

***REINFORCING DETAILING OF R.C.C  
MEMBERS***

- A design engineer's responsibility should include assuring the structural **safety** of the design, **details, checking** shop drawing.
- Detailing is as important as design since proper detailing of engineering designs is an essential link in the planning and engineering process as some of the most devastating collapses in history have been caused by defective connections or DETAILING. There are many examples explained in the book" DESIGN AND CONSTRUCTION FAILURES by Dov Kaminetzky.
- Detailing is very important not only for the proper execution of the structures but for the safety of the structures.
- Detailing is necessary not only for the steel structures but also for the RCC members as it is the translation of all the mathematical expression's and equation's results.

- For the RCC members for most commonly used for buildings we can divide the detailing for

SLABS-WITH OR WITHOUT OPENINGS.(RECTANGULAR,CIRCULAR,NON-RECTANGULAR-PYRAMID SLAB,TRIANGULAR ETC)

-BALCONY SLAB, etc.

BEAMS- WITH OR WITHOUT OPENINGS.(SHALLOW & DEEP BEAMS)

COLUMNS.(RECTANGULAR,L-SHAPE,T-SHAPE,  
CIRCULAR,OCTAGONAL,CROSS SHAPE etc)

#### 4. FOUNDATIONS.

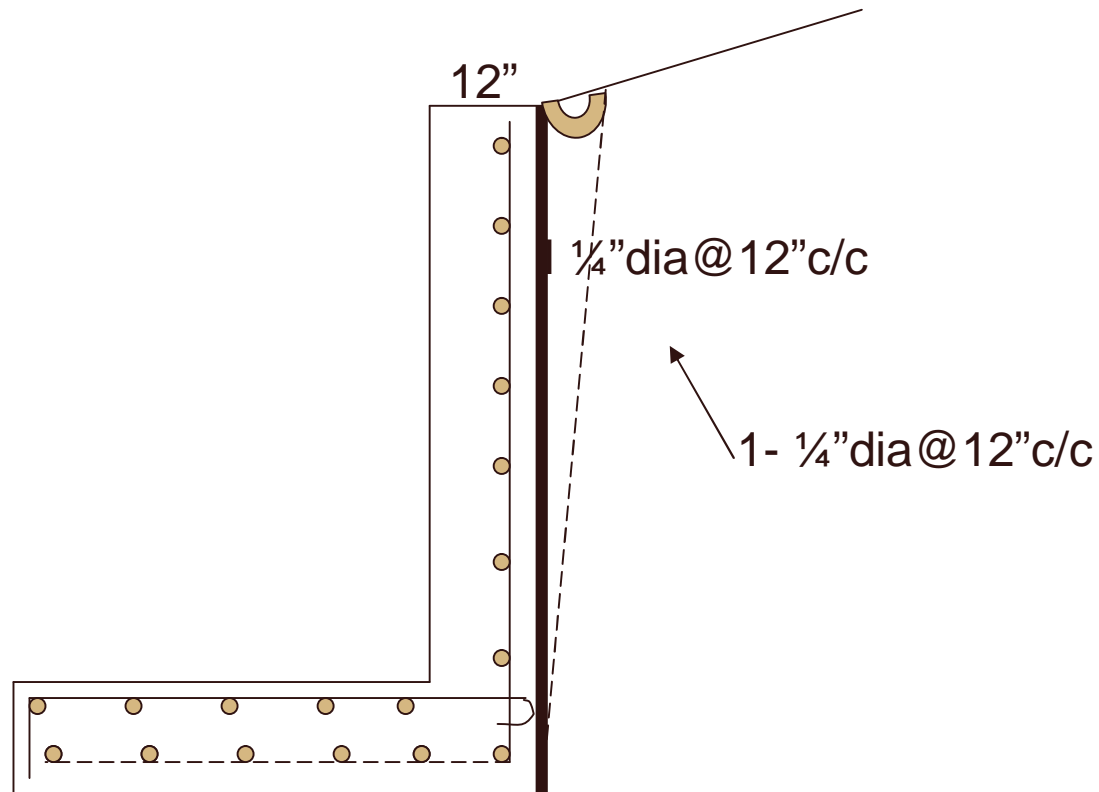
- Detailing for gravity loads is different from the lateral loads specially for the SEISMIC FORCES.
- Apart from the detailing for the above there is a different detailing required for the Rehabilitation and strengthening of damaged structures.
- We will now dwell on the DETAILING OF MEMBERS FOR THE GRAVITY AND SOME CODAL DETAILINGS AS PER IS CODE IS 13920 AND IS 4326 AS REQUIRED FOR SEISMIC FORCES.

# DO'S & DONOT'S FOR DETAILING



## DO'S-GENERAL

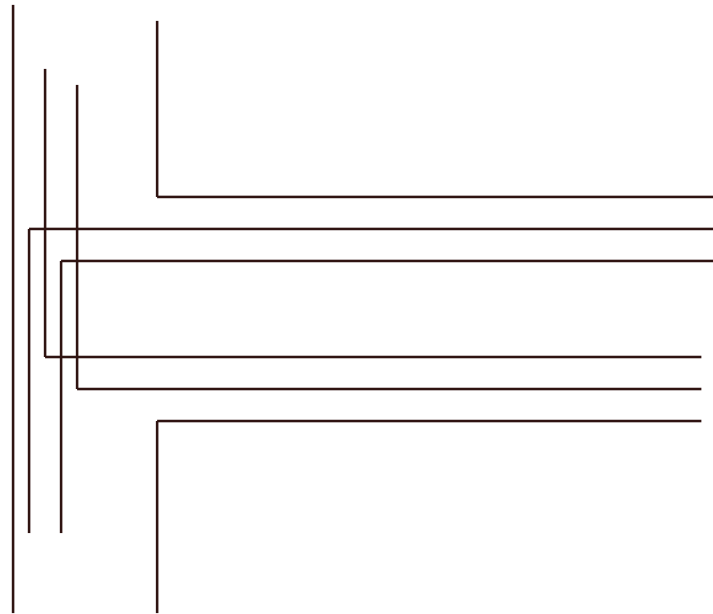
1. Prepare drawings properly & accurately if possible label each bar and show its shape for clarity.



Cross section of retaining wall which collapsed immediately after placing of soil backfill because 1/4" rather than 1-1/4" dia. were used. Error occurred because Correct rebar dia. Was covered by a dimension line.

2. Prepare bar-bending schedule , if necessary.
3. Indicate proper cover-clear cover, nominal cover or effective cover to reinforcement.
4. Decide detailed location of opening/hole and supply adequate details for reinforcements around the openings.
5. Use commonly available size of bars and spirals. For a single structural member the number of different sizes of bars shall be kept minimum.
6. The grade of the steel shall be clearly stated in the drawing.
7. Deformed bars need not have hooks at their ends.
8. Show enlarged details at corners, intersections of walls, beams and column joint and at similar situations.

9. Congestion of bars should be avoided at points where members intersect and make certain that all rein. Can be properly placed.
10. In the case of bundled bars, lapped splice of bundled bars shall be made by splicing one bar at a time; such individual splices within the bundle shall be staggered.
11. Make sure that hooked and bent up bars can be placed and have adequate concrete protection.



12. Indicate all expansion, construction and contraction joints on plans and provide details for such joints.
13. The location of construction joints shall be at the point of minimum shear approximately at mid or near the mid points. It shall be formed vertically and not in a sloped manner.

#### DO'S – BEAMS & SLABS:

1. Where splices are provided in bars, they shall be , as far as possible, away from the sections of maximum stresses and shall be staggered.
2. Where the depth of beams exceeds 750mm in case of beams without torsion and 450mm with torsion provide face rein. as per IS456-2000.
3. Deflection in slabs/beams may be reduced by providing compression reinforcement.
4. Only closed stirrups shall be used for transverse rein. For members subjected to torsion and for members likely to be subjected to reversal of stresses as in Seismic forces.

5. To accommodate bottom bars, it is good practice to make secondary beams shallower than main beams, at least by 50mm.

#### Do's –COLUMNS.

1. A reinforced column shall have at least six bars of longitudinal reinforcement for using in transverse helical reinforcement.-for CIRCULAR sections.
2. A min four bars one at each corner of the column in the case of rectangular sections.
3. Keep outer dimensions of column constant, as far as possible , for reuse of forms.
4. Preferably avoid use of 2 grades of vertical bars in the same element.

#### DONOT'S-GENERAL:

1. Reinforcement shall not extend across an expansion joint and the break between the sections shall be complete.
2. Flexural reinforcement preferably shall not be terminated in a tension zone.



3. Bars larger than 36mm dia. Shall not be bundled.
4. Lap splices shall be not be used for bars larger than 36mm dia. Except where welded.
5. Where dowels are provided, their diameter shall not exceed the diameter of the column bars by more than 3mm.
6. Where bent up bars are provided, their contribution towards shear resistance shall not be more than 50% of the total shear to be resisted.  
USE OF SINGEL BENT UP BARS(CRANKED) ARE NOT ALLOWED IN THE CASE OF EARTHQUAKE RESISTANCE STRUCTURES.

■ Minimum and max.reinforcement % in beams, slabs and columns as per codal provisions should be followed.

■ **SLABS:**

■ It is better to provide a max spacing of 200mm(8") for main bars and 250mm(10") in order to control the crack width and spacing.

■ A min. of 0.24% shall be used for the roof slabs since it is subjected to higher temperature. Variations than the floor slabs. This is required to take care of temp. differences.

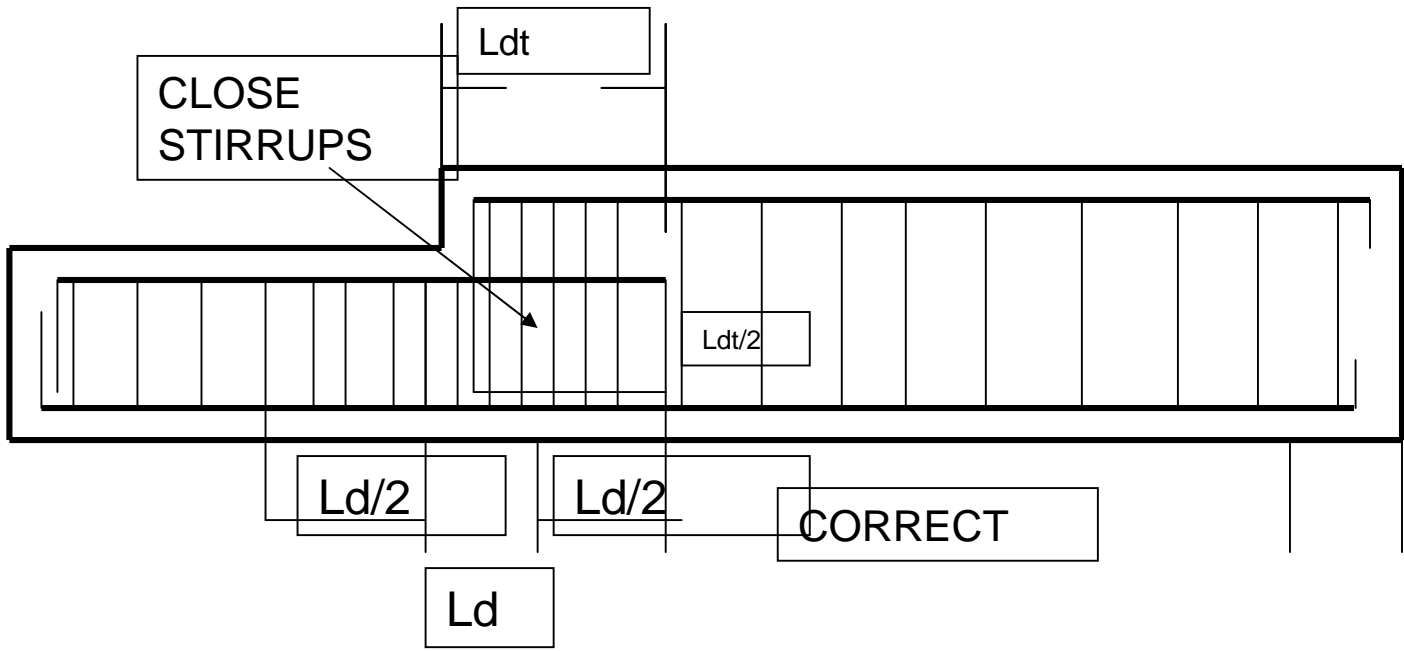
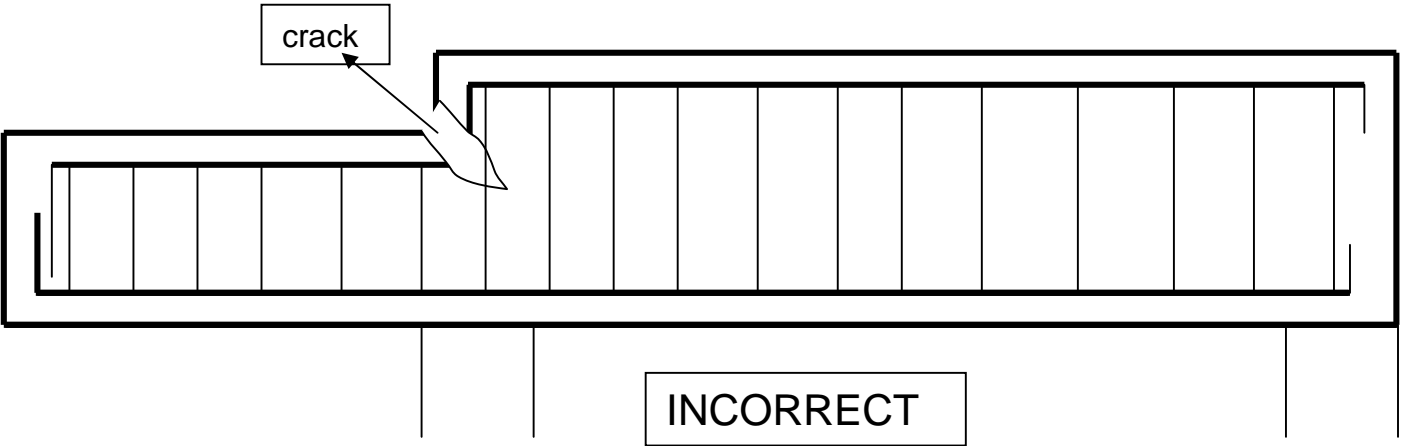
■ It is advisable to not to use 6mm bars as main bars as this size available in the local market is of inferior not only with respect to size but also the quality since like TATA and SAIL are not producing this size of bar.

■ **BEAMS:**

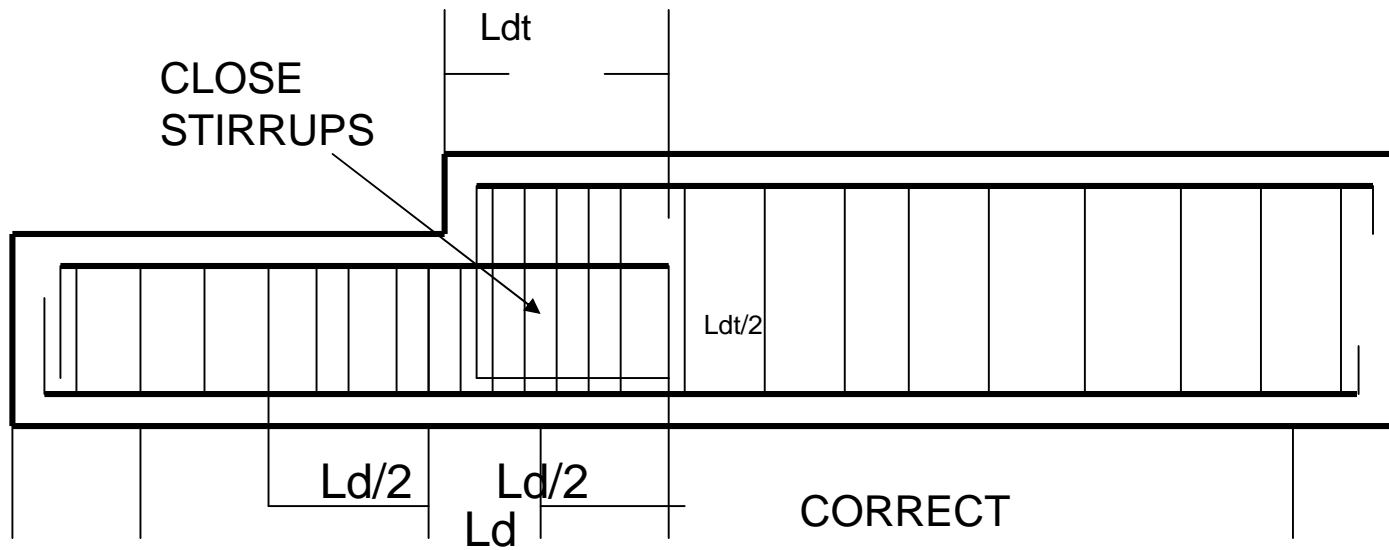
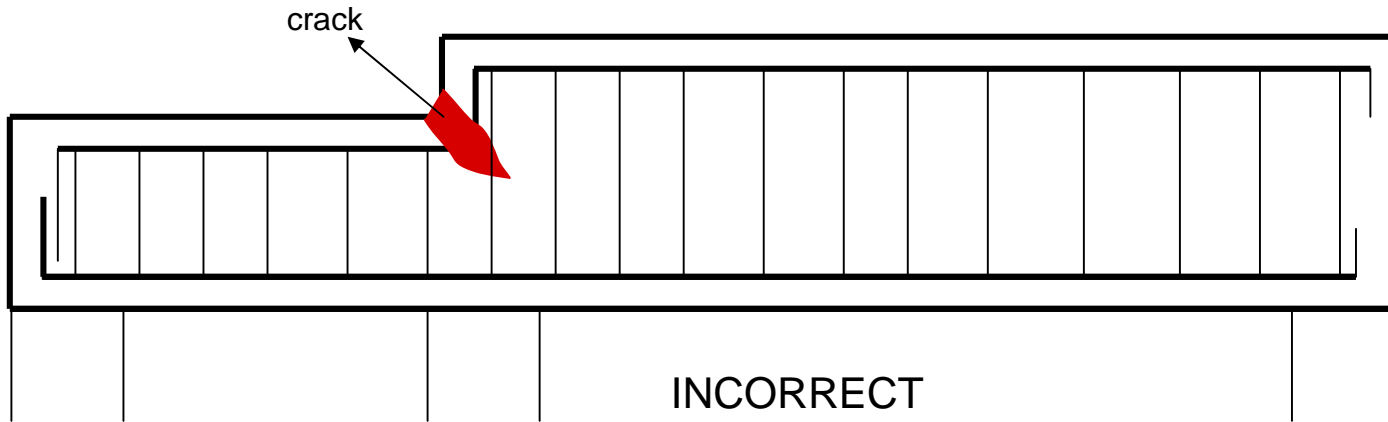
■ A min. of 0.2% is to be provided for the compression bars in order to take care of the deflection.

