

Loading

Introduction to EN 1990

- Covers the 'Basis of Structural Design'
- Use with the other Eurocodes
- Gives safety factors needed for ULS and SLS verifications
 - partial factors (see Table 1)
 - combination factors (See Table 2)

ULS Checks

EQU: static equilibrium

STR: strength/buckling etc

GEO: Failure of excessive deformation of ground

FAT: fatigue failure

Actions

Permanent actions , **G** (Dead loads)

Variable actions , **Q** (Live loads)

- Q_k Characteristic value ($\psi = 1.0$)
- $\psi_0 Q_k$ Combination value
- $\psi_1 Q_k$ Frequent value
- $\psi_2 Q_k$ Quasi-permanent value

Partial Factors

	Unfavourable	Favourable
γ_G	1.35	1.0
γ_Q	1.5	0

Table 1: Partial Factor values from the UK NA

Combination Factors ψ

Action	ψ_0	ψ_1	ψ_2
Imposed loads in buildings, Category A : domestic/residential areas	0.7	0.5	0.3
Category B : office areas	0.7	0.5	0.3
Category C : congregation areas	0.7	0.7	0.6
Category D : shopping areas	0.7	0.7	0.6
Category E : storage areas	1.0	0.9	0.8
Category F : traffic area, < 30kN	0.7	0.7	0.6
Category G : traffic area, 30– 160 kN	0.7	0.5	0.3
Category H : roofs	0.7	0	0
Snow (sites up to 1000m)	0.5	0.2	0
Wind	0.5	0.2	0

Table 2: Extract from Table NA.A1.1

Combinations of Actions

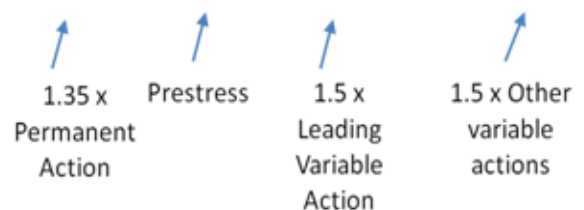
Can use either:

- Equation 6.10
- Less favourable of 6.10a and 6.10b

Method: Get the factors from Tables 1 and 2 and substitute them into the equation you are using, check for a range of different loading combinations and take the least favourable result.

Equation 6.10

$$\sum \gamma_{G,j} G_{k,j} \text{ "+" } \gamma_P P \text{ "+" } \gamma_{Q,1} Q_{k,1} \text{ "+" } \sum \gamma_{Q,i} \psi_{0,i} Q_{k,i}$$



Equation 6.10a

$$\sum \gamma_{G,j} G_{k,j} \text{ "+" } \gamma_P P \text{ "+" } \gamma_{Q,1} \psi_{0,i} Q_{k,1} \text{ "+" } \sum \gamma_{Q,i} \psi_{0,i} Q_{k,i}$$

Equation 6.10b

$$\sum \xi_j \gamma_{G,j} G_{k,j} \text{ "+" } \gamma_P P \text{ "+" } \gamma_{Q,1} Q_{k,1} \text{ "+" } \sum \gamma_{Q,i} \psi_{0,i} Q_{k,i}$$

ξ_j is 0.925 (From NA 2.2.3.2)