GOVERNMENT POLYTECHNIC,BALASORE

CONSTRUCTION WORK PRACTICE & MS PROJECT LAB MANUAL

CIVIL ENGINEERING DEPARTMENT

DEPARTMENT OF CIVIL ENGINEERING

LAB MANUAL FOR
CONSTRUCTION WORK PRACTICE & MS PROJECT

C O N T E N T S

EXPERIMENT-1

AIM OF THE EXPERIMENT

To study about various types of construction tools used in brick and stone masonry.

APPARATUS REQUIRED

Various types of tools discussed as below:-

1) Trowel: - To lift and spread mortar

2) Spirit level: - To check the horizontality of the work.

3) Plumb rule & Bob: - To check the verticality of the work.

4) Square: - To set right angles.

5) Line and Pins: - To maintain the alignment.

6) Spall hammer:- To dress the stores in the quarry.

7) Scrabbling hammer: - To remove the irregular bushings.

8) Mash hammer:

9) Waller's hammer: — To dress the stones.

10) Club hammer: - To strike the narrow-headed chisels.

11) Mallet: - To strike the mallet-headed chisels.

12) Dummy: - Similar to mallet but used for carving work.

13) Axe:-

14) Ordinary pick:-

15) Serrated pick: -

16) Scrabbling pick:-

17) Crow bar:- — To dress roughly and to split the stones in the quarry.

TROWEL

SPIRIT LEVEL

PLUMB BOB

SQUARE

LINE & PIN

SCABLLING HAMMER

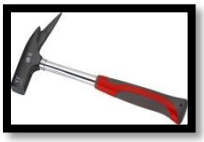
MASH HAMMER

WALLER'S HAMMER

CLUB HAMMER

MALLET

AXE



SCRABLING PICK

PITCHING TOOL

PUNCH & POINT

GAUGE

WOOD CHISEL

18) Pitching tool: - To make the stones of required size.

19) Punch:- To dress roughly the stones.

20) Point:- To dress roughly the hard stones.

21) Gauge:- To dress the stones for cornices string courses etc.

22) Broad tool or nickel:- To form tone chisel lines in the surfaces of stones.

23) Boaster:- To cut the soft stones.

24) Wood handled chisel:- To dress the soft stones.

25) Claw chisel:

26) Tooth chisel:

To dress the hard stones.

27) Jumper:- To bore holes for blasting purposes in a quarry.

28) Drag:- To make a level surface.

29) Gad:- To split the stones.

30) Hand saw:- To cut the soft stones.

31) Cross cut saw:- To cut the hard stones.

32) Frame saw:- To cut the large blocks of stones.

33) Bevel:- To set out angles.

CONCLUSION

From the above study I learn the above tools which are used in brick and stone masonry construction.

EXPERIMENT-2

AIM OF THE EXPERIMENT

Layout plan of a building.

APPARATUS REQUIRED

- Tape/Chain
- Tri-square
- Arrow
- Peg
- Thread/Nail

MATERIAL REQUIRED

- Lime
- Small amount of sand

THEORY

To arrange in a pattern or design to plan something dry showing its every parts is known as layout. Layout plan of a building means the arrangement of different parts of building i.e., rooms, kitchen, toilet etc. in an synchronize position.

PROCEDURE

- Two no. s offsets are taken from the existing building for making parallel.
- The required size of the room is 4m*5m.
- Now the line AB is taken by the help of chain. It measured as 4m.
- By the help of tri-square BC line is plotted and measured as 5m.
- Now the corner AC is measured and it should be 6.40m.
- Each side of the plotted line marked by the given nail and thread. Arrows are also provided on corner point.
- Again, the remaining sides i.e., CD & DA are plotted, so as corner BD.
- After plotting the building, the sides are made vibrant by using the mixture of lime and sand.
- The corners of the plotted lines are marked by multiplication sign so as to indicate the pillar.

CONCLUSION

From the above experiment I learned to determine the layout plan of a single room building.

EXPERIMENT-3

AIM OF THE EXPERIMENT

Construction of 1 & 1.5 brick thick walls in English Bond in mud mortar.

