Frame
Braced
Concrete Beams

Serviceability
Shear
Moment
Design

Ch. 5
Ch. 6 (Little Serviceability - Δ)
Ch. 7
Ch. 8
Ch. 3
(2.1, 2.2, 2.4)
\[ \varepsilon_1 = \varepsilon_2 = \varepsilon_3 \]
\[ n = \frac{E_1}{E_2} \]

Concrete

Steel

Perfect bond between steel and concrete

Nonlinear strain distribution

Plane section remains plane


dc
\[ E_0 = 0.003 \text{ in.} \]

Concrete, Compression

Shear

U.S. Concrete, Compression (Concrete at Heart, Cross-Section, Crack)

Once another fiber cracks, all tension

10-15 ksi

Modulus of rupture

Cracking

Concrete, Carrier Fissure Precise
Loads

With the effect of the external internal stresses are in equilibrium
\[ P = 2.56 \; P_f + F \]

\[ m = 30 \pm 1.5 \; m - 1.6 \]

\[ \sqrt{h_f} = \sqrt{h_f + \sqrt{y} + \sqrt{\frac{12}{(15)(18)}}} = \sqrt{5.832} \]

\[ \frac{12}{(15)(18)} = 9.9 \]

\[ W_c = \frac{f_c}{f} \]

\[ W_c' = 2.1 \]

\[ f = 6000 \; psf \]

\[ f_c = 4 \; 000 \; psf \]