For Structural Tees there is an additional term, the monosymmetry section constant (β_x), in the formula for M_{oa} to account for the asymmetry about the x-axis. For more details of this constant refer to Clause 5.6.1.2 and Appendix H4 of AS4100.

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, and Ref. [5.5] provides 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 5.3-10.

Tables 5.3-1 to 5.3-10 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 $\alpha_m(\phi M_b)$ where ϕM_b is the value given in the appropriate table for the same effective length for α_m = 1.0

5.3.5 Segment Length for Full Lateral Restraint (FLR)

Section 5.2.2.2 provides information for the calculation of FLR for open sections. The tabulated values of FLR in Tables 5.3-1 to 5.3-10 are based on the conservative value of β_m = -1.0. Higher values of FLR may be obtained if transverse loads are present on the beam segment or if the end moments of the beam segment are different in magnitude or direction – Clause 5.3.2.4 of AS 4100 should be consulted in these situations.

5.3.6 Examples

1. Beam with Restraint at Load Points and Ends

A simply supported beam as shown in Figure 5.4 has two concentrated loads applied to the top flange. Full restraint is provided at the load points and the supports. The calculated design load at each point is 20kN and includes an allowance for self weight. What size Universal Beam is required to support these loads?