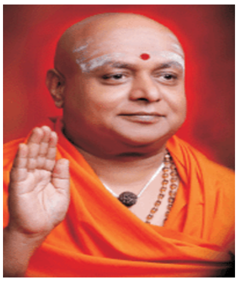

|| Jai Sri Gurudev||

ADICHUNCHANAGIRI UNIVERSITY

BGS INSTITUTE OF TECHNOLOGY

Bellur Cross, Nagamangala Taluk, Mandya District, Karnataka

LABORATORY MANUAL

CONSTRUCTION PRACTICE

(18CVL58)

(As per ACU Syllabus)

Prepared By

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Construction Practice Lab (18CVL58)

List of Equipments Required

Equipment Name
Trowel
Mortar pans
Plumb bob
Shovel
Spades
Pick axes
Bar bending table
Wire brush
Spirit level
Tri square
Bar bending tools
Plumbing tools kit
Pipe wrench
Plumbing and sanitary fixtures, fittings
Threading die set
Model of door and window with fastenings
Brushes and rollers of different sizes
Sand paper
Scrappers
Mixing pan
Putty blades

Experiment No. 1 **Date:**

Study of Tools used in Construction

Bolster

Bolster is like chisel but it is used to cut bricks. Its cutting edge is wider than the width of brick. It is useful for accurate cutting of bricks.

Boning Rods

Boning rods are made of wood and they are T shape. They are used to level the excavated trench throughout its length. Minimum three boning rods are used to level the trench surface.

Brick Hammer

Brick hammer is used to cut the bricks and also used to push the bricks if they come out of the course line.

Bump Cutter

Bump cutter is used to level the concrete surfaces like concrete floors, foundations etc. It is also called screed.

Chain Lewis and Pin Lewis

Chain lewis and pin lewis are two different tools which are used to lift heavy stones especially in the construction of stone masonry.

Chisel

Chisel is generally used in wood work and this must be useful to remove the concrete bumps or excess concrete in hardened surface.

Circular Saw

Circular saw used to cut the wood boards, frames etc. It is used when accurate cutting is required in less time. It is safer than hand saw.

Concrete Mixer

Concrete mixer is machine which mixes the ingredients water, fine aggregate, coarse aggregate and cement to deliver the perfectly mixed concrete.

Crowbar

Crowbar is used for digging the ground and to remove the roots of trees in the ground, nails etc.

Digging Bar

Digging bar is solid metal rod with pin shape at the bottom. It is also used to dig the hard surfaces of ground.

Drill Machine

Drill machine is used to make holes in the walls, slabs, doors, window frames etc.

End Frames

Their use is similar to the line and pins. But instead of pins, L shaped frames are used at the end of thread which hold the brick work effectively and level the alignment accurately.

Float

Float is made of wood which is used to smoothen the plastered concrete surface. It contains handle on its top and smooth wooden surface on its bottom.

Gloves

Gloves are required to prevent the hands from direct contact with cement, paints etc. and to avoid injury while using machines, tools etc.

Hand Saw

Hand saw is used to cut the wood materials like doors, windows, slab panels etc.

Head Pan

Head pan is made of iron, which is used to lift the excavated soil or cement, or concrete to the working site etc. it is more commonly used in construction sites.

Hoe

Hoe is also used to excavate the soil but in this case the metal plate is provided with acute angle to the wooden handle.

Jack Plane

Jack plane is used in the wood work to smoothen the surface of doors and windows etc.

Ladder

Ladder is also required in construction works. To check slab work, to transport material to the higher floors, to paint the walls etc.

Line and Pins

Line and pins consists a thread whose ends are connected with two solid metal rods with pin points. It is used to level the alignment of brick course while brick laying.

Mason’s Square

Mason’s square is used to achieve perfect right angle at the corner of masonry wall. It is “L” shape. First course is laid properly using Mason’s square then based on the first, remaining layers of bricks are set out.

Measuring Box

Measuring box is used to measure the quantity of sand and aggregate used for making concrete. It is of fixed dimensions so, aggregate need not to be weighted for every time. The general dimensions of a measuring box are 300mm X 300mm X 400mm (length x width x depth).

The volume of measuring box is generally 1 Cubic Feet, which makes it easy to measure concrete ratio or mortar ratio.

Measuring Tape

Measuring tape is used to check the thickness, length, widths of masonry walls, foundation beds, excavated trenches etc.

Measuring Wheel

Measuring wheel is used to measure the distances or lengths. It contains a wheel of known diameter, which record the no.of complete revolutions from which the distance can be measured. It makes the work easier.

Pick Axe

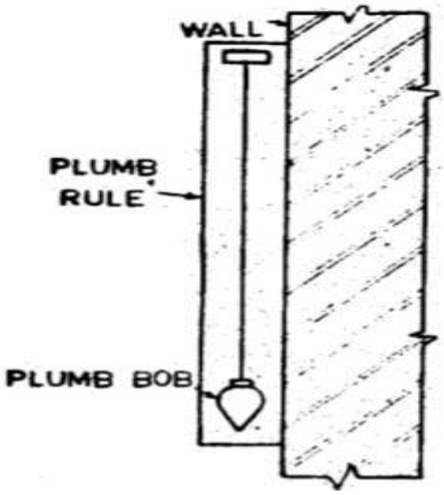
Pick axe is used to excavate the soil. It is more suitable for hard soil which is quite difficult to dig with spade or hoe.

Plumb Bob

Plumb bob is used to check the verticality of structures. It contains a solid metal bob connected to the end of a thread. It is also used inn surveying to level the instrument position.

Plumb Rule

Plumb rule is used to check the vertical line of wall whether it is perfect vertical or not. It contains a straight wood board with uniform edges. On its center a groove is provided in which plumb bob is situated. When the rule is placed vertically with the wall the plumb bob should be in the groove line otherwise the wall will not be vertical.



Polisher

Polisher is used to smoothen the surface of tiles, wood works etc. The smoothening makes them shine and the process is called polishing.

Putty Knife

Putty knife is used level the putty finishing and also used to reduce the thickness of finish when it is more thick.

Earth Rammer

After the excavation of ground, the lower surface may be uneven. To level the surface earth rammer is used. It contains big square shaped block at its end with which the ground is leveled.

Sand Screen Machine

The fine aggregate used in concrete should not contain impurities or coarse particles. The sand screen machine is used to screen the sand or fine aggregate before mixing it with concrete. This screen is also used for screening fine sand for plastering work.

Scratchers

Plastering of a surface is carried out layer wise. Minimum 2 coats are necessary for plastering. To provide the good bond between the coats, bottom layer is scratched with a tool called scratchers.

Sledge Hammer

Sledge hammer is used when the ground is hard and contains rock layers. A large weighted metal head is provided at the wooden handle with which hard layers can be cracked, which makes easy for digging.

Spade

Spade is used to dig the soil for foundation trenches etc. It contains metal plate at the end of long wooden handle.

Spirit Level

Spirit level is made of wood or hard plastic with bubble tube in the middle. The bubble tube is filled with alcohol partially. So, the air bubble is formed in it.

Spirit level is used in brick masonry to check the level of the surface. The spirit level is placed on surface and bubble is checked. The surface is leveled when the bubble in the tube settles at middle of tube.

