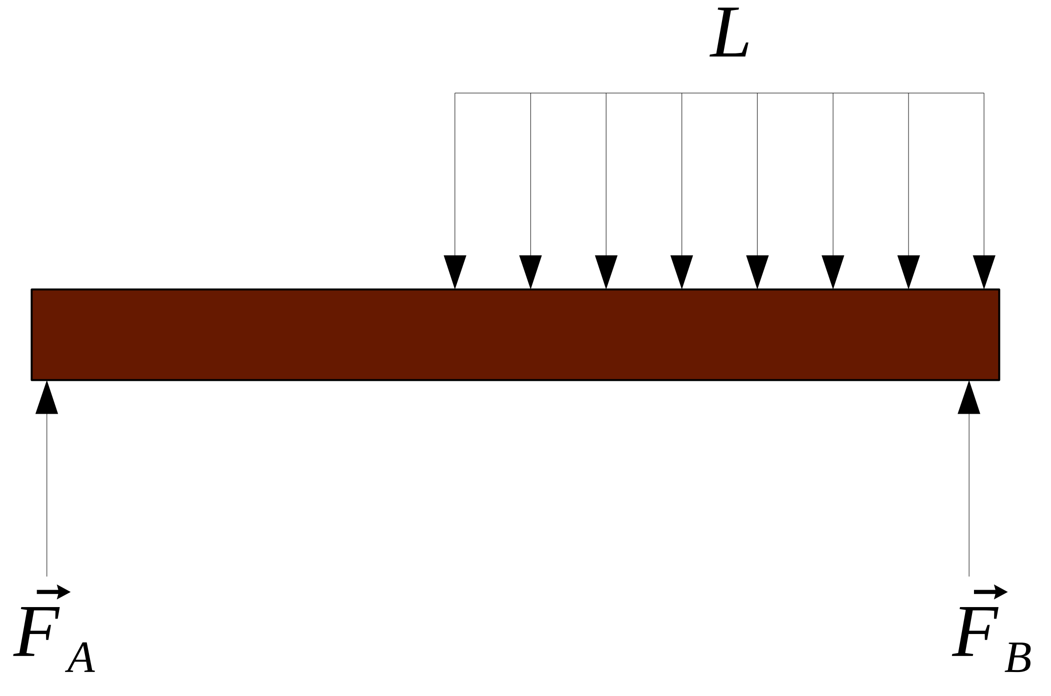
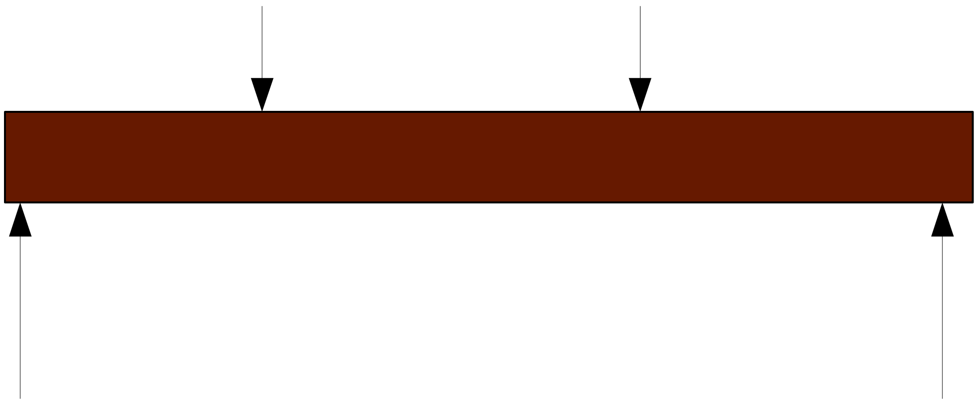
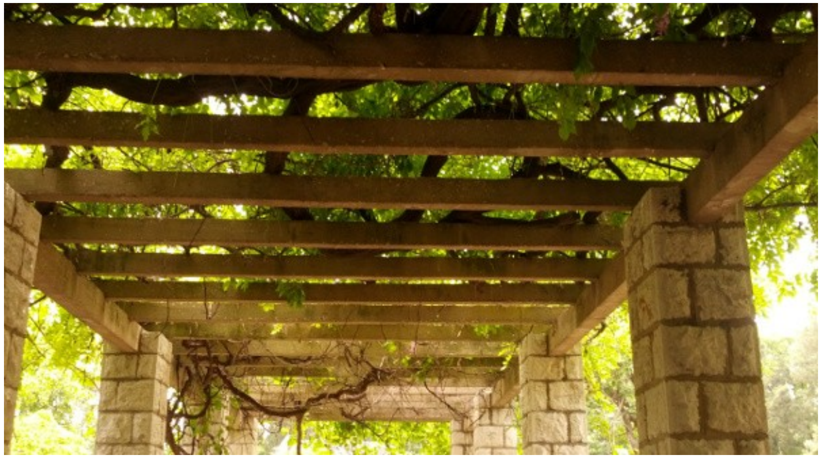
Beam reactions and distributed loads



