

2.14 Maintenance

The Construction (Design and Maintenance) Regulations¹⁵ require the Designer to consider risks to the health and safety of persons engaged in the maintenance of the structure, to provide safe means of access to elements needing maintenance, and to provide this information for recording in the health and safety file.

2.15 Service class

2.15.1 Effect of moisture on strength and stiffness

An increase in moisture content reduces the strength and stiffness properties of timber and wood-based materials and increases the amount of creep that occurs. Designs to EC5 should allow for the effects of moisture on strength and creep, but not on the instantaneous stiffness properties (see Section 2.17).

2.15.2 Definitions of service classes

Moisture content depends on both temperature and atmospheric humidity. For simplicity the moisture content is related to one of three ‘service classes’ which are defined in Table 2.1.

Service class	Temperature	Approximate maximum humidity	EMC^a (%)	Examples from the EC5 NA
1	20°C	65%	12%	Warm roofs, intermediate floors, timber-frame walls – internal and party walls
2	20°C	85%	20%	Cold roofs, ground floors, timber-frame walls – external walls, external uses where member is protected from direct wetting
3	Conditions leading to higher moisture contents than service class 2.		> 20%	External uses – fully exposed

Note
^a EMC = Maximum equilibrium moisture content for most softwoods.

2.16 Load duration

2.16.1 Effect of load duration on strength and stiffness

An increase in load duration reduces the loads which timber can resist and increases the creep but not the instantaneous elastic stiffness. Designs to EC5 should allow for these effects (see Section 2.17).

Table 4.5 Continued

Quick conversion formulae			
Material	Density units	Weight	Symbols
Beam and column materials	ρ (kg/m ³)	$9.81\rho bh \times 10^{-9}$ kN/m	b = breadth mm h = depth mm
Sheet materials	ρ (kg/m ³)	$9.81\rho t \times 10^{-6}$ kN/m ²	t = thickness mm
Sheet materials	ρ (kg/m ³)	$9.81\rho \times 10^{-3}$ kN/m ³	

4.8 Roofs

4.8.1 Introduction

Section 7 describes the structural functions of roofs and the principal types of timber roof. Table 4.6 shows some typical timber roof solutions with feasible spans, typical proportions and suitable materials. Figure 4.2 shows the most common forms of trussed rafter configuration.

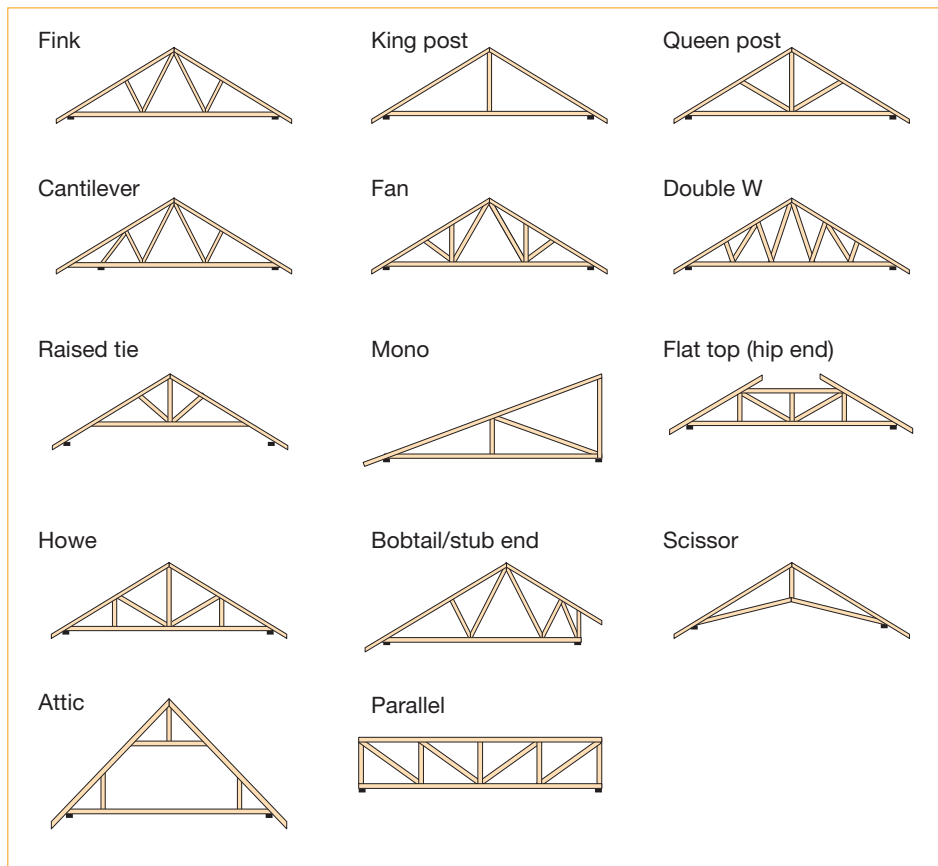


Fig 4.2 Trussed rafter configurations

6.8.2.4 Axially loaded rods

- i) The axial strength of the threaded rod should be checked based on its yield strength and its root diameter (see BS EN ISO 898-1⁹³ and EC3).
- ii) For the strength of the adhesive bond between the timber and rods inserted either parallel or perpendicular to the grain, verify that:

$$F_{ax,d} \leq \frac{nk_{mod} f_{short} \rho_k d_{ef} l}{\gamma_M} \text{ N, for } l < 200\text{mm} \quad \text{or}$$

$$F_{ax,d} \leq \frac{nk_{mod} f_{long} \rho_k d_{ef} \sqrt{l}}{\gamma_M} \text{ N, for } l \geq 200\text{mm}$$

