




13th Edition 2024

A Practical Book for

Mohammed Haroon

BUILDING ESTIMATION & QUANTITY SURVEYING

For All Civil Engineers & Architects (Diploma,Degree & Masters)

Sub-Structure | Super-Structure | Concrete & Reinforcement - Calculations

Format & Procedures for Project Work of Residential & Commercial Buildings

A Practical book for

BUILDING ESTIMATIONS

A book for all Civil Engineers & Architects (Diploma, Degree, & Masters)

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FIRST EDITION – 2012
SECOND EDITION – 2013 Revised Edition
THIRD EDITION – 2014 Revised Edition
FOURTH EDITION – 2015 Revised Edition

TO MY
MOTHER & FATHER

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SUB-STRUCTURE REINFORCEMENT CALCULATIONS

SUPER-STRUCTURE REINFORCEMENT CALCULATIONS

A Practical book for Quantity Surveying

Definition: Quantity Surveying

If any building is to be constructed, then finding out the quantities of all materials and cost required to construct it, is called as Quantity Surveying.

Topics under Quantity Surveying:

1. Types of footings.
2. Types of columns.
3. Types of beams.
4. Types of slabs.
5. Types of walls.
6. Unit conversion→one/two/three →dimension conversion.
7. Length calculation.
8. Area calculation.
9. Volume calculation.
10. Module-I → Sub-structure calculation [Item below ground level].
11. Module-II → Super-structure calculation [Item above ground level].
12. Module-III → Reinforcement calculation for R.C.C and Steel structure.
13. Module-IV → Computer Application (MS Excel sheet and Auto-cad).
14. Module-V → Project work.

(A). List of items to be calculated below Ground level [sub structure]

1. P.C.C under footings
2. Footings
3. Neck columns
4. Tie beams and Strap beams
5. P.C.C under Tie beams
6. Plinth beams or Ground beams
7. P.CC. under plinth beams
8. Grade Slab or Slab on Grade

9. Retaining wall
10. Retaining wall Base.
11. Retaining wall P.C.C.
12. Water calculation
13. Rectangular Sump
14. Circular Sump
15. Septic tank
16. Lift pit
17. Earth work Excavation calculation
18. Back- Fill calculation
19. Abstract for the Quantities of Sub-structure.
20. Bill of Quantities
21. Concrete proportions and Ratios with Concrete mix-design

List of items to be calculated for each item below Ground level

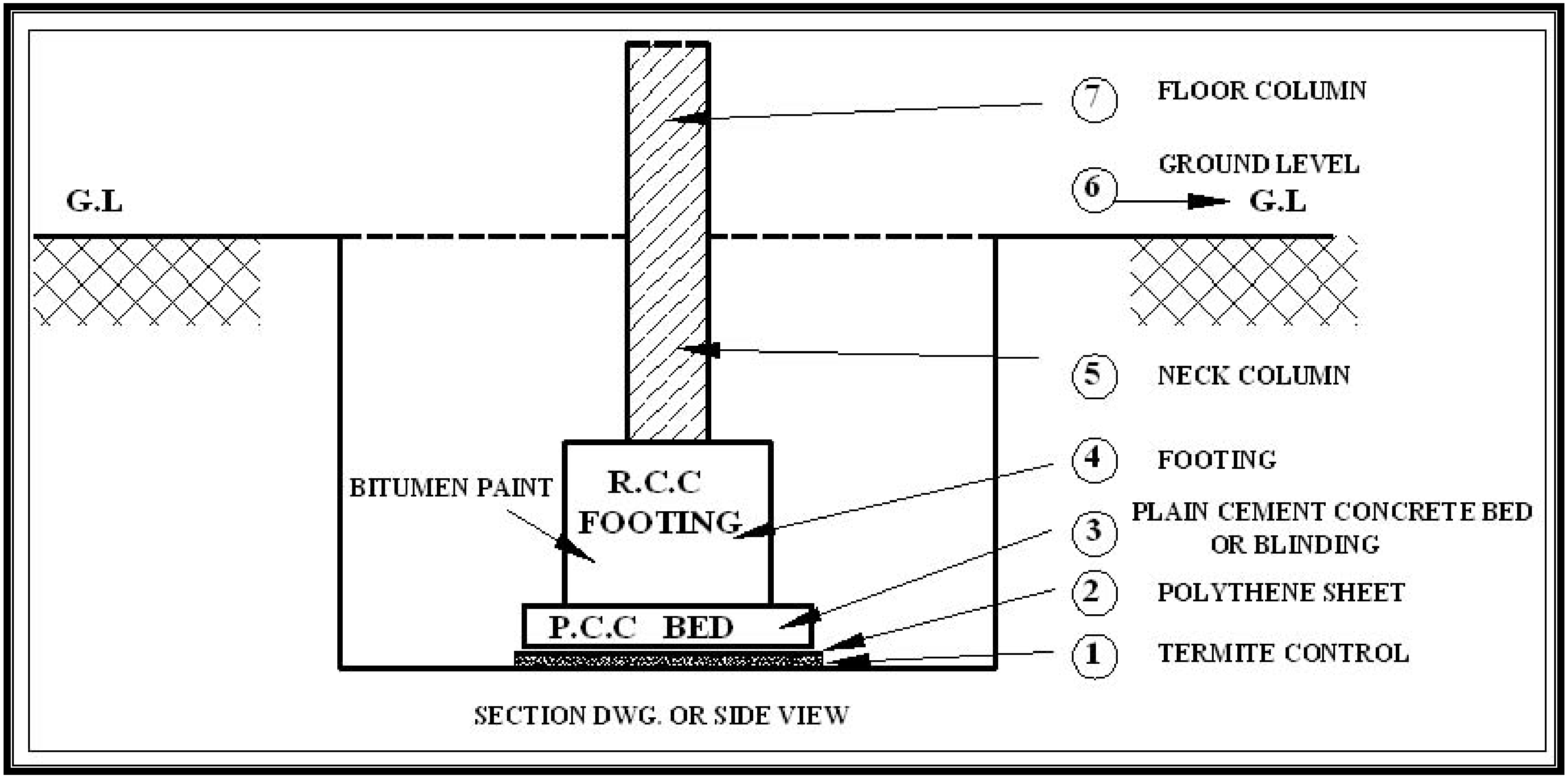
1. Volume of Concrete in m^3
2. Area of Shuttering in m^2
3. Area of Water-proof membrane with bitumen paint in m^2
4. Area of Termite control in m^2
5. Area of Polythene sheet or Vapour Barrier in m^2
6. Reinforcement in Kgs or Tones

(B). List of items to be calculated above Ground level [Super Structure]

1. Floor columns
2. Floor beams
3. Floor slabs
4. Stair cases (Typical & Semi-Circular)
5. Ramp (inclined & Semi-Circular)
6. Parking platform
7. Brick work (No. of bricks required)

8. Cement: Mortar required for brick work
9. Wall putty calculation
10. Paint calculations in Liters (Emulsion paint & Enamel paint)
11. False-Ceiling Calculations in m^2
12. Flooring Calculations (Marble tiles, Vitrified tiles, Parking Tiles & Inter-lock Tiles)
13. Wall Skirting Calculations
14. Wall Tiles (Ceramic Tiles) calculations
15. Wood calculations for doors & windows
16. Doors & Windows Fittings (Tower bolt, Door handle etc)
17. Windows grill, Glass, and Iron Gate calculations
18. Over-Head Water tank Calculations
19. Expansion Joint Details
20. Weight of Concrete Calculations for Pre-cast Wall, Column, Slabs etc.
21. Calculation for the miscellaneous item (Lintel, Loft (Chajjas), Window Sunshade & Kitchen Platforms.
22. Abstract for the quantities of super structure
23. Bill of Quantities for Super structure.

PROCESS OF EXECUTING WORK ON SITE



1. Termite control (anti-fungus spray)
2. Polythene sheet (thickness =2mm to 4mm)
3. Plain Cement concrete bed or Blinding (thickness of blinding = 10cm) P.C.C bed without Reinforcement.
4. R.C.C Footing (Reinforced cement concrete bed)
5. Neck column (From top of footing up to bottom of Ground beam)
6. Ground level
7. Floor column (Part of Column above Ground Level)
8. Bitumen Paint

Earth work excavation:

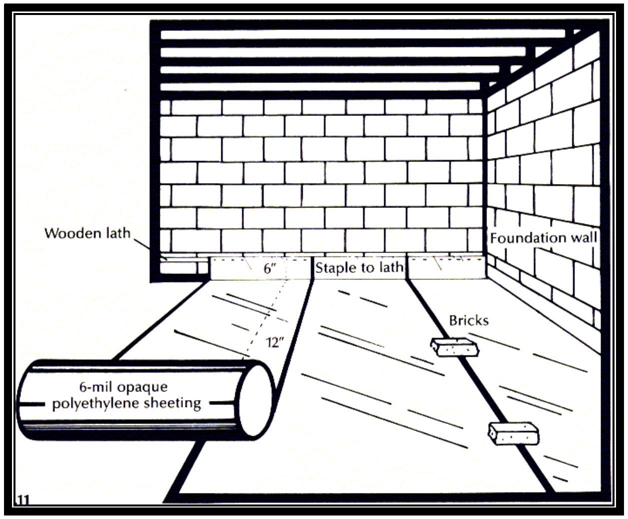
This is the process of digging earth on site where the foundation is to be laid.

Termite Control:

After excavation, compaction is done on the earth's surface and then it is treated with ***termite control (Anti fungus spray)*.** Generally Earth is treated to control the attack of the insects to the structure and protecting the Sub-Structure item from future damage; Liquid spray is sprayed on the Surface of the Earth and is kept open to the atmosphere for 24 hours to kill all types of insects which is likely to come in future time.

Polythene sheet:

Polythene sheet is laid on the surface of ground after Termite Control Spray is spread. Generally they are 2mm to 6mm thick.
The purpose of laying sheet is to hold the water of concrete and not letting it to have seepage on ground.
Generally when plain Cement concrete is put on surface of the ground, the water from the concrete will come out and it will be absorbed by the earth, then concrete will loose its workability and strength.



Plain Cement Concrete bed: [P.C.C. Bed]

This is also called as blinding. It is just a mixture of cement, sand and aggregate without reinforcement. Generally the Grade of concrete for P.C.C is used as $M_{7.5}$ with ratio or proportion of concrete as 1:4:8. Where 1 = one bag of cement; 4 = four bags of Sand; 8 = eight bags of Aggregate. And 40 liters of water / m^3. The thickness of Blinding is 10cm or 100mm or 0.10m.

Reinforced cement concrete (R.C.C):

This is a Concrete with cement, sand and aggregate with reinforcement. Generally the Grade of concrete is used as M_{15} with ratio 1:2:4, Where 1 = one bag of cement; 2 = two bags of Sand; 4 = four bags of Aggregate. And 30 liters of water / m^3

Neck column:

The part of Column which comes between the top of footing to bottom of Ground beam is called as **Neck column**.

Bitumen paint: It can be in liquid form or in Sheet form.

It's a black colour paint, painted to the structure wshich is under ground before back filling of Soil. The purpose of using the ***Bitumen paint*** is to

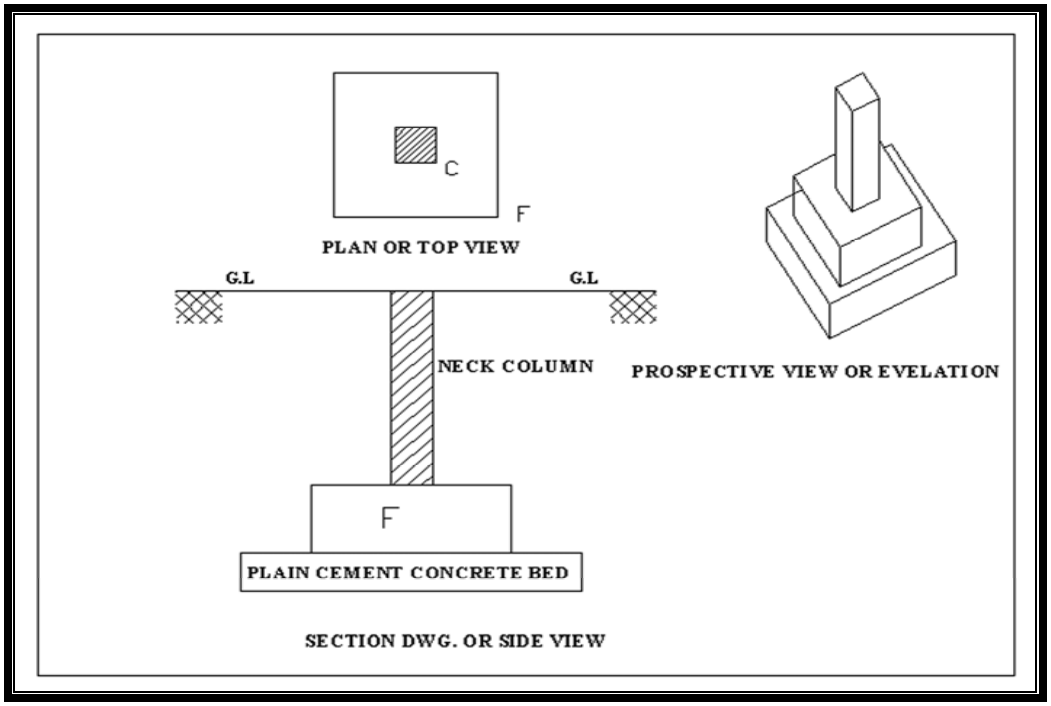
(i) Increase the life of the structure
(ii) Give strength to it
(iii) To acts as water-proofing agent
(iv) And to safe the structure from Corrosion.

Types of Footings

1. Plain Footing
2. Step Footing
3. Isolated/Strip/Tapered Footing
4. Plain Combined Footing
5. Isolated Combined Footing
6. Strap footing or Neighbor footing or Shoe Footing
7. Raft Footing
8. Pile Footing

1. **<u>Plain Footing:-</u>**

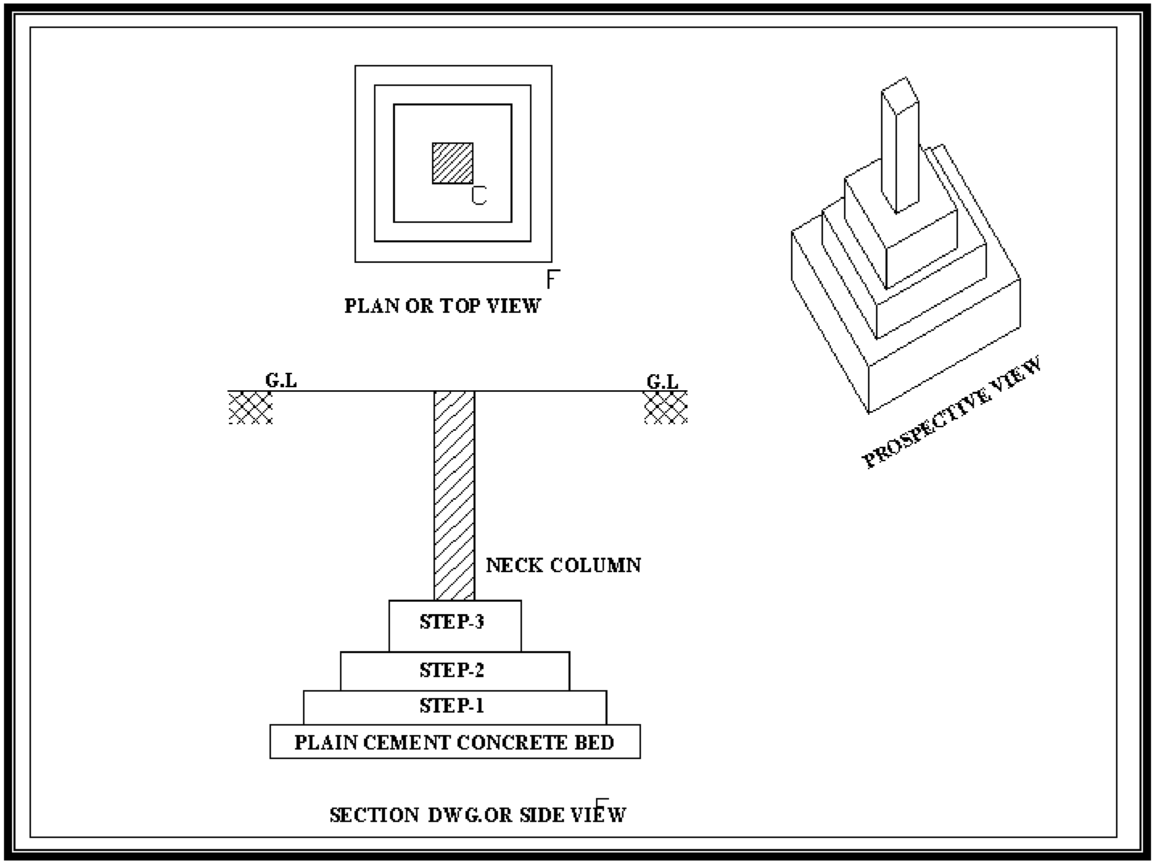
These footings are generally common in both India as well as Gulf countries. It is easy to construct and consume less time. It is constructed where the soil bearing capacity is normal (Good). SBC = 24kn / m^3



C=Column; F=Footing

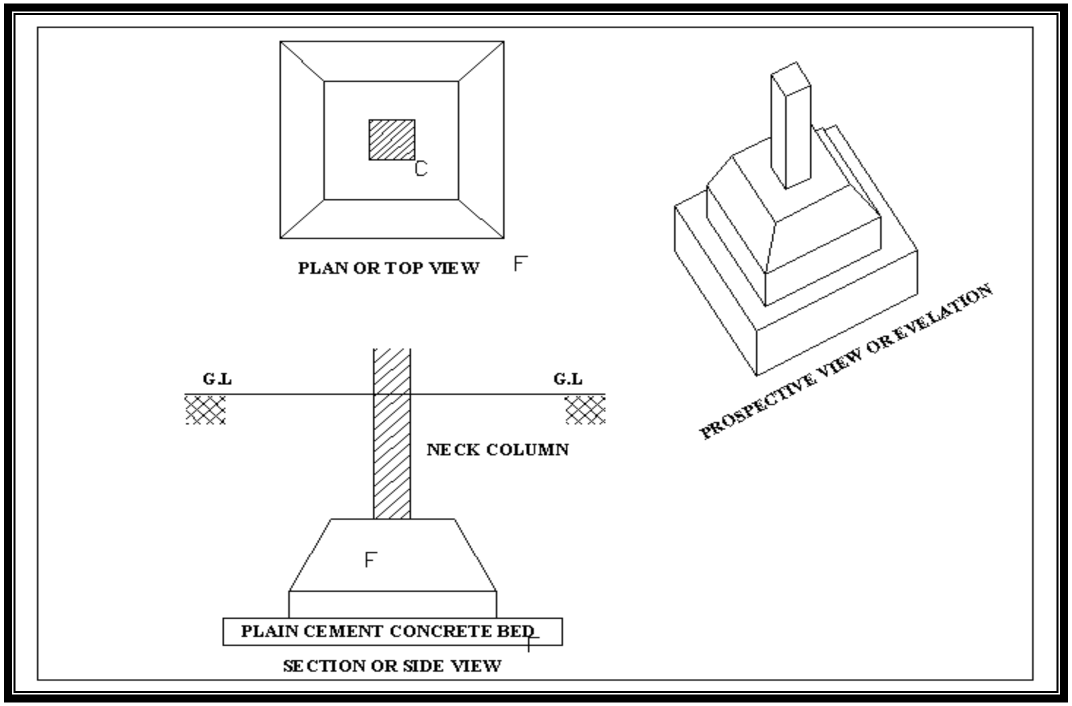
2. **<u>Step footing:-</u>**

These types of footings were constructed in olden days, now they are out dated.



3. **Isolated Footing:-**

These types of footings are constructed for single column and they may be in square or rectangular shape.


C
PLAN OR TOP VIEW
F
PROSPECTIVE VIEW OR EVELATION
G.L
G.L
NECK COLUMN
F
PLAIN CEMENT CONCRETE BED
SECTION OR SIDE VIEW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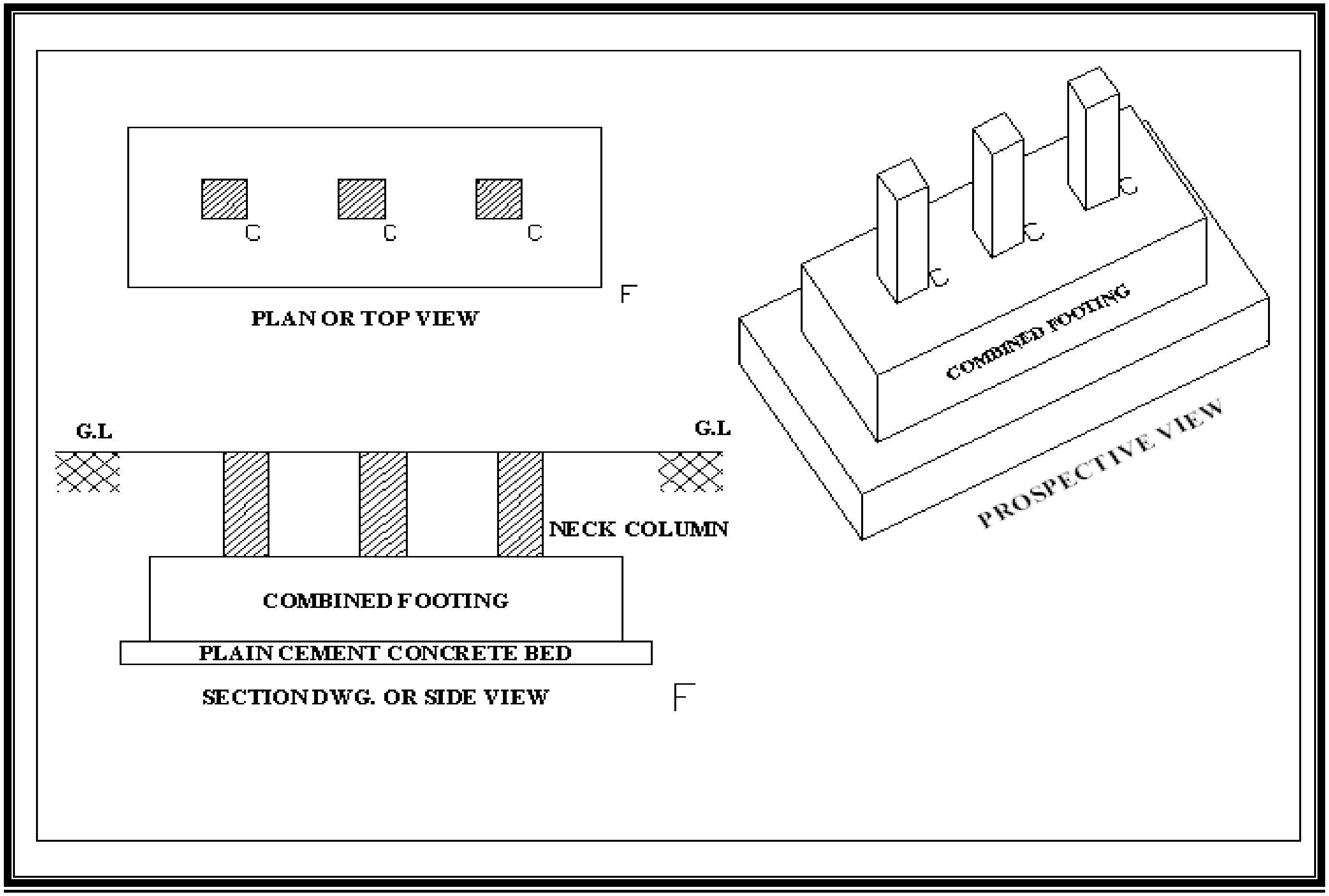
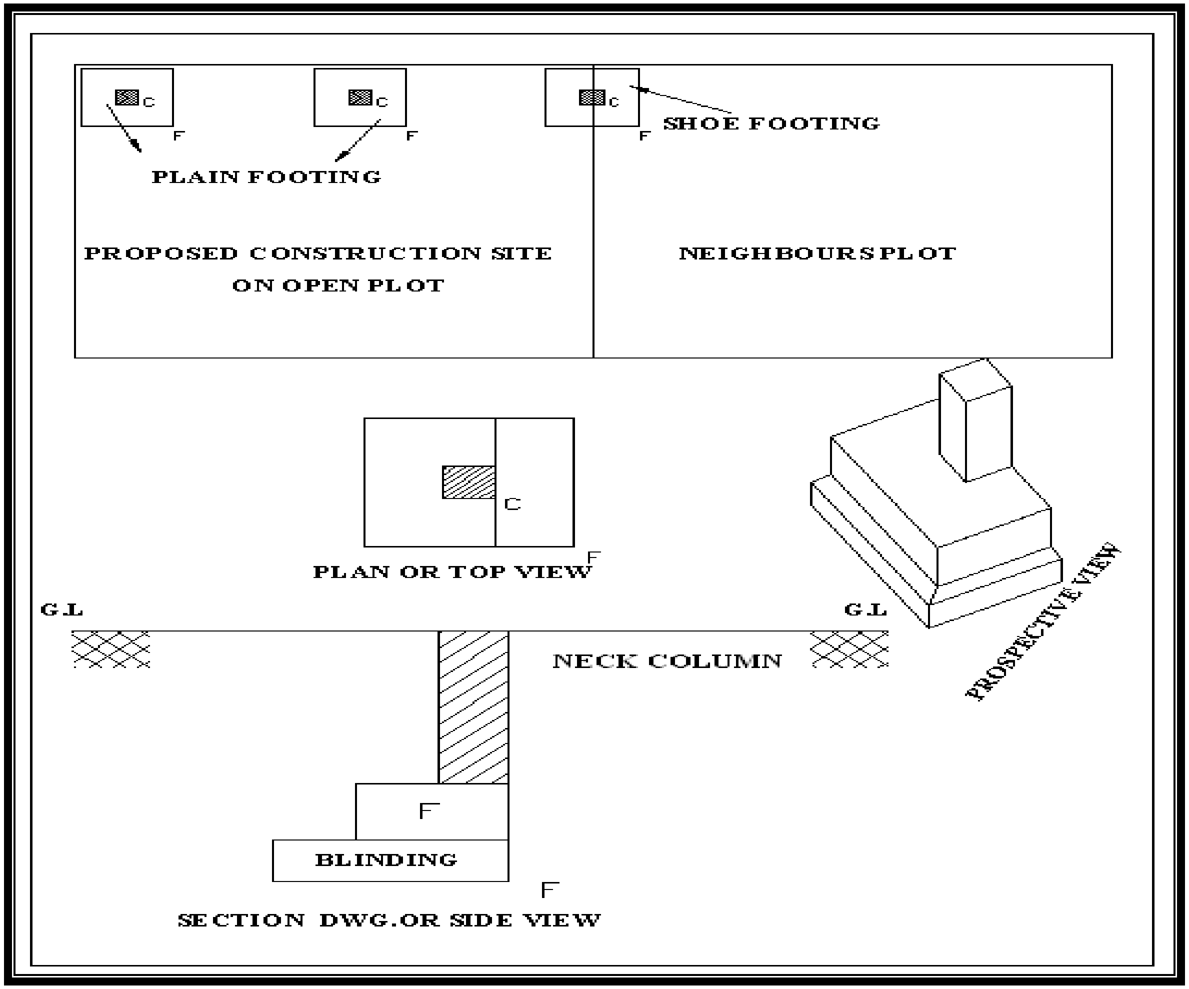
4. Combined Footing:-

A footing which has more than one column is called as combined footing. They are constructed for two or more column and they may be in rectangular or trapezoidal in shape. It is design in a place where the space is limited, where due to lack of space we cannot cast individual footings, therefore footings are combined in to one footing.



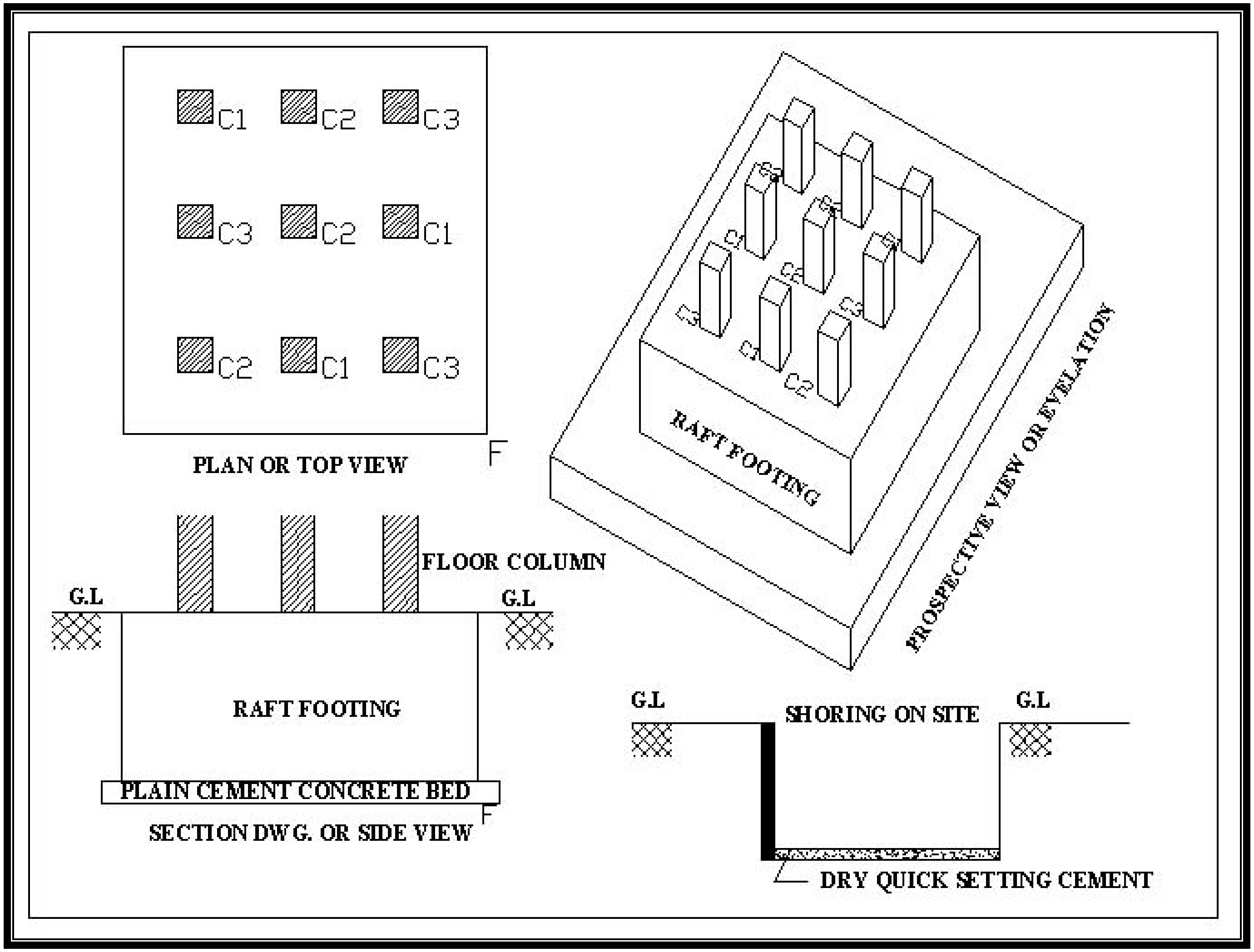
5. Strap or Neighbor or Shoe-footing:-

Shoe footing is the half footing cut-out from the original footing and which has shape of Shoe. It is provided on the corner of plot next to Neighbors' plot. Where there is no provision of setback area. They are constructed on property boundary.