Stefan Bracher

Beam: A horizontal structural element with vertical loads

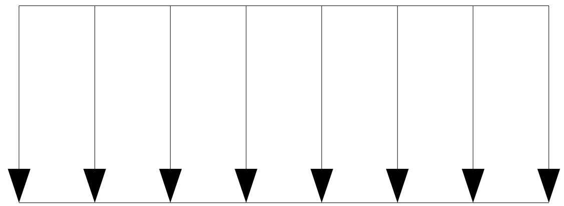




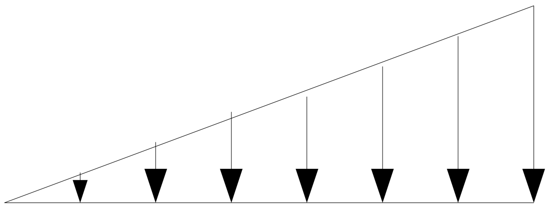
Photos: “Various Beam Structures” by Stefan Bracher

Distributed load: A load that is distributed over some area instead of acting on a single point.

Uniform

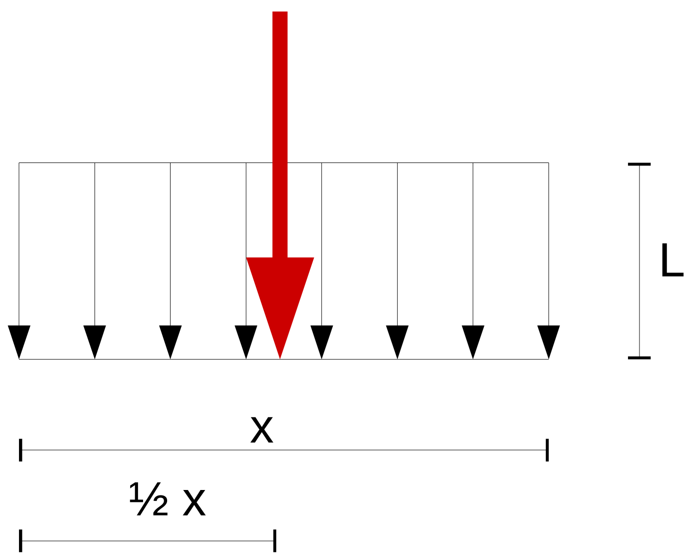


Triangular



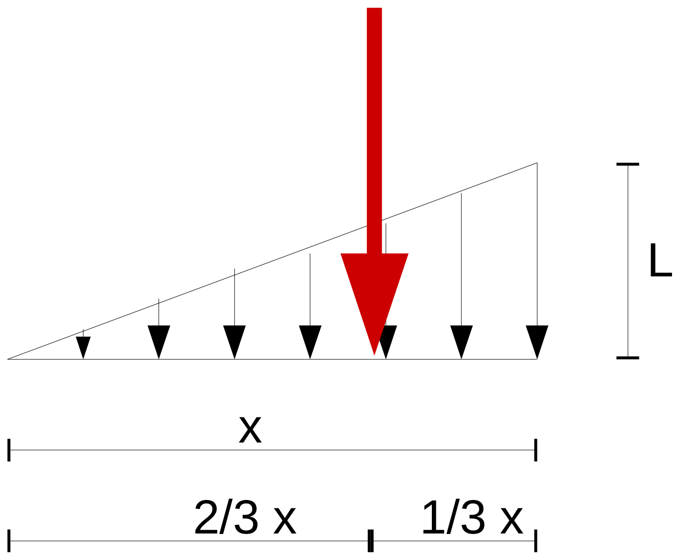
Equivalent Point Loads: Needed to calculate the reaction forces

