BHUBANANANDA ODISHA SCHOOL OF ENGINEERING, CUTTACK

DEPARTMENT OF CIVIL ENGINEERING

LECTURE NOTE ON: BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY

(TH-3) 3TH SEMESTER

PREPARED BY: M. S. KAR

GUEST FACULTY IN CIVIL ENGINEERING DEPT

BOSE, CUTTACK

STONE

LECT.1

BY:-ER. M.S. KAR

1 Stone

1.1 Classification of rock, uses of stone, natural bed of stone,

1.2 Qualities of good building stone,

1.3 Dressing of stone

1.4 Characteristics of different types of stone and their uses

Classification of ROCK:-

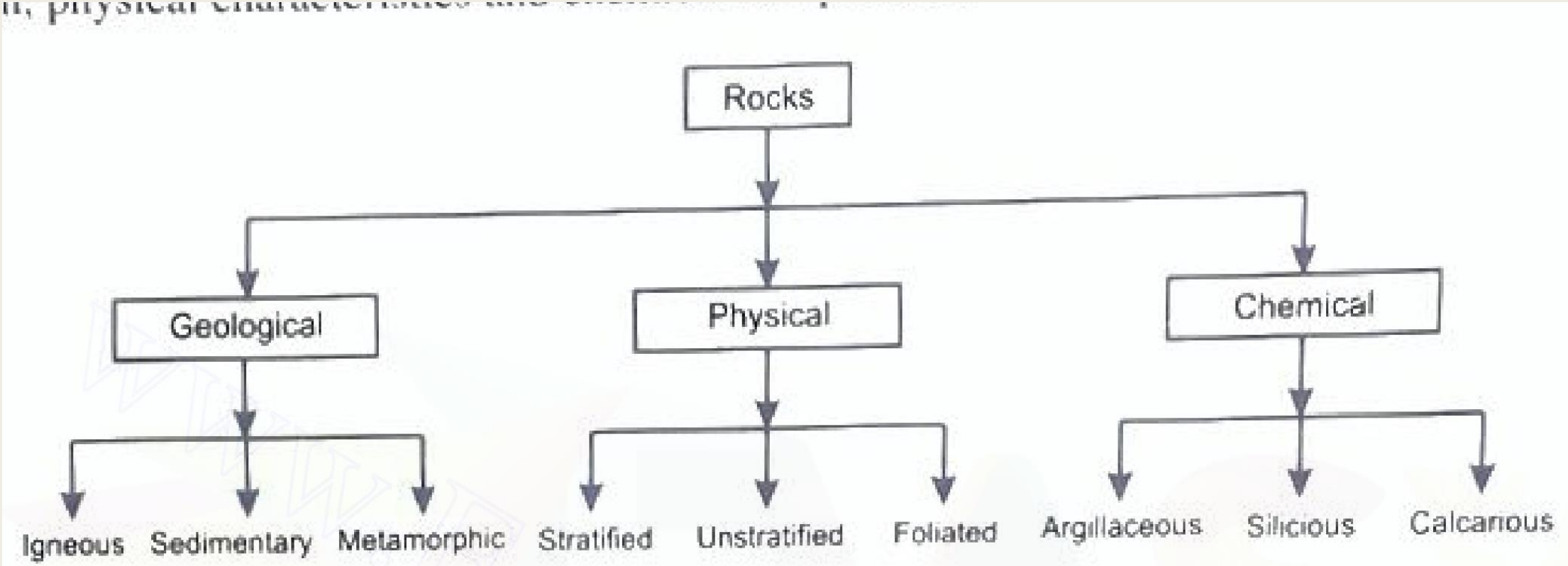


Fig. 2.1

CP G IS ME CASS FUS GAYE

GEOLOGICAL CLASSIFICATION :-

- ***Igneous rocks*** are formed by the solidification of magma below the earth's surface. When the magma is unable to erupt through the earth surface during its upward journey, it is held up below the earth's surface and unable to descend. This magma cools down gradually and solidifies into igneous rocks.

1. Plutonic:- (greater depth solidification and best igneous rock) ex :- granite
2. Volcanic:- (solidification of the rock occurs near to the earth surface and extremely fine grained structure) ex:- BASALT
3. Hypobasal:- (shallow depth from the earth's surface & the finely grained crystalline structure of rock will be obtained) ex:- Dolerite

- ***Sedimentary Rocks*** formed by the deposition of sediments obtained by the weathering of pre-existing rocks and these sediments are transported by various agents such as water, wind, frost, gravity, etc.

Ex:- Sandstone, limestone, lignite, etc.

- ***Metamorphic rocks*** are formed by the metamorphism process. Metamorphism is the process of changing the characteristics of the pre-existing rocks under the influence of heat and pressure. The pre-existing rocks may be of the sedimentary or igneous type of rocks.

Examples: Slate, Gneiss, Schist, marble, soapstone etc.

S.No.	Original rocks	Metamorphic rock
1.	Granite	Gneiss
2.	Syenite	Gneiss
3.	Sandstone	Quartzite
4.	Limestone	Marble, schist
5.	Marl	Marble
6.	Shale	Slate, schist, phyallite
7.	Mudstone	Slate
8.	Dolomite	Marble
9.	Dolerite, basalt	Schist
10.	Felsite, tuff	Schist, slate
11.	Conglomerate	Gneiss, schist

Fig 2: Igneous Rock – Granite

Fig 3: Metamorphic Rock – Gneiss

PHYSICAL CLASSIFICATION

- ***Stratified rocks*** consist of different layers in its structure and these layers are separated by planes of stratification. These planes are also called cleavage planes or bedding planes. These rocks can easily split up along these bedding planes.

Ex:- sandstone, limestone, shale,

- ***unstratified rocks*** is crystalline or compact granular.
- They possess a similar kind of structure throughout their whole body. Most of the igneous rocks and some sedimentary rocks come under unstratified rocks.

Ex:- Granite, marble, trap

- ***Foliated rocks*** possess a layered or banded structure which is obtained by exposure of pressure and heat. Unlike the stratified rocks, these rocks can split up in a certain direction only.

examples are gneiss, schist, slate etc.

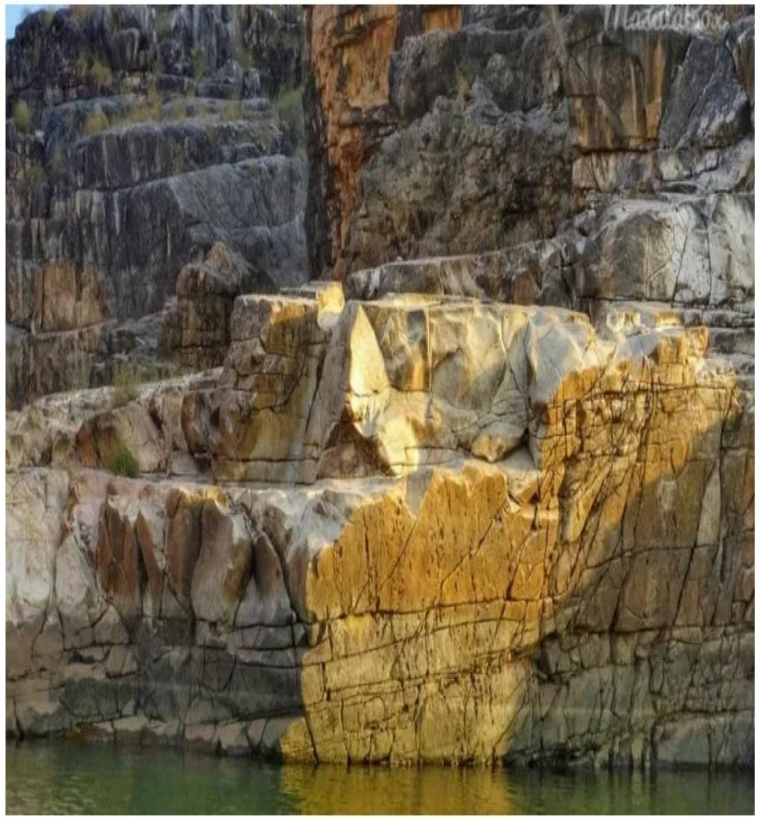


Fig 5: Unstratified Rock

Fig 6: Foliated Rock

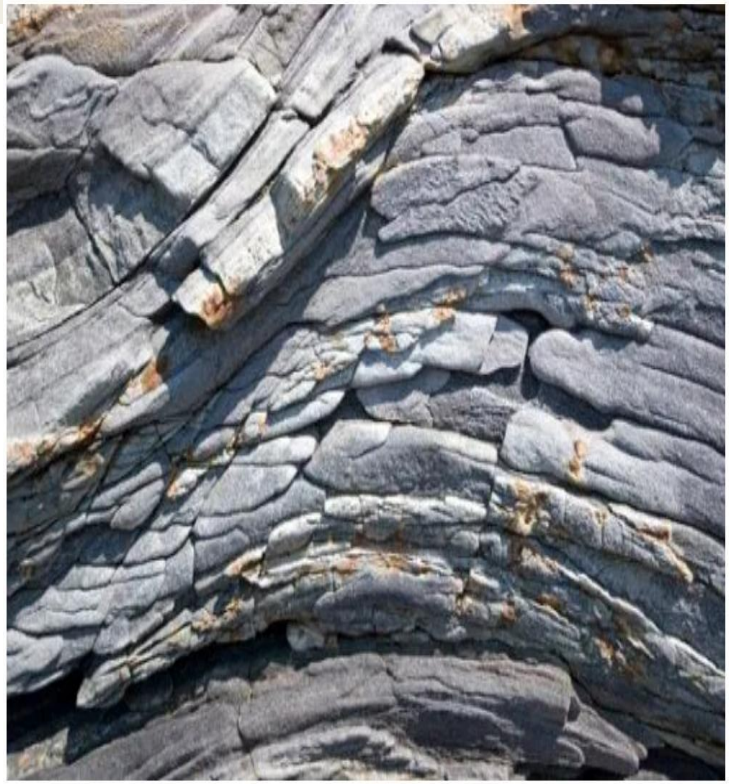


Fig 4: Stratified Rock

3. Chemical Classification: This classification is known as the scientific or engineering classification and according to this classifications, the rocks are of the following three types:

(i) Silicious rocks
(ii) Argillaceous rocks
(iii) Calcareous rocks

(i) Silicious rocks: In these rocks the major constituent is silica (SiO_2) i.e. sand. The rocks are very hard and durable. e.g.: granite, basalt, trap, quartzite, gneiss, syenite etc.

(ii) Argillaceous rocks: In these rocks, the argil or clay predominates. Such rocks may be dense and compact or they may be soft. These stones are hard and durable but brittle. e.g.: slates, laterites etc.

(iii) Calcarious: In these rocks, the major constituent is lime. The durability of these rocks will depend upon the constituent present in the surrounding atmosphere. e.g. limestones, marbles, dolomite, etc.

- ***QUALITIES OF GOOD BUILDING STONES :-*** *(SWIFT CAR IS HARD, DURABLE & TOUGH)*

1. Specific gravity :- minimum 2.7
2. Water absorption :- must be less than 5%
3. Fracture:- fracture should be sharp, even bright and clean with grains well cemented together.
4. Texture.:- there should not any sign of cavities, cracks or patches of soft or loose material.
5. Crushing strength :- minimum 100N/mm^2
6. Appearance :- must be good in appearance i.e. fine and compact structure Which is used for face work.
7. Resistance to fire:- it must resist fire with temp 600ºC.
8. Hardness:- stone should not scratch when rubbed with steel ball in loss angles machine (17- Road work,14 to 17 medium hardness and less than 14 soft stone used for ornamental work)
9. Durable :- must have resistance to atmospheric action
10. Toughness:- must have resistance against impact or sudden loading.

- ***Dressing of stone:-***
- The stones, after being quarried, are to be cut into suitable sizes and with suitable surfaces .This process is known as the dressing of stones .

it is carried out for the following purposes:

(i) To get the desired appearance from stone work,

(ii) To make the transport from quarry easy and economical,

(iii)To suit to the requirements of stone masonry

Uses of Stones:

The stones are used in the construction of buildings from the ancient times and most of the ancient temples and forts of our country were built with stones.

Following are the various uses to which stones are employed:

(1) Structure:

The stones are used for foundation, walls, columns, lintels, arches, roofs, floors, damp-proof courses, etc.

