

TD2 : TENSION/COMPRESSION

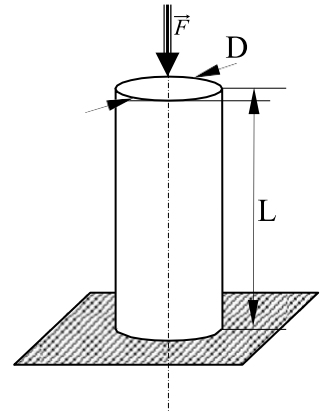
EXERCISE :1

A concrete column with a circular cross-section, resting vertically on a rigid foundation, is subjected to a force F acting through its axis.

- 1) What type of stress is the column subjected to?
- 2) Calculate the normal stress in the column.
- 3) Verify the column's strength.
- 4) Calculate the axial strain of the column.
- 5) Calculate the change in length ΔL .

Given :

$$|\vec{F}| = 10^6 \text{N}, D=30\text{cm}, L=3\text{m}, \sigma_e=25\text{Mpa}, E=10^4 \text{N/mm}^2$$



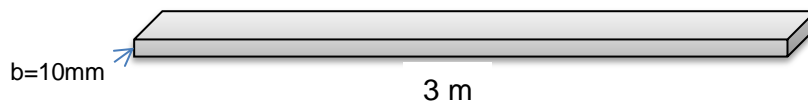
EXERCISE 2

A cable with a diameter of 8 mm and a length of 300 m, made of steel with a modulus of elasticity $E = 200 \text{ GPa}$ and a tensile strength $R_e = 295 \text{ MPa}$, is subjected to a stress of 40 MPa.

- 1- Verify that the safety factor applied to this cable is greater than 4.
- 2- Calculate the force applied to this cable.
- 3- Calculate the elongation of this cable.
- 4- Calculate the relative elongation.
- 5- Determine the diameter that this cable should have if the safety factor is greater than or equal to 10.

EXERCISE 3

A flat iron bar, 3 m long and 10 mm thick, is subjected to a tensile force of 80 kN.



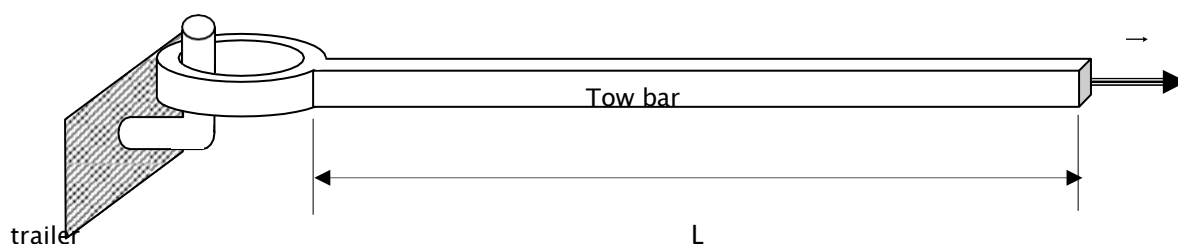
Determine its width so that its elongation does not exceed 2 mm. $E = 2.1 \times 10^5 \text{ MPa}$ and $[\sigma] = 144 \text{ MPa}$.

EXERCISE 4

A trailer is pulled by means of a square-section steel tow bar and is subjected to a force F .

- 1) What type of stress is the bar subjected to?
- 2) Find the minimum cross-sectional area of the bar required to withstand the force F .
- 3) Calculate the change in length ΔL .

Given: $F = 8000\text{N}$, $L=2\text{m}$, $\sigma_e=36\text{daN/mm}^2$, $E=2.10^5 \text{N/mm}^2$, Safety factor = 3.



EXERCISE 6

A steel cable of length L , composed of 7 twisted wires of diameter d each, lifts a load Q . 1) What type of stress is the cable subjected to?

- 2) Calculate the stress in the cable.
- 3) Verify the cable's strength.
- 4) Calculate the axial strain of the cable.
- 5) Calculate the change in the cable's length.

Given: $Q = 1.2 \text{ t}$, $d = 2.5 \text{ mm}$, $L = 10 \text{ m}$,
 $E = 210,000 \text{ MPa}$, $\sigma_e = 420 \text{ MPa}$, safety factor = 1.2

