Punching Shear around a Column in a Flat Slab

Critical perimeter and punching shear stress around an interior, edge or corner column in a slab, the ratio to an allowable stress and the depth needed.

Method: Two-way (punching) shear at a critical perimeter

Input parameters

Unit system: SI

Parameter	Value	Unit
Column position	Interior	
Punching shear force	600.00	kN
Column dimension c_1	400.00	mm
Column dimension c_2 (along the edge)	400.00	mm
Slab effective depth	200.00	mm
Allowable punching shear stress	1.4000	MPa

Calculated results

Parameter	Value	Unit
Critical perimeter at d/2	2,400.0	mm
Shear stress	1.2500	MPa
Utilisation	89.286	%
Effective depth needed	183.59	mm

Notes for this case

• Critical section d/2 from the column faces: interior $b_0 = 2(c_1 + c_2) + 4d$, edge $2c_1 + c_2 + 2d$, corner $c_1 + c_2 + d$. Unbalanced moments at edge and corner columns raise the peak stress well above $V/(b_0 d)$; take allowable stress and moment transfer rules from your code.

Formula and method

$$b_0 = A + Bd, \quad v = \frac{V}{b_0 d}, \quad d_{req} = \frac{-Av_c + \sqrt{A^2 v_c^2 + 4Bv_c V}}{2Bv_c}$$

Variables

pos	Column position	-
V	Punching shear force	N
c_1	Column dimension c_1	m
c_2	Column dimension c_2 (along the edge)	m
d	Slab effective depth	m
v_c	Allowable punching shear stress	Pa
b_0	Critical perimeter at d/2	m
v	Shear stress	Pa
v/v_c	Utilisation	-
d_{req}	Effective depth needed	m

Method and standards

Punching perimeter.

Assumptions and limits

- Rectangular column; no openings near the column.

References
Two-way (punching) shear at a critical perimeter

Report details

Report reference	FCC-SXHS-TCM0 (the same inputs always give the same reference)
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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/punching-shear-slab

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Reopens the calculator with the inputs of this report.