Building Construction Technology I

(Beams & Columns)

Department of Architectural Engineering/2nd stage

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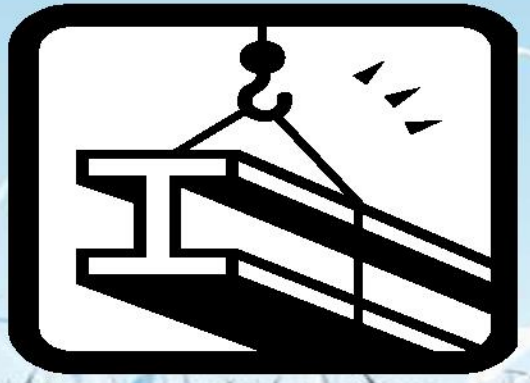
BEAMS

Beam is the horizontal member of a structure, carrying transverse loads. Beam is rectangular in cross-section. Beam carry the Floor slab or the roof slab. Bram transfer all the loads including its self-weight to the columns or walls.



R.C.C. BEAMS

R.C.C. Beam is subjected to bending moments and shear. Due to the vertical external load , bending compresses the top fibers of the beam and elongates the bottom fibers. The strength of R.C.C. beam depends on the compsite action of concrete and steels

Load Acting on a Structure

- **Dead Load**

  Dead load is the self-weight of thevarious components of a building.

- **Live Load**

  Live load is the external superimposed load on a structure. Live loads may be

  (i) Uniformly distributed load

  (ii) Uniformly varying load

  (iii) Concentrated load

Types of BEAMS

- SIMPLY SUPPORTED BEAM
- FIXED BEAM
- CANTILEVER BEAM
- CONTINUOUS BEAM
- OVERHANGING BEAM

Simply supported beam

It is a beam supported freely at the two ends on walls or columns. In actual practice, no beam rests freely on the supports (walls or columns).

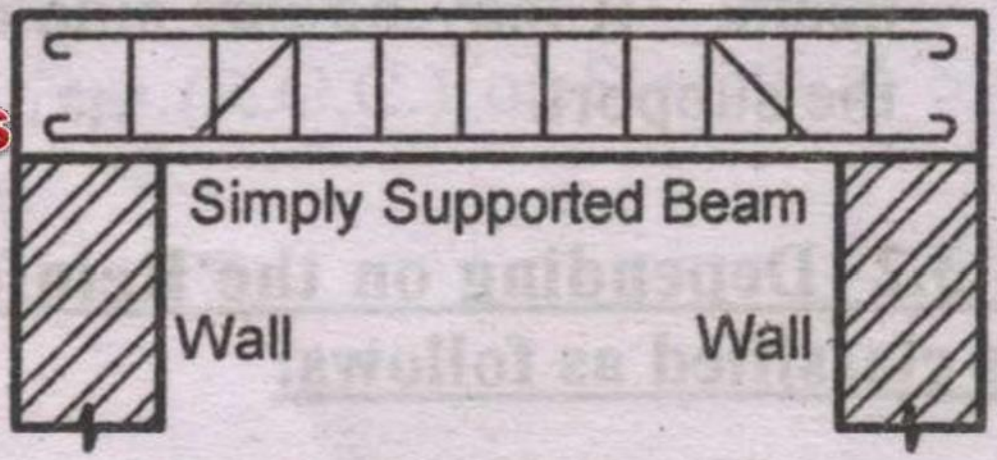


FIG. 1 SIMPLY SUPPORTED BEAM

Fixed beam

In this beam, both ends of the beam are rigidly fixed into the supports. Also, Main reinforcement bars and stirrups are provided.

