considered to be dispersed through the flange at a slope of 1:2.5 to the point where the beam flange joins the web, that being the critical position for web bearing (see Figure 5.22).

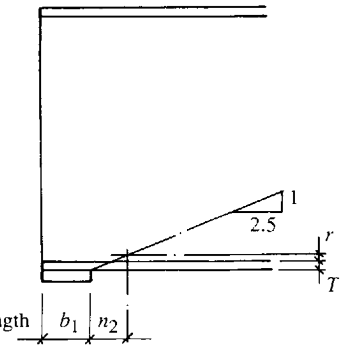

Figure 5.22 *Web bearing resistance: load dispersal*

The ultimate web bearing capacity P_{crip} of a beam is given by the following expression:

$$P_{crip} = (b_1 + n_2)tp_{yw}$$

where

b_1 stiff bearing length
n_2 length obtained by dispersion at a slope of 1:2.5 through the flange to the flange to web connection: $n_2 = 2.5(r + T)$
r root radius of the beam, from section tables
T beam flange thickness, from section tables
p_{yw} design strength of the web: $p_{yw} = p_y$

Example 5.9

Check the web bearing capacity of the beam that was designed for bending in Example 5.1. It may be assumed that the beam is supported on a stiff bearing length of 75 mm, as indicated in Figure 5.23.

From the loading diagram for this beam shown in Figure 5.17, the maximum ultimate reaction is 198.4 kN.

The section selected to resist bending was a 457 × 152 × 60 kg/m UB, for which the relevant properties for checking web bearing, from Table 5.2, are as follows:

$$r = 10.2\,\text{mm} \qquad T = 13.3\,\text{mm} \qquad t = 8.0\,\text{mm}$$

$$\text{Stiff bearing length } b_1 = 75\,\text{mm}$$

$$n_2 = 2.5(r + T) = 2.5(10.2 + 13.3) = 58.75\,\text{mm}$$

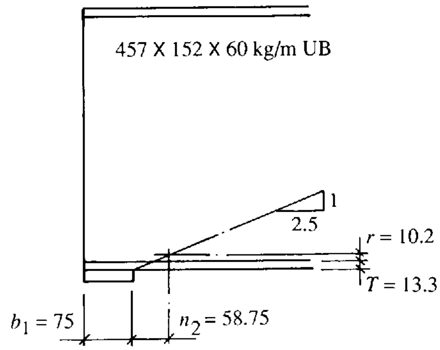

Figure 5.23 *Web bearing check dimensions*

Hence

$$P_{crip} = (b_1 + n_2)tp_{yw} = (75 + 58.75)8 \times 275 = 294\,250\,\text{N} = 294\,\text{kN} > 198.4\,\text{kN}$$

Thus the bearing resistance of the unstiffened web is greater than the maximum reaction, and therefore the web does not require stiffening to resist crushing due to bearing.

5.10.8 Design summary for steel beams

Having examined the various aspects that can influence the design of steel beams, the general procedure when using grade 43 rolled sections may be summarized as follows.

Bending

(a) Decide if the beam will be laterally restrained or laterally unrestrained.

(b) If the beam is laterally restrained, ensure that the moment capacity M_{cx} of the section is greater than the applied ultimate moment M_u:

$$M_{cx} = p_y S_x \geqslant M_u$$

(c) If the beam is laterally unrestrained, the lateral torsional buckling resistance of the section will have to be checked. This may be done using a rigorous approach or a conservative approach. In both methods, account should be taken of any loading between restraints.

(i) Using the rigorous approach, ensure that the applied equivalent uniform moment $\bar{M}$ is less than the buckling resistance moment M_b of the section:

$$\bar{M} = mM_A \leqslant M_b = p_b S_x$$

(ii) Using the conservative approach, ensure that the maximum moment M_x occurring between lateral restraints does not exceed the buckling resistance moment M_b of the section:

$$M_x \leqslant M_b = p_b S_x$$