(2) Face- Work:

The stones are adopted to give massive appearance to the structure. The walls are of bricks and facing is done in stones of desired shades. This is known as the composite masonary.

(3) Paving:

The stones are used to cover floor of buildings of various types such as residential, commercial, industrial, etc. They are also adopted to form paving of roads, footpaths, etc.

(4) Basic Material:

The stones are disintegrated and converted to form a basic material for cement concrete, marum of roads, calcareous cements, artificial stones, hollow blocks, etc.

(5) Miscellaneous:

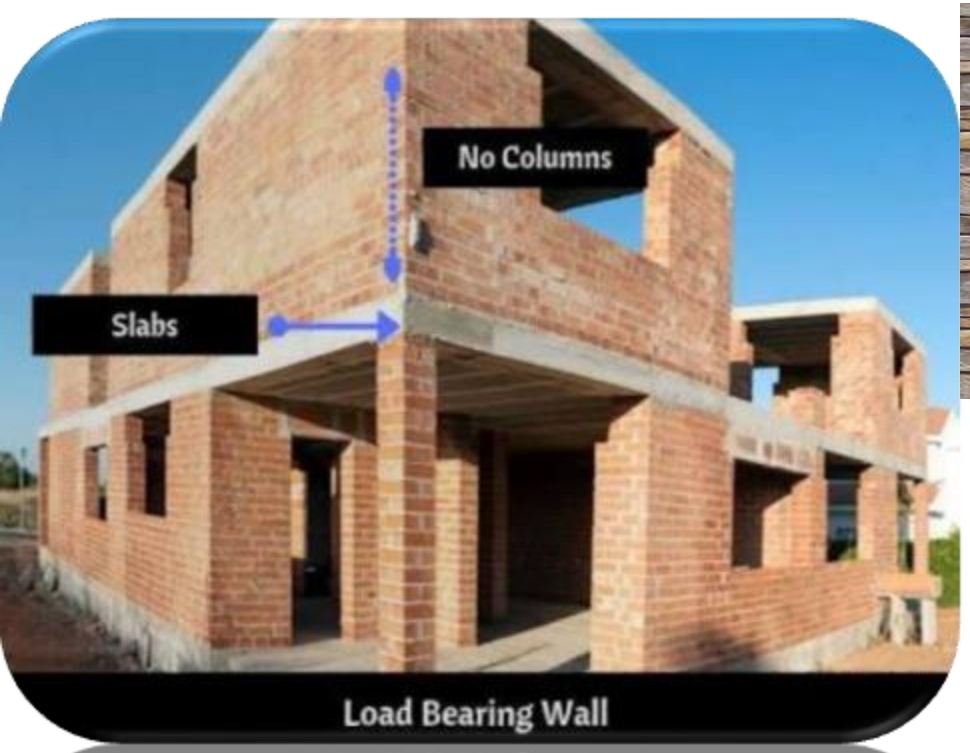
In addition to above uses, the stones are also used as:

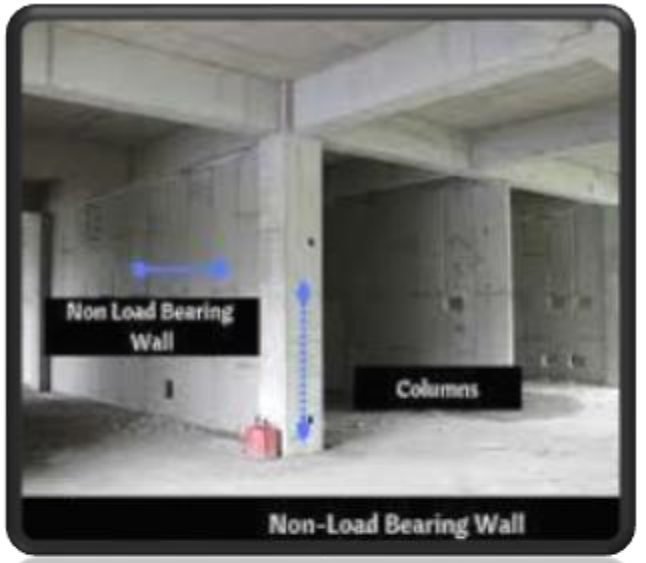
(i) Ballast for railways,

(ii) Flux in blast furnaces,

(iii) Blocks in the construction of bridges, piers, abutments, retaining walls, light houses, dams, etc.

S.No.	Stone	Suitability	Characteristics
1.	Granite or Syenite	1. Most suitable for important Engg. works. 2. Used for Exterior facing of buildings 3. Fine grained granite offers high resistance to weathering	1. It can be easily polished & worked 2. Excess of felspar causes Early decay. 3. Water absorption < 1%
2	Marble	1. Most suitable for Monuments, ornamental work 2. Flooring & Decorative work (Electric switch boards also)	1. Specific gravity = 2.65 2. Crushing strength = 70 N/mm²
3	Basalt	1. Road metal & Concrete aggregates	1. High sp gr = 2.6 – 3 2. High Crushing = 150-190 N/mm²
4	Quartzite	1. Railway Ballast, Road metal & C.A	
5	Slate	1. Used in Cisterns, Damp proofings. 2. Excellent roof Covering material	2. Specific gravity = 2.89 1. Crushing Stn = 77-210
6	Sandstone	1. Tile stone (Roofing), Flag stone (Paving) 2. Grit (Heavy work), Natural (Ornamental)	1. 2.65 – 2.95 2. 65 N/mm² 3. Quartz + lime + Silica
7	Lime stone	1. Flooring, roofing & Pavings & walls. 2. In the manufacture of Lime & Cement	1. 2 – 2.75, 55 N/mm² 2. Affected by frost & atmos
8	Gneiss	1. Rough stone work (like street pavings)	1. Quartz + felspar (Strong & durable)
9	Laterite	1. Very good road metal	1. Sandy clay Stone
10	Kankar	1. Foundation of buildings	1. Irregular in shape 2. Impure lime stone
11	Moorum	1. Fancy paths, like garden walks.	1. Decomposed Laterite





CHAPTER 3
(CONSTRUCTION TECHNOLOGY)
WALL & MASONARY WORK

Walls & Masonry Works

3.1 Purpose of walls

3.2 Classification of walls — load bearing, non-load bearing walls, retaining walls.

3.3 Classification of walls as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls (Concept Only).

3.4 Partition Walls : Suitability and uses of brick and wooden partition walls

3.5 Brick masonry : Definition of different terms

3.6 Bond — meaning and necessity: English bond for land 1-1/2 Brick thick walls. T, X and right angled corner junctions. Thickness for land 1-1/2 brick square pillars in English bond

3.7 Stone Masonry :

3.8 Glossary of terms —String course, corbel, cornice, block-in-course, grouting, mouldings, templates, throating, through stones, parapet, coping, pilaster and buttress

3.1 Purpose of Wall :-

The **purposes of walls** in buildings are to support roofs, floors and ceilings; to enclose a space as part of the building envelope along with a roof to give buildings form; and to provide shelter and security.

Functions of Wall:-

1. STRENGTH

A wall should be strong enough to take up the loads safely due to its own weight, super imposed loads and lateral pressure such as wind.

2. STABILITY

It should be stable against overturning by lateral forces (due to wind load) and buckling caused by excessive slenderness.

3. WEATHER RESISTANCE

All the external walls, whether of load bearing or panel construction, should provide adequate resistance to rain, sun and wind penetration.

4. FIRE RESISTANCE

The walls should offer sufficient resistance to fire, as they behave as vertical barriers for spread of fire in the horizontal direction. So the walls should be made of such a material which neither ignite nor allow the spread of the fire through them.

5. HEAT INSULATION

It should be possible for walls to attain insulation against heat. For this, the walls are made either thicker, or cavity wall construction is employed. Heat insulating materials are also used in construction of walls.

6. SOUND INSULATION

The walls, both load bearing and non-load bearing, should be made of such materials and by such techniques, viz., cavity wall construction, so as to insulate building against indoor and outdoor noises.

7. PRIVACY & SECURITY

The walls, particularly external walls, should also provide sufficient privacy and afford security against burglary.

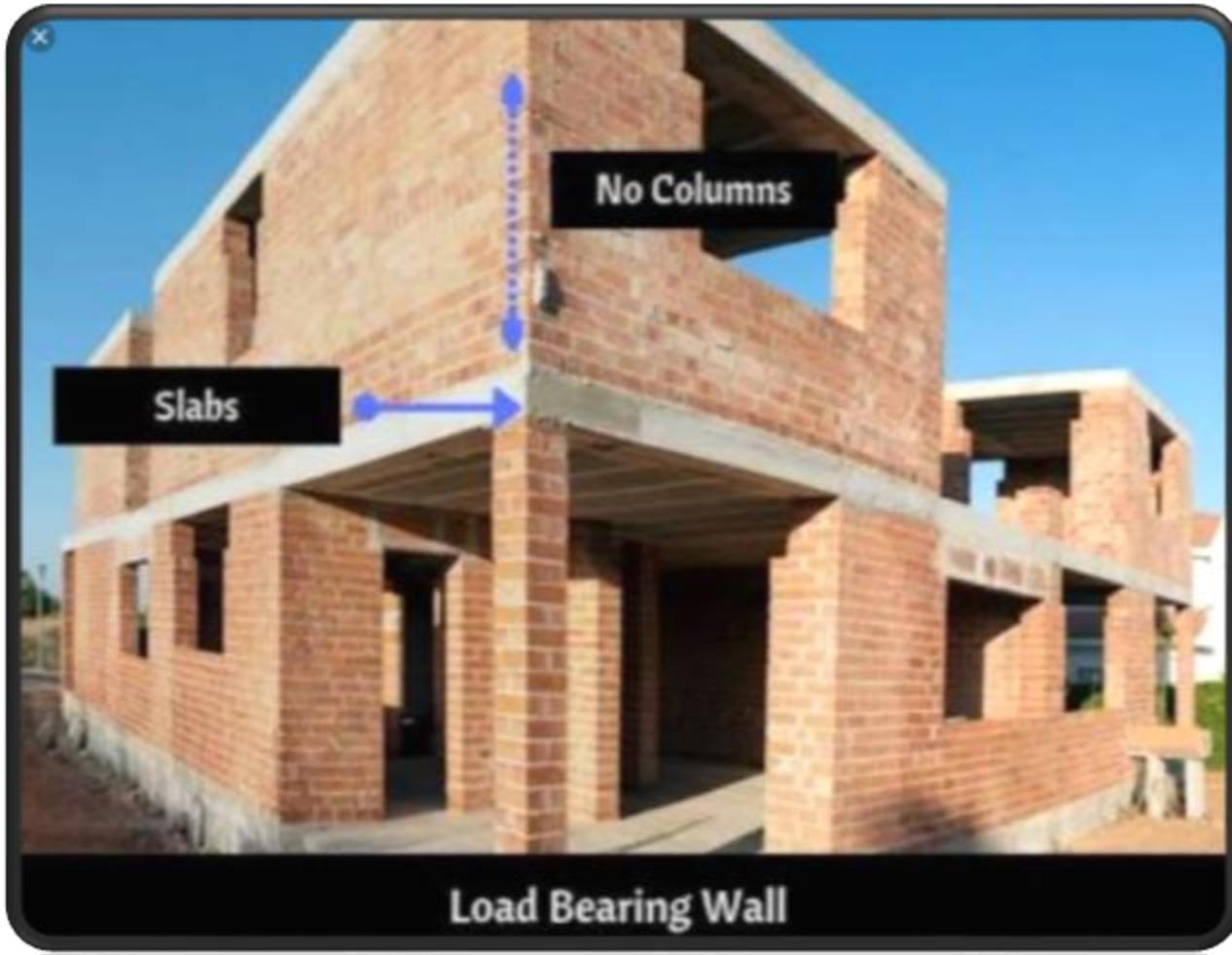
3.2 Classification of walls — load bearing, non-load bearing walls, retaining walls.

3.2.1 Load bearing Wall:-

Load bearing wall is a structural element.