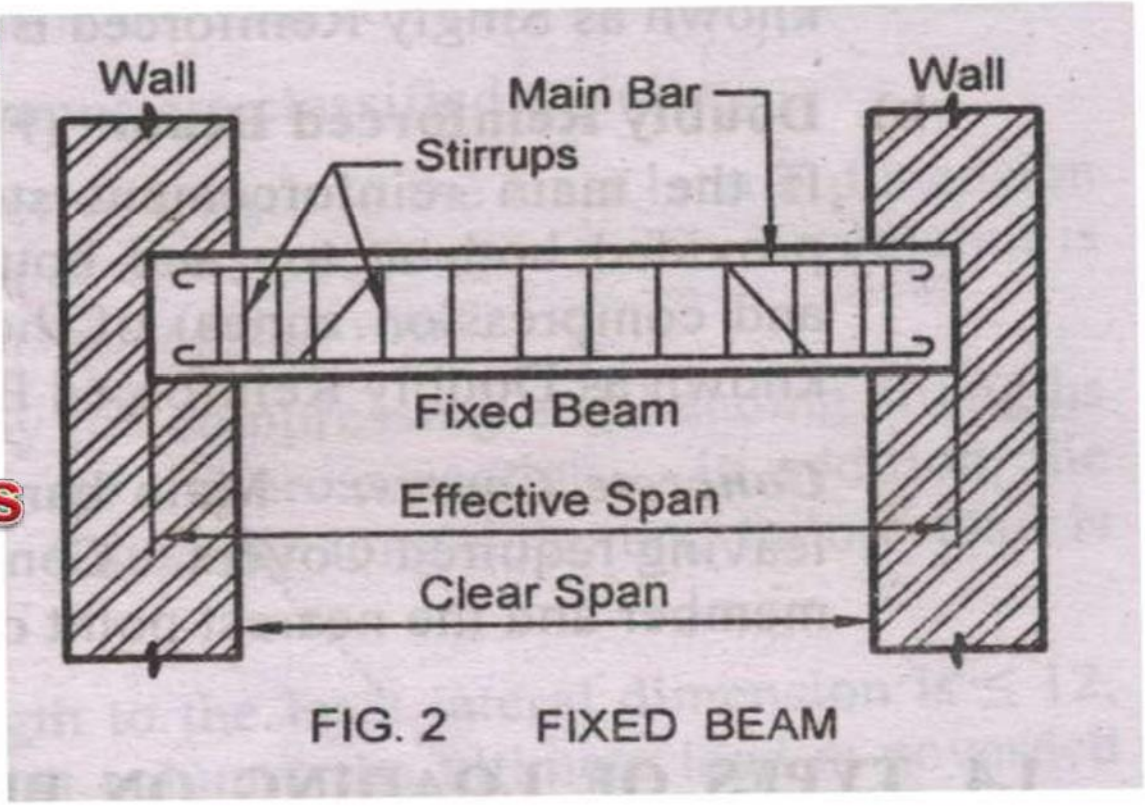


FIG. 2 FIXED BEAM

Cantilever beam

It is fixed in a wall or column at one end and the other end is free, it is called cantilever beam. It has tension zone in the top side and compression zone in the bottom side

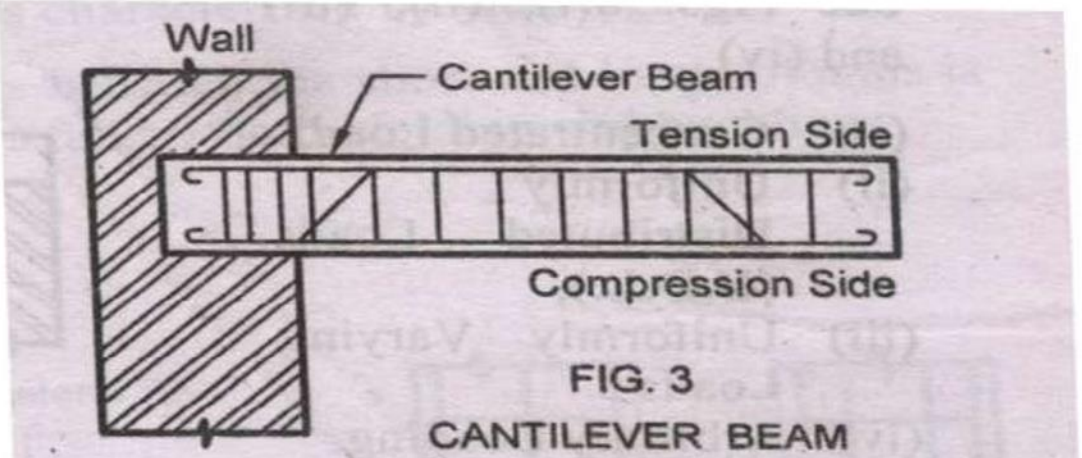


FIG. 3
CANTILEVER BEAM

Continuous beam

It is supported on more than two supports . This beam is more economical for any span lengths.

