Banha University
Faculty of Engineering - Shoubra
Civil Engineering Department

REINFORCED CONCRETE 1 - A

For 2nd Year Civil – 1st Term

Prof. Youssef Hashem, Prof. Ahmed Abd-alFattah,
Assoc. Prof. Fouad Bakheet, Assoc. Prof. Taha Awad & Assoc. Prof. Tarek Sayed

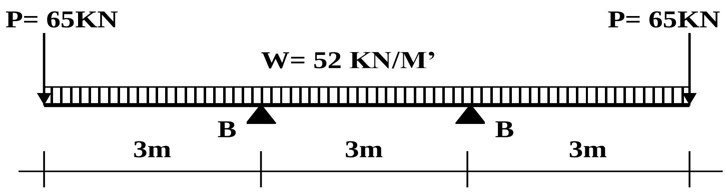
<u>Assignments</u>

BANHA UNIVERSITY | **SECOND YEAR -1st TERM**
FACULTY OF ENGINEERING (SHOBRA) | **REINFORCED CONCRETE 1**
DEPARTMENT OF CIVIL ENGINEERING | **Sheet (1) Internal Forces Diagrams**

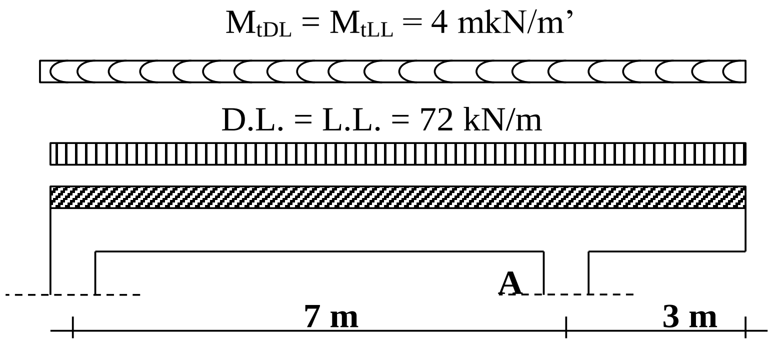
- Systematic arrangement of calculations and clear neat sketches are essential;
- Take: **f_{cu} = 25 MPa, f_y = 240 MPa (for Φ $\le$ 8 mm) , f_y = 400 MPa (for Φ $\ge$10 mm), Φ $\le$ 25 mm**.
- Any missing data may be reasonably assumed according to ECP 2007 & economical design rules.

---

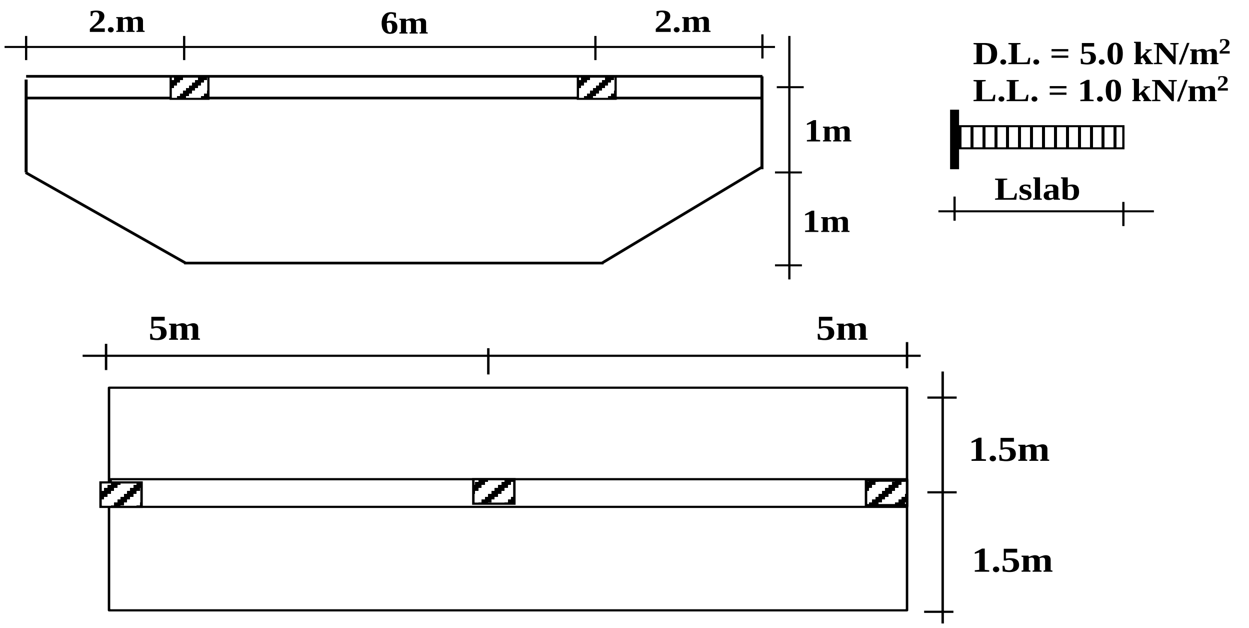
[1] For the shown overhanging projected beams, it is required to draw the max. ultimate B.M.D & S.F.D. and to calculate max. support reaction.