Straight Edge Brushes

Straight edge brushes are used to provide finishing to the plastered surface especially at corners and edges of walls.

Tile Cutter

Tile cutter is used to cut the tiles. Sometimes, normal tile size is larger than required at the corners where floor meets the wall in that case tile cutter is useful.

Trowel

Trowel is used to lift and apply the cement mortar in small quantities. It is made of steel and wooden handle is provided for holding. The ends of trowel may be pointed or bull nosed.

Vibrator

Vibrator is used to compact the concrete by this the air gaps are filled with water and workability varies without adding water to it.

Wedge

Wedge is a small hard metal blade which is used to cut the rock surfaces with the help of sledge hammer.

Wheel Barrow

Wheel barrow is used to transport bulk weights of materials like cement, sand, concrete mix etc. it contains one or two wheels at its front and two handles at its back which are used to push the wheel barrow.

SANITARY FIXTURES

P TRAP **INDIAN TOILET PAN** **FLOOR TRAP**

SPRAY GUN

WASH BASIN

SHOWER

MIXER TAP

TRAP

- **PVC pipe:** Poly Vinyl Chloride pipe used for plumbing work.
- **Elbow pipe:** An elbow is installed between two lengths of pipe to allow a change of direction, usually a 90° or 45°.
- **Door elbow pipe:** An elbow is installed between two lengths of pipe to allowa change of direction with door for cleaning.
- **Equal tee:** A pipe tee that has three branches that can change fluid direction. The branch diameter of this tee is same with the main pipe.
- **Tee reducer:** A pipe tee that has three branches that can change fluid direction. The branch diameter of this tee is less with the main pipe.
- **Connector:** A pipe fitting is used in pipe systems to connect straight pipe.
- **Trap:** A trap is a device shaped with a bending pipe path to retain fluid to prevent sewer gases from entering buildings while allowing waste materials to pass through.
- **Sink:** A bowl shaped plumbing fixture used for washing hands and dish washing.
- **Wash basin:** A basin, typically fixed to a wall or on a pedestal, used for washing hands and face.
- **Mixer tap:** A tap through which both hot and cold water can be drawn at the same time by means of separate controls.

Experiment No. 2 **Date:**

Demonstration of safety kits and accessories used in construction site

Construction work is one of the riskiest jobs as it involves machines and humans both. So, construction workers face some common risk factors that can turn out to be life-threatening. When it comes to protecting workers at a job site, personal protective equipment (PPE) is the best option. These PPE guard workers against accidents and prevents injuries. Employers should make sure that all safety measures must be followed. For the construction industry, there are some common safety gears that workers must have:

SAFETY HELMETS OR HARD HATS: If we talk about safety gear for the construction industry, the first equipment that comes in our mind is safety helmet or hard hat. Head injuries are very common in construction work because there is always a risk of falling objects on site. Hard hats protect workers from striking head injuries. Safety helmets are also useful to protect workers from rain, direct sun rays, and electric shock. These headgears are made up of high-density polyethylene that makes them ideal for head protection.

SAFETY SHOES: Many fatal injuries are caused by tripping, slipping and falling. These accidents happen due to unsafe ladders or scaffolds. This is why protective footwear is important. Every worker present at a construction site must wear anti-skid or gripping boots. Wearing steel or composite toe boots can prevent feet injury caused due to falling hammers and needles. Safety shoes offer a high level of protection. Those who work outside at extremely hot and cold temperatures must wear composite toe shoes because these are lighter and do not conduct heat.

EAR MUFFS OR EAR PLUGS: Construction site workers often use tools like chainsaw, jackhammers, and other heavy equipment that make noise. This prolonged noise can damage a worker's hearing capability. To reduce the effect of noise to the ear, workers must use pre-molded or formable earplugs. Acoustic foam-lined ear muffs also work well in this situation.

SAFETY GOGGLES: Eyes are one of the most sensitive body parts; hence they need the utmost safety precautions. Most of the eye injuries occur due to exposure to hazardous particles, gases, molten metals, acids, vapors, and light radiation. So, on the job site, while working with concrete, grinding, cutting, welding, and nailing, workers must wear safety goggles. The safety equipment may vary according to the task. Along with safety glasses, workers should also wear face masks, welding shields, chemical splash goggles, and dust goggles.

SAFETY GLOVES: A majority of construction work requires active use of hands. Hence, it is necessary to take proper precautions to avoid hand injuries like cuts and burns. For this, employers should provide hand gloves to workers. Different types of hand gloves are suitable for different jobs like heavy-duty leather and canvas gloves are suitable to avoid cuts and burns for the construction workers, welding gloves for welders, rubber gloves for workers working with concrete, insulated gloves for electric hazards, and chemical-resistant gloves for working with chemical agents.

Experiment No. 3 **Date:**

Bar bending schedule and fabrication of singly reinforced beam

Aim:- To calculate the quantity of steel required for the given singly reinforced beam.

The following beam details are to be given to conduct the experiment.

Beam size

Clear cover

Wall bearing

Clear span of beam

Main bars details

Anchor bar details

Vertical stirrups details.

Tools required-

Bar bending table, tape, chisel, chalk piece, binding wires, hammer and steel rods.

Important formulae-

1. Total length of straight bar with hook on both sides(L)= l+2xH

   Where H- 9 times of diameter of bar

   l- Effective length – 2 times of Clear cover

2. Total length of straight bar with bent on both sides(L)= l+2Xb

   Where l- Effective length – 2 times of Clear cover

   B- 6 times of diameter of bar

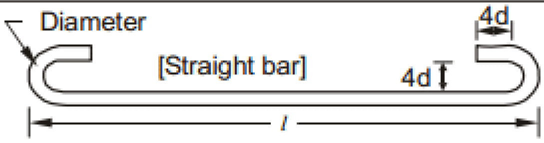
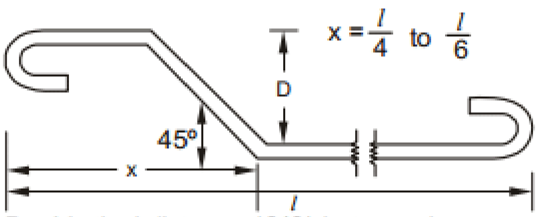
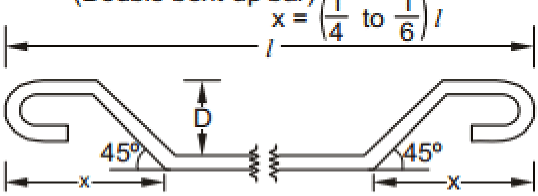
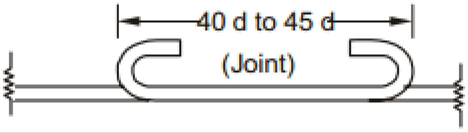
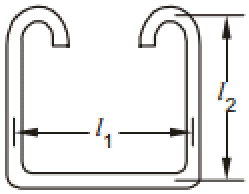
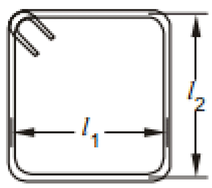
3. Total length of Stirrup with 135 degree hook= 2a+2b+2(12d)

   Where a- Length of stirrup

   b- Width of stirrup

   d- Diameter of stirrup

Figures-

Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.	[Bent-up at one end only]]  D = Vertical distance (C/C) between bars	2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.	(Double bent-up bar) 	2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.	(Overlap of bars) 	2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	$[l_1 + 2l_2 + 28\ d]$
6.		2(12d) = 24 d	$[2(l_1 + l_2) + 24\ d]$

Procedure-

1. Draw the figures showing the beam with reinforcement details.
2. Calculate the length of one bar and number of bars required by using standard formulae and procedures.
3. Prepare the bar bending schedule which contains details of reinforcement of the given structure.
4. Collect the quantity of steel required in bar bending schedule.
5. Check the dimensions in drawings and mark the dimensions on specified bars using tape.
6. Bend the steel bars according to the bar bending schedule using bar bending table and bar bending lever.