Note: All the Shoe-footings are constructed on the soil, where the soil bearing capacity (SBC) is normal. SBC = 24kn / m^3

6. **Raft Footing:-** Its is one footing in on whole plot and it provided in a places like seashore area, coastal area or beach area where the water table is very high and the soil bearing capacity is weak. Such as five star hotels and High-rise buildings near the beaches.
   When number of column in more than one row, provided with a combined footing, the footing is called as Mat or Raft Footing.



Process of executing Raft:

There are two steps involved in executing the Raft Footing, Namely
(i) De-watering and
(ii) Shoring

i) De-watering:

It is the process of taking off water from excavated area and discharging it to any other place.

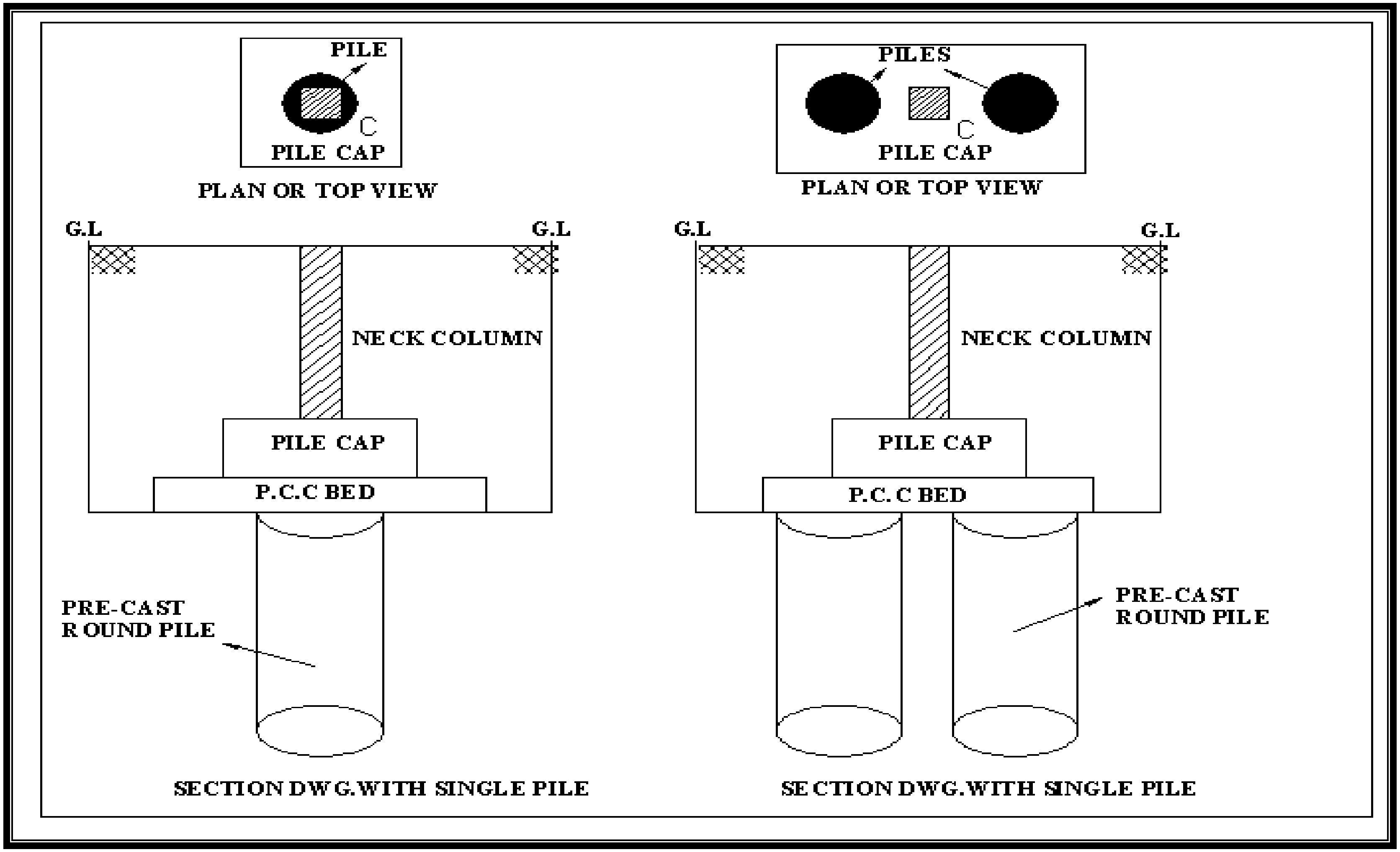
ii) **Shoring:** It is nothing but Shuttering for the wall of excavated pit, to avoid the sliding of soil.

.

Note: Raft footing does not have Neck column, they start directly from the ground surface but reinforcement of neck column starts from Raft.

7. **Pile Footing:-** They are constructed where excessive settlement is to be eliminated and where the load is to be transferred through soft soil stratum, where the Soil bearing capacity is sufficient.

- Piles are nothing but round columns, they may be pre-cast or cast- in- situ [cast on site]
- These types of footings are provided when the Soil bearing capacity of soil is very weak and the Ground water table (level) is high,
- The main objective of providing piles under the footing is to prevent structure from settlement.
- If we don't provide pile under the footing, then the building will have settlement.
- Piles are hammered in to the ground till hard strata (in compressible) layer of earth is found.
- These types of footings are generally designed on sea shore areas.


PILE
C
PILE CAP
PLAN OR TOP VIEW
G.L
G.L
NECK COLUMN
PILE CAP
P.C.C BED
PRE-CAST
ROUND PILE
SECTION DWG.WITH SINGLE PILE
PILES
C
PILE CAP
PLAN OR TOP VIEW
G.L
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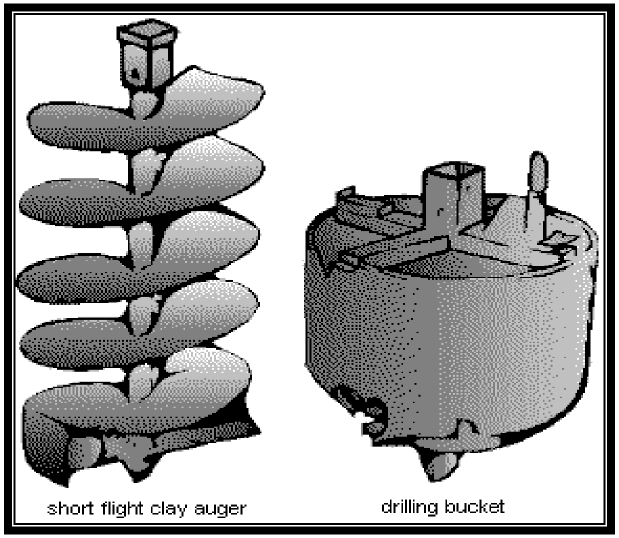
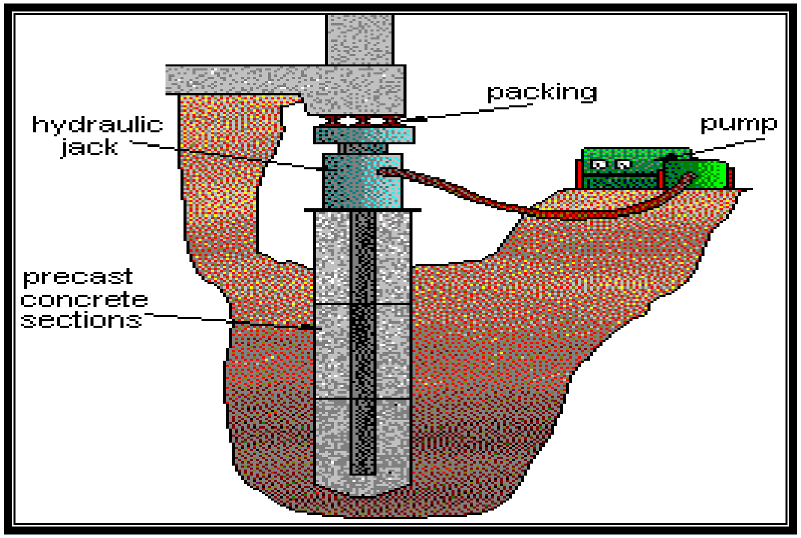
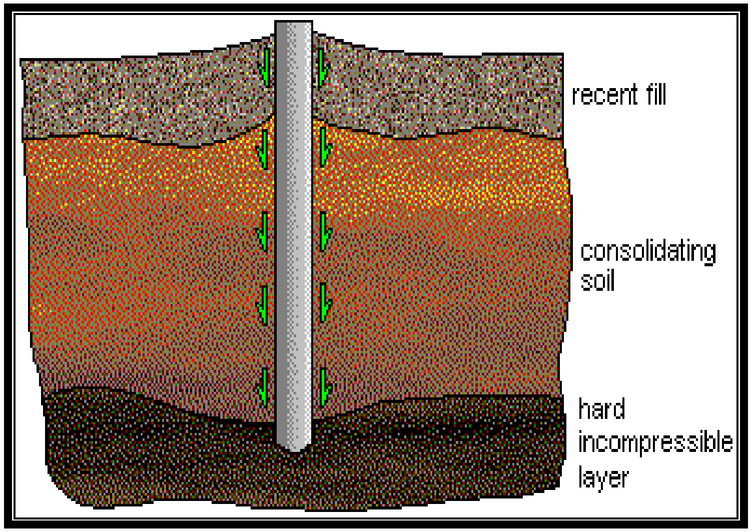
NECK COLUMN
PILE CAP
P.C.C BED
PRE-CAST
ROUND PILE
SECTION DWG.WITH SINGLE PILE


short flight clay auger
drilling bucket


packing
hydraulic jack
pump
precast concrete sections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consolidating soil
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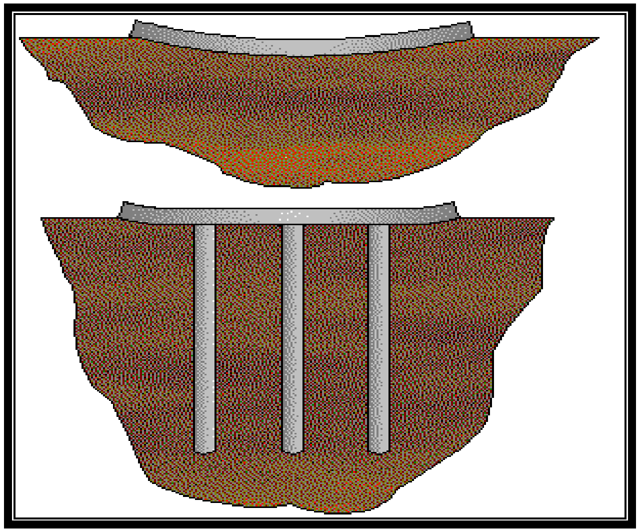


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Types of Columns

- **Square column or Rectangular column:**

  They are generally used in construction of buildings, which are common in practice; these types of column are provided only if the shape of room is rectangular or square.

- **Circular column:**

  They are special designed columns; they are generally used in piling and in the elevation of buildings.

- **"L" type column:**

  They are generally used in the corners of the boundary wall.

- **"T" type column:**

  They are used depending on design requirements and also in over bridges, etc.

- **"V" type column:**

  Depending upon the structure, they are also constructed in buildings, if the shape of the room is trapezoidal.

- **Hexagon type column:**
  They are generally modified columns to give a good look to the column, which is provided in open verandah and Halls.

- **Arch type column:**
  These types of columns are design if the room has arch shape.

- **"Y" type column:**

  These types of columns are generally used in the construction of bridges, fly-over's, etc.

- **<u>"Y" type column with arch:</u>**

It is similar to Y column, but to give a good look to the column, arch shape is provided.

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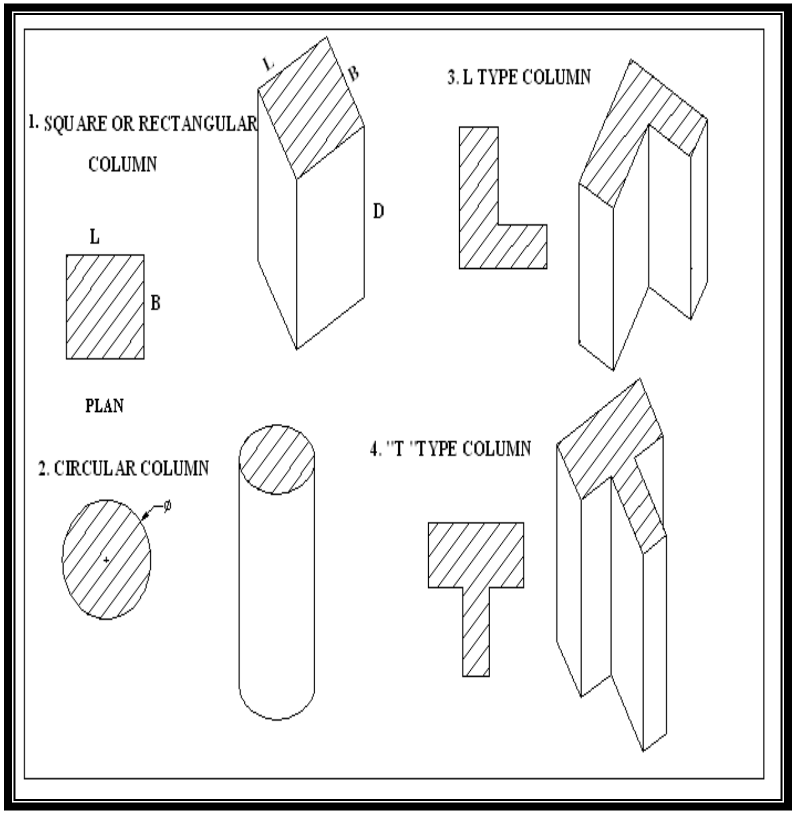

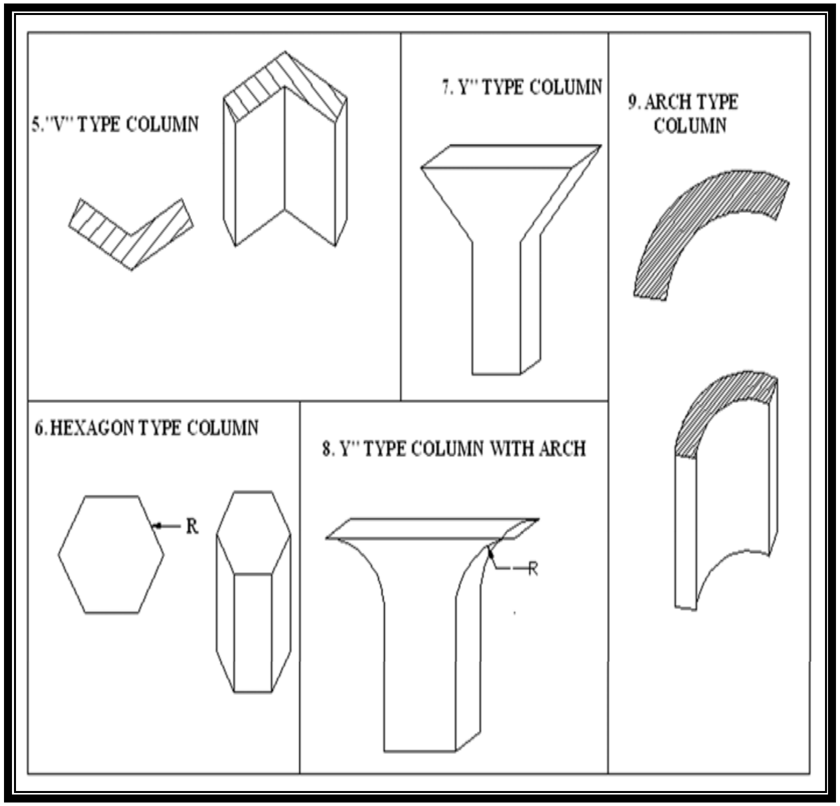

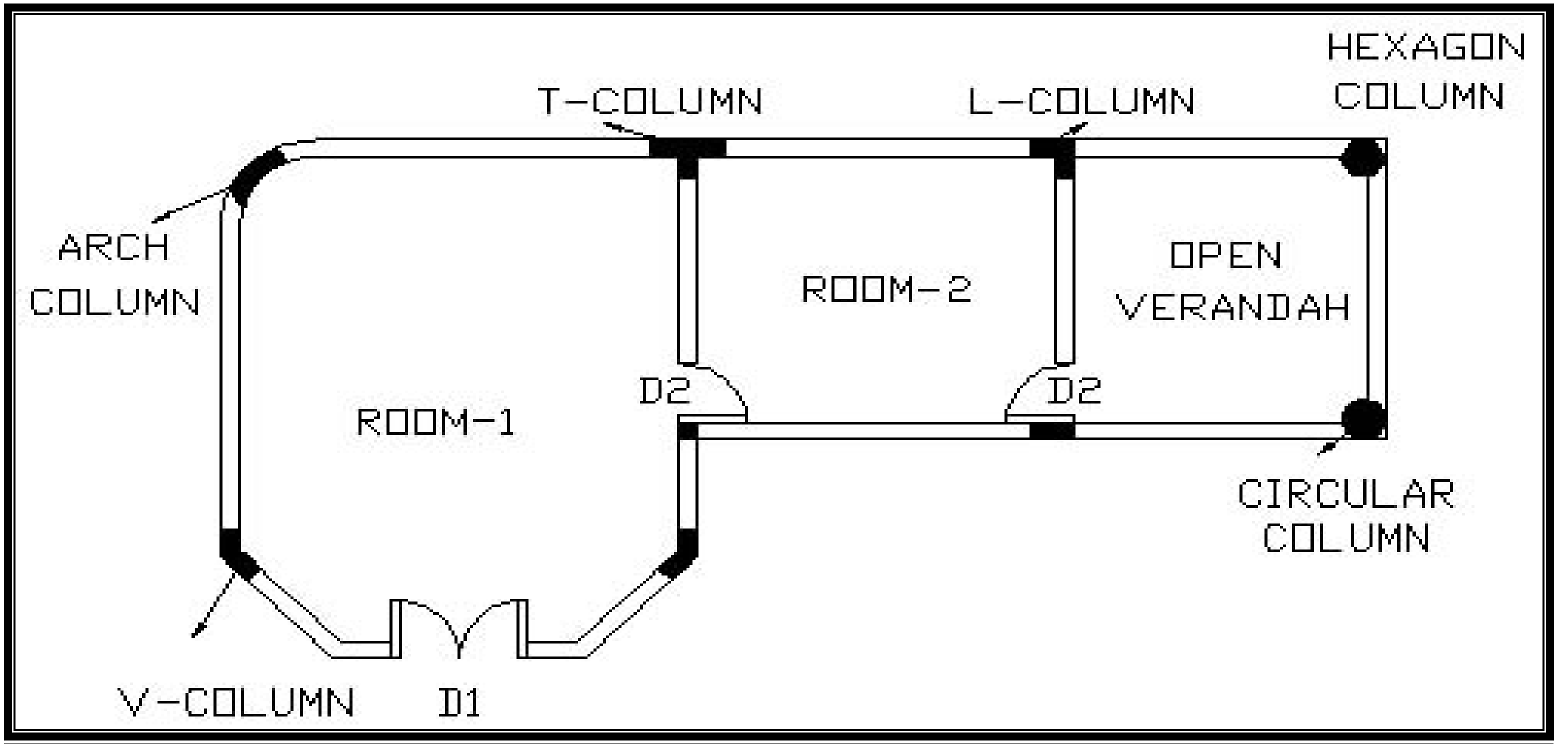
HEXAGON COLUMN
T-COLUMN
L-COLUMN
ARCH COLUMN
ROOM-2
OPEN VERANDAH
D2
D2
ROOM-1
CIRCULAR COLUMN
V-COLUMN
D1


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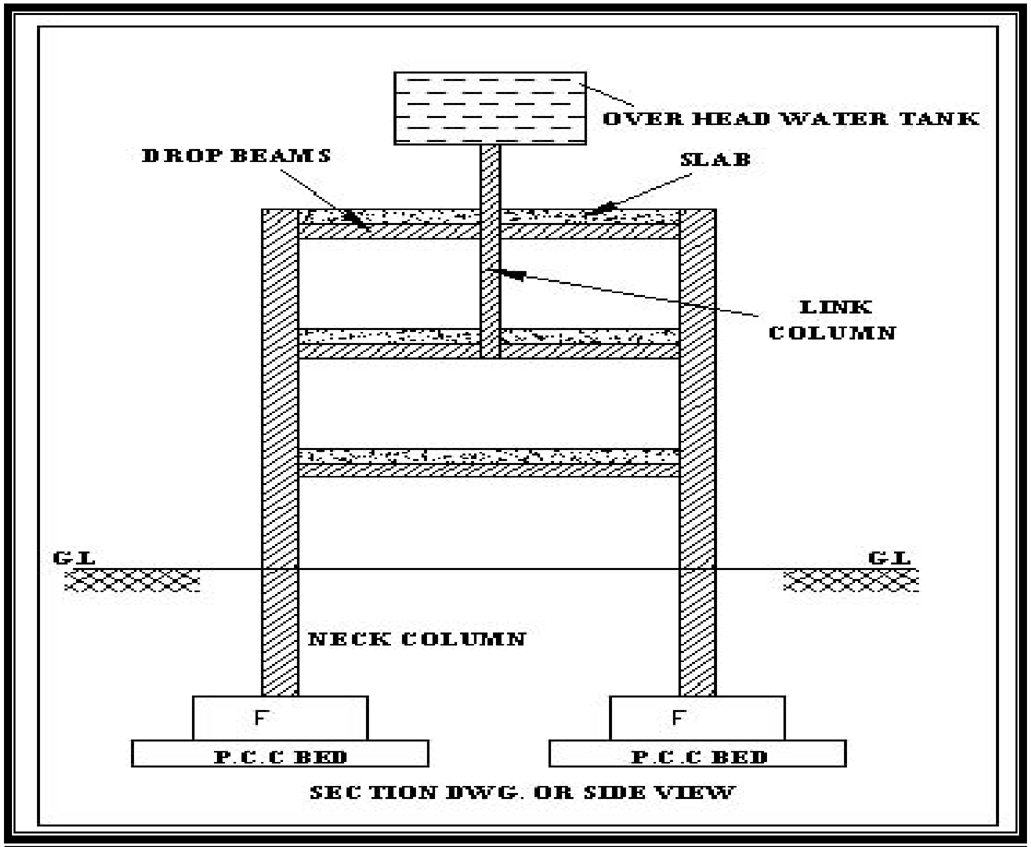


Types of Floors:

- Basement Floor
- Podium Floor
- Ground Floor
- Mezzanine Floor
- First Floor
- Typical Floor
- Helipad

Basement Floor:
The floor which is constructed below ground level for store rooms or mechanical room or parking is called as Basement Floor.

Podium Floor:
The floor which is constructed either below ground level or above ground level, especially for car parking is called as Podium floor.

Ground Floor:
The floor which is constructed on ground level is called as Ground floor.

Mezzanine Floor:
The floor which is constructed between Ground and First Floor is called as Mezzanine floor. This type of floor is constructed for Services of building, shops & offices, to provide facilities for the occupants who are living in High-rise buildings. For proper ventilation the ceiling height of floor is increase 1metre more than the normal ceiling height.

First Floor:
The floor which is constructed above ground floor or above mezzanine floor is called as first floor.

Typical Floor: Typical floor is nothing but repeated floor.

The plan which is design for Ground floor and want to have the same plan for other floors, then these floors are called as Typical floor-1 or typical floor-2, etc.

Helipad:

The floor which is constructed above Roof Floor and which is used for Landing of Helicopter or Taking off of Helicopter is called as Helipad.

Types of load

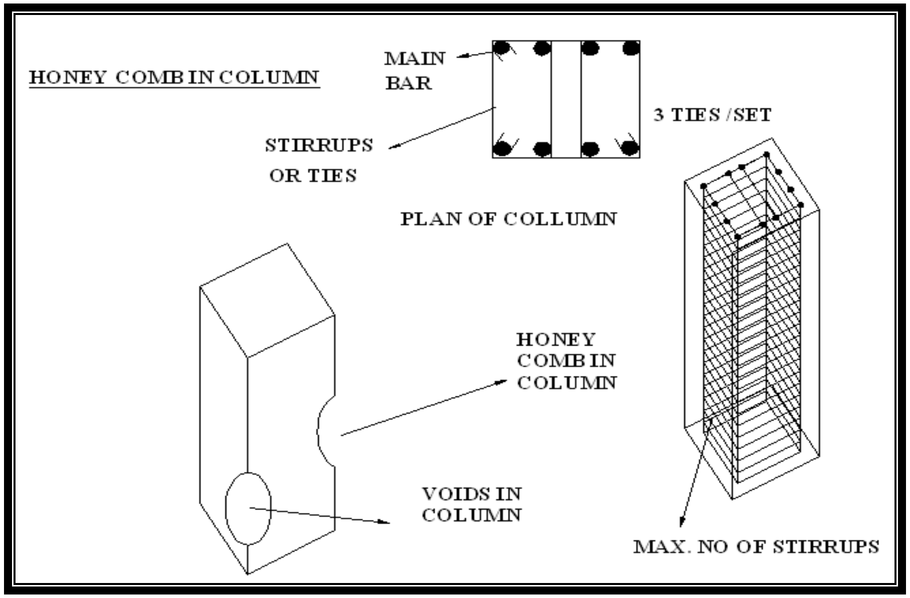
1. Point load
2. Uniformly Distributed Load [UDL]
3. Wind load
4. Concentric load
5. Rolling load or Moving load
6. Dead load
7. Live load
8. Self load
9. Seismic load
10. Eccentric load

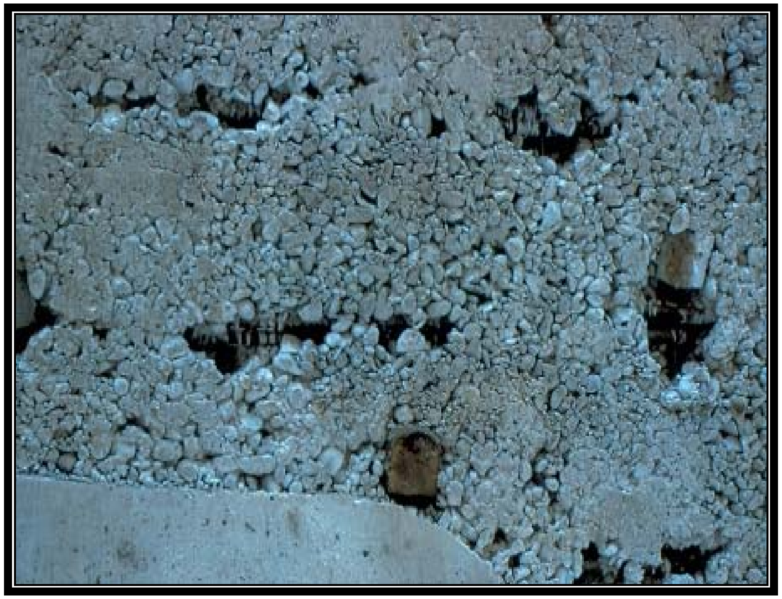
Honey comb

Honey comb is nothing but voids or gaps in the concrete structure after removing the wooden or iron Shutter. Honey comb appears in concrete structure mainly due to heavy reinforcement inside structure. (For example more no. of stirrups in columns or beams etc.)

To prevent concrete from honey comb, Vibrator should run in concrete in proper manner during filling of concrete. The vibrator should run with specific time. The duration of running vibrator should not exceed more than 30 seconds; otherwise it will start separating water from concrete, which will let the concrete to lose its workability and strength.

In some cases even after running the vibrator honey comb will appear and in such cases add the admixture to cement: mortar and paste it in voids and concrete will regain its strength.