- It carries the weight of a house from the roof and upper floors, all the way to the foundation. It supports structural members like beams, slab and walls on above floors above. **A wall directly above the beam is called load bearing wall.**
- It is designed to carry the vertical load. In another way, if a wall doesn't have any walls, posts or other supports directly above it, it is more likely to be a load-bearing wall.
- Load bearing walls also carry their own weight. This wall is typically over one another on each floor.
- Load bearing walls can be used as interior or exterior wall. This kind of wall will often be perpendicular to floor joists or ridge.
- Concrete is an ideal material to support these loads. The beams go directly into the concrete foundation. Load bearing walls inside the house tend to run the same direction as the ridge

Non-Load Bearing Wall



Load Bearing Wall

3.2.2 Non load bearing wall:-

- A wall which doesn't help the structure to stand up and holds up only itself is known as a non-load bearing wall.
- It doesn't support floor roof loads above. It is a framed structure. Most of the time, They are interior walls whose purpose is to divide the structure into rooms. They are built lighter.
- One can remove any non-load bearing walls without endangering the safety of the building. Non-load bearing walls can be identified by the joists and rafters.
- They are not responsible for gravitational support for the property. It is cost effective. This wall is referred to as "curtain wall".

Types of Non-Load Bearing Wall:

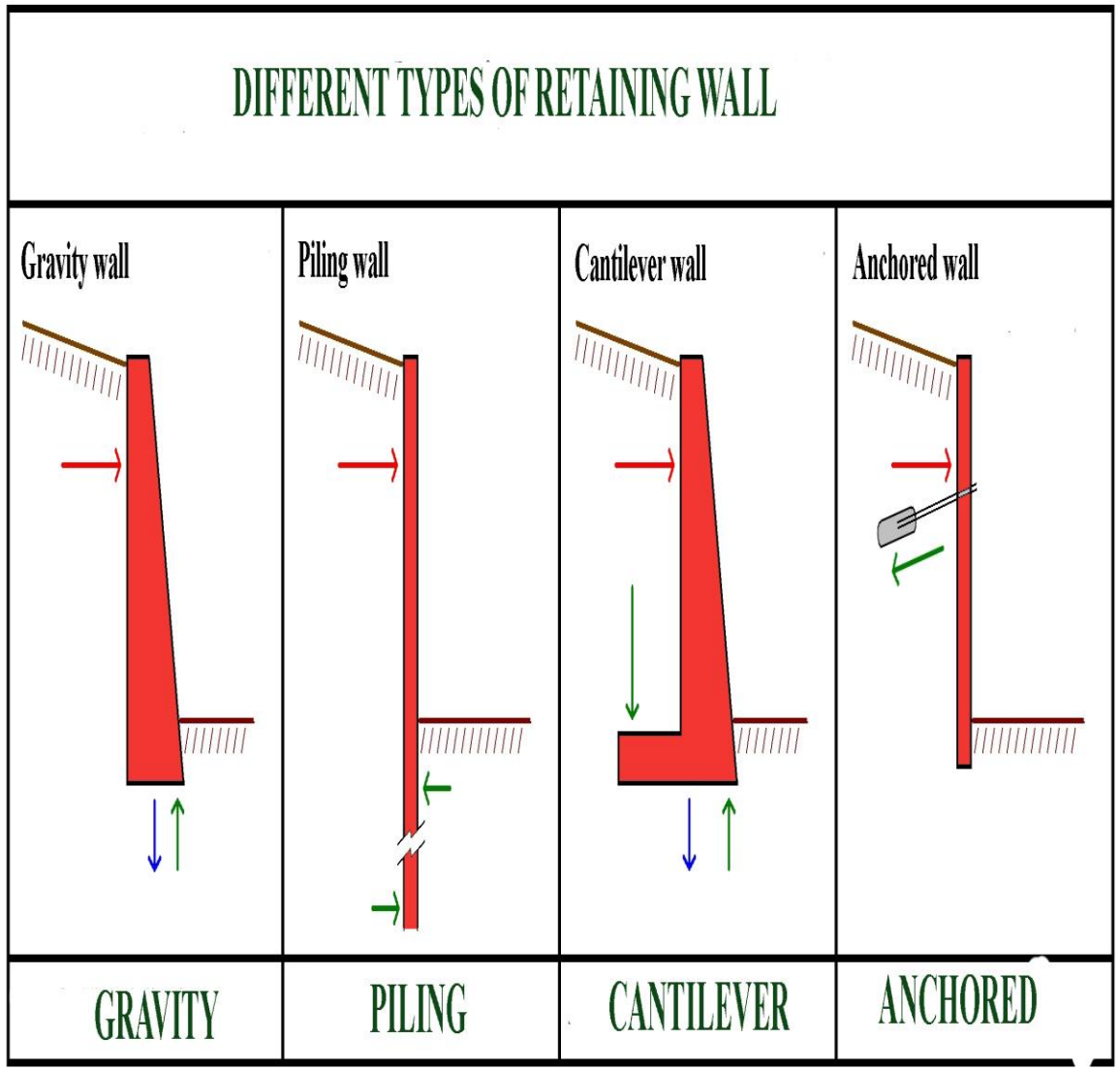
- Hollow Concrete Block
- Facade Bricks
- Hollow Bricks
- Brick Walls

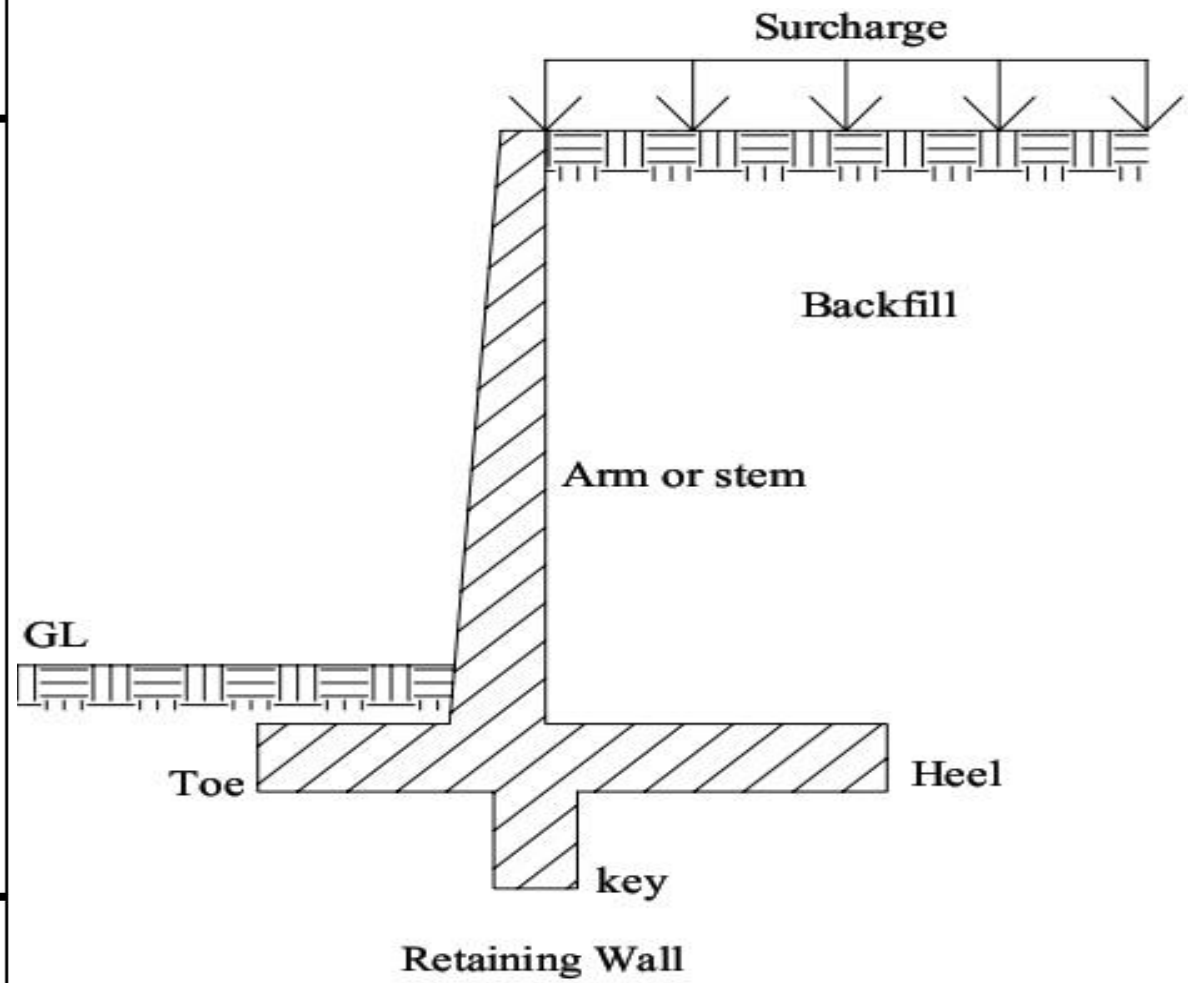
3.2.3 Retaining wall:-

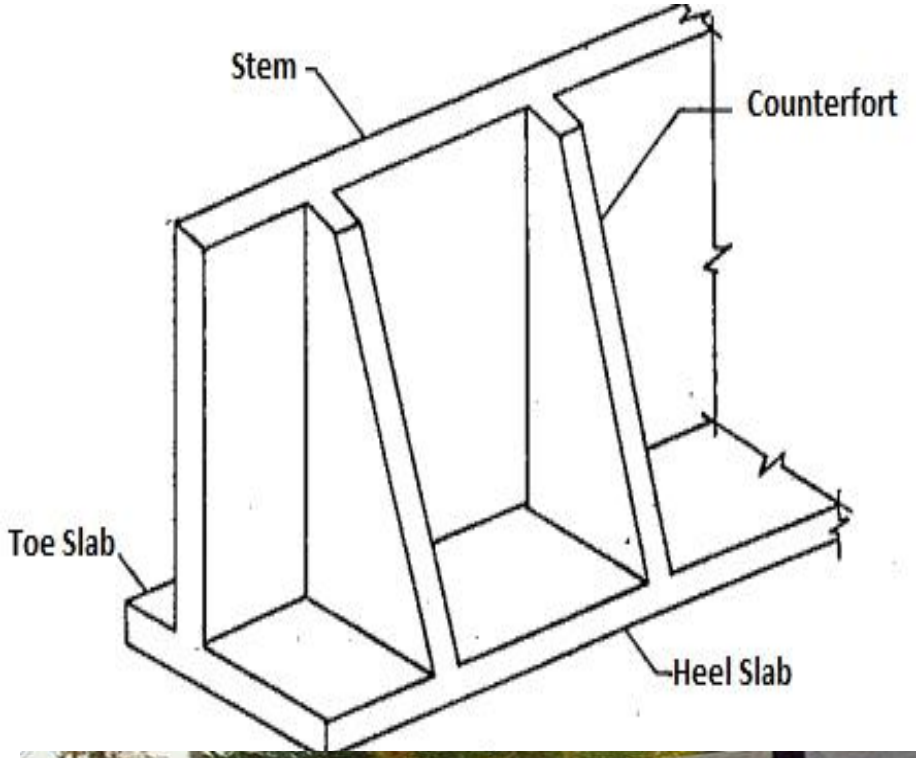
- Retaining wall is a structure that retain (holds back) any material (usually earth) and prevents it from sliding or eroding away. It is designed so that to resist the material pressure of the material that it is holding back.

Types of Retaining Wall

- An earth retaining structure can be considered to have the following types:
- Gravity Walls
  - Reinforced Gravity Walls
    - Concrete Cantilever retaining wall
    - Counter-fort / Buttressed retaining wall
    - Precast concrete Retaining wall
    - Pre-stressed retaining wall


DIFFERENT TYPES OF RETAINING WALL
Gravity wall
Piling wall
Cantilever wall
Anchored wall
GRAVITY
PILING
CANTILEVER
ANCHORED


Surcharge
Backfill
Arm or stem
GL
Toe
Heel
key
Retaining Wall


Stem
Counterfort
Toe Slab
Heel Slab

Gravity Retaining Wall:-

- Gravity Retaining Wall can be constructed from concrete, stone or even brick masonry. Gravity retaining walls are much thicker in section.
- Geometry of these walls also help them to maintain the stability.
- Mass concrete walls are suitable for retained heights of up to 3 m

Cantilever retaining wall

- A cantilever retaining wall is one that consists of a wall which is connected to foundation.
- A cantilever wall holds back a significant amount of soil, so it must be well engineered. They are the most common type used as retaining walls.
- Cantilever wall rest on a slab foundation. This slab foundation is also loaded by back-fill and thus the weight of the back-fill and surcharge also stabilizes the wall against overturning and sliding.