[2] For the shown overhanging beam in elevation under the given service dead & live loads, it is required to draw max. ultimate B.M.D, S.F.D. & T.M.D. and to calculate max. support reactions.



[3] For the beams (**bxt = 300x800 mm, t_s =160 mm**) in the shown plan of a shed roof under the given slab service dead **(D.L.)** & live **(L.L.)** loads and **beam own weight= 5 kN/m'**, it is required to draw the max. ultimate B.M.D., S.F.D. and T.M.D. and to calculate max. support reactions.



– Systematic arrangement of calculations and clear neat sketches are essential;
– Take: **f_{cu} = 30 MPa, f_y = 240 MPa (for $\Phi \leq$ 8 mm) , f_y = 400 MPa (for $\Phi \geq$10 mm), $\Phi \leq$ 25 mm**.
– Any missing data may be reasonably assumed according to ECP 2007 & economical design rules.

---

[1] a- Calculate M_u for R-section (bxt = 250x700 mm, A_s= 4Φ18, A_s= 0.0, d'= 50mm)
b- Recalculate M_u if b = 300 mm
c- Recalculate M_u if t = 900 mm
d- Recalculate M_u if f_{cu} = 35 MPa
e- Recalculate M_u if f_y = 360 MPa
f- Recalculate M_u if A_s = 6Φ18
g- Recalculate M_u if A_s' = 0.3 A_s
h- Recalculate M_u if B= 5b, t_s = 140 mm

[2] For R-section (bxt =300x750 mm, d'=50 mm), draw the relationships of M_u – A_s, strain ducility –A_s and (c/d) – A_s such that $A_{smin} \leq A_s \leq 1.2A_{sb}$ (Take A_s = A_{smin} , 0.5A_{smax} , A_{smax} , A_{sb} , 1.2A_{sb}).

[3] For the following R-sections (bxt = 300x750 mm, d'=50 mm), calculate M_u and strain distribution diagram.
a- A_s = 2Φ22
b- A_s = 4Φ22
c- A_s = 8Φ22
d- A_s = 6Φ22, A_s'= 2Φ22, d_{top}'= 40mm)
e- A_s = 6Φ22, A_s'= 4Φ22, d_{top}'= 60mm

[4] For the following flanged sections (t= 850 mm, d'=50 mm), calculate M_u and strain distribution diagram.
a- T-section (t_s= 120mm, A_s= 6Φ25, b= 250mm)
b- L-section (t_s= 80mm, A_s= 6Φ25, b= 250mm, B= 550mm)
c- Box-section (t_w = t_f = 100mm, A_s= 8Φ25, B= 850mm)

[5] Calculate M_{umin}, M_{umax}, M_{ub} and corresponding strain ductility for the following sections (bxt= 250x800mm, d'=50 mm).
a- R-section (A_s'= 0.0)
b- R-section (A_s'= 0.2 A_s)
c- T-section (t_s= 120mm)
d- L-section (t_s= 100mm)
e- Trapezoidal section (b_{top} = 750mm)
f- Triangular section

[6] For a simply supported beam under uniformly distributed service load (W kN/m'), the critical section is singly reinforced R-section (bxt = 300x700 mm). It is required to:
a- Calculate the largest span (L_{max}) if W= 40 kN/m'
b- Calculate W if L= 7mm, A_s = 0.5 A_{sb}