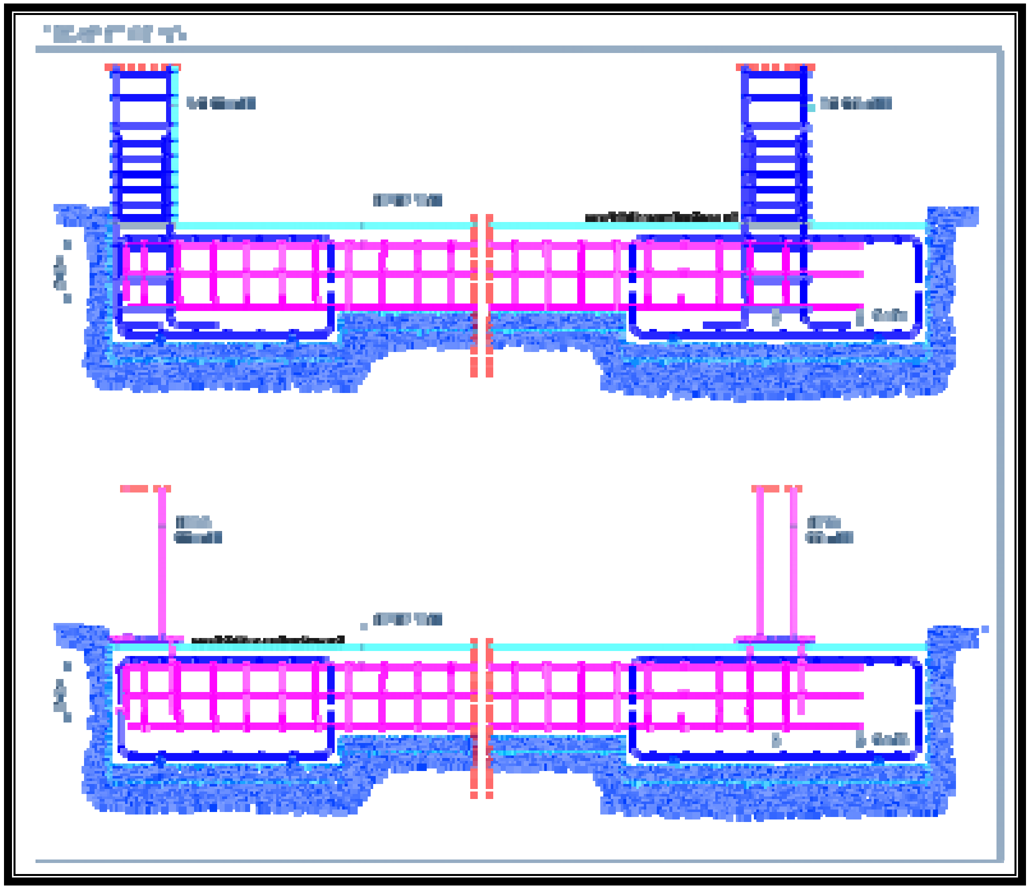




Types of Beams

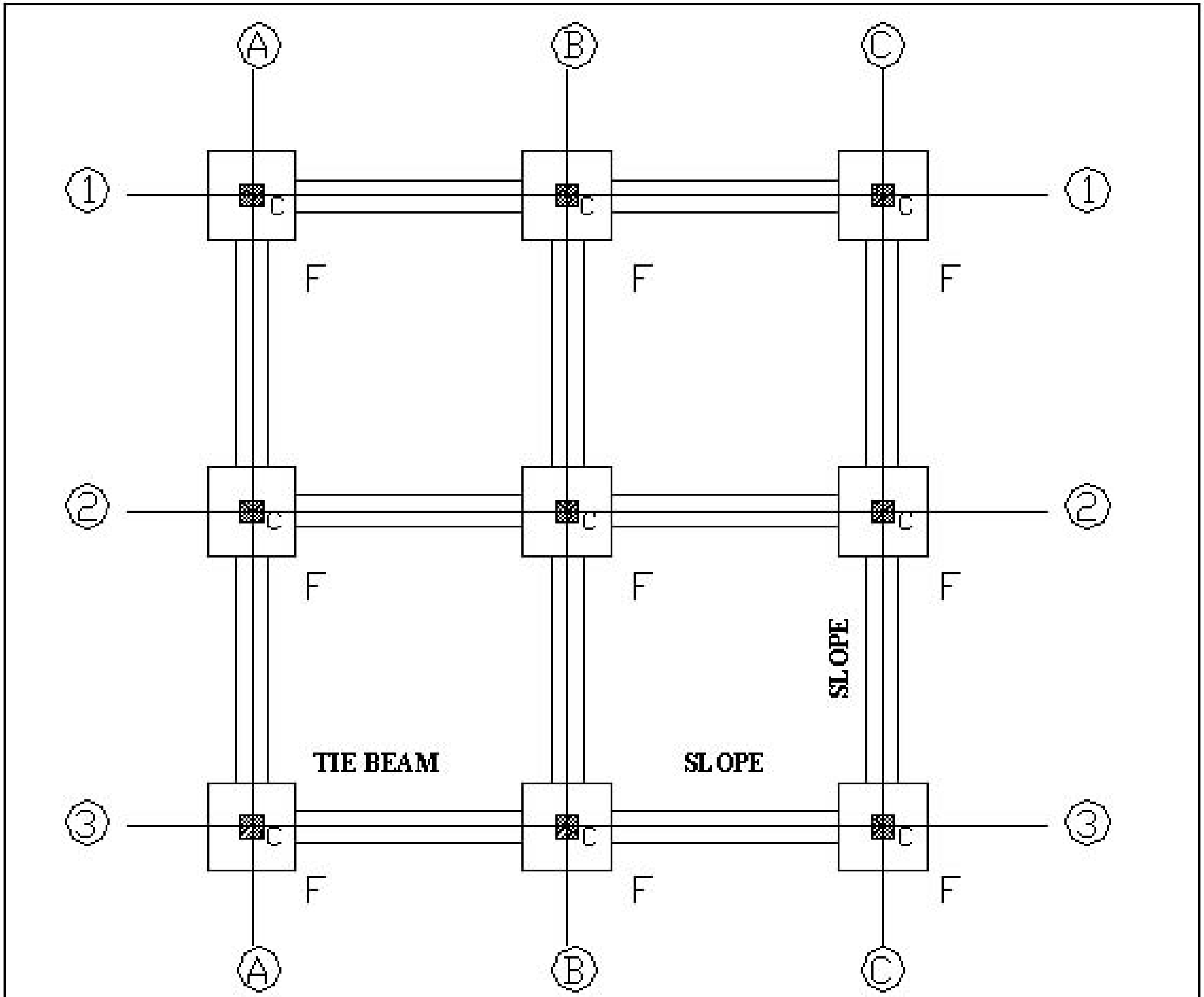
1. **Tie beam:**

   The beam which ties two footings from one face of footing to the other face of footing with linear (straight) length is called as Tie beam.



2. **<u>STRAP beam:</u>**

   The beam which ties two footings from one face of footing to another face of footing with inclined length or with an angle is called as Strap beam.



PLAN SHOWING TIE BEAMS WITH FOOTING

3. **<u>Plinth beam or Ground beam:</u>**

The beam which ties two columns from one face of column to another face of the Column is called as plinth beam. Plinth beams are casted above natural ground **level (N.G.L)** and below building ground level **(B.G.L)**.

4. **<u>Drop beam & Inverted beam :</u>**

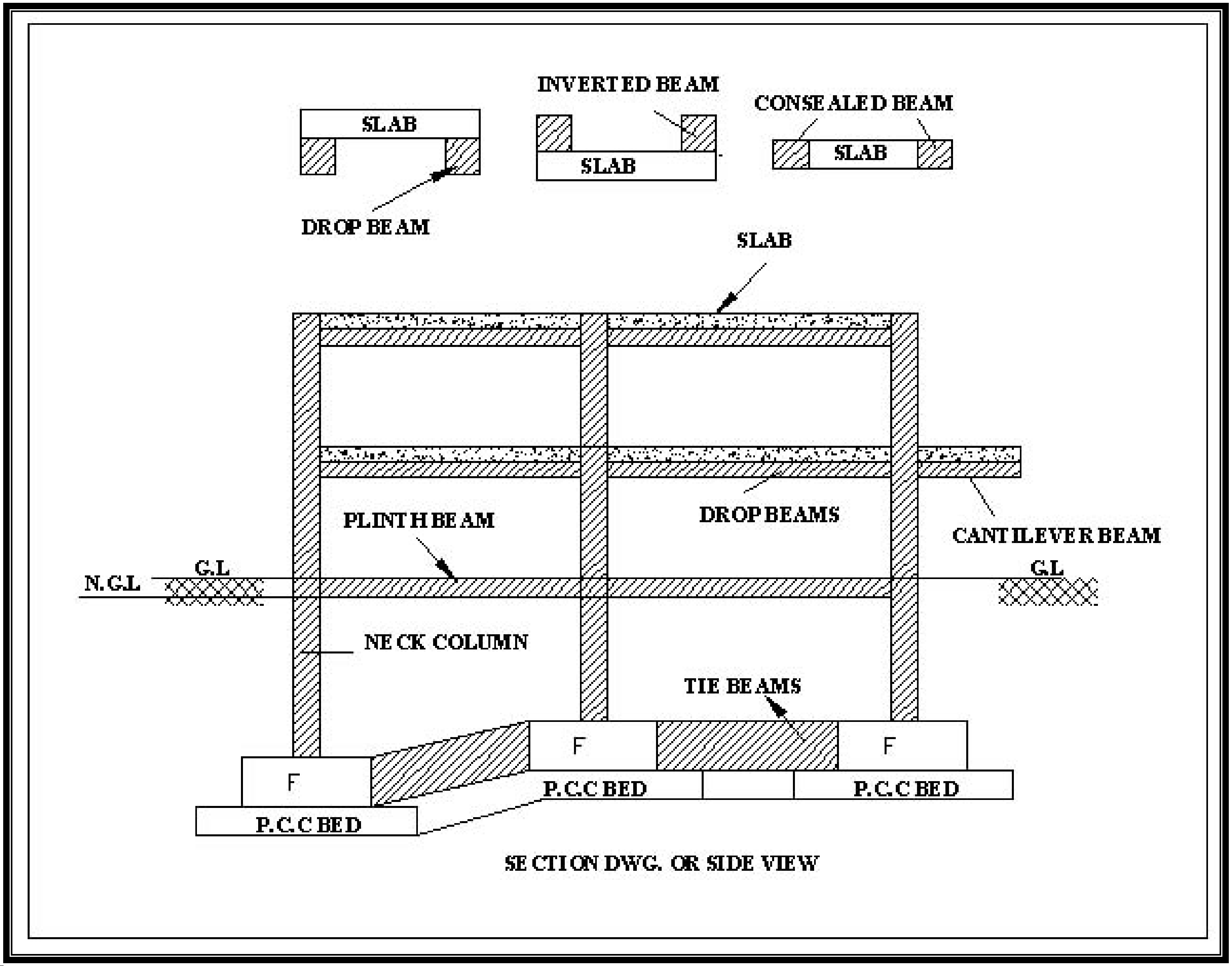
Beams under the Slab are called as Drop beams and if they are inverted, then they are called as Inverted beams.

5. **<u>Concealed beam:</u>**

The beam which supports the slab within the thickness of the slab is called as concealed beam.

6. **<u>Cantilever beam:</u>**

The beam supported on one end and free on other end is called as Cantilever beam.



INVERTED BEAM
CONSEALED BEAM
SLAB
SLAB
SLAB
DROP BEAM
SLAB
PLINTH BEAM
DROP BEAMS
CANTILEVER BEAM
N.G.L
G.L
G.L
NECK COLUMN
TIE BEAMS
F
F
F
P.C.C BED
P.C.C BED
P.C.C BED
SECTION DWG. OR SIDE VIEW

-

Types of Slab

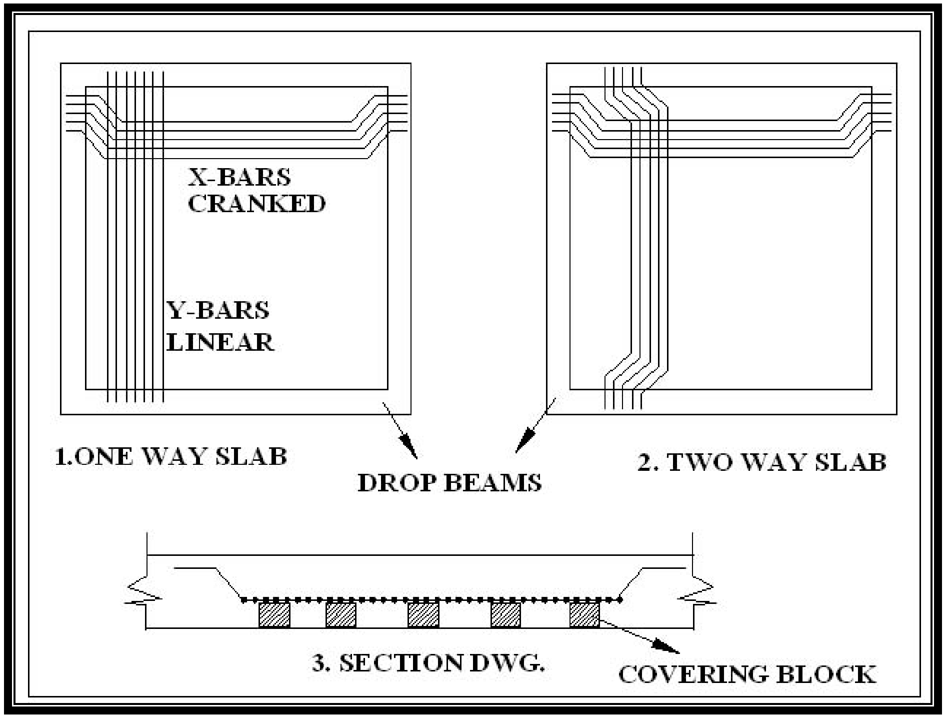
1. Conventional Slab
   (i)one-way slab
   (ii)Two ways slab
2. Hardy or Hordy slab
3. Waffle slab
4. Dome slab
5. Pitch roof
6. Projected slab or portico slab
7. Pre-stressed slab
8. Cable suspension slab
9. Slab with arches
10. Grade slab
11. Hollow-core ribbed slab
12. Sunken-slab or Depressed slab
13. Low roof / Loft or Chajja

1. **<u>Flat slabs:</u> The slab which is supported on Columns head or Column caps without beams is called as Flat slab.**

Conventional or Ordinary slabs are of two types,

(i) **One way slab:** Main reinforcement for bending moment will be only in one direction, the other reinforcement will be distribution steel.

(ii) **Two way slab:** Reinforcement for bending moment will be in two directions.



2. **<u>Hordy or Hardy slab:</u>**

Hardy slab or Hordy slab is a type of slab which is most commonly used in overseas, the process of execution is as follows:-

Step 1→ Form work is arranged and then shutters are fixed on the form work

.

Step 2 → Hardy blocks are placed on the shutter with one brick gap on the entire shutter

Step 3 → The gaps between the blocks are called as rib. Reinforcement is provided in a form of beam within the gap such as rib.

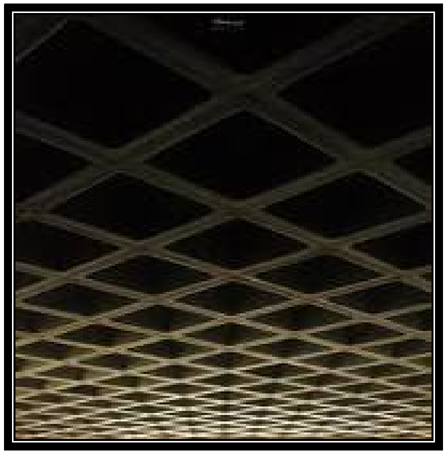
Step 4 → After placing the rib, the Plane steel mesh is placed on the entire slab area resting on ribs.

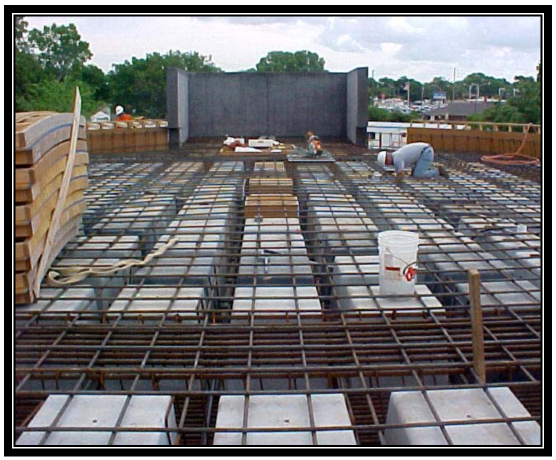
Step 5→ Now, pouring of concrete is done on whole slab.

Note → the thickness of slab = 27cm; the thickness of Hardy block = 20cm.

3. **Waffle slab:**

This is a type of slab where we find hollow hole in the slab when the form work is removed. This is generally constructed in the hotels, universities and restaurants, etc.



4. **<u>Dome slab:</u>**

   These types of slabs are generally constructed in temples, mosques, palaces, etc.



5. **Pitch roof:**

Pitch roof is an inclined slab, generally constructed on resorts for a natural look.
They are also constructed near gardens, re-creation centers, etc

.

6. **Projected slab:**
   The slab which has one side fixed and the other side is free is called as Projected slab. These types of slabs are generally constructed in hotels, universities functions, halls, etc. to use that area for dropping or picking up zone and for loading and unloading area.

7. **Pre-stress Concrete slab:**
   Pre-stressing is artificially induced compressive stresses in a structure before it is loaded so that the tensile stresses which might be caused by the external dead and live load are automatically canceled and the cracks are eliminated. These are done by pre-tensioning and post tensioning. It is best suited for mass production of pre-cast members.




8. **Cable suspension slab:**

   If the span of slab is very long, then we go for cable suspension slab which is supported on cable, such as Howrah Bridge and London Bridge, etc.

9. **Ground slab or Grade Slab**:
   The slab which is casted on surface of earth is called as Ground slab. This type of slab is used in Basement Floor.

10. **Slab with arches:**

This is a type of slab which is generally adopted in construction of bridges.

11. **Hollow core ribbed slab:**

This is a type pre-cast slab used to reduce the weight of slab. This slab is directly placed on floor beam with the help of cranes and pasted with screed.






12. **Sunken slab or Depressed slab:**
This kind of slab is provided only for toilets & kitchens, so that the drainage pipe can be laid in to it.



13. **Low Roof and Loft:** low roof is provided on lintel-level of doors and loft is provided in kitchens for storage of house material.

Low roof

Loft

Types of walls

1. Brick masonry wall
2. Course rubble stone masonry wall or C.R.S Wall
3. Random rubble stone masonry wall or R.R.S Wall.
4. Retaining wall
5. Shear wall
6. Curtain wall
7. Pre-cast wall
8. Parapet wall
9. Compound or boundary wall
10. Drop wall
11. Partition wall
12. Load bearing wall
13. Core wall

1. **Brick masonry wall:**

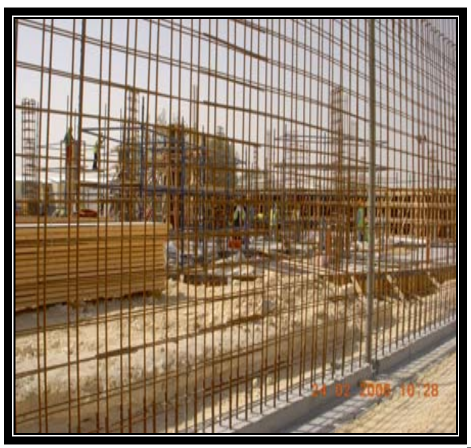
   The wall which is constructed with bricks is called as brick wall. The thickness of brick wall could be 10cm or 20cm.
   10cm wall is called as Single brick wall or partition wall.
   20cm wall is called as Double brick wall or outer wall of house or boundary wall.
   The density of Brick = 2.42 kgs/cm^3
   With fine clay = 1.92 kgs/cm^3

Note: the length of the Brick wall in single stretch should not exceed more than 4m. If it exceeds a column must and should be constructed with bricks or R.C.C.

2. **Course Rubble Stone masonry:**
   The wall which is constructed with regular size of Granites is called as course rubble stone masonry.
3. **Random Rubble Stone:**
   The wall which is constructed with irregular size of granite is called as Random Rubble Stone masonry.

(i) Brick wall (ii) C.R.S wall (iii) R.R.S wall

4. **Retaining wall:** A wall designed to maintain unequal level of ground on its two faces is called as retaining wall.
   The wall which is constructed all around the plot below ground level to retain the soil and land sliding after the earth work excavation on site is called as retaining wall. Retaining wall can be made up of R.C.C or C.R.S





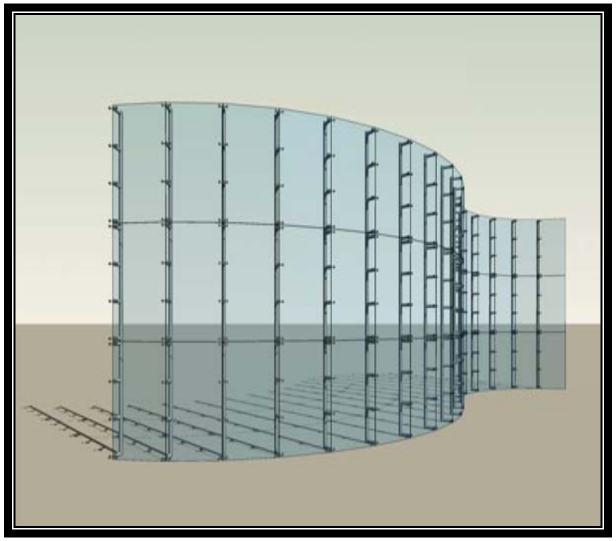
5. **Shear wall:**

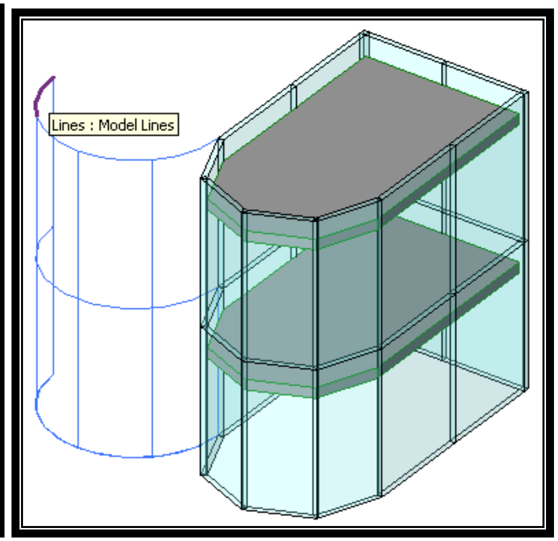
The wall which is constructed around the water Sump, lift pit or stair case to retain the soil is called as Shear wall. It will share two pressures i.e, water pressure & soil pressure or water pressure & wind pressure.




6. **Curtain wall:**

The wall which is constructed with glass and aluminum or steel frame in a long hall to make individual cabins is called as Curtain wall.




Lines : Model Lines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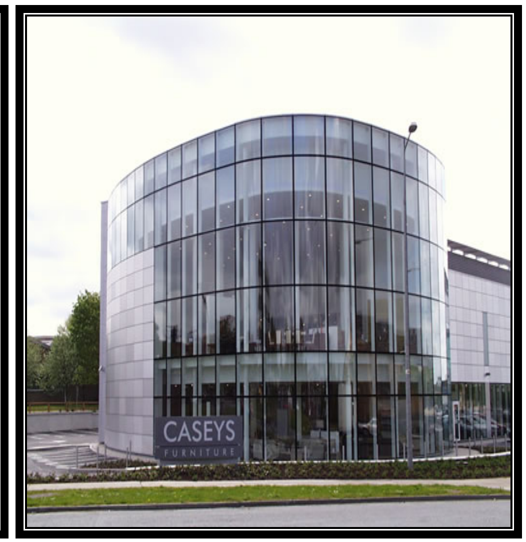
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7. **Pre-cast wall:**

The readymade wall which is made up of R.C.C and which is directly installed on site is called as Pre-cast wall.


8. **Parapet wall:**

The wall is constructed on the top roof of the building to prevent the falling in anything from the roof. The height of wall = 3 ft.



9. **Boundary wall or compound wall:**

The wall which is constructed all around the house to show the limits of plot is called as Boundary wall.

10. **Drop wall or Non-Load bearing wall:**

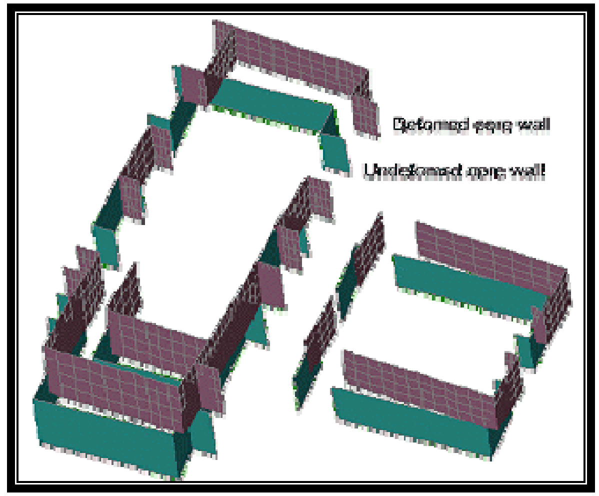
It is a type of wall which is very thin of having thickness 1" to 2". Generally it is constructed with Reinforced mesh (kabutar jali) and cement : mortar plaster.

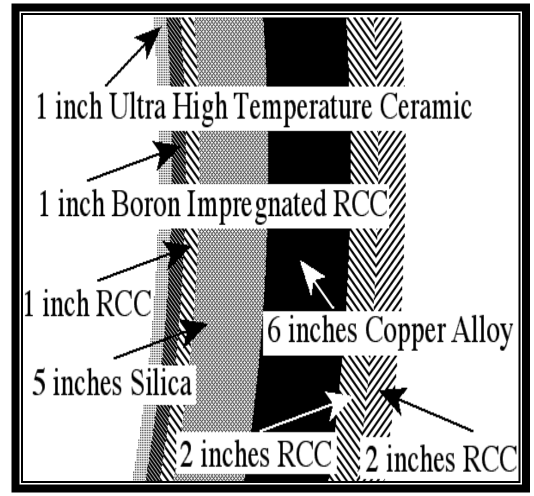
11. **<u>Partition wall:</u>**
    The wall which divides one room to two rooms is called as Partition wall.

12. **<u>Load bearing wall:</u>**
    The building structure which is resting on walls instead of columns, those walls which are bearing the weight of structure are called as Load bearing wall. The thickness of wall = 30 cm to 40cm.

13. <u>Core wall:</u>

This wall is constructed from foundation and it is used as columns in buildings and which will rise up to the height of the building.

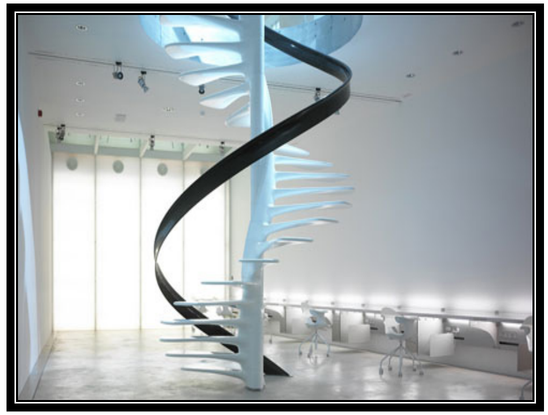




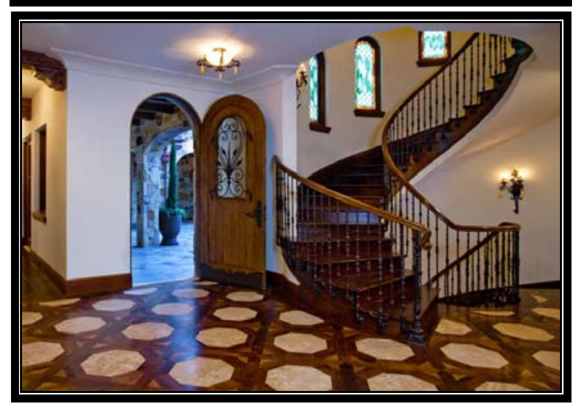
Types of Stair-case:











Unit Conversion

One dimensional calculation:

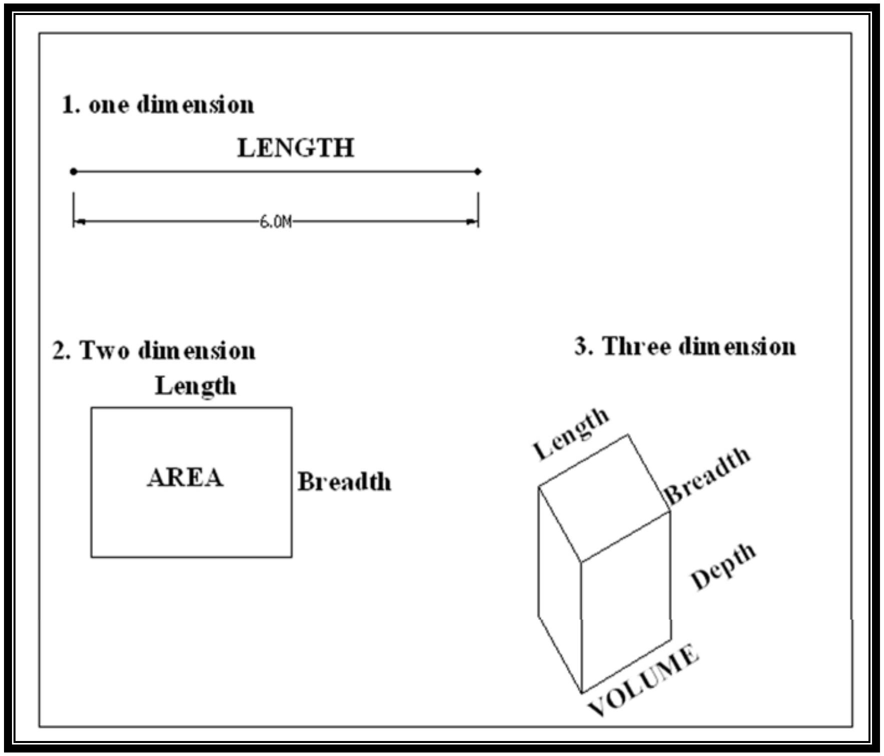
The distance between two points is called as length and the length calculation is called as one dimensional calculation.

Two-dimensional calculation:

Two-dimensional calculation is carried out in two directions, i.e. “X” and “Y” axes, so it is also called as area calculation or two dimensional calculations.

Three-dimensional calculation:

Three-dimensional calculation is carried out in three directions, i.e. “X”,”Y”&”Z” axes and it is called as volume calculation or three dimensional calculation.



Types of unit conversion:

M.K.S unit (Meter-Kilogram/Second): Meters, Centimeters, millimeters. These units are called as Engineering units.

F.P.S unit (Foot-Pound/Second): Feet, inches & yards. These units are called as Architectural units.