Uniform



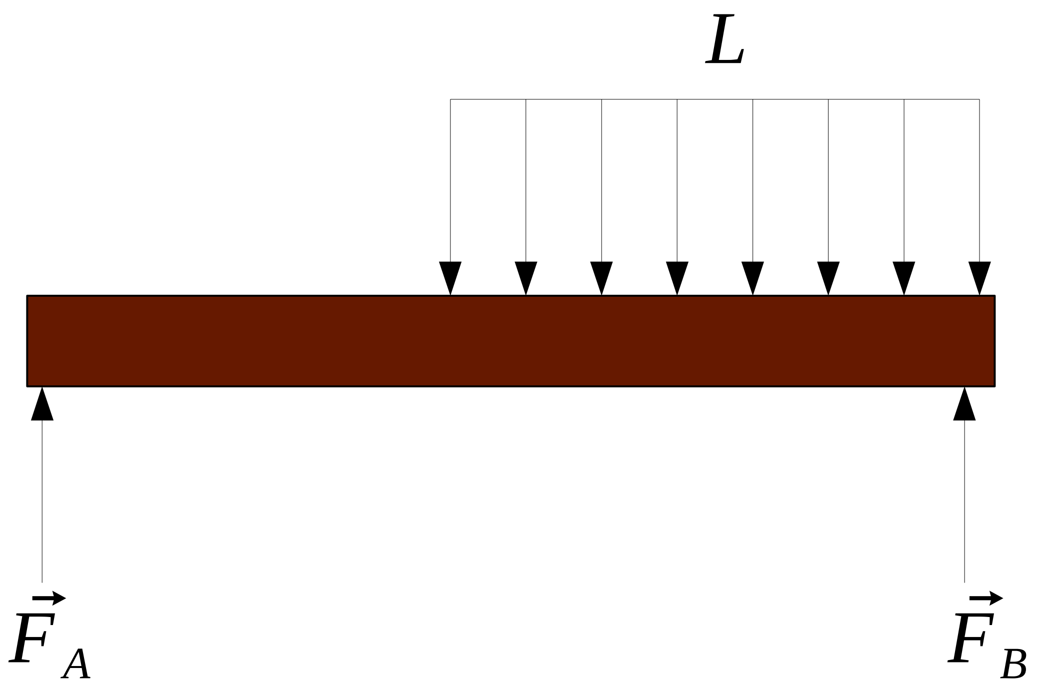
$$F_{eq} = x \cdot L$$

Triangular



$$F_{eq} = \frac{1}{2} \cdot x \cdot L$$

Beam reactions: The forces in the supports of a beam



Calculating the reaction forces:

1. Replace the distributed loads by equivalent point loads

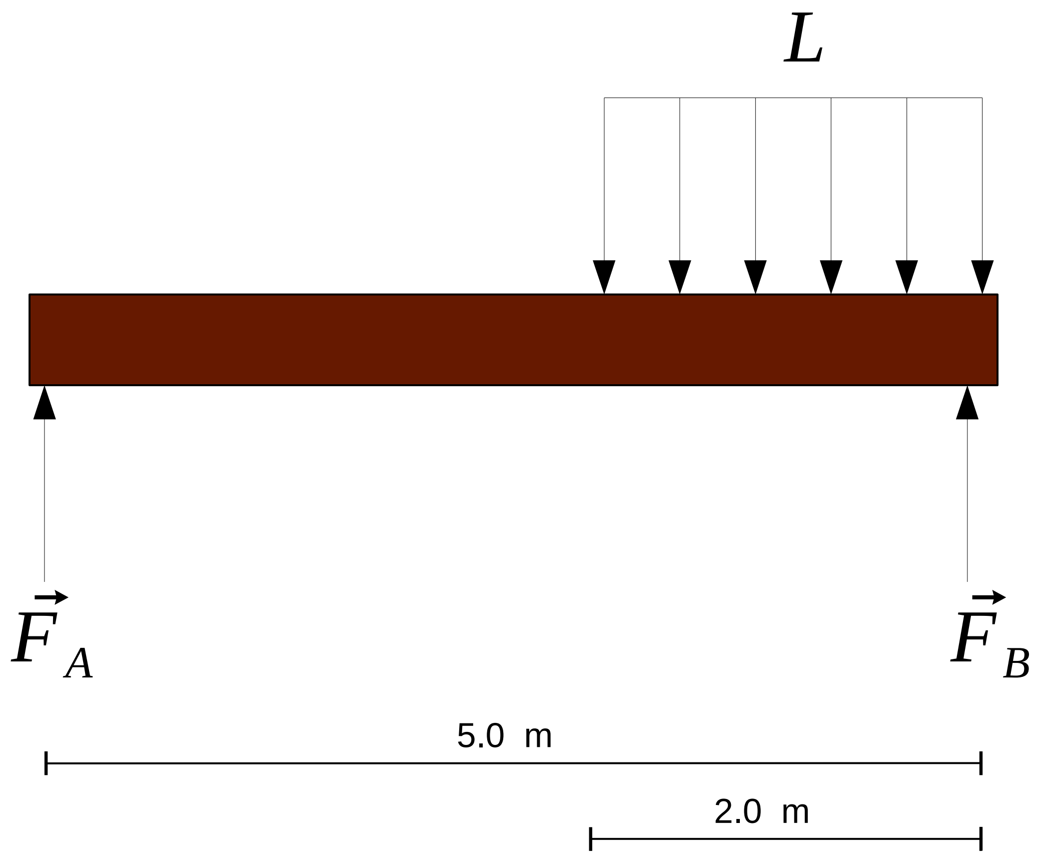
2. Draw the Free Body Diagram

3. Solve the rotational equilibrium

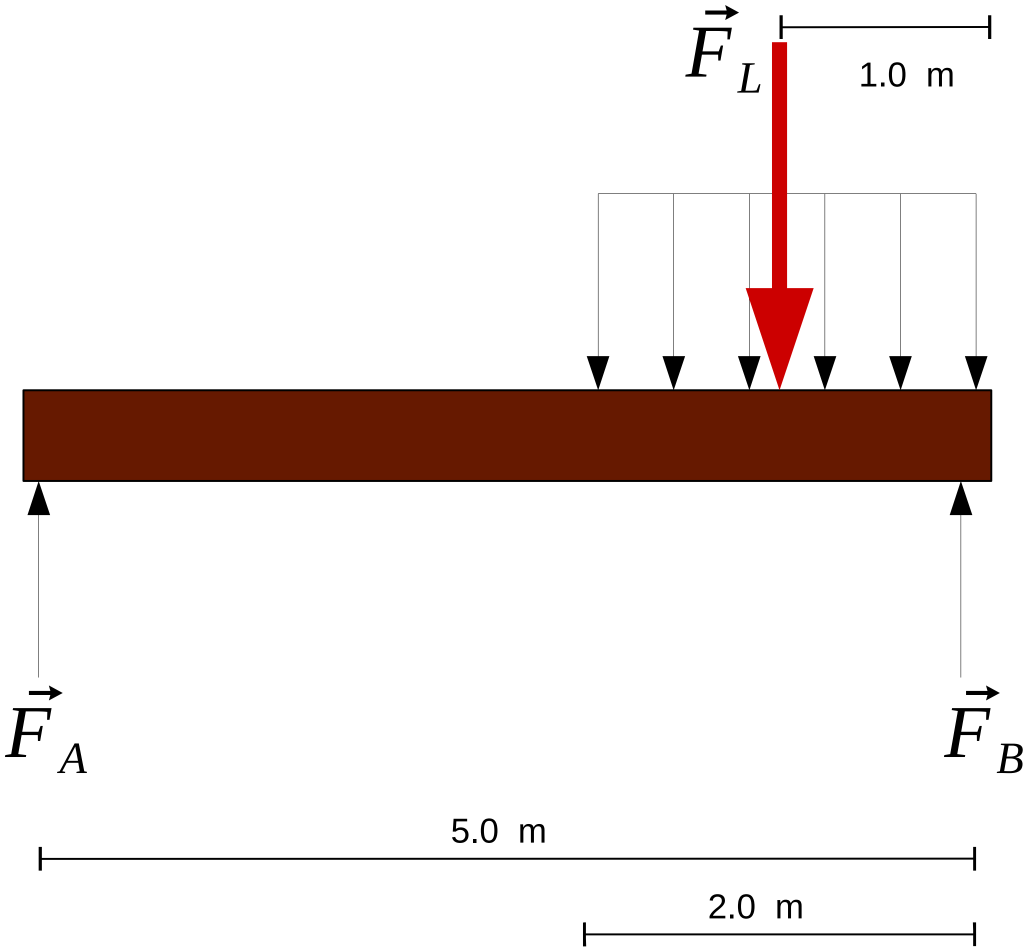
4. Solve the translational equilibrium

Step 1 is the only new item !

Example: A 300 kg beam is loaded with 500 N/m as shown.

