Compression perpendicular to the grain

The studs are supported at the base by the bottom plate which is stressed by compression forces perpendicular to the grain.

The following expression shall be satisfied:

$$\sigma_{c,90,d} \leq k_{c,90,d} \cdot f_{c,90,d}$$

with

$$\sigma_{c,90,d} = \frac{F_{c,90,d}}{A_{ef}}$$

where:

$\sigma_{c,90,d}$ is the design compressive stress in the effective contact area perpendicular to the grain;

$F_{c,90,d}$ is the design compressive load perpendicular to the grain;

A_{ef} is the effective contact area in compression perpendicular to the grain;

$f_{c,90,d}$ is the design compressive strength perpendicular to the grain;

$k_{c,90,d}$ is a factor taking into account the load configuration, the possibility of splitting and the degree of compressive deformation.

The effective contact area perpendicular to the grain, A_{ef}, should be determined taking into account an effective contact length parallel to the grain, where the actual contact length, l, at each side is increased by 30 mm, but not more than a, l or l1/2, see Figure 6.2 of EN 1995-1-1.

The value of $k_{c,90}$ should be taken as 1,0 unless the conditions in the following paragraphs apply. For members on continuous supports, provided that $l_1 \geq 2h$ (see Figure 6.2a of EN 1995-1-1), the value of $k_{c,90}$ should be taken as:

$k_{c,90}$ = 1,25 for solid softwood timber

$k_{c,90}$ = 1,5 for glued laminated softwood timber

where h is the depth of the member and l is the contact length.

The values of the actions in the tables below are related, for each wall, to the most severe combination of load for the compression Ultimate Limit State.

Wall name	Length [m]	Comb.	Dur.	N [kN]
Wall 1	5.00	ULS 53	Medium-term	111.35

The following table summarizes the compression (perpendicular to the grain) checks for plates of the framed walls.

Wall name: Wall ID

A_{eff}: Effective contact area in compression perpendicular to the grain of the bottom plate

$k_{c,90}$: Factor taking into account the load configuration, the possibility of splitting and the degree of compressive deformation

Comb.: The most severe combination

k_{mod}: Modification factor taking into account the effect of the duration of load and moisture content

γ_M: Partial factor for a material property

$f_{c,90,k}$: Characteristic compressive strength perpendicular to grain

$\sigma_{c,90,d}$: Design compressive stress perpendicular to grain

Wall name	Section	Stud	A_{eff} [mm^2]	$k_{c,90}$	Comb.	Service class	k_{mod}	γ_M	$f_{c,90,k}$ [MPa]	N [kN]	$\sigma_{c,90,d}$ [MPa]	Check
Wall 1	Frame with OSB - 2 SIDES	Internal	25600.00	1.25	ULS 53	1	0.8	1.3	2.50	13.92	0.54	28%
Wall 1	Frame with OSB - 2 SIDES	External	20800.00	1.25	ULS 53	1	0.8	1.3	2.50	7.52	0.36	19%