Assignment #4

3 Problems, Total = 60 marks

Problem 1 (20 marks)

For the T-beam shown in **Figure 1**:

a. Determine the moment resistance using hand calculations

b. Repeat, however this time use the CDH tables

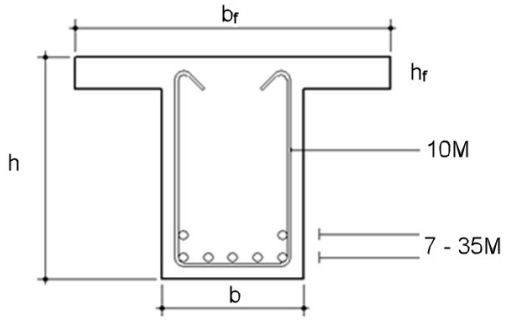


Figure 1

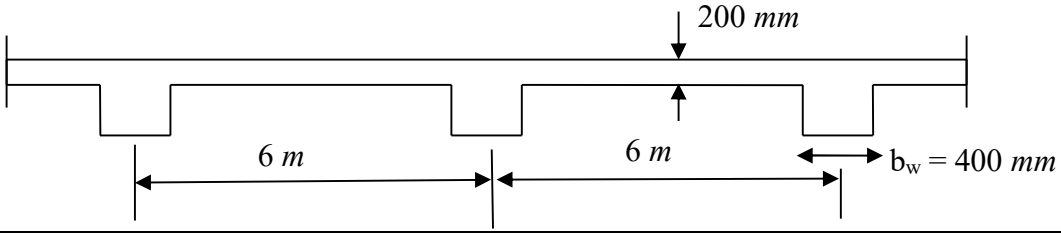
NOTE:
* f'c = **30 MPa**, fy = **400 MPa**
* bf = **1000 mm**, hf = **100 mm**
* h = **700 mm**, b = **450 mm**
* **30 mm** clear cover
* **40 mm** clear spacing between layers of steel

Problem 2 (20 marks)

Consider a typical interior T-beam which is part of the floor system shown in the **Figure 2**. The floor supports a *service* dead load of 8 kPa (<u>including self-weight</u>) and a *service* live load of 6 kPa. Each simply supported T-beam spans 8 *m* (with clear span of 7.6 m) and the center to center spacing between the beams is *6m* as shown in the figure.

The engineer proposes a design for the midspan section that uses 8-30M bars in 2 layers with 30 mm cover and 10M stirrups. Is the design acceptable in terms of moment resistance ?

<u>Note:</u> verify the design using hand calculations (not the CDH tables).
<u>Hint:</u> It may be that As < As_{ref} (i.e. a < hf). So make sure to check this before calculating Mr.



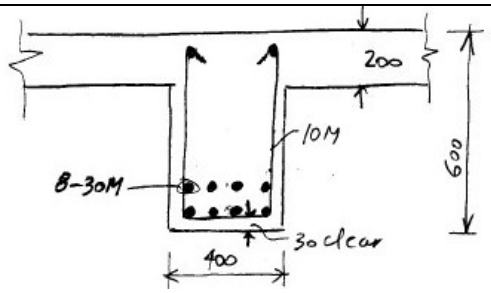


Figure 2

NOTE:
- f'c = **25 MPa**, fy = **400 MPa**
- **30 mm** clear cover
- **42 mm** clear spacing in between layers
- **30M** bars, **10M** stirrups

Problem 3 (20 marks)
Design the beam shown in **Figure 3** which is part of a continuous girder. For preliminary design the beam can be considered to be fixed-fixed. The beam cross-section dimensions that are to be used in design are shown in the figure. The beam can be considered to have interior exposure conditions.

Note: use f'c = **30 MPa**, **25 mm** aggregate, fy = **400 MPa**
Note: use **30 mm** clear cover, **10M** stirrups, **20M bars**.

Note: you can use the CDH tables to determine As and to verify Mr

a. Design the critical beam section in positive bending such that the CSA A23.3 requirements for strength (Mr ≥ Mf), cover, bar spacing and crack control (z-factor) are met.
b. Repeat for the critical beam section in negative bending
c. Provide a design summary figure for the beam (do not calculate bar cutoffs, however sketch approximately how the reinforcement would be placed along the beam length and also show the critical beam cross-section details)

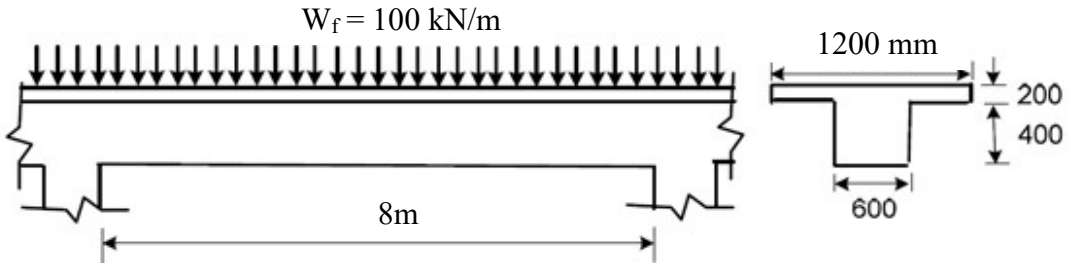


Figure 3

Note: use the following figure to determine moments; the section for question "a" is in the middle, the section for question "b" is at the ends !