APPARATUS REQUIRED

1. No. of bricks
2. Plumb bob
3. Tray, trowel, bucket
4. Line and pins

MATERIAL REQUIRED

1. Mud
2. Sand
3. Water

THEORY

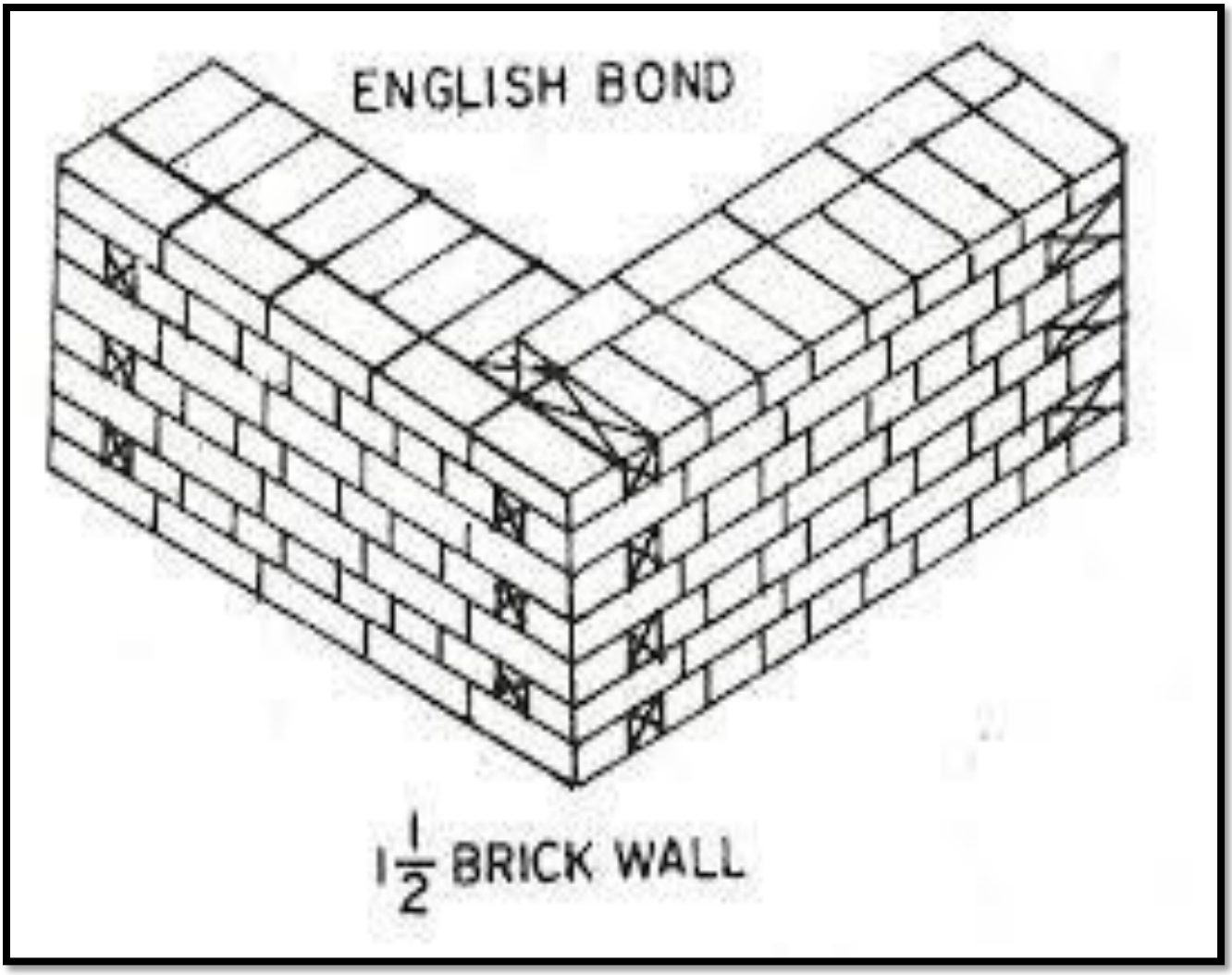
- A brick construction pattern with alternate courses of brick laid as stretchers and headers forms an English Bond.
- A brick construction pattern that consist of alternate header and stretchers for each courses is known as Flemish Bond.

PROCEDURE

- At first mud is collected from near by site and mud mortar is prepared by mixing sand and water with it using tray and trowel.
- The bricks are laid in stretcher course and the mortar is applied in two consecutive bricks to make a joint.
- After applying mortar in allover the bricks next courses of header of bricks are placed and the process is continued.
- A plumb bob is used to check the verticality of the work.
- The bricks are so placed that each course of bricks consist of header and stretcher alternately to a certain height to construct a brick wall.
- A queen closer is placed near the header or stretcher course to give more joint strength.
- This process is repeated for 1.5 thick brick wall to a certain height to get a wall using mud mortar.

CONCLUSION

From the above experiment, I constructed 1 & 1.5 thick brick wall by using mud mortar.



EXPERIMENT-4

AIM OF THE EXPERIMENT

To construct a 1 & 1.5 brick thick pillar by using mud mortar.

APPARATUS REQUIRED

1. No. of bricks
2. Plumb bob
3. Tray, trowel, bucket

MATERIAL REQUIRED

1. Mud
2. Sand
3. Water

PROCEDURE

- At first mud mortar is prepared by mixing mud, sand and required quantity of water by using tray and trowel.
- Two numbers of brick are placed in stretcher length at a suitable place where the pillar is to be constructed.
- Mortar should be applied in between two consecutive bricks to make a joint in between them.
- After applying the mortar allover the bricks, another two no. s of brick placed above the stretcher length brick in header position to give a certain size of the pillar.
- Again the mortar is placed in between the joints as well as the surface of the brick.
- This process is repeated to a certain height and the plumb bob is used to check the verticality of the work.
- Thus the process is done for both 1 & 1..5 thick brick pillar to a certain height to construct a brick pillar.

CONCLUSION

By doing this experiment, I constructed 1 & 1.5 brick thick pillar by using mud mortar.

EXPERIMENT-5

AIM OF THE EXPERIMENT

Bar bending and fabrication of reinforcement for a beam.

