POSITION 4: STERLING OSB

1. Input parameters

1.1. ribs (vertical), flanges (horizontal)

service class 1
panel width/height = **187.5 / 300.0 cm**
ribs **6.0 / 22.0 cm** from solid coniferous timber, C24 (S10) with ρ_k = 350 kg/m³, a_r = 62.5 cm
flanges **6.0 / 22.0 cm** from solid coniferous timber, C24 (S10) with ρ_k = 350 kg/m³

1.2. sheathing on one side

OSB 3 with ρ_k = 550 kg/m³, service class 1, t = 15.0 mm
staple, 2.15 x 64 mm, br = 5.5 mm , resined, timber at fibre saturation point
detailed verification acc. to DIN EN 1995, 8.2.2, distance a_v = 100 mm, 1-row
$F_{v,Rk}$ increased acc. to DIN EN 1995, 8.2.2(2)
vertical loads transmitted only by ribs

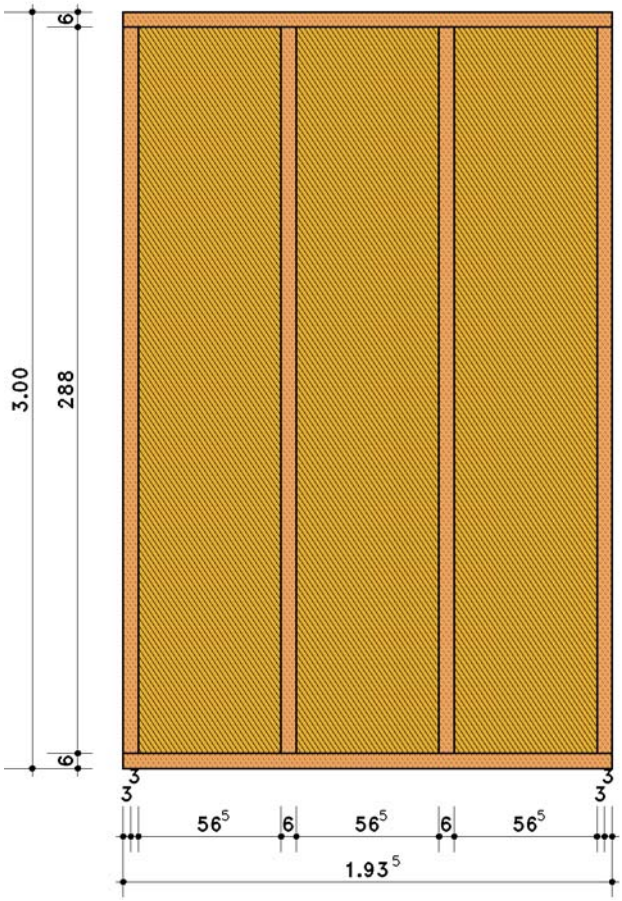
1.3. Combinations of internal forces for verifications at ultimate limit state

Nr	$F_{v,d}$ kN	E_{d1} kN/m	E_{dr} kN/m	$F_{1c,d}$ kN	$F_{2c,d}$ kN	$k_{mod,r}$ -	$k_{mod,b1}$ -	A
1	6.700	0.000	2.000	10.150	20.300	0.900	0.900	

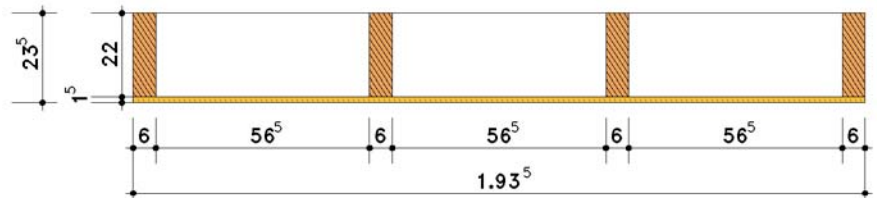
1.4. Combinations of internal forces for verifications at serviceability limit state

Nr	$F_{v,k}$ kN	E_{k1} 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

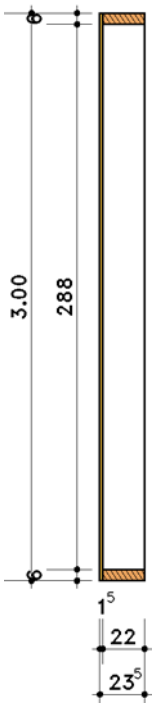
elevation scale 1:30



longitudinal section scale 1:20



transversal section scale 1:40



2. verifications acc. to DIN EN 1995, Germany

2.1. Fasteners sheathing 1

fastener ends in rib, penetration depth t = 49 mm
$f_{1k,\ Tab.\ 14}$ = 2.45 N/mm², f_{2k} = 17.50 N/mm², $F_{ax,Rk}$ = 202.80 N, ⇒ $\Delta F_{v,R}$ = **50.70 N**
f_{uk} = 600 N/mm², M_{yk} = 1317 Nmm, f_{hk} = 49.87 N/mm², β = 0.46
decisive is Eq. (Eq.(f)), γ_M = 1.30, **$F_{v,Rk}$ = 677.9 N + $\Delta F_{v,Rk}$ (50.7 N) = 728.6 N, $F_{v,Rd}$ = 504.4 N**
per staple