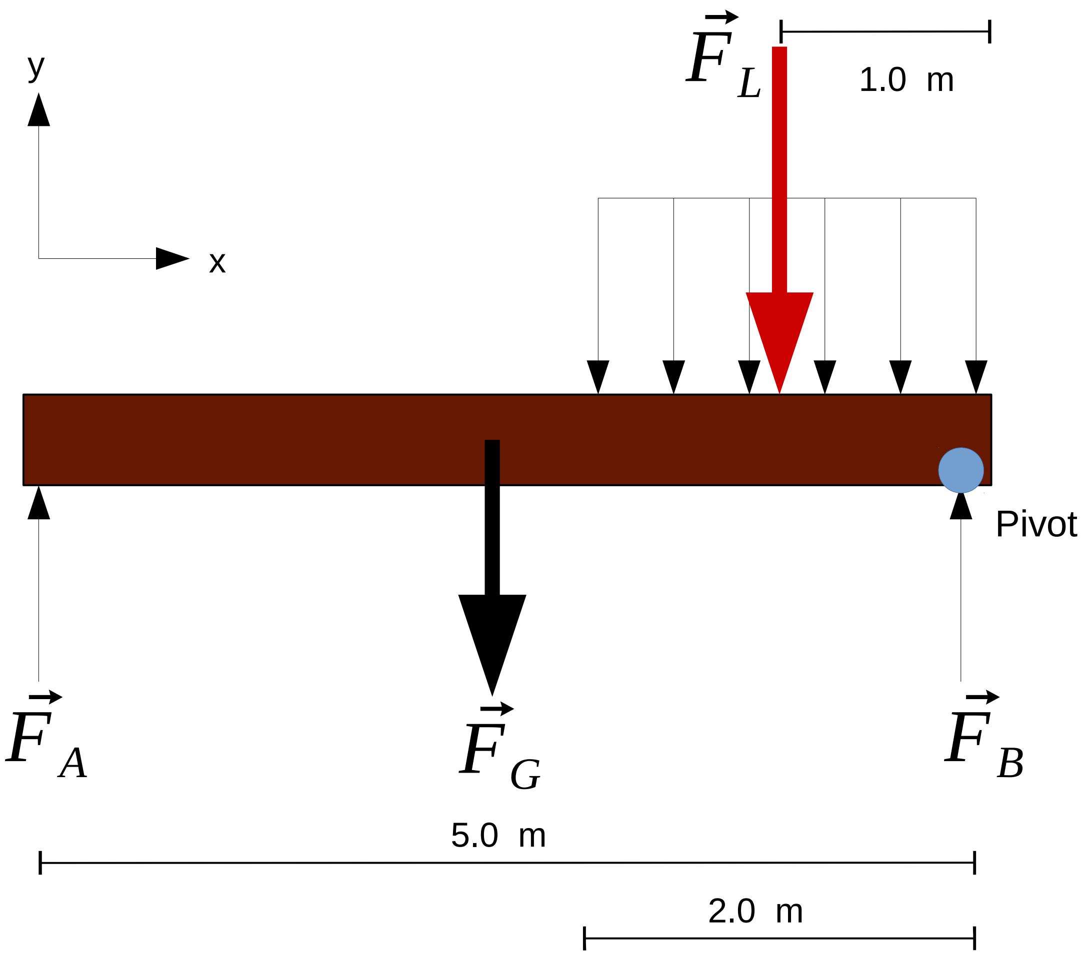


1. *Replace the distributed loads by equivalent point loads*



