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:

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

with

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

where:

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

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

A is the area of the applied force;

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

$k_{c,90,d}$ is the stress spreading factor accounting for the distribution of compressive stresses in the member;

k_{mat} is the factor accounting for the material behaviour and degree of compressive deformation perpendicular to grain.

The value of k_{mat} is taken from Table 8.1 of EN 1995-1-1:2025 when applicable; otherwise, a value of 1.0 is adopted.

The stress spreading factor $k_{c,90}$ is determined from the following expression:

$$k_{c,90} = \sqrt{\frac{A_{ef}}{A}} \leq 4$$

where:

A_{ef} is the effective spreading area;

According to EN 1995-1-1:2025, the loaded area A was determined from the contact area between the stud and the bottom plate. The effective spreading area A_{ef} was then determined by applying the stress spreading gradient α specified in Table 8.2, taking into account the distribution of compressive stresses within the member.

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	SLU 66	Media	115,10

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

Wall name: Wall ID

A_{ef}: Effective spreading area

$k_{c,90}$: Stress spreading factor accounting for the distribution of compressive stresses in the member

k_{mat}: Factor accounting for the material behaviour and degree of compressive deformation perpendicular to grain.

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_{ef} [mm²]	k_{mat}	$k_{c,90}$	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	Interno	48000,00	1,40	1,73	SLU 66	1	0,8	1,3	2,50	14,39	0,90	24%
Wall 1	Frame with OSB - 2 SIDES	Esterno	32000,00	1,40	1,41	SLU 66	1	0,8	1,3	2,50	7,77	0,49	16%