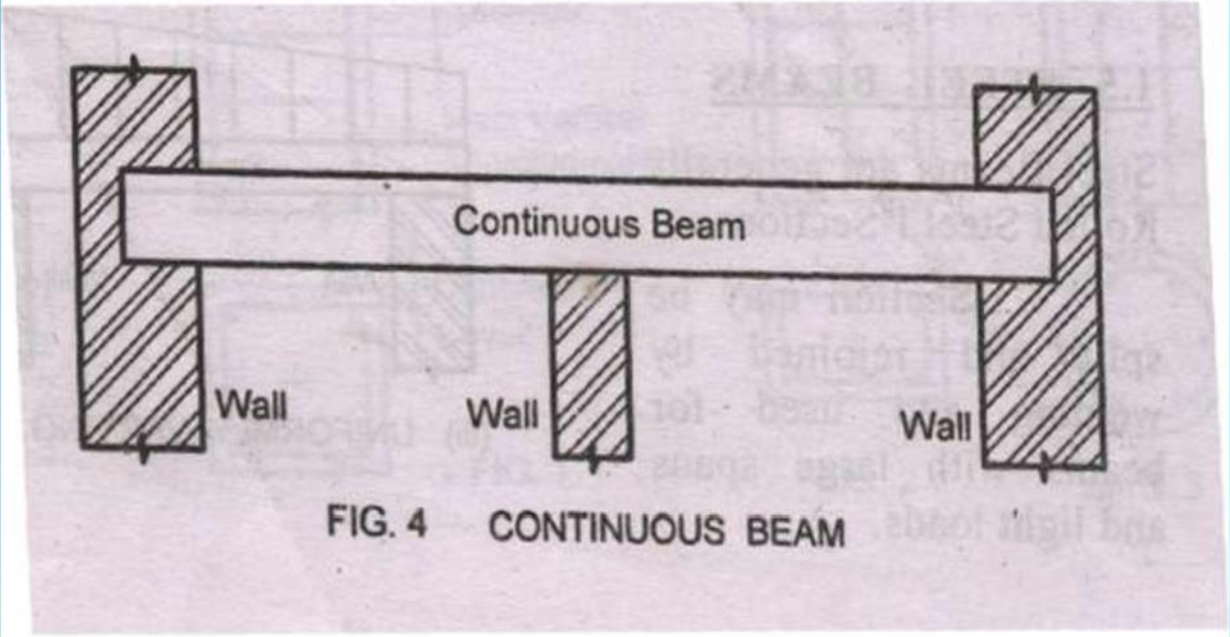


FIG. 4 CONTINUOUS BEAM

Overhanging beam

In overhanging beam, Its end extends beyond the wall or column support. Overhanging of the beam is the unsupported portion of the beam. It may be one side or both the sides of the support.

