Shear Flow and Fastener Spacing in a Built-Up Beam

Shear flow at a joint of a built-up beam from shear force, first moment of area and second moment of area, and the bolt, nail or weld spacing needed.

Method: Shear flow in built-up members

Input parameters

Unit system: SI

Parameter	Value	Unit
Shear force	120.00	kN
First moment of the connected part about the neutral axis	900.00	cm^3
Second moment of area of the whole section	45,000	cm^4
Capacity of one fastener	60.000	kN
Fasteners per row (across the joint)	2.0000	
Width at the joint (for stress)	12.000	mm

Calculated results

Parameter	Value	Unit
Shear flow	240.00	kN/m
Maximum fastener row spacing	500.00	mm
Shear stress at the joint	20.000	MPa

Notes for this case

• Bending stresses differ on either side of a short length of beam, and the difference must be passed across any joint between the parts as a longitudinal shear flow q = VQ/I, where Q is the first moment about the neutral axis of the part outside the joint. Fasteners at spacing s each carry q·s/n_f, so s ≤ n_fF_c/q; welds must resist q per metre. Spacing can widen where the shear force is smaller, but stays within detailing limits.

Formula and method

$$q = \frac{VQ}{I}, \quad s = \frac{n_f F_c}{q}, \quad \tau = \frac{q}{b}$$

Variables

V	Shear force	N
Q	First moment of the connected part about the neutral axis	m^3
I	Second moment of area of the whole section	m^4
F_c	Capacity of one fastener	N
n_f	Fasteners per row (across the joint)	-
b	Width at the joint (for stress)	m
q	Shear flow	N/m
s	Maximum fastener row spacing	m
τ	Shear stress at the joint	Pa

Method and standards

Shear flow.

Assumptions and limits

- Elastic bending; prismatic section; shear evenly shared by fasteners in a row.

References

Shear flow in built-up members

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/steel/shear-flow-built-up-beam

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.