6.3 Design Member Capacity in Axial Compression

The design member capacity in axial compression accounts for the effect of overall member buckling and is obtained using Clause 6.3 of AS 4100 and is given by:

$$\phi N_c = \phi \alpha_c N_s \le \phi N_s$$

where ϕ = 0.9 (Table 3.4 of AS 4100)

α_c = member slenderness reduction factor

The member slenderness reduction factor (α_c) depends on the modified member slenderness (λ_n) and the member section constant (α_b). From Clause 6.3.3 of AS 4100:

$$\alpha_c = \xi\left\{1-\sqrt{\left[1-\left(\frac{90}{\xi\lambda}\right)^2\right]}\right\}$$

where

$$\xi = \frac{\left(\frac{\lambda}{90}\right)^2 + 1 + \eta}{2\left(\frac{\lambda}{90}\right)^2} \qquad \lambda_n = \left(\frac{l_e}{r}\right)\sqrt{k_f}\sqrt{\left(\frac{f_y}{250}\right)}$$

$$\lambda = \lambda_n + \alpha_a\alpha_b \qquad \alpha_a = \frac{2100(\lambda_n - 13.5)}{\lambda_n^2 - 15.3\lambda_n + 2050}$$

$\eta = 0.00326\,(\lambda - 13.5) \ge 0$

l_e = effective length of a compression member about the axis of buckling

r = radius of gyration about the axis of buckling

For routine design the above equations need not be used. Table 6.3.3(3) of AS 4100 may be consulted to obtain the value of (α_c) directly once λ_n and α_b are evaluated.

Note that the design member capacity equals the design section capacity (i.e. $\phi N_c = \phi N_s$) when the effective length is zero (l_e = 0).

Table T6.1 lists values of α_b for the sections considered in these Tables. (From Table 6.3.3 of AS 4100)

TABLE T6.1: Values of Member Section Constant (α_b)

Section	Residual Stresses (Table 6.2.4 of AS 4100)	Yield Slenderness Limit λ_{ey}	α_b	
			k_f = 1.0	k_f < 1.0
WB, WC	HW	35 (web), 14 (flange)	0	0.5
UB, UC, TFB	HR	45 (web), 16 (flange)	0	0
PFC	HR	45 (web), 16 (flange)	0.5	1.0
BT, CT	HR	45 (web), 16 (flange)	0.5	1.0
EA, UA	HR	16 (flange)	0.5	1.0