Tabular column-

Sl No.	Shape of the bar	Diameter of the bar(mm)	Numbers	Length of one bar(m)	Total length of bar(m)	Weight of bar/ Unit length(Kg/m)	Weight bar(Kg)

Total weight of steel- ________________ Kg

Result-

Total weight of steel- ___________________Kg

Experiment No. 4 **Date:**

Bar bending schedule and fabrication of doubly reinforced beam

Aim:- To calculate the quantity of steel required for the given doubly reinforced beam.

The following beam details are to be given to conduct the experiment.

Beam size

Clear cover

Wall bearing

Clear span of beam

Tension bars details

Compression bar details

Vertical stirrups details.

Tools required-

Bar bending table, tape, chisel, chalk piece, binding wires, hammer and steel rods.

Important formulae-

1. Total length of straight bar with hook on both sides(L)= l+2xH

   Where H- 9 times of diameter of bar

   l- Effective length – 2 times of Clear cover

2. Total length of straight bar with bent on both sides(L)= l+2Xb

   Where l- Effective length – 2 times of Clear cover

   B- 6 times of diameter of bar

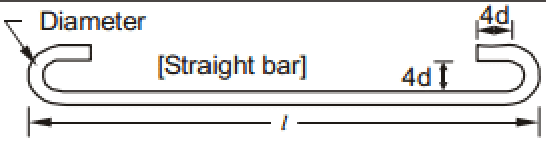
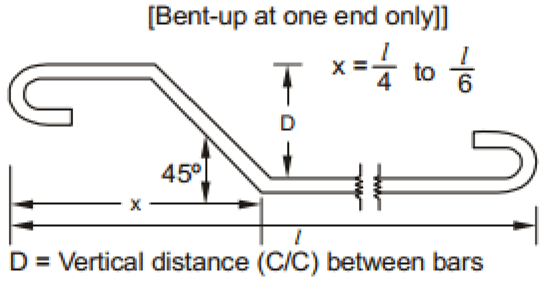
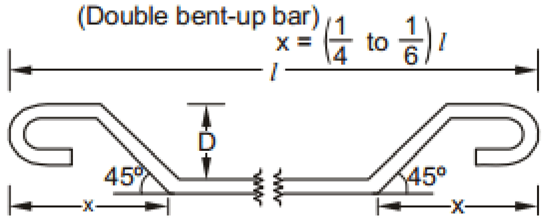
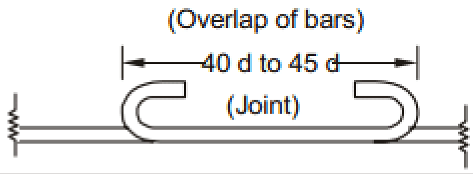
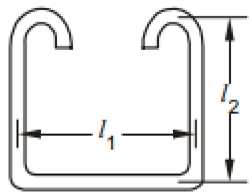
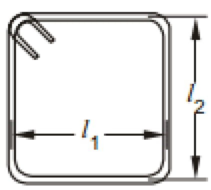
3. Total length of Stirrup with 135 degree hook= 2a+2b+2(12d)

   Where a- Length of stirrup

   b- Width of stirrup

   d- Diameter of stirrup

Figures-

Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.		2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.		2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.		2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	[l_1 + 2l_2 + 28 d]
6.		2(12d) = 24 d	[2(l_1 + l_2) + 24 d]

Procedure-

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2. Calculate the length of one bar and number of bars required by using standard formulae and procedures.
3. Prepare the bar bending schedule which contains details of reinforcement of the given structure.
4. Collect the quantity of steel required in bar bending schedule.
5. Check the dimensions in drawings and mark the dimensions on specified bars using tape.
6. Bend the steel bars according to the bar bending schedule using bar bending table and bar bending lever.

Tabular column-

Sl No.	Shape of the bar	Diameter of the bar(mm)	Numbers	Length of one bar(m)	Total length of bar(m)	Weight of bar/ Unit length(Kg/m)	Weight bar(Kg)

Total weight of steel- ________________ Kg

Result-

Total weight of steel- ___________________Kg

Experiment No. 5 **Date:**

Bar bending schedule and fabrication of one-way slab

<u>Aim</u>:- To calculate the quantity of steel required for the given one way slab.

The following slab details are to be given to conduct the experiment.

Room dimension

Clear cover

Wall bearing

Slab thickness

Reinforcement details in both directions.

<u>Tools required-</u>

Bar bending table, tape, chisel, chalk piece, binding wires, hammer and steel rods.

<u>Important formulae-</u>

1. Total length of straight bar with hook on both sides(L)= l+2xH

   Where H- 9 times of diameter of bar

   l- Effective length – 2 times of Clear cover

2. Total length of straight bar with bent on both sides(L)= l+2Xb

   Where l- Effective length – 2 times of Clear cover

   B- 6 times of diameter of bar

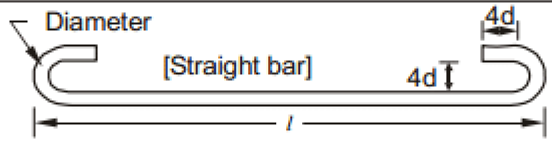
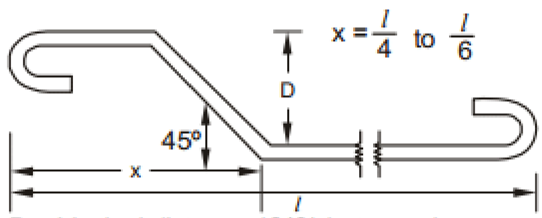
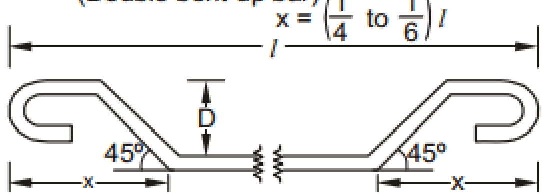
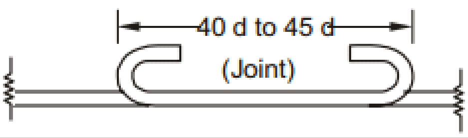
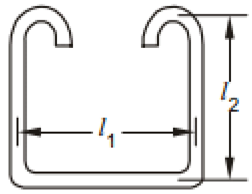
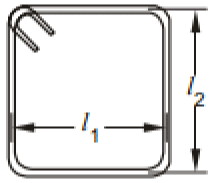
3. Total length of Stirrup with 135 degree hook= 2a+2b+2(12d)

   Where a- Length of stirrup

   b- Width of stirrup

   d- Diameter of stirrup

<u>Figures-</u>

Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.	[Bent-up at one end only]]  D = Vertical distance (C/C) between bars	2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.	(Double bent-up bar) 	2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.	(Overlap of bars) 	2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	[l_1 + 2l_2 + 28 d]
6.		2(12d) = 24 d	[2(l_1 + l_2) + 24 d]

Procedure-

1. Draw the figures showing the beam with reinforcement details.

2. Calculate the length of one bar and number of bars required by using standard formulae and procedures.
3. Prepare the bar bending schedule which contains details of reinforcement of the given structure.
4. Collect the quantity of steel required in bar bending schedule.
5. Check the dimensions in drawings and mark the dimensions on specified bars using tape.
6. Bend the steel bars according to the bar bending schedule using bar bending table and bar bending lever.

