Slender sections are those whose thickness ratios exceed the limits for semi-compact sections. Their design strength p_y has to be reduced using a stress reduction factor for slender elements, obtained from Table 8 of BS 5950.

The stress distribution and moment capacity for each class of section is shown in Figure 5.8.

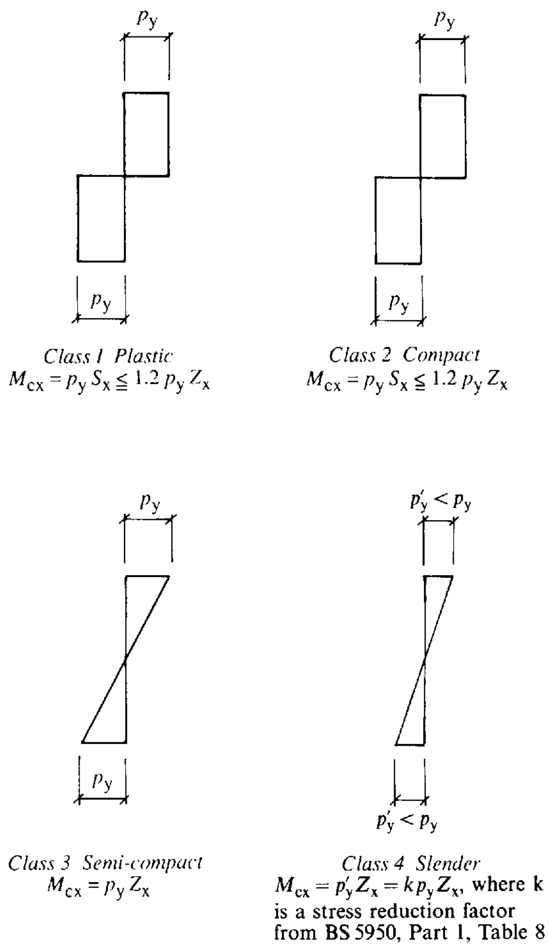

Figure 5.8 *Stress distribution diagrams and moment capacities for section classes*

The examples contained in this manual are based upon the use of grade 43 steel sections. All the UB sections formed from grade 43 steel satisfy either the plastic or the compact classification parameters, and hence the stress reduction factor for slender elements does not apply. Furthermore, their plastic modulus S_x never exceeds 1.2 times their elastic modulus Z_x. Therefore the moment capacity of grade 43 beams will be given by the expression

$$M_{cx} = p_y S_x$$

By rearranging this expression, the plastic modulus needed for a grade 43 UB section to resist a particular ultimate moment may be determined:

$$S_x \textit{ required} = \frac{M_u}{p_y}$$

Example 5.1

Steel floor beams arranged as shown in Figure 5.9 support a 150 mm thick reinforced concrete slab which fully restrains the beams laterally. If the floor has to support a specified imposed load of 5 kN/m^2 and reinforced concrete weighs 2400 kg/m^3, determine the size of grade 43 UBs required.

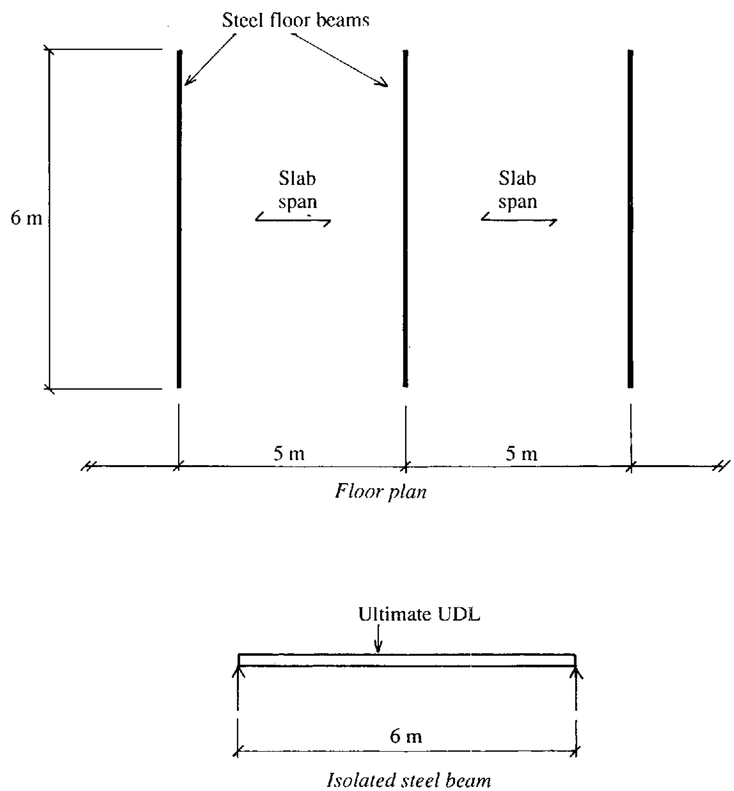

Figure 5.9 *Floor beam arrangement*

Before proceeding to the design of the actual beams it is first necessary to calculate the ultimate design load on an individual beam. This basically follows the procedure explained in Chapter 1, except that partial safety factors for load γ_f need to be applied since we are using limit state design.

Specified dead load 150 mm slab $= 0.15 \times 2400/100 = 3.6$ kN/m^2

Specified dead load UDL $= (3.6 \times 6 \times 5) + \text{SW} = 108 + \text{ say } 4 = 112$ kN