

Design resistance

CALCULATION OF THE DESIGN RESISTANCE

The design value of resistance R_d , in any direction and for all type of failure, is calculated from the characteristic resistance and the partial safety factor.

$$R_d = \frac{R_k}{\gamma_M}$$

with R_k : Characteristic resistance of the anchor
 γ_M : partial safety factor depends on the type of failure

CHARACTERISTIC RESISTANCE

- The characteristic load of the anchor for concrete cone failure, in any direction, is calculated from the average value of the mean failure load for the single anchor, without the effect of spacing and edges. The characteristic load corresponds to the 5% - fractile of failure loads for the level of confidence (90%).

$$F_{Rk} = (1 - k \cdot v) \cdot F_{Rk,m}$$

This calculation depends on number of tests (k) and the variation coefficient of tests (v)
Example : for a number of tests equal to 10 anchors, we can take $k = 2,568$.

- The characteristic load of steel failure are calculated as follows :

- For tensile load:

$$N_{Rk,s} = A_0 \cdot f_{uk} \text{ [N]}$$

A_0 : min cross section [mm²]

f_{uk} : min tensile strength [N/mm²]

- For shear load:

$$V_{Rk,s} = 0,5 \cdot A_s \cdot f_{uk} \text{ [N]}$$

A_s : stressed cross section [mm²]

f_{uk} : min tensile strength [N/mm²]

CALCULATION OF PARTIAL SAFETY FACTOR

- For concrete cone failure: $\gamma_{Mc} = \gamma_c \cdot \gamma_1 \cdot \gamma_2$

γ_c : Partial safety factor for concrete under compression : $\gamma_c = 1,5$

γ_1 : Partial safety factor taking account of the scatter of the tensile strength of site concrete.

$\gamma_1 = 1$ for concrete produced and cured with normal care (EUROCODE 2 chap. 7)

γ_2 : Partial safety factor taking into account of the installation safety* of an anchor system

Tensile load:

$\gamma_2 = 1$ for systems with high installation safety*,

$\gamma_2 = 1,2$ for systems with normal installation safety*,

$\gamma_2 = 1,4$ for systems with low but still acceptable installation safety*.

Shear load:

$\gamma_2 = 1$

- For steel failure: γ_{Ms}

Tensile load:

$$\gamma_{Ms} = \frac{1,2}{f_{yk}/f_{uk}} \geq 1,4$$

Shear load:

- $\gamma_{Ms} = \frac{1,0}{f_{yk}/f_{uk}} \geq 1,25$ with $f_{uk} \leq 800\text{N/mm}^2$ and $f_{yk}/f_{uk} \leq 0,8$

- $\gamma_{Ms} = 1,5$ with $f_{uk} > 800\text{N/mm}^2$ or $f_{yk}/f_{uk} > 0,8$

(*) Installation safety means the influence of installation defects, such as diameter of drilled hole, cleaning of the hole, intensity of anchorage and striking the reinforcement during drilling.