- The stirrups shall be min.size of 8mm in the case of lateral load resistance .
- The hooks shall be bent to 135 degree .

# CANTILEVER BEAM

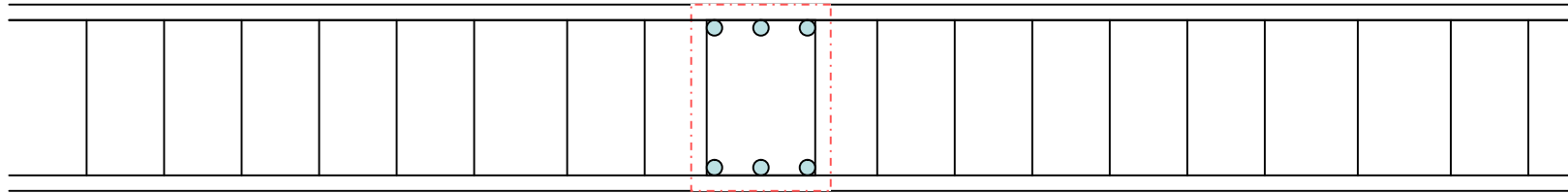


# NON PRISMATIC BEAM

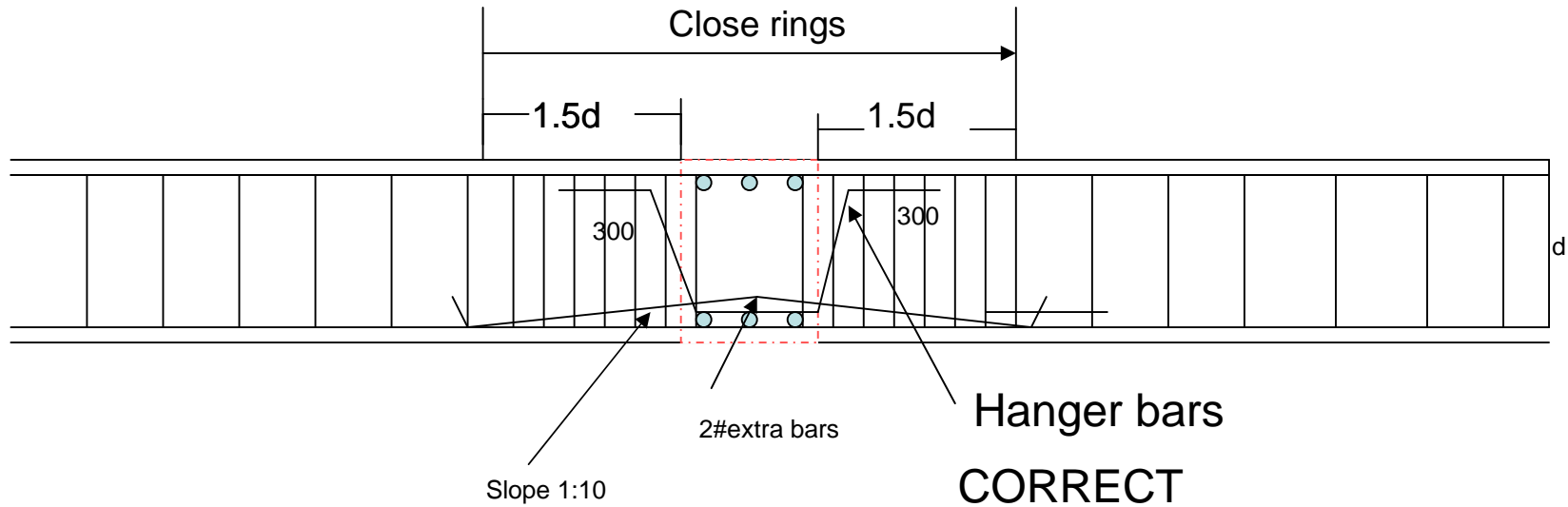


# GRID BEAM

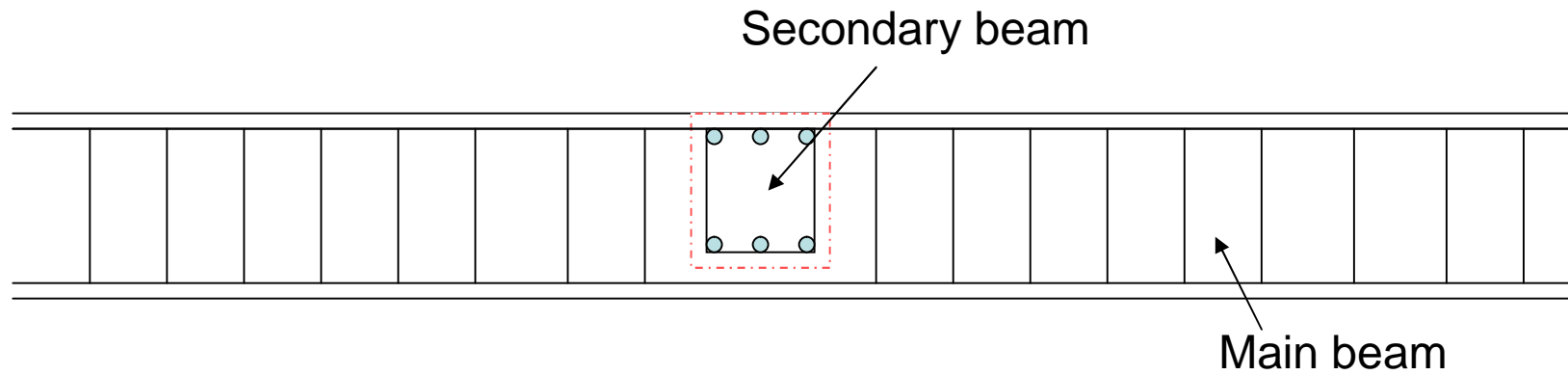
## GRID BEAM



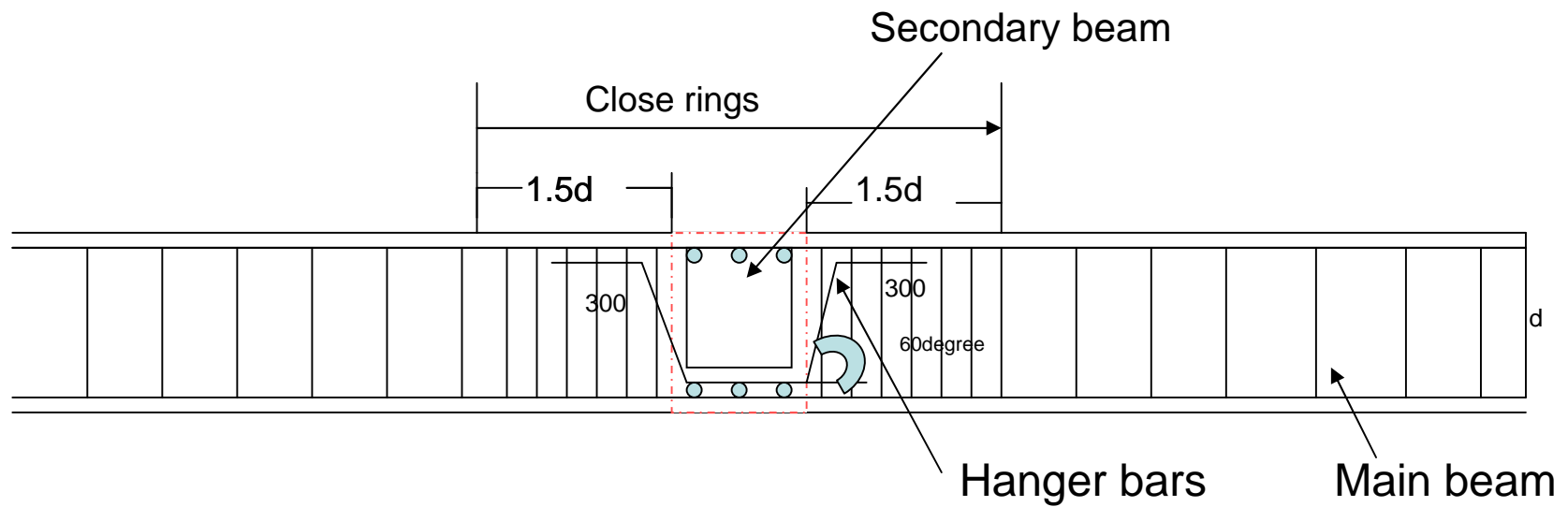
INCORRECT



# Details of Main & Secondary beams

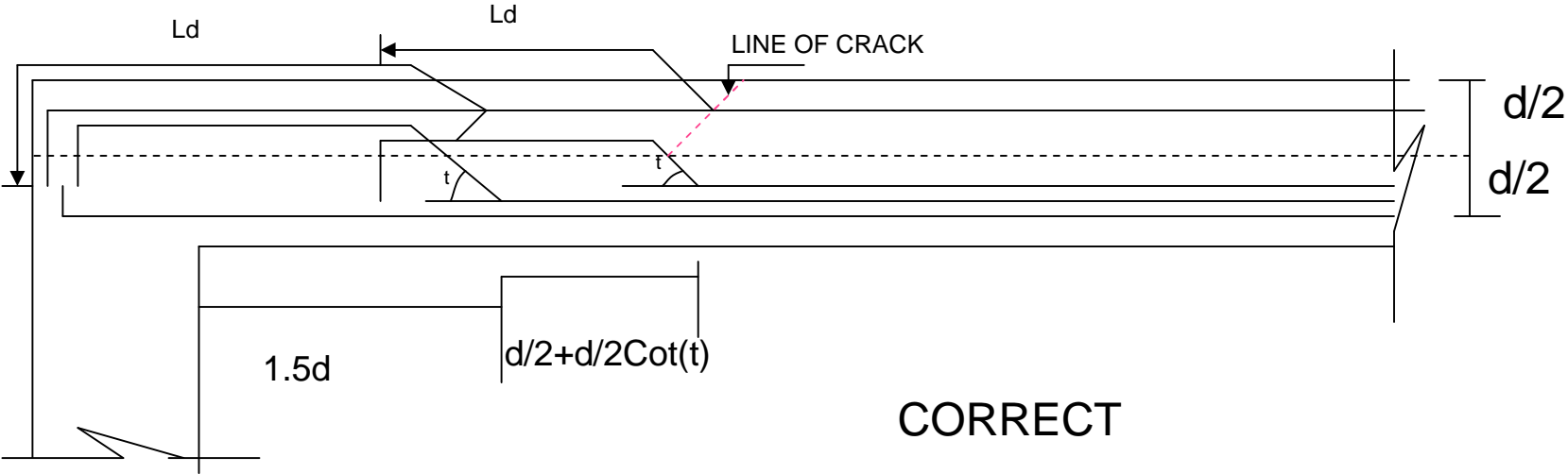
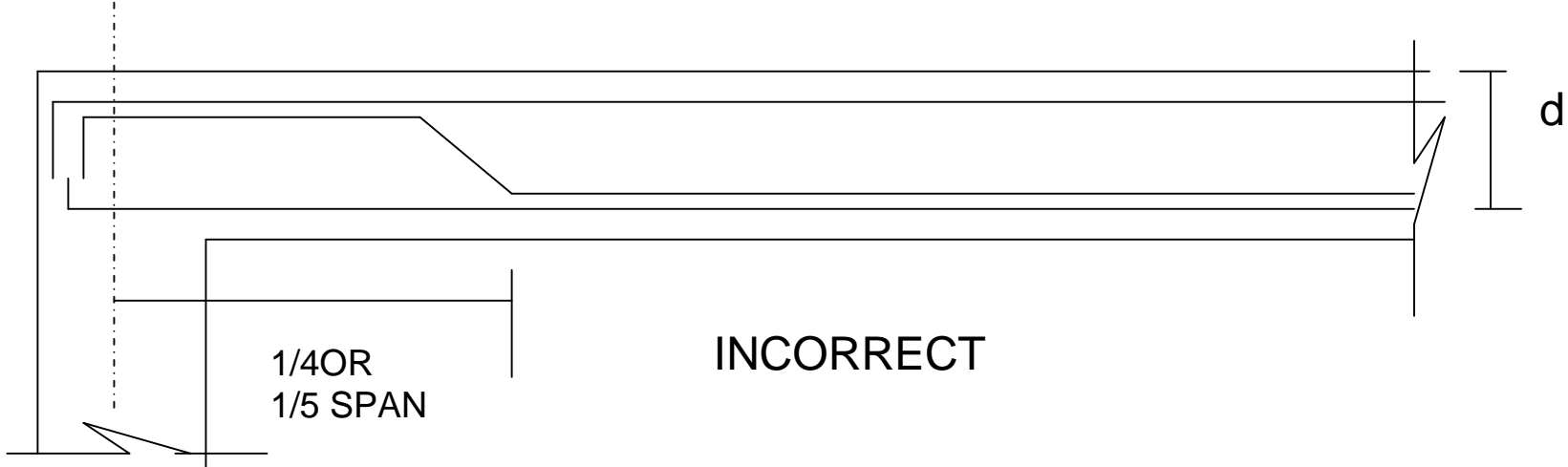


INCORRECT



CORRECT

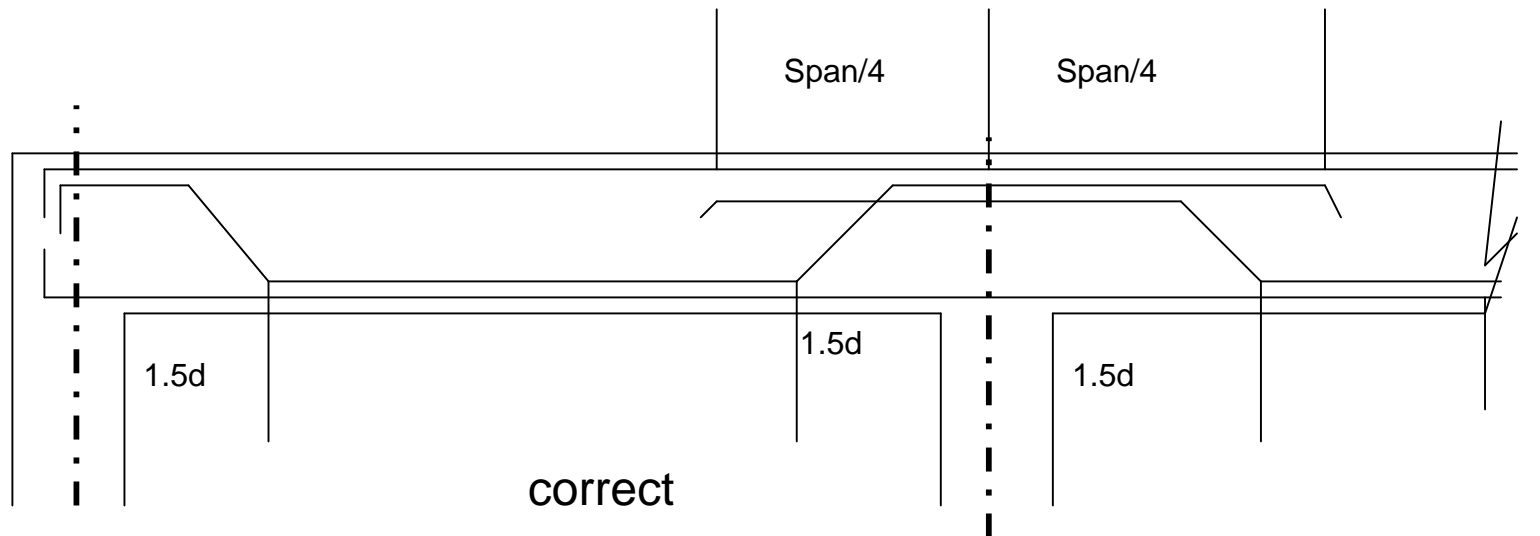
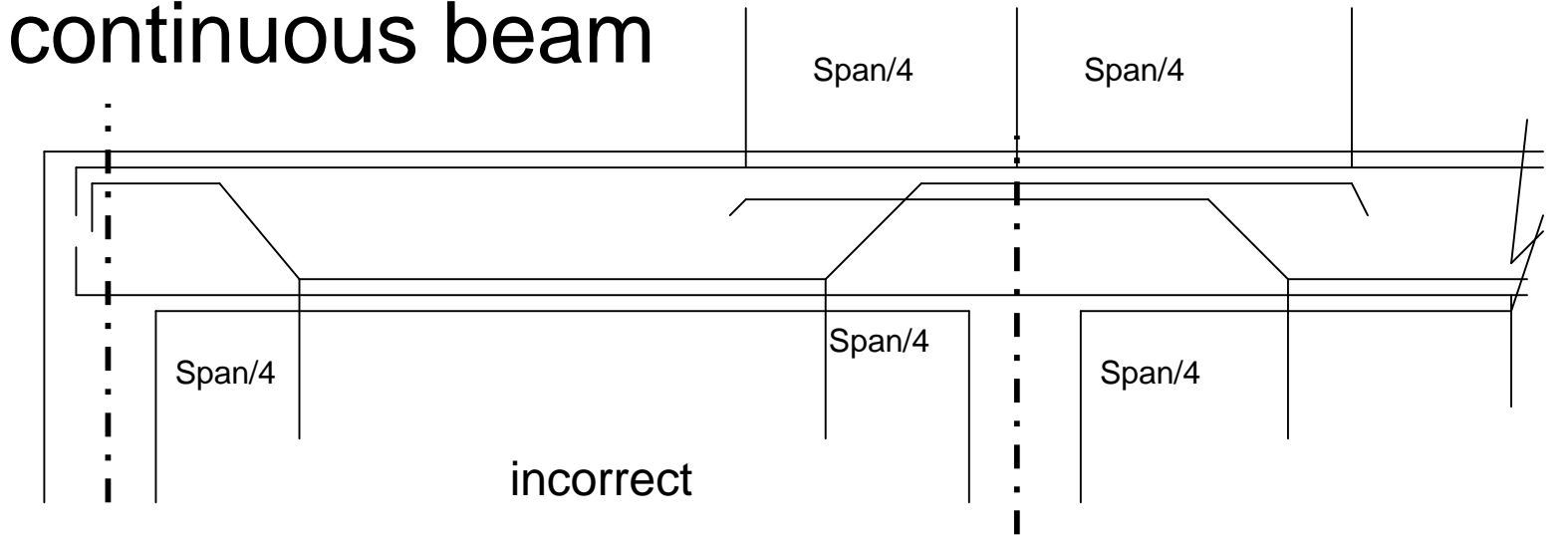
# BEAM