APPARATUS REQUIRED

For 4m clear span

1. 16 mm dia. Bar
2. 8 mm dia. Bar
3. No. of stirrups
4. Wooden block for fabrication / wooden ply & battens.

THEORY

Bar bending schedule for detailed beam

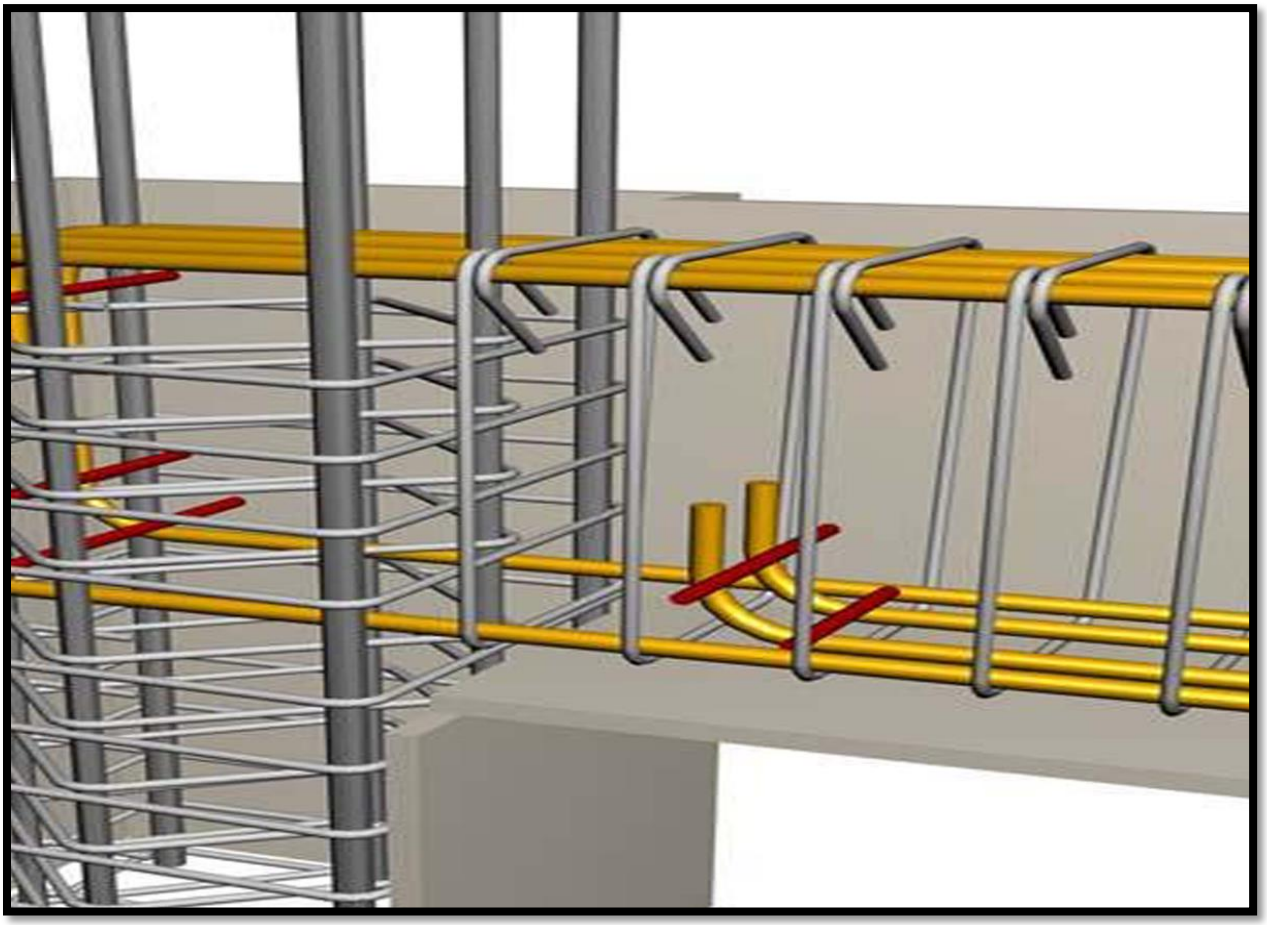
- For a beam has the clear span of 6m consists of two layers of the bottom, where 2 no. s of 20 mm dia. bar and one layer of the top where 2 no. s of 12 mm dia. bar is required.
- It consists of 3 zones where zone 1,3 has stirrups of 150 mm spacing & zone 2 has stirrups of 200 mm spacing.
- For singly reinforced beams, two additional bars are provided in compression face of the beam so that stirrups can be tied with bar.

PROCEDURE

- For 4m length and 2m width the main bar required is D16 and stirrups is D8
- The bars are placed in there section with the middle section having bent-up bar.
- The spacing of the bar is equal to the diameter of the bar.
- The height (H) of the beam should be 4/12=0.33m is equal to 30 cm.
- Now fabrication will be done by using wooden ply and battens for concreting.
- After mixing the concrete is poured to the designed structure for beam.

CONCLUSION

Thus the above procedure I can construct bar bending and fabrication of reinforcement of a beam.



EXPERIMENT-6

AIM OF THE EXPERIMENT

Bar bending and fabrication of reinforcement for a slab.