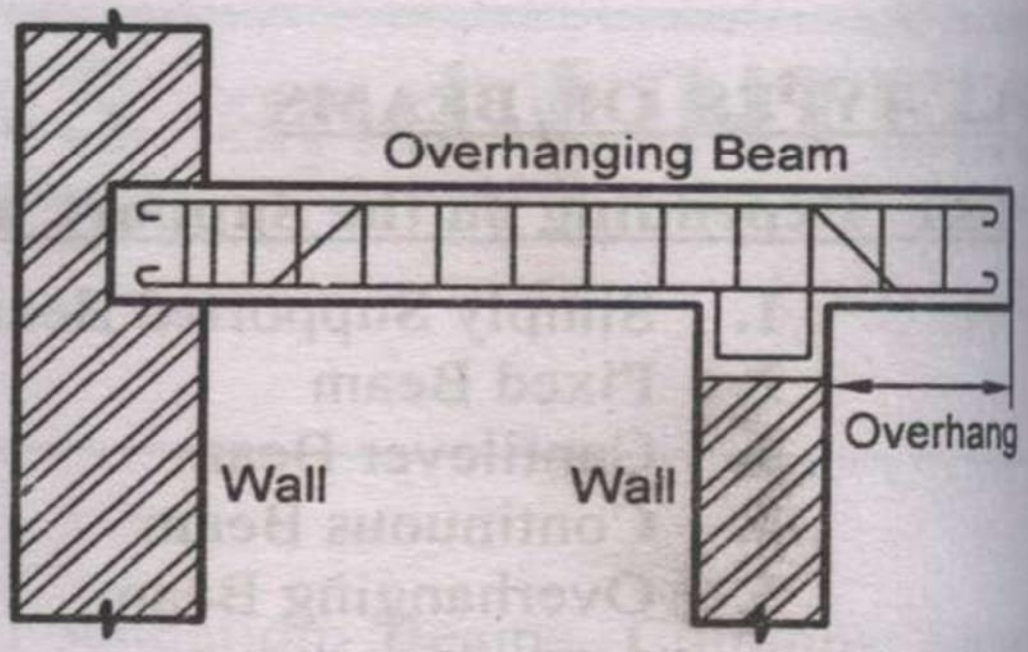