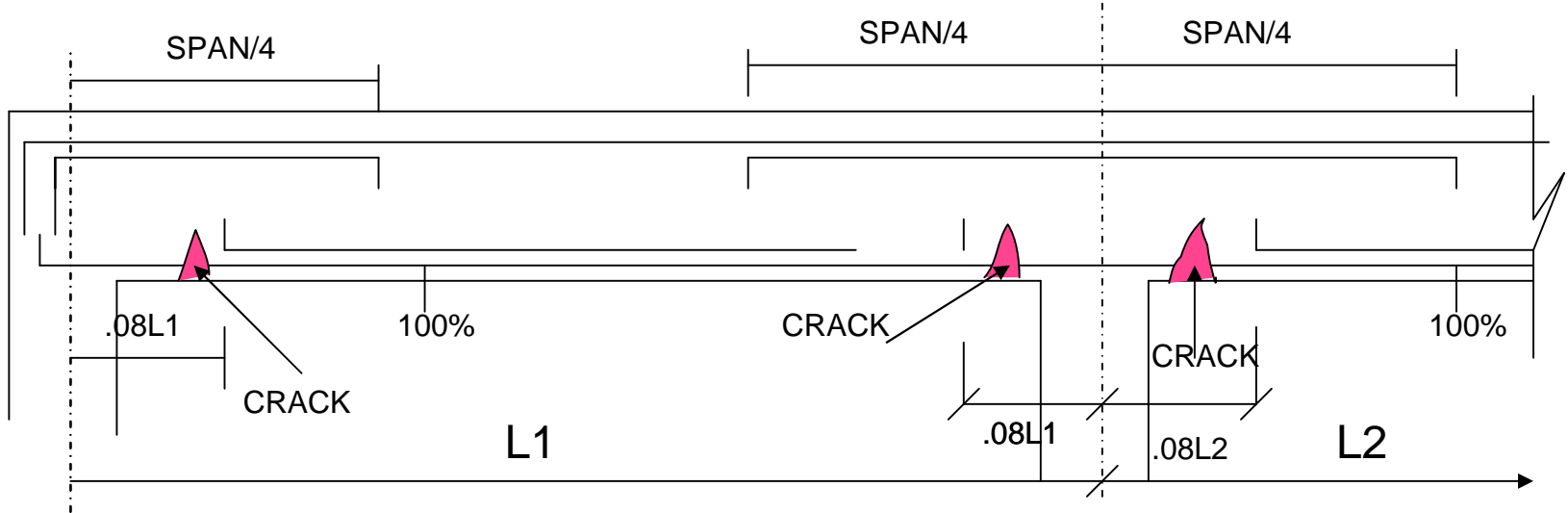


# Continuous beam

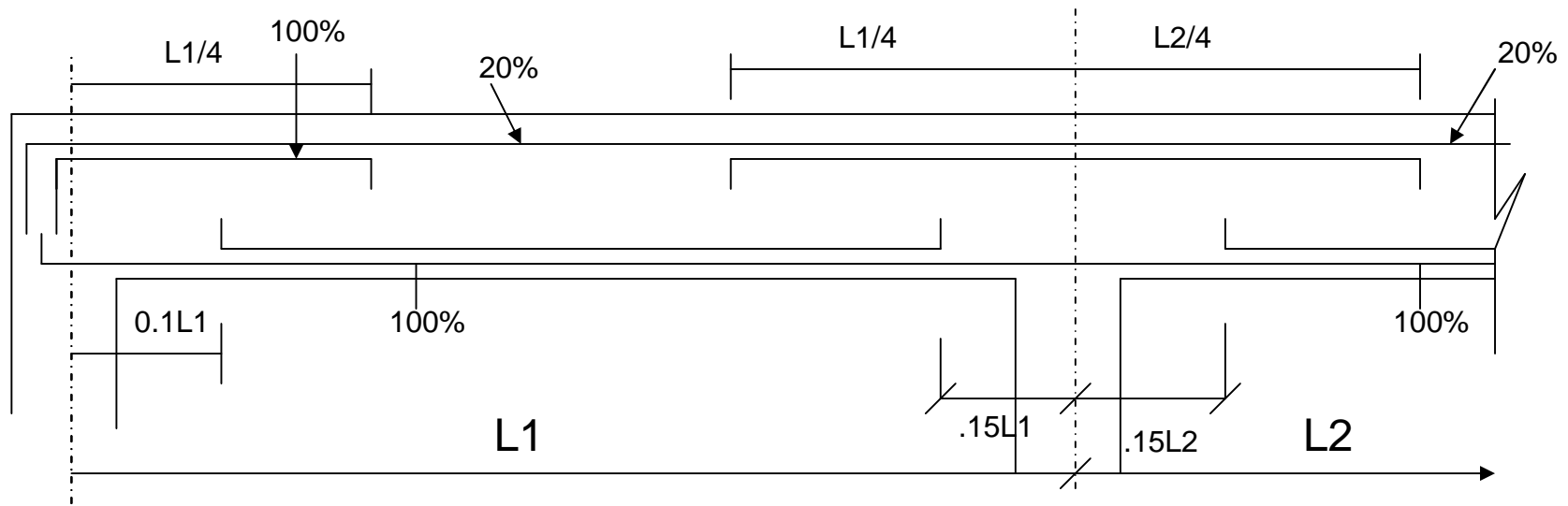
- continuous beam



# CONTINUOUS BEAM

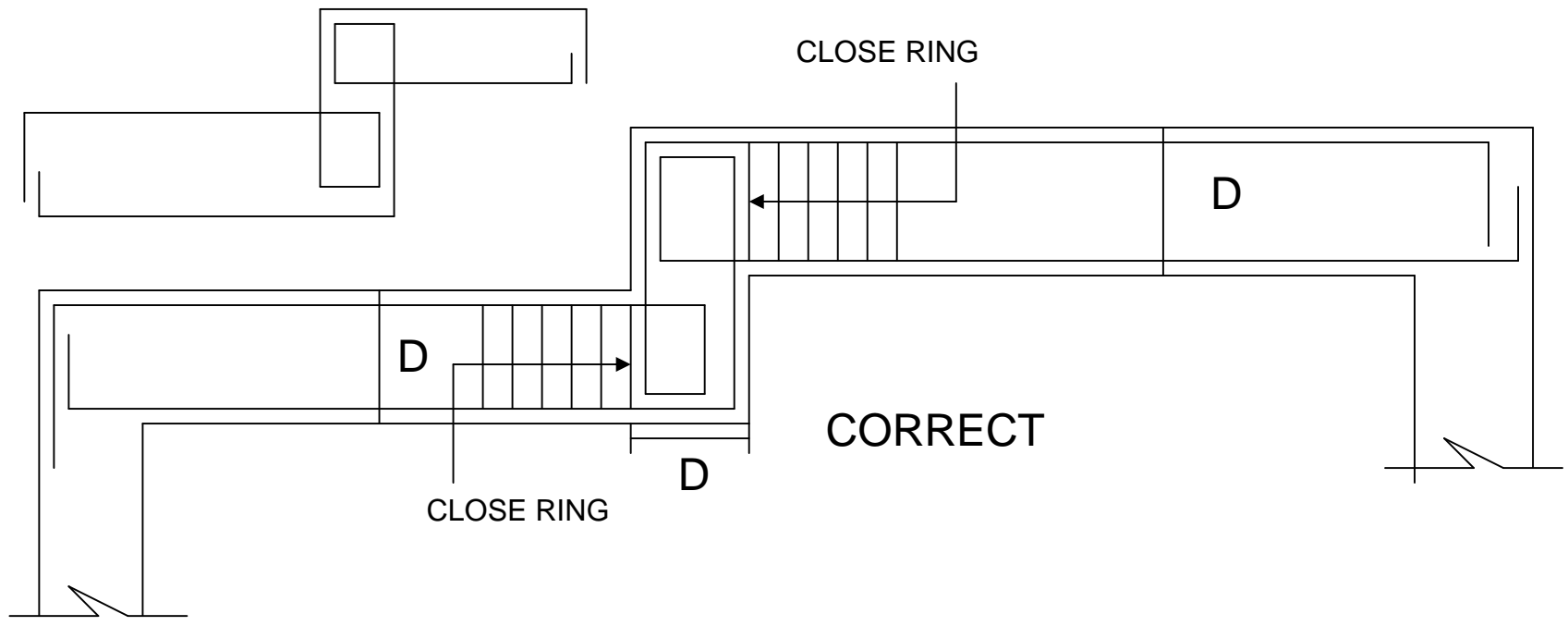
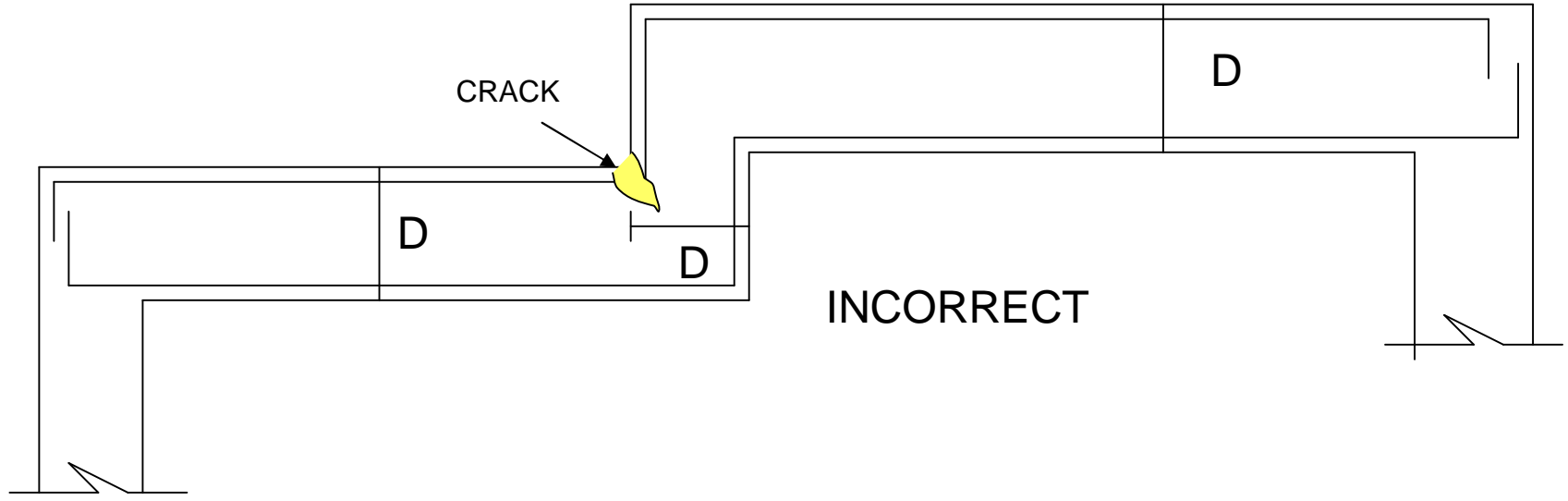


INCORRECT

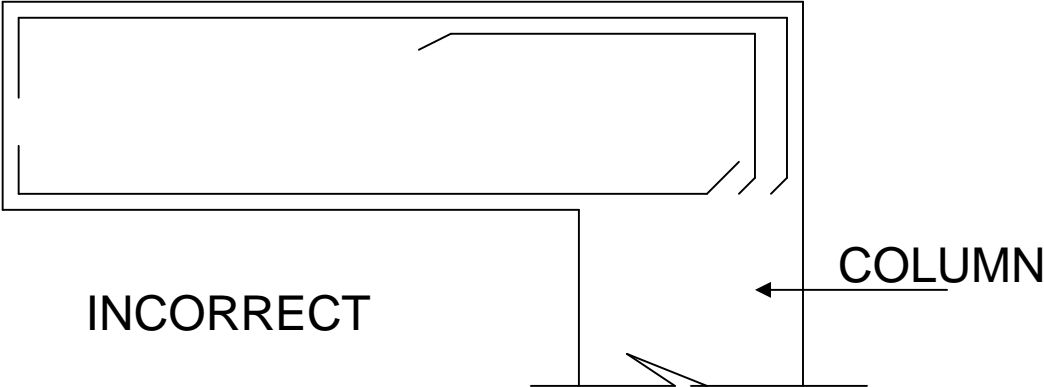


CORRECT

# NONPRISMATIC SECTION OF BEAM



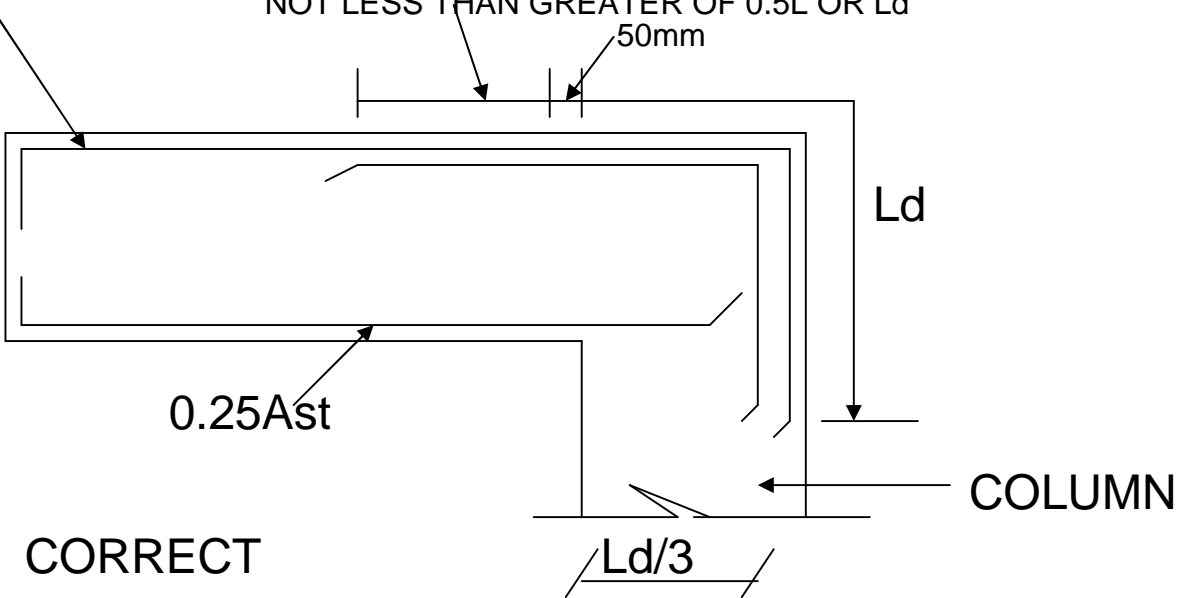
# CANTILEVER BEAM PROJECTING FROM COLUMN