APPARATUS REQUIRED

1. Required dia. of bars
2. Required dia. of stirrup
3. Instrument required for bar bending/rebar
4. Wooden or steel fabrication

THEORY

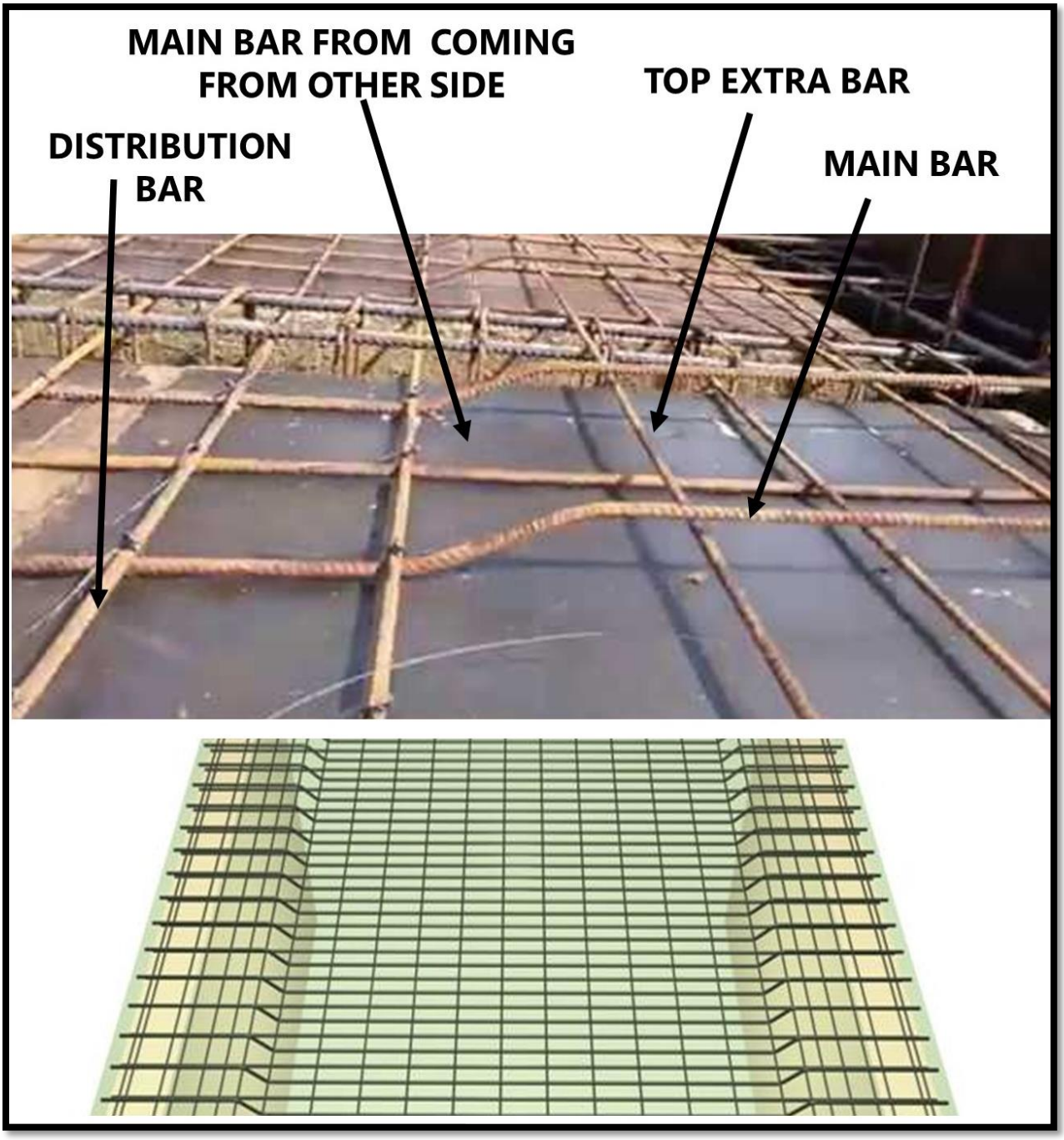
- In one way slab main reinforcement is parallel to shorter direction and the reinforcement parallel to longer direction is called distribution steel.
- In two way slab main reinforcement is provided along both direction.
- minimum reinforcement is 0.12% for HYSD bars and 0.15% for mild steel bars.

PROCEDURE

- Conventional concrete slabs are square in shape and have a length of 4m.
- Reinforcement is provided in conventional slab and the bars which are set in horizontal are called main reinforcement bars and bars which are set vertical are called distribution bars.
- Before provision of bars for slab centering is done.
- Centering is the formwork usually made from wood, that is used to support the masonry, before masonry is placed and before it has gained sufficient strength to support its own weight.
- Now reinforcement should be placed low enough so saw cutting doesn't cut the reinforcement.
- For welded wire reinforcement, the wire reinforcement institute recommends steel placement 2 inches below the surface or within the upper third of the slab thickness, whichever is closed to the surface.
- The bars are setup accordingly and bent up bars also provided in the required section to create a reinforcement of a slab.

CONCLUSION

From the above procedure I learn to construct the bar bending & fabrication of reinforcement for a slab.