S.no	Unit	Denoted by symbol	One dimension (Length)	Two Dimension (Area)	Three dimension (Volume)
1	Meter	M	M	M x M = M^2 or SQM or Square meter	M x M x M = M^3 or CUM or Cubic meter
2	Centimeter	CM	CM	CM x CM = CM^2 or SCM or Square centimeter	CM x CM x CM = CM^3 or CUCM or Cubic centimeter
3	Millimeter	MM	MM	MM x MM = MM^2 or SMM or Square Millimeter	MM x MM x MM = MM^3 or CUMM or Cubic millimeter
4	Feet	FT	FT	FT x FT = FT^2 or SFT or Square feet	FT x FT x FT = FT^3 or CFT or Cubic feet
5	Inch	INCH	INCH	INCH x INCH = $INCH^2$ or SINCH or Square inch	INCH x INCH x INCH = $INCH^3$ or CINCH or Cubic inch
6	Yard	YD	YD	YD x YD = YD^2 or SYD or Square yard	YD x YD x YD = YD^3 or CYD or Cubic yard

Scales:

1 meter = 1000 mm
1 meter = 100 cm
1 cm = 10 mm
1 meter = 1.0936 yd
1 meter = 3.28 ft
1 meter = 39.37”
1 feet = 12”

1” = 2.54 cm
1” = 25.4 mm
1 yard = 36”
1 yard = 3 feet
$1yd^2$ = 9 square feet
1 acre = 4840 yd^2
1 hectare = 2.47 acre

Problems on unit conversion with solutions			
S.no	One dimensional problem conversion (length conversion)	Two dimensional problem conversion (Area conversion)	Three dimensional problem conversion (Volume conversion)
1	15m = ? fts Since 1m = 3.28 ft Therefore 15 x 3.28 = 49.212 ft	$15m^2$ = ? fts^2 Since 1m = 3.28 ft Therefore 15 x 3.28^2 = 161.458 ft^2	$15m^3$ = ? fts^3 Since 1m = 3.28 ft Therefore 15 x 3.28^3 = 529.72 ft^3
2	22 m = ? inches Since 1m = 39.37” Therefore 22 x 39.37” = 866.141”	22 m^2 = ? $inches^2$ Since 1m = 39.37” Therefore 22 x 39.37”^{2} = 34100.06”^{2}	22 m^3 = ? $inches^3$ Since 1m = 39.37” Therefore 22 x 39.37”^{3} = 1342522.37”^{3}
3	2.5 m = ? mm Since 1m = 1000mm Therefore 2.5 x 1000 = 2500 mm	2.5 m^2 = ? mm^2 Since 1m = 1000mm Therefore 2.5 x 1000^2 = 2500000 mm^2	2.5 m^3 = ? mm^3 Since 1m = 1000mm Therefore 2.5 x 1000^3 = 2500000000 mm^3
4	2.0 m = ? cm Since 1m = 100 cm Therefore 2.0 x 100 = 200 cm	2.0 m^2 = ? cm^2 Since 1m = 100 cm Therefore 2.0 x 100^2 = 20000 cm^2	2.0 m^3 = ? cm^3 Since 1m = 100 cm Therefore 2.0 x 100^3 = 2000000 cm^3
5	14m = ? yd Since 1m = 1.093 yd Therefore 14 x 1.093 = 15.302 yd	$14m^2$ = ? yd^2 Since 1m = 1.093 yd Therefore 14 x 1.093^2 = 16.74 yd^2	$14m^3$ = ? yd^3 Since 1m = 1.093 yd Therefore 14 x 1.093^3 = 18.31 yd^3
6	18ft = ? yd Since 1 yd = 3’ Therefore 18 / 3 = 6.0 yd	$18ft^2$ = ? yd^2 Since 1 yd = 3’ Therefore 18 / 3^2 = 2.0 yd^2	$18ft^3$ = ? yd^3 Since 1 yd = 3’ Therefore 18 / 3^3 = 0.666 yd^3
7	15ft = ? inches Since 1 ft = 12” Therefore 15 x 12 = 180”	$15ft^2$ = ? $inches^2$ Since 1 ft = 12” Therefore 15 x 12^2 = 2160”^{2}	$15ft^3$ = ? $inches^3$ Since 1 ft = 12” Therefore 15 x 12^3 = 25920”^{3}
8	15ft = ? m Since 1 m = 3.28 ft Therefore 15/3.28 = 4.57 m	$15ft^2$ = ? m^2 Since 1 m = 3.28 ft Therefore 15/3.28^2 = 1.394 m^2	$15ft^3$ = ? m^3 Since 1 m = 3.28 ft Therefore 15/3.28^3 = 0.425m^3

9	15ft = ? cm Since 1 ft = 12” Therefore 15 x 12 = 180” Since 1” = 2.54cm Therefore 180 x 2.54 = 457.20 cm	$15ft^2$ = ? cm^2 Since 1 ft = 12” Therefore 15 x 12^2 = 2160$”^2$ Since 1” = 2.54cm Therefore 2160 x 2.54^2 = 13935.456 cm^2	$15ft^3$ = ? cm^3 Since 1 ft = 12” Therefore 15 x 12^3 = 25920$”^3$ Since 1” = 2.54cm Therefore 25920 x 2.54^3 = 424752.69 cm^3
10	1ft = ? mm Since 1 ft = 12” Therefore 1 x 12 = 12” Since 1” = 25.4mm Therefore 12 x 25.4 = 304.8 mm	$1ft^2$ = ? mm^2 Since 1 ft = 12” Therefore 1 x 12^2 = 144$”^2$ Since 1” = 25.4mm Therefore 144 x 25.4^2 = 92903.04 mm^2	$1ft^3$ = ? mm^3 Since 1 ft = 12” Therefore 1 x 12^3 = 1728$”^3$ Since 1” = 25.4mm Therefore 1728 x 25.4^3 = 28316846.59 mm^3
11	12 yd = ? mm Since 1 yd = 36” Therefore 12 x 36 = 432” Since 1” = 25.4mm Therefore 432 x 25.4 = 10972.8 mm	12 yd^2 = ? mm^2 Since 1 yd = 36” Therefore 12 x 36^2= 15552$”^2$ Since 1” = 25.4mm Therefore 15552 x 25.4^2 = 10033528.32 mm^2	12 yd^3 = ? mm^3 Since 1 yd = 36” Therefore 12 x 36^3= 559872$”^3$ Since 1” = 25.4mm Therefore 559872 x 25.4^3 = 9174658296 mm^3
12	1.5 yd = ? cm Since 1 yd = 36” Therefore 1.5 x 36 = 54” Since 1” = 2.54cm Therefore 54 x 2.54 = 137.16 cm	1.5 yd^2 = ? cm^2 Since 1 yd = 36” Therefore 1.5 x 36^2 = 1944$”^2$ Since 1” = 2.54cm Therefore 1944 x 2.54^2 = 12541.91 cm^2	1.5 yd^3 = ? cm^3 Since 1 yd = 36” Therefore 1.5 x 36^3 = 69984$”^3$ Since 1” = 2.54cm Therefore 69984 x 2.54^3 = 1146832.287 cm^3
13	15 yd = ? m Since 1 m = 1.093 yd Therefore 15 / 1.093 = 13.723 m	15 yd^2 = ? m^2 Since 1 m = 1.093 yd Therefore 15 / 1.093^2 = 12.555 m^2	15 yd^3 = ? m^3 Since 1 m = 1.093 yd Therefore 15 / 1.093^3 = 11.487 m^3
14	25 yd = ? ft Since 1 yd = 3 ft Therefore 25 x 3 = 75 ft	25 yd^2 = ? ft^2 Since 1 yd = 3 ft Therefore 25 x 3^2 = 225 ft^2	25 yd^3 = ? ft^3 Since 1 yd = 3 ft Therefore 25 x 3^3 = 675 ft^3
15	18 yd = ? inches Since 1 yd = 36”	18 yd^2 = ? $inches^2$ Since 1 yd = 36”	18 yd^3 = ? $inches^3$ Since 1 yd = 36”

	Therefore 18 x 36 = 648”	Therefore 18 x 36^2 = 23328”^{2}	Therefore 18 x 36^3 = 839808”^{3}
16	9600 mm = ? inches Since 1 inch = 25.4mm Therefore 9600 / 25.4 = 377.952”	9600 mm^2= ? $inches^2$ Since 1 inch = 25.4mm Therefore 9600 / 25.4^2 = 14.88”^{2}	9600 mm^3= ? $inches^3$ Since 1 inch = 25.4mm Therefore 9600 / 25.4^3 = 0.585”^{3}
17	5500 mm = ? ft Since 1 inch = 25.4mm Therefore 5500 / 25.4 = 216.535” Since 1ft = 12” Therefore 216.535/12 = 18.044 ft	5500 mm^2 = ? ft^2 Since 1 inch = 25.4mm Therefore 5500 / 25.4^2 = 8.525”^{2} Since 1ft = 12” Therefore 8.525/12^2 = 0.059 ft^2	5500 mm^3 = ? ft^3 Since 1 inch = 25.4mm Therefore 5500 / 25.4^3 = 0.335”^{3} Since 1ft = 12” Therefore 0.335/12^3 = 0.000194 ft^3
18	800 mm = ? cm Since 1 cm = 10 mm Therefore 800 / 10 = 80 cm	800 mm^2 = ? cm^2 Since 1 cm = 10 mm Therefore 800 / 10^2 = 8 cm^2	800 mm^3 = ? cm^3 Since 1 cm = 10 mm Therefore 800 / 10^3 = 0.8 cm^3
19	800 mm = ? m Since 1 m = 1000 mm Therefore 800 / 1000 = 0.8 m	800 mm^2 = ? m^2 Since 1 m = 1000 mm Therefore 800 / 1000^2 = 0.0008 m^2	800 mm^3 = ? m^3 Since 1 m = 1000 mm Therefore 800 / 1000^3 = 0.0000008 m^3
20	9500 mm = ? yd Since 1 inch = 25.4 mm Therefore 9500 / 25.4 = 374.015” Since 1 yd = 36” Therefore 374.015/36 = 10.389 yd	9500 mm^2 = ? yd^2 Since 1 inch = 25.4 mm Therefore 9500 / 25.4^2 = 14.725”^{2} Since 1 yd = 36” Therefore 14.725/36^2 = 0.011361 yd^2	9500 mm^3 = ? yd^3 Since 1 inch = 25.4 mm Therefore 9500 / 25.4^3 = 0.5797”^{3} Since 1 yd = 36” Therefore 0.579/36^3 = 0.0000124 yd^3
21	850 cm = ? yd Since 1 inch = 2.54 cm Therefore 850 / 2.54 = 334.645” Since 1 yd = 36” Therefore 334.645/36 = 9.295 yd	850 cm^2 = ? yd^2 Since 1 inch = 2.54 cm Therefore 850 / 2.54^2 = 131.75”^{2} Since 1 yd = 36” Therefore 131.75/36^2= 0.1016 yd^2	850 cm^3 = ? yd^3 Since 1 inch = 2.54 cm Therefore 850 / 2.54^3 = 51.87”^{3} Since 1 yd = 36” Therefore 51.87/36^3= 0.00111 yd^3
22	600 cm = ? ft Since 1 inch = 2.54 cm Therefore 600/ 2.54 = 236.22” Since 1 ft = 12”	600 cm^2= ? ft^2 Since 1 inch = 2.54 cm Therefore 600/ 2.54^2 = 93.0”^{2} Since 1 ft = 12”	600 cm^3= ? ft^3 Since 1 inch = 2.54 cm Therefore 600/ 2.54^3 = 36.614”^{3} Since 1 ft = 12”

	Therefore 236.22/12 = 19.685 ft	Therefore 93.0 /12^2 = 0.645 ft^2	Therefore 93.0 /12^3 = 0.0538 ft^3
23	100 cm = ? inch Since 1 inch = 2.54 cm Therefore 100 / 2.54 = 39.37”	100 cm^2 = ? $inch^2$ Since 1 inch = 2.54 cm Therefore 100 / 2.54^2 = 15.50$”^2$	100 cm^3 = ? $inch^3$ Since 1 inch = 2.54 cm Therefore 100 / 2.54^3 = 6.10$”^3$
24	3500 mm = ? m Since 1 m = 1000 mm Therefore 3500 / 1000 = 3.50 m	3500 mm^2 = ? m^2 Since 1 m = 1000 mm Therefore 3500 / 1000^2 = 0.0035 m^2	3500 mm^3 = ? m^3 Since 1 m = 1000 mm Therefore 3500 / 1000^3 = 0.0000035 m^3
25	650 cm = ? mm Since 1 cm = 10 mm Therefore 650 x 10 = 6500 mm	650 cm^2 = ? mm^2 Since 1 cm = 10 mm Therefore 650 x 10^2 = 65000 mm	650 cm^3 = ? mm^3 Since 1 cm = 10 mm Therefore 650 x 10^3 = 650000 mm
26	300 inch = ? mm Since 1 inch = 25.4 mm Therefore 300 x 25.4 = 7620 mm	300 $inch^2$ = ? mm^2 Since 1 inch = 25.4 mm Therefore 300 x 25.4^2 = 193548 mm^2	300 $inch^3$ = ? mm^3 Since 1 inch = 25.4 mm Therefore 300 x 25.4^3 = 4916119.2 mm^3
27	28 inch = ? cm Since 1 inch = 2.54 cm Therefore 28 x 2.54 = 71.12 cm	28 $inch^2$ = ? cm^2 Since 1 inch = 2.54 cm Therefore 28 x 2.54^2 = 180.644 cm^2	28 $inch^3$ = ? cm^3 Since 1 inch = 2.54 cm Therefore 28 x 2.54^3 = 458.837 cm^3
28	915 inch = ? m Since 1 m = 39.37” Therefore 915 / 39.37 = 23.241 m	915 $inch^2$ = ? m^2 Since 1 m = 39.37” Therefore 915 / 39.37^2 = 0.59 m^2	915 $inch^3$ = ? m^3 Since 1 m = 39.37” Therefore 915 / 39.37^3 = 0.0149 m^3
29	665 inch = ? ft Since 1ft = 12” Therefore 665 / 12 = 55.416 ft	665 $inch^2$ = ? ft^2 Since 1ft = 12” Therefore 665 / 12^2 = 4.618 ft^2	665 $inch^3$ = ? ft^3 Since 1ft = 12” Therefore 665 / 12^3 = 0.384 ft^3
30	6512 inch = ? yd Since 1yd = 36” Therefore 6512 / 36 = 180.888 yd	6512 $inch^2$ = ? yd^2 Since 1yd = 36” Therefore 6512 / 36^2 = 5.024 yd^2	6512 $inch^3$ = ? yd^3 Since 1yd = 36” Therefore 6512 / 36^3 = 0.139 yd^3
31	6’6” = ? ft Since 1 ft = 12” 6 / 12 = 0.5 ft Therefore 6’ + 0.5’ = 6.5 ft	-	-
32	9’3”= ? m Since 1 ft = 12”	-	-

	3 / 12 = 0.25 ft Therefore 9’ + 0.25’ = 9.25 ft Since 1m = 3.28 ft Therefore 9.25/3.28 = 2.82 m		
33	8’3/4” = ? inch Since 1 ft = 12” 8 x 12 = 96” 96” +3/4”’ = 96” + 0.75” = 96.75”	-	-
34	4’4” = ? cm Since 1 ft = 12” Therefore 4 x 12 = 48” 48” + 4”’ = 52” Since 1” = 2.54 cm Therefore 52 x 2.54 = 132.08 cm	-	-
35	12’4” = ? mm Since 1 ft = 12” Therefore 12 x 12 = 144” 144” + 4” = 148” Since 1” = 25.4mm Therefore 148 x 25.4 = 3759.2 mm	-	-
36	18’12” = ? yd Since 1 ft = 12” Therefore 12 / 12 = 1 ft 18’ + 1’ = 19 ft Since 1yd = 3 ft Therefore 19/3 = 6.33 yd	-	-

Rate Conversion

Problem-1 : if Rate/ft = 12 rupees; what will be Rate/m = ?

Solution:

Method-1:
Since 1 m = 3.28 ft
= 12 x 3.28
= 39.36 or approximately equal to 40 rupees / m

Method-2:
1ft = ? m
Since 1m 3.28 ft
= 1/3.28
= 0.304 m
Since 1ft = 0.304 m
= 0.304 m = 12 rupees
= 1 m = ?
= (1/0.304) x 12
= 39.47 or approximately equal to 40 rupees / m

Problem-2 :
Rate/Sft = 25 rupees
Rate/m^2 = ?
Solution :
Method-1:
Since 1 m = 3.28 ft
= 25 x 3.28^2
= 268.96 or approximately equal to 269.0 rupees / m^2

Method-2:

$1ft^2 = ?\ m^2$

Since 1m 3.28 ft

$= 1/3.28^2$

$= 0.0929\ m^2$

Since $1ft^2 = 0.0929\ m^2$

$= 0.0929\ m^2 = 25$ rupees

$= 1\ m^2 = ?$

= (1/0.0929) x 25

= 269.0 rupees / m^2

Problem-3 :

Rate/Cft = 55 rupees

Rate/m^3 = ?

Solution

Method-1:

Since 1 m = 3.28 ft

$= 55 \times 3.28^3$

= 1940.81 or approximately equal to 1941.0 rupees / m^3

Method-2:

$1ft^3 = ?\ m^3$

Since 1m 3.28 ft

$= 1/3.28^3$

$= 0.02833\ m^3$

Since $1ft^3 = 0.02833\ m^3$

$= 0.02833\ m^3 = 55$ rupees

$= 1\ m^3 = ?$

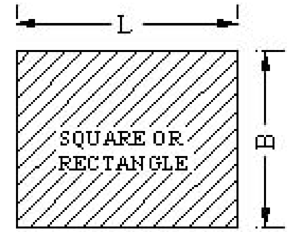
= (1/0.02833) x 55

= 1941.40 rupees / m^3

Length and Area Calculations

Formulas:

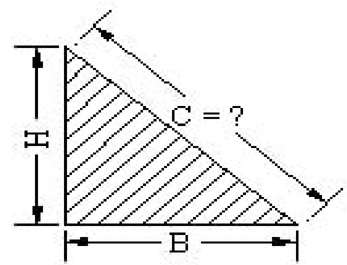
1. Square or Rectangle



(i) Area = A = L x B

(ii) Peripheral Length = L = (L+B) x 2

2. Pythagoras theorem

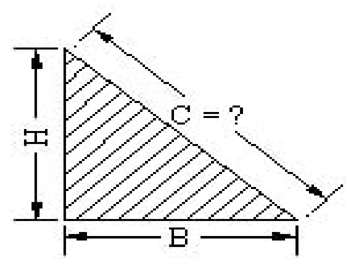


this theorem is used to find out any inclined length

$c^2 = a^2 + b^2$

$c = V(a^2 + b^2)$

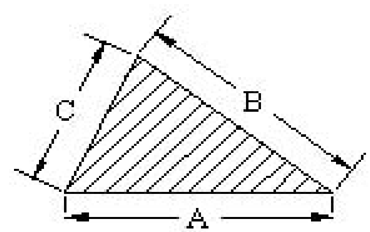
3. Tri-angle



(i) Area = A = 1/2 x B x H

(ii) Peripheral Length = L = B + H + C

4. Irregular Tri-angle



(i) Area = A = V (s(s-a) (s-b) (s-c))

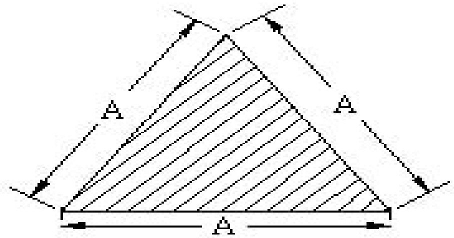
where s = (a + b + c)/2

(ii) Peripheral Length = L = a + b + c

5. Equilateral Tri-angle

(i) Area = A = $(a^2/4)$ x V3

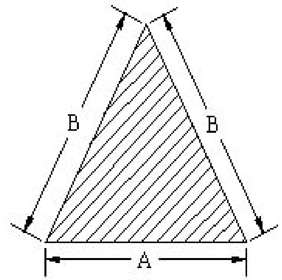
(ii) Peripheral Length = L = a + a + a = 3a



6. Isosceles Tri-angle

(i) Area = A = (a/4) x V $4b^2$-a^2

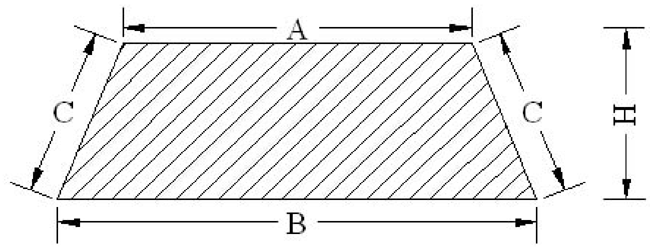
(ii) Peripheral Length = L = a + b + b = a + 2b



7. Trapezoidal

(i) Area = A = 1/2 (a+ b) x h

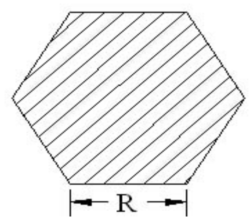
(ii) Peripheral Length = L = a + b + c + c



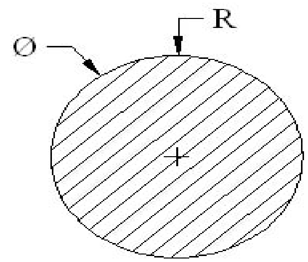
8. Hexagon

(i) Area = A = (0.5 x r x 0.5 x r x Tan60) x 6

(ii) Peripheral Length = L = 6r



9. Circle



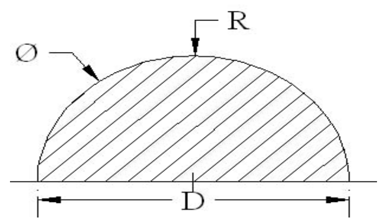
(i) Area = $A = \pi/4 \times d^2$

where d = diameter of circle ; $\pi = 3.14$

(ii) Peripheral Length = $L = 2 \times \pi \times r$

where r = radius of circle

10. Semi-Circle



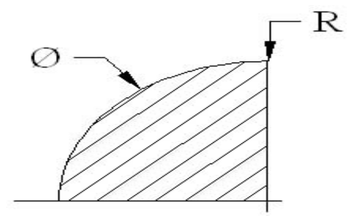
(i) Area = $A = \pi/4 \times d^2 \times 0.50$

where d = diameter of circle ; $\pi = 3.14$

(ii) Peripheral Length = $L = 2 \times \pi \times r \times 0.50$

where r = radius of circle

11. Quarter Circle



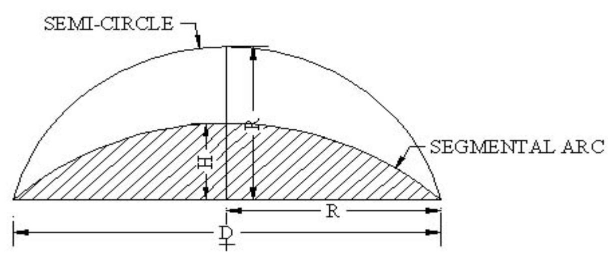
(i) Area = $A = \pi/4 \times d^2 \times 0.25$

where d = diameter of circle ; $\pi = 3.14$

(ii) Peripheral Length = $L = 2 \times \pi \times r \times 0.25$

where r = radius of circle

12. Segmental Arc



(i) Area = $A = (2/3 \times D \times H) + (H^3/2D)$

where d = diameter of circle

H = height of arc

(ii) Arc Length = $L = (8b - 2r)/3$

where r = radius of circle

$b = V (r^2 + h^2)$

Wooden or Iron Shuttering Area Calculations

Problem-1: find shuttering area for the given column

Solution: Shuttering area = Peripheral length x depth

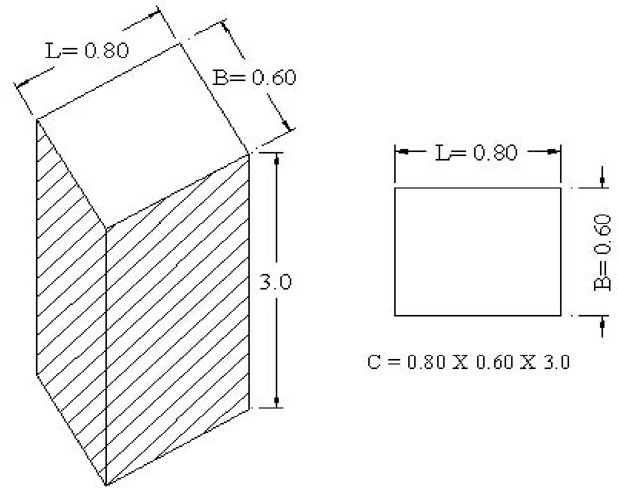
.= 2.80 x 3.0

.= 8.4 m^2

peripheral length = L = (L+B) x 2

L = (0.80 + 0.60) x 2

L = 2.80 m



Problem-2: find shuttering area for the given column

Solution: Shuttering area = Peripheral length x depth

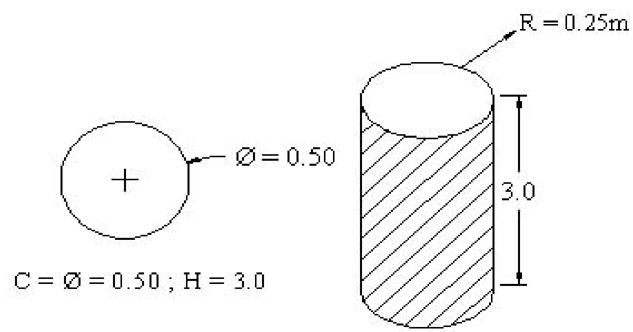
.= 1.57 x 3.0

.= 4.71 m^2

peripheral length = L = 2 x π x r

L = 2 x π x 0.25

L = 1.57 m



Volume of Concrete Calculations

Problem-1: find Volume of concrete for the given Rectangular column

Solution: volume of Concrete = Area x Depth

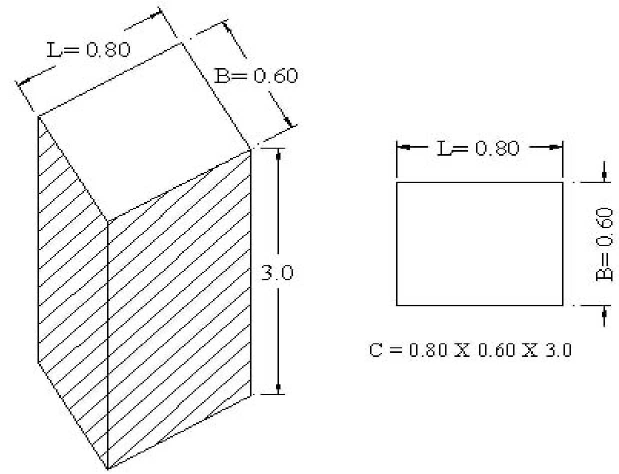
.= 0.48 x 3.0

.= 1.44 m^3

therefore area of column = L x B

A = 0.80 x 0.60

A = 0.48 m^2



Problem-2: find Volume of concrete for the given column

Solution: volume of Concrete = Area x Depth

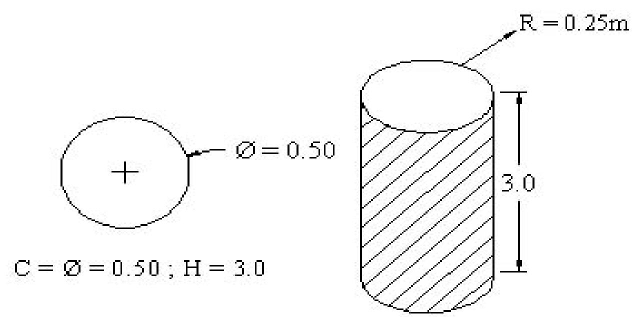
.= 0.196 x 3.0

.= 0.588 m^3

therefore area of column = $\pi/4$ xd^2

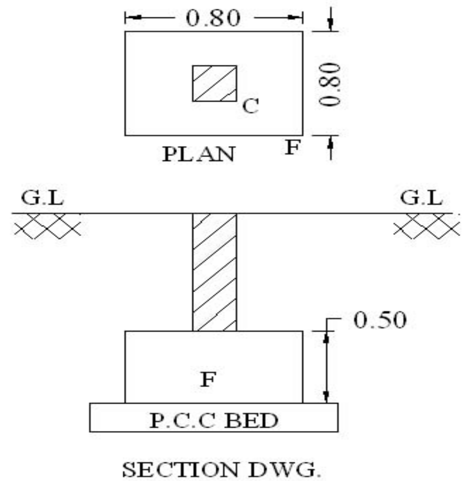
A = $\pi/4$ x 0.5^2

A = 0.196 m^2



Problems on Footings

Problem-1: For a given Plain-footing find
1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint



F = 0.80m x 0.80m x 0.50m

C = 0.35m x 0.35m

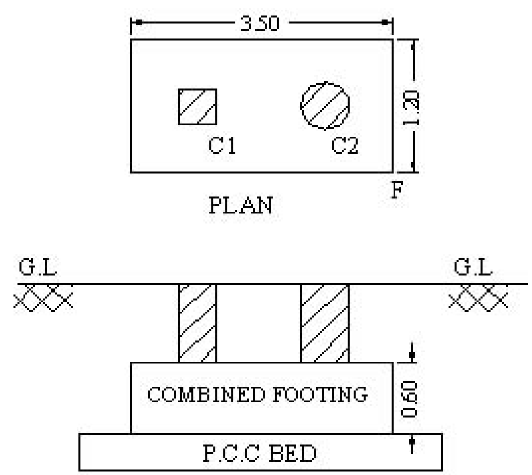
Solution:

1. Volume of Concrete = Area x Depth
   .= L x B x D
   .= 0.80 x 0.80 x 0.50
   .= 0.32 m^3

2. Shuttering Area = Peripheral Length x Depth
   .= (L + B) x 2 x D
   .= (0.80 + 0.80) x 2 x 0.50
   .= 1.6 m^2

3. Bitumen paint Area = peripheral length x Depth + top area - Column Area
   .= (L + B) x 2 x D + L x B - l x b (Column Dimension)
   .= (0.80 + 0.80) x 2 x 0.50 + 0.80 x 0.80 - 0.35 x 0.35
   .= 2.117 m^2

Problem-2: For a given Plain-Combined footing find
1. volume of concrete F = 3.50m x 1.20m x 0.60m
2. Area of Shuttering C_1 = 0.40m x 0.40m
3. Area of Bitumen paint C_2 = Ø=0.50 ;



Solution:

1. Volume of Concrete = Area x Depth
   .= L x B x D
   .= 3.5 x 1.20 x 0.60
   .= 2.52 m^3

2. Shuttering Area = Peripheral Length x Depth
   .= (L + B) x 2 x D
   .= (3.5 + 1.2) x 2 x 0.60
   .= 5.64 m^2

3. Bitumen paint Area = peripheral length x Depth + top area - Column Area

.= (L + B) x 2 x D + L x B - l x b (Column Dimensions)

.= (3.5 + 1.2) x 2 x 0.60 + 3.5 x 1.2 - 0.40 x 0.40 - $\pi/4 \times 0.5^2$

.= 9.483 m^2

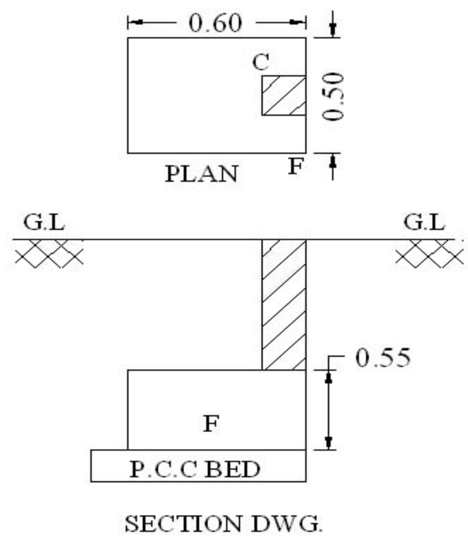
Problem-3: For a given Shoe-footing find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint

F = 0.60m x 0.50m x 0.55m

C = 0.25m x 0.25m

Solution:



1. Volume of Concrete = Area x Depth

.= L x B x D

.= 0.6 x 0.50 x 0.55

.= 0.165 m^3

2. Shuttering Area = Peripheral Length x Depth

.= (L + B) x 2 x D

.= (0.60 + 0.50) x 2 x 0.55

.= 1.21 m^2

3. Bitumen paint Area = peripheral length x Depth + top area - Column Area

.= (L + B) x 2 x D + L x B - l x b (Column Dimension)

.= (0.60 + 0.50) x 2 x 0.55 + 0.60 x 0.50 - 0.25 x 0.25

.= 1.447 m^2

Problem-4: For a given Raft-footing find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint

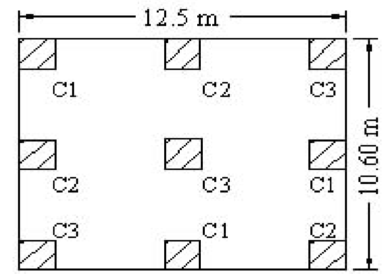
F = 12.5m x 10.6m x 1.40m

C_1 = 0.40m x 0.40m

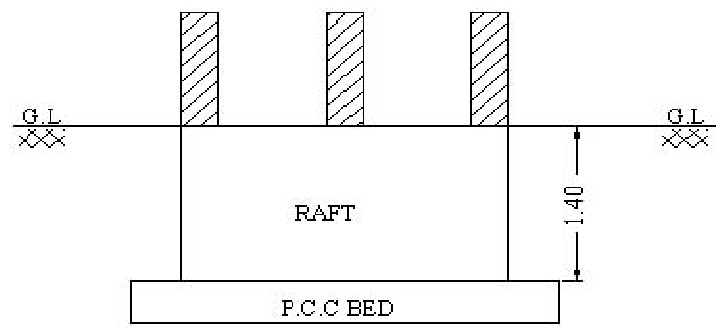
C_2 = 0.40m x 0.50m

C_3 = 0.50m x 0.50m

Solution:



PLAN



SECTION DWG.

