

Assignment #5

2 Questions, total = 60 marks

Problem 1 (30 marks)

Consider the beam shown in **Figure 1** which must resist a factored moment of 850 kNm. The beam has a height $h = 650 \text{ mm}$ and width $b = 400 \text{ mm}$.

- a. Using a simple calculation (i.e. with ρ_{\max}) show that the design shown in **Figure 1(a)** will result in an over-reinforced beam.
- b. Using a simple calculation (i.e. with ρ_{\max}) show that the revised design shown in **Figure 1(b)** will result in an under-reinforced beam.
- c. Using hand calculations, find the moment resistance of the beam in **Figure 1(b)**
 - **Note: do not use the CDH design tables**
- d. Repeat "c", however this time use the CDH tables

NOTE: $f_c = 25 \text{ MPa}$, $f_y = 400 \text{ MPa}$, 30 mm clear cover (top & bottom), clear spacing of 42 mm between layers.

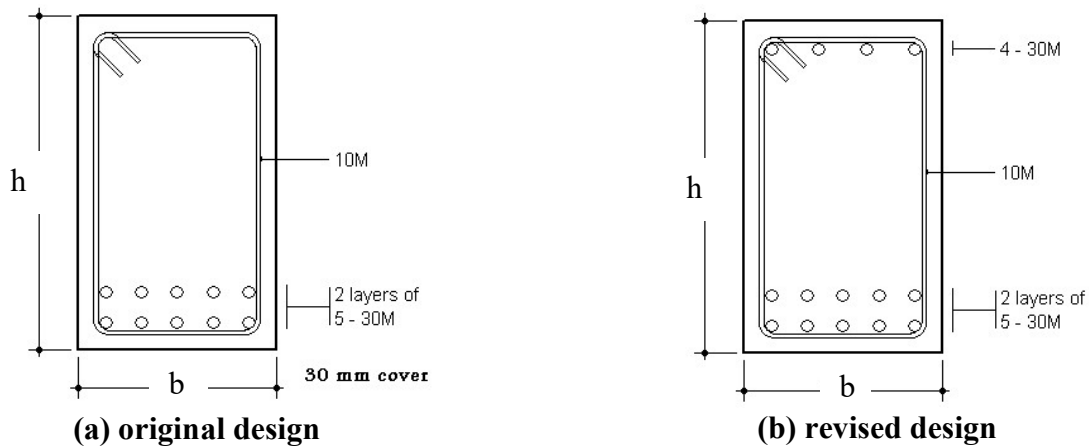


Figure 2

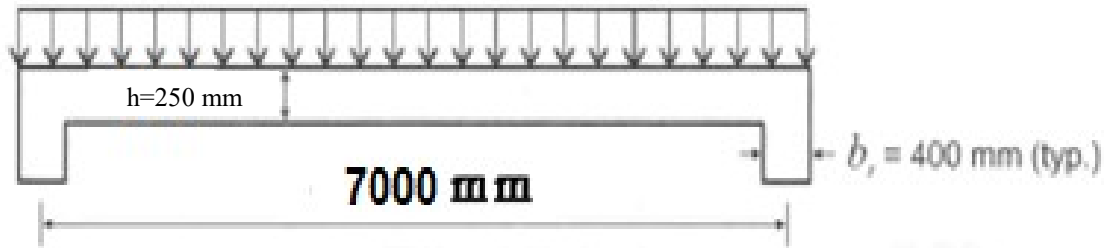
Problem 2 (20 marks)

Consider the simply supported reinforced concrete slab shown in **Figure 2**. The engineer has chosen a **275 mm** thick slab and selected **15M @ 175 mm** for the main tension steel and **15M @ 500 mm** for the shrinkage reinforcement.

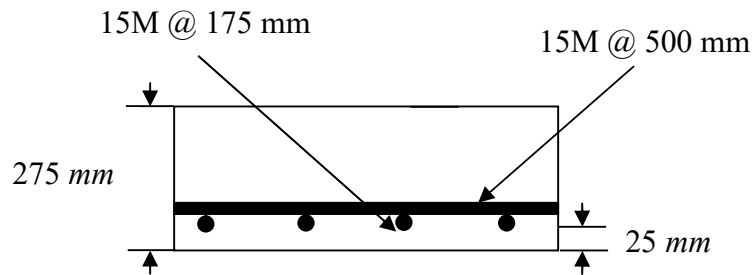
The maximum aggregate size is **20 mm**. $f'_c = 35 \text{ MPa}$, $f_y = 400 \text{ MPa}$. Loads are shown on drawing, consider $1.25D + 1.5L$ and use clear span (L_n) when calculating M_f .

- Check that the spacing for the main tension steel satisfies the $M_r \geq M_f$, as well as the s_{max} and A_{smin} requirements of the CSA standard.
- Check that the chosen spacing for the shrinkage steel satisfies the s_{max} and A_{smin} requirements of the CSA standard
- Check if the slab is thick enough to provide adequate shear resistance

$$D = 5 \text{ kPa}, L = 4 \text{ kPa}$$



(a) slab



Section @ midspan

(b) slab design details

Figure 2