Counter-fort / Buttressed retaining wall

- Counterfort walls are cantilever walls strengthened with counter forts monolithic with the back of the wall slab and base slab.
- The counter-forts act as tension stiffeners and connect the wall slab and the base to reduce the bending and shearing stresses.
- To reduce the bending moments in vertical walls of great height, counterforts are used.

3.3 Classification of walls as per materials of construction:

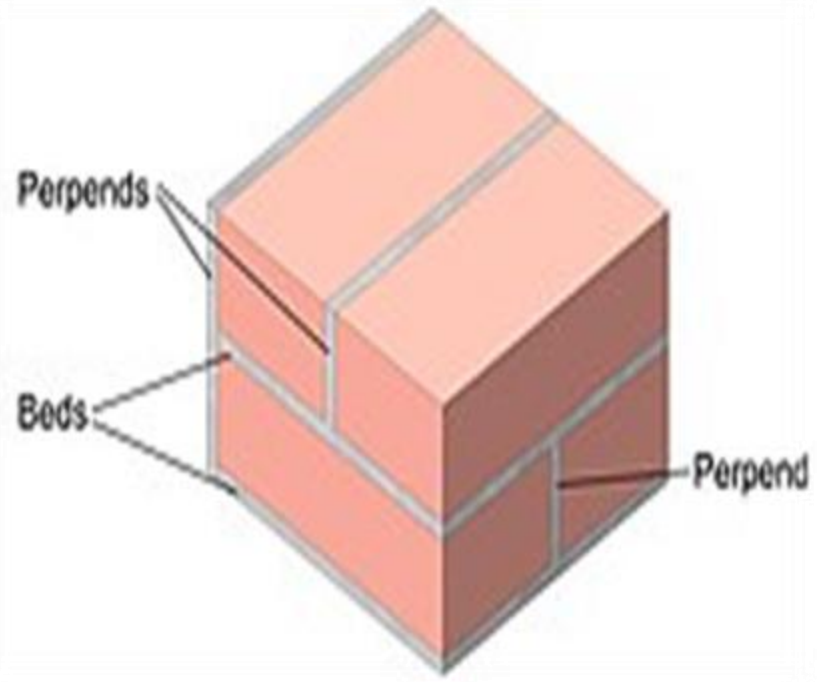
BRICK WALL:-

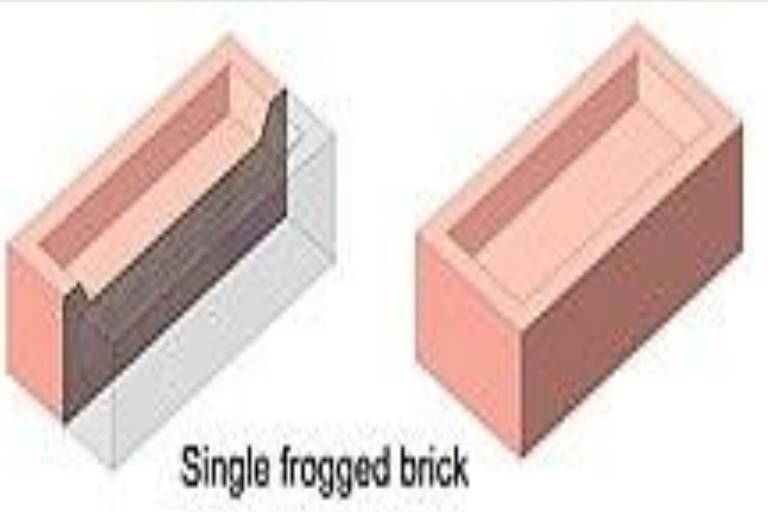
- Brickwork is masonry produced by a bricklayer, using bricks and mortar. Typically, rows of bricks called courses are laid on top of one another to build up a structure such as a brick wall. Bricks may be differentiated from blocks by size.

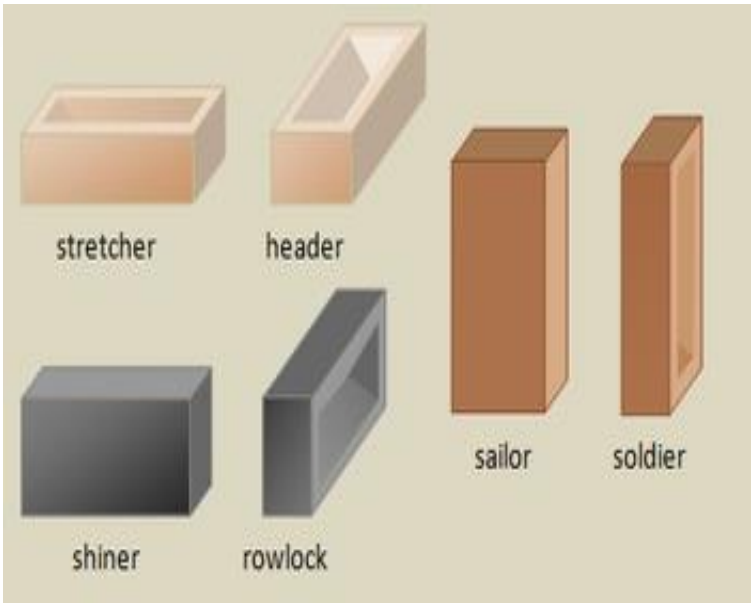
As the most common bricks are rectangular prisms, six surfaces are named as follows:

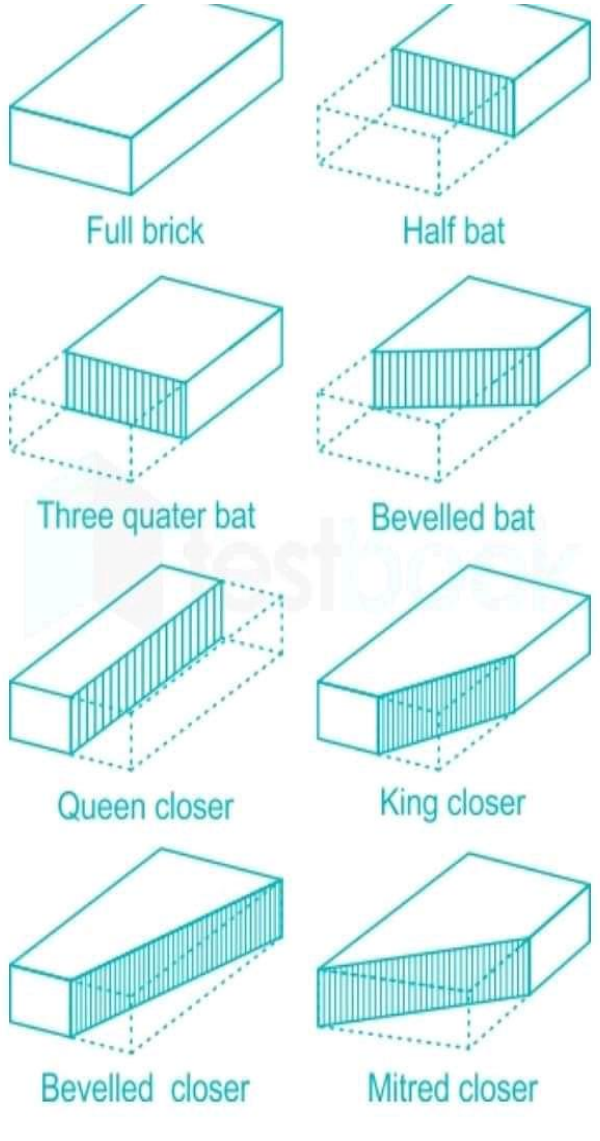
- Top and bottom surfaces are called Beds
- Ends or narrow surfaces are called Headers or header faces
- Sides or wider surfaces are called Stretchers or stretcher faces
- Mortar terminology- showing perpends and bed.
- Mortar placed between bricks is also given separate names with respect to their position. Mortar placed horizontally below or top of a brick is called a bed, and mortar Placed vertically between bricks is called a perpend.
- ***Three-quarter bat, stretching*** A brick cut to three-quarters of its length, and laid flat with its long, narrow side exposed.
- ***Three-quarter bat***, headingA brick cut to three-quarters of its length, and laid flat with its short side exposed. Half batA brick cut in half across its length, and laid flat.
- ***Queen closer :-***A brick cut in half down its width, and laid with its smallest face exposed and standing vertically. A queen closer is often used for the purpose of creating a lap


Bed
Header
Stretcher


Perpends
Beds
Perpend

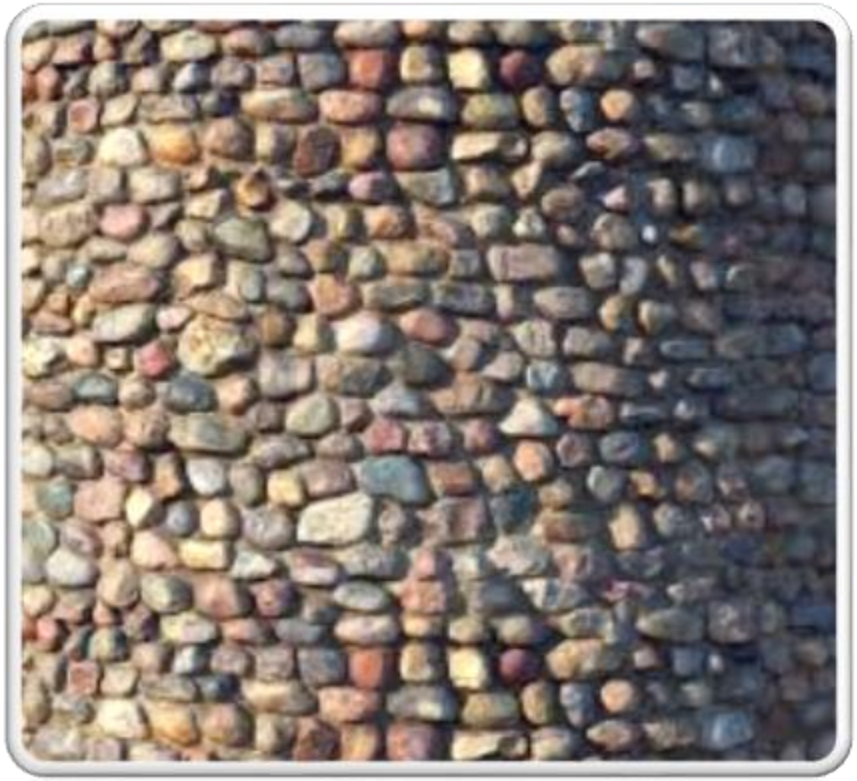

Single frogged brick


stretcher
header
sailor
soldier
shiner
rowlock


Full brick
Half bat
Three quater bat
Bevelled bat
Queen closer
King closer
Bevelled closer
Mitred closer

