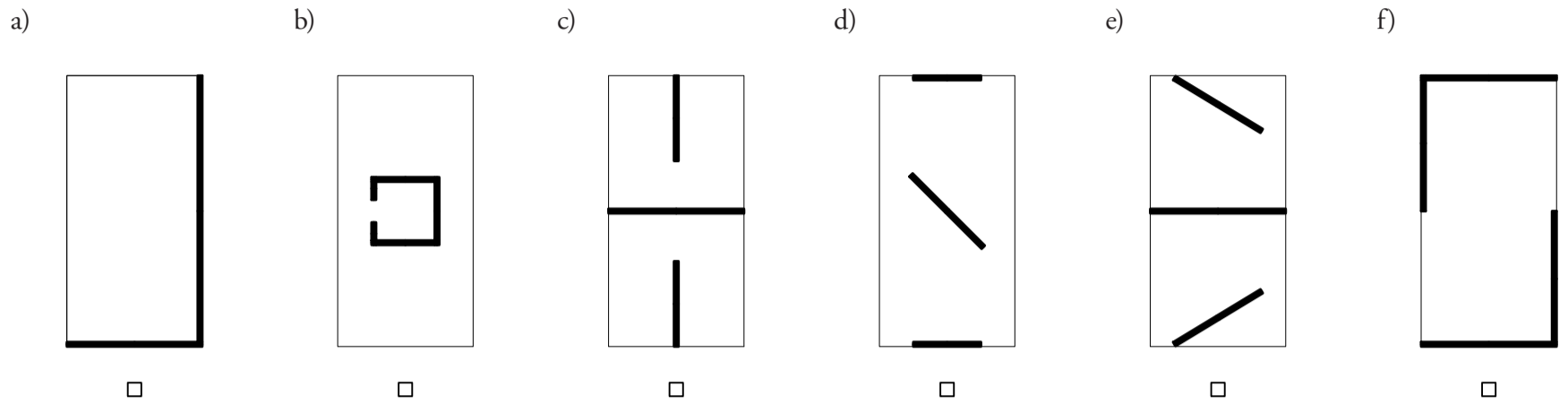


**Task 1 Bracing**

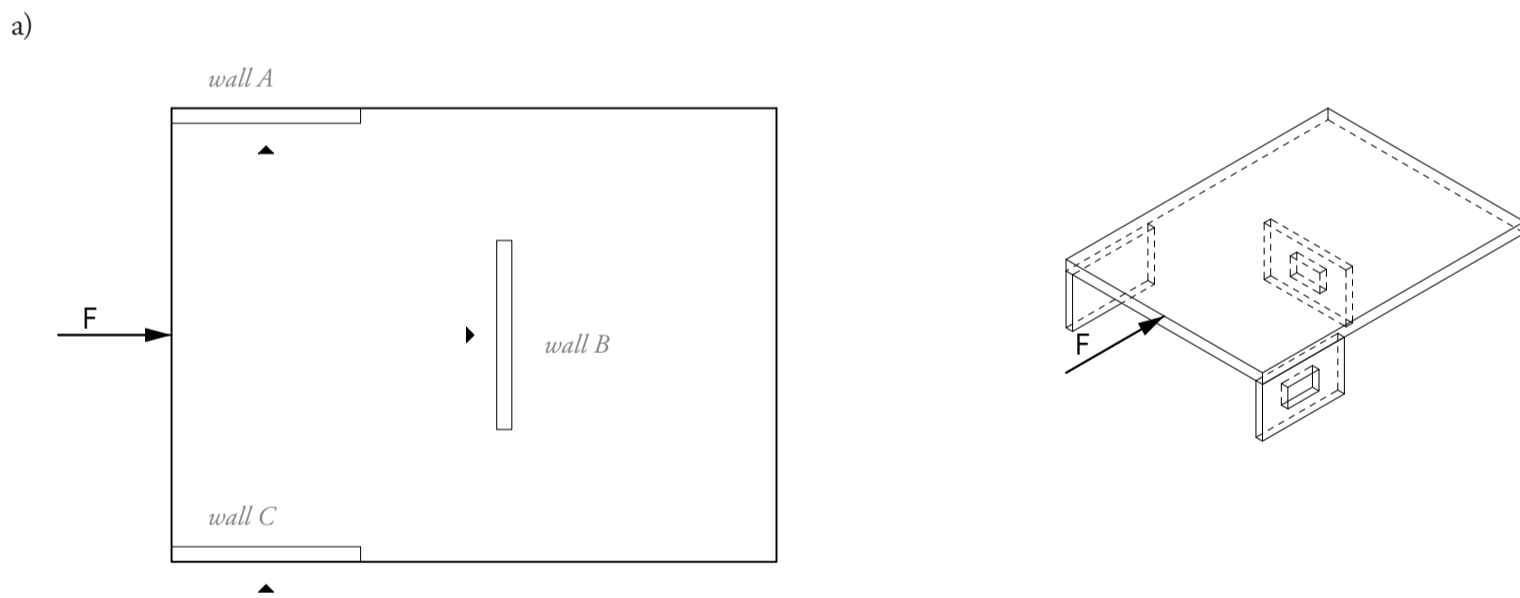
The subtasks a) to f) show different layouts of walls acting as bracing schemes of a plate. Tick the box if the bracing is working.