EXPERIMENT-7

AIM OF THE EXPERIMENT

Bar bending and fabrication of reinforcement for a lintel with chajja.

APPARATUS REQUIRED

1. Required dia. of main bar
2. Steels for main bar
3. No. of stirrups
4. Wooden or steel fabrication

THEORY

- The minimum bearing for lintels onto brickwork shall be 150 mm.
- The minimum bearing for lintels onto blockwork shall be 300 mm.
- Lintels shall bear on whole not cut blocks.
- Lintels are to be bedded in mortar similar to that used for laying the units.

PROCEDURE

- For the bar bending of lintels first calculate length of one main bar.

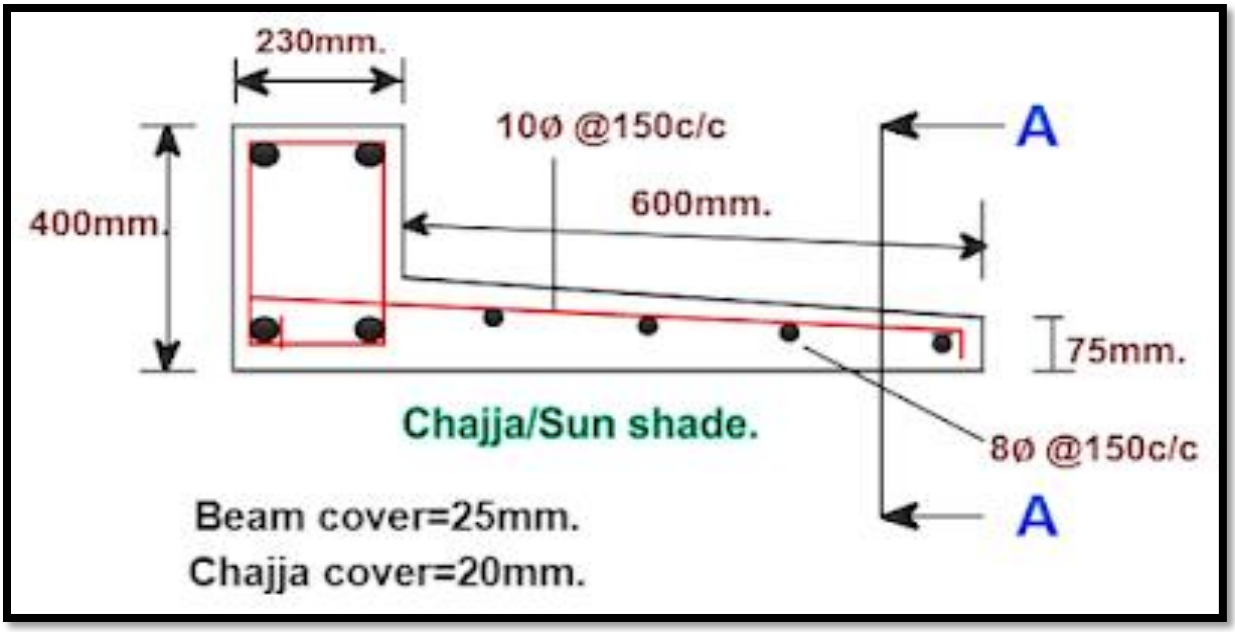
Length of one bar = {(length of door opening) + (2×bearing length)} – clear cover for both sides

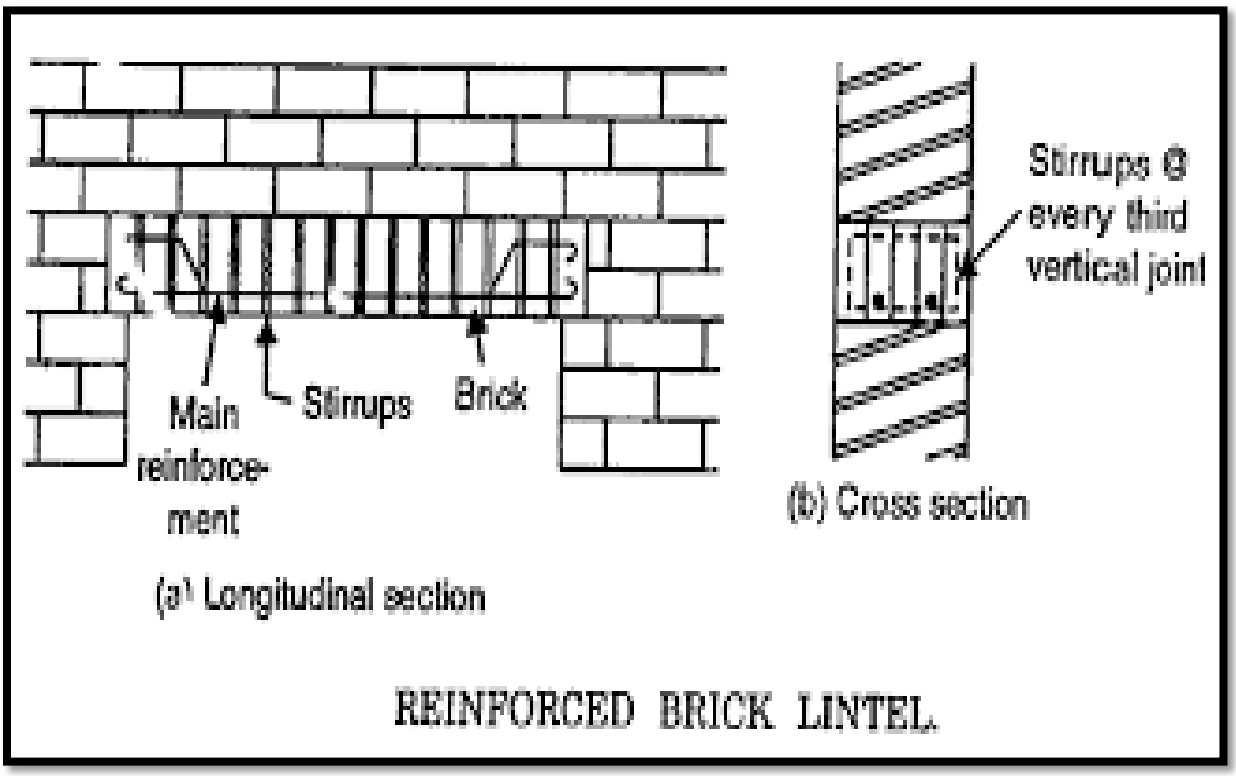
- Then calculate the total length of main bars i.e. No. of bars × Its length.
- Calculate weight of steel for main bars i.e.

