RC Short Column Axial Load Capacity

Squash load, nominal and design axial capacity of a short reinforced concrete column with a factor for minimum eccentricity, and the steel area for a design load.

Method: Axial capacity of short tied columns

Input parameters

Unit system: SI

Parameter	Value	Unit
Concrete strength	30.000	MPa
Steel yield strength	420.00	MPa
Column width	400.00	mm
Column depth	400.00	mm
Longitudinal steel area	2,400.0	mm²
Concrete stress factor	0.85000	
Factor for minimum eccentricity	80.000	%
Strength reduction factor	65.000	%
Design axial load	2,500.0	kN

Calculated results

Parameter	Value	Unit
Steel ratio	1.5000	%
Squash load	5,026.8	kN
Nominal capacity	4,021.4	kN
Design capacity	2,613.9	kN
Steel area for the design load	1,844.6	mm²

Notes for this case

• P₀ = α₁f'_c(A_g − A_st) + f_yA_st. Valid for short, braced columns under nearly axial load; slender columns and real moments need an interaction diagram. Take k_e, φ and steel limits (usually 1–4 %) from your code; a zero steel area means concrete alone suffices and minimum steel governs.

Formula and method

$$P_0 = \alpha_1 f'_c (A_g - A_{st}) + f_y A_{st}, \quad \phi P_n = \phi k_e P_0$$

Variables

f'_c	Concrete strength	Pa
f_y	Steel yield strength	Pa
b	Column width	m
h	Column depth	m
A_{st}	Longitudinal steel area	m²
α_1	Concrete stress factor	-
k_e	Factor for minimum eccentricity	-
ϕ	Strength reduction factor	-
P_u	Design axial load	N
ρ_g	Steel ratio	-

P_0	Squash load	N
P_n	Nominal capacity	N
ϕP_n	Design capacity	N
$A_{st,req}$	Steel area for the design load	m²

Method and standards

Axial capacity.

Assumptions and limits

- Short braced column; concentric load.

References

Axial capacity of short tied columns

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/concrete/rc-short-column-axial-capacity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.