BANHA UNIVERSITY | **SECOND YEAR -1st TERM**
FACULTY OF ENGINEERING (SHOBRA) | **REINFORCED CONCRETE 1**
Civil Engineering Dept. | **Sheet (3) Flexural Design of RC Sections**

– Systematic arrangement of calculations and clear neat sketches are essential;
– Take: **f_{cu} = 30 MPa, f_y = 240 MPa (for $\Phi \le$ 8 mm) , f_y = 400 MPa (for $\Phi \ge$10 mm), $\Phi \le$ 25 mm**.
– Any missing data may be reasonably assumed according to ECP 2007 & economical design rules.

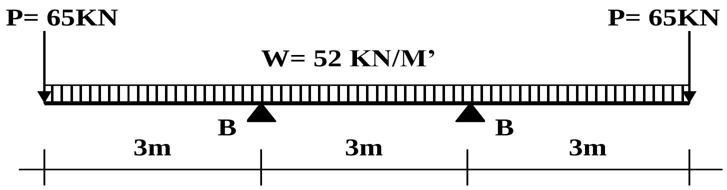
---

[1] Design & draw R-section (bxt= 300x900mm) to carry the following ultimate moment:
a- 350 m.kN   b- 900 m.kN   c- 1400 m.kN

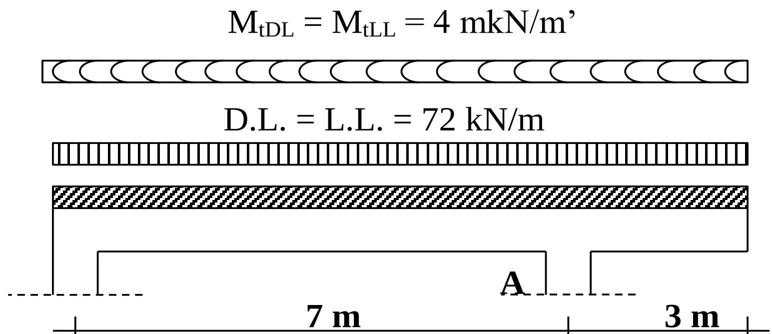
[2] Design & draw R-section (b= 300mm) under M_u= 900 m.kN such that:
a- The section is having the largest effective depth   b- The section is having the smallest effective depth
c- Steel ratio = 0.4 max. steel ratio   d- d_{given} = 0.8 $d_{minimum}$

[3] Design & draw T-section (b= 300mm, t_s = 120mm) under M_u= 900 m.kN such that:
a- Section is having the largest effective depth   b- Section is having (1.3*the smallest effective depth)
c- Steel ratio = 0.3 max. steel ratio   d- d_{given} = 1.2 d_{max}

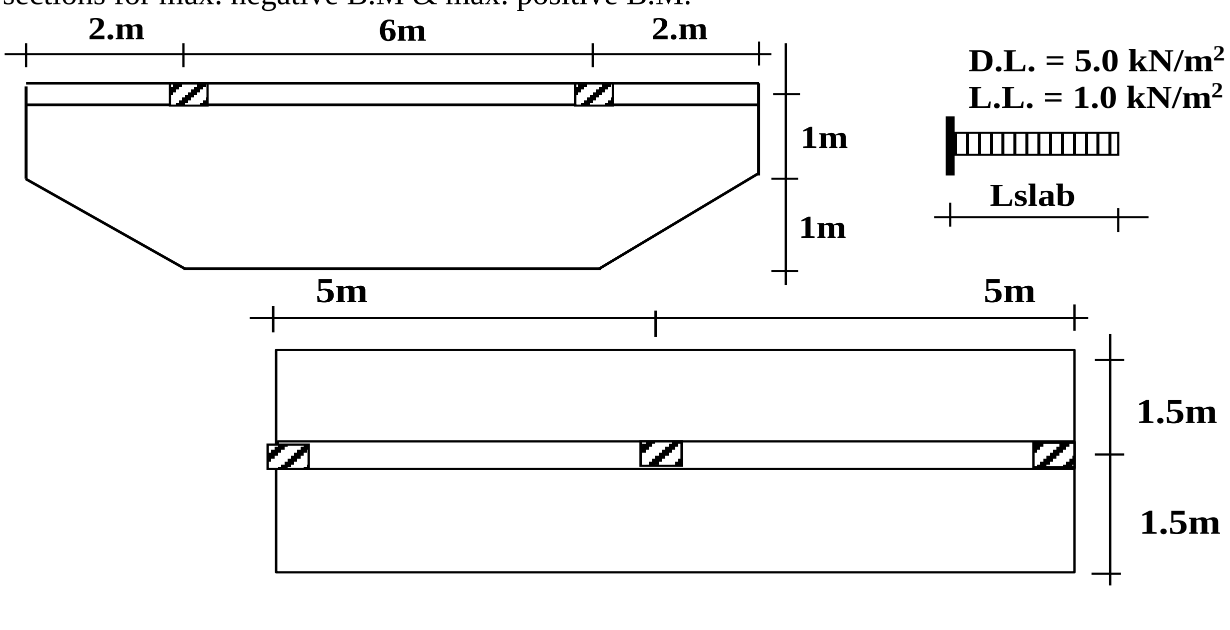
[4] For the shown overhanging projected beams (**b=300mm, t_s=120mm**, d=0.8**d_{min} at support**), it is required to design & draw critical sections for max. negative B.M & max. positive B.M.