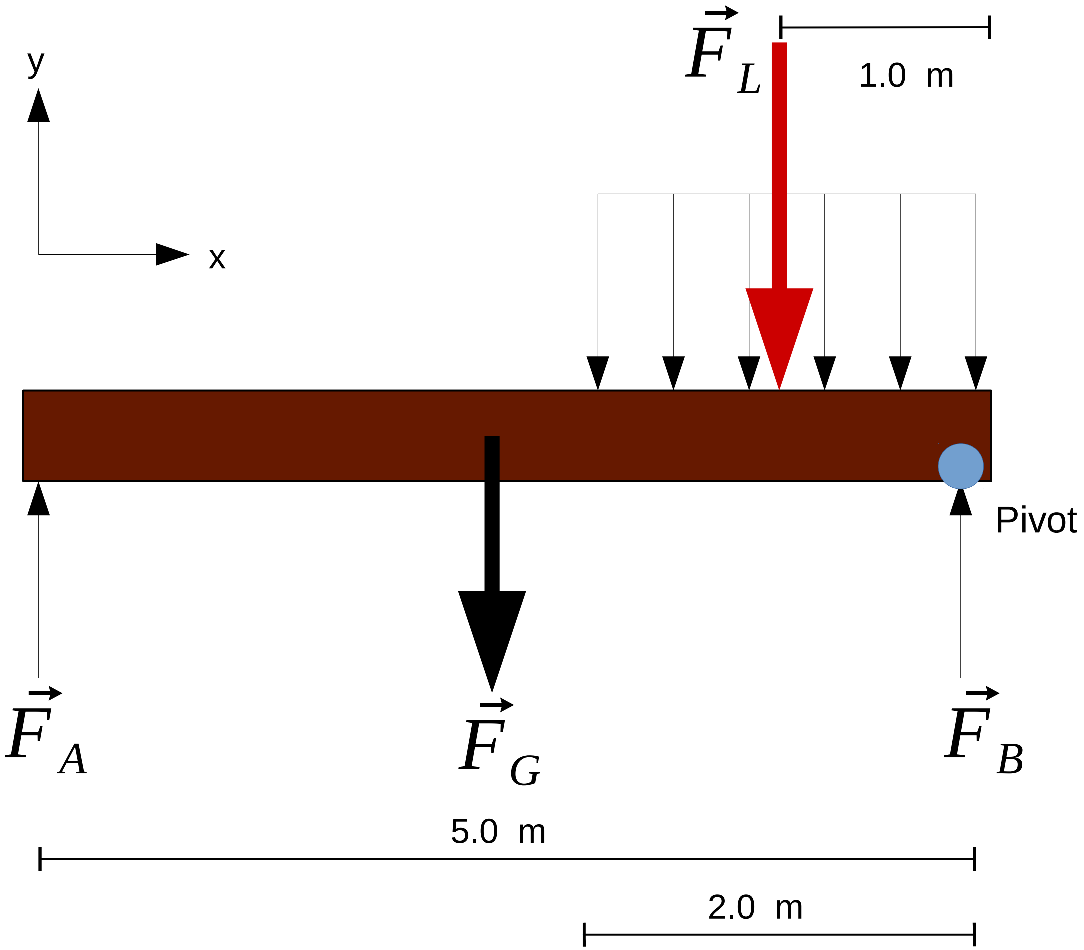
$$F_L = 500\,N/m \cdot 2.0\,m = 1000\,N$$