  $Weight\ of\ steel\ for\ 10\ mm\ bar = \frac{D^2L}{162}$
- Calculate length of one stirrups.
  Cutting length of stirrups
  =(2 × depth distance) + (2 × width depth) + hooks length – bend
- Calculate no. of stirrups
- $no.of\ stirrups = \left(\frac{total\ length\ of\ lintel}{distance\ between\ stirrups}\right) + 1$
- Then calculate weight of steel for stirrups$= \frac{D^2L}{162}$

CONCLUSION

By following the above procedure we can able to construct a lintel with chajja.





REINFORCED BRICK LINTEL

EXPERIMENT-8

AIM OF THE EXPERIMENT

Bar bending and fabrication of reinforcement for column.

APPARATUS REQUIRED

1. 6 no. s of 20 mm dia. bar
2. 8 mm stirrup
3. Instrument required for bar bending
4. Wooden or steel fabrication

THEORY

For construction of column following data are needed.

- Slab thickness – 125 mm & 100 mm
- Floor height – 3000 mm or 3 m
- Ground floor level – 3300 mm
- Footing height – 300 mm
- Development length – 50 d
- Column has 6 no. of 20 mm dia. bars
- 8 mm stirrup @ 150 mm c/c
- Footing clear cover – 40 mm
- Slab clear cover – 25 mm

PROCEDURE

Following steps are involved in column construction

Step 1 - Find the length of vertical bar.

- Length of vertical bar = Development length (Ld)+Height of ground level +Floor height (1,2,3) + slab thickness + Overlap length
  =(50×20)+3300+(3×3300)+(3×125)+100+(50×20)
  =14775mm or 14.78 m
- Now we know the length of one vertical bar.

Step 2 - Find out lapping

As we know that lapping length required is 50 d

=50 ×dia. of bar =50×20=1000mm

- We know that each bar is 12.25m or 40 ft. length.

- Total length of vertical bar = 14.78m is ore than 12.25m, so each rod will be lapped at least once to attain the required length.
- So we have added the lapping length with the total length i.e. 14.78+1=15.78m

Step 3 - Cutting length of stirrups

Length of one hook=9d

Cutting length of stirrups=Perimeter of stirrups + no. of bends +no. of hooks

=2(a+b)+3 no.s of 90^0 bends+2 no.sof hooks

=2(500+200)+(3×2d)+(2×9d)

