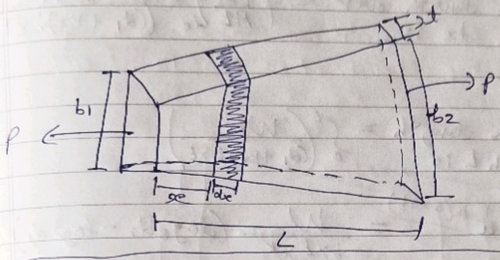
Deformation in Rectangular tapred bar

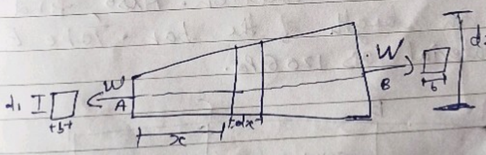
Deformation of tapered bar with rectangular cross-section:-



$$\Rightarrow \delta = \frac{2.302 P l}{tE(b_2 - b_1)} (\log b_2 - \log b_1)$$

where, P = Axial force, E = Modulus of Elasticity, L = Length of the member, b_1 = Smaller depth, b_2 = larger depth, t = Thickness of the member, δ = Change in length of tapered bar.

Consider an element of length, dx at a distance x from A,



Depth at x, $= d_1 + \frac{(d_2 - d_1)}{L} \times x$

$= d_1 + K \times x.$

c/s area at x, $= (d_1 + Kx)b$

Change in length over a length dx is, $= \left(\frac{Pl}{AE}\right)_{dx} = \left(\frac{W dx}{(d_1 + Kx) b \times E}\right)$

Change in length over a length L is, $= \int_0^L \left(\frac{W dx}{(d_1 + Kx) b \times E}\right)$

formula: $\int \frac{1}{ax+b} dx = \frac{1}{a} \ln(ax+b)$

$= \frac{W}{b \times E \times K} (\log_e d_2 - \log_e d_1)$

$= \frac{2.302 \times W \times L}{b \times E \times (d_2 - d_1)} (\log d_2 - \log d_1)$

Change in the length $= \frac{2.302 \times W \times L}{b \times E \times (d_2 - d_1)} (\log d_2 - \log d_1)$