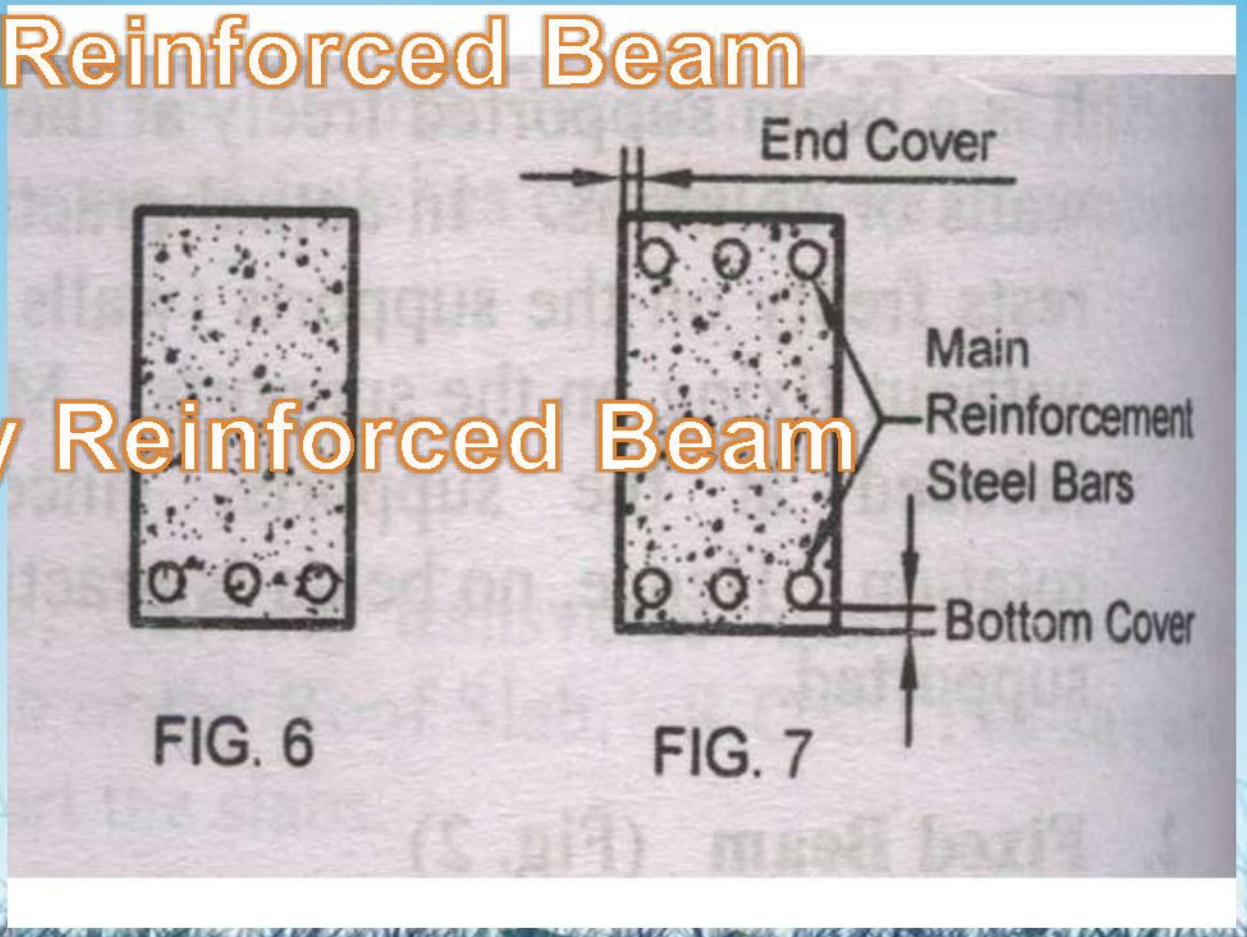


