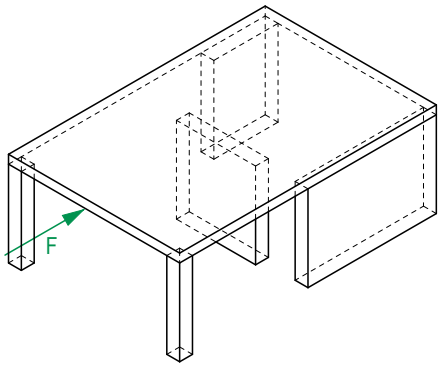
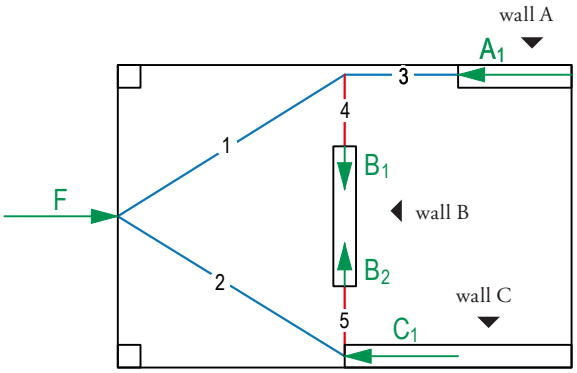
10.1 Compendium Structural Design I&II

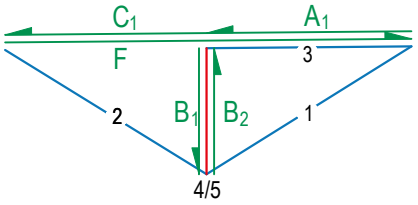
Horizontal Forces

A possible force flow in a slab is sought, which brings the horizontally acting load into the vertical load-bearing elements. To solve such a situation, the elements (slab and walls) are considered as individual subsystems.

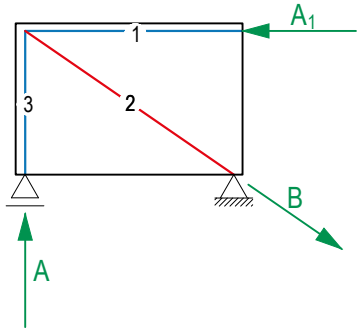


Since walls can only absorb forces along their axis, the possible lines of action of the walls and thus their points of intersection are drawn into the slab first. If more than one intersection is found, the system is properly braces. If possible, the applied force is guided into the intersection points found and can then be redirected into the axes of the walls. In the example below, the force F is guided into the intersection points via two pressure elements. From there, the compression force is redirected in the direction of wall B with one tension member each and introduced into walls A and C.
Finally, the external forces acting from the walls on the subsystem «slab» are added to the internal force flow and their magnitude is determined in the force diagram. The force flow in the ceiling is in equilibrium when all external forces in the force diagram cancel each other out.

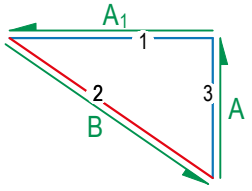




In order to now bring the horizontal forces in the slab via the walls into the floor, a corresponding force flow must be found in each wall.
Wall A is viewed from above (see arrow), which means that the force applied by the ceiling occurs on the right side of the wall. The magnitude of the applied force A_1 corresponds to the reaction force A_1 found in the subsystem «ceiling». Again, the direction of the force must be changed when switching between the subsystems.
So now a force A_1 pushes on the wall from the right. This force is then led all the way to the left through the wall, where it is redirected by a tension element and finally runs vertically into the roller support A. The tension element can be guided directly into the second support B. The effect of the force A_1 finally results in the reaction forces A and B. The same can be done with the other two subsystems of walls B and C.



form diagrams 1:100



force diagrams 1cm ≙ 10kN