UNIVERSITY CENTER OF MILA **2024-2025**

InstitutE Science and Technology — Reinforced Concrete – 3rd Year Civil Engineering
Département of civil engineering

Tutorial Series No. 05 – Simple Tension (Traction)

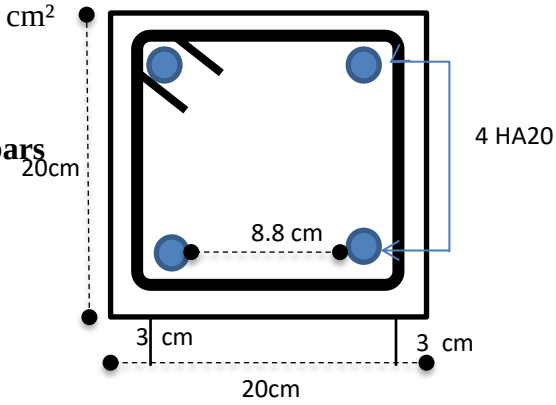
Exercice0 1 :

Determine the required steel cross-sectional area for a **reinforced concrete tie** subjected to an axial **simple tensile force** applied at the centroid of the section.

- **Steel**: FeE400 **; Concrete**: $f_{c28} = 30$ MPa
- **Cracking case**: Detrimental cracking (fissuration préjudiciable)

Given Data:

- Ultimate axial force: $N_u = 220$ kN ; Service axial force: $N_{ser} = 160$ kN
- Cross-section of tie: 15 × 15 cm ; Cover: 3 cm
- Provided reinforcement: 4 HA20 ; Reinforcement area: 8.8 cm²



Exercice 02:

. Check the following construction details:

A **tie element with a 20 × 20 cm section** reinforced with **4 HA20 bars**

Material Properties:

- Concrete: $f_{c28} = 25$ MPa ; Steel: FeE400
- Maximum aggregate size: $C_g \leq 20$ mm
- Cracking case: Detrimental cracking

*2. Calculate the **tensile strength of concrete** f_{t28}*

*3. Determine the force resisted by the tie at **ULS (ultimate limit state)** and **SLS (service limit state)***

Exercice 03:

Determine the **required reinforcement area** and check the construction details for the **horizontal tie** shown in the adjacent figure. This tie connects the inclined legs of a frame at the support level. It rests on the ground and its self-weight is not considered. Its purpose is to balance the **horizontal thrusts** of the frame.

Geometry:

- Width: 20 cm ; Height: 30 cm ; Concrete cover: 4 cm

Materials:

- Steel: FeE400 ; Stirrup: HA6 ; Concrete: $f_{c28} = 27$ MPa
- Cracking case: Very detrimental cracking
- Ground classified as **aggressive**

Forces:

- Ultimate axial force: $N_u = 540$ kN

Service axial force: $N_{ser} = 365$ kN.