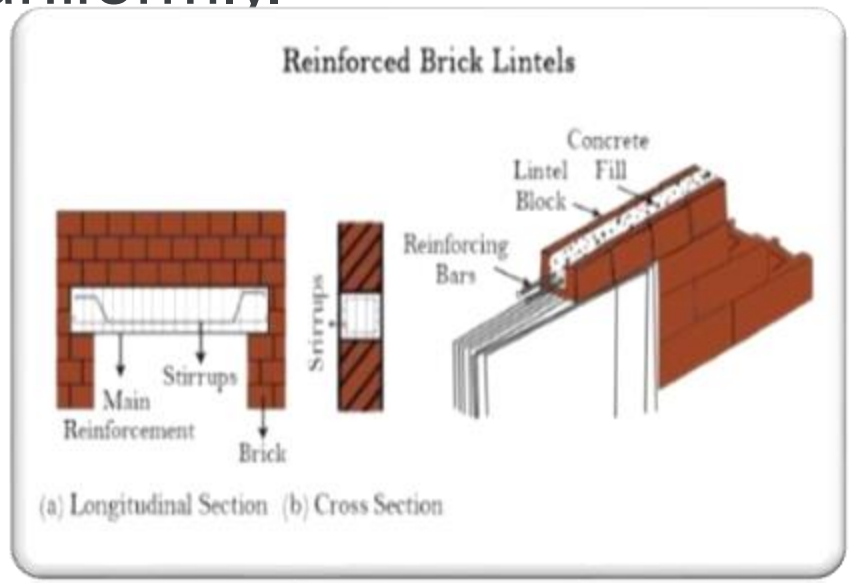
STONE WALL:-

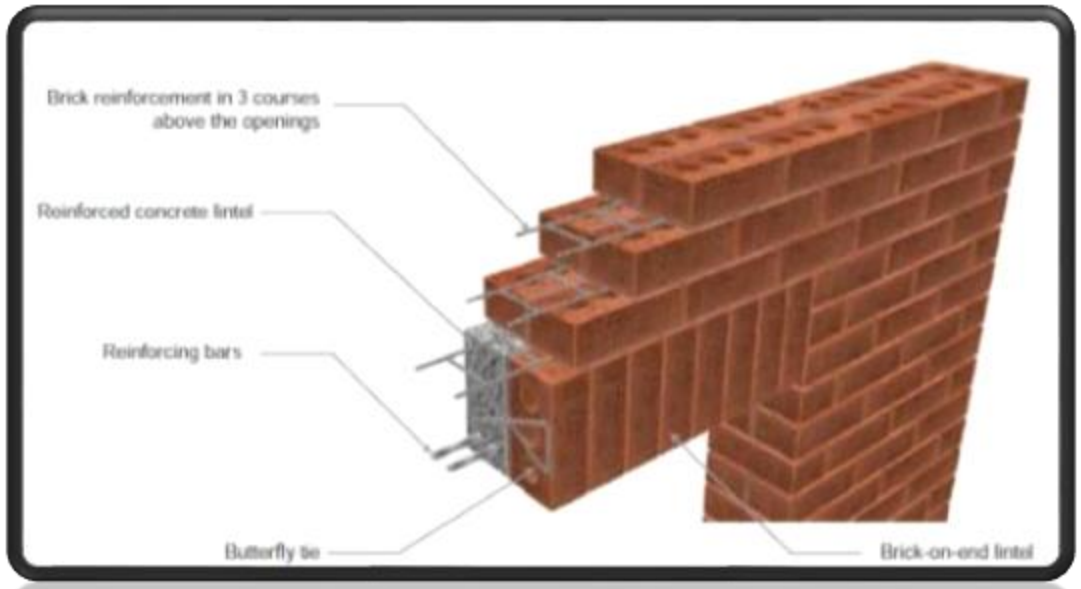
- Stone walls are a kind of masonry construction that has been used for thousands of years. The first stone walls were constructed by farmers and primitive people by piling loose field stones into a dry stone wall



REINFORCED BRICK WALL:-

- Reinforced Brick Wall: Walls that are prone to tensile forces are needed to be reinforced, and both horizontal and vertical reinforcement is required.
- Horizontal reinforcement is provided at every third or fourth course, consists of steel mesh spread flat on the cement mortar and pressed uniformly.





REINFORCED CONCRETE WALL:-

- These wall are of 3 types
  1. Solid concrete block
  2. Hollow concrete Block
  3. Precast concrete block

The residential and commercial construction industries make wide use of a form of concrete building material known officially as a *concrete masonry unit* (CMU). These hollow-core blocks can be made of standard concrete with traditional sand and gravel aggregate held together with Portland cement. Or, they can substitute lighter-weight industrial waste materials, such as fly ash or coal cinders, for the sand and gravel aggregate, in which case they are usually known as *cinder block*

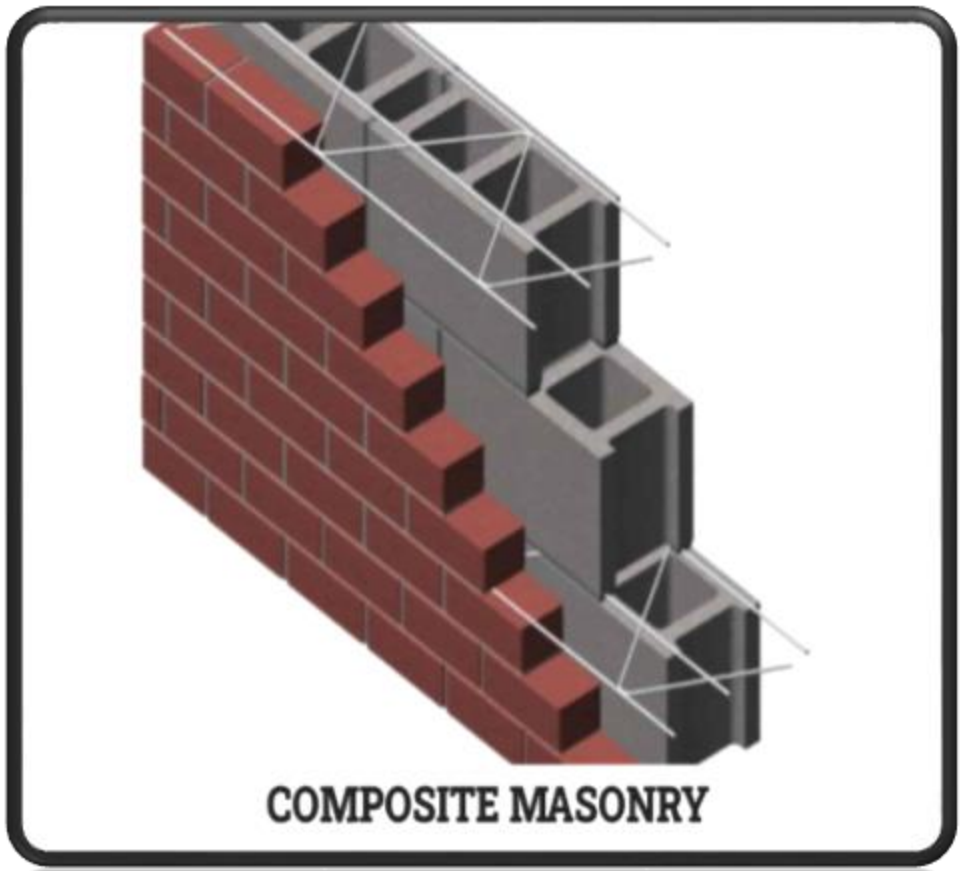

alamy stock photo

Composite Masonary Wall:-

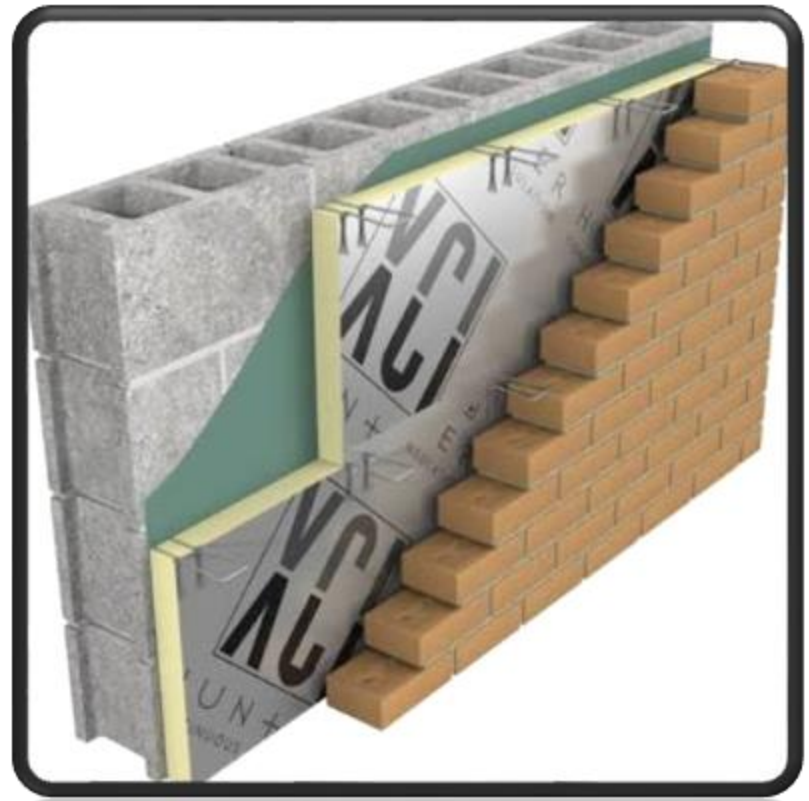
- Composite masonry is a masonry constructed with two or more types of construction units or different types of construction materials, i.e. bricks, stones, etc.

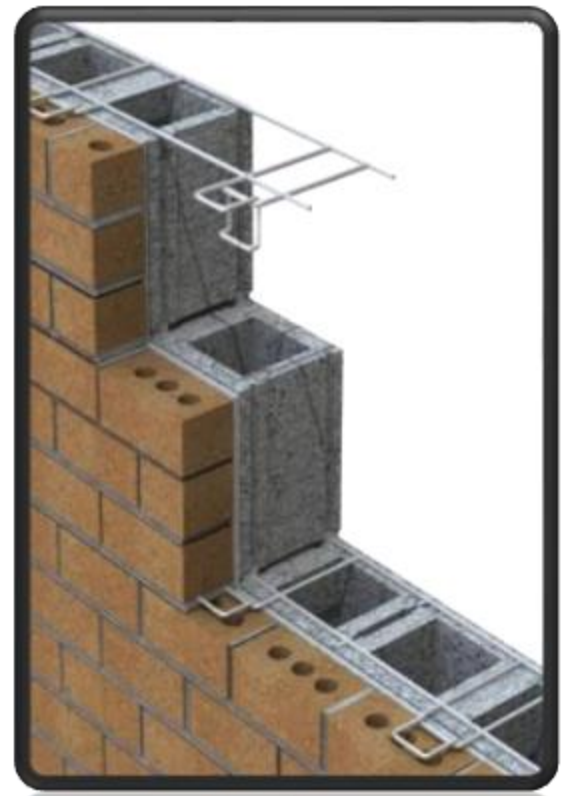
Composite masonry is adopted for the following reasons:

1. This masonry reduces the overall cost of construction.
2. It makes the structure more durable by providing better quality and good workmanship material in the faces.
3. Also, improves the appearance of the structure by concealing the inferior function.
4. It achieves optimum economy using locally available materials



COMPOSITE MASONRY





Partition Walls : Suitability and uses of brick and wooden partition walls

- A partition wall defined as a wall or division made up of bricks, studding, glass or other such material and provided for dividing from one room to another room.
- Partition Wall can be constructed as a load-bearing wall or non-load bearing wall. The load-bearing partition wall is known as the internal wall.
- These internal walls do not carry any weight. Sometimes partition wall may be folded, collapsible, or fixed type.
- Partition walls or walls can be constructed in various shapes like – thin, light, or thick, heavy, etc. Mainly, these walls' requirements are based on building materials and design

Requirements of a Good Partition Wall:

- Thin in cross-section so that maximum floor area can be utilized.
- Provide adequate privacy in rooms both in respect of sight and sound.
- Constructed from light, sound, uniform, homogeneous, durable and sound insulated materials.
- Simple in nature, easy and economical in construction having proper coherence with the type of building structure.
- Offer sufficient resistance against fire, heat, dampness, white ant or fungus, etc.
- Rigid enough to take the vibrations caused due to loads.
- Strong enough to support sanitary fittings and heavy fixtures.

