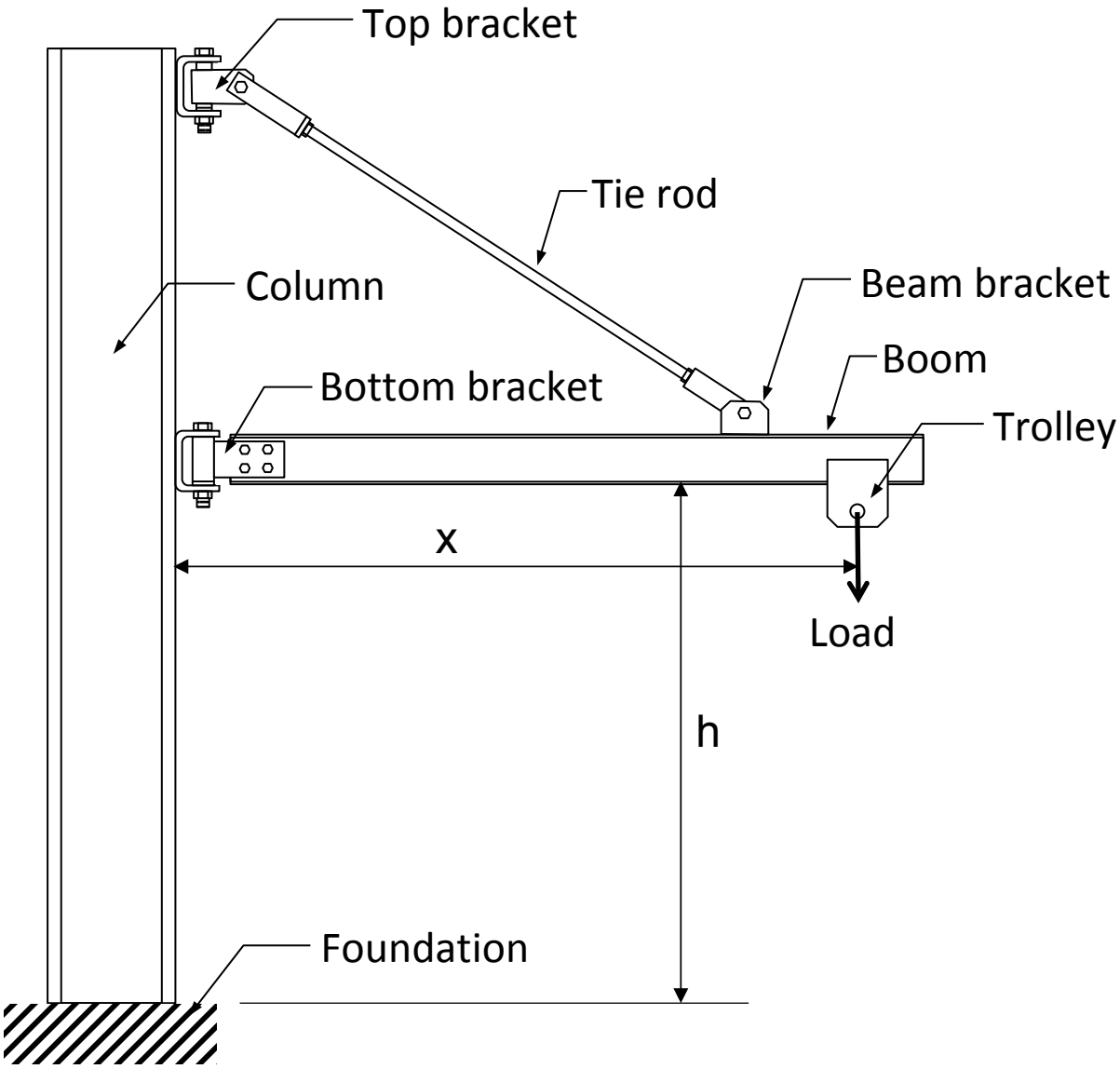
Course of Mechanical Design and Machine Elements

Homework 1, part B: Design and verification of the mechanical joints



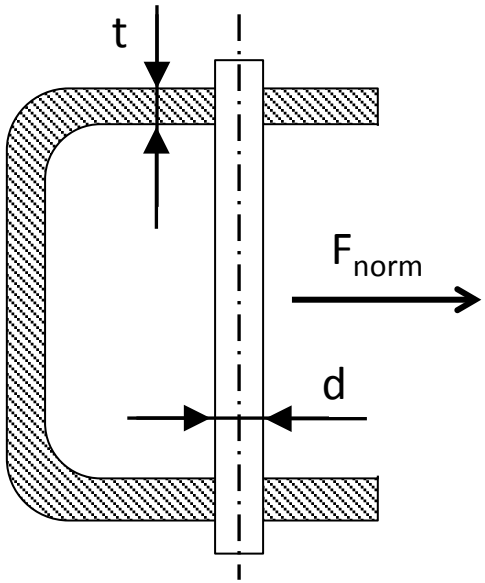
It is requested to:

1) preliminarly design the brackets
2) design and verify the full penetration welds of the box beam of the column
3) design and verify the fillet welds to join the brackets to the beams
4) design and verify the bolted joint between boom and bottom bracket
5) prepare a technical report containing: (i) product design specification, (ii) solutions analysis, (iii) loads analysis and verifications, (iv) conclusions, (v) technical drawings.

Hints

1. Design of the brackets:
   - The load component parallel to the pin is born by the contact between bracket plates.
   - The load component normal to the pin axis is borne by the contact between plate hole and pin. Bracket material tolerates a maximum contact pressure of 100 MPa. This is related to the pin diameter and bracket plate thickness t by the formula:

$$p = \frac{F_{norm}}{2dt}$$



   - As a rule a thumb, take a bracket plate thickness equal to pin diameter d. In this way, from the formula above you can estimate the pin diameter.

Hints

2. Design of welds and bolted joints
    - Use the same safety factor equal to 3 taken in the design of the beams. Assume the structure to be statically loaded.
    - In case of full-penetration welding, make sure that the plate thickness is lower than 20 mm.
    - The bolted joints is composed of three members (2 bracket plates + boom beam) carrying through-holes for bolts (screws+nuts).
    - Feel free to select the bracket width and length. A reasonable value would be the same width as the I beam of the boom. The overall length of the brackets should be around 300 mm, as stated in the previous part of the exercise.