4.440 / 4.462 Basic Structural Design
Spring 2009

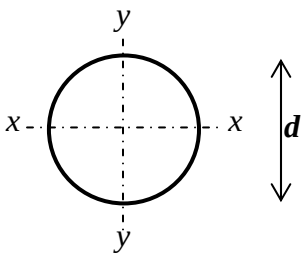
EQUATIONS FOR STRUCTURAL DESIGN

Axial stress: $\sigma = P/A$

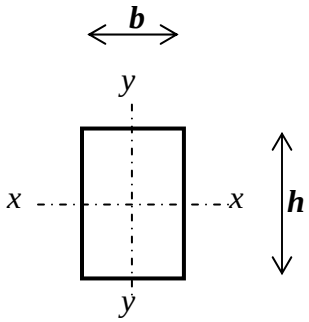
Bending stress due to an applied moment, M: $\sigma = My/I$
where y is the distance from the neutral axis of the beam

Critical buckling load for a column in axial compression: $P_{cr} = \pi^2 EI/(kL)^2$

Moment of Inertia (I):



$I_{xx} = I_{yy} = \pi d^4/64$

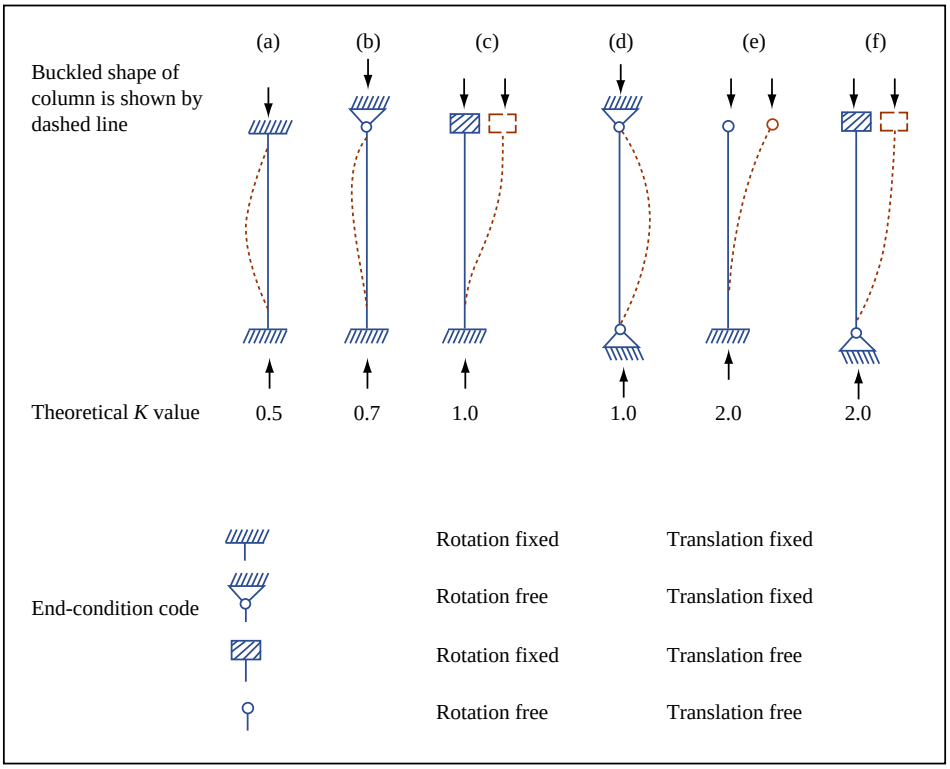


$I_{xx} = bh^3/12$ $\quad I_{yy} = hb^3/12$

- Modulus of Elasticity (E): Approximate values for six common structural materials:

E_{steel} = 29,000 ksi	E_{glass} = 10,000 ksi	$E_{aluminum}$ = 10,000 ksi
$E_{concrete}$ = 3,000 ksi	E_{timber} = 1,600 ksi	E_{brick} = 3,000 ksi

- Effective Length of the column (k):



Effective Length Factors k for centrally loaded columns with various idealized end conditions. (*)

(*) Taken from: Basic Steel Design with LRFD, T.V. Galambos, F.J. Lin and B.G. Johnston, Prentice Hall, Upper Saddle River, New Jersey, 1996, pp. 88-89.