POSITION 8: RAUTENSTRAUCH S. 264

1. Input parameters

1.1. ribs (vertical), flanges (horizontal)

service class 1
panel width/height = **250.0 / 255.0 cm**, sheet edges transmitting shear on all sides
ribs **5.0 / 12.0 cm** from solid coniferous timber, C24 (S10) with ρ_k = 350 kg/m³, a_r = 62.5 cm
flanges **5.0 / 12.0 cm** from solid coniferous timber, C24 (S10) with ρ_k = 350 kg/m³

1.2. sheathing on one side

OSB 4 with ρ_k = 550 kg/m³, service class 1, t = 18.0 mm
special nail 1A, 2.5 x 50.0 mm, d_k = 5.0 mm, l_{ef} = 50.0 mm, not predrilled
simplified verification acc. to NA.8.2.4, distance a_v = 90 mm, 1-row
vertical loads transmitted only by ribs

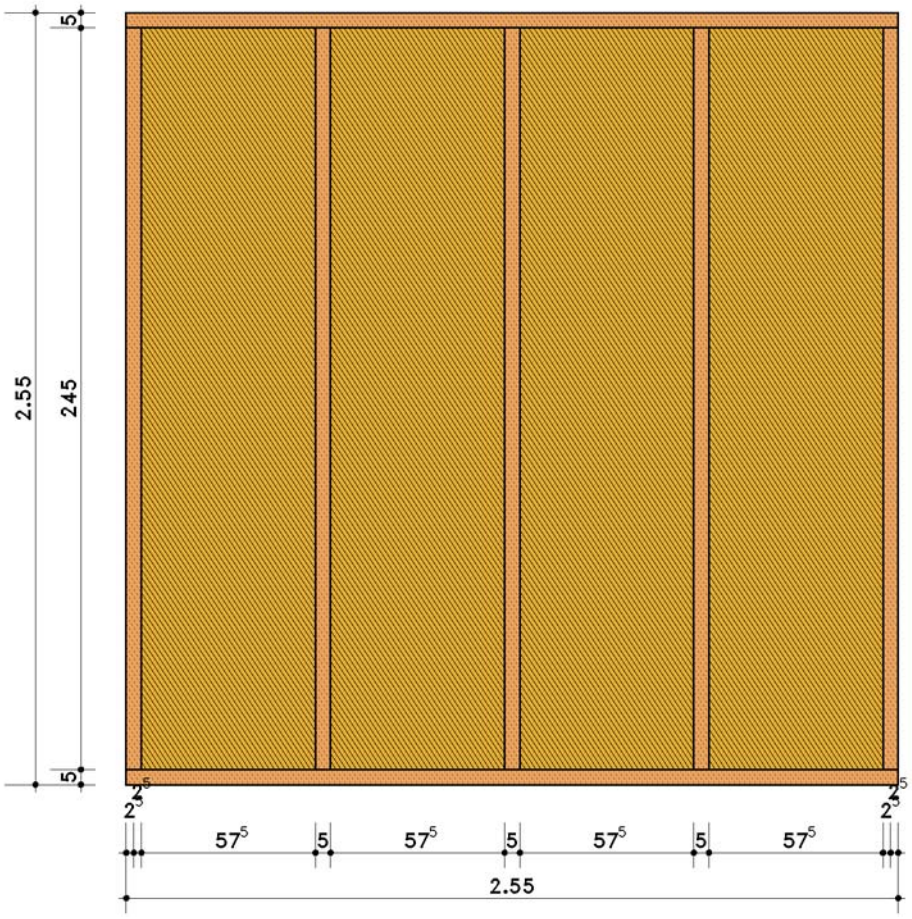
1.3. Combinations of internal forces for verifications at ultimate limit state

Nr	$F_{v,d}$ kN	E_{dl} kN/m	E_{dr} kN/m	$F_{1c,d}$ kN	$F_{2c,d}$ kN	$k_{mod,r}$ -	$k_{mod,bl}$ -	A
1	9.180	0.000	2.000	7.950	0.000	0.900	0.900	

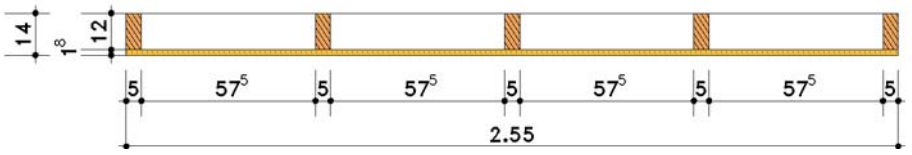
1.4. Combinations of internal forces for verifications at serviceability limit state

Nr	$F_{v,k}$ kN	E_{kl} kN/m	E_{kr} kN/m	$F_{1c,k}$ kN	$F_{2c,k}$ kN
1	5.000	0.000	0.000	1.000	1.000