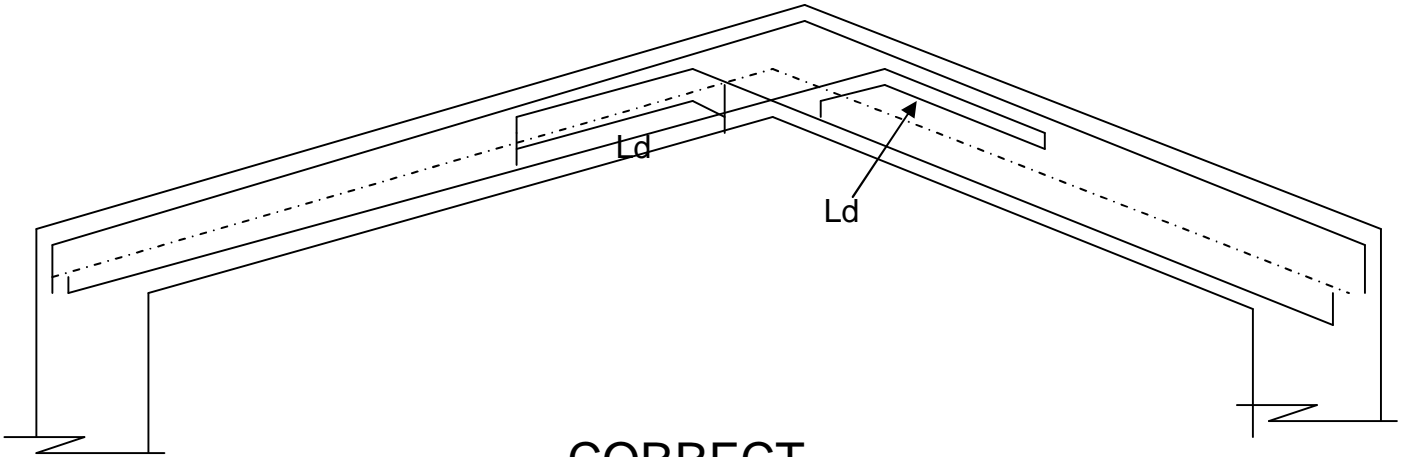
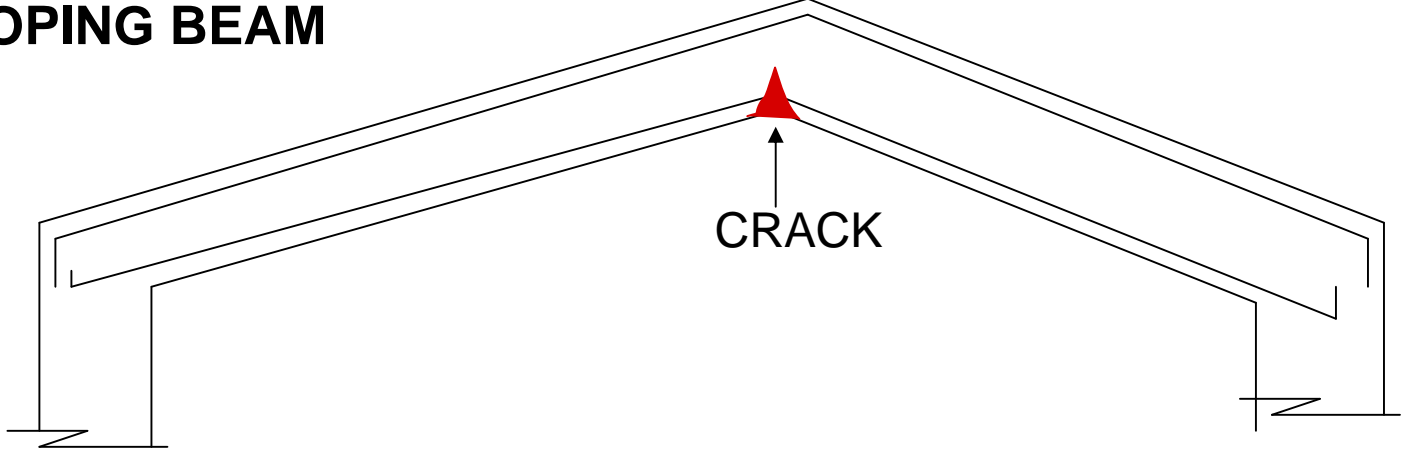
NOT LESS THAN  $0.5A_{st}$

NOT LESS THAN GREATER OF  $0.5L$  OR  $L_d$

50mm

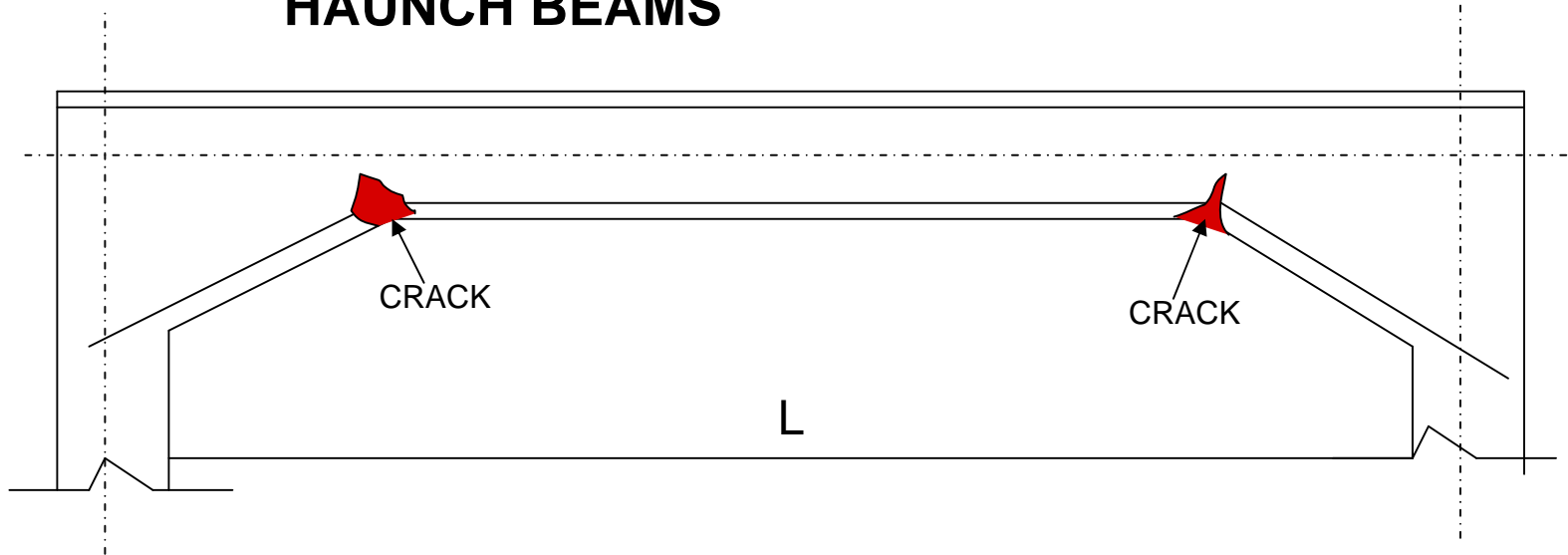


# SLOPING BEAM

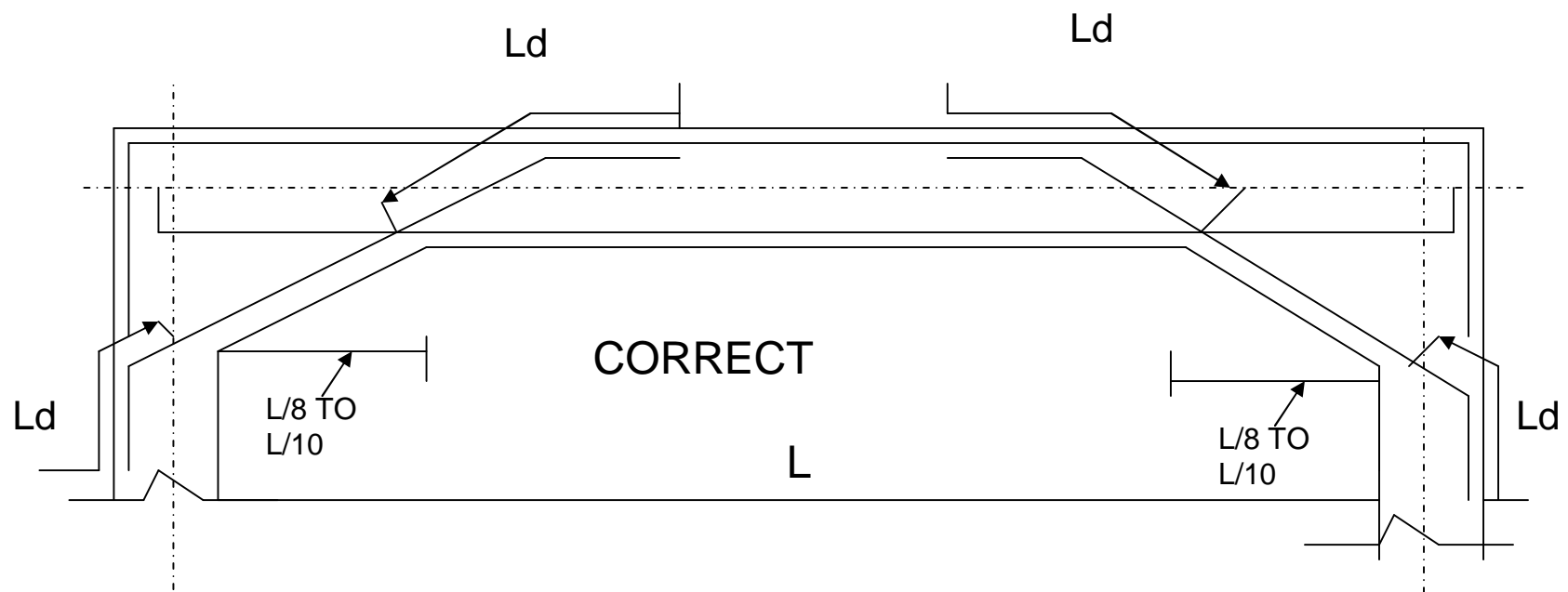


CORRECT

# HAUNCH BEAMS



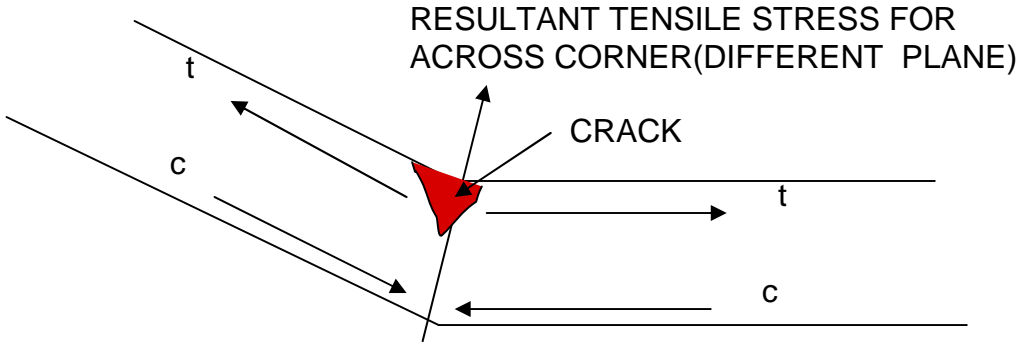
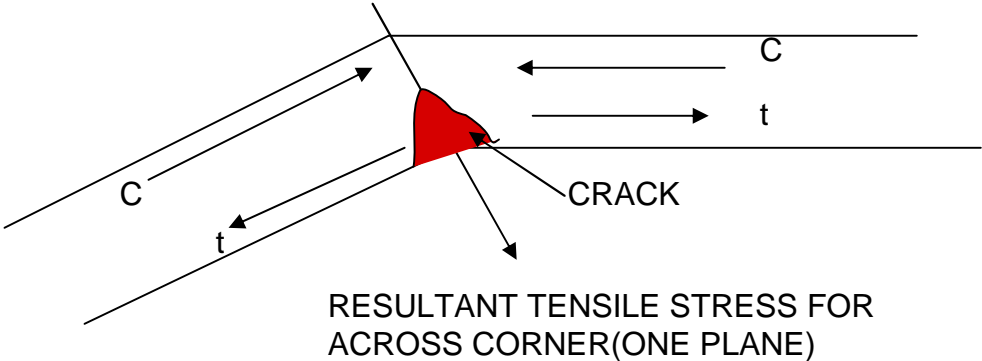
INCORRECT



# STRESSES AT CORNERS

C-COMPRESSION

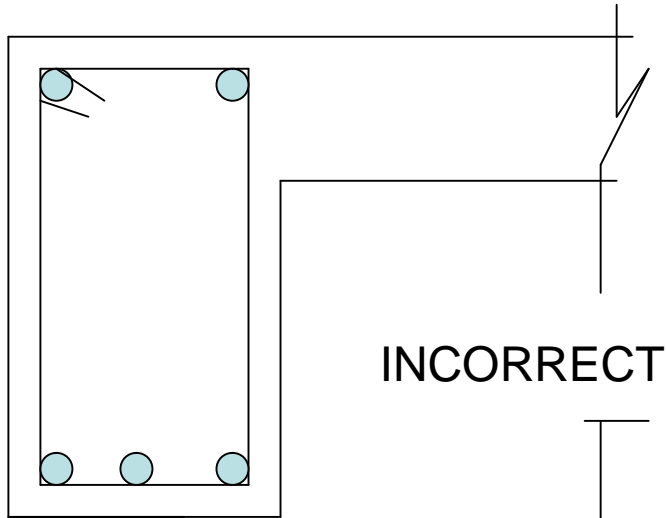
T-TENSION



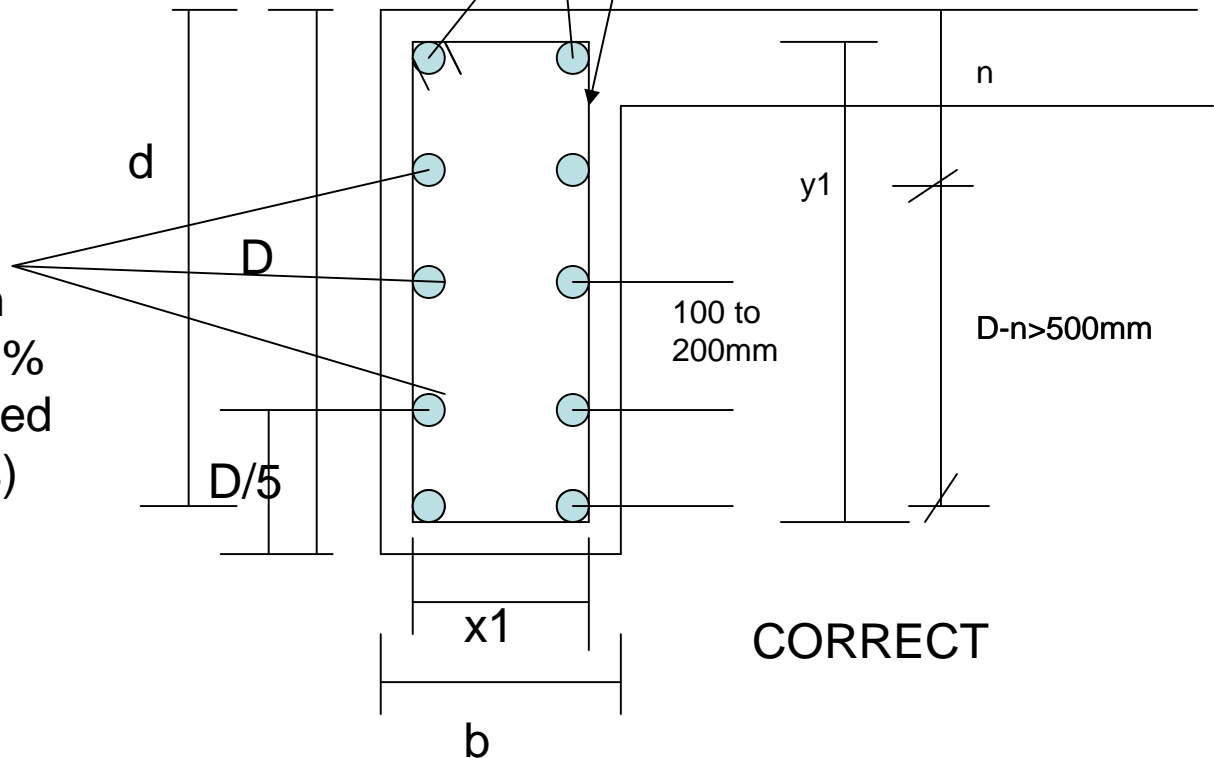
# SHEAR AND TORSION REIN. IN BEAMS

Stirrups taken round outermost bars spacing  $\leq x_1$   
 $\leq (x_1+y_1)/4$   
 $\leq 300\text{mm}$

Min  $0.2\%bd$  to control deflection as well as for seismic requ.