1. Volume of Concrete = Area x Depth

.= L x B x D

.= 12.5 x 10.6 x 1.4

.= 185.50 m^3

2. Shuttering Area = Peripheral Length x Depth

.= (L + B) x 2 x D

.= (12.5 + 10.6) x 2 x 1.40

.= 64.68m^2

therefore column area = L x B x no. of columns

C_1 = 0.40 x 0.40 x 3 = 0.48 m^2

C_2 = 0.40 x 0.50 x 3 = 0.60 m^2

C_3 = 0.50 x 0.50 x 3 = 0.75 m^2

Total Column area = 0.48 + 0.60 + 0.75 = 1.83 m^2

3. Bitumen paint Area = peripheral length x Depth + top area - Column Area

.= (L + B) x 2 x D + L x B - l x b (Column Area)

.= (12.5 + 10.6) x 2 x 1.40 + 12.5 x 10.6 - 1.83

.= 195.35 m^2

Problem-5: For a given Step-footing find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint

F = step-1 : 0.80m x 0.80m x 0.25m

F = step-2 : 0.70m x 0.70m x 0.25m

F = step-3 : 0.60m x 0.60m x 0.25m

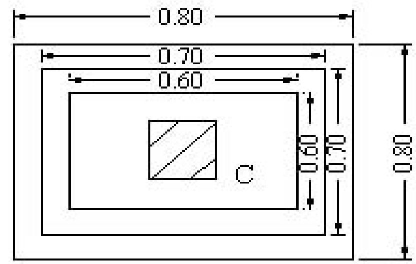
C = 0.30m x 0.30m

Solution:

1. Volume of Concrete = Area x Depth

.= L x B x D

step-1	.= 0.80 x 0.80 x 0.25	.= 0.16 m^3
step-2	.= 0.70 x 0.70 x 0.25	.= 0.122 m^3
step-3	.= 0.60 x 0.60 x 0.25	.= 0.09 m^3
	Total Volume	.= 0.372 m^3

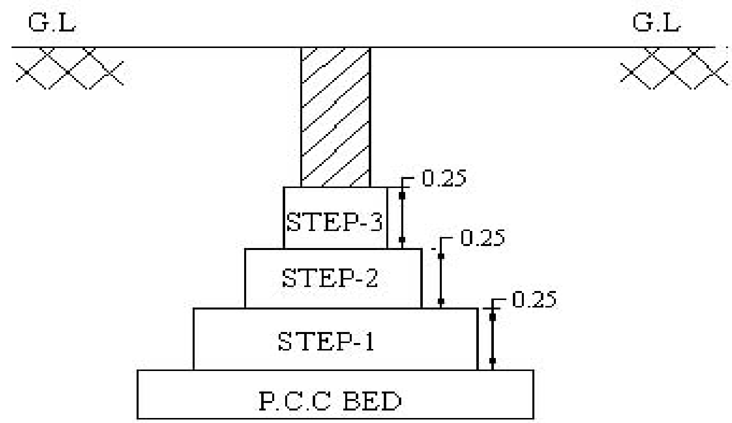


PLAN F

2. Shuttering Area = Peripheral Length x Depth

.= (L + B) x 2 x D

step-1	.= (0.80 + 0.80) x 2 x 0.25	. = 0.80 m^2
step-2	.= (0.70 + 0.70) x 2 x 0.25	. = 0.70 m^2
step-3	.= (0.60 + 0.60) x 2 x 0.25	. = 0.60 m^2
	Total Area	.= 2.10 m^2



SECTION DWG.

3. Bitumen paint Area = peripheral length x Depth + top area - top step area

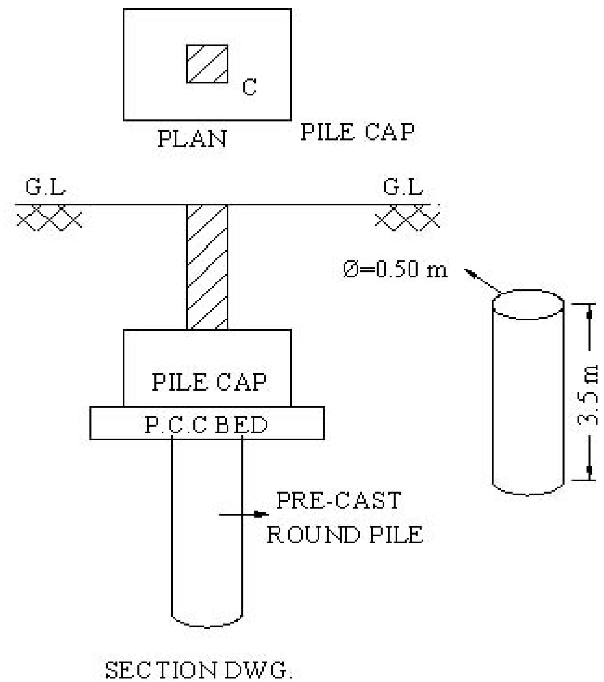
step-1	.= (0.80 + 0.80) x 2 x 0.25 + 0.80 x 0.80 - 0.7 x 0.70	. = 0.95 m^2
step-2	.= (0.70 + 0.70) x 2 x 0.25 + 0.70 x 0.70 - 0.60 x 0.60	. = 0.83 m^2
step-3	.= (0.60 + 0.60) x 2 x 0.25 + 0.60 x 0.60 - 0.30 x 0.30	. = 0.87 m^2
	Total Area	.= 2.65 m^2

Problem-6: For a given Pile-under footing (pile-cap) find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint

Pile Dimension :

Ø = 0.50m ; height = 3.5m



Solution:

1. Volume of Concrete = Area x Depth

.= $\pi/4 \times d^2 \times D$

.= $\pi/4 \times 0.5^2 \times 3.5$

.= 0.687 m^3

2. Shuttering Area = Peripheral Length x Depth

.= $2 \times \pi \times r \times D$

.= $2 \times \pi \times 0.25 \times 3.50$

.= 5.49 m^2

3. Bitumen paint Area = peripheral length x Depth + bottom area

.= $2 \times \pi \times r \times D + \pi/4 \times d^2$

.= $2 \times \pi \times 0.25 \times 3.50 + \pi/4 \times 0.5^2$

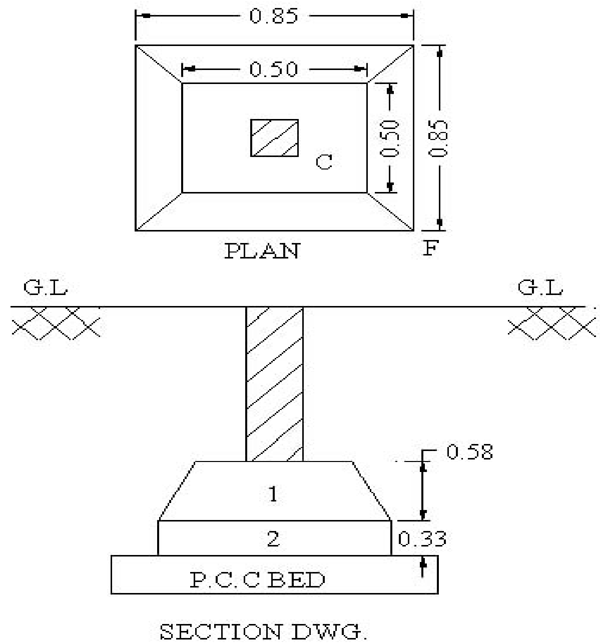
.= 5.68 m^2

Problem-7: For a given Isolated-footing find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint

footing dimension:
Bottom dimension : L_1 = 0.85m; B_1= 0.85m
Top dimension : L_2 = 0.50m; B_2 = 0.50
Depth of Footing = 0.91m

Solution: C = 0.35 x 0.35



1. Volume of Concrete = Area x Depth

Part-1: .= L x B x D
.= 0.675 x 0.675 x 0.58
.= 0.264 m^3

Therefore Average length "L" = $(L_1 + L_2)/2$
.= (0.85 +0.50)/2
.= 0.675m

Therefore Average Breadth "B" = $(B_1 + B_2)/2$
.= (0.85 +0.50)/2
.= 0.675m

1. Volume of Concrete = Area x Depth

Part-2: .= L x B x D
.= 0.85 x 0.85 x 0.33
.= 0.238 m^3

Total volume of concrete for the footing = vol. of part-1 + vol. of part-2
.= 0.264 + 0.238
.= 0.502m^3

2. Shuttering Area = Peripheral Length x Depth

Part-1: .= (L + B) x 2 x D
.= (0.675 + 0.675) x 2 x 0.58
.= 1.566 m^2

Part-2: .= (L + B) x 2 x D
.= (0.85 + 0.85) x 2 x 0.33
.= 1.122 m^2

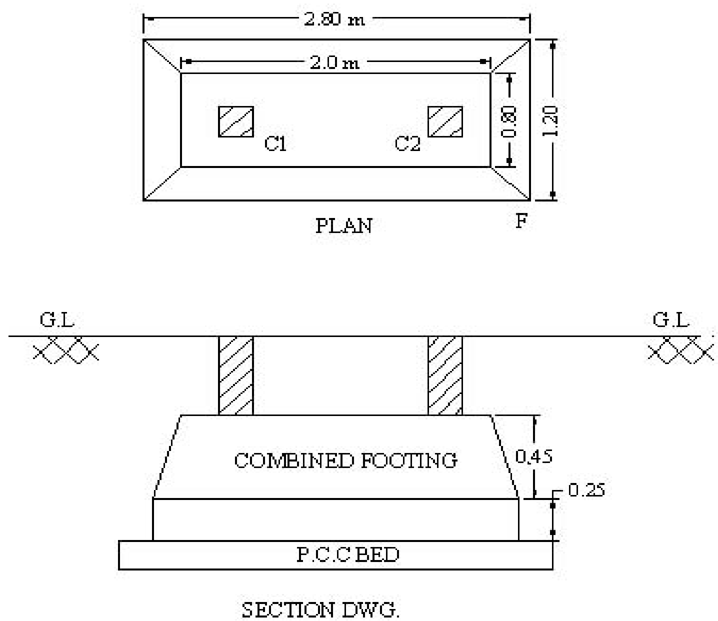
Total shuttering area for the footing = area. of part-1 + area of part-2
.= 1.566 + 1.122
.= 2.688 m^2

3. Bitumen paint Area = peripheral length x Depth + top area - Column Area
Part-1: .= (L + B) x 2 x D + L x B - L x B (Column area)
.= (0.675 + 0.675) x 2 x 0.58 + 0.50 x 0.50 - 0.35 x 0.35
.= 1.693 m^2

Bitumen paint Area = peripheral length x Depth
Part-2: .= (L + B) x 2 x D
.= (0.85 + 0.85) x 2 x 0.33
.= 1.122 m^2

Total Bitumen paint area for the footing = area. of part-1 + area of part-2
.= 1.693 + 1.122
.= 2.815 m^2

Problem-8: For a given Combined Isolated-footing find
1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint
footing dimension:
Bottom dimension : L_1 = 0.85m; B_1= 0.85m
Top dimension : L_2 = 0.50m; B_2 = 0.50
Depth of Footing = 0.91m
C_1= 0.35 x 0.35
C_2= 0.40 x 0.40



Solution:
1. Volume of Concrete = Area x Depth
Part-1: .= L x B x D
.= 2.40 x 1.0 x 0.45
.= 1.08 m^3
Therefore Average length "L" = $(L_1 + L_2)/2$
.= (2.80 + 2.0)/2
.= 2.40m

Therefore Average Breadth "B" = $(B_1 + B_2)/2$

.= (1.20 +0.80)/2

.= 1.0m

1. Volume of Concrete = Area x Depth

Part-2: .= L x B x D

.= 2.80 x 1.20 x 0.25

.= 0.84 m^3

Total volume of concrete for the footing = vol. of part-1 + vol. of part-2

.= 1.08 + 0.84

.= 1.92m^3

2. Shuttering Area = Peripheral Length x Depth

Part-1: .= (L + B) x 2 x D

.= (2.40 + 1.0) x 2 x 0.45

.= 3.06 m^2

Part-2: .= (L + B) x 2 x D

.= (2.80 + 1.20) x 2 x 0.25

.= 2.0 m^2

Total shuttering area for the footing = area. of part-1 + area of part-2

.= 3.06 + 2.0

.= 5.06 m^2

3. Bitumen paint Area = peripheral length x Depth + top area - Column Area

Part-1: .= (L + B) x 2 x D + L x B - L x B (Column area)

.= (2.40 + 1.0) x 2 x 0.45 + 2.0 x 0.80 - (0.35 x 0.35 + 0.40 x 0.40)

.= 4.3775 m^2

Bitumen paint Area = peripheral length x Depth

Part-2: .= (L + B) x 2 x D

.= (2.80 + 1.20) x 2 x 0.25

.= 2.0 m^2

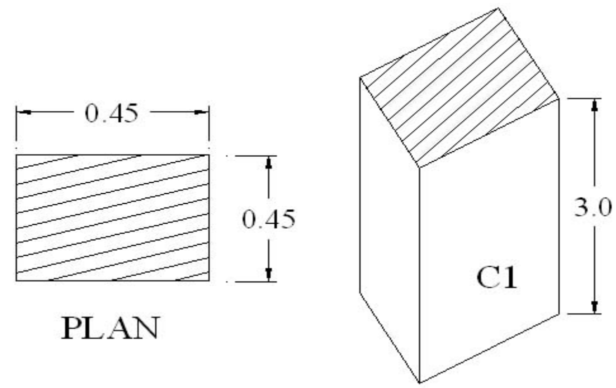
Total Bitumen paint area for the footing = area. of part-1 + area of part-2

.= 4.3775 + 2.0

.= 6.3775 m^2

Problems on Columns

Problem-1: For a given Square Column find
1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint



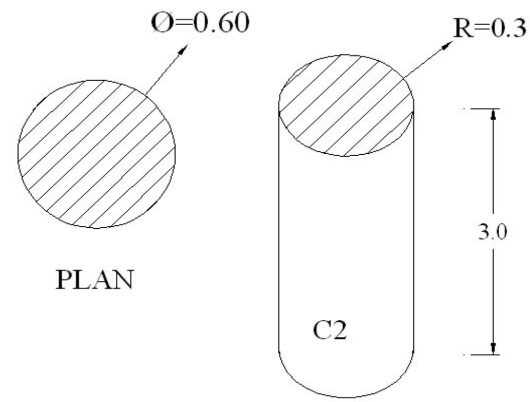
Solution:

1. Volume of Concrete = Area x Depth
   .= L x B x D
   .= 0.45 x 0.45 x 3.0
   .= 0.607 m^3

2. Area of Shuttering = Peripheral Length x Depth
   .= (L+B) x 2 x D
   .= (0.45 + 0.45) x 2 x 3.0
   .= 5.40 m^2

3. Area of Bitumen paint = Peripheral Length x Depth
   .= (L+B) x 2 x D
   .= (0.45 + 0.45) x 2 x 3.0
   .= 5.40 m^2

Problem-2: For a given Circular Column find
1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint



Solution:

1. Volume of Concrete = Area x Depth
   .= $\pi/4 \times d^2 \times D$
   .= $\pi/4 \times 0.6^2 \times 3.0$
   .= 0.848 m^3

2. Area of Shuttering = Peripheral Length x Depth

.= 2 x π x r x D

.= 2 x π x 0.30 x 3.0

.= 5.654 m^2

3. Area of Bitumen paint = Peripheral Length x Depth

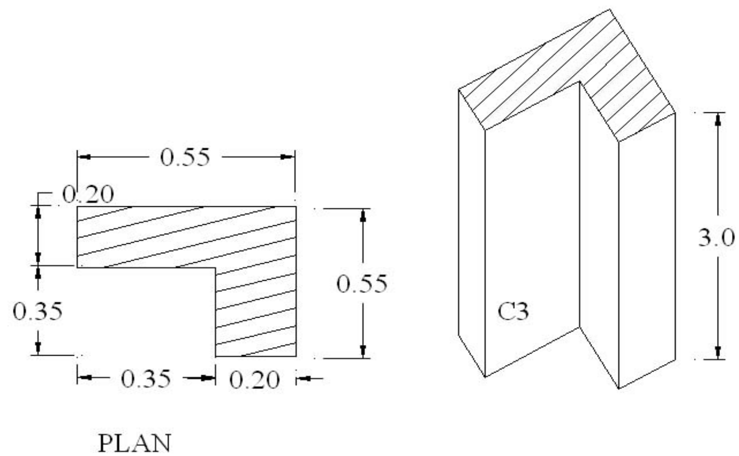
.= 2 x π x r x D

.= 2 x π x 0.30 x 3.0

.= 5.654 m^2

Problem-3: For a given L-type Column find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint



Solution:

1. Volume of Concrete = Area x Depth

.= 0.18 x 3.0

.= 0.54 m^3

To find the area of column divide area in to two parts

therefore area1 = 0.55 x 0.20 = 0.11

area2 = 0.20 x 0.35 = 0.07

total area 0.18 m^2

2. Shuttering Area = Peripheral length x Depth

.= 2.20 x 3.0

.= 6.60 m^2

therefore Peripheral length = 0.55 + 0.55 + 0.20 + 0.35 + 0.35 + 0.20

.= 2.20m

3. Area of Bitumen paint = Peripheral Length x Depth

.= 2.20 x 3.0

.= 6.60 m^2

2. Area of Shuttering = Peripheral Length x Depth

.= $2 \times \pi \times r \times D$

.= $2 \times \pi \times 0.30 \times 3.0$

.= 5.654 m^2

3. Area of Bitumen paint = Peripheral Length x Depth

.= $2 \times \pi \times r \times D$

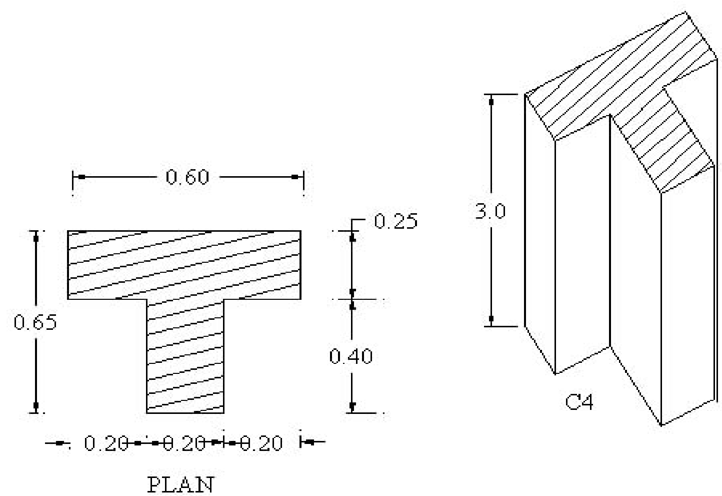
.= $2 \times \pi \times 0.30 \times 3.0$

.= 5.654 m^2

Problem-4: For a given T-type Column find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint

Solution:



1. Volume of Concrete = Area x Depth

.= 0.23 x 3.0

.= 0.69 m^3

To find the area of column divide area in to two parts

therefore area1 = 0.60 x 0.25 = 0.15

area2 = 0.20 x 0.40 = 0.08

total area 0.23 m^2

2. Shuttering Area = Peripheral length x Depth

.= 2.50 x 3.0

.= 7.50 m^2

therefore Peripheral length = 0.60 + 0.25 + 0.20 + 0.40 + 0.20 + 0.40 + 0.20 + 0.25

.= 2.50m

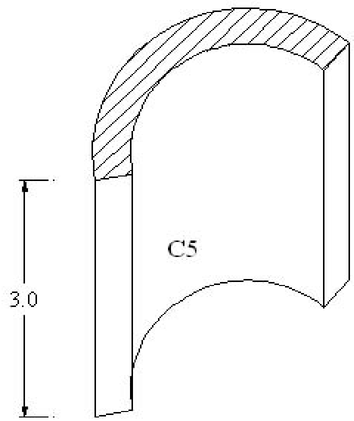
3. Area of Bitumen paint = Peripheral Length x Depth

.= 2.50 x 3.0

.= 7.50 m^2

Problem-5: For a given arc-type Column find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint



Solution:

first find the arc length and to find this, use segmental arc length formula

arc length = (8B - 2r)/3

where B = V $H^2 + r^2$

therefore with centre line method

Height of arc' H' = 0.50m

Radius of arc 'r' = 0.60m

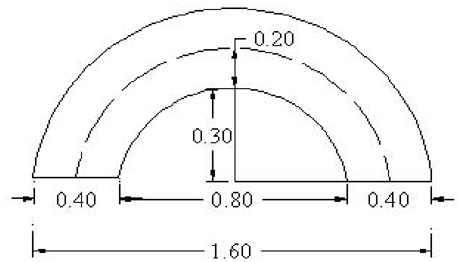
B = V $0.50^2 + 0.60^2$

B = 0.781

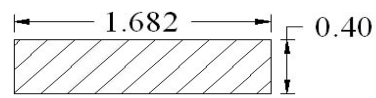
arc length = (8B - 2r)/3

.= (8 x 0.781 - 2 x 0.60) /3

.= 1.682m



PLAN



therefore Length of column = 1.682m ; Breadth of column = 0.40m and Depth of column = 3.0m

1. Volume of Concrete = Area x Depth

.= L x B x D

.= 1.682 x 0.40 x 3.0

.= 2.018 m^3

2. Shuttering Area = Peripheral length x Depth

.= (L + B) x 2 x D

.= (1.682 + 0.40) x 2 x 3.0

.= 12.492 m^2

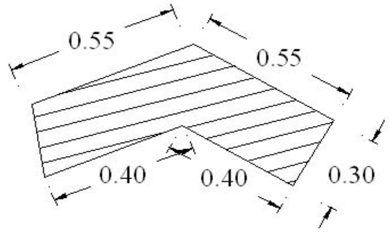
3. Area of Bitumen paint = Peripheral Length x Depth

.= (L + B) x 2 x D

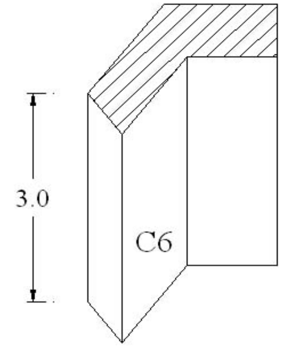
.= (1.682 + 0.40) x 2 x 3.0

.= 12.492 m^2

Problem-6: For a given 'V'-type Column find
1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint



PLAN



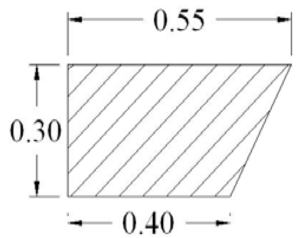
Solution:

1. Volume of Concrete = Area x Depth
.= 0.285 x 3.0
.= 0.855 m^3

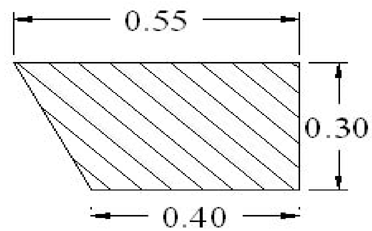
To find the area of column divide area in to two parts

therefore $area_1$ = L x B = 0.475 x 0.30 = 0.1425
$area_2$ = L x B = 0.475 x 0.30 = 0.1425
total area = 0.285 m^2

L_1 = 0.55; L_2 = 0.40 and B = 0.30



(i) area-1



(ii) area-2

average L =(L_1 + L_2)/2
L .= (0.55 + 0.40) /2
L .= 0.475m

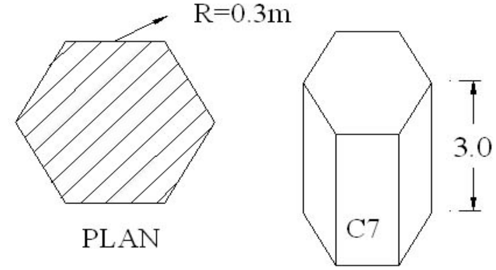
2. Shuttering Area = Peripheral length x Depth
.= 2.50 x 3.0
.= 7.50 m^2

therefore Peripheral length = 0.55 + 0.55 + 0.30 + 0.40 + 0.40 +0.30
.= 2.50m

3. Area of Bitumen paint = Peripheral Length x Depth
.= 2.50 x 3.0
.= 7.50 m^2

Problem-7: For a given Hexagon-type Column find

1. volume of concrete
2. Area of Shuttering
3. Area of Bitumen paint



Solution:

1. Volume of Concrete = Area x Depth

.= 0.233 x 3.0

.= 0.699 m^3

Formula to find out area of Hexagon= (0.50 x r x 0.50 x r x Tan60) x 6

.= (0.50 x 0.30 x 0.50 x 0.30 x 1.732) x 6

.= 0.233 m^2

2. Shuttering Area = Peripheral length x Depth

.= 6 x r x D

.= 6 x 0.30 x 3.0

.= 5.40 m^2

therefore Peripheral length = 6r

3. Area of Bitumen paint = Peripheral Length x Depth

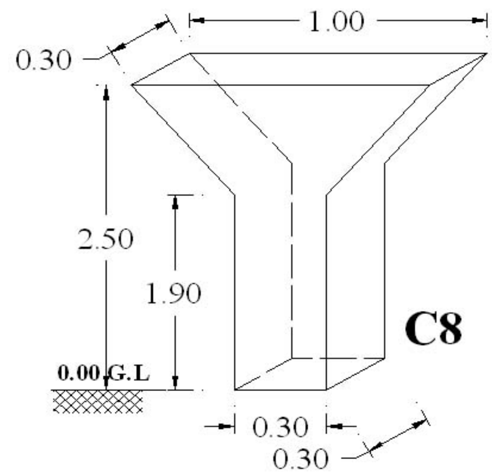
.= 6 x r x D

.= 6 x 0.30 x 3.0

.= 5.40 m^2

Problem-8: For a given 'Y'-type Column find

1. volume of concrete
2. Area of Shuttering
3. Area of paint



Solution:

1. Volume of Concrete = front area of Column x thickness of Column
.= 0.96 x 0.30
.= 0.288 m^3

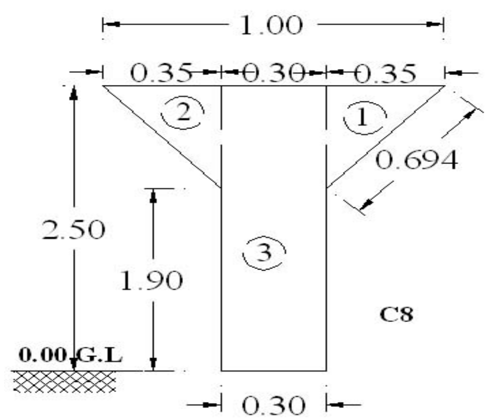
To find out front area of Column, divide front area of column in to three parts

Area of part-1 (triangle shape) .= 1/2 x b x h
.= 0.50 x 0.35 x 0.60
.= 0.105 m^2

Area of part-2 (triangle shape) .= 1/2 x b x h
.= 0.50 x 0.35 x 0.60
.= 0.105 m^2

Area of part-3 (rectangle shape) .= L x B
.= 0.30 x 2.50
.= 0.75 m^2

Total Front area of Column = 0.105 + 0.105 + 0.75
.= 0.96 m^2



2. Shuttering Area = front area of column + back area of column + side area of column + side area of column
.= 0.96 + 0.96 + 0.778 + 0.778
.= 3.476 m^2

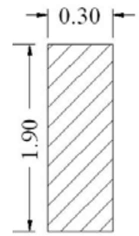
therefore side area can be find out by dividing the side area in to two parts :

part-1:

side area for part-1 = L x B

.= 0.30 x 1.90

.= 0.57 m^2

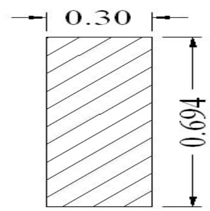


part-2:

side area for part-2 = L x B

.= 0.30 x 0.694

.= 0.208 m^2

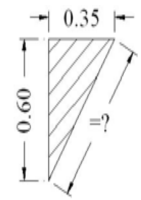


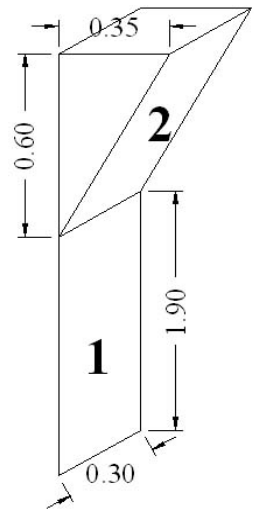
according to Pythagoras theorem:

inclined length = c = $V (a^2 + b^2)$

.= $V (0.35^2 + 0.60^2)$

.= 0.694m





Hence total side area = $A_1 + A_2$

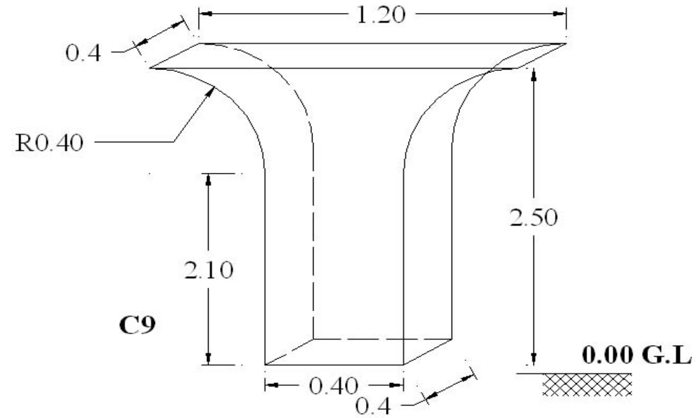
.= 0.57 + 0.208

.= 0.778 m^2

3. Area of paint = Area of Shuttering

.= 3.476 m^2

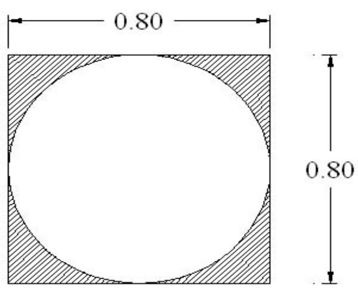
Problem-9: For a given 'Y'-type Column with arch find
1. volume of concrete
2. Area of Shuttering
3. Area of paint

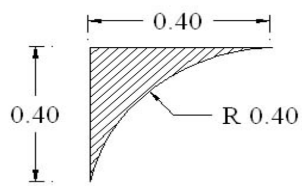


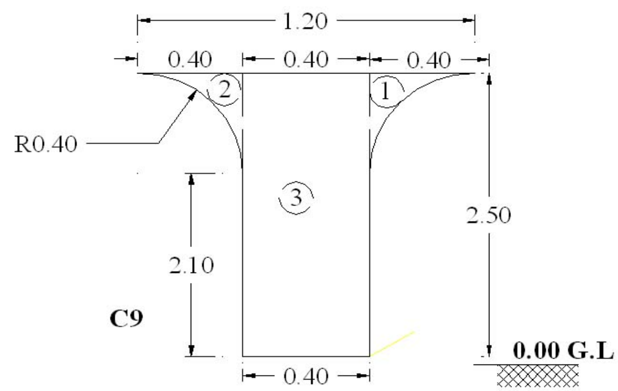
Solution:

1. Volume of Concrete = Front Area x thickness of Column
.= 1.069 x 0.40
.= 0.4276 m^3

To find out front area of Column, divide front area of column in to three parts







1. area of Square = L x B = 0.80 x 0.80
.= 0.64 m^2

2.area of Circle = $\pi/4 \times d^2$
. = $\pi/4 \times 0.8^2$
.= 0.502m^2

Deduction of circle area from square area .= 0.64 - 0.502
Area for four panels .= 0.138 m^2
Area of each panel .= 0.138/4
.= 0.0345 m^2