=2×700+3×2×20+2×9×20 = 1880 mm

Cutting length of stirrups = 1880 mm

Step 4 - Number of stirrups

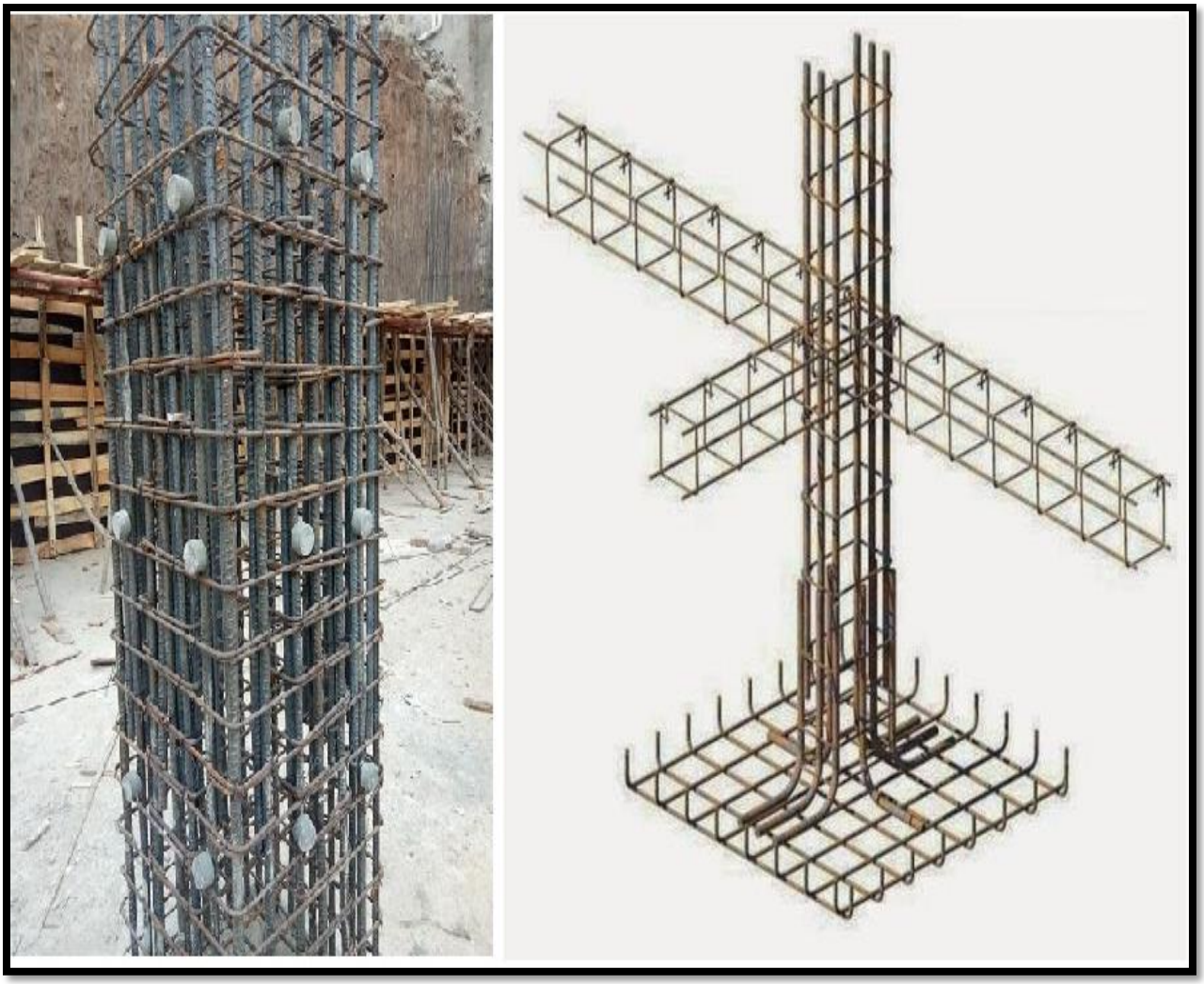
$$no.of\ stirrups = \left(\frac{total\ length\ of\ lintel}{distance\ between\ stirrups}\right) + 1$$

Step 5 - Bar bending schedule

	Dia. of bar	No. s	Cutting length	Total length
Vertical bar	20 mm	6	14.7 m	85.2 m
Stirrups bar	8 mm	85	1.88 m	159.8 m

CONCLUSION

From the above experiment we learn the bar bending schedule for reinforcement of column.



EXPERIMENT-9

AIM OF THE EXPERIMENT

Conducting a non destructive compressive strength test on concrete beam using rebound hammer.

APPARATUS REQUIRED

1. Rebound hammer
2. Plunger
3. Ingredient for concrete

THEORY

- Rebound hammer test is a non-destructive testing method of concrete which provided a convenient and rapid indication of the compressive strength of the concrete.
- When the plunger of rebound hammer is pressed against the surface of concrete a spring controlled mass with a constant energy is made to hit concrete surface to rebound back.
- The extent of rebound, which is a measure of surface hardness is measured on a graduated scale.
- This measured value is designated as rebound number. A concrete with low strength and low stiffness will absorb more energy to yield in a lower rebound value.

PROCEDURE

- For rebound hammer test on concrete structure starts with calibration of the rebound hammer.
- For this the rebound hammer is tested against the test made of steel having Brinell hardness number of about 5000 N/MM^2
- After rebound test is done the rebound hammer is held at right angles to the surface of the concrete structure for taking the reading.
- The test thus can be conducted horizontally on vertical surface and vertically upward or downward in horizontally surface.
- If the rebound hammer is held at intermediate angle, the rebound number will be different for the same concrete.
- The impact energy required for the rebound hammer is different for different application.

