5.3.2 Design Member Moment Capacity

Designers must ensure that the design bending moment (M^*) $\leq$ ϕM_b for all beam segments. The tabulated values of design member moment capacity (ϕM_b) are determined in accordance with Clause 5.6.1.4 of AS 4100 as:

$\phi M_b = \phi \alpha_m \alpha_s M_s \leq \phi M_s$

where ϕ = 0.9 (Table 3.4 of AS 4100)

α_m = moment modification factor (Clause 5.6.1.1 of AS 4100)

= 1.0 **(Assumed for all entries in Tables 5.3-1 to 5.3-2 – based on uniform moment case)**

α_s = slenderness reduction modification factor (Clause 5.6.1.1 of AS 4100)

$$= 0.6\left\{\sqrt{\left[\left(\frac{M_s}{M_{oa}}\right)^2 + 3\right]} - \left(\frac{M_s}{M_{oa}}\right)\right\}$$ (Equation 5.6.1.1(2) of AS 4100)

M_{oa} = M_o – the reference buckling moment (Clause 5.6.1.1(a)(iv)(A) of AS 4100)

$$= \sqrt{\left(\frac{\pi^2 EI_y}{L_e^2}\right) GJ}$$ (equation 5.6.1.1(3) of AS 4100 with $I_w = 0$)

L_e = effective length of beam segment.

5.3.3 Beam Effective Length

The value of ϕM_b depends on the effective length (L_e) of the flexural member. L_e is determined by:

	L_e	$= k_t\, k_l\, k_r\, L$	(Clause 5.6.3 of AS 4100)
where	k_t	= twist restraint factor	(Table 5.6.3(1) of AS 4100)
	k_l	= load height factor	(Table 5.6.3(2) of AS 4100)
	k_r	= lateral rotation restraint factor	(Table 5.6.3(3) of AS 4100)
	L	= length of segment	

Ref. [5.4] provides guidance on the restraint conditions on flexural members provided by many common structural steelwork connections. Additionally, Ref. [5.5] considers further guidance on unbraced cantilevers.

5.3.4 Other Loading and Restraint Conditions

The design member moment capacities presented in the 5.3 series tables can be used for other loading conditions. For these situations the effective length (L_e) corresponding to the actual length and restraint conditions must be assessed and the appropriate value of α_m determined in accordance with Clause 5.6.1.1(a) of AS 4100. The design member moment capacity can then be determined as the *lesser* of:

$\phi M_{sx} = \phi Z_{ex} f_y$

and $\phi M_b = \phi \alpha_m \alpha_s Z_{ex} f_y$

where ϕ = 0.9 (Table 3.4 of AS 4100)

ϕM_b = α_m times the value of ϕM_b (= $\phi \alpha_s Z_{ex} f_y$) given in Tables 5.3-1 to 5.3-2.

Tables 5.3-1 to 5.3-2 are based on the most critical moment distribution – i.e. uniform moment over the entire beam segment (α_m = 1.0). For other values of α_m, designers should use the *lesser* of ϕM_{sx} and α_m (ϕM_b) where ϕM_b is the value given in the appropriate table for the same effective length.

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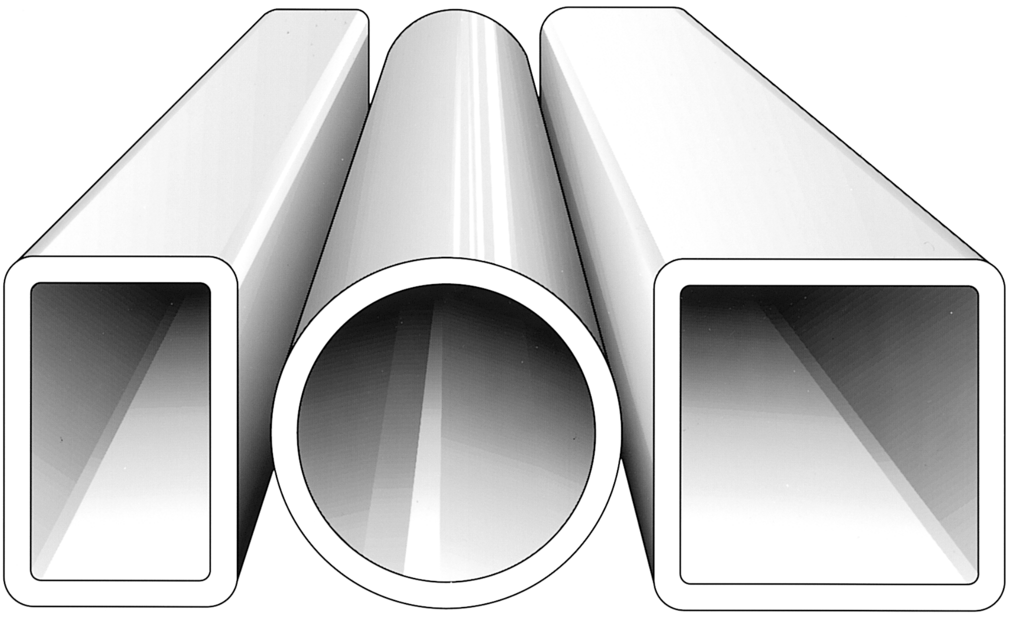

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$S^* \leq \phi R_u$

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TABLES

NOTE: SEE SECTION 2.1 FOR THE SPECIFIC MATERAL STANDARD (AS 1163) REFERRED TO BY THE SECTION TYPE AND STEEL GRADE IN THESE TABLES