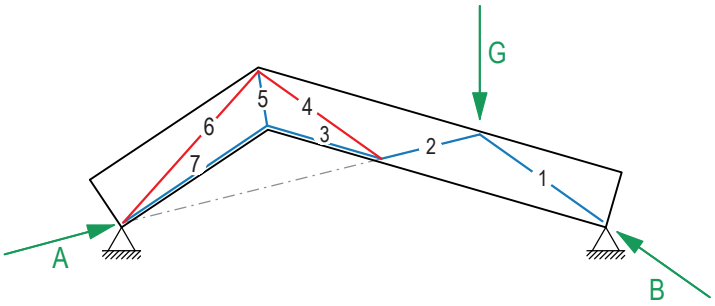
8.1

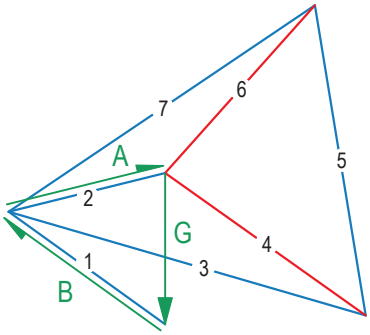
Redirecting Forces

In order to develop possible, necessary deflections of the internal forces in beams, frames or wall panels, it is useful to start from the direct course of the applied force into the supports. With this so-called thrust line, the global equilibrium is found. However, since the thrust line may run outside the material, the internal forces must be redirected in such a way that they run through the material.

Frame corner

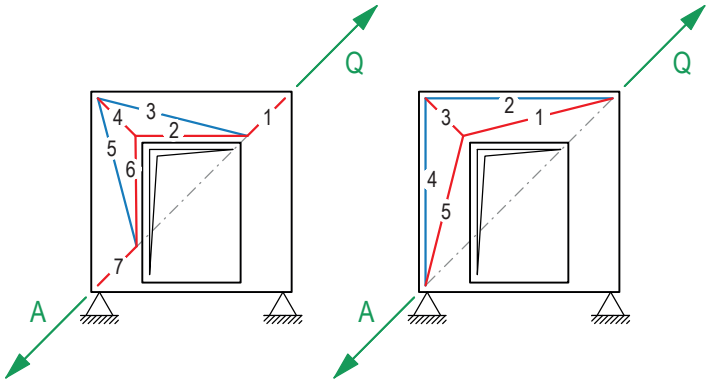
First, the global equilibrium is found with the help of the thrust line. Then, looking at the internal force flow, element 1 follows the thrust line and directs the applied force on the right-hand side directly into support B. On the left-hand side, however, the thrust line runs outside the material, which is why this compression force must be redirected there. Therefore, from where it would leave the material, it is guided into support A with the help of two tension cables and an additional compression element.

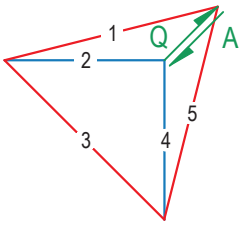




Wall with opening

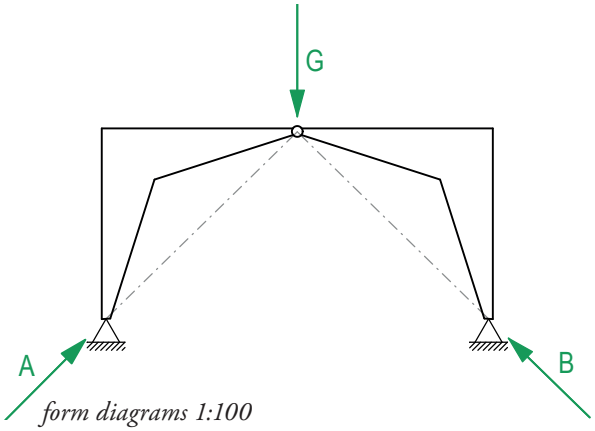
In the lower left example, the force flow follows the thrust line, equal to the frame corner above, as long as it remains inside the material and is deflected from where it leaves the material. For comparison, the example on the right shows the simplest type of deflection, consisting of two cantilevers and a frame corner. In this way, elements can be spared in the form diagram and thus in the force diagram. This simplest deflection can be used likewise for both, compression and tension elements.



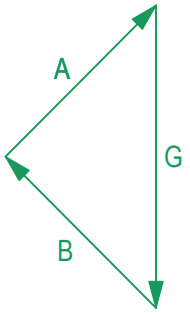


Hinges and global Equilibrium

The lines of action of the applied force and those of the reaction forces (thrust line) always intersect at the hinge in the form diagram, since the sum of all forces equals zero there. This helps us to find the global equilibrium.



form diagrams 1:100



force diagrams 1cm ≙ 10kN