FIG. 5 OVERHANGING BEAM

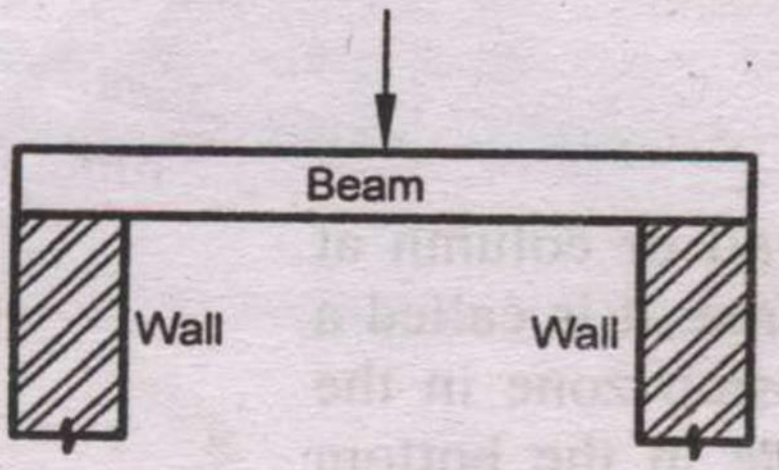
R.C.C. Beams

- Singly Reinforced Beam
- Doubly Reinforced Beam

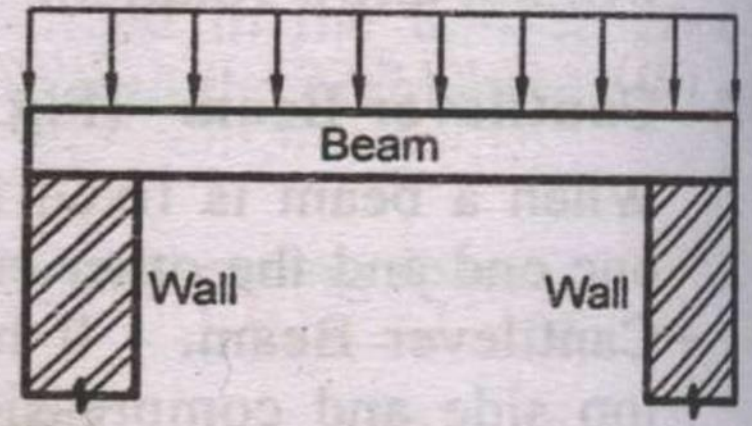


Types of Loading on Beams

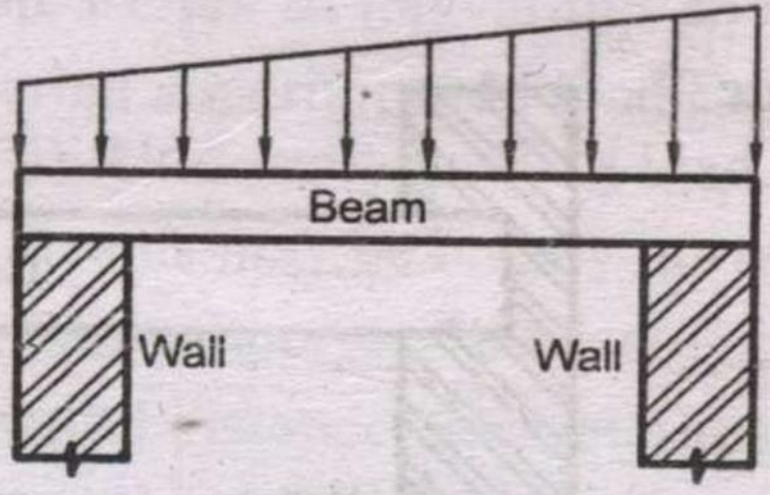
- Concentrated Load
- Uniformly Distributed Loads
- Uniformly Varying Loads
- Arbitrary Loading



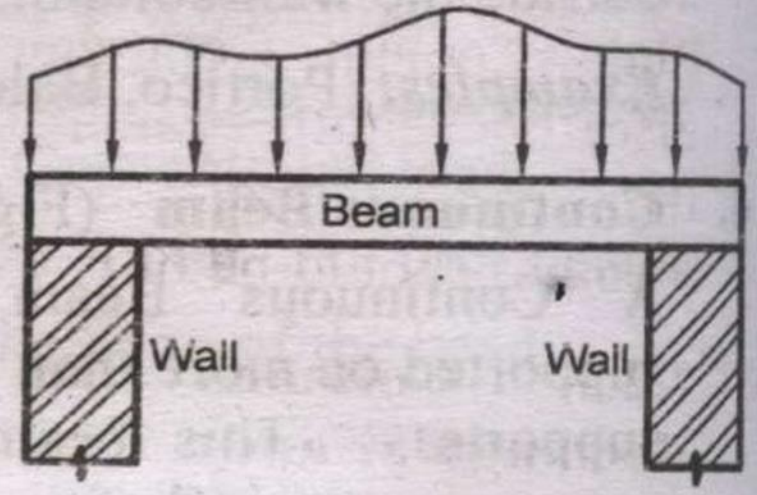
(i) CONCENTRATED LOAD



(ii) U.D.L.



(iii) UNIFORMLY VARYING LOAD



(iv) ARBITRARY LOADING

FIG. 8

Construction of a Beam

Types of Formworks

STEEL FORMWORK

WOODEN FORMWORK

Reinforcement in Beam

- A min. of 0.2% bar is to be provided for the compression in order to take care of the deflection
- Extra tops are used in the support joints

Stirrup

- Used to resist shear and diagonal tension stresses in a beam
- Shall be minimum size of 8mm ∅ in case of lateral load resistance

Hooks

- Alternate hook is provided
- The hooks shall be bent to 135°
- Stirrup distribution is dense near support

Casting and Curing

- Casting and Curing are done simultaneously for beam and slab.
- Casting of lower part is done earlier

Removal of Formwork

- Side of formwork is removed after 3 days
- Bottom part is removed after 21-28 days