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Sl No.	Shape of the bar	Diameter of the bar(mm)	Numbers	Length of one bar(m)	Total length of bar(m)	Weight of bar/ Unit length(Kg/m)	Weight bar(Kg)

Total weight of steel- ________________ Kg

Result-

Total weight of steel- ___________________Kg

Experiment No. 6 **Date:**

Bar bending schedule and fabrication of two-way slab

Aim:- To calculate the quantity of steel required for the given two way slab.

The following slab details are to be given to conduct the experiment.

Room dimension

Clear cover

Wall bearing

Slab thickness

Reinforcement details in both directions.

Tools required-

Bar bending table, tape, chisel, chalk piece, binding wires, hammer and steel rods.

Important formulae-

1. Total length of straight bar with hook on both sides(L)= l+2xH

   Where H- 9 times of diameter of bar

   l- Effective length – 2 times of Clear cover

2. Total length of straight bar with bent on both sides(L)= l+2Xb

   Where l- Effective length – 2 times of Clear cover

   B- 6 times of diameter of bar

3. Total length of Stirrup with 135 degree hook= 2a+2b+2(12d)

   Where a- Length of stirrup

   b- Width of stirrup

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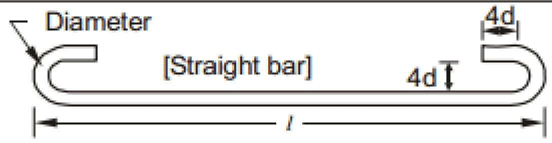
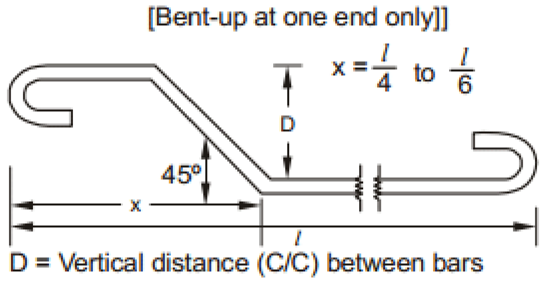
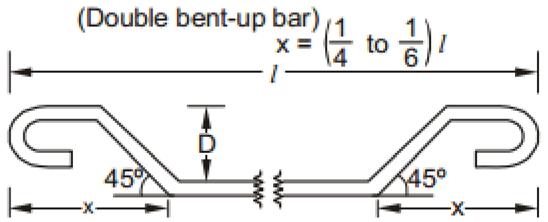
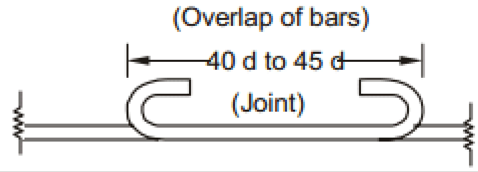
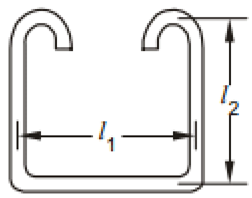
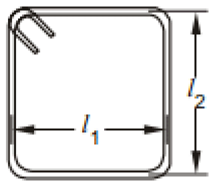
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.		2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.		2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.		2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	$[l_1 + 2l_2 + 28\ d]$
6.		2(12d) = 24 d	$[2(l_1 + l_2) + 24\ d]$

Procedure-

1. Draw the figures showing the beam with reinforcement details.

2. Calculate the length of one bar and number of bars required by using standard formulae and procedures.
3. Prepare the bar bending schedule which contains details of reinforcement of the given structure.
4. Collect the quantity of steel required in bar bending schedule.
5. Check the dimensions in drawings and mark the dimensions on specified bars using tape.
6. Bend the steel bars according to the bar bending schedule using bar bending table and bar bending lever.

Tabular column-

Sl No.	Shape of the bar	Diameter of the bar(mm)	Numbers	Length of one bar(m)	Total length of bar(m)	Weight of bar/ Unit length(Kg/m)	Weight bar(Kg)

Total weight of steel- ________________ Kg

Result-

Total weight of steel- ___________________Kg

Experiment No. 7 **Date:**

Bar bending schedule and fabrication of lintel with chejja

Aim:- To calculate the quantity of steel required for the given lintel with chejja.

The following lintel and chejja details are to be given to conduct the experiment.

Lintel size

Extension of chejja from wall

Chejja thickness

Length of lintel

Reinforcement details of lintel and chejja

Clear cover

Wall bearing

Tools required-

Bar bending table, tape, chisel, chalk piece, binding wires, hammer and steel rods.

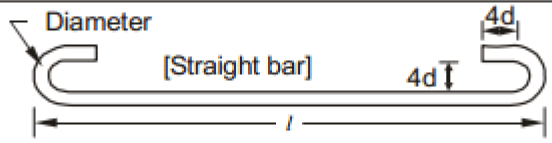
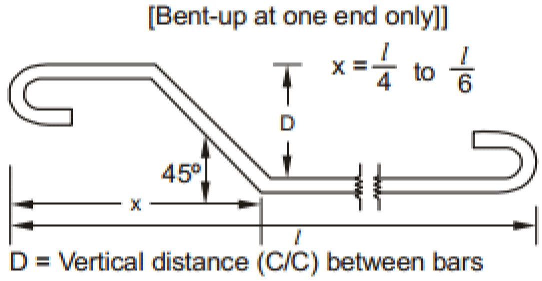
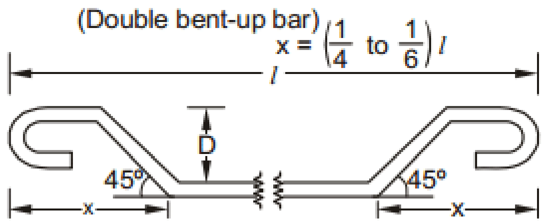
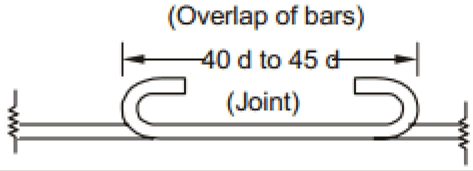
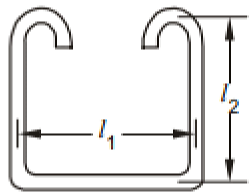
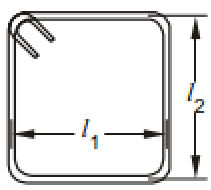
Important formulae-

