Euler Buckling

Mechanical Engineering

Why a long strut fails on stiffness and length, not on material strength.

A slender column buckles at a load set by stiffness, section and effective length, not by strength.

$$P_{cr} = \pi^2 E I \div L_e^2 \cdot L_e = K L$$

Both ends pinned — K = 1.0

Effective length = L.

Both ends fixed — K = 0.5

Four times the load.

Fixed one end, free — K = 2.0

A quarter the load.

THE COMMON MISTAKE

× **Checking the yield stress only**

✓ **Check slenderness first**

A slender column buckles far below yield. Doubling the length quarters the critical load, and strength does not appear in the formula at all.

Assumes a perfectly straight, elastic, axially loaded column. Real struts need an imperfection method and a code check.