Front area of column:

1. Part-1 = 0.0345 m^2
2. Part-2 = 0.0345 m^2
3. Part-3 = L x B = 0.40 x 2.50 = 1.0 m^2

total area = 0.0345 + 0.0345 + 1.0 = 1.069 m^2

2. Shuttering Area = front area of column + back area of column + side area of column + side area of column

.= 1.069 + 1.069 + 1.091 + 1.091

.= 4.32 m^2

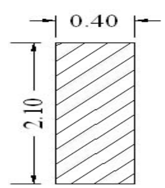
therefore side area can be find out by dividing the side area in to two parts :

part-1:

side area for part-1 = L x B

.= 0.40 x 2.10

.= 0.84 m^2

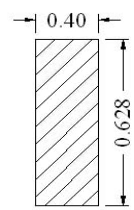


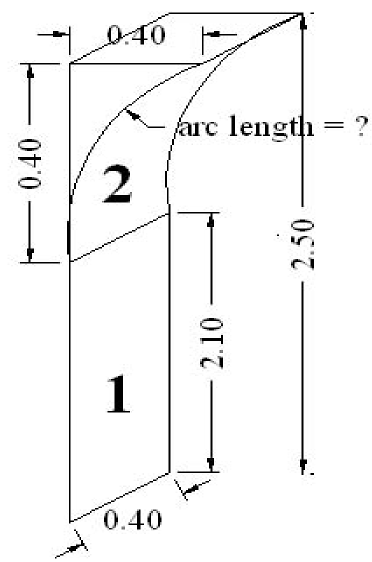
part-2:

side area for part-2 = L x B

.= 0.40 x 0.628

.= 0.251 m^2



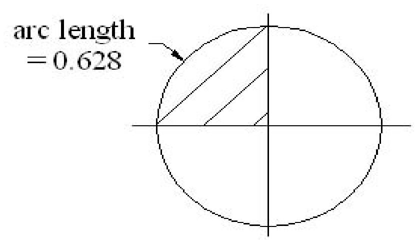


Formula to find out arc length for quarter circle :

arc length = 2 x π x r x 1/4

.= 2 x π x 0.40 x 0.25

.= 0.628 m



Hence total side area = $A_1 + A_2$

.= 0.84 + 0.251

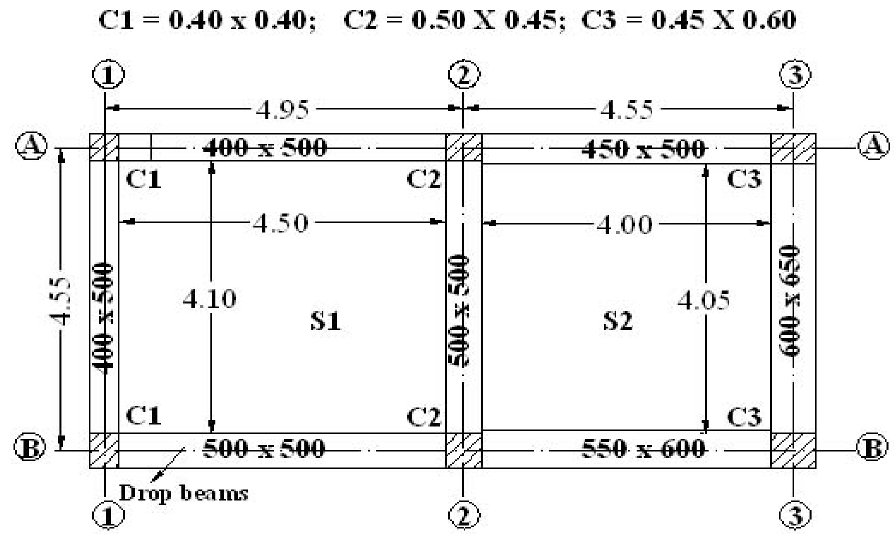
.= 1.091 m^2

3. Area of paint = Area of Shuttering

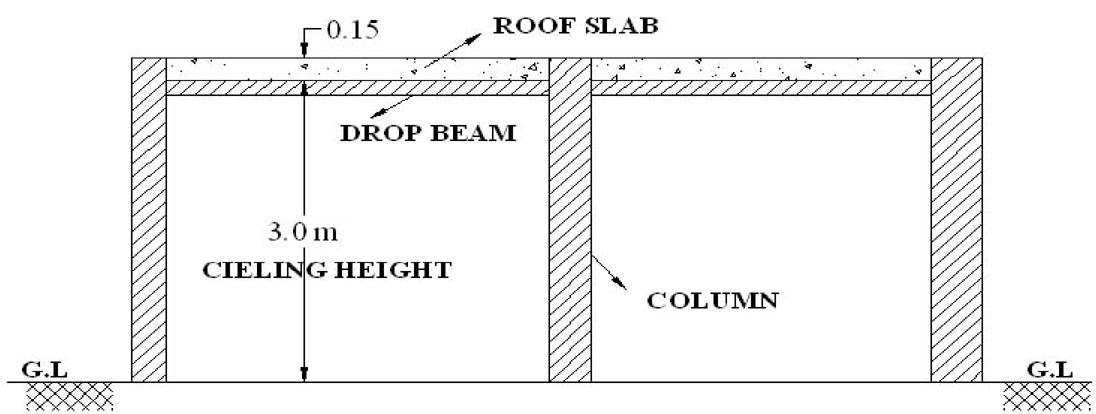
.= 4.322 m^2

Problem-10: For a given Roof frame find volume of concrete & area of shuttering for

1. Columns
2. Drop Beams
3. Roof Slabs



PLAN SHOWING ROOF FRAME DETAILS



SECTION DWG.

(i) Solution for Columns:

1. Volume of Concrete = Area x Depth x no. of Columns

.= L x B x D x no.s

Column-1 .= 0.40 x 0.40 x 3.15 x 2 = 1.008 m^3

Column-2 .= 0.50 x 0.45 x 3.15 x 2 = 1.417 m^3

Column-3 .= 0.45 x 0.60 x 3.15 x 2 = 1.701 m^3

Total volume of concrete required for Floor columns = 4.126 m^3

2. Shuttering Area = Peripheral length x Depth x no. of Columns

.= (L + B) x 2 x D x no.s

Column-1 .= (0.40 + 0.40) x 2 x 3.0 x 2 = 9.60 m^2

Column-2 .= (0.50 + 0.45) x 2 x 3.0 x 2 = 11.40 m^2

Column-3 .= (0.45 + 0.60) x 2 x 3.0 x 2 = 12.60 m^2

Total shuttering area required for Floor Columns = 33.60 m^3

Note : while calculating shuttering area for Columns, Height of column should be taken up to Ceiling Height, excluding Slab thickness.

(ii) Solution for Drop Beams:

1. Volume of Concrete for Drop beam = Area x Length x no. of beams

.= L x B x D

a. Drop beam on axis-A between axis-1 and axis-2 .= 4.50 x 0.40 x 0.50 = 0.90 m^3

b. Drop beam on axis-A between axis-2 and axis-3 .= 4.00 x 0.45 x 0.50 = 0.90 m^3

c. Drop beam on axis-B between axis-1 and axis-2 .= 4.50 x 0.50 x 0.50 = 1.125 m^3

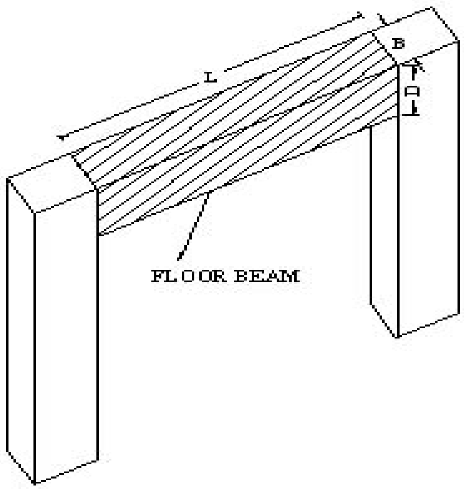
d. Drop beam on axis-B between axis-2 and axis-3 .= 4.00 x 0.55 x 0.60 = 1.32 m^3

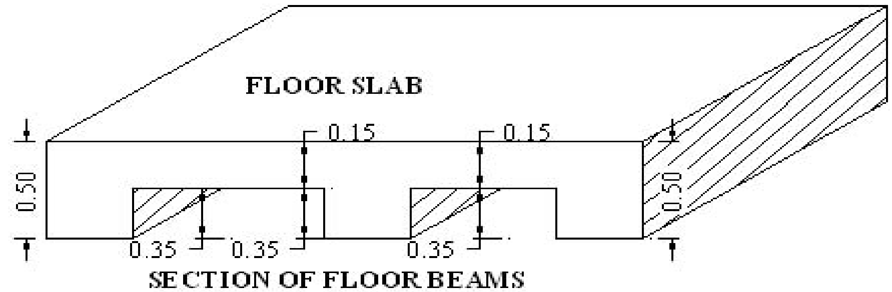
e. Drop beam on axis-1 between axis-A and axis-B .= 4.10 x 0.40 x 0.50 = 0.82 m^3

f. Drop beam on axis-2 between axis-A and axis-B .= 4.10 x 0.50 x 0.50 = 1.025 m^3

g. Drop beam on axis-3 between axis-A and axis-B .= 4.05 x 0.60 x 0.65 = 1.579 m^3

Total volume of Concrete for Drop beams = 7.669 m^3





2. Shuttering Area for Drop beams = Front area + back area + bottom area

.= L x D + L x D + L x B

Note:

(i) for finding out shuttering area for Drop beam, for internal beams, slab thickness is to be deducted from both side of beams, i.e. external and internal face.

Calculations:

a.	Drop beam on axis-A between axis-1 and axis-2	.= 4.50 x 0.50 + 4.50 x 0.35 + 4.5 x 0.40	= 5.625 m^2
	Note: for external Drop beams Slab thickness has to be deducted from depth of beam from internal face of beams		
b.	Drop beam on axis-A between axis-2 and axis-3	.= 4.0 x 0.50 + 4.0 x 0.35 + 4.0 x 0.45	= 5.20 m^2
c.	Drop beam on axis-B between axis-1 and axis-2	.= 4.50 x 0.5 + 4.50 x 0.35 + 4.50 x 0.50	= 6.075 m^2
d.	Drop beam on axis-B between axis-2 and axis-3	.= 4.00 x 0.60 + 4.0 x 0.45 + 4.0 x 0.55	= 6.40 m^2
e.	Drop beam on axis-1 between axis-A and axis-B	.= 4.10 x 0.50 + 4.10 x 0.35 + 4.10 x 0.40	= 5.125 m^2
f.	Drop beam on axis-2 between axis-A and axis-B	.= 4.10 x 0.35 + 4.10 x 0.35 + 4.10 x 0.50	= 4.92 m^2
	Note: for internal Drop beams Slab thickness has to be deducted from depth of beam from both side of beams		
g.	Drop beam on axis-3 between axis-A and axis-B	.= 4.05 x 0.65 + 4.05 x 0.50 + 4.05 x 0.60	= 7.0875 m^2
		Total Shuttering area for Drop beams	= 40.432 m^2

(ii) Solution for Roof Slab:

1. Volume of Concrete = Area x Depth

.= L x B x D

Slab-1 (S1) .= 4.50 x 4.10 x 0.15 = 2.76 m^3

Slab-2 (S2) .= 4.0 x 4.05 x 0.15 = 2.43 m^3

Total Volume = 5.19 m^3

2. Shuttering Area = Bottom area of Slab

.= L x B

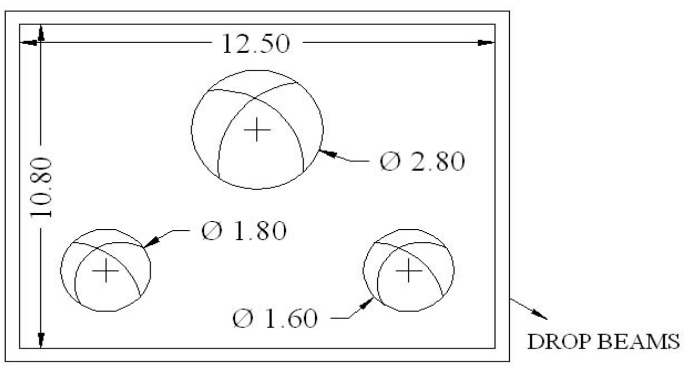
Slab-1 (S1) .= 4.50 x 4.10 = 18.45 m^2

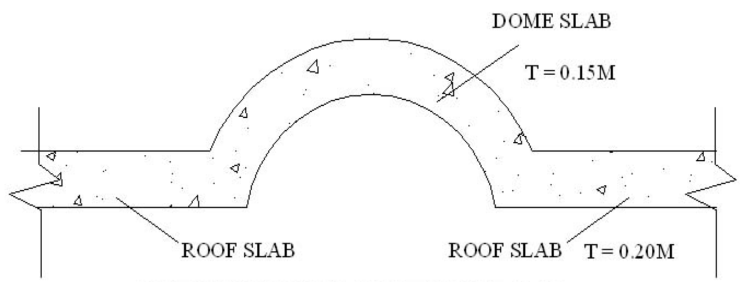
Slab-2 (S2) .= 4.00 x 4.05 = 16.20 m^2

DOME SLAB CALCULATION

Problem-11: For a given Roof frame find volume of concrete & area of shuttering for

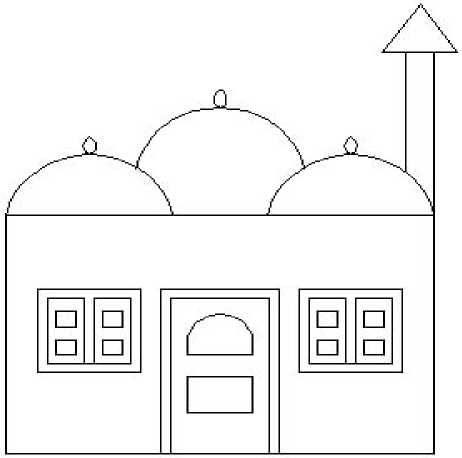
1. Roof Slab
2. Dome Slabs



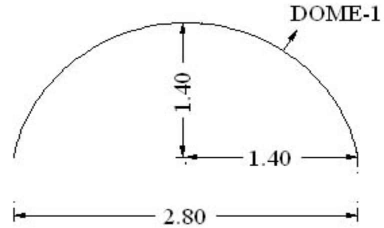


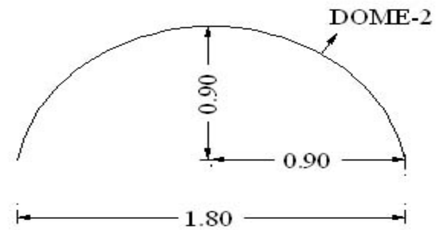
SECTION OF ROOF SLAB WITH DOME SLAB

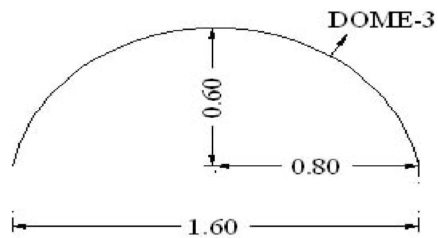
PLAN SHOWING DETAILS OF ROOF SLAB WITH DOME SLAB

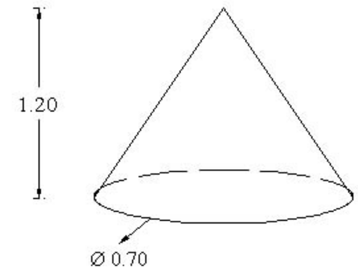


FRONT VIEW OR ELEVATION









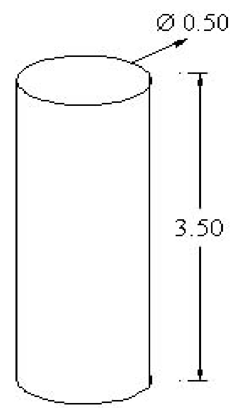
Cone Details

(A) Solution for Roof Slab :

1. Volume of Concrete = Area x Depth x no. of Slabs

.= L x B x D x no.s

.= 12.50 x 10.80 x 0.20 x 1 = 27.0 m^3



Cylinder details

Deduction of Dome area

(i) Dome-1 = Area x Depth

.= $\pi /4 \times d^2 \times D$

.= $\pi /4 \times 2.80^2 \times 0.20$

.= 1.231 m^3

(ii) Dome-2 = Area x Depth

.= $\pi /4 \times d^2 \times D$

.= $\pi /4 \times 1.80^2 \times 0.20$

.= 0.508 m^3

(iii) Dome-3 = Area x Depth

.= $\pi /4 \times d^2 \times D$

.= $\pi /4 \times 1.60^2 \times 0.20$

.= 0.402 m^3

Total volume of concrete required = 27.0 - 1.231 - 0.508 - 0.402

.= 24.859 m^3

2. Shuttering area = (Bottom area of floor slab + peripheral length of Dome-1 x Depth + peripheral length of Dome-2 x Depth + peripheral length of Dome-3 x Depth)

$.= L \times B + 2 \times \pi \times r_1 \times D + 2 \times \pi \times r_2 \times D + 2 \times \pi \times r_3 \times D$

$.= 12.50 \times 10.80 + 2 \times \pi \times 1.40 \times 0.20 + 2 \times \pi \times 0.90 \times 0.20 + 2 \times \pi \times 0.80 \times 0.20$

$.= 138.89\ m^2$

Deduction of Dome area

(i) Dome-1 = Bottom Area of Dome-1

$.= \pi /4 \times d^2$

$.= \pi /4 \times 2.80^2$

$.= 6.157\ m^2$

(ii) Dome-2 = Bottom Area of Dome-2

$.= \pi /4 \times d^2$

$.= \pi /4 \times 1.80^2$

$.= 2.544\ m^2$

(iii) Dome-3 = Bottom Area of Dome-3

$.= \pi /4 \times d^2$

$.= \pi /4 \times 1.60^2$

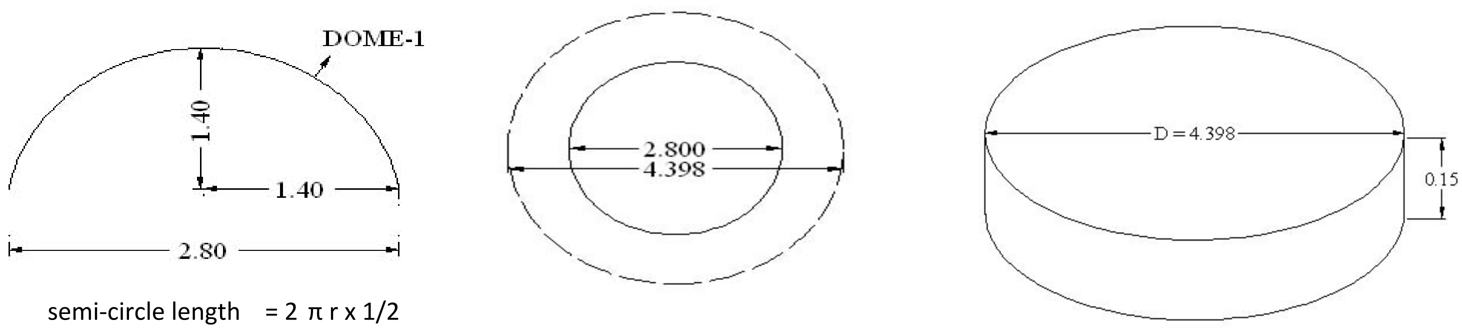
$.= 2.01\ m^2$

Total shuttering area required = 138.89 - 6.157 - 2.544 - 2.01

$.= 128.176\ m^2$

(B) Solution for Dome Slabs :

Dome-1:



semi-circle length $= 2\ \pi\ r \times 1/2$

$.= 2 \times \pi \times 1.40 \times 0.5$

$.= 4.398\ m$

1. Volume of Concrete = Area x Depth

$.= \pi /4 \times d^2 \times D$

$.= \pi /4 \times 4.398^2 \times 0.15$

$.= 2.278\ m^3$

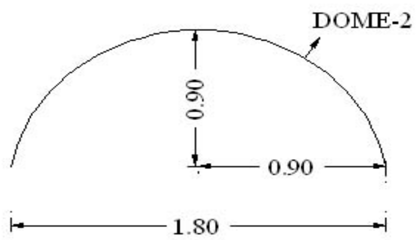
2. Shuttering area = bottom area of dome

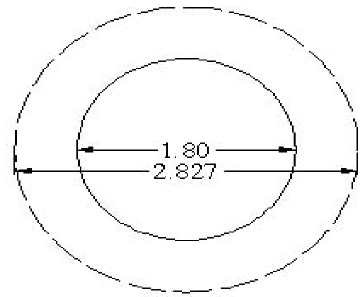
$.= \pi /4 \times d^2$

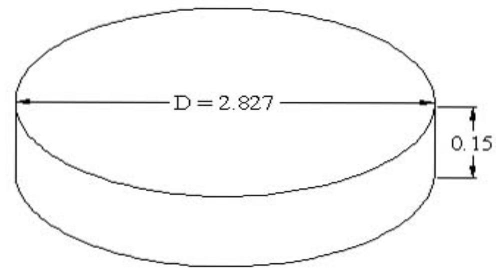
$.= \pi /4 \times 4.398^2$

$.= 15.191\ m^2$

Dome-2:





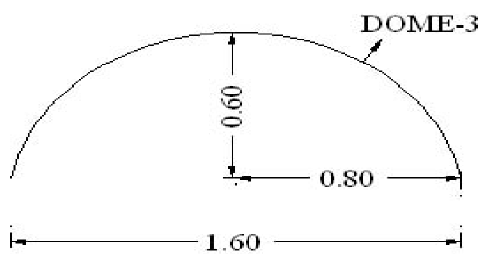


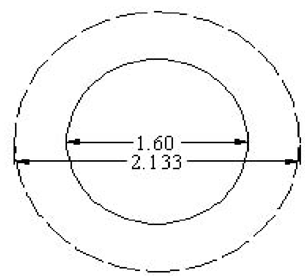
semi-circle length = 2 π r x 1/2
.= 2 x π x 0.90 x 0.5
.= 2.827 m

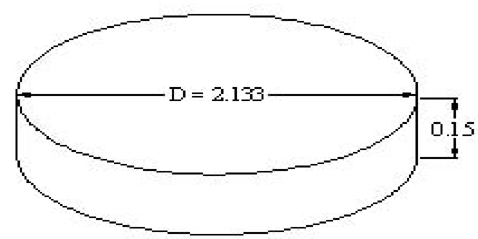
1. Volume of Concrete = Area x Depth
.= π /4 x d^2 x D
.= π /4 x 2.827^2 x 0.15
.= 0.941 m^3

2. Shuttering area = bottom area of dome
.= π /4 x d^2
.= π /4 x 2.827^2
.= 6.276 m^2

Dome-3:







Segmental arc length = (8B-2R)/3 where B =V $R^2 + H^2$
therefore D= 1.60m ; R = 0.80m ; H = 0.60m
B =V $R^2 + H^2$
B =V $0.80^2 + 0.60^2$
B = 1.0
Arc length 'L' = (8 x 1.0 - 2 x 0.80)/3
.= 2.133m

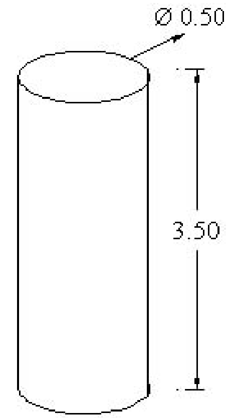
1. Volume of Concrete = Area x Depth
.= $\pi/4 \times d^2 \times D$
.= $\pi/4 \times 2.133^2 \times 0.15$
.= $0.535\ m^3$

2. Shuttering area = bottom area of dome
.= $\pi/4 \times d^2$
.= $\pi/4 \times 2.133^2$
.= $3.573\ m^2$

(B) Solution for Minaret :

Cylinder:

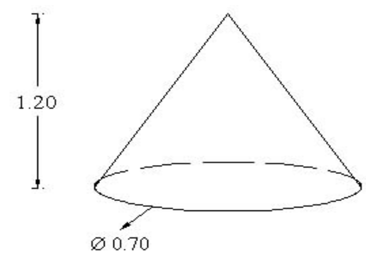
1. Volume of Concrete = Area x Depth
.= $\pi/4 \times d^2 \times D$
.= $\pi/4 \times 0.50^2 \times 3.50$
.= $0.687\ m^3$



2. Shuttering Area = Peripheral length x depth
.= $2 \times \pi \times r \times D$
.= $2 \times \pi \times 0.25 \times 3.5$
.= $5.497\ m^2$

Cone:

1. Volume of Concrete = Area x Depth x 1/3
.= $\pi/4 \times d^2 \times D \times 1/3$
.= $\pi/4 \times 0.70^2 \times 1.20 \times 1/3$
.= $0.153\ m^3$



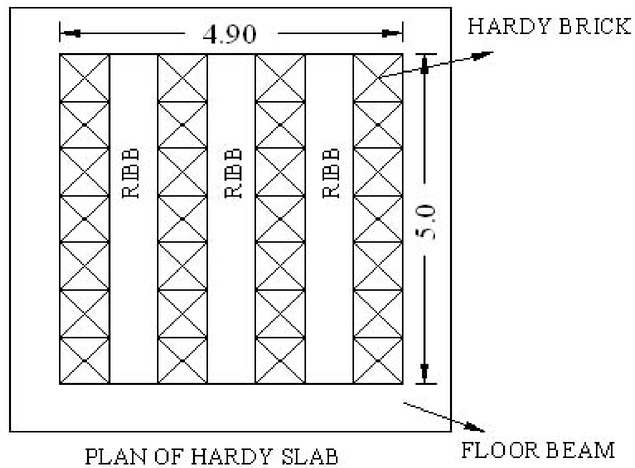
2. Shuttering Area = Peripheral length x depth x 1/3
.= $2 \times \pi \times r \times D \times 1/3$
.= $2 \times \pi \times 0.35 \times 1.20 \times 1/3$
.= $0.879\ m^2$

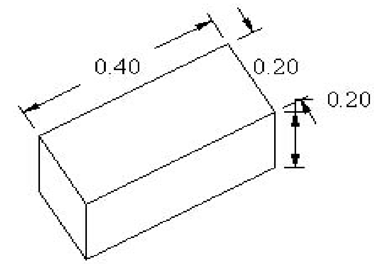
Calculation for the Quantities of Roof Slab with Dome Slab									
S.no	**Description**	**item**	**no.s**	**length in metre**	**breadth in metre**	**depth in metre**	**Volume of Concrete in m^3**	**area of shutter in m^2**	**Remarks**
1	**Floor Slab**	**S**	**1**	**12.500**	**10.800**	**0.200**	**27.000**	**138.896**	
	Deduction of area								
	Dome-1	**DM1**	**1**	**Ǿ =**	**2.800**	**0.200**	**-1.232**	**-6.158**	
	Dome-2	**DM2**	**1**	**Ǿ =**	**1.800**	**0.200**	**-0.509**	**-2.545**	
	Dome-3	**DM3**	**1**	**Ǿ =**	**1.600**	**0.200**	**-0.402**	**-2.011**	
2	**Dome-1**	**DM1**	**1**	**Ǿ =**	**4.398**	**0.150**	**2.279**	**15.191**	
	Dome-2	**DM2**	**1**	**Ǿ =**	**2.827**	**0.150**	**0.942**	**6.277**	
	Dome-3	**DM3**	**1**	**Ǿ =**	**2.133**	**0.150**	**0.536**	**3.573**	
3	**Minaret**								
	Cylinder	**cyl**	**1**	**Ǿ =**	**0.500**	**3.500**	**0.687**	**5.498**	
	Cone	**cne**	**1**	**Ǿ =**	**0.700**	**1.200**	**0.154**	**0.880**	
						Total	**29.455**	**159.602**	

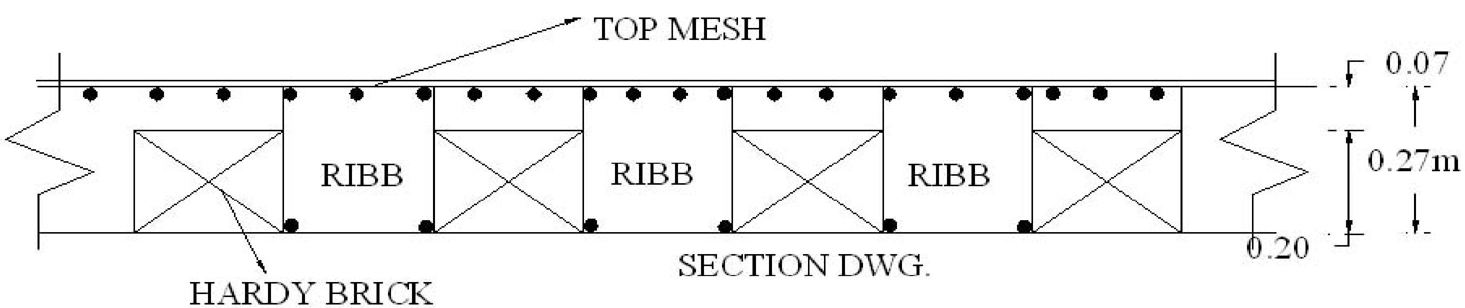
HARDY SLAB CALCULATION

Problem-12: For a given drawing of Hardy Slab find

1. Volume of Concrete
2. Area of Shuttering







(A) Solution for Hardy Slab :

1. Volume of Concrete = Area x Depth

.= L x B x D

.= 4.90 x 5.0 x 0.27 = 6.615 m^3

Deduction for the Hardy Bricks:

Volume of Hardy Brick = L x B x D x no. of Bricks

.= 0.40 x 0.20 x 0.20 x 28

.= 0.448 m^3

Total Volume of Concrete required = 6.615 - 0.448

` .= 6.167 m^3

2. Shuttering Area = Bottom area of Slab

.= L x B

.= 4.90 x 5.0

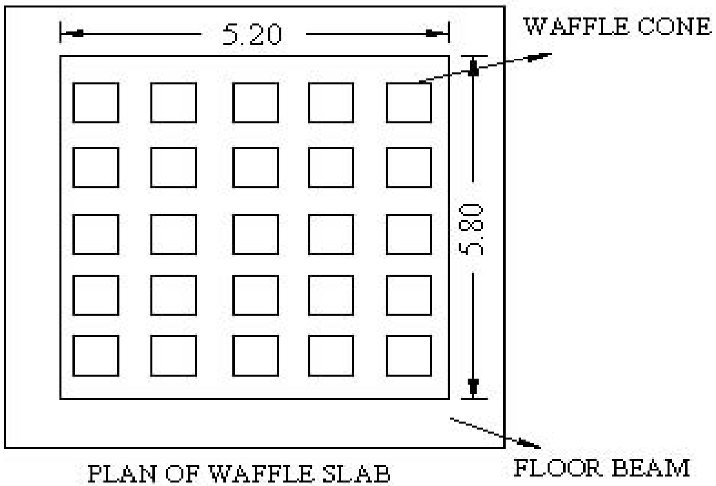
.= 24.50 m^2

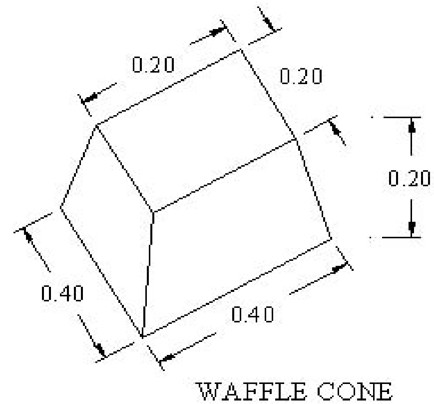
PICTURE SHOWING DETAILS OF HARDY SLAB & HARDY BRICKS PLACED ON SHUTTERING

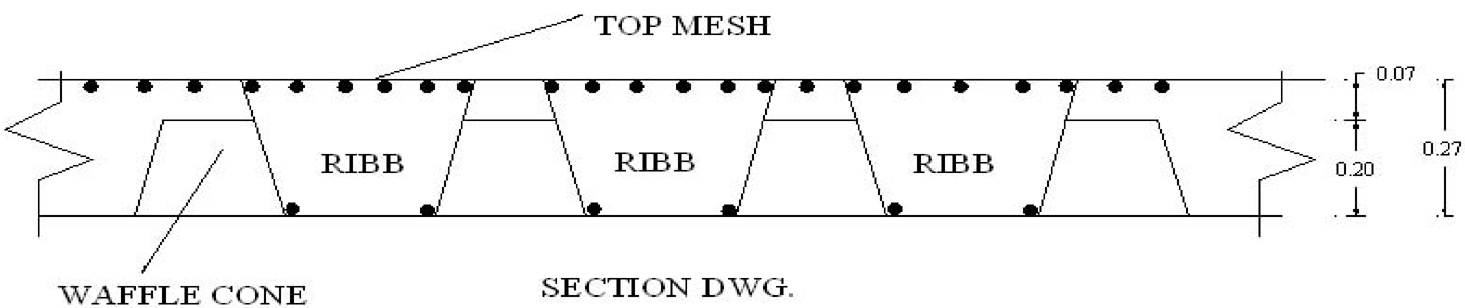
WAFFLE SLAB CALCULATION

Problem-13: For a given drawing of Waffle Slab find

1. Volume of Concrete
2. Area of Shuttering







(A) Solution for Waffle Slab :

1. Volume of Concrete = Area x Depth
.= L x B x D
.= 5.20 x 5.80 x 0.27 = 8.143 m^3

Deduction for the Waffle Cone:

Volume of Waffle Cone = L x B x D x no. of Cones
.= 0.30 x 0.30 x 0.20 x 25
.= 0.45 m^3

Total Volume of Concrete required = 8.1432 - 0.45
` .= 7.6932 m^3

2. Shuttering Area = Bottom area of Slab
.= L x B
.= 5.20 x 5.80
.= 30.16 m^2

L1 = 0.20; B1 = 0.20
L2 = 0.40: B2 = 0.40
Average Length = (L1 + L2)/2
.= (0.20 + 0.40)/2
.= 0.30m

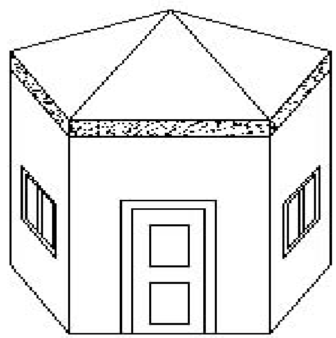
Average Breadth = (B1 + B2)/2
.= (0.20 + 0.40)/2
.= 0.30m

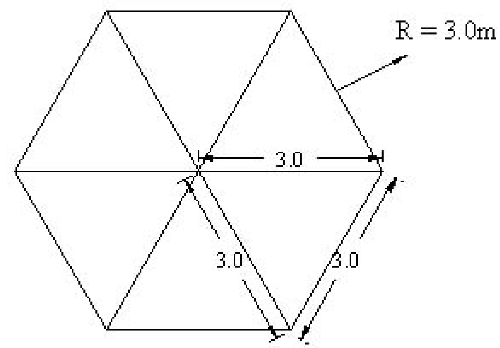


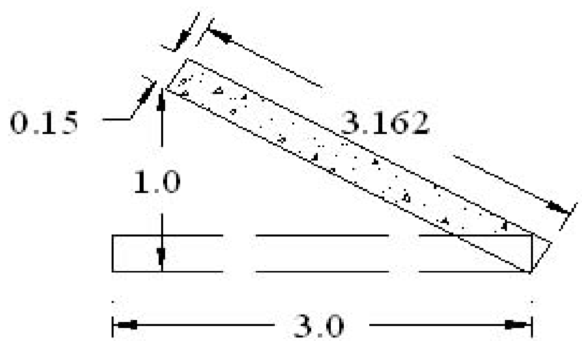
PITCH ROOF CALCULATION

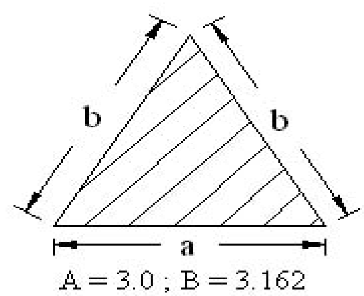
Problem-14: For a given drawing of Pitch Roof find

1. Volume of Concrete
2. Area of Shuttering









$c = V(3.0^2 + 1.0^2)$

c = 3.162 m (inclined length)

(A) Solution for Pitch Roof :

1. Volume of Concrete for each panel = Area x thickness of slab

.= (a/4) x V($4b^2$ - a^2) x t

.= (3/4) x V(4 x 3.162^2 - 3.0^2) x 0.15

.= 4.175 x 0.15

.= 0.626 m^3

no. of panels = 6

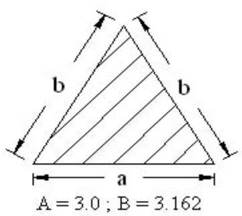
total Volume of Concrete required = 0.626 x 6 = 3.756 m^3

2. Shuttering Area = Peripheral length x thickness of slab + Bottom area of Slab

.= 6R x t + slab area

.= 6 x 3.0 x 0.15 + 25.05

.= 27.75 m^2



area of each panel = (a/4) x V($4b^2$ - a^2)

.= (3/4) x V(4 x 3.162^2 - 3.0^2)

.= 4.175 m^2

no. of panels = 6

total area = 6 x 4.175 = 25.05 m^2

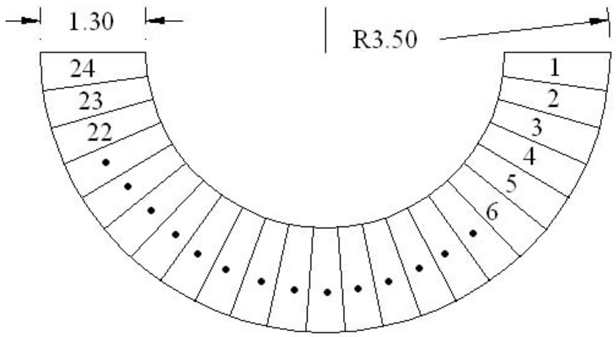
SEMI-ROUND STAIR-CASE CALCULATION

Problem-15: For a given drawing of Semi-round Stair-case find

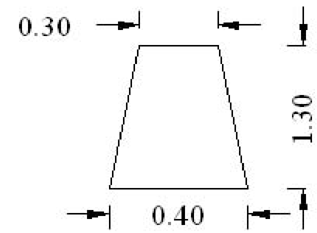
1. Volume of Concrete
2. Area of Shuttering

Height of riser = 0.15m

Tread =



PLAN OF HALF-ROUND STAIR CASE



Radius of waist Slab = 3.50m

Height of Ceiling = Height of Riser x No. of Riser

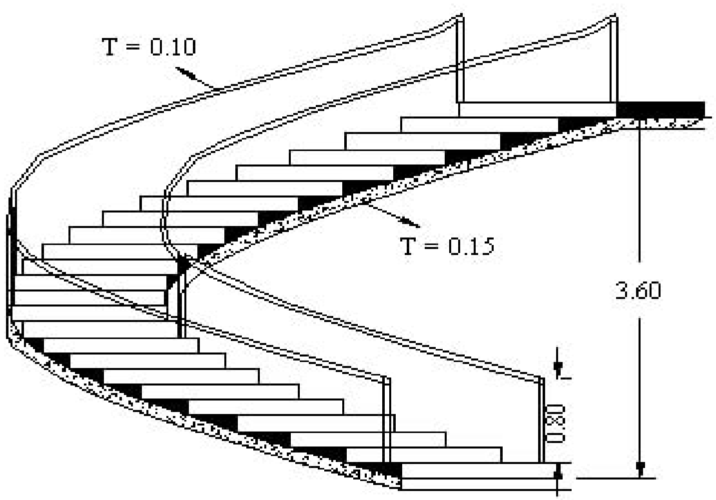
.= 0.15 x 24

.= 3.60m

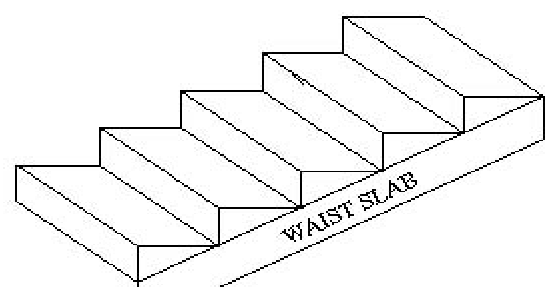
Waist Slab thickness = 0.15m

Width of Waist Slab = 1.30m

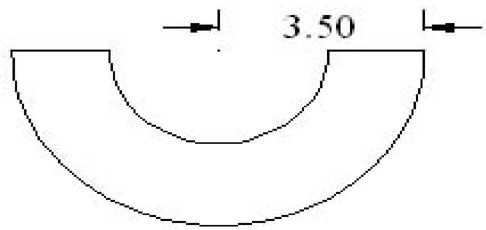
no. of Step = 24



SECTION DWG.

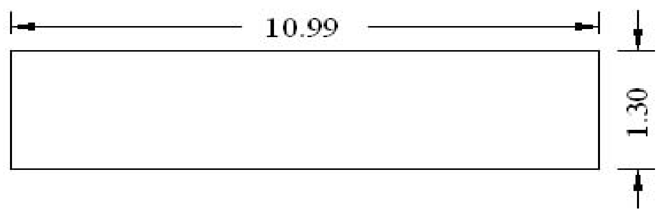


(A) Solution for stair case :

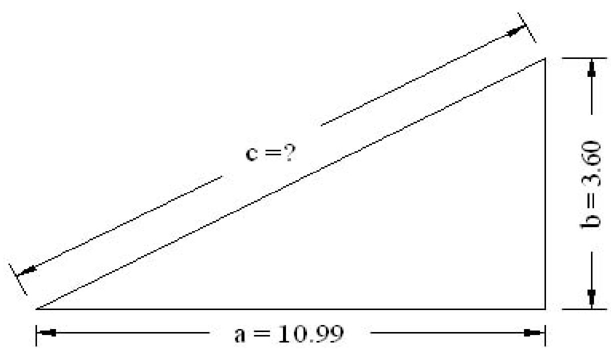


To find out semi-circle length the formula = 2 x π x r x 0.50
therefore radius of waist slab 'r'= 3.50m

.= 2 x π x 3.5 x 0.50
.= 10.99m (linear length)



Inclined length = V(10.99^2 + 3.60^2)
C .= 11.56m



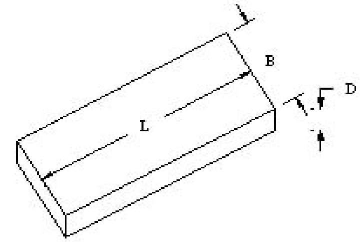
1. Waist Slab:

(a) Volume of Concrete for waist slab .= Area x thickness

.= L x B x D

.= 11.56 x 1.30 x 0.15

.= 2.254 m^3

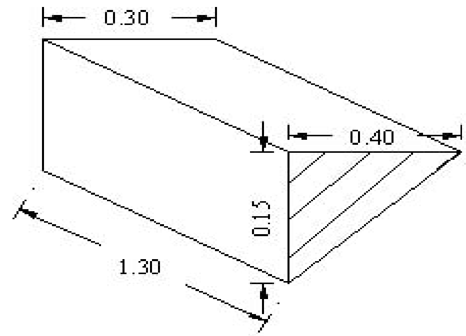


(b) Shuttering Area for waist slab .= L x D x 2 + B x D + L x B

.= 11.56 x 0.15 x 2 + 1.30 x 0.15 + 11.56 x 1.30

.= 18.691 m^2

2. Steps:



length of step = 1.30m

width of tread = 0.30m on one side and 0.40m on other side

Average width of riser = (0.30 + 0.40)/2

B .= 0.35m

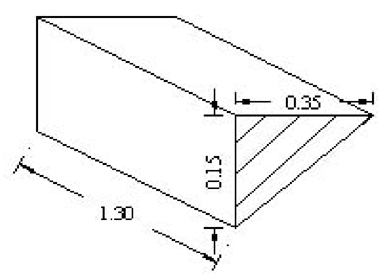
Height of Riser = 0.15m

(a) Volume of Concrete for Step .= Area x length of step x no. of steps

.= 1/2 x b x h x L x no. of steps

.= 0.50 x 0.35 x 0.15 x 1.3 x 24

.= 0.819 m^3



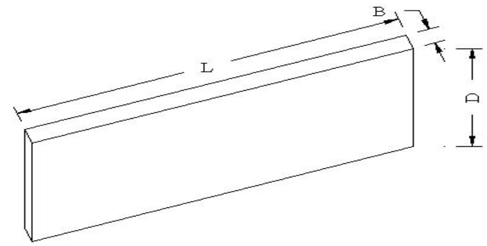
(b) Shuttering area for Step .= (1/2 x B x H x 2 + L x D) x no.s

.= (0.50 x 0.35 x 0.15 x 2 + 1.30 x 0.15) x 24

.= 5.94 m^2

3. Hand-Rail :

therefore L = 11.56m
B = 0.10m
D = 0.80m
no.s = 2



(a) Volume of Concrete for Hand-Rail .= area x depth x no. of Hand rails
.= L x B x D x no.s
.= 11.56 x 0.10 x x 0.80 x 2
.= 1.849 m^3

(b) Shuttering area for Hand-Rail .= (L+B) x 2 x D x no.s
.= (11.56 + 0.10) x 2 x 0.80 x 2
.= 37.312 m^2

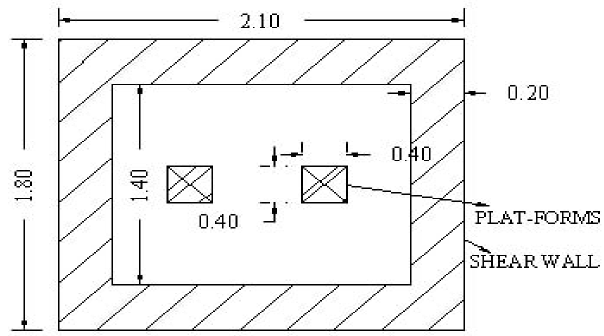
(i) Total Concrete for stair case .= 2.254 + 0.819 + 1.849
.= 4.922 m^3

(ii) Total Shuttering area for stair-case .= 18.691 + 5.94 + 37.312
.= 61.943 m^2

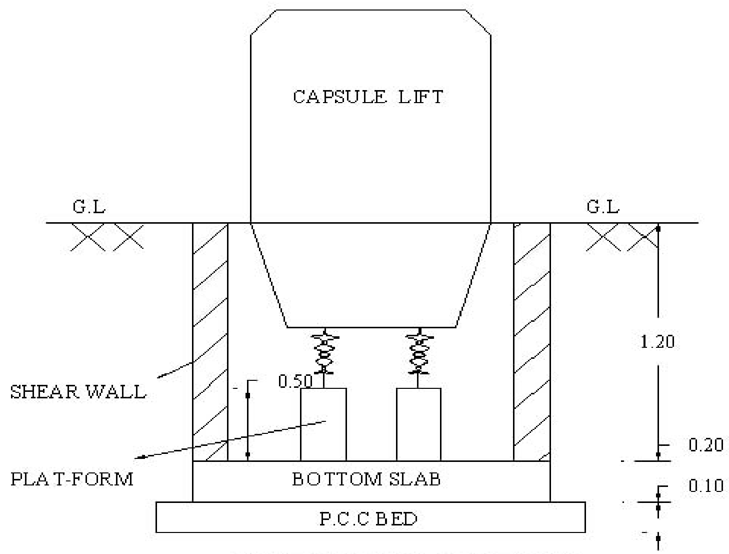
LIFT-PIT CALCULATION

Problem-15: For a given drawing of Lift-Pit find

1. Volume of Concrete
2. Area of Shuttering



PLAN OF LIFT-PIT



SECTION DWG. OF LIFT-PIT

(A) Solution for Lift-Pit :

1. Plain Cement Concrete Bed :

L = 2.30m ; B = 2.0m ; T = 0.10m

(a) Volume of Concrete for p.c.c bed .= area x thickness of p.c.c bed
.= L x B x D
.= 2.30 x 2.0 x 0.10
.= 0.46 m^3

(b) Shuttering area for p.c.c bed .= (L+B) x 2 x D
.= (2.30 + 2.0) x 2 x 0.10
.= 0.86 m^2

2. Bottom slab :

L = 2.10m ; B = 1.80m ; T = 0.20m

(a) Volume of Concrete for Bottom slab .= area x thickness of bottom slab
.= L x B x D
.= 2.10 x 1.80 x 0.20
.= 0.756 m^3

(b) Shuttering area for Bottom slab .= (L+B) x 2 x D
.= (2.10 + 1.80) x 2 x 0.20
.= 1.56 m^2

3. Shear wall along Horizontal plane :

L = 2.10m ; B = 0.20m ; H = 1.20 m

(a) Volume of Concrete for Shear wall .= area x depth x no. of walls
.= L x B x D x no.s
.= 2.10 x 0.20 x 1.20 x 2
.= 1.008 m^3

(b) Shuttering area for Shear wall .= L x D x 2 x no.s
.= 2.10 x 1.20 x 2 x 2
.= 10.08 m^2

4. Shear wall along vertical plane :

L = 1.40m ; B = 0.20m ; H = 1.20 m

(a) Volume of Concrete for Shear wall .= area x depth x no. of walls
.= L x B x D x no.s
.= 1.40 x 0.20 x 1.20 x 2
.= 0.672 m^3

(b) Shuttering area for Shear wall .= L x D x 2 x no.s
.= 1.40 x 1.20 x 2 x 2
.= 6.72m^2

5. Plat-forms :

L = 0.40m ; B = 0.40m ; H = 0.50 m

(a) Volume of Concrete for Plat-form .= area x depth x no. of plat-forms
.= L x B x D x no.s
.= 0.40 x 0.40 x 0.50 x 2
.= 0.16 m^3

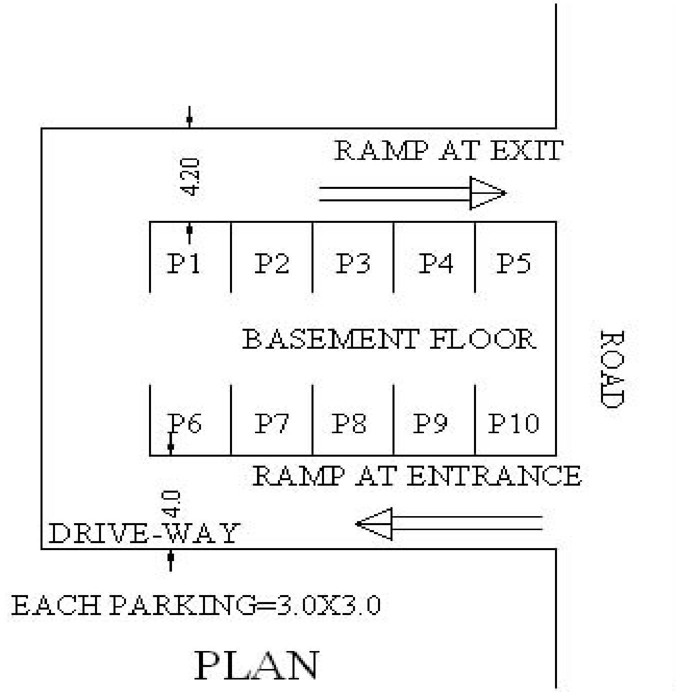
(b) Shuttering area for Plat-form .= (L + B) x 2 x D x no.s
.= (0.40 + 0.40) x 2 0.50 x 2
.= 1.60 m^2

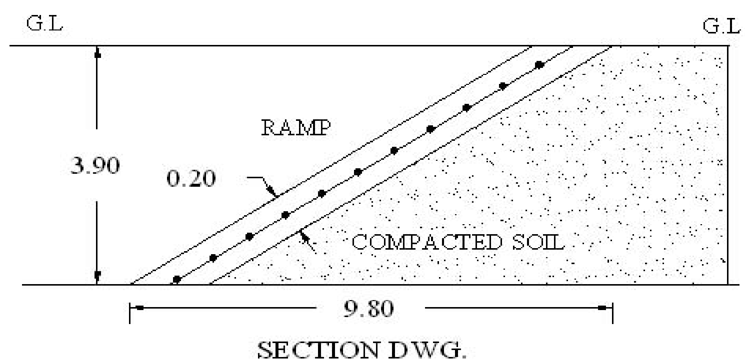
(i) Total Volume of Concrete for Lift-Pit .= 0.46 + 0.756 + 1.008 + 0.672 + 0.16 = 3.056 m^3
(ii) Total Shuttering area for Lift-Pit .= 0.86 + 1.56 + 10.08 + 6.72 + 1.60 = 20.82 m^2

RAMP CALCULATION

Problem-15: For a given drawing of Ramp find

1. Volume of Concrete
2. Area of Shuttering



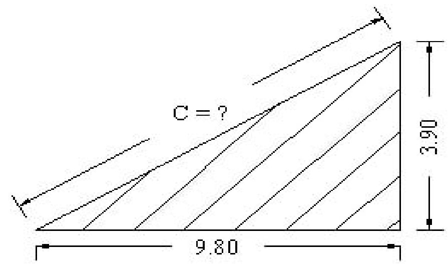


(A) Solution for Ramp :

1. Ramp at entrance:

L = 10.547 m ; B = 4.0m ; T = 0.20m

c = V(a^2 + b^2)
c = V(9.80^2 + 3.90^2)
c = 10.547m



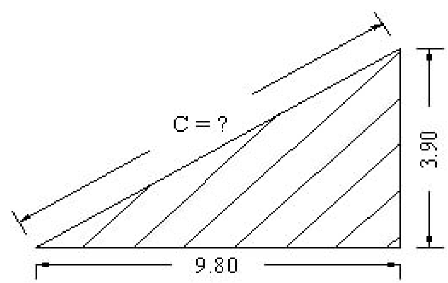
(a) Volume of Concrete for Ramp .= area x thickness of Ramp
.= L x B x D
.= 10.547 x 4.0 x 0.20
.= 8.437 m^3

(b) Shuttering area for p.c.c bed .= (L+B) x 2 x D
.= (10.547 + 4.0) x 2 x 0.20
.= 5.81 m^2

2. Ramp at exit:

L = 10.547 m ; B = 4.20m ; T = 0.20m

c = V(a^2 + b^2)
c = V(9.80^2 + 3.90^2)
c = 10.547m



(a) Volume of Concrete for Ramp .= area x thickness of Ramp

.= L x B x D

.= 10.547 x 4.20 x 0.20

.= 8.859 m^3

(b) Shuttering area for p.c.c bed .= (L+B) x 2 x D

.= (10.547 + 4.20) x 2 x 0.20

.= 5.89 m^2

(i) Total Concrete for both Ramps = 8.437+ 8.859 = 17.296 m^3

(ii) Total Shuttering area for both Ramps = 5.81 + 5.89 = 11.70 m^3

STANDARD DATA IN METRIC SYSTEM

1 Cement : Mortar Required for Brick work/m^3
2 Cement : Mortar Required for Plastering/m^3
3 Concrete-Mix Design with different proportion & ratios/m^3

(a)

Cement : Mortar required for Brick Work (for 1m^3 of Brick work)					
S.no	Proportion or ratio	Sand in in m^3	Cement in Kgs	Cement in Bags	Cement in m^3
1	. 1:3	0.20	96.00	1.920	0.066
2	. 1:4	0.20	72.00	1.440	0.050
3	. 1:5	0.20	57.60	1.152	0.040
4	. 1:6	0.20	48.00	0.960	0.033
5	. 1:7	0.20	41.14	0.822	0.028
6	. 1:8	0.20	36.00	0.720	0.025

Cement in m^3 : 1440 kgs = 1m^3

96.0 kgs = ? m^3

96.0/1440

.= 0.066 m^3

For 1m^3 of C:M Sand = 0.20 m^3 Constant for all proportion

For 1m^3 of C:M Cement in kgs = (0.20 x 1440)/last digit of ratio or proportion

.= 0.20 x 1440/3

.= 96.0 kgs

therefore each bag of cement = 50kgs

Cement in Bags .= 96.0/50

.= 1.92 bags

Standard Weight & Density

1 Weight of Cement in kgs/m^3 .= 1440 kgs
2 Weight of each Cement Bag .= 50 kgs
3 No. of Cement bags /m^3 .= 1440/50
.= 28.80 or approximately equal to 29 bags
4 Weight of Sand /m^3 .= 1600kgs to 1750 kgs. Sand weight varies depending on condition i.e. Dry or Moisturizing
5 Weight of Aggregate /m^3 .= 2400 kgs
6 Weight of Water / m^3 .= 1000 kgs
7 Weight of Water /litre .= 1 kg
8 Density of Concrete /m^3 .= 2400 kgs
9 Density of Steel /m^3 .= 7850 kgs
10 Density of Brick .= 1.92 grms/cm^3 (Normal clay) or 2.42 grms/cm^3 (Fine Clay)
11 Weight of Concrete /m^3 .= 2500 kgs to 2800 kgs (R.C.C)
12 M_{15} = 1:2:4

Where M_{15} = Grade of Concrete
M= Mix-Design
15 = Compressive Strength of Concrete
1 = 1 bag of Cement
2 = 2 bags of Sand
4 = 4 bags of Aggregate

1 ton = 1000 kgs
1 quintal = 100 kgs
1 kg = 1000 grms

(b)

Cement : Mortar required for Plastering (for 1m^3 of C:M for Plastering)					
S.no	**Proportion or ratio**	**Sand in**	**Cement**	**Cement**	**Cement**
		in m^3	**in Kgs**	**in Bags**	**in m^3**
1	**. 1:3**	**1.25**	**600.00**	**12.0**	**0.417**
2	**. 1:4**	**1.25**	**450.00**	**9.0**	**0.313**
3	**. 1:5**	**1.25**	**360.00**	**7.2**	**0.250**
4	**. 1:6**	**1.25**	**300.00**	**6.0**	**0.208**
5	**. 1:7**	**1.25**	**257.14**	**5.143**	**0.179**
6	**. 1:8**	**1.25**	**225.00**	**4.5**	**0.156**

Cement in m^3 :
1440 kgs = 1m^3
600.0 kgs = ? m^3
600.0/1440
.= 0.4166 m^3

For 1m^3 of C:M Sand = 1.25 m^3 Constant for all proportion
For 1m^3 of C:M Cement in kgs = (1.25 x 1440)/last digit of ratio or proportion
.= 1.25 x 1440/3
.= 600.0 kgs
therefore each bag of cement = 50kgs
Cement in Bags .= 600/50 .= 12 bags

General Practice :

Plastering is done in two coats i.e. 1st coat & 2nd coat

1st coat is called as Rough Coat with Cement : Mortar ratio 1:6

2nd Coat is called as Finish Coat with Cement : Mortar ratio 1:3

Total thickness of Plaster should be consider as 20mm or 2cm or 0.02 m

thickness for 1st coat of plaster . = 12mm

thickness for 2nd coat of plaster . = 8mm

total thickness .= 20mm

(c)

Cement, Sand & Aggregate required for different Grades of Concrete /m 3							
S.no	Grade of Concrete	Ratio of Concrete	Sand in in m^3	Aggregate in m^3	Cement in Kgs	Cement in Bags	Cement in m^3
1	$M_{7.5}$	. 1:4:8	0.46	0.92	165.6	3.312	0.115
2	M_{10}	. 1:3:6	0.46	0.92	220.8	4.416	0.153
3	M_{15}	. 1:2:4	0.46	0.92	331.2	6.624	0.230
4	M_{20}	. 1:1.5:3	0.46	0.92	441.6	8.832	0.307
5	M_{25}	. 1:1:2	0.46	0.92	662.4	13.248	0.460
6	M_{30}	.1:0.75:1.5	0.46	0.92	883.2	17.664	0.613
7	M_{35}	. 1:0.5:1	0.46	0.92	1324.8	26.496	0.920
8	M_{40}	.1:0.25:0.5	0.46	0.92	2649.6	52.992	1.840

Cement in m^3 :

1440 kgs = $1m^3$

165.60 kgs = ? m^3

165.60/1440

.= 0.115 m^3

For $1m^3$ of Concrete Sand = 0.46 m^3 Constant for all proportion

For $1m^3$ of Concrete Aggregate = 0.92 m^3 Constant for all proportion

For $1m^3$ of Concrete Cement in kgs = (0.92 x 1440)/last digit of ratio or proportion

.= 0.92 x 1440/8

.= 165.60 kgs

Each bag of cement = 50kgs

Therefore Cement in Bags .= 165.60/50

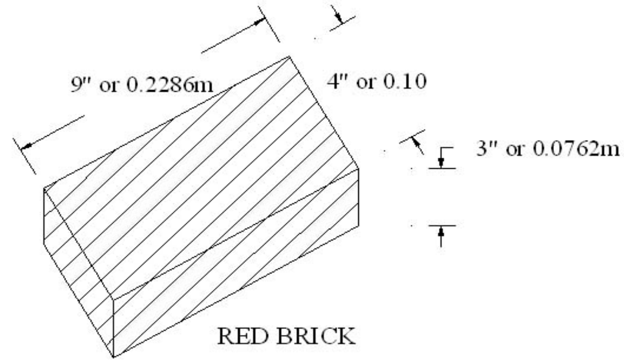
.= 3.312 bags

Brick Work Calculations & problems

A. Indian Red Brick

Size of Brick . = 9" x 4" x 3"

.= 0.2286m x 0.10m x 0.0762m



Volume of each Brick = 0.001741 m^3

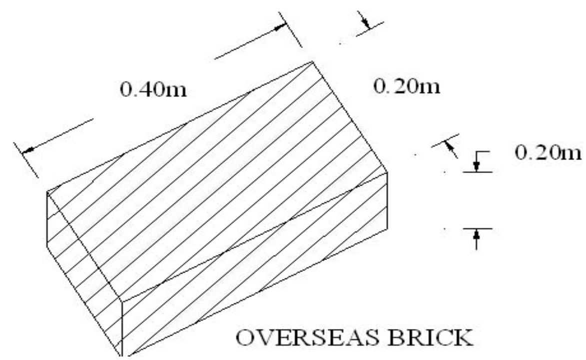
no. of bricks / m^3 .= $\frac{\text{total Volume of brick work}}{\text{Volume of each Brick}}$

.= 1/0.001741

.= 574.38 or approximately equal to 575 bricks

B. Overseas Bricks

Size of each Brick .= 0.40m x 0.20m x 0.20m



Volume of each Brick = 0.016 m^3

no. of bricks / m^3 .= $\frac{\text{total Volume of brick work}}{\text{Volume of each Brick}}$