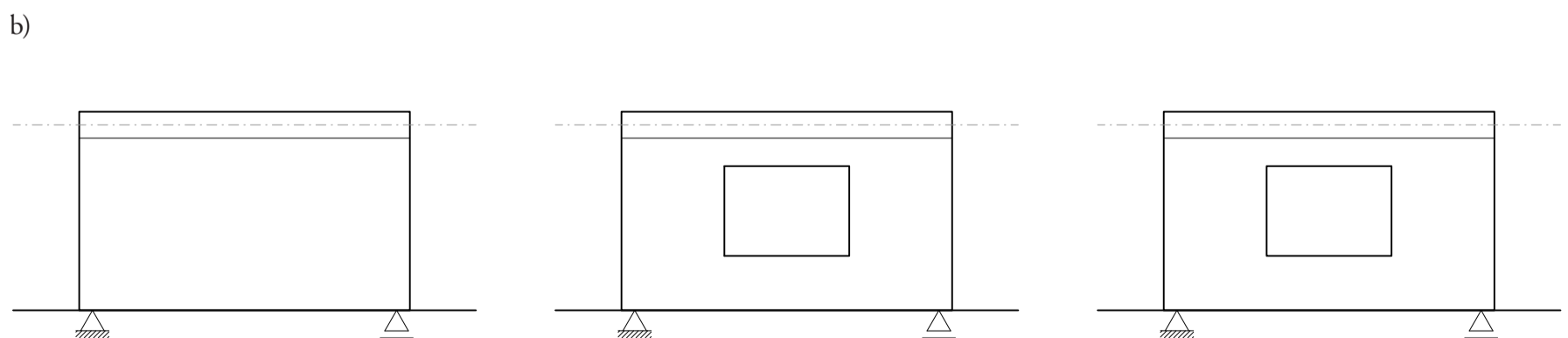
**Task 2 Horizontal Forces (qualitatively)**

Analyse the force flow within the ceiling due to an applied horizontal force. The walls are used for bracing.

- Find a qualitative internal force flow in the plate such that it can be redirected into the ground through the walls.
- Then find a possible internal force flow in the walls A, B and C. First draw the applied horizontal force for each wall into the corresponding form diagram. Then, find the support forces. Indicate tension forces with red, compression forces with blue and reaction forces with green.