2. Draw the Free Body Diagram



$$F_L = 500\,N/m \cdot 2.0\,m = 1000\,N$$

3. Solve the rotational equilibrium

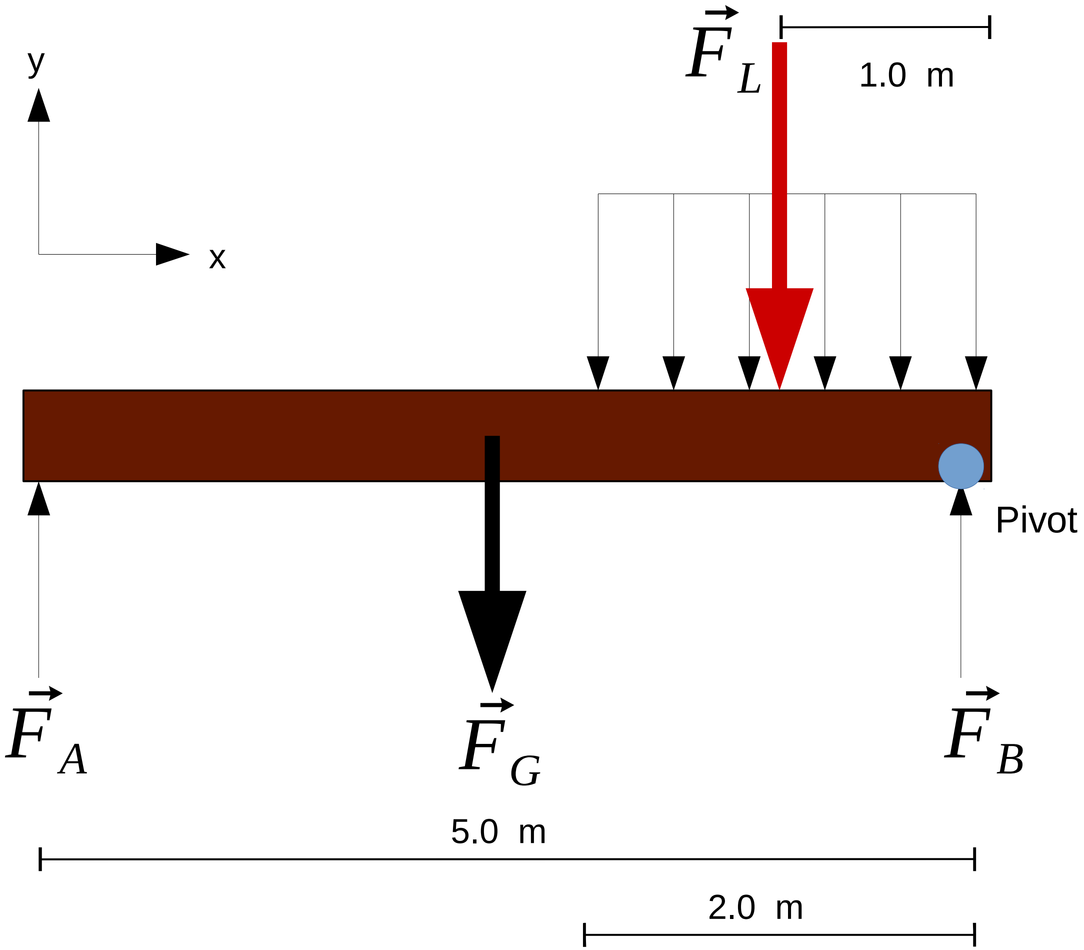


$$F_L = 500\,N/m \cdot 2.0\,m = 1000\,N$$

$$\sum \vec{\tau} = 0$$

$$F_A = 1700\,N$$