Brick Partition Wall

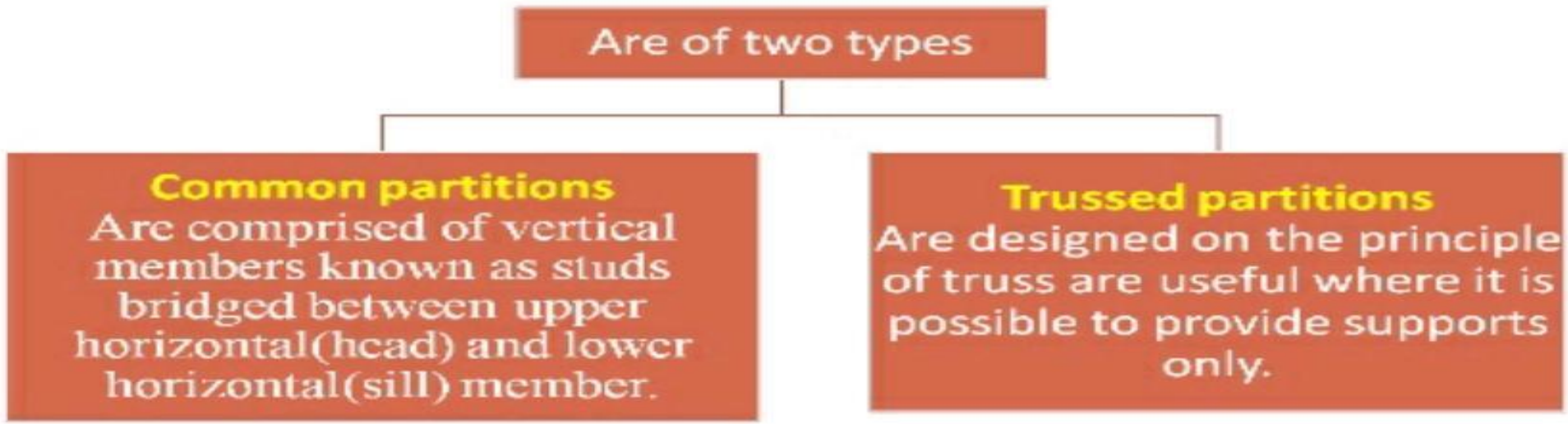
- Brick walls are known for their stretcher bond as the wall is plastered at both sides. Raw materials are used to make this wall, which makes it economical. They tend to be hard, durable, reusable, and recyclable.
- The height of the plain brick partition of half brick stiffness is not more than 2m

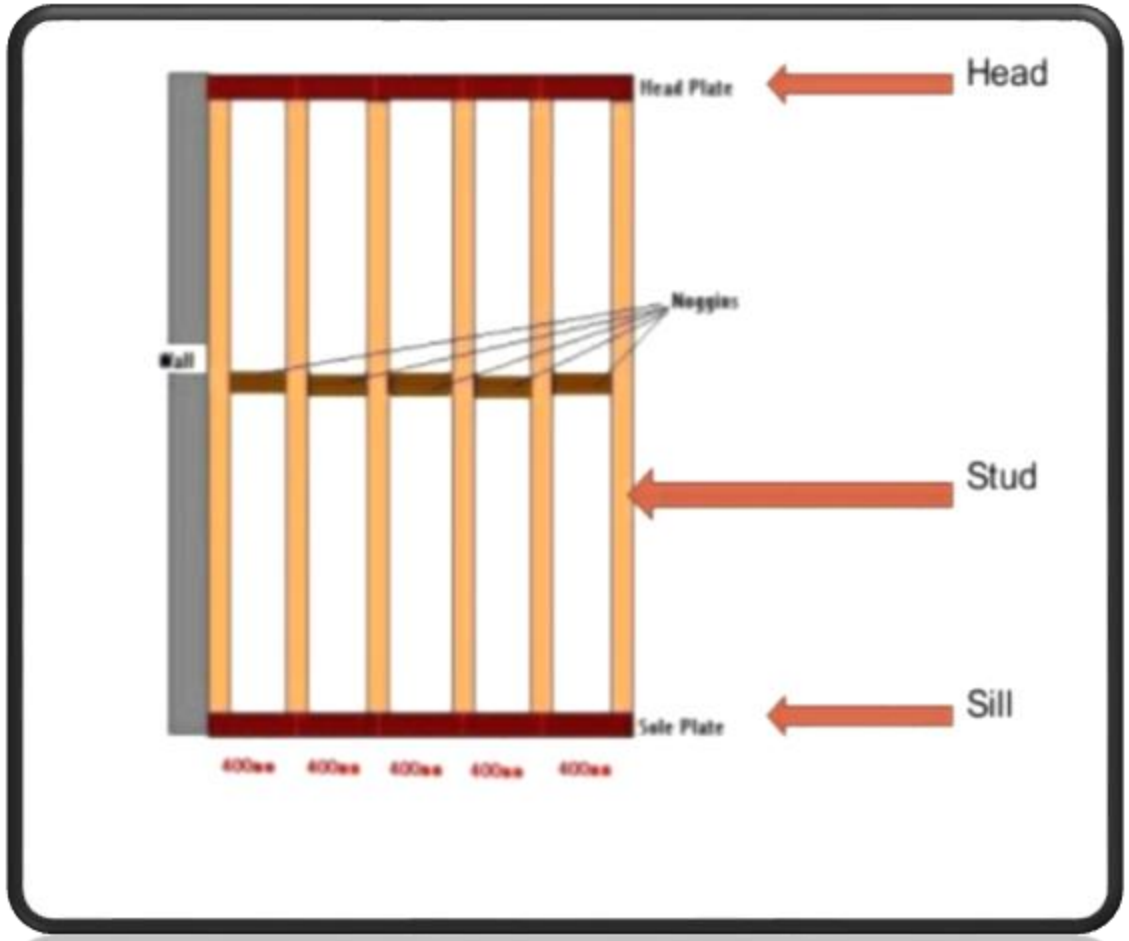
ADVANTAGES

1. Economical (Raw material is easily available)
2. Hard and durableCompressive strength is good enough for ordinary construction
3. Different orientations and sizes give different surface textures
4. Very low maintenance cost is required
5. Demolishing of brick structures is very easy, less time consuming and hence economicReusable and Recyclable
6. Highly fire rsistant
7. Produces less environmental pdlution during manufacturing process

Wooden partition

- Lighter in weight and easy to construct.
- Neither sound-proof nor fire-proof.
- Not suitable for damp locations.





Wooden partition wall

- **Wooden Partition Wall**
- Wooden partition walls are lighter in weight and simple to construct, neither sound-proof nor fire-proof.
- This partition wall is not appropriate for damp locations. Wooden partitions contain wooden edges that are connected to a sidewall and tied down to the floor.

Wood partition walls are two types –

  - Common Partitions
  - Trussed Partitions.

- Standard partitions are composed of vertical members referred to as studs bridged between the higher horizontal (head) and lower horizontal (sill) members.
- Trussed partitions are designed on the principle of the truss are helpful wherever it is attainable to produce solely.
- Wood partitions are light-weight and easy to construct, but they are prone to rot, and insect infestation and are not fire-resistant either.

- 3.5 Brick masonry : Definition of different terms

COURSE

- A continuous horizontal layer of similar bricks or stones that are bonded with mortar in a masonry structure and is one unit high

BAT

- The portion of brick that is cut across the width.

  a) Three Quarter Bat

  When the length of the bat is equal to three-quarters of the length of the original brick.

  b) **Bevelled Bat**

  When a bat has its width bevelled.

  C,)**Half Bat**

  When the length of a bat is equal to half of the length of the original brick.

BOND

- The method of arranging bricks in a pattern so that the individual units are tied together. Bonding is crucial to eliminate consecutive vertical joints both in the body as well as on the face of the wall, as this will create a weak brick structure. It is also referred as the adhesion between mortar and brick or stone units and when attaching several types of masonry walls by overlapping masonry units.

Stretching Bond

- Course of bricks that are all laid as stretchers. It is also called a running bond. If used as a structural bond it needs the proper reinforcement.

Heading Bond

- Course of bricks that are all laid as headers on the faces. A three-quarter bat is used in every other course as quoins and to properly overlap

Flemish Bond

- An alternate course of bricks that are composed of one header to one stretcher. It can also have several stretches in a row. Many times, the stretcher and headers will be of different color to create patterns.

- **English Bond**

- Alternate courses of stretchers and headers. Considered the strongest bond in brickwork. The second and the previous to last is a queen closer for all the heading courses. Alternate color shades are used for aesthetics.

Stack Bond

- Pattern when all courses are perfectly aligned. This type of bond is used for decorative purposes as it is a weak masonry structure with no strength

BULL NOSE

- A bull nose brick is a type of brick that has one or some of its corners rounded off. The are typically used to build soft and attractive curved edges to steps, ledges, or in capping walls. There are many types of bull nose bricks.

CLOSER

- The portion of the brick cut lengthwise in such a manner that its one long face remains uncut. Usually used to end a brick course or building beautiful corners.

Queen Closer (Half)

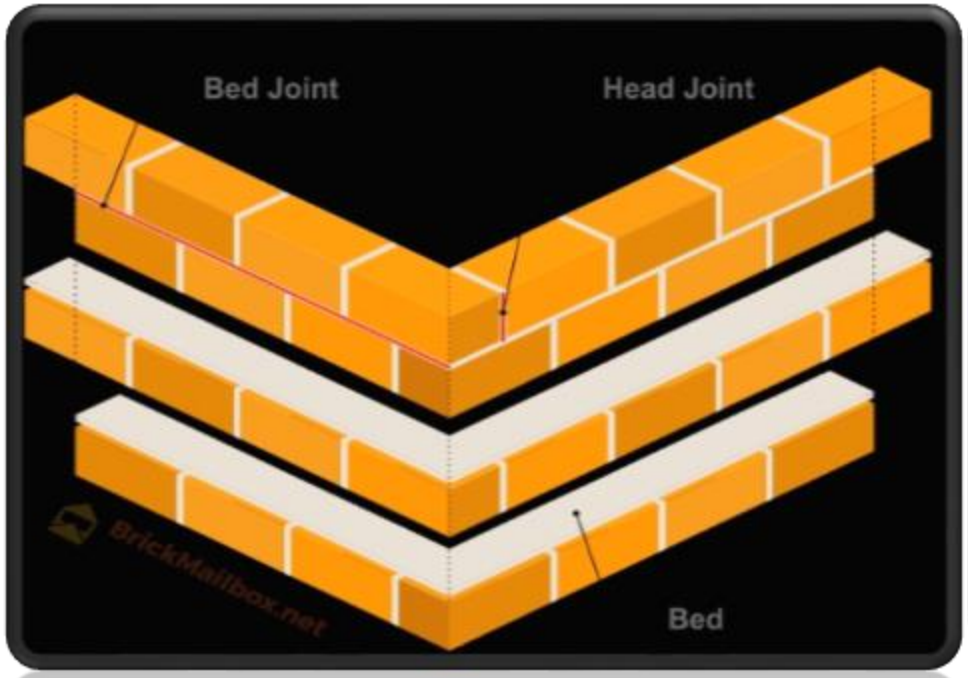
- The piece of brick taken by cutting a brick lengthwise into two parts.

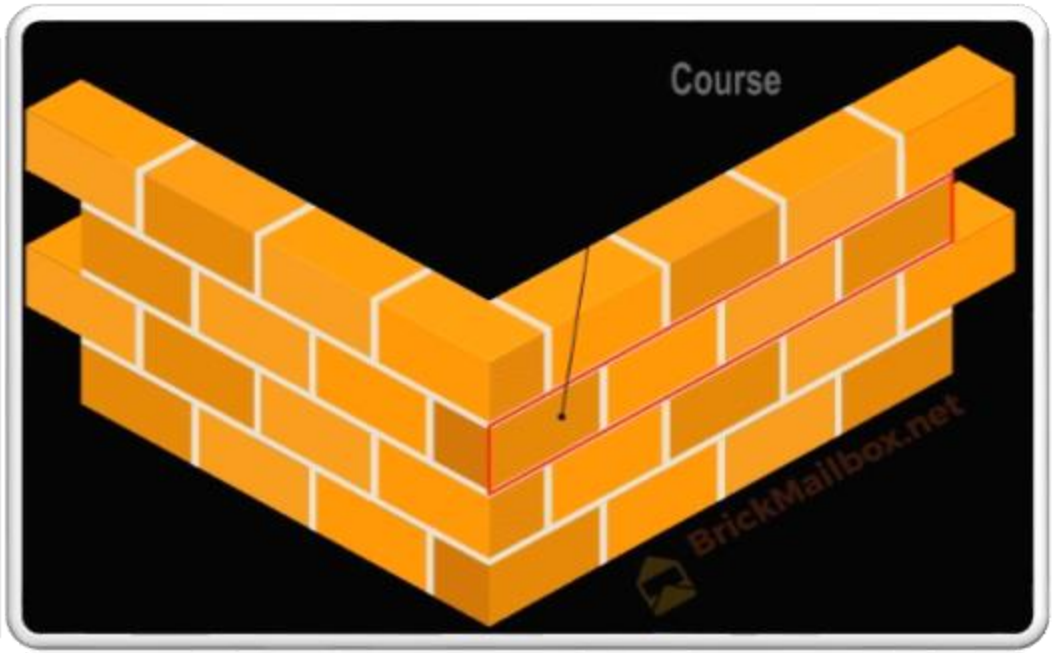
Queen Closer (Quarter)

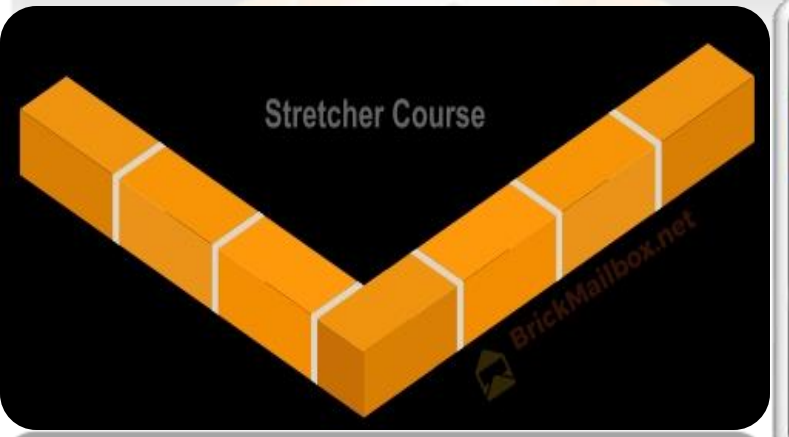
- When the queen closer is cut in half, then it is called a queen closer quarter.