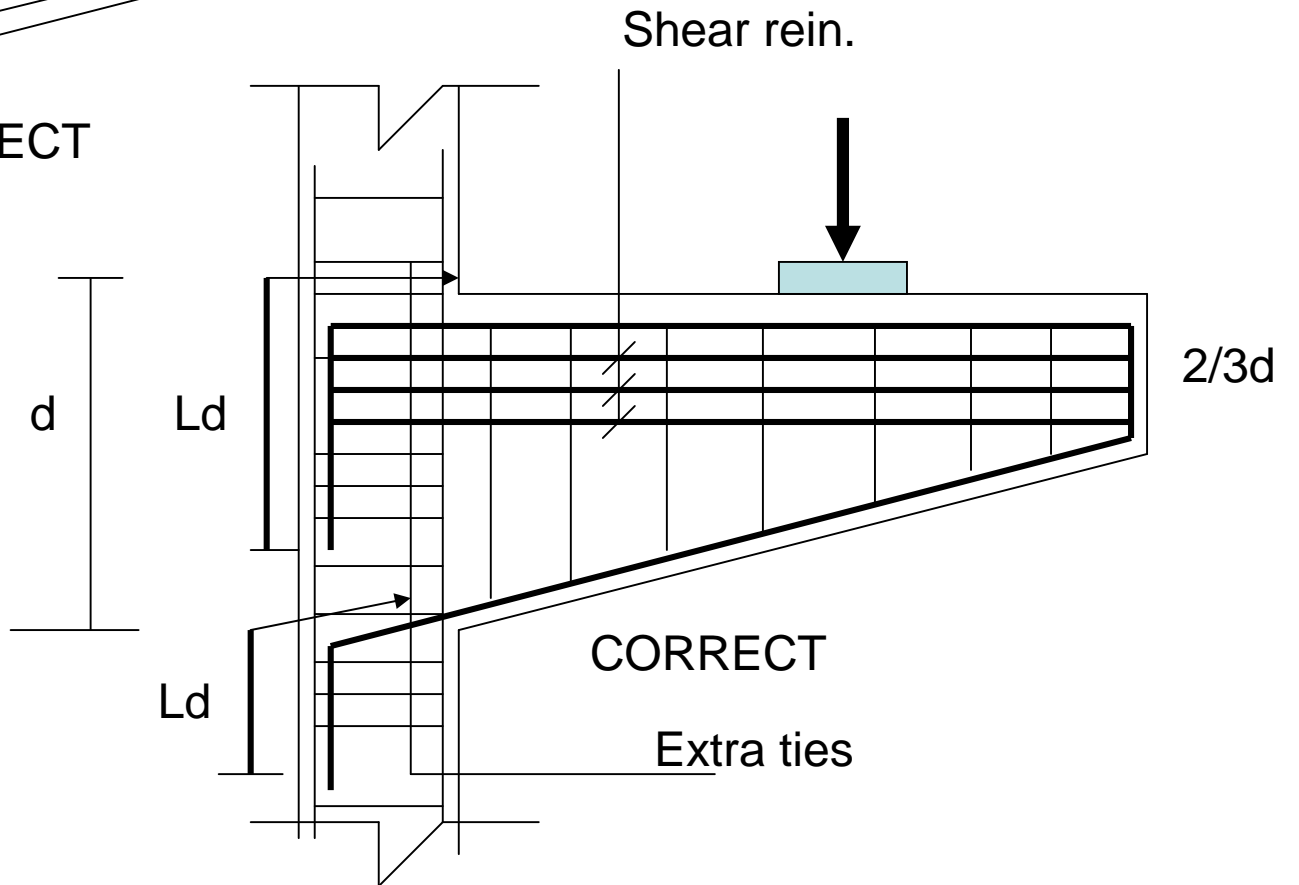
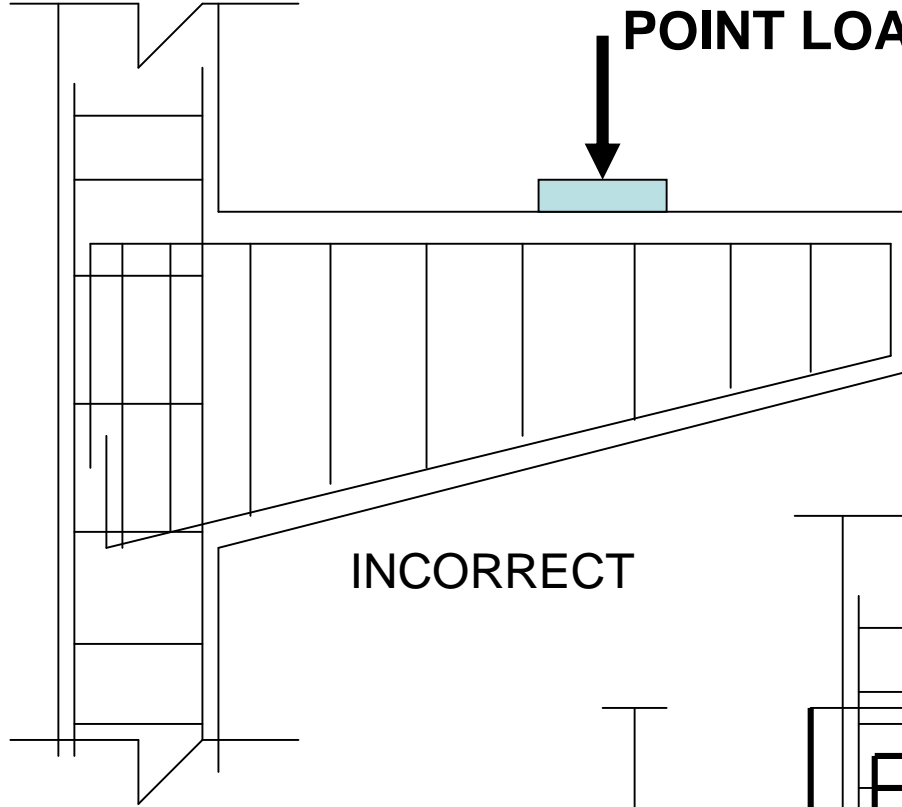


Skin rein.  $10d$  is required when depth exceeds  $450\text{mm}$  ( $0.1\%$  of web area distributed equally on two faces)