[5] For the shown overhanging beam in elevation (**b x t = 350 x 900 mm, t_s=120 mm**) under the given service loads, it is required to design & draw critical sections for max. negative & max. positive B.M.



[6] For the beams (**bxt = 300x800 mm, t_s =160 mm**) in the shown plan of a shed roof under the given slab service dead **(D.L.)** & live **(L.L.)** loads and **beam own weight= 5 kN/m'**, it is required to design & draw critical sections for max. negative B.M & max. positive B.M.



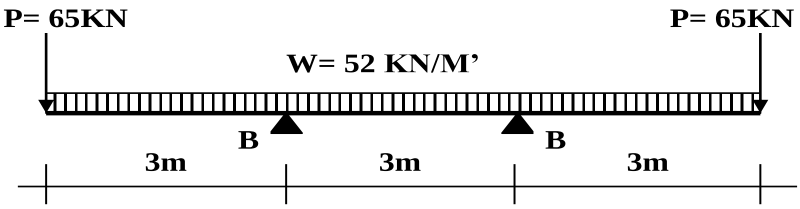
BANHA UNIVERSITY | **SECOND YEAR -1st TERM**
FACULTY OF ENGINEERING (SHOBRA) | **REINFORCED CONCRETE 1**
Civil Engineering Dept. | **Sheet (4) Design for Shear and Torsion**

- Systematic arrangement of calculations and clear neat sketches are essential;
- Take: **f_{cu} = 30 MPa, f_y = 240 MPa (for Φ ≤ 8 mm) , f_y = 400 MPa (for Φ ≥10 mm), Φ ≤ 25 mm**.
- Any missing data may be reasonably assumed according to ECP 2007 & economical design rules.

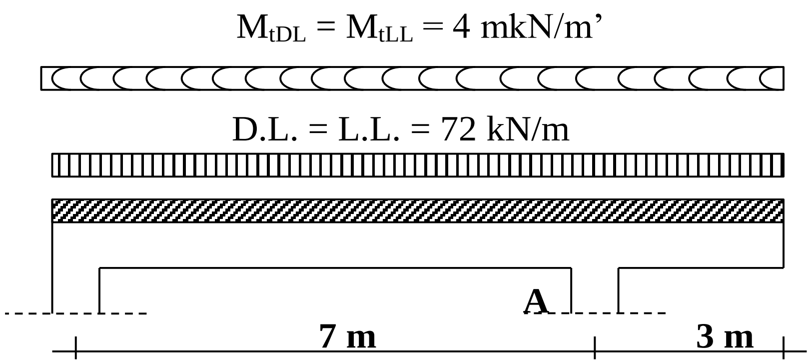
---

[1] Design a corbel which is projected from a rectangular column (bxt= 300x500mm) to support the following beam reactions: Dead load= 40 kN, Live load= 120 kN & Horizontal load= 15 kN.