top view 1:200



form diagram wall A 1:100

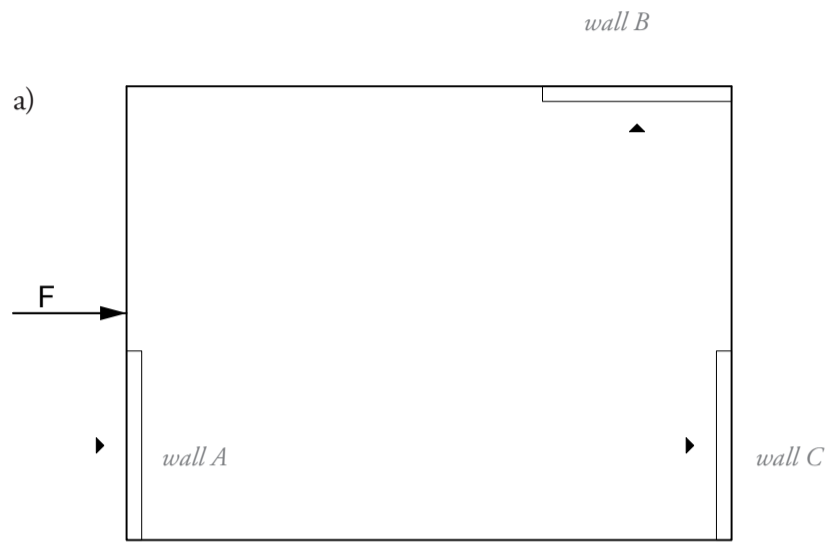
form diagram wall B 1:100

form diagram wall C 1:100

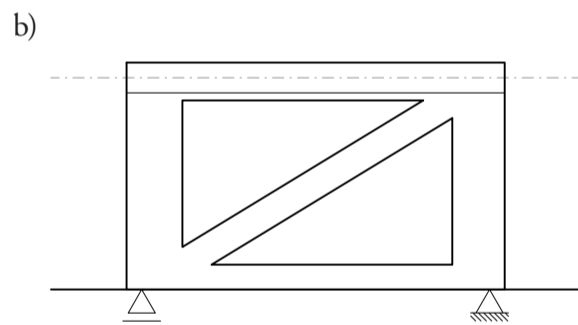
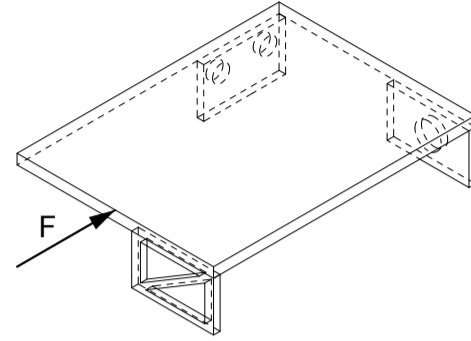
**Task 3 Horizontal Forces (quantitatively)**

Analyse the force flow within the ceiling due to an applied horizontal force. The walls are used for bracing.

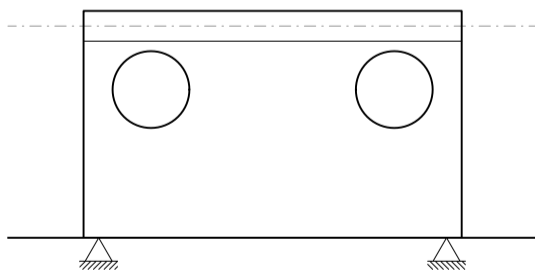
- a) First, find an internal force flow in the plate such as it can be redirected into the ground through the walls. Draw the corresponding force diagram if  $F = 100$  kN.
- b) Then find a possible internal force flow in the walls A, B and C. First draw the applied horizontal force for each wall into the corresponding form diagram. Secondly, draw the force diagram for each wall. Indicate tension forces with red, compression forces with blue and reaction forces with green.



