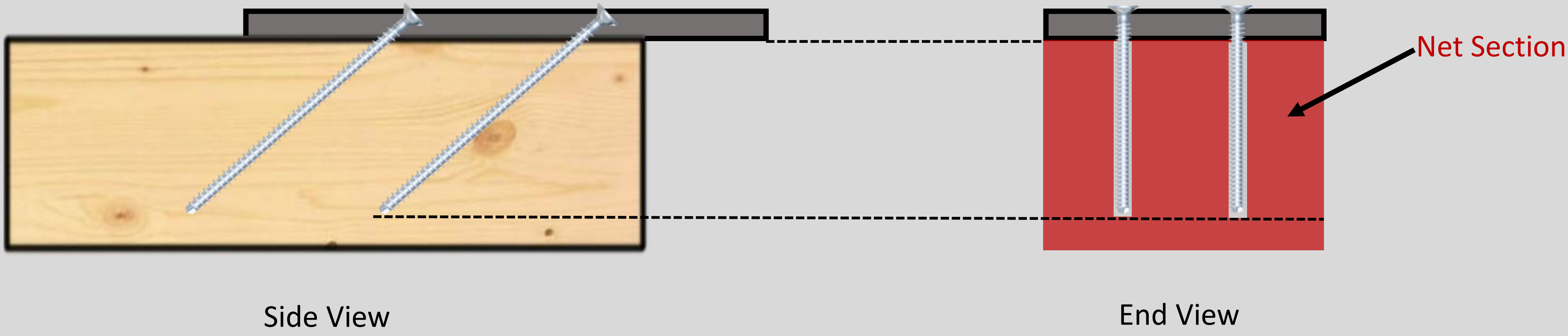


Geometry requirements



Symmetrical/ mutually parallel

Basic Theory and Behavior of Inclined Screws



(Ringhofer A, Brandner R, & Schickhofer G. 2014)

Webinar Session 2

Basic Theory and Behavior of Inclined Screws

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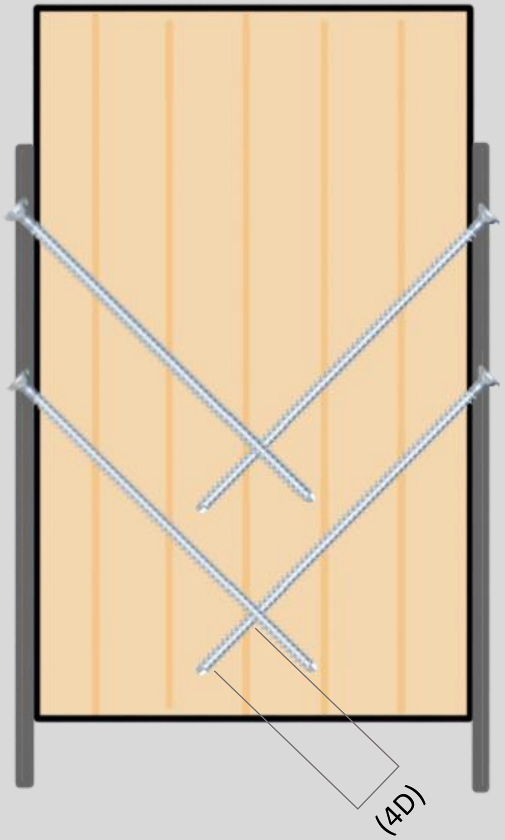

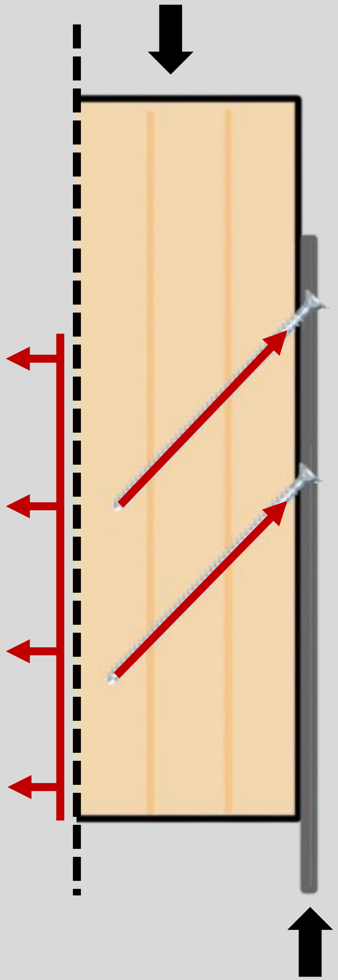

(Krenn & Schickhofer, 2009)