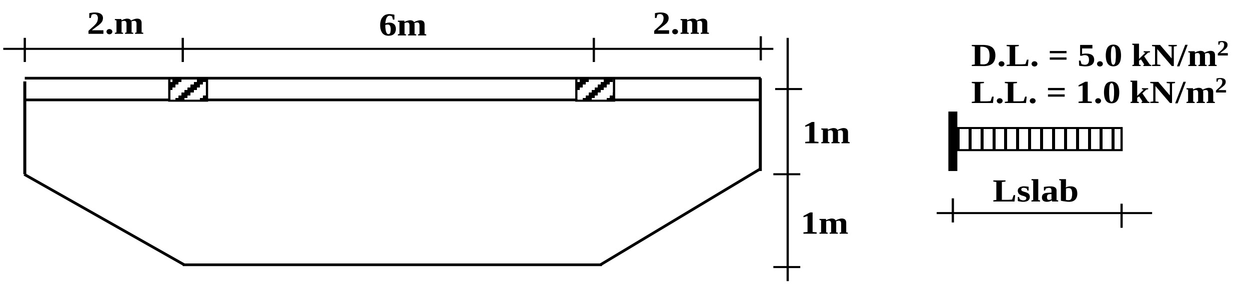
[2] For the shown overhanging projected beams (**b=300mm, t_s=120mm**, d=0.8**d_{min} at support**), it is required to design & draw the critical section for shear (Vertical stirrups, 45^0 inclined stirrups, 60^0 inclined stirrups)

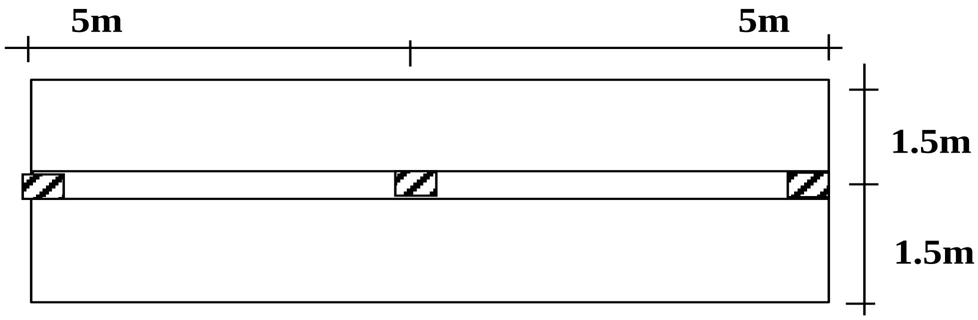


[3] For the shown overhanging beam in elevation (**b x t = 350 x 900 mm, t_s=120 mm**) under the given service loads, it is required to design & draw the critical sections for shear and torsion at supports as T-sections (Vertical stirrups).



[4] For the beams (**bxt = 300x800 mm, t_s =160 mm**) in the shown plan of a shed roof under the given slab service dead **(D.L.)** & live **(L.L.)** loads and **beam own weight= 5 kN/m'**, it is required to design & draw the critical sections for shear and torsion as R-sections.





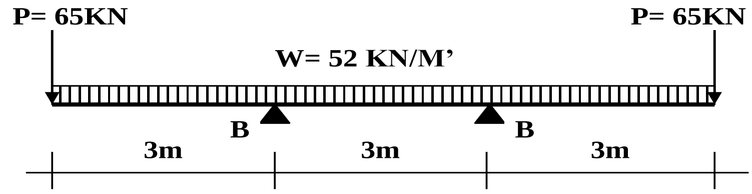
BANHA UNIVERSITY — **SECOND YEAR -1st TERM**
FACULTY OF ENGINEERING (SHOBRA) — **REINFORCED CONCRETE 1**
Civil Engineering Dept. — **Sheet (5) Sections Under Eccentric Forces**

- Systematic arrangement of calculations and clear neat sketches are essential;
- Take: **f_{cu} = 30 MPa, f_y = 240 MPa (for Φ $\le$ 8 mm) , f_y = 400 MPa (for Φ $\ge$10 mm), Φ $\le$ 25 mm**.
- Any missing data may be reasonably assumed according to ECP 2007 & economical design rules.
- For design of sections with uniform steel arrangement try with 1.0 % $\le \mu \le$ 2.0 %, while for design of sections with top and bottom steel arrangement try with 0.5 % $\le \mu \le$1.5%.

