Wind Bracing Diagonal: Force, Slenderness and Buckling Load

Axial force and stress in the diagonal of a braced bay from a horizontal load, for tension-only or paired bracing, with slenderness and Euler load.

Method: Statics of a braced bay; Euler buckling

Input parameters

Unit system: SI

Parameter	Value	Unit
Horizontal force on the bay	120.00	kN
Bay width	6.0000	m
Bay height	5.0000	m
Bracing action	Tension-only (one diagonal acts)	
Diagonal cross-section area	1,500.0	mm²
Minimum radius of gyration	30.000	mm
Elastic modulus	200.00	GPa
Effective length factor	0.85000	

Calculated results

Parameter	Value	Unit
Diagonal length	7.8102	m
Diagonal force	156.20	kN
Axial stress	104.14	MPa
Slenderness ratio	221.29	
Euler buckling load	60.464	kN

Notes for this case

• F = H/cosα = H·L_d/b for one acting diagonal; with both diagonals sharing, each carries half, one in tension and one in compression. Compare compression with the user's column curve rather than Euler alone; tension-only rods and flats are usually limited to slenderness of a few hundred to stop sag and rattle.

Formula and method

$$L_d = \sqrt{b^2 + h^2}, \quad F = \frac{H L_d}{b}, \quad P_E = \frac{\pi^2 E A}{(K L_d / r)^2}$$

Variables

H	Horizontal force on the bay	N
b	Bay width	m
h	Bay height	m
mode	Bracing action	-
A	Diagonal cross-section area	m²
r	Minimum radius of gyration	m
E	Elastic modulus	Pa
K	Effective length factor	-
L_d	Diagonal length	m
F	Diagonal force	N

σ	Axial stress	Pa
KL/r	Slenderness ratio	-
P_E	Euler buckling load	N

Method and standards

Bracing force.

Assumptions and limits

- Pin-jointed bay; single horizontal load; elastic buckling.

References

Statics of a braced bay; Euler buckling

Report details

Report reference	FCC-KGYR-98XM (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/steel/bracing-diagonal-force

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.