ANNEX F

(*Clauses* 35.3.2 *and* 43.1)

CALCULATION OF CRACK WIDTH

Provided that the strain in the tension reinforcement is limited to $0.8 F_y / E_s$, the design surface crack width, which should not exceed the appropriate value given in **35.3.2** may be calculated from the following equation:

Design surface crack width

$$W_{cr} = \frac{3 a_{cr} \varepsilon_m}{1 + \frac{2(a_{cr} - C_{min})}{h - x}}$$

where

a_{cr} = distance from the point considered to the surface of the nearest longitudinal bar,

C_{min} = minimum cover to the longitudinal bar;

ε_m = average steel strain at the level considered,

h = overall depth of the member, and

x = depth of the neutral axis.

The average steel strain ε_m may be calculated on the basis of the following assumption:

The concrete and the steel are both considered to be fully elastic in tension and in compression. The elastic modulus of the steel may be taken as 200 kN/mm² and the elastic modulus of the concrete is as derived from the equation given in **6.2.3.1** both in compression and in tension.

These assumptions are illustrated in Fig. 28,

where

h = the overall depth of the section,

x = the depth from the compression face to the neutral axis,

f_c = the maximum compressive stress in the concrete,

f_s = the tensile stress in the reinforcement, and

E_s = the modulus of elasticity of the reinforcement.

Alternatively, as an approximation, it will normally be satisfactory to calculate the steel stress on the basis of a cracked section and then reduce this by an amount equal to the tensile force generated by the triangular distributions, having a value of zero at the neutral axis and a value at the centroid of the tension steel of 1N/mm² instantaneously, reducing to 0.55 N/mm² in the long-term, acting over the tension zone divided by the steel area. For a rectangular tension zone, this gives

$$\varepsilon_m = \varepsilon_1 - \frac{b\,(h-x)(a-x)}{3 E_s A_s (d-x)}$$

where

A_s = area of tension reinforcement,

b = width of the section at the centroid of the tension steel,

ε_1 = strain at the level considered, calculated ignoring the stiffening of the concrete in the tension zone,

a = distance from the compression face to the point at which the crack width is being calculated, and

d = effective depth.

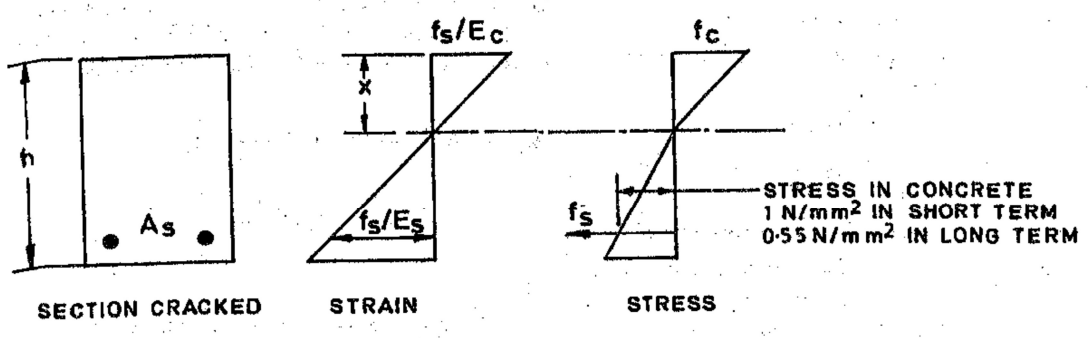

FIG. 28