COLUMNS

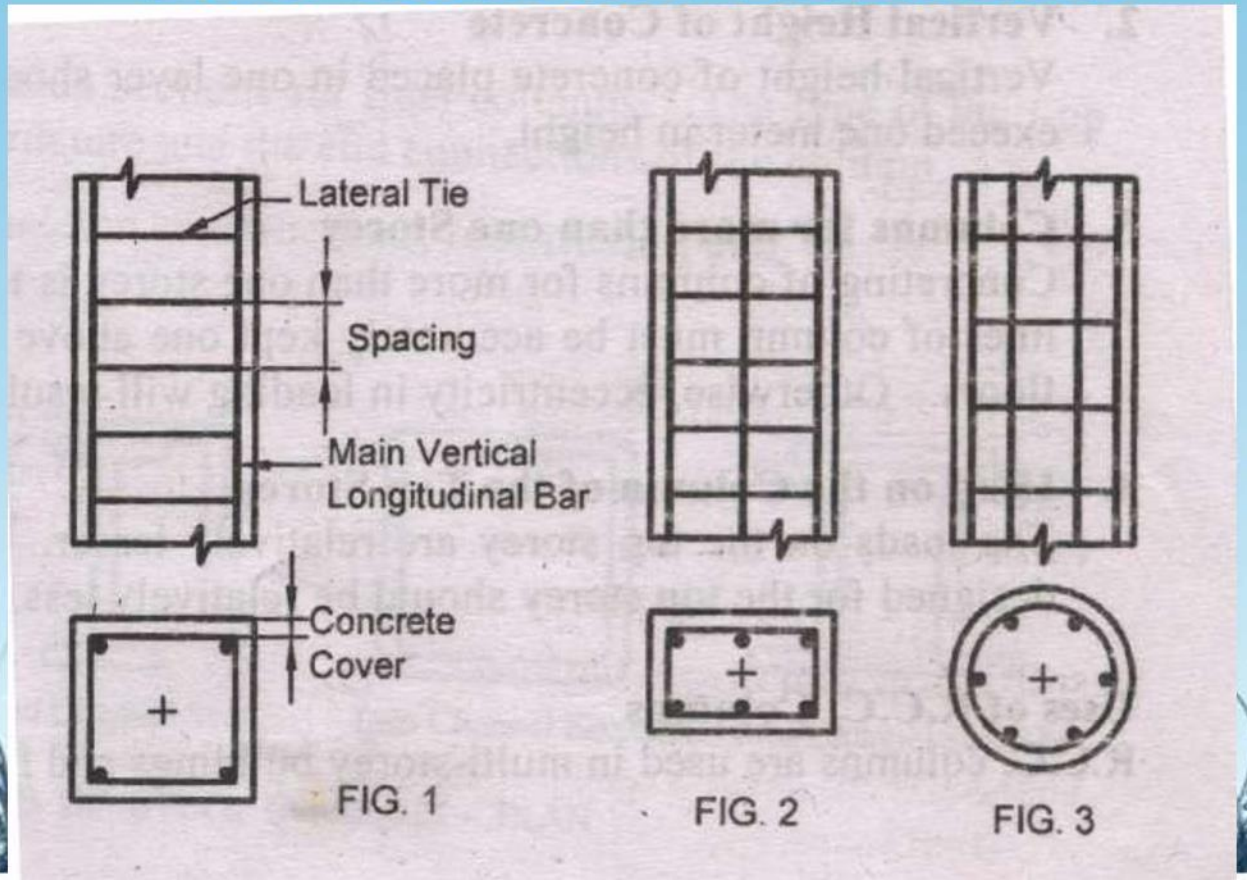
Column is a vertical structural member. It transmits the load from ceiling/roof slab and beam, including its self-weight to the foundation. Columns may be subjected to a pure compressive load. R.C.C. columns are the most widely used now-a-days.

Types of Columns

- Long Column Or Slender
- Short Column
- Intermediate Column

R.C.C. Columns

Columns of square, rectangular and circular sections

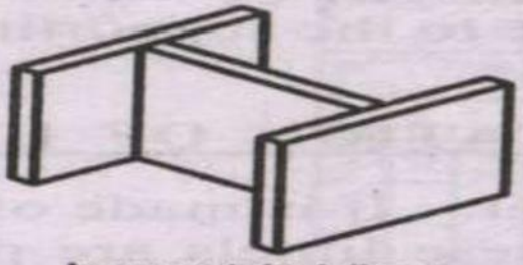


Précautions of Columns construction

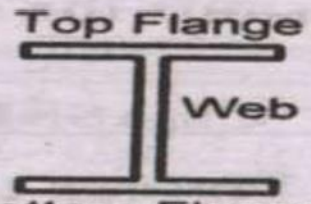
- Process of construction
- Vertical Height of concrete
- Columns for more then one storey
- Load on the column of the top storey

Steel Columns or Stanchions

- Standard Structural Steel Sections

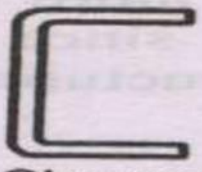


Isometric View.

