14. JANUARY 2026

Worked example

Rafter connection to the purlin and the wall plate

ESSVE academy

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Disclaimer:
The following information is still under discussion and review and should not be used for design purposes.
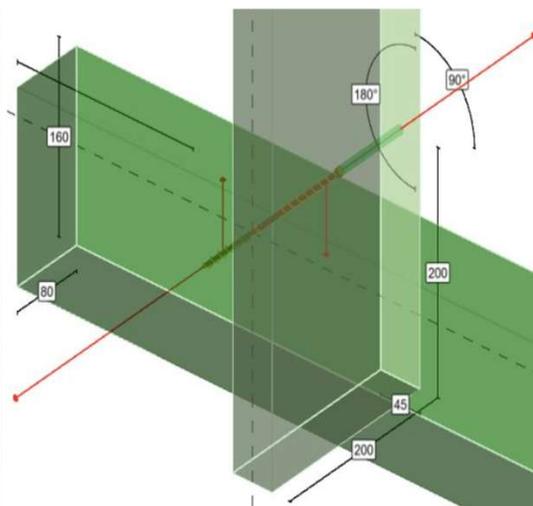The information may be incomplete and may contain errors.

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EUROCODE 5: CONNECTIONS

Challenges related to roof design

Image: Reet Sau

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EUROCODE 5: CONNECTIONS

Challenges related to roof design: loads

Wind zones of a duopitch roof

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EUROCODE 5: CONNECTIONS

Challenges related to roof design: resistance of horizontal reactions

Rug & Mönck „Holzbau"

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EUROCODE 5: CONNECTIONS

Resisting horizontal reactions using steel shoes

EUROCODE 5: CONNECTIONS

Rafters supported by purlins

EUROCODE 5: CONNECTIONS

Horizontal reactions resisted by the collar tie
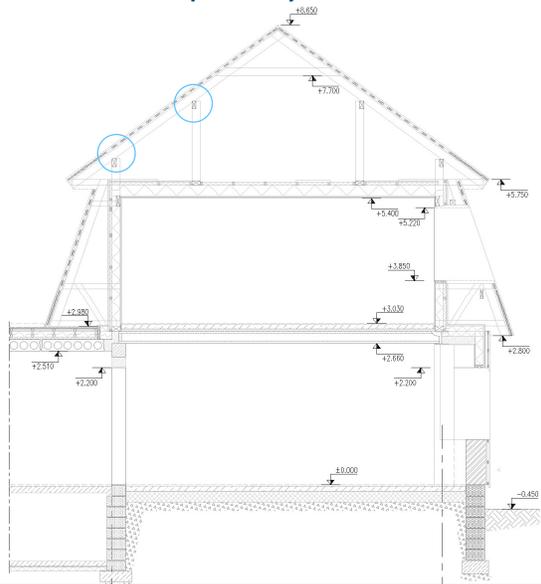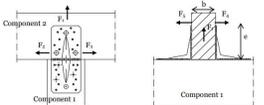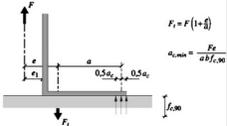

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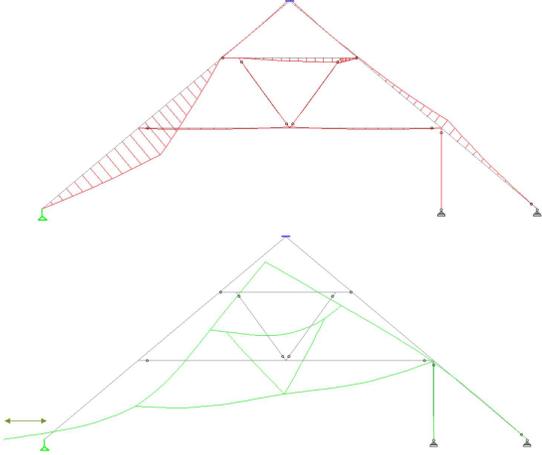
EUROCODE 5: CONNECTIONS

Purlin-and-post systems

$$\left(\frac{F_{1,d}}{F_{Rd,1}}\right)^2 + \left(\frac{F_{2,d}}{F_{Rd,2}}\right)^2 + \left(\frac{F_{3,d}}{F_{Rd,3}}\right)^2 + \left(\frac{F_{4,d}}{F_{Rd,4}}\right)^2 + \left(\frac{F_{5,d}}{F_{Rd,5}}\right)^2 \leq 1$$

https://www.elmwoodfencing.co.uk

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EUROCODE 5: CONNECTIONS

Rafter anchoring

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EUROCODE 5: CONNECTIONS

Principle of calculating the force acting on a screw

characteristic withdrawal resistance

$$F_{ax,t,d} = min \begin{cases} \dfrac{k_{mod}}{\gamma_R} \; max\{F_{pull,k} \; ; F_{w,k}\} & \text{TIMBER} \\ \dfrac{F_{t,k}}{\gamma_{M2}} & \text{STEEL} \end{cases}$$

characteristic withdrawal strength

$$F_{w,k} = \pi \cdot d \cdot l_w \cdot f_{w,k}$$

$$f_{w,k} = k_{screw} \cdot k_w \cdot k_{mat} \cdot d^{-0,33} \cdot \left(\frac{\rho_k}{350}\right)^{k^\rho}$$

$$\eta = \left(\frac{F_{ax,Ed}}{F_{ax,t,Rd}}\right)^2 + \left(\frac{F_{v,Ed}}{F_{v,Rd}}\right)^2$$

$$k_{screw} = k_{red} \cdot \frac{f_{ax,k}(\rho_{ref})}{\pi} \cdot \frac{l_d}{l_d - l_p} \cdot \frac{1}{k_w \cdot k_{mat} \cdot d^{-0,33}}$$

k_{screw}: default value = 8,2

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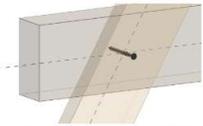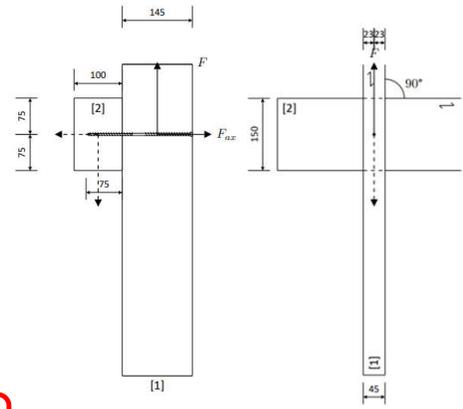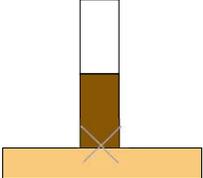
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