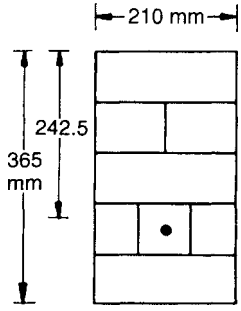

Fig. 11.8 Cross-section of the beam for example 3.

Masonry strain at tendon level

$$\varepsilon_{me} = \frac{1}{E_m}\left(\frac{P}{A} + \frac{Pey}{I}\right)$$

$$= \frac{259.2 \times 10^3}{15.3 \times 10^3}\left(\frac{1}{76\,650} + \frac{60 \times 60}{8.5 \times 10^8}\right)$$

$$= 0.000\,293$$

From equation (11.22),

$$\varepsilon_{su} = \varepsilon_m\left(\frac{d - d_c}{d_c}\right) + \varepsilon_{me} + \varepsilon_{se}$$

$$= 0.0035[(242.5 - d_c)/d_c)] + 0.000\,293 + 900/(195 \times 10^3)$$

$$= 0.8488/d_c + 0.0035 + 0.000\,293 + 0.004\,615$$

$$= 0.8488/d_c + 0.001\,41$$

Therefore

$$d_c = \frac{0.8488}{\varepsilon_{su} - 0.001\,41}$$

From equation (11.18) and using the stress block of BS 5628: Part 2

$$f_m b d_c / \gamma_{mm} = A_{ps} f_{su}$$

$$(1 \times 21/2)\ 210 d_c = 288 f_{su}$$

or

$$f_{su} = \frac{21 \times 210}{2 \times 288} d_c = 7.66 d_c$$

Therefore

$$f_{su} = \frac{7.66 \times 0.8488}{\varepsilon_{su} - 0.001\,41} = \frac{6.5}{\varepsilon_{su} - 0.001\,41}$$

This is solved with the stress-strain curve given in Fig. 2.7.

$$f_{su} = 1214\ \text{N/mm}^2 \quad \varepsilon_{su} = 0.006\,76$$

Therefore

$$d_c = 1214/7.66 = 158.5\ \text{mm}$$

From equation (11.24)

$$M_u = A_{su} f_{su} (d - \lambda_2 d_c) \quad \text{where } \lambda_2 = 0.5 \text{ (BS 5628)}$$

$$= 288 \times 1214\ (242.5 - 0.5 \times 158.5)\ /10^6\ \text{kN m}$$

$$= 57.0\ \text{kN m}$$

11.5 SHEAR STRESS

The shear stress due to the loading must be checked to ensure that the value is within the acceptable limit. The characteristic shear strength with bonded tendons for elements prestressed parallel to the bed joint should be taken as 0.35N/mm^2. The characteristic shear strength for prestressed elements with bonded tendons, where prestressing is normal to the bed joint, can be obtained from

$$f_v = 0.87 + 0.21\, g_b$$

where g_b is the prestressing stress. The maximum value should not exceed 1.75N/mm^2.

The prestressed elements with unbonded tendons have much lower strength than with bonded tendons. The value given by the equation above is quite different from the recommendation of BS 5628: Part 2, which does not differentiate between bonded and unbonded tendons. This may not be correct according to the limited experimental results at present available.