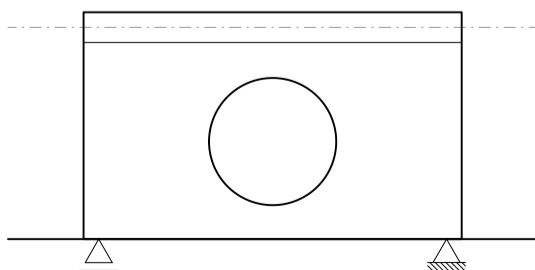
top view 1:200



form diagram wall A 1:100



form diagram wall B 1:100

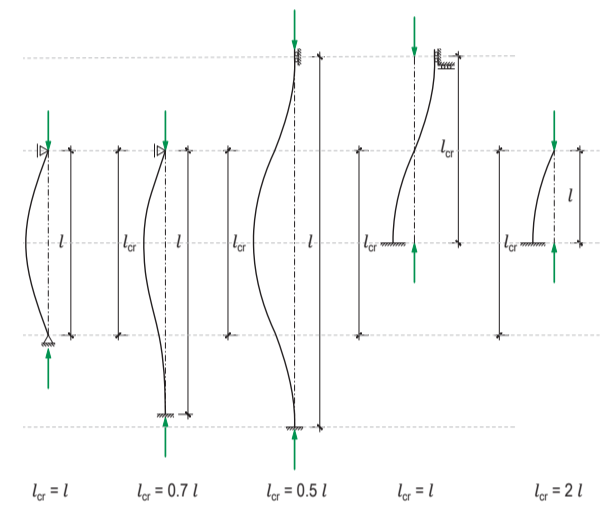
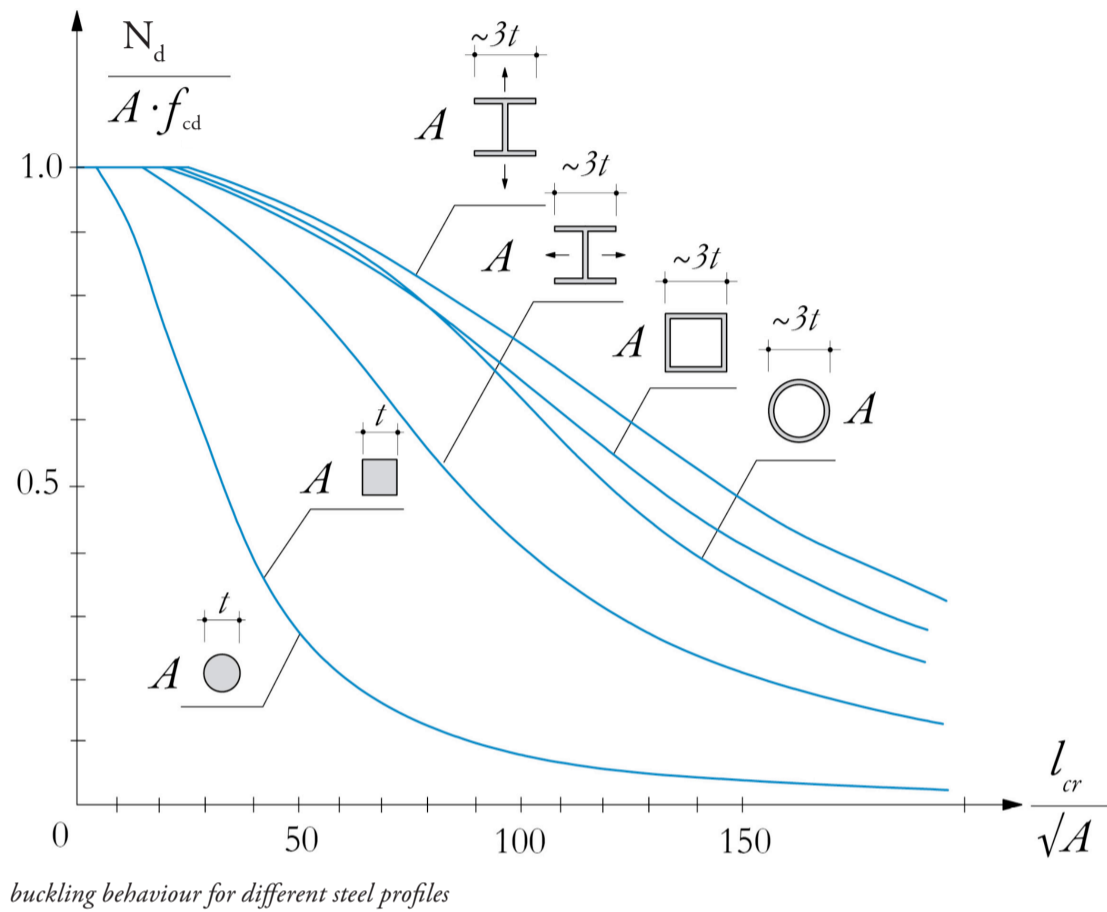


form diagram wall C 1:100

### Task 4 Stability against buckling

Given is a 2.4 m long column made of steel S355. It is designed as a round solid profile with a cross-sectional area of 400 mm<sup>2</sup>. It is subjected to a force  $N_d=54$  kN, and has a hinged support at the top and bottom.