2.2. Verification of diaphragm loading

web
γ = 1.30, f_{vk} = 6.8 N/mm², f_{ck} = 12.7 N/mm², k_{v1} = 0.66, k_{v2} = 0.33

2.2.1. Load combination 1

wall panel in horizontal diaphragm loading
sheathing 1
$F_{v,Rd}$ = 504 N, f_{vd} = 4.71 N/mm², f_{cd} = 8.79 N/mm²
f_{v0d} = 3.33 N/mm (fastener), f_{v90d} = 5.04 N/mm (fastener)
⇒ utilization: u_{0d} = 1.07, u_{90} = -1.00 ⇒ **u = 1.07 verification not successful!!!**

2.3. Verification of compression of bottom edge beam

$A_{ef\ li}$ = 19800 mm², $A_{ef\ inside}$ = 26400 mm², $A_{ef\ re}$ = 19800 mm², x_1 = 1.00 DIN 1052, 8.7.5, k_{c90} = 1.25

2.3.1. Load combination 1

f_{v90d} = 5.04 N/mm², f_{c90d} = 2.08 N/mm², f_{rib} = 1.00
$\Sigma F_{c,d\ edge}$ = 21328 N, $\Sigma F_{c,d\ inside}$ = 21299 N, $\sigma_{c,d\ li}$ = 1.08 N/mm², $\sigma_{c,d\ inside}$ = 0.81 N/mm², $\sigma_{c,d\ re}$ = 1.08 N/mm²
⇒ utilization: **U = 0.41 verification successful**

2.4. Verification of compression flange

$E_{0,05}$ = 7333 N/mm², f_{c0k} = 21.0 N/mm², l = 1875 cm, i_r = 17.3 mm, A = 13200 mm²
flanges secured against buckling perpendicular to the wall surface

2.4.1. Load combination 1

f_{c0d} = 14.54 N/mm², $F_{c,d}$ = 6700 N, **$\sigma_{c0,d}$ = 0.51 N/mm²**
⇒ utilization: **U = 0.03 verification successful**

2.5. verification of vertical Borderribs

f_{c0k} = 21.0 N/mm², h = 300 cm, i_r = 63.6 mm, A = 13200 mm²
k = 0.873, k_c = 0.823, β_c = 0.200, $\lambda_{rel,c}$ = 0.8037, λ = 47.18

2.5.1. Load combination 1

f_{c0d} = 14.54 N/mm², $\Sigma F_{c,d}$ = 21328 N ⇒ **σ_c = 1.62 N/mm²**
⇒ utilization: **U = 0.14 verification successful**

2.6. Verification of vertical ribs (inside)

f_{c0k} = 21.0 N/mm², h = 300 cm, i_r = 63.6 mm, A = 13200 mm²
k = 0.873, k_c = 0.823, β_c = 0.200, $\lambda_{rel,c}$ = 0.8037, λ = 47.18

2.6.1. Load combination 1

f_{c0d} = 14.54 N/mm², $\Sigma F_{c,d}$ = 21299 N ⇒ **σ_c = 1.61 N/mm²**
⇒ utilization: **U = 0.13 verification successful**

2.7. Verification of deformation at ultimate limit state

k_{ser} = 285.7 N/mm, k_{c90} = 1.25, A_r = 10914.3 mm², l_1 = 565 mm, u_{zul} = 30.0 mm
G_{mean} = 830.8 N/mm², $E_{0,mean}$ = 8461.5 N/mm², f_{c90} = 1.92 N/mm²

2.7.1. Load combination 1

σ_{c90} = 1.08 N/mm², u_k = 6.50 mm, u_G = 0.86 mm, u_E = 0.46 mm, u_v = 1.19 mm, K_d = 742.75 N/mm
Σ u = 9.02 mm ⇒ utilization: **U = 0.30 verification successful**

2.8. Verification of deformation at serviceability limit state

k_{ser} = 557.2 N/mm, k_{c90} = 1.25, A_r = 10914.3 mm², l_1 = 565 mm, u_{zul} = 20.0 mm
G_{mean} = 1080.0 N/mm², $E_{0,mean}$ = 11000.0 N/mm², f_{c90} = 2.50 N/mm²

2.8.1. Load combination 1

σ_{c90} = 0.40 N/mm², u_k = 2.49 mm, u_G = 0.49 mm, u_E = 0.27 mm, u_v = 0.34 mm, K_d = 1391.72 N/mm
Σ u = 3.59 mm ⇒ utilization: **U = 0.18 verification successful**

3. Summary

maximum utilization of all verifications U_{max} = 1.07 > 1 ⇒ **verification not successful** **!!**