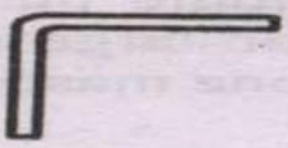


Cross-Section

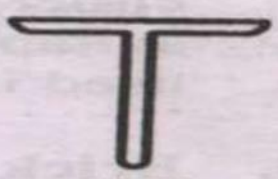
FIG. 5 STEEL COLUMN - I SECTION



Channel



Equal Angle



Tee

FIG. 6 STEEL COLUMN SECTIONS

Build-up Column Sections

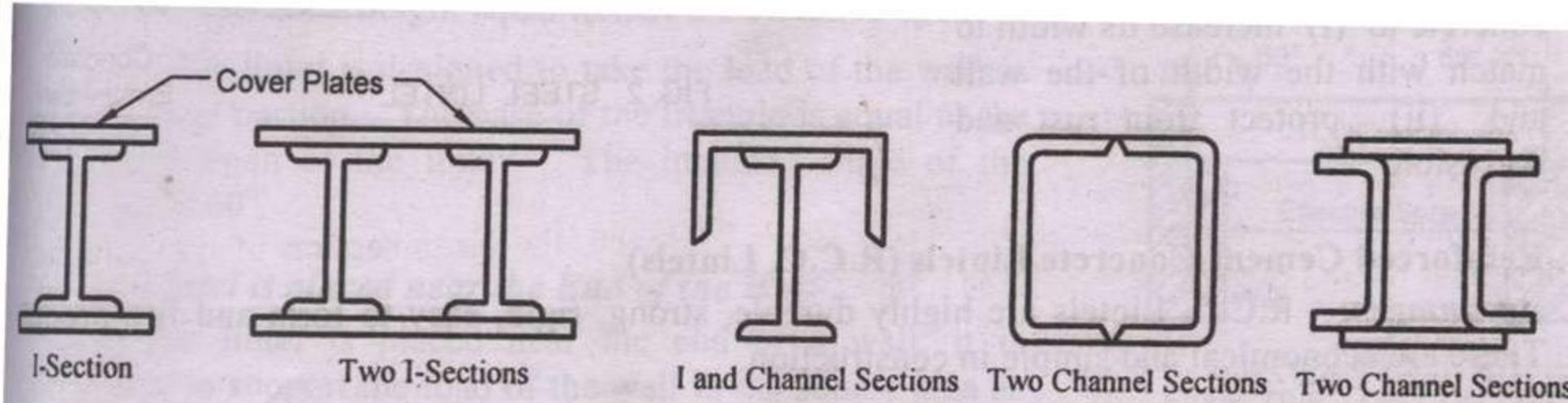


FIG. 7 BUILT-UP SECTIONS OF STEEL COLUMNS - PLAN

Construction of a Column

Vertical Reinforcement

- A rectangular column must have at least 4 reinforcements at 4 corners

Circular Column in Reinforcement

- Circular column should have minimum 6 reinforcements
- Reinforcement should be min 1% and max 8%

Over Lapping of Rods

- It is done when length of reinforcement bar is small but we need longer reinforcement
- Provided in mid span
- Tied with hooks

Ties

- Columns have closed lateral ties spaced approximately uniformly across the column
- Resist shear force and bursting out effect
- 10mm Ø, 12mm Ø bars are used

Placement of Ties

- Normal spacing = S in mid span
- Spacing near support joint = S/2

Hooks

- Used to resist expansion
- The hooks shall be bent to 135°

Formwork

- Must be leak proof, smooth inside and properly aligned
- Should be maintained 1.5 in clear cover

Casting in Column

- Concrete is casted in two lifts
- It should not be casted from more than 5 feet high to avoid concrete segregation

Compaction and Removal of Formwork

- Compaction is done by vibrator
- Construction joints are provided for better bonding between new and old concrete
- Formwork is removed after 3 days

Curing

- Provides water for hydration reaction
- Increases the strength up to 2.5 times
- Done for 21 days
- Gunny bags are used for curing