PERMISSIBLE STRESS IN STRUCTURAL DESIGN OF TIMBER

List of Design checks:

In timber structural design, list of checks for the permissible stresses are:

1) Flexural strength
2) Shear strength
3) Bearing strength
4) Lateral stability
5) Deflection

For each strength parameter, allowable value must be greater than the actual or applied value. The determination of the allowable value depends on the modification factors K_1 , K_2 , K_3 , K_4 , and K_5 . Use characteristic load, $W = 1.0\ G_k + 1.0\ Q_k$ for the calculation of the actual stresses.

Modification factors:

1. Duration of Loading, K_1

Refer to Table 5 MS 544. For long term, use $K_1 = 1.0$

2. Load sharing factor, K_2

If the number of member in one row is more than 4, and the spacing of the members is < 600 mm, $K_2 = 1.1$ and use average E . Otherwise, use $K_2 = 1.0$ use E minimum.

3. Length and position of bearing, K_3

Refer to Clause 11.2 MS 544, Table 6 and Figure 1. Conservatively, assume as 1.0.

4. Notch at the end of member, K_4

Refer to Clause 11.4 and Figure 2.

5. Shape factor, K_5

Refer to Clause 11.5.

6. Depth factor, K_6

Refer to Clause 11.6.

Design Check Calculation:

1) Deflection

Actual deflection, $\Delta s = \frac{5WL^3}{384\,EI}$ for uniformly distributed load

Permissible deflection $\Delta p = 0.003L$

2) Flexural strength

$f_s = M / Z$

$f_p = f_g \times k_1 \times k_2 \times k_5 \times k_6$

3) Shear strength

$q_s =$ 1.5 x Average shear stress

$q_p = q_g \times k_1 \times k_2 \times k_4$

where; q_g = grade shear stress normal to grain

4) Bearing stress

C_{ts} = Bearing force (or support reaction) / Bearing area

$C_{tp} = C_{tg} \times k_1 \times k_2 \times k_3$

C_{tg} = grade bearing stress normal to grain

5) Lateral stability

$$\left(\frac{D}{B}\right)_s < \left(\frac{D}{B}\right)_p$$

where ; D = depth
B = width

Refer to Table 7 for the allowable limit of D/B ratio.