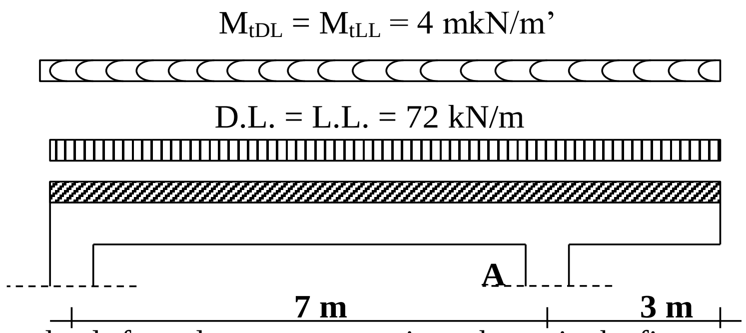
---

[1] For the shown overhanging projected beams (**b=300mm, t_s=120mm**, d=0.8**d_{min} at support**), it is required to design & draw column sections to resist six times the max. reaction as follows:

a- Square tied column
b- Rectangular tied column (b $\ge$ 250mm)
c- Circular tied column
d- Spiral circular column

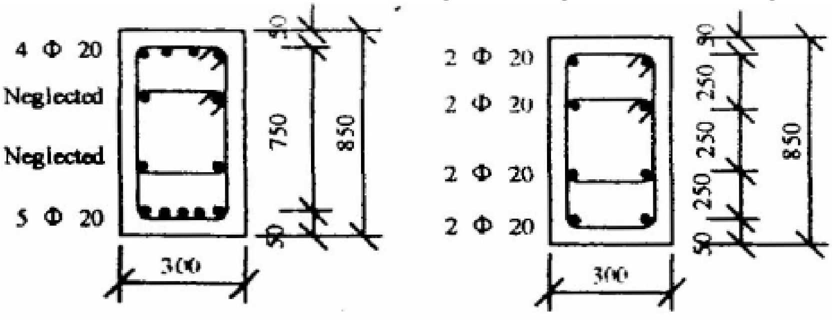


[2] For the shown overhanging beam in elevation (**b x t = 350 x 900 mm, t_s=120 mm**) under the given service loads, it is required to design & draw square sections to resist ten times max. reactions at A&B.



[3] Calculate the ultimate loads for columns cross sections shown in the figure using interaction diagrams

a- e = e_{min}
b- e = 0.5 t
c- e = e_b
d- e = 2.0 t



[4] Design **R-section** for the following cases (b = 250 mm- T and N in kN and M in kN.m)
(Using the interaction diagrams for eccentric compression)

a-	Tension Force	$T_{D.L}$ = 500	& $T_{L.L}$ = 1000	and $M_{D.L}$ = 0	& $M_{L.L}$ = 0
b-	Comp. Force	$N_{D.L}$ = 500	& $N_{L.L}$ = 1000	and $M_{D.L}$ = 0	& $M_{L.L}$ = 0
c-	Tension Force	$T_{D.L}$ = 500	& $T_{L.L}$ = 1000	and $M_{D.L}$ = 50	& $M_{L.L}$ = 100
d-	Comp. Force	$N_{D.L}$ = 1500	& $N_{L.L}$ = 1500	and $M_{D.L}$ = 100	& $M_{L.L}$ = 150
e-	Tension Force	$T_{D.L}$ = 100	& $T_{L.L}$ = 200	and $M_{D.L}$ = 1000	& $M_{L.L}$ = 1000
f-	Comp. Force	$N_{D.L}$ = 100	& $N_{L.L}$ = 200	and $M_{D.L}$ = 1000	& $M_{L.L}$ = 1000

[5] Design a circular column section for the following cases:

a- Comp. Force $N_{D.L}$ = 500 kN $N_{L.L}$ = 1500 kN and $M_{D.L}$ = 100.0 kN.m $M_{L.L}$ = 200.0 kN.m
b- Comp. Force $N_{D.L}$ = 500 kN $N_{L.L}$ = 1500 kN and $M_{D.L}$ = 200.0 kN.m $M_{L.L}$ = 500.0 kN.m