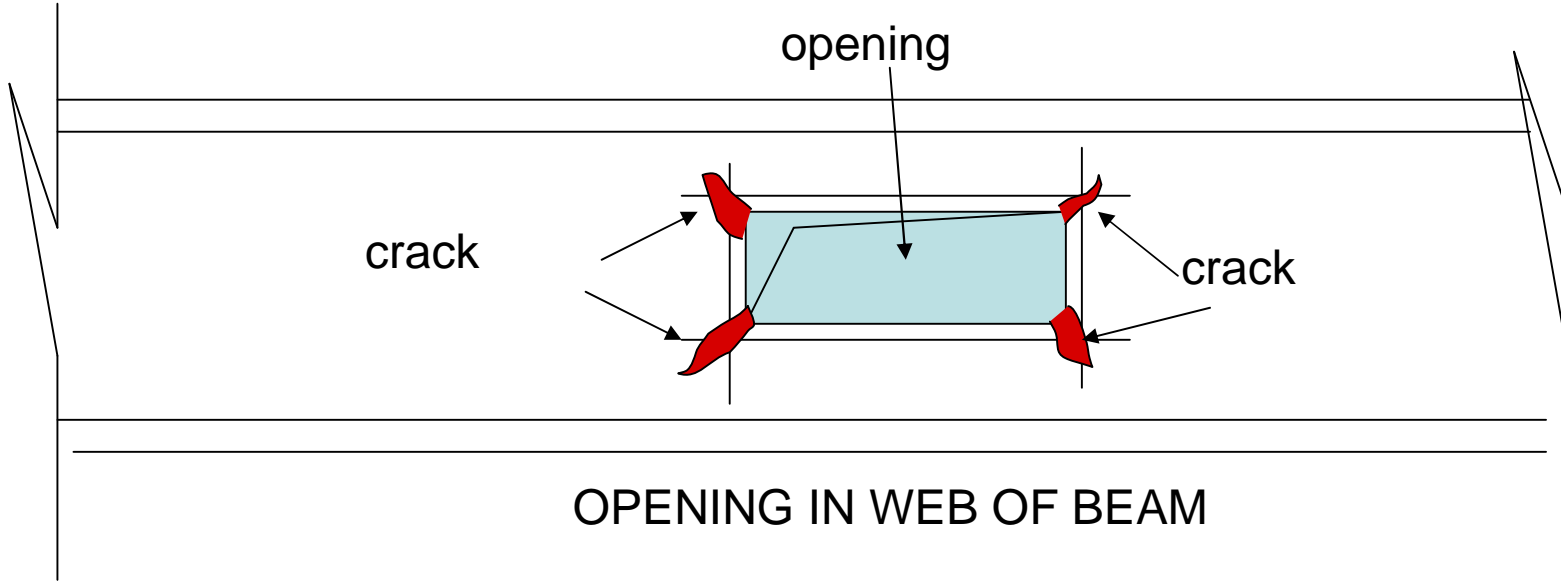




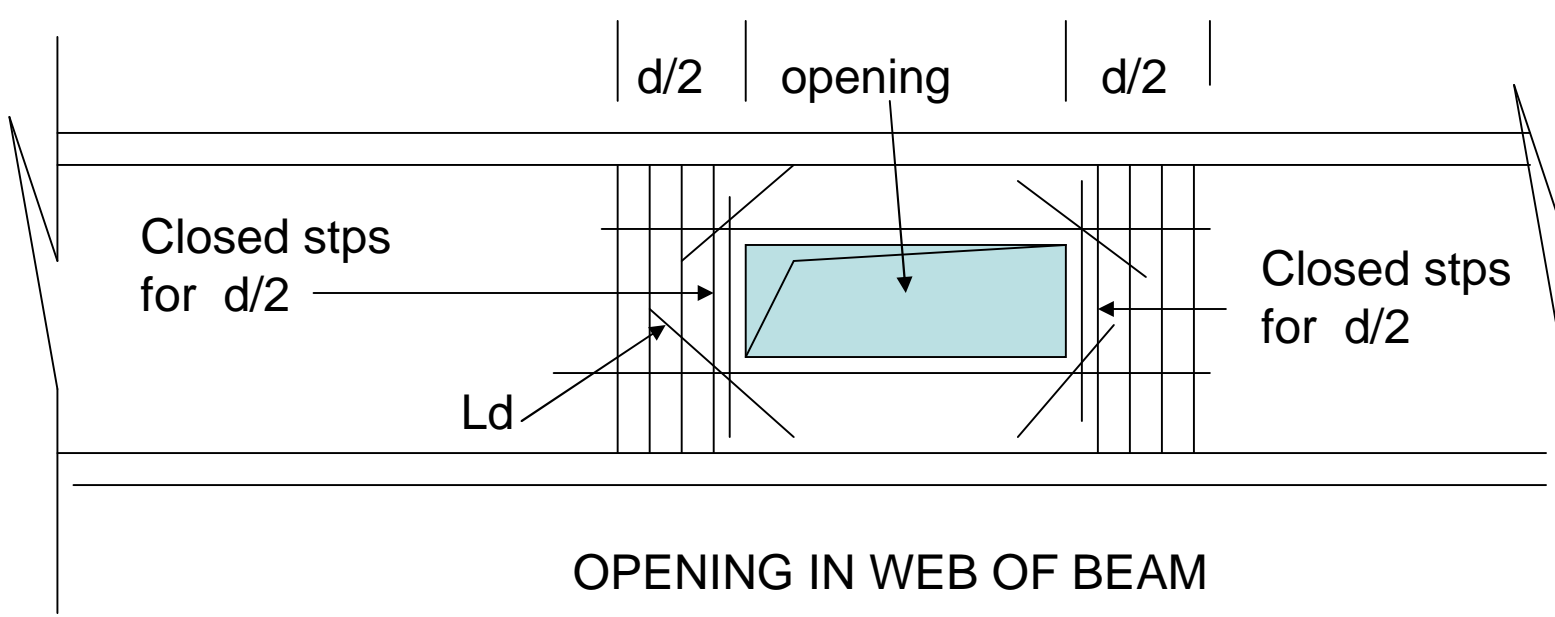
# CANTILEVER BEAM WITH POINT LOAD



INCORRECT



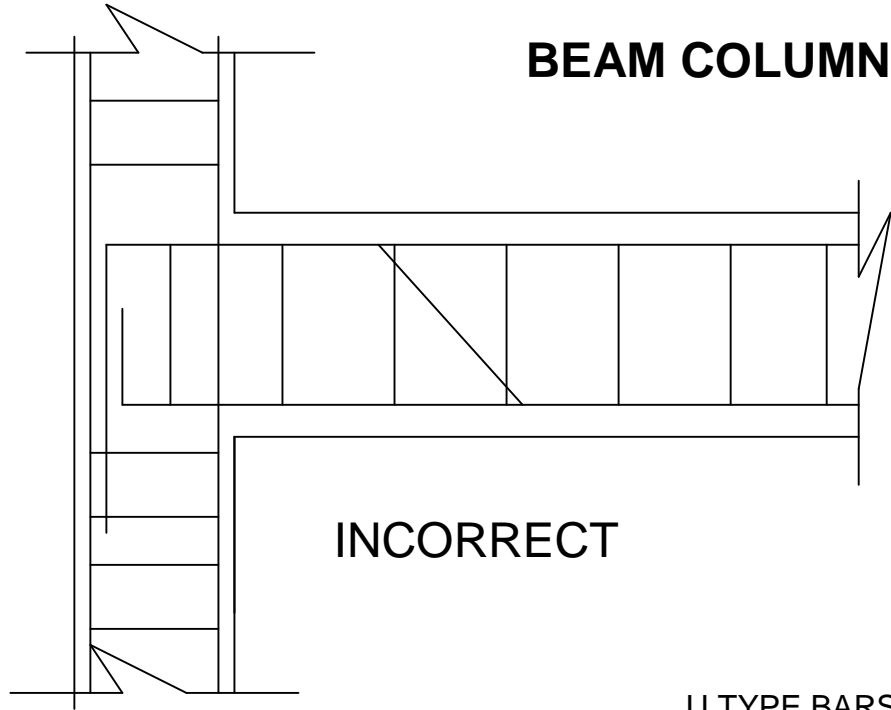
OPENING IN WEB OF BEAM



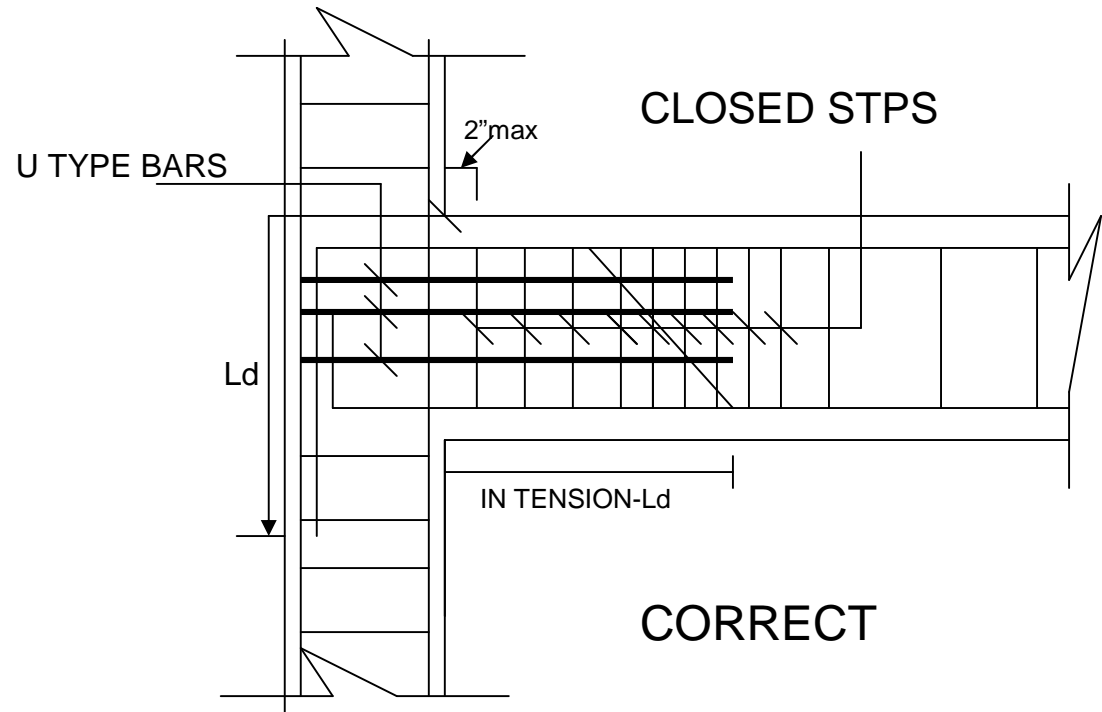
OPENING IN WEB OF BEAM

CORRECT

# BEAM COLUMN JUNCTION-EXTERIOR COLUMN



INCORRECT



CLOSED STPS

2"max

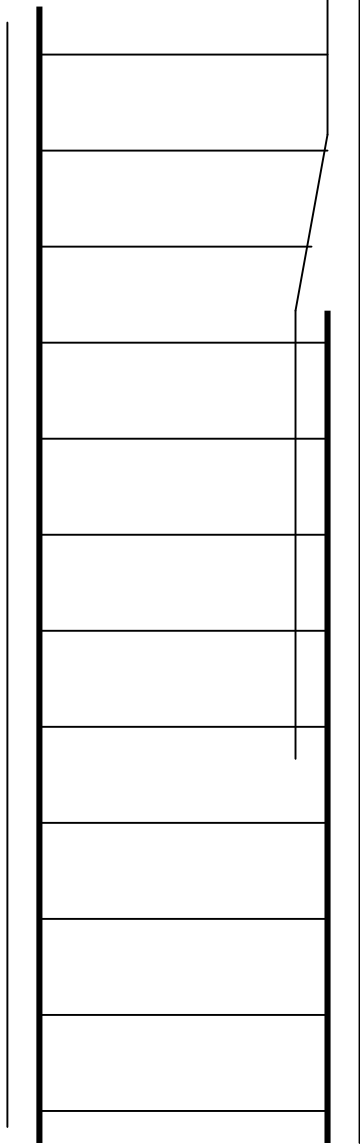
U TYPE BARS

$L_d$

IN TENSION- $L_d$

CORRECT

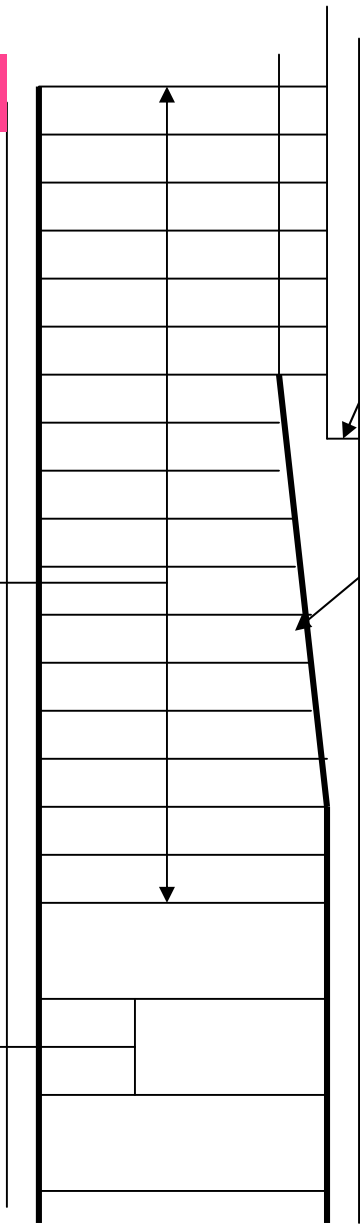
# SPLICE DETAIL FOR COLUMN



INCORRECT

CLOSE  
TIES @S/2

S-SPACING

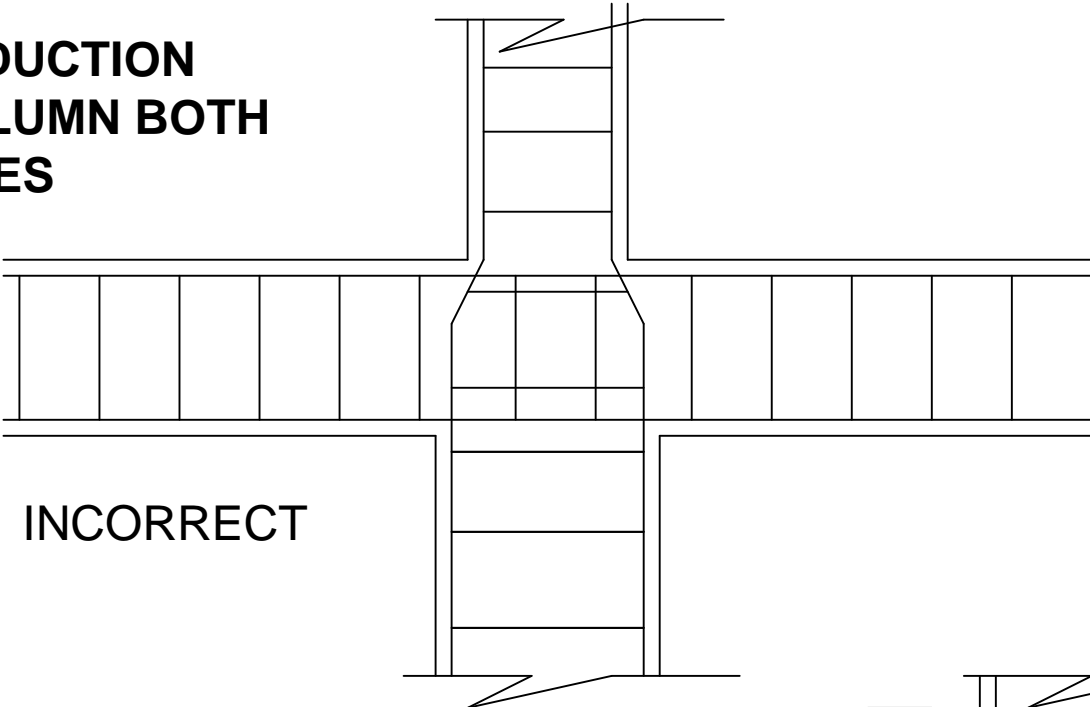


COVER

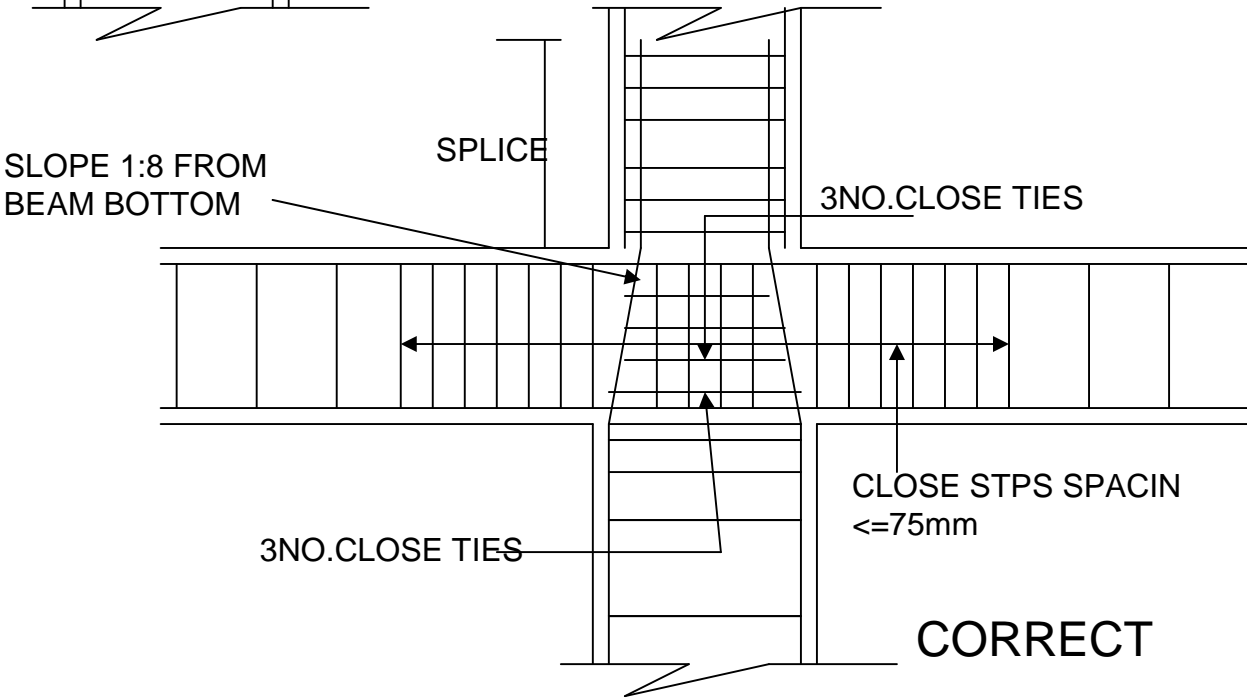
SLOPE 1:6

CORRECT

**REDUCTION  
COLUMN BOTH  
SIDES**



**INCORRECT**



SLOPE 1:8 FROM  
BEAM BOTTOM

SPLICE

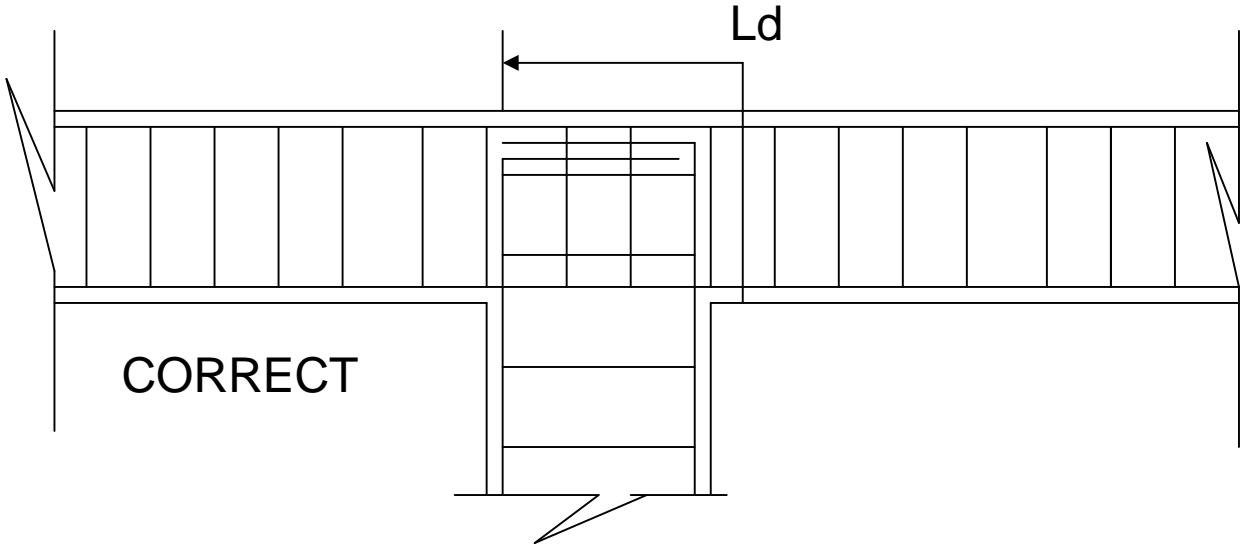
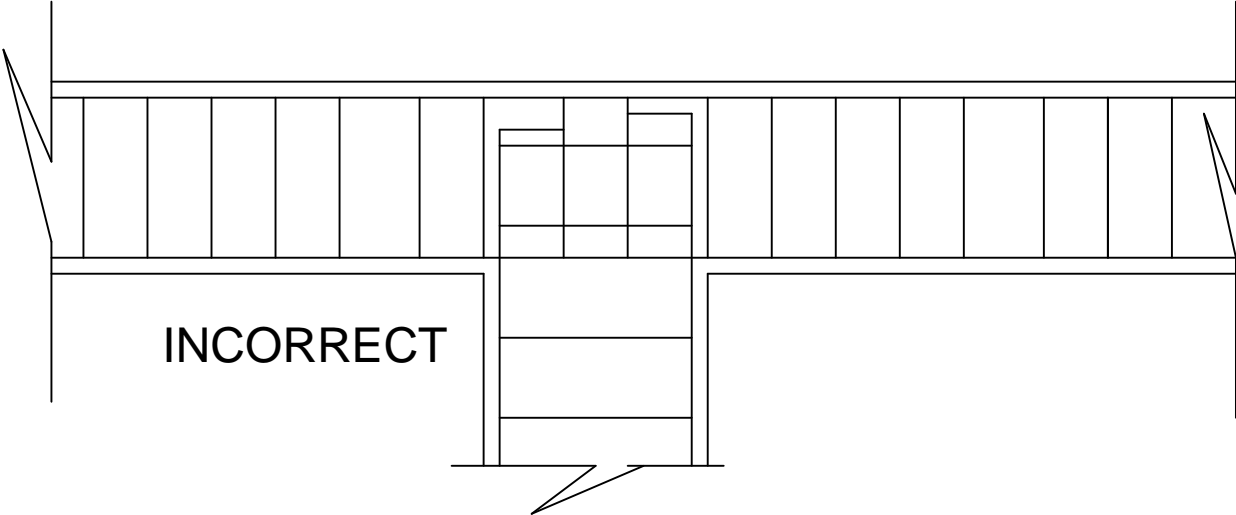
3NO.CLOSE TIES

3NO.CLOSE TIES

CLOSE STPS SPACIN  
<=75mm

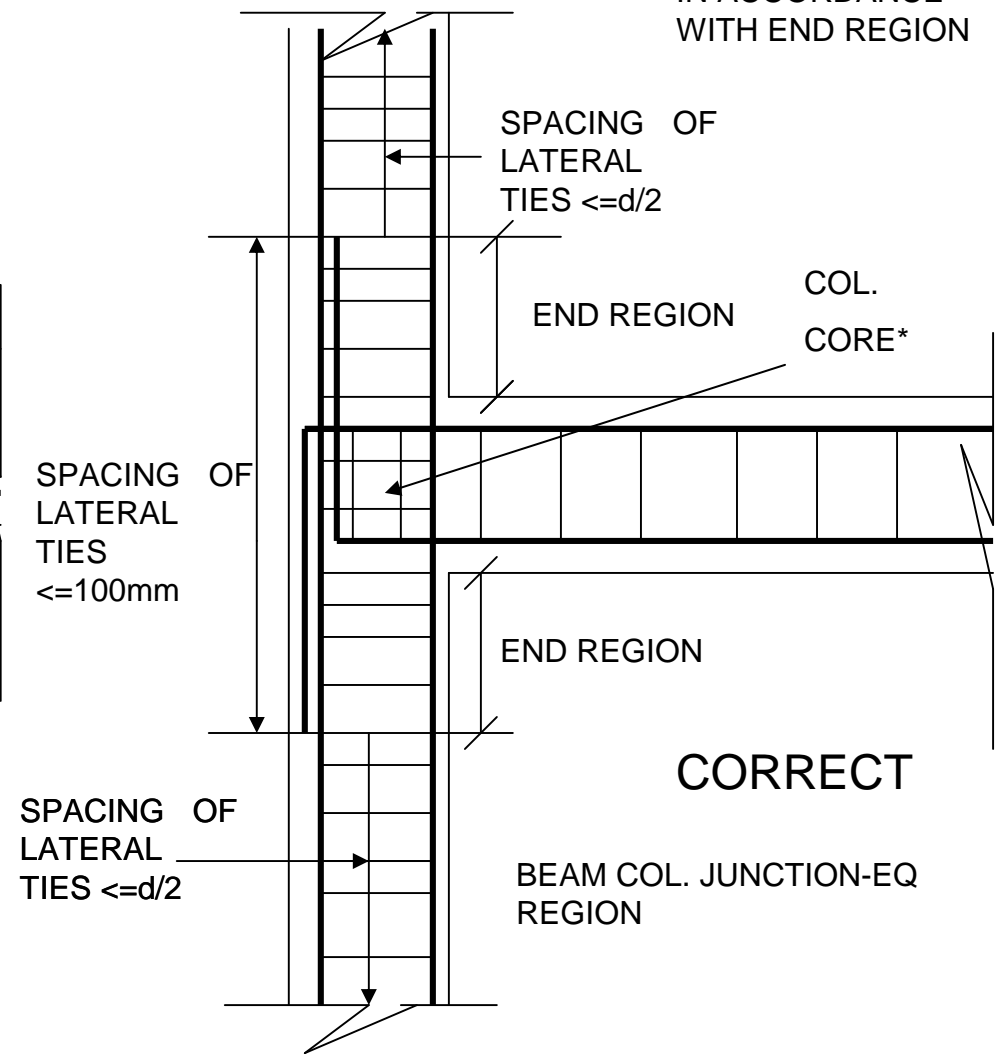
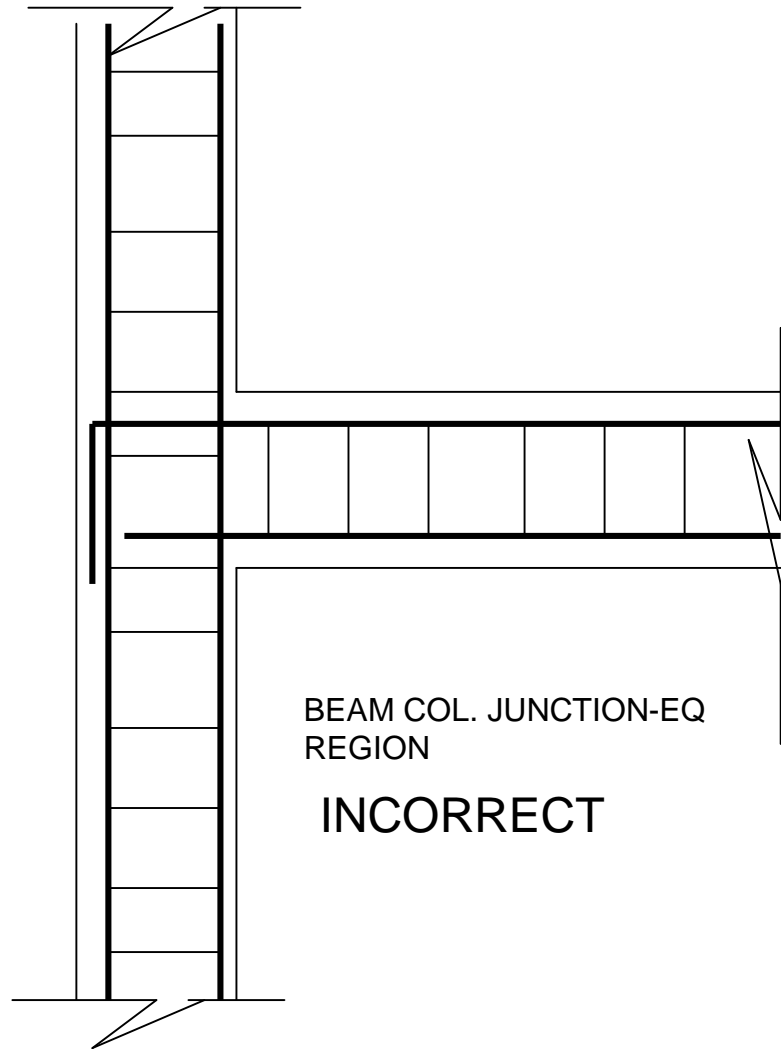
**CORRECT**