1. Total length of straight bar with hook on both sides(L)= l+2xH

   Where H- 9 times of diameter of bar
   l- Effective length – 2 times of Clear cover

2. Total length of straight bar with bent on both sides(L)= l+2Xb
   Where l- Effective length – 2 times of Clear cover
   B- 6 times of diameter of bar
3. Total length of Stirrup with 135 degree hook= 2a+2b+2(12d)
   Where a- Length of stirrup
   b- Width of stirrup
   d- Diameter of stirrup

Figures-

Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.		2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.		2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.		2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	[l_1 + 2l_2 + 28 d]
6.		2(12d) = 24 d	[2(l_1 + l_2) + 24 d]

Procedure-

1. Draw the figures showing the beam with reinforcement details.
2. Calculate the length of one bar and number of bars required by using standard formulae and procedures.
3. Prepare the bar bending schedule which contains details of reinforcement of the given structure.
4. Collect the quantity of steel required in bar bending schedule.
5. Check the dimensions in drawings and mark the dimensions on specified bars using tape.
6. Bend the steel bars according to the bar bending schedule using bar bending table and bar bending lever.

Tabular column-

Sl No.	Shape of the bar	Diameter of the bar(mm)	Numbers	Length of one bar(m)	Total length of bar(m)	Weight of bar/ Unit length(Kg/m)	Weight bar(Kg)

Total weight of steel- ________________ Kg

Result-

Total weight of steel- ___________________Kg

Experiment No. 8 **Date:**

Bar bending schedule and fabrication of column with footing

Aim:- To calculate the quantity of steel required for the given column with footing

The following column and footing details are to be given to conduct the experiment.

Lintel size

Extension of chejja from wall

Chejja thickness

Length of lintel

Reinforcement details of lintel and chejja

Clear cover

Wall bearing

Tools required-

Bar bending table, tape, chisel, chalk piece, binding wires, hammer and steel rods.

Important formulae-

1. Total length of straight bar with hook on both sides(L)= l+2xH

   Where H- 9 times of diameter of bar

   l- Effective length – 2 times of Clear cover

2. Total length of straight bar with bent on both sides(L)= l+2Xb

   Where l- Effective length – 2 times of Clear cover

   B- 6 times of diameter of bar

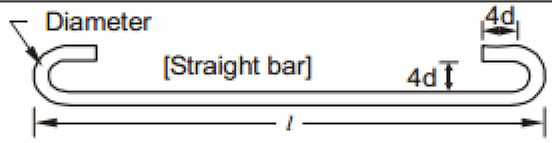
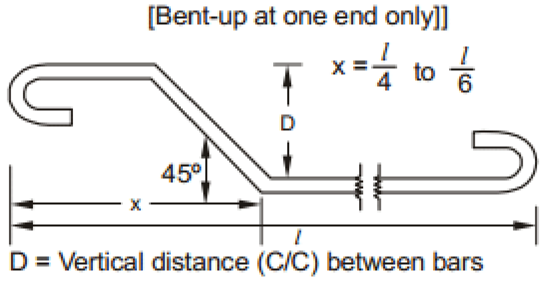
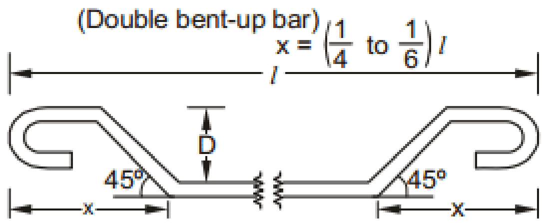
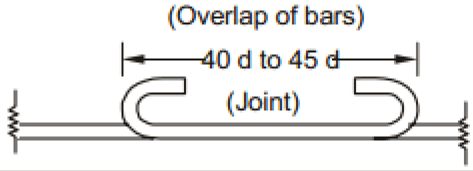
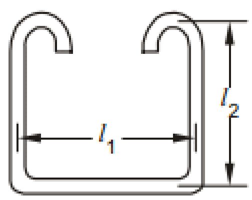
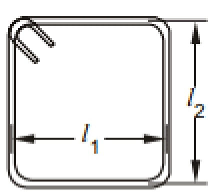
3. Total length of Stirrup with 135 degree hook= 2a+2b+2(12d)

   Where a- Length of stirrup

   b- Width of stirrup

   d- Diameter of stirrup

Figures-

Sl. No.	Details of Bar Shape	Length of Hooks	Total Length of Bar
1.		2[9d] = 18 d (both hooks together)	[l + 18 d]
2.		2[9d] = 18d (both hooks together)	[l + 18 d + 0.42 D]
3.		2[9d] = 18d (as for above cases)	[l + 18 d + 2 × 0.42 D]
4.		2[9d] = 18d	Overlap length at joint = [(40 d to 45 d) + 18 d]
5.		[Here, one hooks height = 14d] 2 × (14d) = 28 d	[l_1 + 2l_2 + 28 d]
6.		2(12d) = 24 d	[2(l_1 + l_2) + 24 d]

Procedure-

1. Draw the figures showing the beam with reinforcement details.

2. Calculate the length of one bar and number of bars required by using standard formulae and procedures.
3. Prepare the bar bending schedule which contains details of reinforcement of the given structure.
4. Collect the quantity of steel required in bar bending schedule.
5. Check the dimensions in drawings and mark the dimensions on specified bars using tape.
6. Bend the steel bars according to the bar bending schedule using bar bending table and bar bending lever.

Tabular column-

Sl No.	Shape of the bar	Diameter of the bar(mm)	Numbers	Length of one bar(m)	Total length of bar(m)	Weight of bar/ Unit length(Kg/m)	Weight bar(Kg)

Total weight of steel- ________________ Kg

Result-

Total weight of steel- ___________________Kg

Experiment No. 9 **Date:**

Setting out center line for a small building, and estimate the quantity of earth work by center line method