- Check the buckling behaviour of the column. Use the relevant buckling curve to check its stability and draw the corresponding values in the diagram.
- In general, how can buckling be prevented?



a) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

b) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Task 5 Redesigning of first floor

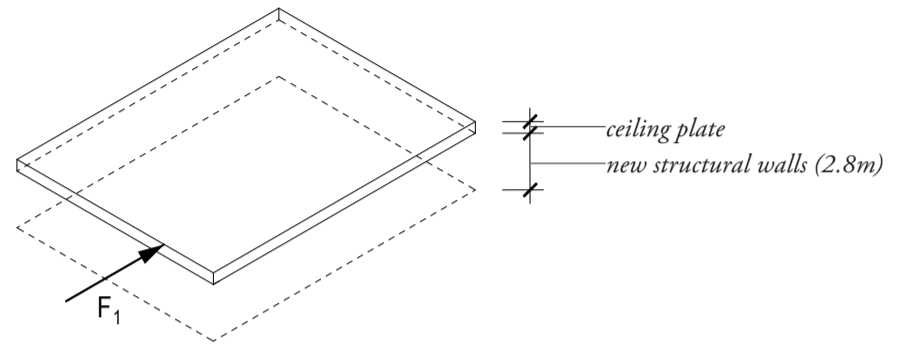
A ceiling plate is considered on which a horizontal force  $F_1 = 100 \text{ kN}$  is applied.

- Place three 2.8m high structural walls in such a way that the system is braced. Sketch a possible internal force flow in the plate such that the forces can be transmitted through the walls into the floor. Draw the corresponding force diagram. Indicate tension forces with red, compression forces with blue and external forces with green.
- Design the side views of the three walls and draw them in scale in the form diagram. Complete the views with the respective qualitative force flow.
- Another force  $F_2 = 100 \text{ kN}$  now acts on the slab. Transfer your bracing scheme from a) and then complete the floor plan qualitatively with a possible internal force flow.

a)



top view 1:200



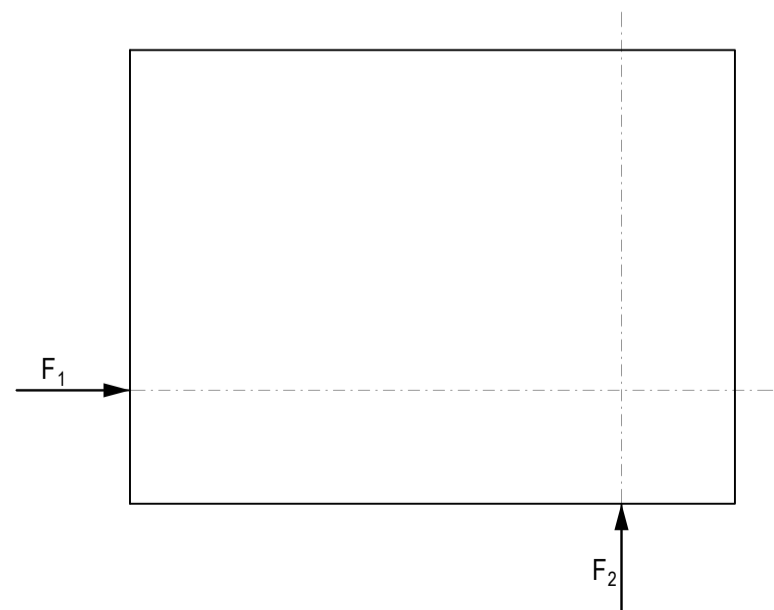
b)

form diagram wall A 1:100

force diagrams 1cm  $\hat{=}$  10kN

form diagram wall B 1:100

c)



form diagram wall C 1:100