4. Solve the translational equilibrium



$$F_L = 500\,N/m \cdot 2.0\,m = 1000\,N$$

$$\sum \vec{F}_y = 0$$

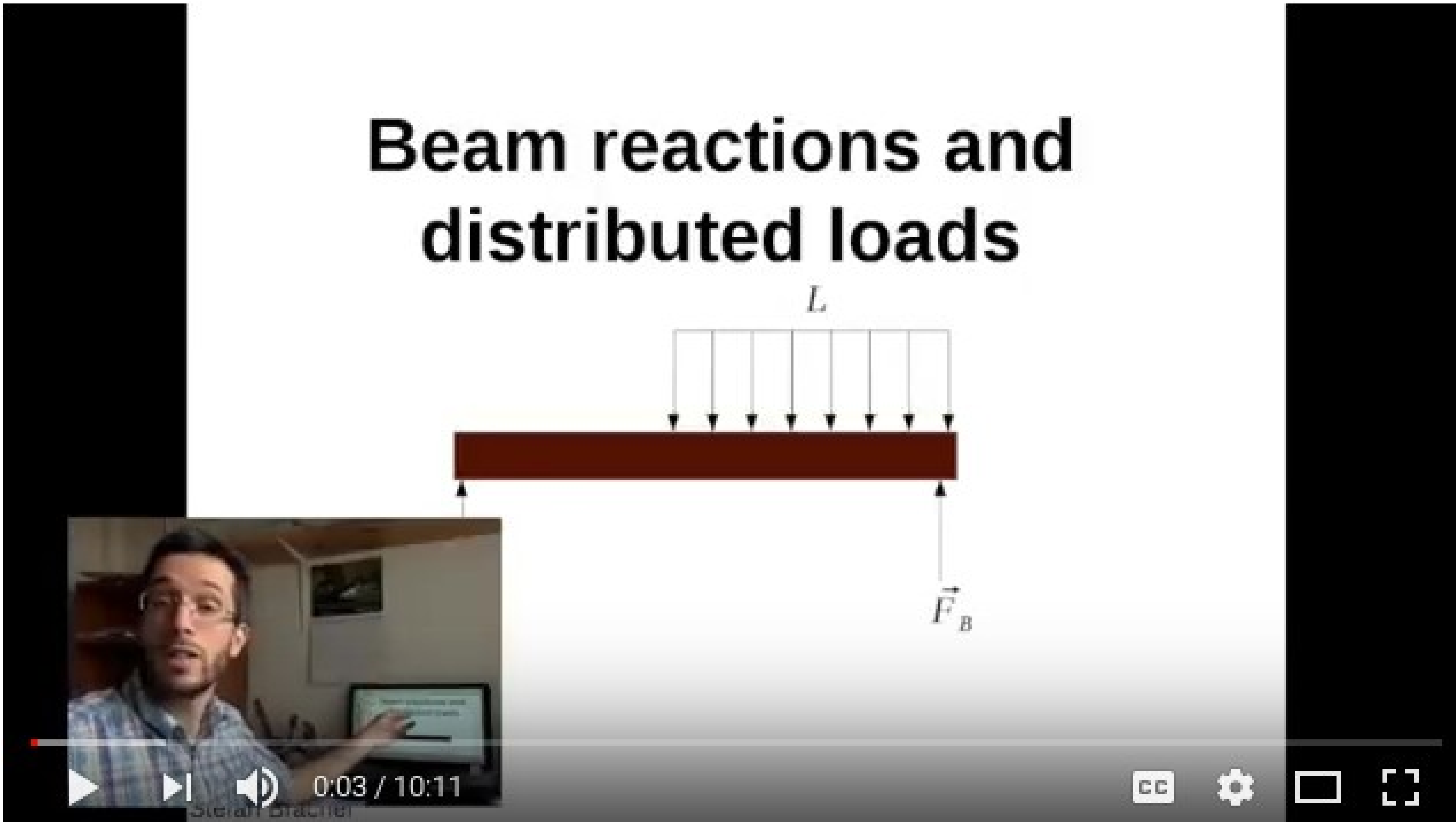
$$F_A = 1700\,N$$

$$F_B = 2300\,N$$

Stefan Bracher

More

This presentation as a video:



https://youtu.be/xCQg4G1eJTM