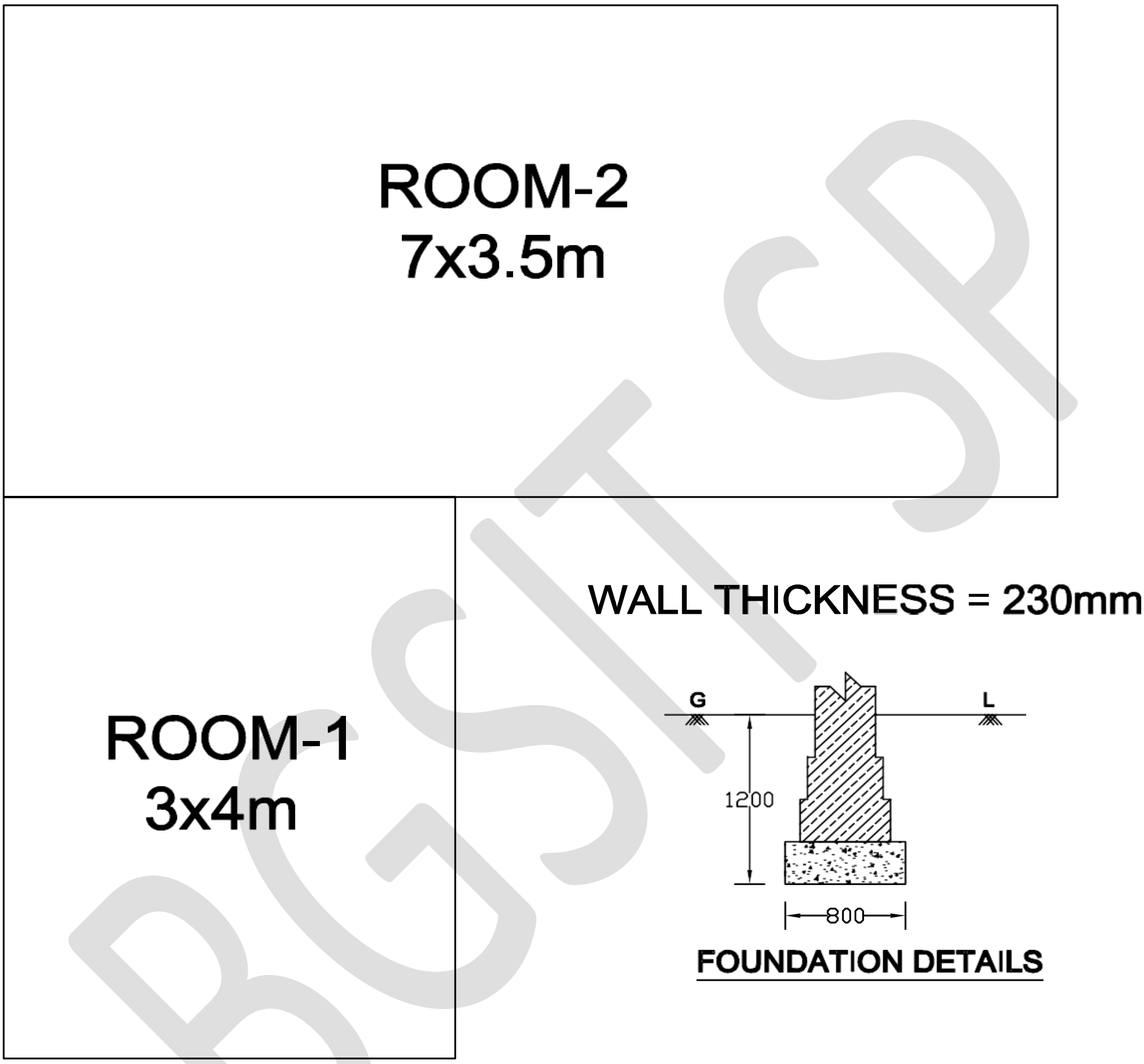
Aim: Setting out center line for a small building and estimating the quantity of earth work by center line method.

Materials and Equipment's: Line string, steel bars, plumb bob, tape, tri square, hammer, tube level and lime powder.

Procedure:

1. Clean central portion of the plot remove the unwanted grass, bushes.
2. Make parallel line at distance of 1.5m from all the four sides of center line of building. Erect steel bars on both ends of these lines.
3. Mark same level on steel bars using tube level and Tie line string at the marked level.
4. By using tape or tri square check the diagonal of building. If any difference in the diagonal adjust by slight shifting.
5. After correct layout of four corners of center line of building start center line marking for every wall. And check the diagonal of each room.
6. After correct layout of center line of building mark the excavation width on ground for all walls by measuring half of excavation width on either side of center line by using tape and lime powder.

SI. No	Particulars	No	L (m)	B (m)	D (m)	Quantity (Cum)	Remarks
01	Earthwork excavation for foundation						


ROOM-2
7x3.5m
ROOM-1
3x4m
WALL THICKNESS = 230mm
G
L
1200
800
FOUNDATION DETAILS

Result-

Experiment No. 10 **Date:**

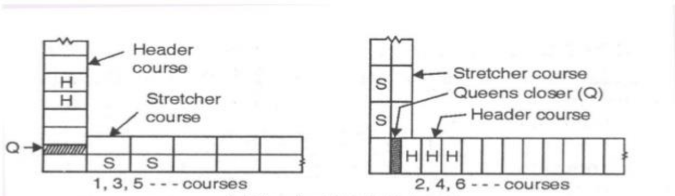
Construct one brick thick wall in English bond to a height of one meter in cement mortar also calculate the quantities

Aim: Construction of one brick thick wall in English bond to a height of one meter in cement mortar and calculation of the quantities.

Materials and Equipment's: line string, tri square, plumb bob, level tube, trowel, measuring tape, spirit level, mortar pan, bucket, spade, sieve, bricks, cement, sand and water.

Figures:

ENGLISH BOND



(a) Plan for 1 brick thick wall

Procedure:

1. Before start of work brick should be immersed in water 24 hours. So that theydon't absorb water from mortar.
2. Bricks should be laid with frog upward.
3. Spread the mortar over an area to be covered by the edges of wall, depth ofmortar spread should be 15mm thick.
4. Lay one brick at the corner press it with hand, the bed joint remains only about10mm thick.
5. Clean the excess mortar from the joint check the level and alignmentsimultaneously. Fill the joints with mortar.
6. Start second coarse by laying the mortar and spreading it over the first coarseand arrange bricks to level and check the alignment of the bricks.
7. The corner constructed should be done with great care by frequently checkingto plumb and

alignment.

8. Repeat the above procedure till the required height.
9. At the end of days work the joints should be clean and finished by raking.

Calculation:

Size of brick = 76x100x230mm

Size of joint = 10mm

Overall size = 86x110x240mm

No of bricks required for 1m^3 = 1 / (86x110x240) = 440.45 ≈ **441** No's.

Mortar required for 1m^3 = 1 – [(0.076x0.1x0.23) x441] = **0.23** m^3

Wall size: length = 0.95m on both directions, thickness = 0.23m, height = 1m.

Volume of brick masonry = [(0.95+0.95) – 0.23] x0.23x1 = **0.384** m^3

No of bricks required = 0.384x441 = 169.3 No's

Add 5% for wastage, = 169.3 + (169.3x5/100) = 177.7 ≈ 178 No's

No of bricks required = 178 No's

Mortar required = 0.23x0.384 = 0.088 m^3

Add 27% from dry to wet volume, = 0.088 + (0.088x27/100) = 0.111 m^{3}Cement mortar in ratio 1: 6

Cement = 0.111 / (1+6) = **0.016** m^3

Sand = 0.016x6 = **0.096** m^3

Density of cement = 1440 kg /m^3

Cement = 1440x0.016 = 23.04 kg.

Density of sand = 1600 kg /m^3

Sand = 1600x0.096 = 153.6 kg.

Result:

Experiment No. 11 **Date:**

Construct one brick thick wall in Flemish bond to a height of one meter in cement mortar also calculate the quantities

Aim: Construction of one brick thick wall in English bond to a height of one meter in cement mortar and calculation of the quantities.

Materials and Equipment's: line string, tri square, plumb bob, level tube, trowel, measuring tape, spirit level, mortar pan, bucket, spade, sieve, bricks, cement, sand and water.

