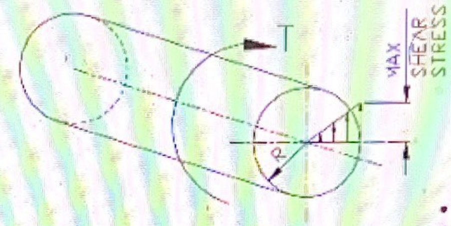
Poisson's Ratio = μ = the ratio of lateral strain to longitudinal strain

$\mu = \frac{\epsilon \ lateral}{\epsilon \ longitudinal}$ = Poisson's Ratio

μ(steel) = 0.3



Torsion Formula:

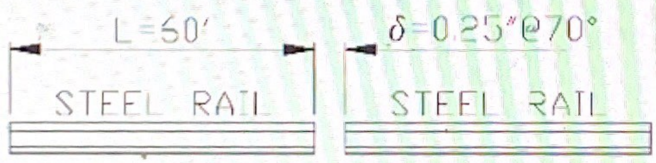
Torsional shear stress is a maximum at the outer surface of a circular shaft.

$f_v = \frac{2T}{\pi R^3}$ = maximum torsional shear stress at the outer surface of a circular shaft

Torsional shear stress varies linearly from zero at the center of a circular shaft to a maximum at the outer surface of the shaft.

WATCH THE UNITS FOR EVERY PROBLEM!!

Problem 5.18 (in textbook):



$\delta = \alpha(\Delta T)L = 0.25''$

$\Delta T = \frac{\delta}{\alpha L} = \frac{0.25}{(6.5x10^{-6})(720'')} = 53.4°$

Final temperature = 70° + 53.4° = 123.4° to close the gap

@150°:

ΔT = 150° - 123.4° = 26.6° increase in temperature

$\delta = \alpha(\Delta T)L = (6.5x10^{-6})(26.6)(720) = 0.124''$ restrained deformation

$\sigma' = \epsilon' E = \frac{\delta'}{L}(E)$ where δ' is the restrained deformation

Restrained deformation = $\delta' = 0.124''$

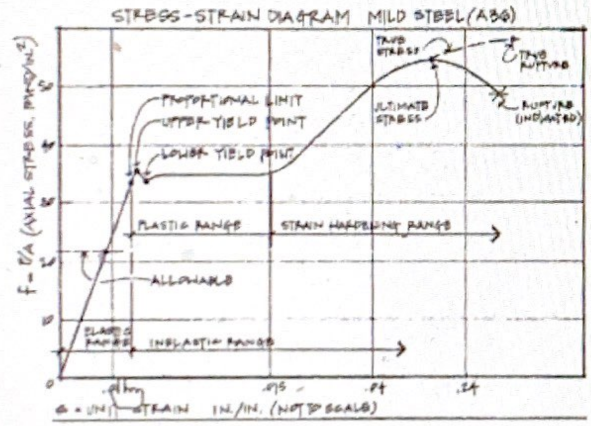
$\sigma' = \epsilon' E = \frac{\delta'}{L}(E) = \frac{0.124}{720}(29x10^{6}) = 4994$ psi

Session #15

Introduction to Building Structures – CMGT 37295 – Rob Gagich, P.E., M.ASCE

A stress-strain diagram provides a graphical indication of the load resisting properties a material by relating the load acting on a structure to the deflection the load will produce.

Steel Stress-Strain Diagram



Concrete Stress-Strain Diagram

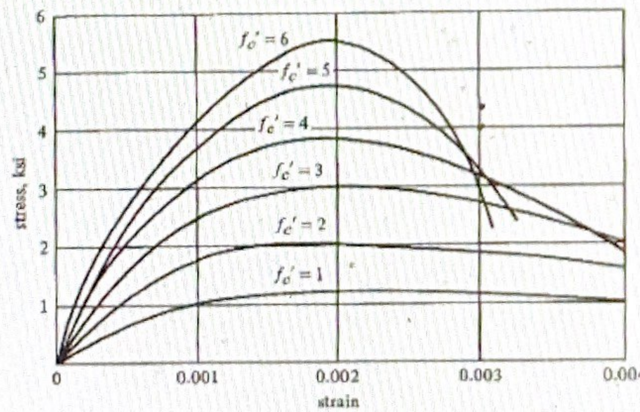


Figure 1.1 Typical Concrete Stress-Strain Curve, Short-Term Loading

Structural steel is the only common construction material that exhibits a defined yield point on the stress-strain diagram.

Concrete stress-strain diagrams are non-linear indicating that the Modulus of Elasticity, E, is estimated and that concrete does not have definite yield strength.

Regardless of compressive strength, all concrete specimens reach their ultimate strength at strains of about 0.002, and all the higher strength specimens fail at a strain of about 0.003.

Modulus of Elasticity = E, a constant of proportionality that is used as a measure of stiffness of a material. "E" is the stress to strain ratio as described by the slope of the straight line portion of the stress-strain diagram. "E" is also referred to Young's Modulus (Thomas Young in 1807)

Modulus of Elasticity, E, is useful for entering the type of material (steel, concrete, wood, etc.) into mathematical equations

Modulus of Elasticity = E = $\frac{\sigma}{\epsilon} = \frac{Stress}{Strain}$

Units = force / unit area

E(steel) = $29x10^6$ psi

E(concrete) = $57000\sqrt{f'c}$ where $f'c$ = compressive strength of concrete, psi

E(wood) = $1.76x10^6$ psi