Basic Theory and Behavior of Inclined Screws

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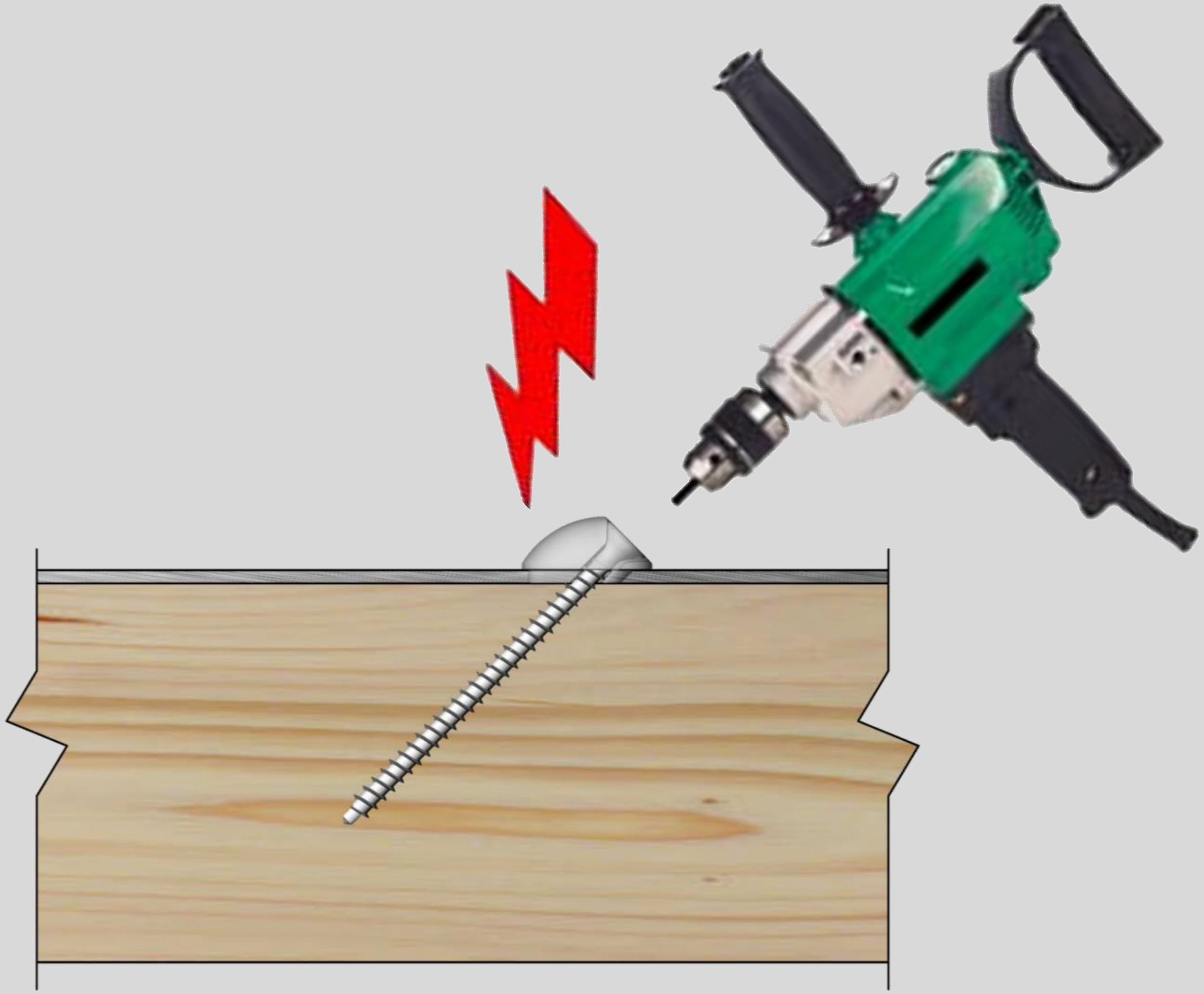