Figures:

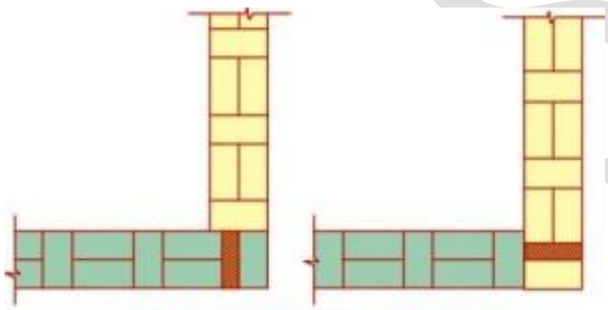


Fig. 2.41 One brick thick flemish bond corner.

Procedure:

1. Before start of work brick should be immersed in water 24 hours. So that theydon't absorb water from mortar.
2. Bricks should be laid with frog upward.
3. Spread the mortar over an area to be covered by the edges of wall, depth ofmortar spread should be 15mm thick.
4. Lay one brick at the corner press it with hand, the bed joint remains only about10mm thick.
5. Clean the excess mortar from the joint check the level and alignmentsimultaneously. Fill the joints with mortar.
6. Start second coarse by laying the mortar and spreading it over the first coarseand arrange bricks to level and check the alignment of the bricks.
7. The corner constructed should be done with great care by frequently checkingto plumb and alignment.
8. Repeat the above procedure till the required height.

9. At the end of days work the joints should be clean and finished by raking.

Calculation:

Size of brick = 76x100x230mm

Size of joint = 10mm

Overall size = 86x110x240mm

No of bricks required for 1m^3 = 1 / (86x110x240) = 440.45 ≈ **441** No's.

Mortar required for 1m^3 = 1 – [(0.076x0.1x0.23) x441] = **0.23** m^3

Wall size: length = 0.95m on both directions, thickness = 0.23m, height = 1m.

Volume of brick masonry = [(0.95+0.95) – 0.23] x0.23x1 = **0.384** m^3

No of bricks required = 0.384x441 = 169.3 No's

Add 5% for wastage, = 169.3 + (169.3x5/100) = 177.7 ≈ 178 No's

No of bricks required = 178 No's

Mortar required = 0.23x0.384 = 0.088 m^3

Add 27% from dry to wet volume, = 0.088 + (0.088x27/100) = 0.111 m^{3}Cement mortar in ratio 1: 6

Cement = 0.111 / (1+6) = **0.016** m^3

Sand = 0.016x6 = **0.096** m^3

Density of cement = 1440 kg /m^3

Cement = 1440x0.016 = 23.04 kg.

Density of sand = 1600 kg /m^3

Sand = 1600x0.096 = 153.6 kg.

Result:

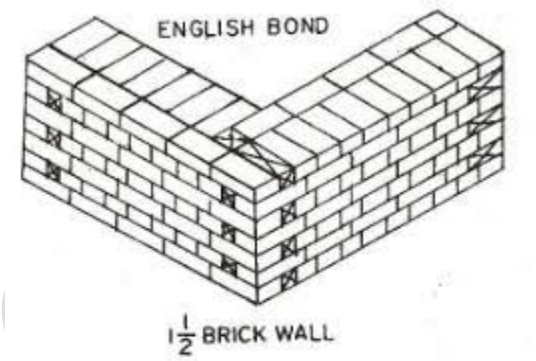
Experiment No. 12 **Date:**

Construct one & half brick thick wall in English bond to a height of one meter in cement mortar also calculate the quantities

Aim: Construction of one & half brick thick wall in English bond to a height of one meter in cement mortar and calculation of the quantities.

Materials and Equipment's: line string, tri square, plumb bob, level tube, trowel, measuring tape, spirit level, mortar pan, bucket, spade, sieve, bricks, cement, sand and water.

Figures:



Procedure:

1. Before start of work brick should be immersed in water 24 hours. So that theydon't absorb water from mortar.
2. Bricks should be laid with frog upward.
3. Spread the mortar over an area to be covered by the edges of wall, depth ofmortar spread should be 15mm thick.
4. Lay one brick at the corner press it with hand, the bed joint remains only about10mm thick.
5. Clean the excess mortar from the joint check the level and alignmentsimultaneously. Fill the joints with mortar.
6. Start second coarse by laying the mortar and spreading it over the first coarseand arrange bricks to level and check the alignment of the bricks.
7. The corner constructed should be done with great care by frequently checkingto plumb and alignment.

8. Repeat the above procedure till the required height.
9. At the end of days work, the joints should be clean and finished by raking.

Calculation:

Size of brick = 76x100x230mm

Size of joint = 10mm

Overall size = 86x110x240mm

No of bricks required for 1m^3 = 1 / (86x110x240) = 440.45 ≈ **441** No's.Mortar required for 1m^3 = 1 – [(0.076x0.1x0.23) x441] = **0.23** m^3

Wall size: length = 0.95m on both directions, thickness = 0.34m, height = 1m.Volume of brick masonry = [(0.95+0.95) – 0.34] x0.34x1 = **0.53** m^3

No of bricks required = 0.53x441 = 233.7 No's

Add 5% for wastage, = 233.7 + (233.7x5/100) = 245.3 ≈ 246 No's

No of bricks required = 246 No's

Mortar required = 0.23x0.53 = 0.122 m^3

Add 27% from dry to wet volume, = 0.122 + (0.122x27/100) = 0.155 m^{3}Cement mortar in ratio 1: 6

Cement = 0.155 / (1+6) = **0.022** m^{3}Sand = 0.022x6 = **0.132** m^3

Density of cement = 1440 kg /m^3 **Cement = 1440x0.022 = 31.68 kg.**

Density of sand = 1600 kg /m^3 **Sand = 1600x0.132 = 211.2 kg.**

Result:

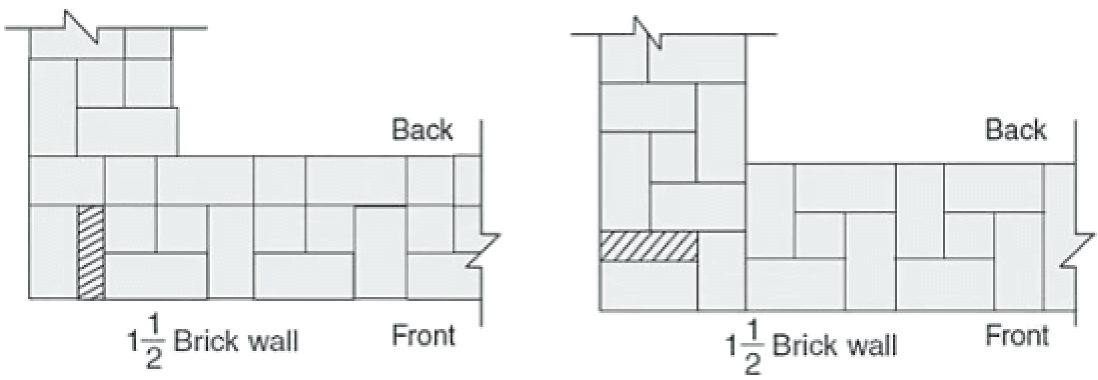
Experiment No. 13 **Date:**

Construct one & half brick thick wall in Flemish bond to a height of one meter in cement mortar also calculate the quantities

Aim: Construction of one & half brick thick wall in English bond to a height of one meter in cement mortar and calculation of the quantities.

