Design for axial load=800kN and

moment=50+31.3=81.3kNm

Assume that d_c=300 mm and A_{s1}=A_{s2}=905 mm^2 (two T24 bars). Since d_c is between $t/2$ and (t-d_2), f_{s2} can be determined from

$$f_{s2} = 2f_y\left(\frac{t-d_2-d_c}{t-2d_2}\right) = 2f_y\left(\frac{460-130-300}{460-260}\right)$$

$$= 0.3f_y$$

Take f_{s1}=0.83f_y. Then

$$N_d = \frac{f_k b d_c}{\gamma_{mm}} + \frac{f_y A_{s1}}{\gamma_{ms}}(0.83-0.3)$$

$$= \frac{13\times 460\times 300}{2.3\times 10^3} + \frac{460\times 905\times 0.53}{1.15\times 10^3}$$

$$= 780 + 192$$

$$= 972 \quad \text{which is adequate}$$

$$M_d = \frac{0.5 f_k b d_c (t-d_c)}{\gamma_{mm}} + \frac{f_y A_{s1}(0.5t-d_1)(0.83+0.3)}{\gamma_{ms}}$$

$$= \frac{0.5\times 13\times 460\times 300\times 160}{2.3\times 10^6} + \frac{460\times 905\times 100\times 1.13}{1.15\times 10^6}$$

$$= 62.4 + 40.9$$

$$= 103.3\,\text{kN m} \quad \text{which is adequate.}$$

10.6 REINFORCED MASONRY COLUMNS, USING ENV 1996–1–1

10.6.1 Introduction

The Eurocode does not refer separately to specific design procedures for reinforced masonry columns although in section 4.7.1.6 of the code reference is made to reinforced masonry members subjected to bending and/or axial load. In the section a diagram showing a range of strain distributions, in the ultimate state, for all the possible load combinations is given and these are based on three limiting strain conditions for the materials.

1. The tensile strain of the reinforcement is limited to 0.01.
2. The compressive strain in the masonry due to bending is limited to -0.0035.

3. The compressive strain in the masonry due to pure compression is limited to -0.002.

Using these conditions a number of strain profiles can be drawn.

For example if it is decided that at the ultimate state the strain in the reinforcement has reached its limiting value then the range of strain diagrams take the form shown in Fig. 10.12. In Fig. 10.12 the strain diagrams all pivot about the point A, the ultimate strain in the reinforcement. Line 2 would represent the strain distribution if the ultimate compressive strain was attained in the masonry at the same time as the ultimate strain was reached in the reinforcement and line 1 an intermediate stage. In the Eurocode additional strain lines, such as line 3, are included in the diagram but since no tension is allowed in the masonry these strain distributions would require upper reinforcement.

If the limiting condition is assumed to be that the strain in the masonry has reached its limiting value then the strain distribution diagrams would be as shown in Fig. 10.13. In Fig. 10.13 the strain diagrams all pivot about the point B, the ultimate compressive strain in the masonry. Line 3 would represent the strain distribution if the ultimate tensile strain was attained in the reinforcement at the same time as the ultimate compressive strain was reached in the masonry and line 2 an intermediate stage. Line 1, representing the limiting line for this range, occurs when the depth of the compression block equals the depth of the section. Compare section 10.5.2.

To allow for pure compression, with a limiting strain value of -0.002, the Eurocode allows for a third type of strain distribution as shown in Fig. 10.14. In Fig. 10.14 the strain diagrams all pivot about the point C at

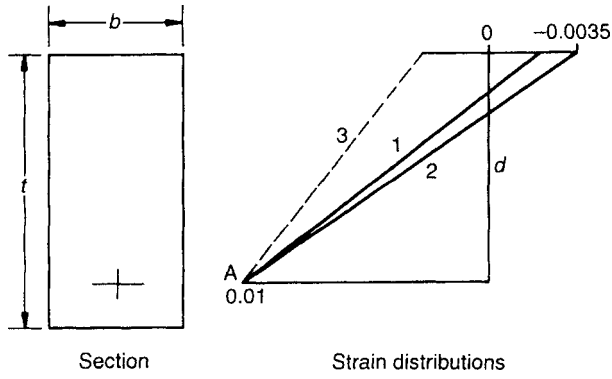

Fig. 10.12 Strain diagrams with reinforcement at ultimate.