Webinar Session 2

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MASTERFORMAT:	06 05 23.14
Evaluation issued:	2013-11-20
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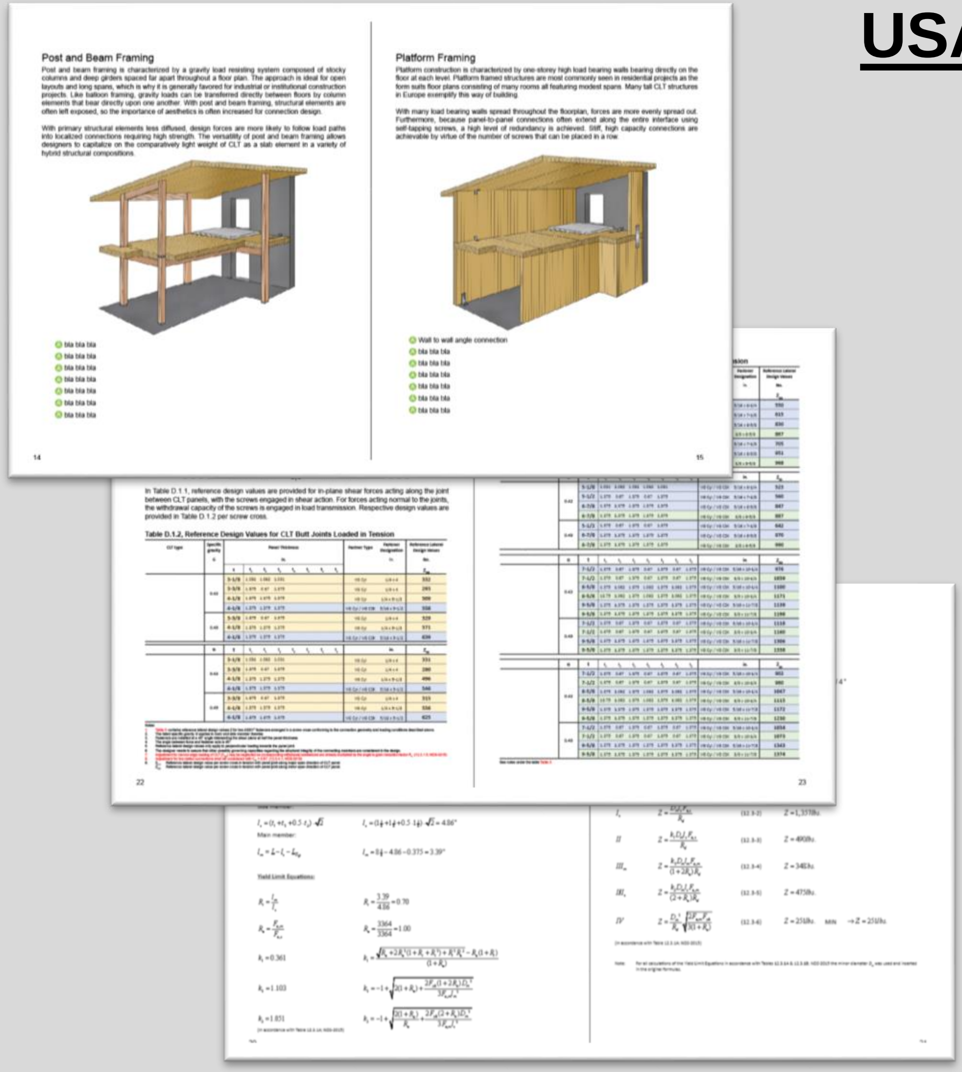
Re-evaluation due:	2019-11-20


Structural Screw
Design Guide
MyTiCon Timber Connectors

Basic Theory and Behavior of Inclined Screws



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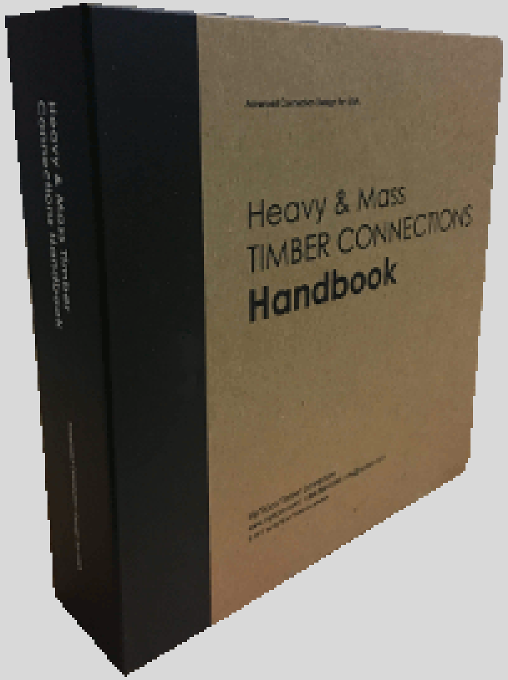

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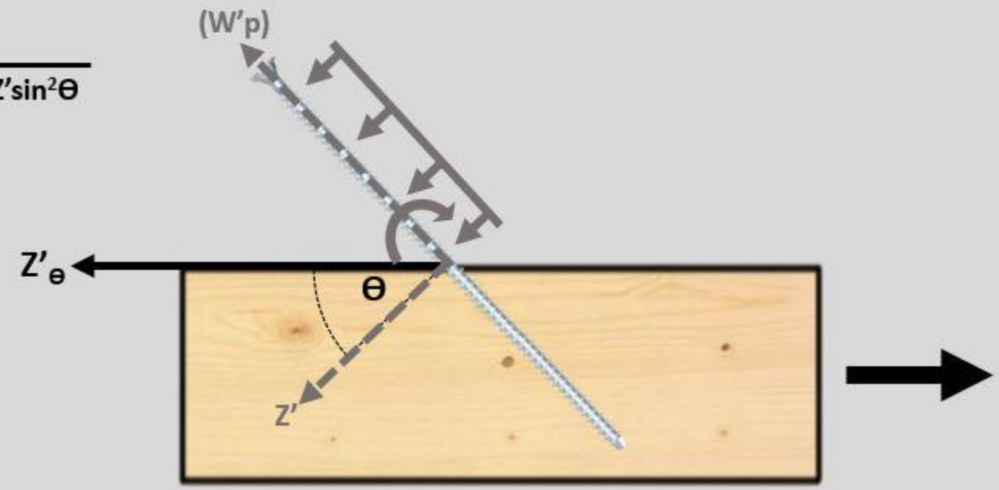
Webinar Session 2.5/4
Advanced Theory and Behavior of Inclined Screws

$$Z'_{\theta} = \frac{(W'p_t)Z'}{(W'p_t)\cos^2\theta + Z'\sin^2\theta}$$



Thank you.

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Resources/Further Reading

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