Materials and Equipment's: line string, tri square, plumb bob, level tube, trowel, measuring tape, spirit level, mortar pan, bucket, spade, sieve, bricks, cement, sand and water.

Figures:



Double flemish bond ($1\frac{1}{2}$ brick thick)

Procedure:

1. Before start of work brick should be immersed in water 24 hours. So that theydon't absorb water from mortar.
2. Bricks should be laid with frog upward.
3. Spread the mortar over an area to be covered by the edges of wall, depth ofmortar spread should be 15mm thick.
4. Lay one brick at the corner press it with hand, the bed joint remains only about10mm thick.
5. Clean the excess mortar from the joint check the level and alignmentsimultaneously. Fill the joints with mortar.
6. Start second coarse by laying the mortar and spreading it over the first coarseand arrange

bricks to level and check the alignment of the bricks.

7. The corner constructed should be done with great care by frequently checkingto plumb and alignment.
8. Repeat the above procedure till the required height.
9. At the end of days work, the joints should be clean and finished by raking.

Calculation:

Size of brick = 76x100x230mm

Size of joint = 10mm

Overall size = 86x110x240mm

No of bricks required for $1m^3$ = 1 / (86x110x240) = 440.45 ≈ **441** No's.Mortar required for $1m^3$ = 1 – [(0.076x0.1x0.23) x441] = **0.23** m^3

Wall size: length = 0.95m on both directions, thickness = 0.34m, height = 1m.Volume of brick masonry = [(0.95+0.95) – 0.34] x0.34x1 = **0.53** m^3

No of bricks required = 0.53x441 = 233.7 No's

Add 5% for wastage, = 233.7 + (233.7x5/100) = 245.3 ≈ 246 No's

No of bricks required = 246 No's

Mortar required = 0.23x0.53 = 0.122 m^3

Add 27% from dry to wet volume, = 0.122 + (0.122x27/100) = 0.155 m^3Cement mortar in ratio 1: 6

Cement = 0.155 / (1+6) = **0.022** m^3Sand = 0.022x6 = **0.132** m^3

Density of cement = 1440 kg /m^3 **Cement = 1440x0.022 = 31.68 kg.**

Density of sand = 1600 kg /m^3 **Sand = 1600x0.132 = 211.2 kg.**

Result:

Experiment No. 14 **Date:**

Plastering for a new masonry wall surface (1 squaremetre area) with cm (1:6)

Aim: plastering for a new masonry wall surface (1 square meter area) with cm (1:6).

Materials and Equipment's: line string, tri square, plumb bob, trowel, wooden float,straight edge, mortar pan, bucket, spade, sieve, cement, sand and water.

Procedure:

1. Keep all the mortar joints of wall rough, so as to give a good bonding to hold plaster.
2. Clean all the joints and surfaces of the wall with wire brush, there should be no oil or grease etc. left on wall surface.
3. If there exist any cavities or holes on the surface, then fill it in advance with appropriate material.
4. In order to get uniform thickness of plastering throughout the wall surface, first fix dots on the wall. A dot means patch of plaster of size 15mm x 15mmand having thickness of about 10mm.
5. Dots are fixed on the wall first horizontally and then vertically at a distance of about 2 meters covering the entire wall surface.
6. Check the verticality of dots, one over the other, by means of plumb bob.
7. After fixing dots, the vertical strips of plaster, known as screeds, are formed in between the dots.
8. In case of brick masonry the thickness of plaster is in general 12mm.
9. The ratio of cement and sand is 1:6.
10. Apply the first coat of plaster between the spaces formed by the screeds on thewall surface. This is done by means of trowel.
11. Level the surface by means of flat wooden floats and straight edges.

Calculation:

Wall surface size: length = 1m, breadth = 1m. Mortar thickness = 0.012m.

Volume of mortar = 1x1x0.012 = **0.012** m^3

Add 27% from dry to wet volume, = 0.012 + (0.012x27/100) = 0.015 m^3 Cement mortar in ratio 1: 6

Cement = 0.015 / (1+6) = **0.0021** m^3 Sand = 0.0021x6 = **0.0126** m^3

Density of cement = 1440 kg /m^3

Cement = 1440x0.0021 = 3.02 kg.

Density of sand = 1600 kg /m^3

Sand = 1600x0.0126 = 20.16 kg.

Result:

Experiment No. 15 **Date:**

Painting for a given area (1 square meter area)

Aim: Painting for a given area (1 square meter area). **Materials and**

Equipment's: roller, primer and paint.

Procedure:

1. Ensure the wall is fully dried.
2. Check your wall for imperfections and fix them up before you get started.
3. Take roller and apply primer in a large W shape. Then, begin using smooth up and down motions to filling the area around the W. keep painting until the area is completely and evenly covered with primer.
4. Allow the primer to dry for one day.
5. Take roller and apply first coat of paint by making up and down motions. Keep painting until the area is completely and evenly covered with paint.
6. Allow the paint to dry for one day.
7. Take roller and apply second coat of paint by making up and down motions. Keep painting until the area is completely and evenly covered with paint.

Calculation:

Wall surface size: length = 1m, breadth = 1m.
One coat of primer:
Exterior wall primer covers 10 sqm per liter in one coat.Primer
required for $1m^2$ = 1/10 = 0.1 liters = **100 ml.**
Exterior wall paint covers 5 sqm per liter in two coats.Paint
required for $1m^2$ = 1/5 = 0.2 liters = **200 ml.**

Result:

Experiment No. 16 **Date:**

Measurement of plastering work for the given existing building

Aim: To measure plastering work for the given existing building

Tools used: Measuring tape.

Procedure:

1. Consider a building for which measurements are to be taken.
2. Observe the structural and non-structural elements of the building
3. Measure the dimensions of the elements of the building individually.
4. Deduct the plastering work quantity wherever it is not carried out.
5. Make a tabular column, which shows the details of specifications and dimensions of the building
6. Calculate the quantities of plastering work for each elements.
7. Finally add quantities of each elements to find the total quantity of plastering work of a given building.

Tabular column:

Sl No.	Particulars	Length	Breadth	Height	Area	Volume	Quantity

Result: Total quantity of plastering work is

Experiment No. 17 **Date:**

Measurement of painting work for the given existing building

Aim: To measure painting work for the given existing building

Tools used: Measuring tape.

Procedure

1. Consider a building for which measurements are to be taken.
2. Observe the structural and non-structural elements of the building
3. Measure the dimensions of the elements of the building individually.
4. Deduct the plastering work quantity wherever it is not carried out.
5. Make a tabular column, which shows the details of specifications and dimensions of the building
6. Calculate the quantities of painting work for each elements.
7. Finally add quantities of each elements to find the total quantity of painting work of a given building.

Tabular column:

Sl No.	Particulars	Length	Breadth	Height	Area	Volume	Quantity

Result: Total quantity of painting work is