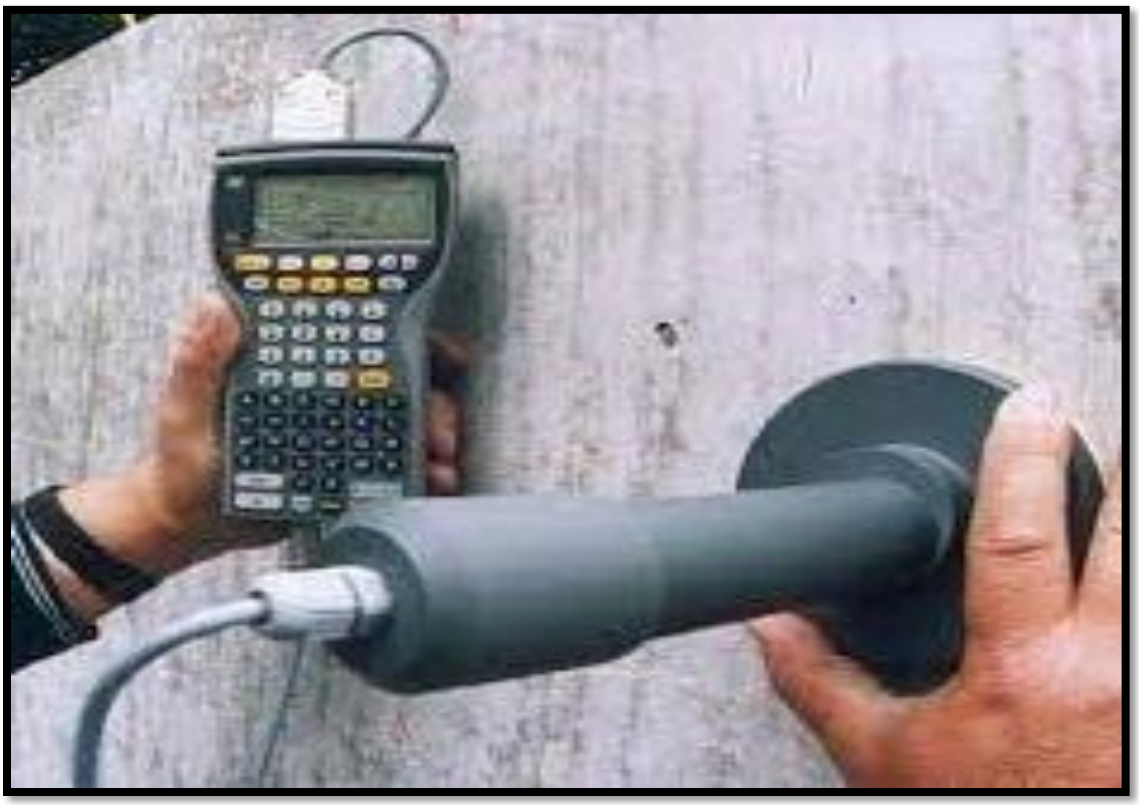
TABULATION

Impact energy for rebound hammer for different application.

Sl. No.	Application	Approximate impact energy In mm
1	For normal weight Concrete for light weight concrete	2.25
2	Small and impact resistive concrete parts for mass concrete testing	0.75
3	In roads, hydraulic structures and pavements	30.00

CONCLUSION

From the above experiment I learned to conducting a non destructive compressive strength test on concrete beam.



EXPERIMENT-10

AIM OF THE EXPERIMENT

Study of pipe joints and plumbing fixtures.

THEORY

PLUMBING JOINTS

- Pipes are connected with the help of joints. A variety of joints are used in an assembly of pipes.
- Connecting two or more pipes together is called a fitting. Joints are also used for multiple pipe connecting and are an important component of plumbing system.

PIPE JOINTS

- Pipes are connected with the help of joints. A variety of joints are used in an assembly of pipes.
- Various types of joints could be used for multiple pipe connection. The pipe joint fitted can easily sustain the pressure created in the pipe.

TYPES OF PIPE JOINT

Various types of pipe joints are as follows

1. Threaded joint
2. Welded joint
3. Brazed joint
4. Soldered joint
5. Grooved joint
6. Flanged joint
7. Compression joint

THREADED JOINT

- When pipes are joined by screwing in threads which are provided in the pipe, it is called a threaded joint.
- Threaded joints are used from 6 mm dia. to 300 mm dia. pipes. Threads are also made in various pipes like PVC, CI pipes, Copper pipes and GI pipes etc.

WELDED JOINT

It is one of the most common methods of joining pipes used in large infrastructure like Commercial, Institutional and Industrial systems.

BRAZED JOINT

When pipes are joined with the help of molten filler material at above 840^0 C, it is called brazing. Brazing is done for connecting copper pipes or copper alloy pipes.

SOLDERED JOINT

Soldering and Brazing are similar activities. In soldering the filler material melts below 840^0 . During soldering flux or metal joining material is used to prevent oxidation due to flame.

GROOVED JOINT

When two pipes are joined together by making grooves at the end of pipes with the help of sockets or coupling, Such joints are called grooved joints.

FLANGED JOINT

This joint is commonly used for joining pipes in plumbing stations . Filter plants, hydraulic laboratories and boiler houses. These joints are preferred due to easy process of assembly and disassembly.

COMPRESSION JOINT

These are applied to join the pipe without any preparation. The cost of installation of these joints is very economical. The pipes having plain ends are joined by fixing fittings at their ends, and such joints are called compression joint.

VALVES

- For proper functioning of the pipe line valves made of iron or brass are used in the water supply mains.
- Valves stop or control the flow of fluid like liquid, gas, condensate etc. These are classified according to their usage like isolation, throttling and non-return corrector.

DIFFERENT TYPES OF VALVES ARE

1. Sluice valve
2. Scour valve
3. Air valve

4. Gate valve
5. Parallel slide valve
6. Globe valve
7. Angle valve
8. Check valve
9. Ferrule
10. Foot valve
11. Float valve

CONCLUSION

From the above description I learned about various types of pipe joints and plumbing fixtures.