

# Assignment B – Load-Bearing Structure

## Geometry

The structure in the attached drawings has to be analysed for snow load. The structure is symmetric and is based on IPE 220 beams where the height has been increased at some locations along the beams. The beam structure may be regarded as attached in moment free joints at the symmetry plane and at the base foundation. It is stabilised in the out-of-plane direction along the roof construction.

## Load

The structure is located in an area where snow zone 2.0 is applicable. The self weight of the roof structure is  $0.45 \text{ kN/m}^2$ .

## Material

See IPE 220 and choose a material such that no plastic strains are developed in the structure for the first order theory.

## Tasks

The main tasks of the assignment are:

1. Make a 3-dimensional shell model of the beam structure. Assume that the beam structure is horizontally stabilized by the roof and the wall.
2. Determine the stresses in the construction for the snow load according to first order theory and elastic material. Does the construction fulfil the requirements?
3. Determine the stability limit according to second order theory.
4. Assume the steel to be an ideal plastic von Mises material. Determine the ultimate load according to third order theory. Determine the influence of imperfections in the geometry by, for instance, applying a small out-of-plane load on the structure.
5. Make comparison of the results from the three models.