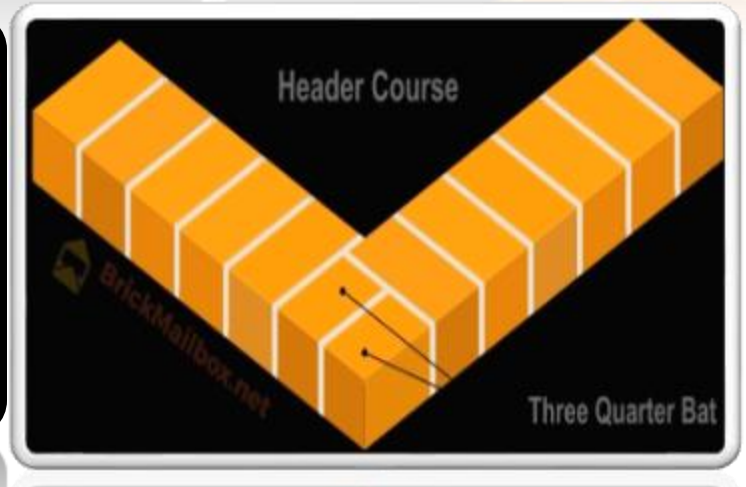
King Closer

- Brick that is obtained by cutting from the center of one header to the center of the stretcher on the other side. They are used to finish corners.

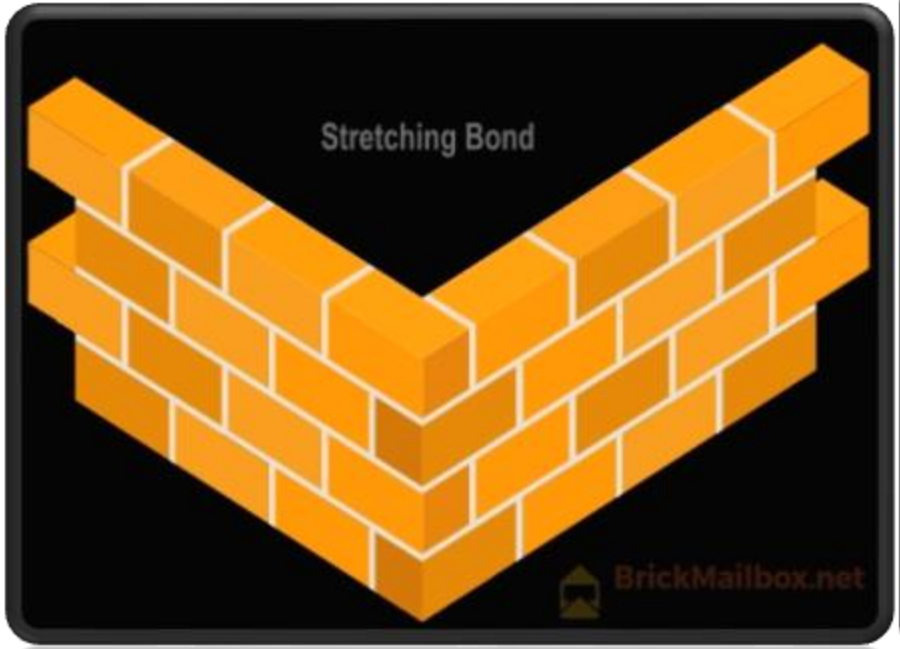

Bed Joint
Head Joint
Bed
BrickMailbox.net

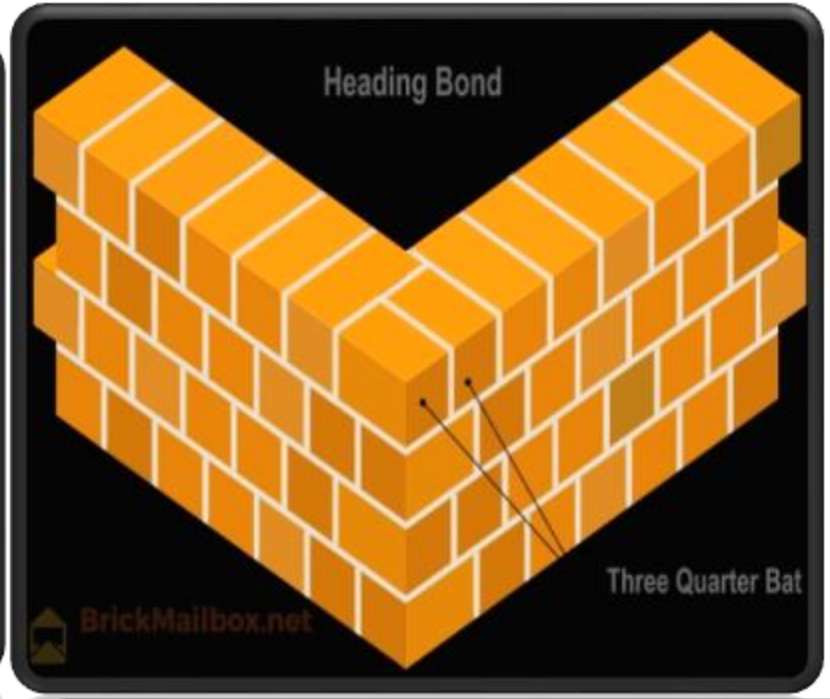

Course
BrickMailbox.net

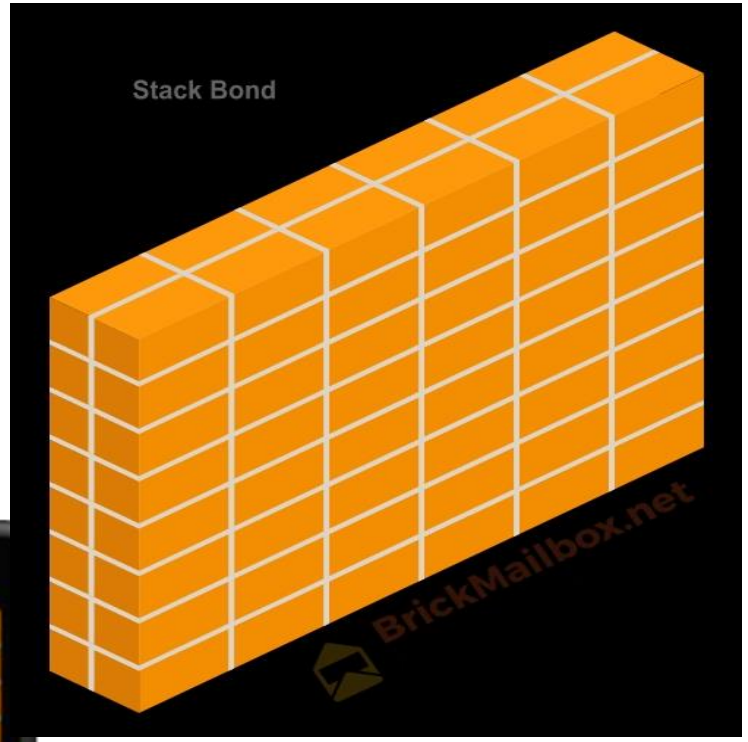

Stretcher Course
BrickMailbox.net


Header Course
Three Quarter Bat
BrickMailbox.net

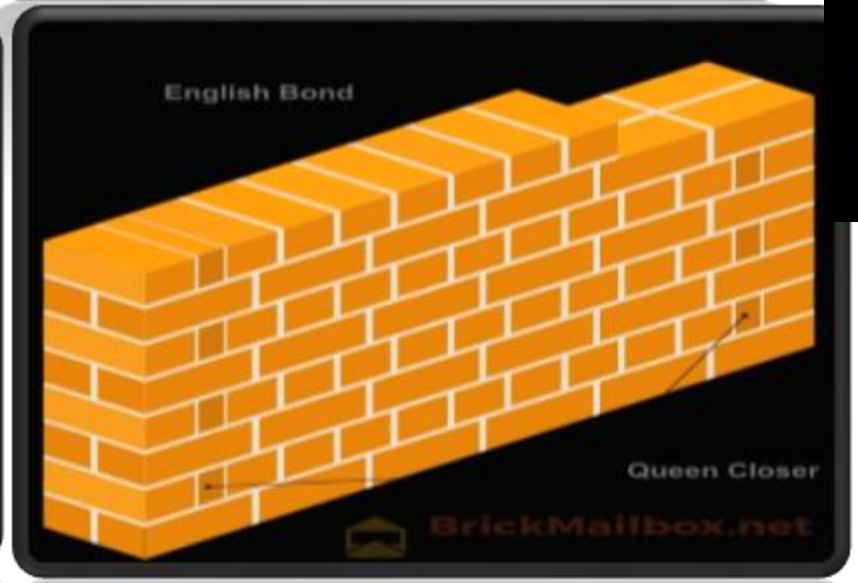

Soldier Course
BrickMailbox.net


Stretching Bond
BrickMailbox.net


Heading Bond
Three Quarter Bat
BrickMailbox.net


Stack Bond
BrickMailbox.net


Flemish Bond
BrickMailbox.net


English Bond
Queen Closer
BrickMailbox.net

. The following additional points should be noted in English bond construction:

(1) In English bond, a heading course should never start with a queen closer as it is liable to get displaced in this position.

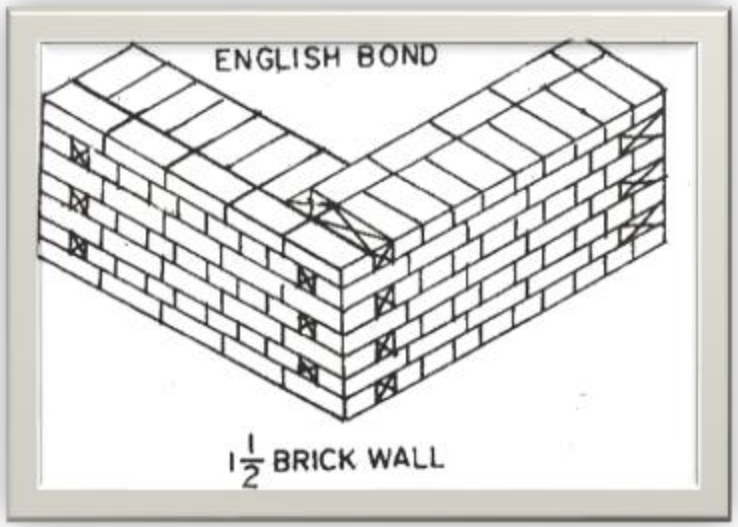
(2) In the stretcher course, the stretchers should have a minimum lap of 1/4th their length over the headers.

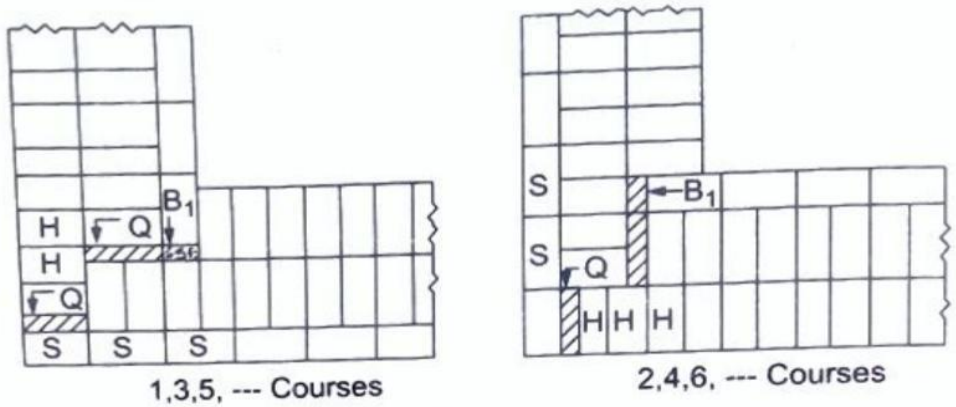
(3) Walls having their thickness equal to an even number of half bricks, i.e., one brick thick wail, 2 brick thick wall, 3 brick thick wall and so on, present the same appearance on both the faces, i .e. a course consisting of headers on front face will show headers on the back face also.

