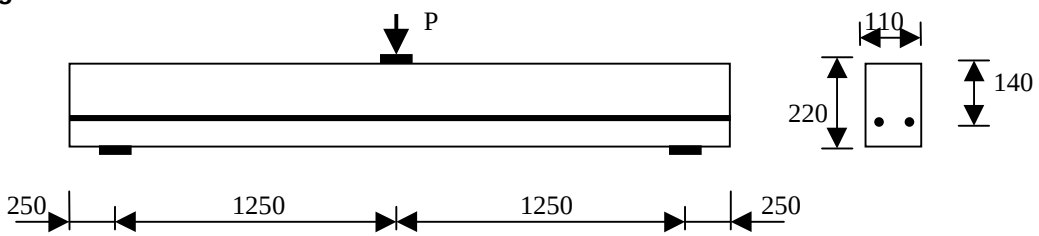
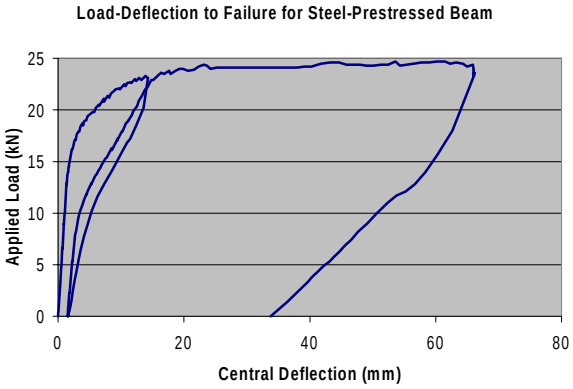
Tutorial Sheet for Steel-Prestressed Beam

Name:

Beam design and dimensions



Concrete cube strength f_{cu} = 53.3N/mm^2, tensile strength f_t = 5.74N/mm^2. Two steel tendons of 7mm ϕ each snap at f_{pu} = 1750N/mm^2. Effective prestress 57% of f_{pu}. Young's Modulus E_s = 200,000N/mm^2 for steel and E_c = 30,000N/mm^2 for concrete.



Cracking behaviour

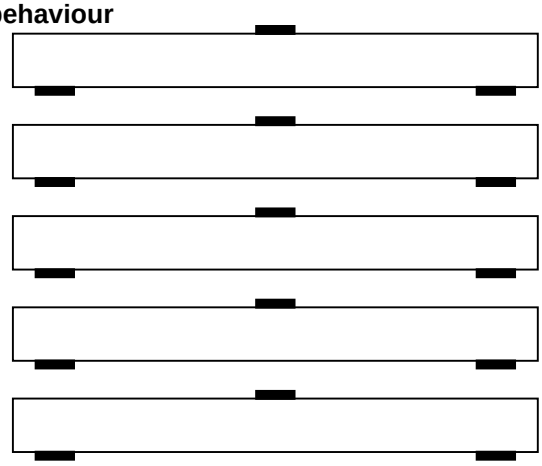
at 15kN:

at 20kN:

at 24kN:

after reload:

at failure:



Comment briefly on the behaviour of the beam through the elastic range, during progressive cracking, up to 24kN, after unloading and reloading, and post-peak behaviour. Comment on whether you think this behaviour was to be expected, and why.

PTO

Estimate the cracking load of the specimen from the load-deflection plot. By using an elastic stress analysis across the section at midspan, calculate the theoretical cracking load and compare with reality. Comment on your result.

By considering equilibrium at midspan at steel yield, predict the *actual* predicted flexural strength of this beam (ie ignore partial safety factors). Comment on the accuracy of your prediction in this case. Show all calculations below and ignore self-weight.