Flexural Crack Width (Gergely–Lutz)

Probable maximum flexural crack width at the tension face of a reinforced concrete beam from the steel stress, cover and bar spacing, by the Gergely–Lutz equation.

Method: Gergely–Lutz crack width equation (SI form)

Input parameters

Unit system: SI

Parameter	Value	Unit
Steel stress at service load	240.00	MPa
Cover to the centre of the bar nearest the tension face	50.000	mm
Width of the tension zone	300.00	mm
Number of bars	4.0000	
Overall depth	600.00	mm
Effective depth	550.00	mm
Neutral axis depth at service load (cracked elastic)	170.00	mm

Calculated results

Parameter	Value	Unit
Effective tension area of concrete per bar	7,500.0	mm²
Strain gradient factor (h − x)/(d − x)	1.1316	
Probable maximum crack width	0.21543	mm

Notes for this case

• Gergely and Lutz fitted measured crack widths: w = 11 × 10⁻⁶ β f_s ∛(d_c A) in mm, with f_s in MPa, d_c in mm and A = 2 d_c b/n in mm². Widths grow with steel stress and cover; many smaller bars give finer cracks than a few large ones. Typical limits are 0.3 mm for interior exposure and 0.1–0.2 mm for water-retaining or aggressive exposure. Crack widths scatter widely: treat the result as a probable maximum, not a guarantee.

Formula and method

$$w = 11 \times 10^{-6}\,\beta\, f_s \sqrt[3]{d_c A} \quad (\text{mm},\ \text{MPa},\ \text{mm}^2), \quad A = \frac{2 d_c b}{n}, \quad \beta = \frac{h - x}{d - x}$$

Variables

f_s	Steel stress at service load	Pa
d_c	Cover to the centre of the bar nearest the tension face	m
b	Width of the tension zone	m
n	Number of bars	-
h	Overall depth	m
d	Effective depth	m
x	Neutral axis depth at service load (cracked elastic)	m
A	Effective tension area of concrete per bar	m²
β	Strain gradient factor (h − x)/(d − x)	-
w	Probable maximum crack width	m

Method and standards

Crack width.

Assumptions and limits

- Flexural cracks at the tension face; one layer of bars.

References

Gergely–Lutz crack width equation (SI form)

Report details

Report reference	FCC-725Q-X2XK (the same inputs always give the same reference)
Generated	23 November 2026, 18:08 UTC
Calculator	Flexural Crack Width (Gergely–Lutz)
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
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/crack-width-gergely-lutz

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.