# TERMINATION OF COLUMN BARS INSIDE BEAM

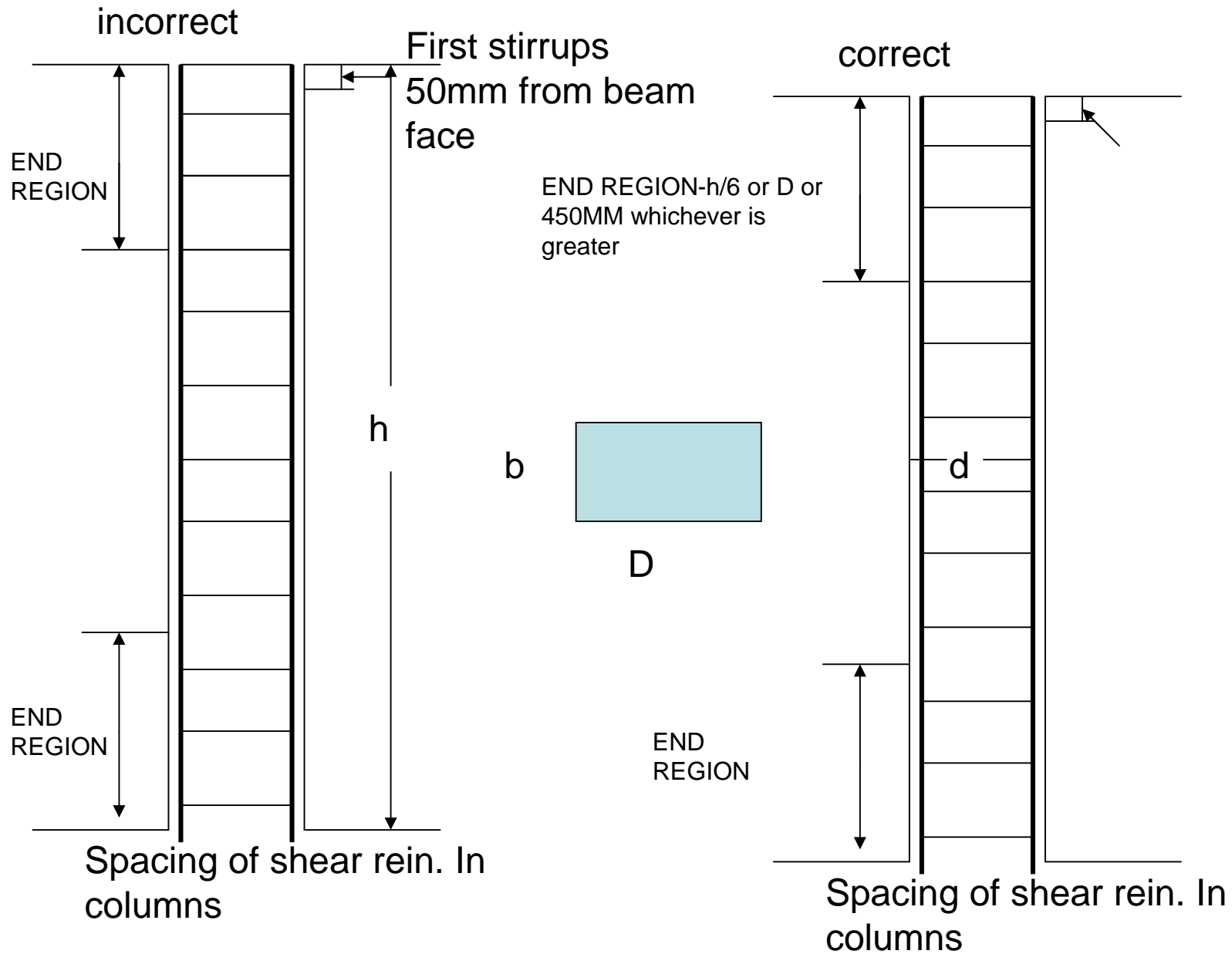


# EQ REGION-BEAM-COL JN-EXTERIOR

\* COL.CORE HAS TO BE CONFINED BY CIRCULAR OR RECTANGULAR TIES IN ACCORDANCE WITH END REGION

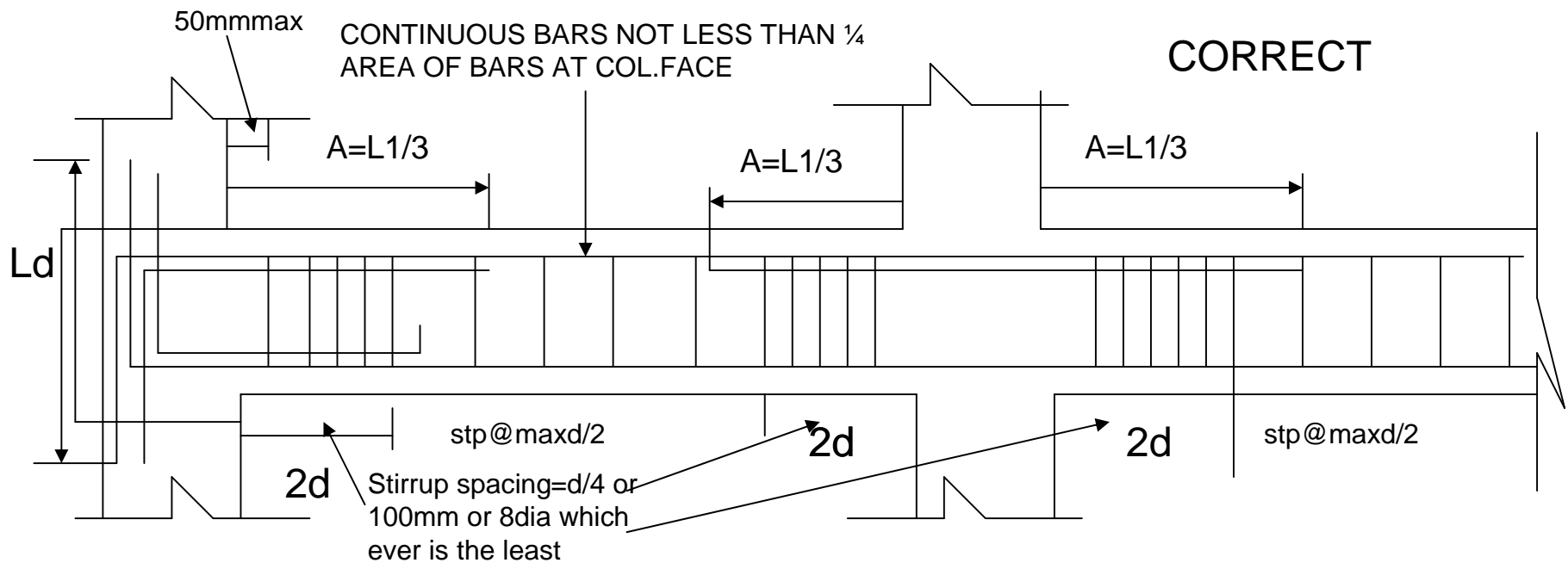
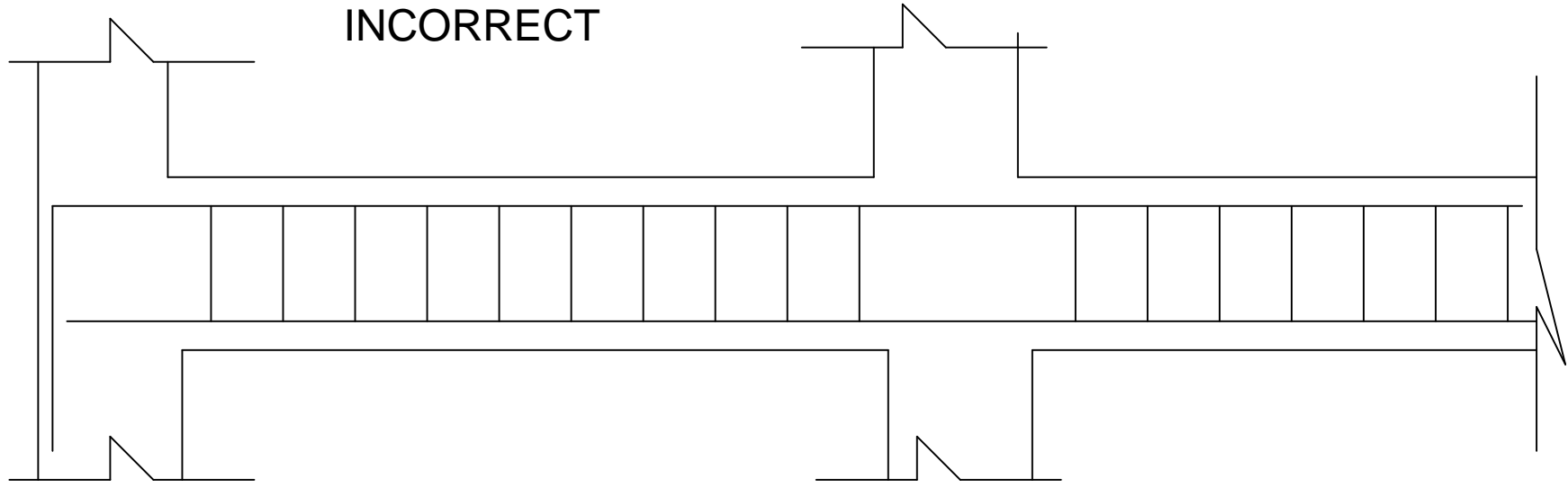


# COLUMN DETAILS IN EQ REGIONS



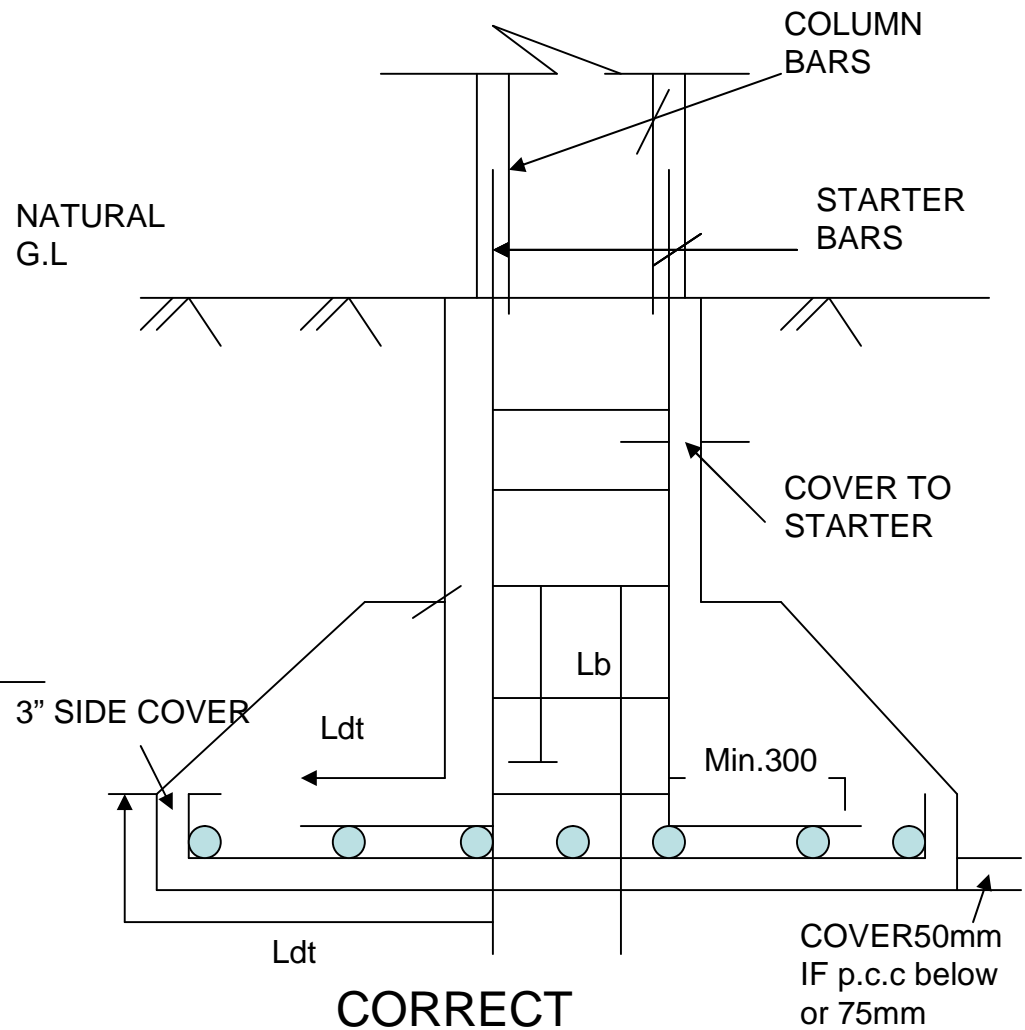
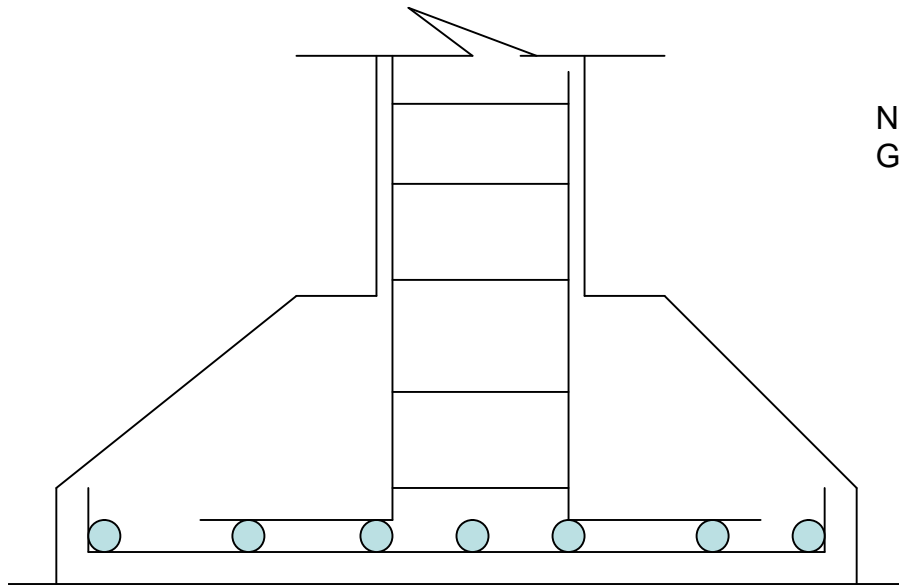


# EQ-REGION-CONTINUOUS BEAM



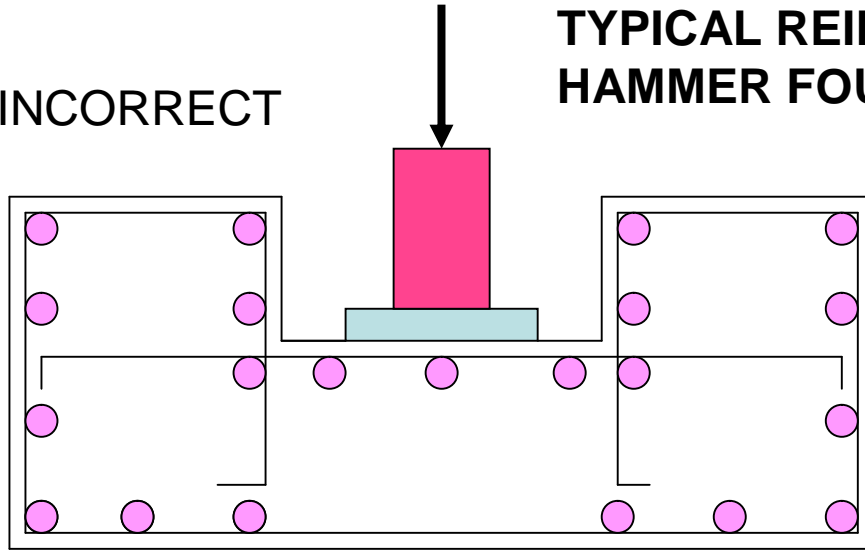
# FOOTING-DETAILS(INDEPENDENT)

