
Beam/lintel section

Calculations for timber beams/lintels are in accordance with BS5268:Pt 2:2002

Number of parallel pieces making up beam/lintel			= 3
Section size of each timber	- 47 wide x 175 deep		
Timber type	- Sawn Softwood as Table NA.2 of BS EN 336		
Span of beam/lintel			= 3 m
Span type			- Simple
End bearing	- left hand end	X	= 0 mm
		Y	= 50 mm
	- right hand end	X	= 0 mm
		Y	= 50 mm
End notches	- left hand end - none specified		
	- right hand end - none specified		
Strength class from Table 8 (service classes 1 & 2)			- C24
Service class	- 2 (Covered and heated or unheated)		
Maximum design moment			= 3.26 kNm
Design shear force at left hand support			= 4.35 kN
Design shear force at right hand support			= 4.35 kN

Load Description	Type	A	B	C	Gk	Qk
	UDL	0	3		1.5	1.4

Grade stresses

Bending parallel to grain	= 7.5 N/mm^2
Shear parallel to grain	= 0.71 N/mm^2
Compression perpendicular to grain (wane prohibited at bearing areas)	= 2.4 N/mm^2

Modification factors

For service class 2	- moment	K_{2M}	= 1
	- shear	K_{2V}	= 1
	- bearing	K_{2B}	= 1
	- Youngs mod	K_{2E}	= 1
	- Shear mod	K_{2E}	= 1
For load duration	- long	K_3	= 1
For end bearing	- left end	K_{4l}	= 1
	- right end	K_{4r}	= 1
For no end notch	- left end	K_{5l}	= 1
For no end notch	- right end	K_{5r}	= 1

For depth between 72 and 300mm $K_7 = (300/h)^{0.11}$

$= (300/175)^{0.11}$

$= 1.06$

For load sharing system $K_8 = 1.1$

For 3 pieces of softwood $K_9 = 1.21$

The section is checked assuming that all the pieces of the beam/lintel act together as a load sharing system. The pieces must be connected together in such a manner to ensure this is achieved.

Bending Design

The allowable bending stress is

$\sigma_{bpall} = \sigma_{bp} * K_{2M} * K_3 * K_7 * K_8$

$= 7.5*1*1*1.06*1.1$

$= 8.75 \text{ N/mm}^2$

The required section modulus is

$z_{reqd} = M*10^6/\sigma_{bpall}$

$= 3.26*10^6/8.75$

$= 372571 \text{ mm}^3$

The section modulus of the beam/lintel chosen is 720000 mm^3.

Shear Design

Left hand support

The allowable shear stress is

$\sigma_{cpaall} = \sigma_{cpa} * K_{2V} * K_3 * K_{5l} * K_8$

$= 0.71*1*1*1*1.1$

$= 0.78 \text{ N/mm}^2$

The required cross sectional area is

$A_{lreqd} = 3*R_l*10^3/(2*\sigma_{cpaall})$

$= 3*4.35*10^3/(2*0.78)$

$= 8365 \text{ mm}^2$

The cross sectional area of the beam/lintel chosen is

$A_{lprov} = N_{tim} * b * h$

$= 3*47*175$

$= 24675 \text{ mm}^2$

Right hand support

The allowable shear stress is

$\sigma_{cpaall} = \sigma_{cpa} * K_{2V} * K_3 * K_{5r} * K_8$

$= 0.71*1*1*1*1.1$

$= 0.78 \text{ N/mm}^2$

The required cross sectional area is

$A_{rreqd} = 3*R_r*10^3/(2*\sigma_{cpaall})$

$= 3*4.35*10^3/(2*0.78)$

$= 8365 \text{ mm}^2$

The cross sectional area of the beam/lintel chosen is

$A_{rprov} = N_{tim} * b * h$

$= 3*47*175$

$= 24675 \text{ mm}^2$

Bearing Design

Left hand support

The allowable bearing stress is

σ_{cpeall} = σ_{cpe}*K_{2B}*K_3*K_{4l}*K_8
= 2.4*1*1*1*1.1
= 2.64 N/mm^2

The required bearing area is

A_{blreqd} = R_l*10^3/σ_{cpeall}
= 4.35*10^3/2.64
= 1648 mm^2

The bearing area of the beam/lintel chosen is

A_{blprov} = N_{tim}*b*Y_l
= 3*47*50
= 7050 mm^2

Right hand support

The allowable bearing stress is

σ_{cpeall} = σ_{cpe}*K_{2B}*K_3*K_{4r}*K_8
= 2.4*1*1*1*1.1
= 2.64 N/mm^2

The required bearing area is

A_{brreqd} = R_r*10^3/σ_{cpeall}
= 4.35*10^3/2.64
= 1648 mm^2

The bearing area of the beam/lintel chosen is

A_{brprov} = N_{tim}*b*Y_r
= 3*47*50
= 7050 mm^2

Deflection check

The deflection calculated includes for shear deflection and is based on the following material properties which incorporate modification factors K_2 and K_9 as appropriate.

- Young's modulus - E = 8712 N/mm^2
- Shear modulus - G = 545 N/mm^2
- Shape factor - F = 1.2 (for rectangular sections)

and section properties of

- Area - A = 247 cm^2
- Mom. of inertia - I = 6300 cm^4

The maximum calculated deflection is 5.8 mm.

The allowable deflection in accordance with clause 2.10.7 is 9 mm (0.003*Span).

The section PASSES all the checks.