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Exercise #6: Steel girder Design Against Lateral Torsional Buckling – Design According to SIA 263, Axial load – bending interaction

Problem 1

The steel beam shown below is a HEA 240 made of S235 steel (nominal f_y =235MPa, γ=78.5kN/m^3). The beam is 10.00m long. Compute the maximum moment M shown in the figure such that lateral torsional buckling does not occur. Use the SIA 263 approach for your computations. Assume that the boundary conditions allow for warping at the member end. The member is restrained against torsion.

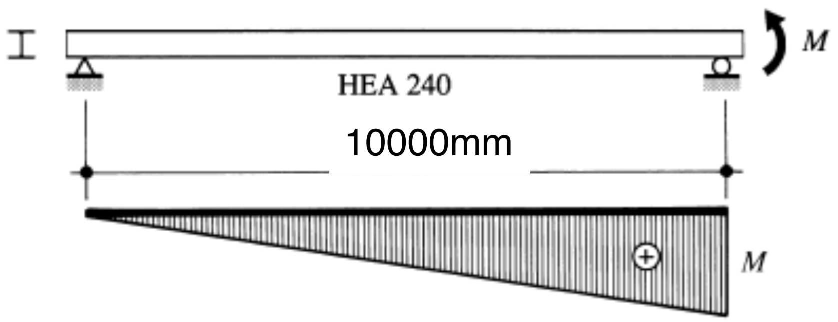


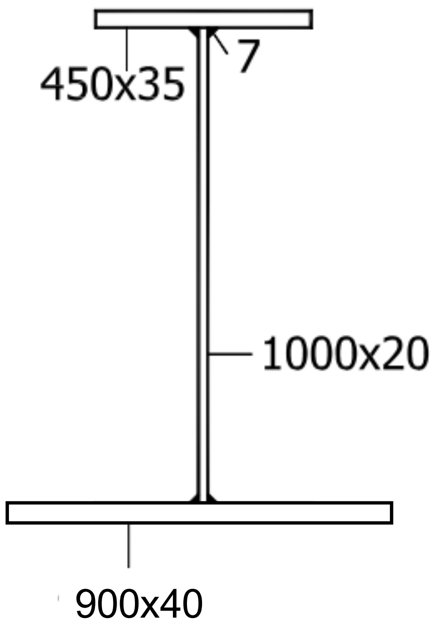
Figure 1. Moment diagram and boundary conditions of steel beam.

Problem 2 (Use of LTBeam/LTBeamN)

The simple supported pedestrian bridge shown in the figure below has a span of 28,00m. The deck is 8,00m long as shown in Figure 2. The load resisting system consists of two main single symmetric steel girders that are welded; from secondary beams and from a concrete slab (γ=25kN/m^3) with thickness of 25cm as shown in Figure 2. The steel girders are made of S235 steel (nominal f_y =235MPa, γ=78.5kN/m^3, coefficient of thermal expansion, $\alpha=10^{-6}$). Assume that the slab does not provide continuous lateral support at the top of the girder.

1. Use LTBeam*/LTBeamN* and calculate the critical moment of the girder due to lateral torsional buckling. Does the main girder sustain the maximum moment from the imposed transverse loading? Check if the girder is adequate for lateral torsional buckling due to dead load. The dead load calculations should be based on the self-weight of the girder and the concrete (1.35xDL).
2. If the girder is under designed against lateral torsional buckling, then lateral bracing should be installed. An HEA 240 steel beam is selected in this case. This transverse beam is placed every 7m. Check the bending resistance of the steel beam against lateral torsional buckling due to dead weight.

3. Use LTBeamN* to compute what the lateral torsional buckling resistance of the girder would be if a compressive axial load develops in the girder due to temperature effects (ΔT = 20ºC).



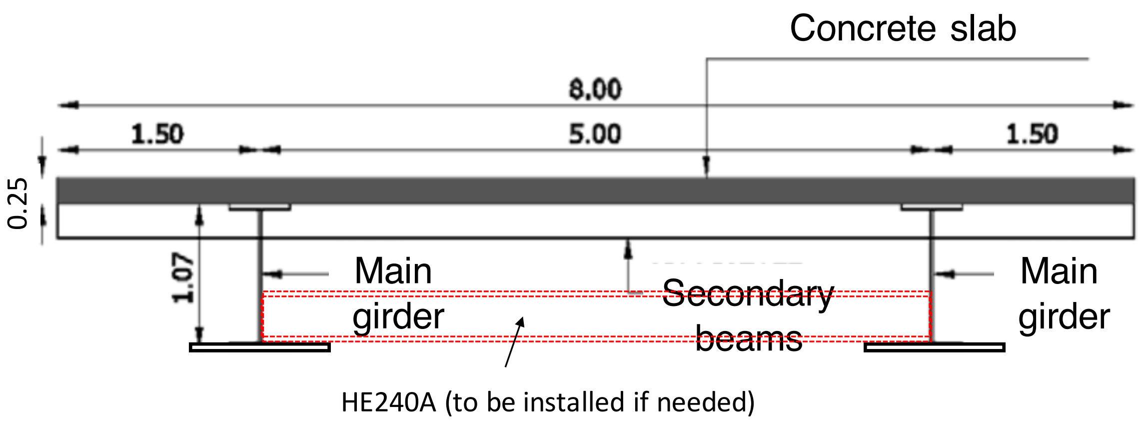


Figure 2. Section of pedestrian bridge deck

* Software is available for free from the following website:
https://www.cticm.com/content/ltbeam-logiciel-calcul-moment-critique-deversement