INCORRECT

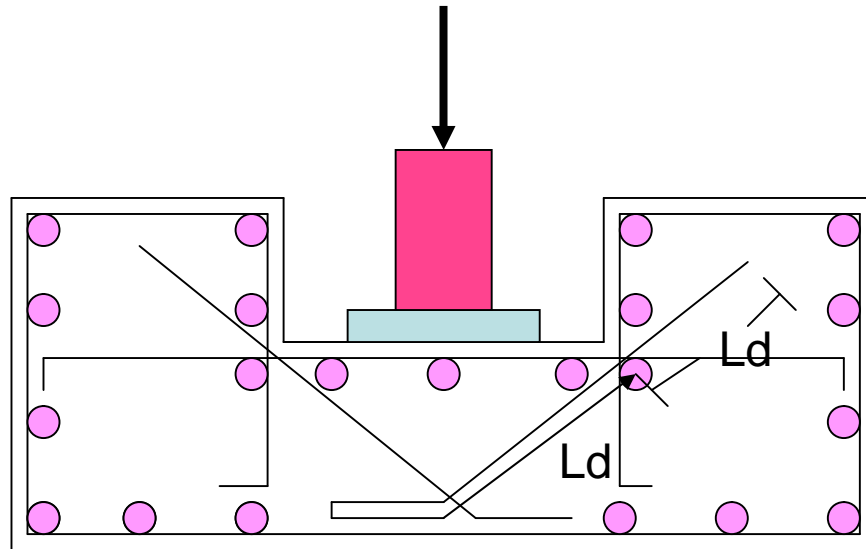


INCORRECT

# TYPICAL REIN DETAILS OF HAMMER FOUNDATION BLOCK

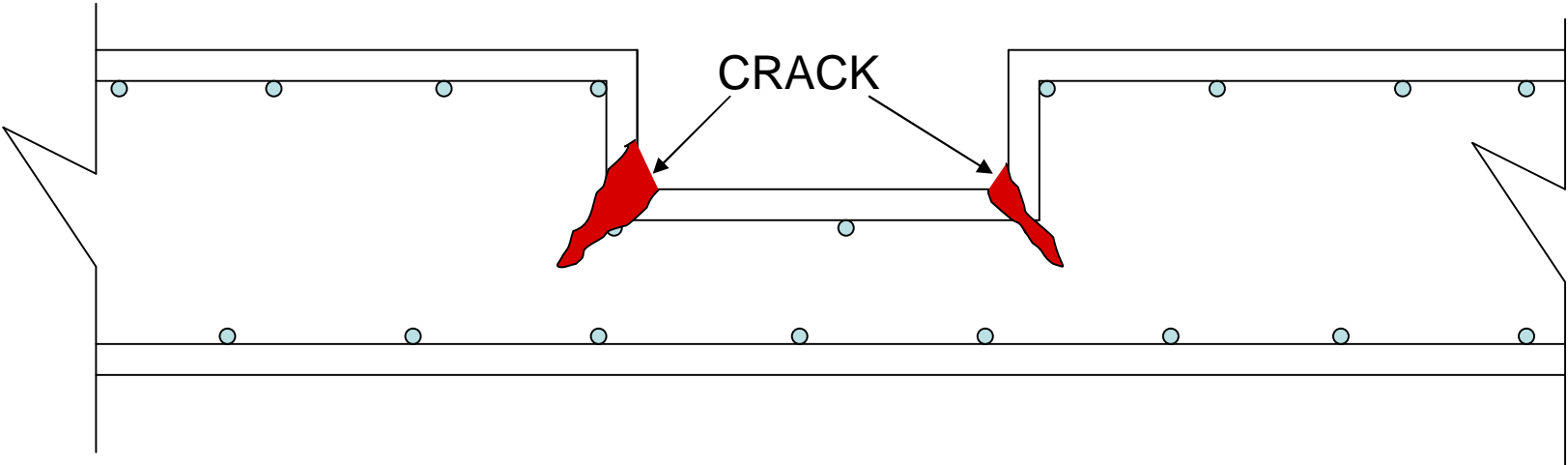


CORRECT

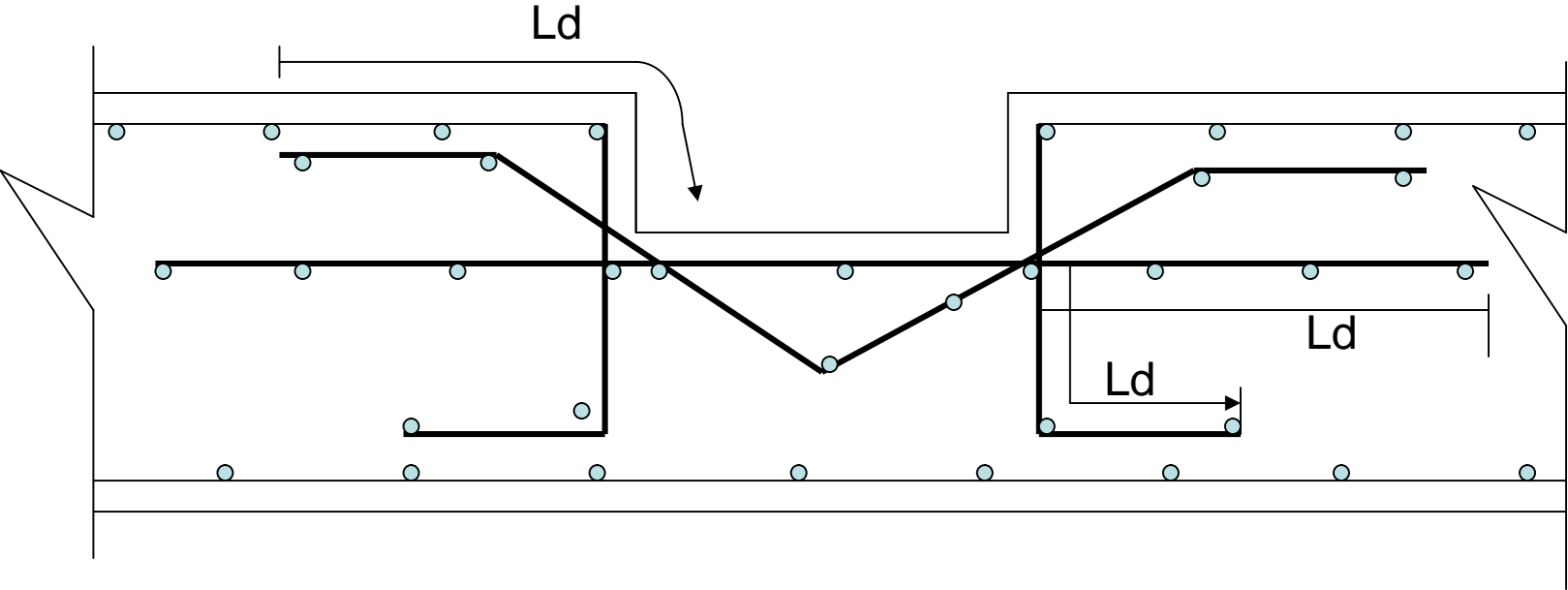


# SECTION OF TRENCH

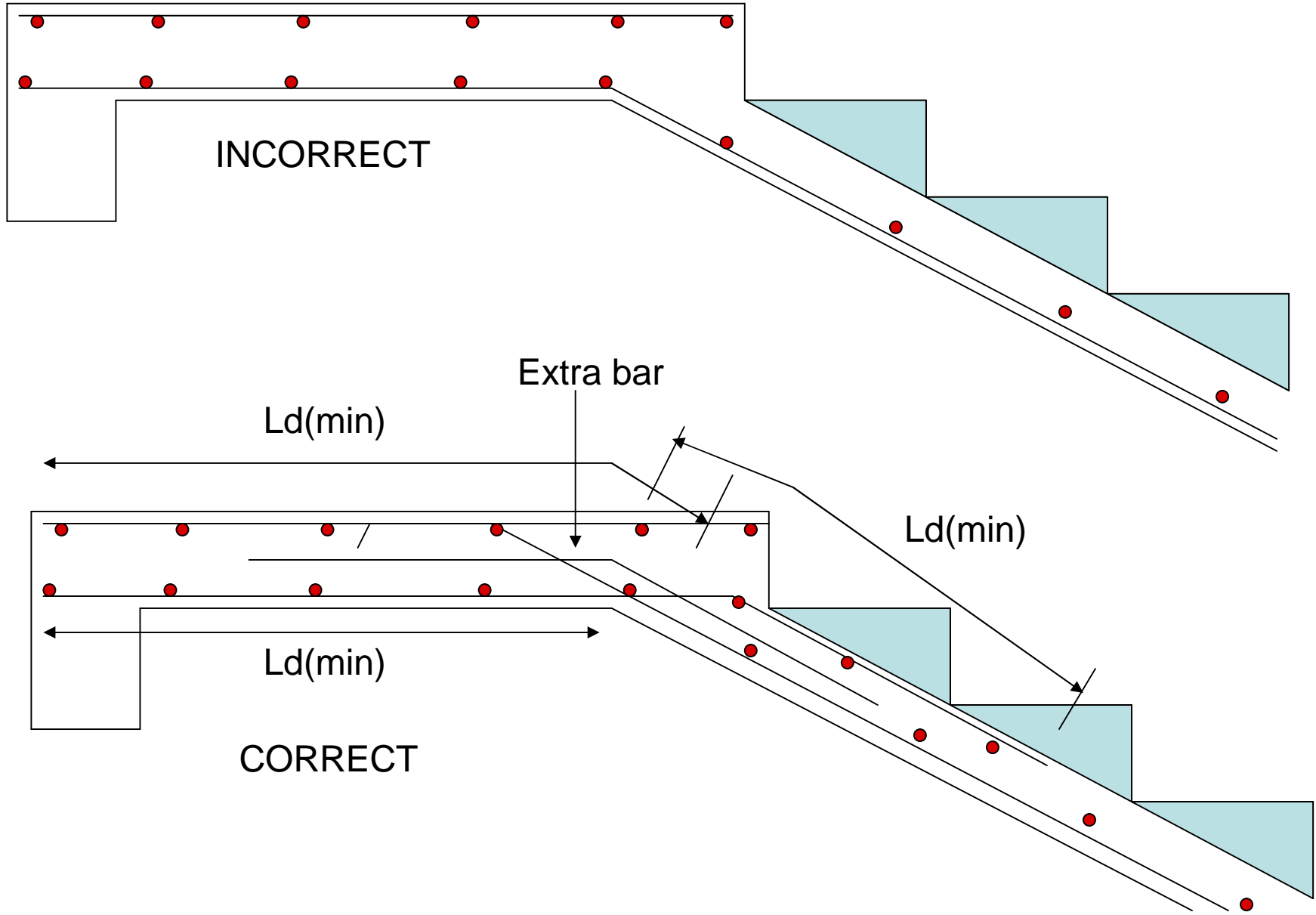
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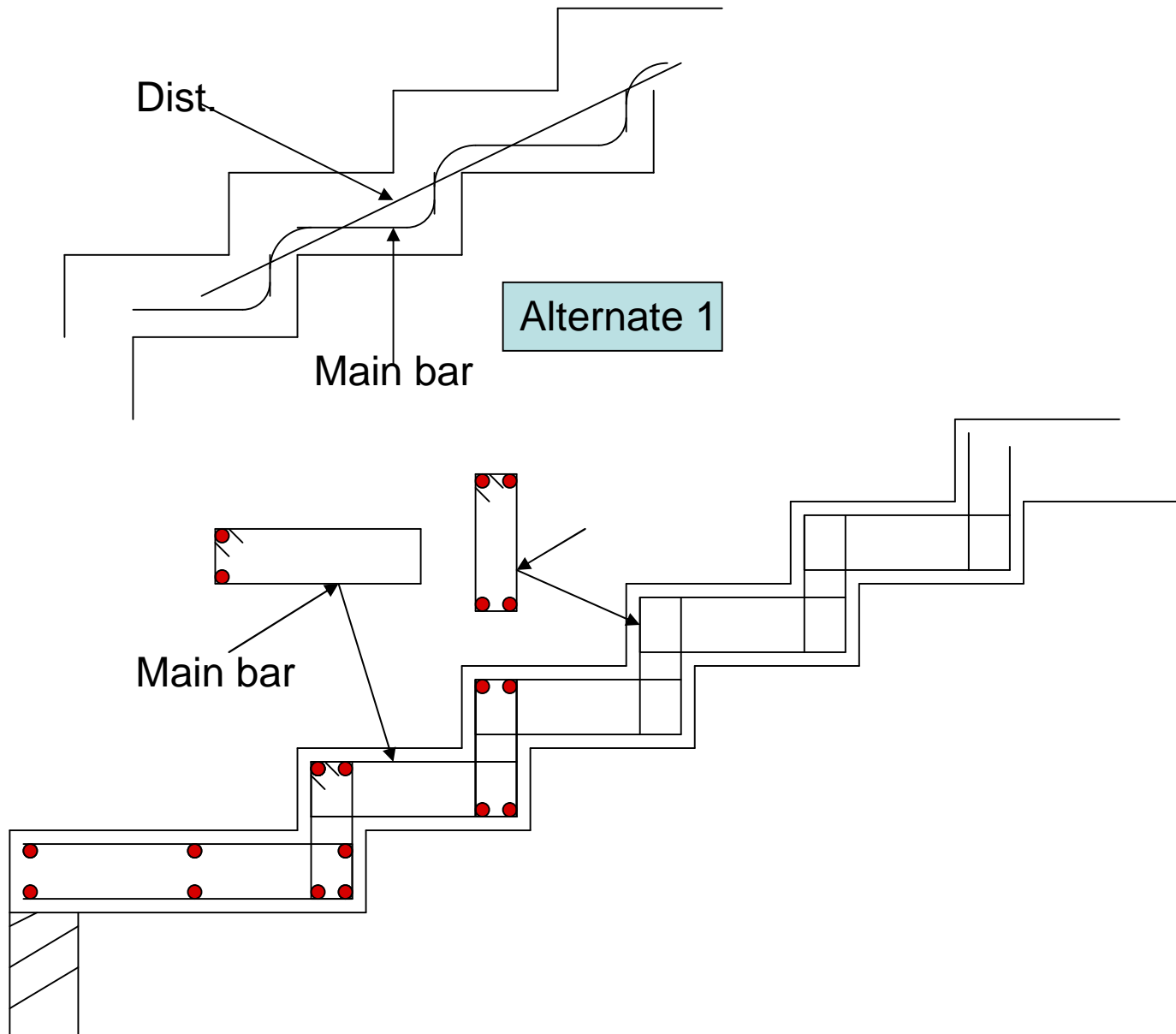
CORRECT



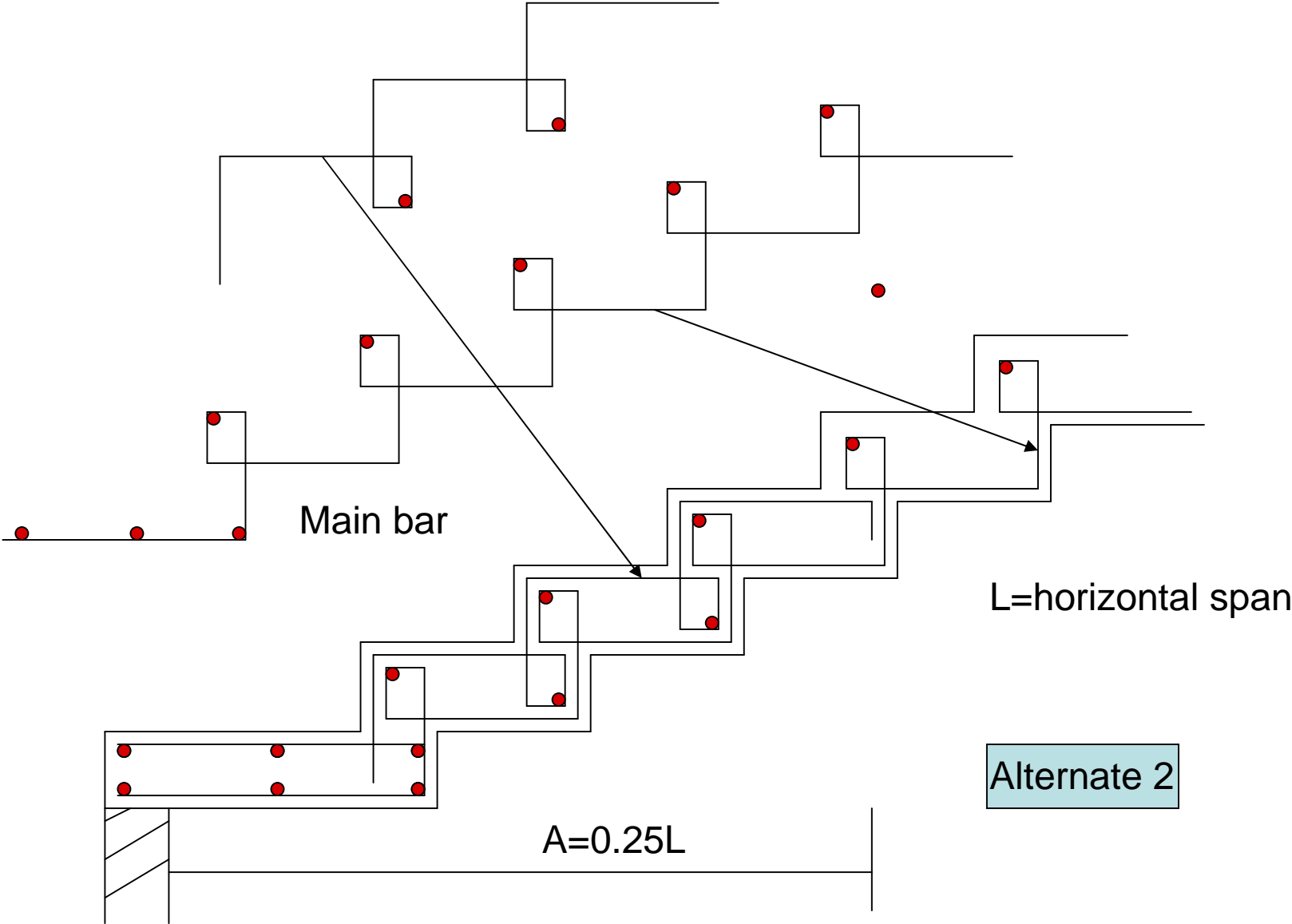
# STAIRCASE-WITH WAIST SLAB



# SLABLESS STAIRCASE



# SLABLESS STAIRCASE



## DEVELOPMENT LENGTH OF BARS

FOR A CONCRETE GRADE M20 & STEEL STRENGTH  $F_y=415$

SLNO	BAR DIA.	TENSION mm	COMPRESSION	REMARKS
1	8	376.0	301.0	
2	10	470.0	376.0	
3	12	564.0	451.0	
4	16	752.0	602.0	
5	20	940.0	752.0	
6	22	1034.0	827.0	
7	25	1175.0	940.0	
8	28	1316.0	1053.0	
9	32	1504.0	1203.0	

APPROXIMATELY USE  $50 \times d_{ia}$  FOR TENSION



## REFERENCES:

1. HANDBOOK ON CONCRETE REINFORCEMENT AND DETAILING-  
SP:34(S&T)-1987.
2. MANUAL OF ENGINEERING & PLACING DRAWINGS FOR  
REINFORCED CONCRETE STRUCTURES-  
(ACI 315-80)
3. MANUAL OF STANDARD PRACTICE –CONCRETE REINFORCING  
STEEL INSTITUTE.
4. TWARD BOARD MANUAL FOR RURAL WATER SUPPLY SCHEMES.
5. DESIGN PRINCIPLES AND DETAILING OF CONCRETE  
STRUCTURES. By D.S.PRAKASH RAO.
6. SIMPLIFIED DESIGN-RC BUILDINGS OF MODERATE SIZE AND  
HEIGHT-BY PORTLAND CEMENT ASSOCIATION,USA.
7. DESIGN AND CONSTRUCTION FAILURES BY DOV KAMINETZKY.

8. IS:2502-1963 CODE OF PRACTICE FOR BENDING AND FIXING OF BARS FOR CONCRETE REINFORCEMENT.
9. IS:1893:2000.
10. IS:4326.
11. IS:456:2000
12. REINFORCED HAND BOOK BY REYNOLD.

**THANK YOU.**