.= 1/0.016

.= 62.50 or approximately equal to 63 bricks

Problem-1:

For an area of 160 m^2 with wall thickness 10 cm find

(i) No. of bricks

(ii) C:M required for Brick work with ratio 1:6

Solution

1. volume of brick work = Area x thickness

.= 160 x 0.10

.= 16 m^3

2. No. of bricks = t otal volume of brick work / Volume of each brick

.= 16/0.001741
.= 9190.12 or approximately equal to 9191 bricks

3. C:M required for Brick work:

(i) Sand = $1 m^3 = 0.20 m^3$
$16 m^3 = ? m^3$
.= 16 x 0.20
.= $3.20 m^3$

(ii) Cement = $1m^3$ = (0.20 x 1440)/6
$1 m^3$.= 48 kgs
$16 m^3$.= $? m^3$
.= 16 x 48
.= 768 kgs

no. of Cement bags = 768 / 50
.= 15.36 or approximately equal to 16 bags

Problem-2:

For an area of 1800 ft^2 with wall thickness 20 cm find
(i) No. of bricks
(ii) C:M required for Brick work with ratio 1:5

Solution

1. volume of brick work = Area x thickness
.= 167.311 x 0.20
.= $33.462 m^3$

$1800 ft^2 = ? m^2$
therefore 1m = 3.28 ft
.= $1800/3.28^2$
.= $167.311 m^2$

2. No. of bricks = t otal volume of brick work / Volume of each brick

.= 33.462/0.001741
.= 19219.98 or approximately equal to 19220 bricks

3. C:M required for Brick work:

(i) Sand = $1m^3 = 0.20\ m^3$

$33.462\ m^3 = ?\ m^3$

.= 33.462 x 0.20

.= $6.692\ m^3$

(ii) Cement = $1m^3$ = (0.20 x 1440)/5

$1\ m^3$.= 57.6 kgs

$33.462\ m^3$.= ? m^3

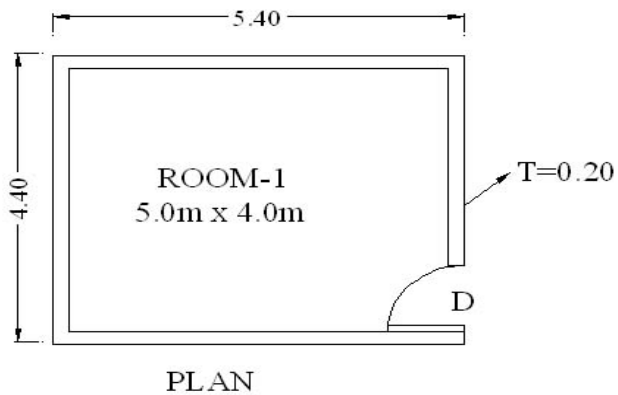
.= 33.462 x 57.60

.= 1927.41 kgs

no. of Cement bags = 1927.41 / 50

.= 38.548 or approximately equal to 39 bags

Problem-3:



For a given plan find

(i) No. of bricks

(ii) C:M required for Brick work with ratio 1:5

D = 1.0 X 2.10

Height of Ceiling = 3.0 m

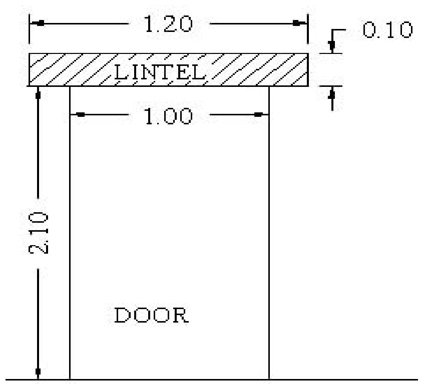
Solution

Length of wall = ' L ' = 5.40 x 2 + 4.0 x 2 = 18.80m

L = 18.80 m

B = 0.20 m

D = 3.0 m



1 volume of brick work = Area x thickness

.= 18.80 x 0.20 x 3.0

.= $11.28\ m^3$

Deduction of Door = L x B x D = 1.0 x 2.10 x 0.20 = $-0.42\ m^3$

Deduction of Door Lintel = L x B x D = 1.20 x 0.10 x 0.20 = $-0.024\ m^3$

Note:

Breadth of Lintel = thickness of wall = 0.20 m

for Lintel Dimension 10cm bearing should be added on each side of length of Door and Height of lintel = 0.10m

Total Volume of brick work after deductions = 11.28 - 0.42 - 0.024 = $10.836\ m^3$

2 No. of bricks = t otal volume of brick work / Volume of each brick

.= 10.836/0.001741
.= 6224.009 or approximately equal to 6225 bricks

3 C:M required for Brick work:

(i) Sand = $1m^3 = 0.20\ m^3$
$10.836\ m^3 = ?\ m^3$
.= 10.836 x 0.20
.= $2.167\ m^3$

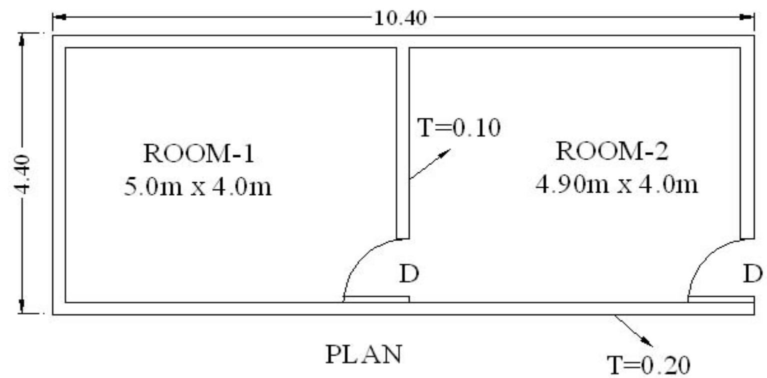
(ii) Cement = $1m^3$ = (0.20 x 1440)/5
$1\ m^3$.= 57.6 kgs
$10.836\ m^3$.= ? m^3
.= 10.836 x 57.60
.= 624.153 kgs

no. of Cement bags = 624.153/ 50
.= 12.48 or approximately equal to 13 bags

Problem-4:

For a given plan find

(i) No. of bricks
(ii) C:M required for Brick work with ratio 1:6
D = 1.0 X 2.10
Height of Ceiling = 3.0 m



PLAN

Solution :

(i) for External wall or 20cm wall
Length of wall = ' L ' = 10.40 x 2 + 4.0 x 2 = 28.80m
L = 28.80 m B = 0.20 m D = 3.0 m

volume of brick work for 20cm wall = Area x thickness
.= L x B x D
.= 28.80 x 0.20 x 3.0
.= $17.28\ m^3$

(ii) for internal wall or 10cm wall

Length of wall = ' L ' = 4.0m

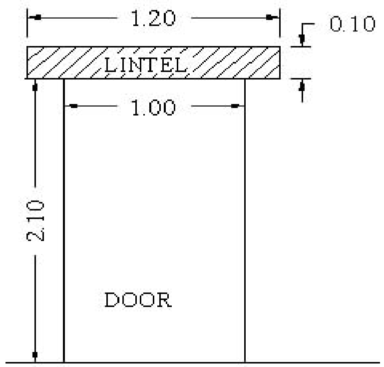
L = 4.0 m   B = 0.10 m   D = 3.0 m

volume of brick work for 10cm wall = Area x thickness

.= L x B x D

.= 4.0 x 0.10 x 3.0

.= 1.20 m^3



(iii) Total Volume of Brick work .= 17.28 + 1.20 = 18.48 m^3

Deduction of Door = L x B x D x no.s = 1.0 x 2.10 x 0.20 x 1 = -0.42 m^3

Deduction of Door = L x B x D x no.s = 1.0 x 2.10 x 0.10 x 1 = -0.21 m^3

Deduction of Door Lintel = L x B x D x no.s = 1.20 x 0.10 x 0.20 x 1 = -0.024 m^3

Deduction of Door Lintel = L x B x D x no.s = 1.20 x 0.10 x 0.10 x 1 = -0.012 m^3

Note:

Breadth of Lintel = thickness of wall = 0.20 m

for Lintel Dimension 10cm bearing should be added on each side of length of Door and Height of lintel = 0.10m

Total Volume of brick work after deductions = 18.48 - 0.42 - 0.21 - 0.024 - 0.012 = 17.814 m^3

(iv) No. of bricks = t otal volume of brick work / Volume of each brick

.= 17.814/0.001741

.= 10232.05 or approximately equal to 10233 bricks

(v) C:M required for Brick work:

(i) Sand = 1m^3 = 0.20 m^3

17.814 m^3 = ? m^3

.= 17.814 x 0.20

.= 3.562 m^3

(ii) Cement = 1m^3 = (0.20 x 1440)/6

1 m^3 .= 48 kgs

17.814 m^3 .= ? m^3

.= 17.814 x 48

.= 855.072 kgs

no. of Cement bags = 855.072 / 50

.= 17.101 or approximately equal to 18 bags

Plastering Calculations & problems

Problem-1:

For an area of 120 m^2 find C:M required for plastering

(i) 1st coat with c:m ratio 1:6

(ii) 2nd coat with c:m ration 1:3

Solution

(i) 1st coat of plaster: thickness of plaster = 12mm or 0.012m C:M = 1:6

volume of C:M for Plastering = Area of plaster x thickness of plaster

.= 120 x 0.012

.= 1.44 m^3

Cement : Mortar required for plastering:

a. Sand :

1m^3 = 1.25 m^3

1.44 m^3 = ? m^3

.= 1.44 x 1.25

.= 1.80 m^3

b. Cement :

1m^3 = (1.25 x 1440)/6

1m^3 = 300 kgs

1.44 m^3 = ? Kgs

.= 1.44 x 300

.= 432.0 kgs

no. of cement bags = 432/50 = 8.64 or 9 bags

(ii) 2nd coat of plaster: thickness of plaster = 8mm or 0.008m C:M = 1:3

volume of C:M for Plastering = Area of plaster x thickness of plaster

.= 120 x 0.008

.= 0.96 m^3

Cement : Mortar required for plastering:

a. Sand :

1m^3 = 1.25 m^3

0.96 m^3 = ? m^3

.= 0.96 x 1.25

.= 1.20 m^3

b. Cement :

1m^3 = (1.25 x 1440)/3

1m^3 = 600 kgs

0.96 m^3 = ? Kgs

.= 0.96 x 600

.= 576.0 kgs

no. of cement bags = 576/50 = 11.52 or 12 bags

total Sand required = 1.80 + 1.20 = 3.0 m^3

Total Cement required = 9 + 12 = 21 bags

Problem-2:

For an area of 2400 Sft find C:M required for plastering
(i) 1st coat with c:m ratio 1:5
(ii) 2nd coat with c:m ration 1:3

Solution

(i) 1st coat of plaster: thickness of plaster = 12mm or 0.012m C:M = 1:5

volume of C:M for Plastering = Area of plaster x thickness of plaster
.= 223.08 x 0.012
.= 2.676 m^3

$2400\ ft^2 = ?\ m^2$
1m = 3.28ft
.= $2400/3.28^2$
.= 223.08 m^2

Cement : Mortar required for plastering:

a. Sand :

$1m^3 = 1.25\ m^3$
$2.676\ m^3 = ?\ m^3$
.= 2.676 x 1.25
.= 3.345 m^3

b. Cement :

$1m^3 = (1.25 \times 1440)/5$
$1m^3$ = 360 kgs
$2.676\ m^3$ = ? Kgs
.= 2.676 x 360
.= 963.36 kgs
no. of cement bags = 963.36/50 = 19.267 or 20 bags

(ii) 2nd coat of plaster: thickness of plaster = 8mm or 0.008m C:M = 1:3

volume of C:M for Plastering = Area of plaster x thickness of plaster
.= 223.08 x 0.008
.= 1.784 m^3

Cement : Mortar required for plastering:

a. Sand :

$1m^3 = 1.25\ m^3$
$1.784\ m^3 = ?\ m^3$
.= 1.784 x 1.25
.= 2.23 m^3

b. Cement :

$1m^3 = (1.25 \times 1440)/3$
$1m^3$ = 600 kgs
$1.784\ m^3$ = ? Kgs
.= 1.784 x 600
.= 1070.40 kgs
no. of cement bags = 1070.40/50 = 21.40 or 22 bags

total Sand required = 3.345 + 2.23 = 5.575 m^3
Total Cement required = 20 + 22 = 42 bags

Problem-3:

For a given plan find

a Area of plastering excluding ceiling area

b C:M required for plastering

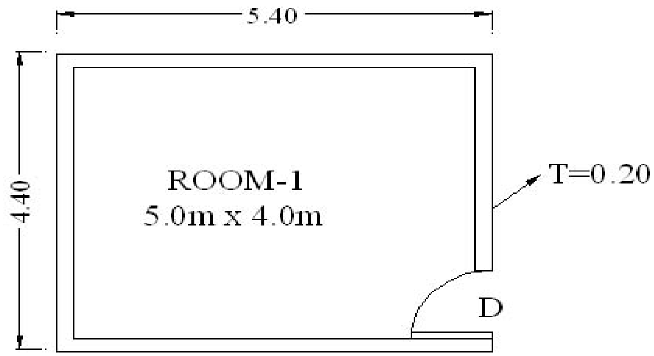
(i) 1st coat with c:m ratio 1:5

(ii) 2nd coat with c:m ration 1:3

(iii) Ceiling height = 3.0m

(iv) Slab thickness = 0.15 m

(v) Door ' D ' = 1.0 x 2.10



PLAN

Solution

a. Area of plastering:

(i) Internal Plaster area = Peripheral Length x Depth

.= (L + B) x 2 x D

.= (5.0 + 4.0) x 2 x 3.0

.= 54.0 m^2

Deduction of door area = L x D = 1.0 x 2.10 = -2.10

total internal plaster area = 54.0 - 2.10 = 51.90 m^2

(ii) External Plaster area = Peripheral Length x Depth

.= (L + B) x 2 x D

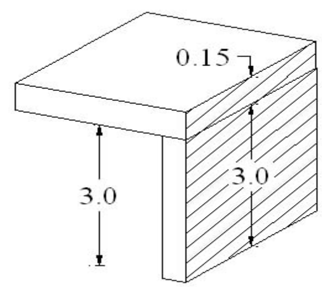
.= (5.4 + 4.4) x 2 x 3.15

.= 61.74 m^2

Deduction of door area = L x D = 1.0 x 2.10 = -2.10

total external plaster area = 61.74 - 2.10 = 59.64 m^2

Note: while finding external plaster area, Slab thickness has to be added with Ceiling height



(iii) Total Plaster area = 51.90 + 59.64 = 111.54 m^2

b. C:M required for plastering:

(i) 1st coat of plaster: thickness of plaster = 12mm or 0.012m C:M = 1:5

volume of C:M for Plastering = Area of plaster x thickness of plaster

.= 111.54 x 0.012

.= 1.338 m^3

Cement : Mortar required for plastering:

a. Sand :

$1m^3 = 1.25\ m^3$

$1.338\ m^3 = ?\ m^3$

.= 1.338 x 1.25

.= 1.672 m^3

b. Cement :

$1m^3 = (1.25 \times 1440)/5$

$1m^3 = 360$ kgs

$1.338\ m^3 = ?$ Kgs

.= 1.338 x 360

.= 481.68 kgs

no. of cement bags = 481.68/50 = 9.633 or 10 bags

(ii) 2nd coat of plaster: thickness of plaster = 8mm or 0.008m C:M = 1:3

volume of C:M for Plastering = Area of plaster x thickness of plaster

.= 111.54 x 0.008

.= 0.892 m^3

Cement : Mortar required for plastering:

a. Sand :

$1m^3 = 1.25\ m^3$

$0.892\ m^3 = ?\ m^3$

.= 0.892 x 1.25

.= 1.115 m^3

b. Cement :

$1m^3 = (1.25 \times 1440)/3$

$1m^3 = 600$ kgs

$0.892\ m^3 = ?$ Kgs

.= 0.892 x 600

.= 535.20 kgs

no. of cement bags = 535.20/50 = 10.704 or 11 bags

total Sand required = 1.672 + 1.115 = 2.787 m^3

Total Cement required = 10 + 11 = 21 bags

Problem-4:

For a given plan find

a Area of plastering excluding ceiling area

b C:M required for plastering

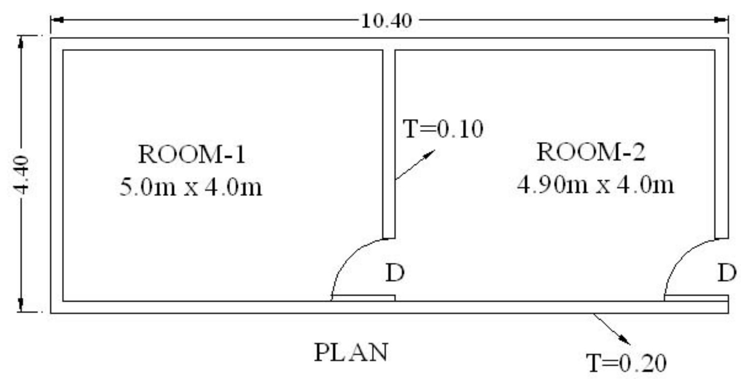
(i) 1st coat with c:m ratio 1:5

(ii) 2nd coat with c:m ration 1:3

(iii) Ceiling height = 3.0m

(iv) Slab thickness = 0.15 m

(v) Door ' D ' = 1.0 x 2.10



Solution

a. Area of plastering:

(i) Internal Plaster area = Peripheral Length x Depth

Room-1 .= (L + B) x 2 x D

.= (5.0 + 4.0) x 2 x 3.0

.= 54.0 m^2

Room-2 .= (L + B) x 2 x D

.= (4.90 + 4.0) x 2 x 3.0

.= 53.40 m^2

(ii) External Plaster area = Peripheral Length x Depth

.= (L + B) x 2 x D

.= (10.4 + 4.4) x 2 x 3.15

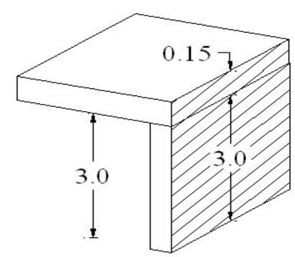
.= 93.24 m^2

Note: while finding external plaster area, Slab thickness has to be added with Ceiling height

(iii) Deduction of door area = L x D x no.s = 1.0 x 2.10 x 4 = -8.40 m^2

Door area has to be deducted from both side i.e. front side & back side

total plaster area = 54.0 + 53.40 + 93.24 - 8.40 = 192.24 m^2



b. C:M required for plastering:

(i) 1st coat of plaster: thickness of plaster = 12mm or 0.012m C:M = 1:5

volume of C:M for Plastering = Area of plaster x thickness of plaster

.= 192.24 x 0.012

.= 2.306 m^3

Cement : Mortar required for plastering:

a. Sand :	b. Cement :
$1m^3 = 1.25\ m^3$	$1m^3 = (1.25 \times 1440)/5$
$2.306\ m^3 = ?\ m^3$	$1m^3 = 360$ kgs
.= 2.306 x 1.25	$2.306\ m^3 = ?$ Kgs
.= 2.88 m^3	.= 2.306 x 360
	.= 830.16 kgs
	no. of cement bags = 830.16/50 = 16.60 or 17 bags

(ii) 2nd coat of plaster: thickness of plaster = 8mm or 0.008m C:M = 1:3

volume of C:M for Plastering = Area of plaster x thickness of plaster

.= 192.24 x 0.008

.= 1.537 m^3

Cement : Mortar required for plastering:

a. Sand :	b. Cement :
$1m^3 = 1.25\ m^3$	$1m^3 = (1.25 \times 1440)/3$
$1.537\ m^3 = ?\ m^3$	$1m^3 = 600$ kgs
.= 1.537 x 1.25	$1.537\ m^3 = ?$ Kgs
.= 1.921 m^3	.= 1.537 x 600
	.= 922.20 kgs
	no. of cement bags = 922.20/50 = 18.44 or 19 bags

total Sand required = 2.88 + 1.921 = 4.801 m^3

Total Cement required = 17 + 19 = 36 bags

Emulsion Paint or Water Bond-Paint for walls (Calculations & problems)

Problem-1:

For a given plan find

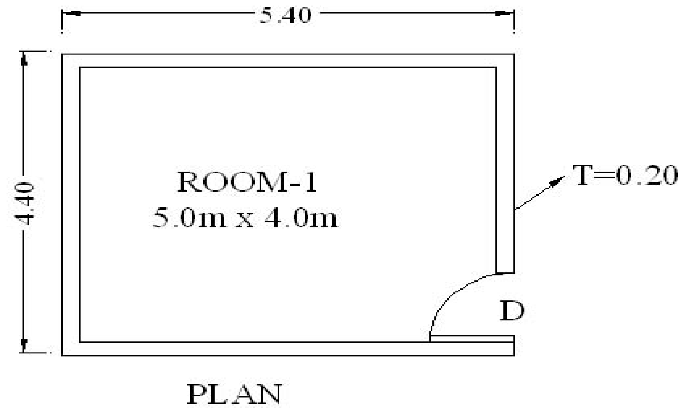
a Area of Paint

b Emulsion Paint required in litres

(i) Ceiling height = 3.0m

(ii) Slab thickness = 0.15 m

(iii) Door ' D ' = 1.0 x 2.10



Solution

a. Area of Emulsion Paint :

(i) Internal Paint area = Peripheral Length x Depth

.= (L + B) x 2 x D

.= (5.0 + 4.0) x 2 x 3.0

.= 54.0 m^2

Deduction of door area = L x D = 1.0 x 2.10 = -2.10

total internal paint area = 54.0 - 2.10 = 51.90 m^2

(ii) External Paint area = Peripheral Length x Depth

.= (L + B) x 2 x D

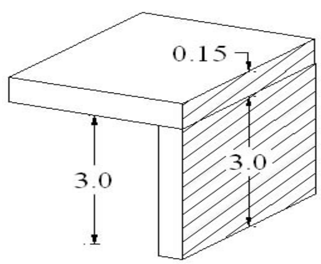
.= (5.4 + 4.4) x 2 x 3.15

.= 61.74 m^2

Deduction of door area = L x D = 1.0 x 2.10 = -2.10

total external paint area = 61.74 - 2.10 = 59.64 m^2

Note: while finding external paint area, Slab thickness has to be added with Ceiling height



(iii) Total Paint area = 51.90 + 59.64 = 111.54 m^2

Standards for Double Coat of Emulsion Paint:

(a) 1 Litre of paint will cover 4.2 m^2 area or

(b) 1 litre of paint will cover 45 Sft area

(iv) Emulsion paint required in litres:

4.2 m^2 = 1 Litre

111.54 m^2 = ? Litre

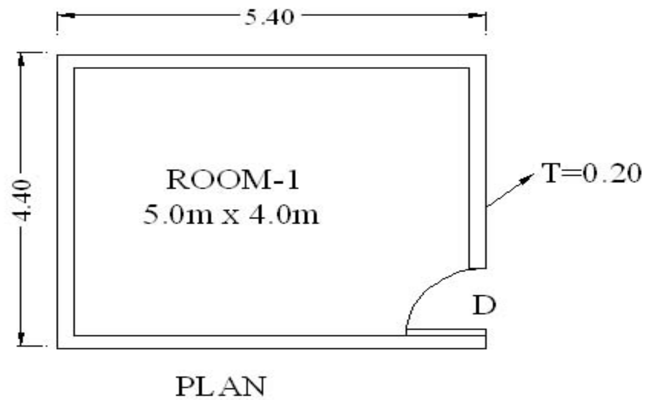
.= 111.54/4.2

.= 26.557 or approximately equal to 27 Litres

Wall Putty- Calculations & problems

Problem-1:

For a given plan find no. of bags required for wall-putty
(only for internal area of walls)
(i) Ceiling height = 3.0m
(ii) Slab thickness = 0.15 m
(iii) Door ' D ' = 1.0 x 2.10



Solution

a. Area of Wall-putty :

(i) Internal area = Peripheral Length x Depth

.= (L + B) x 2 x D

.= (5.0 + 4.0) x 2 x 3.0

.= 54.0 m^2

Deduction of door area = L x D = 1.0 x 2.10 = -2.10

total internal area = 54.0 - 2.10 = 51.90 m^2

Standards for Wall-Putty :

Thickness of Wall-putty layer = 3mm or 0.003m

Weight of Wall-putty/m^3 = 849.0 kgs

Volume of Wall-putty = Area x thickness

.= 51.90 x .003

.= 0.155 m^3

1 m3 = 849.0 kgs

0.155 m3 = ? Kgs

.= 0.155 x 849

.= 131.595 kgs

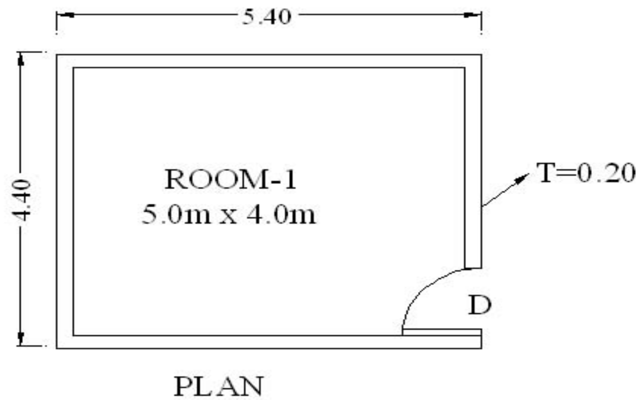
Available bag of Wall-putty = 5 kgs, 10 kg, 20 kg & 40 kg

no. of bags required = 131.595/40

.= 3.289 or approximately equal to 4 bags of 40 kgs

Flooring- Calculations & problem

Problem-1:



For a given plan find no. of Tiles required for Flooring
if the size of each Floor Tile = 12" x 12"

Solution

a. Area of Flooring :

(i) Floor area = L x B

.= 5.0 x 4.0

.= 20.0 m^2

(ii) Size of each Floor tile = 12" x 12"

.= $144''^2$

$144''^2$ = ? M^2

therefore 1 m = 39.37"

.= $144''^2/39.37^2$

.= 0.0929 m^2

(iii) no. of floor tiles required = Total floor area / area of each tile

.= 20.0/0.0929

.= 215.28 or approximately equal to 216 Tiles

Over-Head Water Tank Calculation & Problem

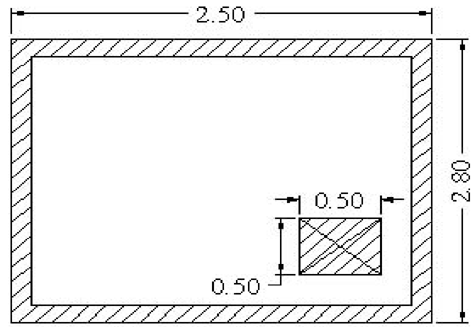
Problem-1:

For a given problem find

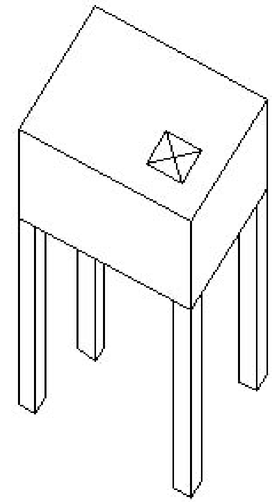
a volume of concrete

b shuttering area

c volume of water in litres.

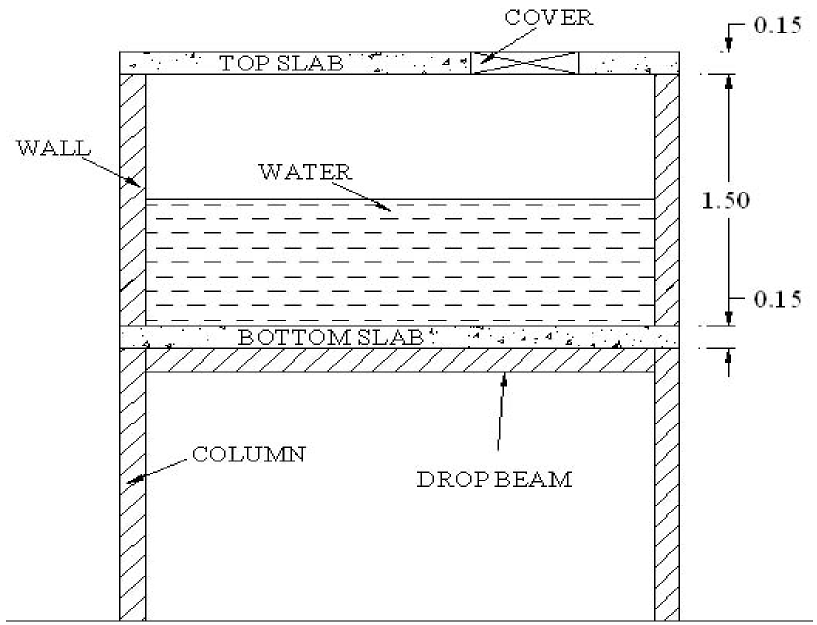


PLAN OF OVER-HEAD WATER TANK



OVER-HEAD WATER TANK

thickness of wall = 0.20m



SECTION OF OVER-HEAD WATER TANK

Solution:

(i) Bottom Slab :

1 Volume of Concrete = L x B x D
.= 2.50 x 2.80 x 0.15
.= 1.05 m^3

2 Shuttering area = (L+B) x 2 x D + L x B
.= (2.50 + 2.80) x 2 x 0.15 + 2.50 x 2.80
.= 8.59 m^2

(ii) Top Slab :

1 Volume of Concrete = L x B x D
.= 2.50 x 2.80 x 0.15
.= 1.05 m^3

2 Shuttering area = (L+B) x 2 x D + l x b(internal dimension) + (L+B) x 2 x D (cover dimension)
.= (2.50 + 2.80) x 2 x 0.15 + 2.10 x 2.40 + (0.50 + 0.50) x 2 x 0.15
.= 6.93 m^2

(iii) wall along horizontal axis:

1 Volume of Concrete = L x B x D x no.s
.= 2.50 x 0.20 x 1.50 x 2
.= 1.50 m^3

2 Shuttering area = L x D x 2 x no.s
.= 2.50 x 1.50 x 2 x 2
.= 15.0 m^2

(iii) wall along vertical axis:

1 Volume of Concrete = L x B x D x no.s
.= 2.40 x 0.20 x 1.50 x 2
.= 1.44 m^3

2 Shuttering area = L x D x 2 x no.s

.= 2.40 x 1.50 x 2 x 2

.= 14.40 m^2

(iv) Total Volume of Concrete = 1.05 + 1.05 + 1.50 + 1.44 = 5.04 m^3

(v) Total Shuttering area = 8.59 + 6.93 + 15.0 + 14.40 = 44.92 m^2

Water calculations :

Internal volume of sump = L x B x D

.= 2.10 x 2.40 x 1.50

.= 7.56 m^3

According to Standards : 1 m^3 = 1000 Litres and 1 ft^3 = 28.34 litres

1m3 = 1000 litres

7.56 m3 = ? Litres

.= 7.56 x 1000

.= 7560 litres

each water tanker (truck) has capacity of 5000 litres

therefore no. of water tanker required = 7560/5000

.= 1.512 or approximately equal to 2 tankers

Plastering with Machine