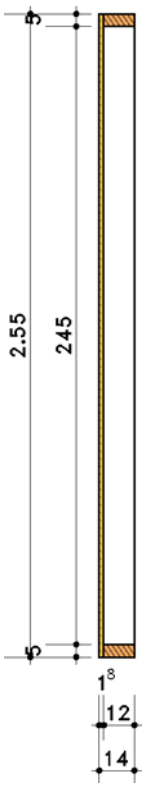
elevation scale 1:25



longitudinal section scale 1:25



transversal section scale 1:30



2. verifications acc. to DIN EN 1995, Germany

2.1. Fasteners sheathing 1

fastener ends in rib, penetration depth t = 32 mm
$F_{v,Rk}$ increased acc. to DIN EN 1995, 9.2.4.2 (5) (sheet edges transmitting shear on all sides)
f_{uk} = 450 N/mm², M_{yk} = 1462 Nmm, f_{hk} = 45.70 N/mm², β = 0.00
$F_{v,Rk}$ = 462.4 N, $F_{v,Rd}$ = 378.3 N per shear plane, γ_M = 1.10

2.2. Verification of diaphragm loading

web
γ = 1.30, f_{vk} = 6.9 N/mm², f_{ck} = 14.0 N/mm², k_{v1} = 1.00, k_{v2} = 0.33

2.2.1. Load combination 1

wall panel in horizontal diaphragm loading
sheathing 1
$F_{v,Rd}$ = 378 N, f_{vd} = 4.78 N/mm², f_{cd} = 9.69 N/mm²
f_{v0d} = 4.20 N/mm (fastener), f_{v90d} = 4.20 N/mm (fastener)
⇒ utilization: U_{0d} = 0.87, U_{90} = -1.00 => **U = 0.87 verification successful**

2.3. Verification of compression of bottom edge beam

$A_{ef\ li}$ = 9600 mm², $A_{ef\ inside}$ = 13200 mm², $A_{ef\ re}$ = 9600 mm², x_1 = 1.00 DIN 1052, 8.7.5, k_{c90} = 1.25

2.3.1. Load combination 1

f_{v90d} = 4.20 N/mm², f_{c90d} = 2.08 N/mm², f_{rib} = 1.00
$\Sigma F_{c,d\ edge}$ = 17781 N, $\Sigma F_{c,d\ inside}$ = 1105 N, $\sigma_{c,d\ li}$ = 1.85 N/mm², $\sigma_{c,d\ inside}$ = 0.08 N/mm², $\sigma_{c,d\ re}$ = 1.85 N/mm²
⇒ utilization: **U = 0.71 verification successful**

2.4. Verification of compression flange

$E_{0,05}$ = 7333 N/mm², f_{c0k} = 21.0 N/mm², l = 2500 cm, i_r = 14.4 mm, A = 6000 mm²
flanges secured against buckling perpendicular to the wall surface

2.4.1. Load combination 1

f_{c0d} = 14.54 N/mm², $F_{c,d}$ = 9180 N, **$\sigma_{c0,d}$ = 1.53 N/mm²**
⇒ utilization: **U = 0.11 verification successful**

2.5. verification of vertical Borderribs

f_{c0k} = 21.0 N/mm², h = 255 cm, i_r = 34.7 mm, A = 6000 mm²
k = 1.380, k_c = 0.511, β_c = 0.200, $\lambda_{rel,c}$ = 1.2525, λ = 73.53

2.5.1. Load combination 1

f_{c0d} = 14.54 N/mm², $\Sigma F_{c,d}$ = 17781 N ⇒ **σ_c = 2.96 N/mm²**
⇒ utilization: **U = 0.40 verification successful**

2.6. Verification of vertical ribs (inside)

f_{c0k} = 21.0 N/mm², h = 255 cm, i_r = 34.7 mm, A = 6000 mm²
k = 1.380, k_c = 0.511, β_c = 0.200, $\lambda_{rel,c}$ = 1.2525, λ = 73.53

2.6.1. Load combination 1

f_{c0d} = 14.54 N/mm², $\Sigma F_{c,d}$ = 1105 N ⇒ **σ_c = 0.18 N/mm²**
⇒ utilization: **U = 0.02 verification successful**

2.7. Verification of deformation at ultimate limit state

k_{ser} = 429.8 N/mm, k_{c90} = 1.25, A_r = 5014.1 mm², l_1 = 575 mm, u_{zul} = 25.5 mm
G_{mean} = 838.5 N/mm², $E_{0,mean}$ = 8461.5 N/mm², f_{c90} = 1.92 N/mm²

2.7.1. Load combination 1

σ_{c90} = 1.85 N/mm², u_k = 3.11 mm, u_G = 0.62 mm, u_E = 0.74 mm, u_v = 1.31 mm, K_d = 1588.29 N/mm
Σ u = 5.78 mm ⇒ utilization: **U = 0.23 verification successful**

2.8. Verification of deformation at serviceability limit state

k_{ser} = 838.2 N/mm, k_{c90} = 1.25, A_r = 5014.1 mm², l_1 = 575 mm, u_{zul} = 17.0 mm
G_{mean} = 1090.0 N/mm², $E_{0,mean}$ = 11000.0 N/mm², f_{c90} = 2.50 N/mm²

2.8.1. Load combination 1

σ_{c90} = 0.53 N/mm², u_k = 0.87 mm, u_G = 0.26 mm, u_E = 0.31 mm, u_v = 0.29 mm, K_d = 2893.55 N/mm
Σ u = 1.73 mm ⇒ utilization: **U = 0.10 verification successful**

3. Summary

maximum utilization of all verifications U_{max} = 0.87 ≤ 1 ⇒ **all verifications successful**