Where n , ρ_k , d_{ef} and l are defined as previously

f_{short}	=	0.037 for epoxy resin, PRF and other brittle adhesives
	=	0.046 for 2-part polyurethane and other non-brittle adhesives
f_{long}	=	0.520 for epoxy resin, PRF and other brittle adhesives
	=	0.650 for 2-part polyurethane and other non-brittle adhesives
γ_M	=	material safety factor for the timber material (Table 3.19)

- iii) For rods inserted parallel to the grain, $F_{ax,d}$ must not exceed the compressive or tensile strength of the effective area of the member behind the rods. Verify that:

$$F_{ax,d} \leq \frac{k_{mod} f_{ax,k} b_{ef} h_{ef}}{\gamma_M}$$

Where $f_{ax,k}$	=	characteristic tension or compression strength, as appropriate (N/mm ²)
b_{ef} , h_{ef}	=	effective breadth and depth of rod group (see Figure 6.8a))
γ_M	=	material safety factor for the timber material (Table 3.19)

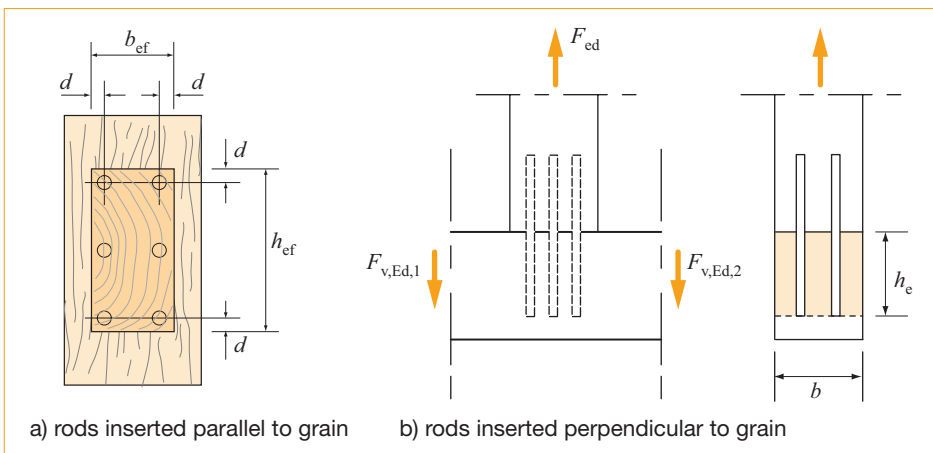


Fig 6.8 Effective cross-sectional dimensions for axially loaded rods

CD1.2 Properties of strength-graded oak

BS 5758:1997 gives grading rules for temperate hardwoods such as oak and sweet chestnut. Grades THA and THB are designated as ‘heavy structural’ grades which are for use when the cross-sectional area is at least 20000mm² and the minimum cross-sectional dimension is 100mm. Grade THA is the higher grade. Grades TH1 and TH2 are for smaller sections, with grade TH1 being the higher grade.

BS 5268-2:2002 gives properties for oak and sweet chestnut graded as above, but these properties cannot be used directly with EC5. However it specifies equivalent solid timber

strength classes for oak graded to TH1, THA and THB, and gives the densities for all four grades. The table below reproduces the properties for the BS EN 338:2003 strength classes to which BS 5268-2 designates the three BS 5758 grades of oak mentioned above, and tabulates the corresponding densities given in BS 5268-2 for all four grades of oak. It also gives properties for TH2 which have been scaled from the values for TH1 using the corresponding values given in BS 5268-2 for TH1 and TH2.

The values tabulated may be conservative compared with the values directly assigned to BS 5758 grades given in BS 5268-2 Table 15.

Table CD1.2 Properties of oak grades ^a BS 5268-2 and BS EN 338					
		Grades to BS 5758			
		TH1	TH2	THA	THB
Strength properties (N/mm ²)					
Bending	$f_{m,k}$	30	24.4	40	30
Tension parallel to grain	$f_{t,0,k}$	18	14.6	24	18
Tension perpendicular to grain	$f_{t,90,k}$	0.6	0.6 ^b	0.6	0.6
Compression parallel to grain	$f_{c,0,k}$	23	20.8	26	23
Compression perpendicular to grain	$f_{c,90,k}$	8.0	8.0	8.8	8.0
Shear parallel to grain	$f_{v,k}$	3.0	3.0	3.8	3.0
Stiffness properties (N/mm ²)					
Mean MOE parallel to grain	$E_{0,mean}$	10000	6720	11000	10000
5th percentile MOE parallel to grain	$E_{0,05}$	8000	6590	9400	8000
Mean MOE perpendicular to grain	$E_{90,mean}$	640	450 ^b	750	640
Mean shear modulus	G_{mean}	600	420 ^b	700	600
Density (kg/m ³)					
Characteristic density	ρ_k	569	598	595	584
Mean density	ρ_{mean}	680	704	713	692
Notes					
a These properties are compatible with timber conditioned at a temperature of 20°C and a relative humidity of 65%.					
b See BS EN 338 Annex A.					