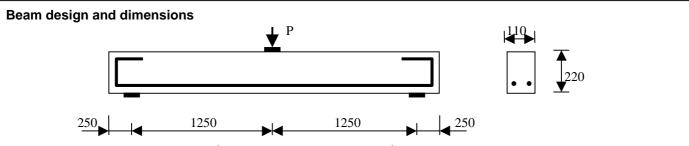
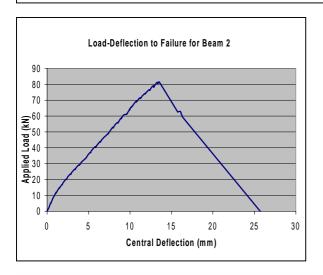
## **Tutorial Sheet for Over-Reinforced Beam**

Name:



Concrete cube strength  $f_{cu} = 52.5 N/mm^2$ , tensile strength  $f_t = 5.65 N/mm^2$ . Bottom reinforcement is 2 T20 bars. Cover is 25mm. Young's Modulus  $E_s = 200,000 N/mm^2$  for the steel and  $E_c = 30,000 N/mm^2$  for the concrete.





Comment briefly on the behaviour of the beam through the elastic range, during progressive cracking, up to peak load and post-peak behaviour. Comment on whether you think this behaviour was to be expected, and why.
Estimate the cracking load of the specimen from the load-deflection plot. By using a transformed section approach, calculate the predicted cracking load and compare with the actual result. Ignore self-weight. Comment on your result. [Hint: Look at page 91 of your Structures 2 notes]

By considering both the load-deflection plot and the behaviour of the beam in the video, do you think the longitudinal steel yielded at failure? By considering equilibrium at midspan, predict the maximum strain in the steel bars at failure.
By using relevant clauses from the appropriate code-of-practice, predict the design strength of this beam. Consider both bending and shear strength. Comment on the accuracy and safety of the code-of-practice in this case. Show all calculations below and ignore self-weight.