(4) In walls having their thickness equal to an odd number of half brick, i.e. 1½ brick thick walls or 2½ brick thick walls and so on, the same course will show stretchers on one face and headers on the other.

(5) In thick walls the middle portion is entirely filled with header to prevent the formation of vertical joints in the body of the wall.

(6) Since the number of vertical joints in the header course is twice the number of joints in the stretcher course, the joints in the header course are made thinner than those in the stretcher course.

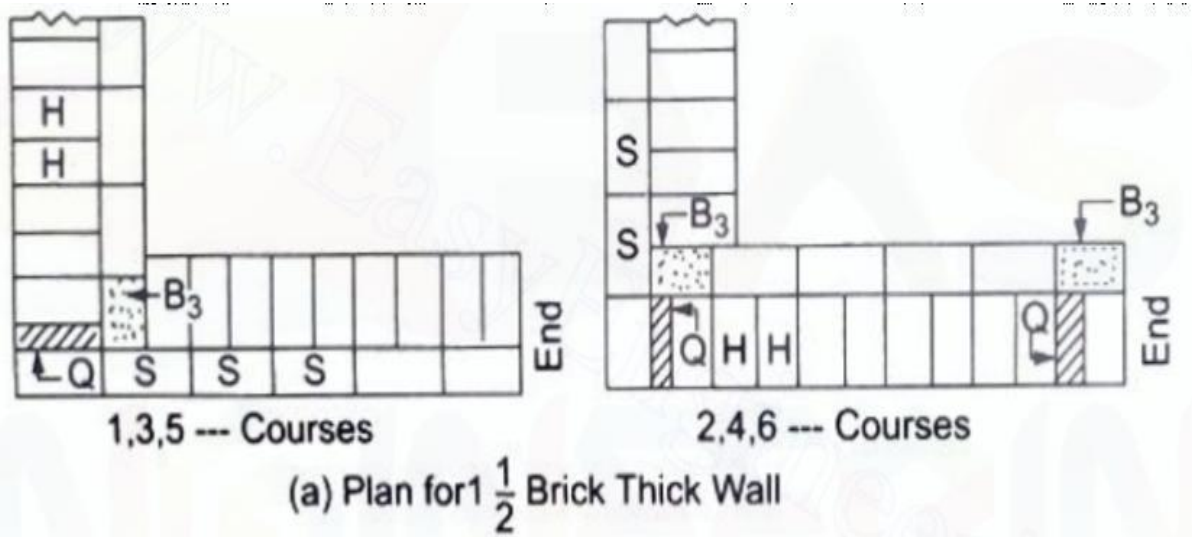




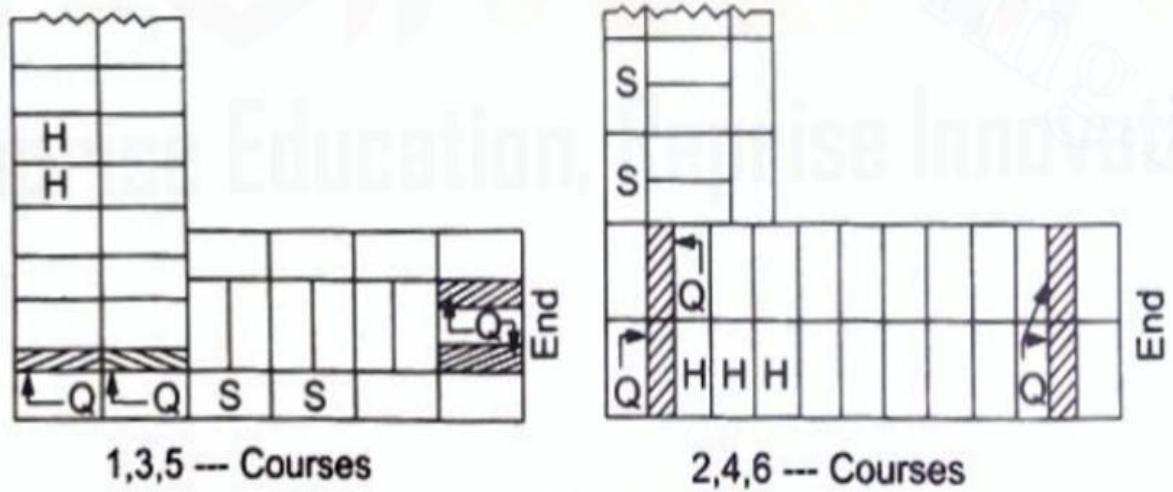
(d) Plan for $2\frac{1}{2}$ Brick Thick Wall

S = Stretcher Facing; H = Header Facing; Q = Queens Closer;
B1 = Quarter Bat (Quarter Queen's Closer)

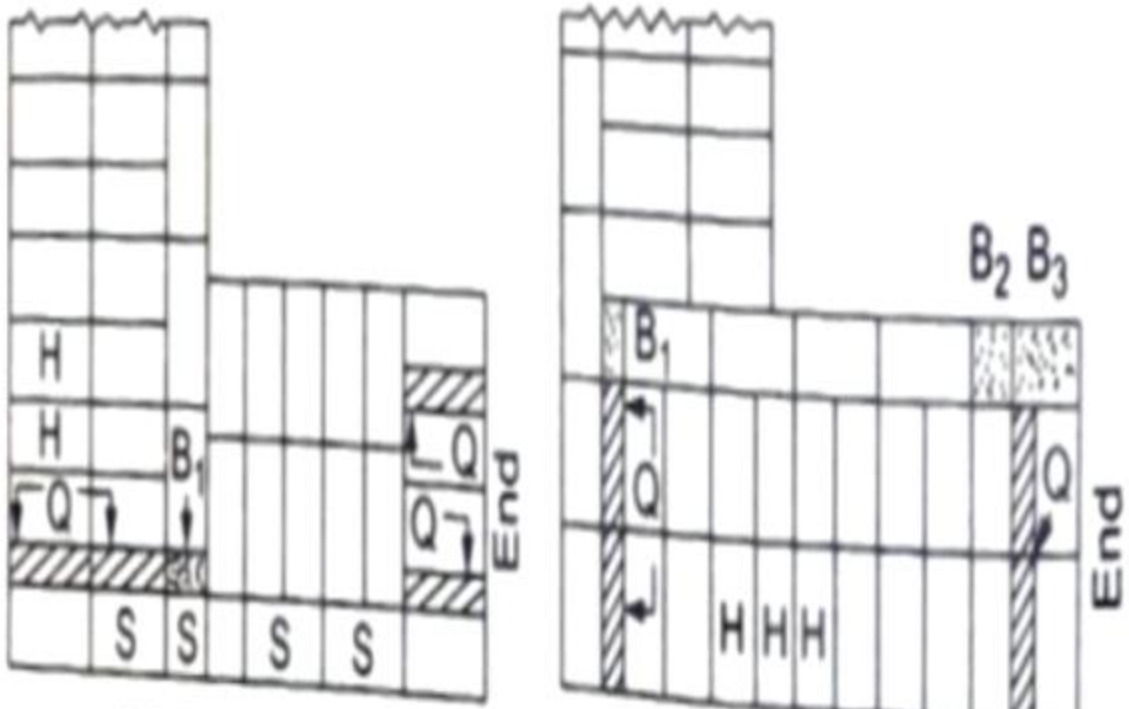
Fig. 3.17 English bond



(a) Plan for $1\frac{1}{2}$ Brick Thick Wall



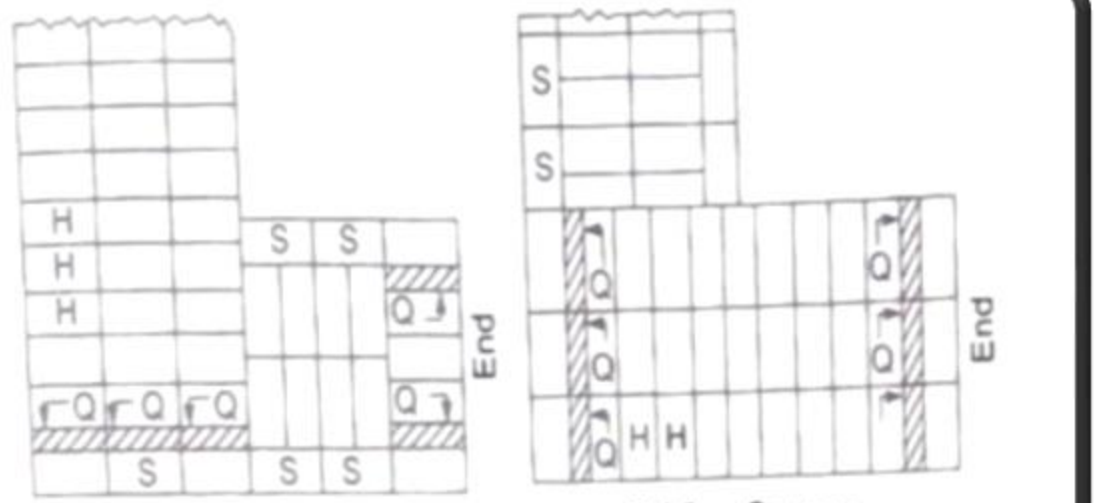
(b) Plan for 2-Brick Thick Wall



1,3,5 --- Courses

2,4,6 --- Courses

(c) Plan for $2\frac{1}{2}$ Brick Thick Wall



1,3,5 --- Courses

2,4,6 --- Courses

(d) Plan for 3-Brick Thick Wall

S = Stretcher Facing; H = Header Facing; Q = Queens Closer;

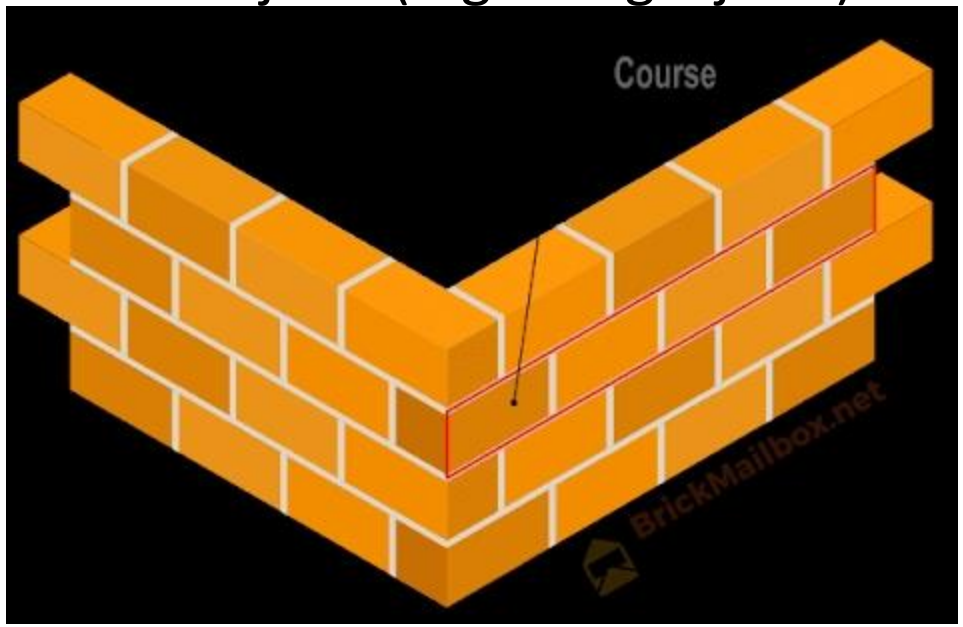
$B_1 = \frac{1}{4}$ Bat; $B_2 = \frac{1}{2}$ Bat; $B_3 = \frac{3}{4}$ Bat

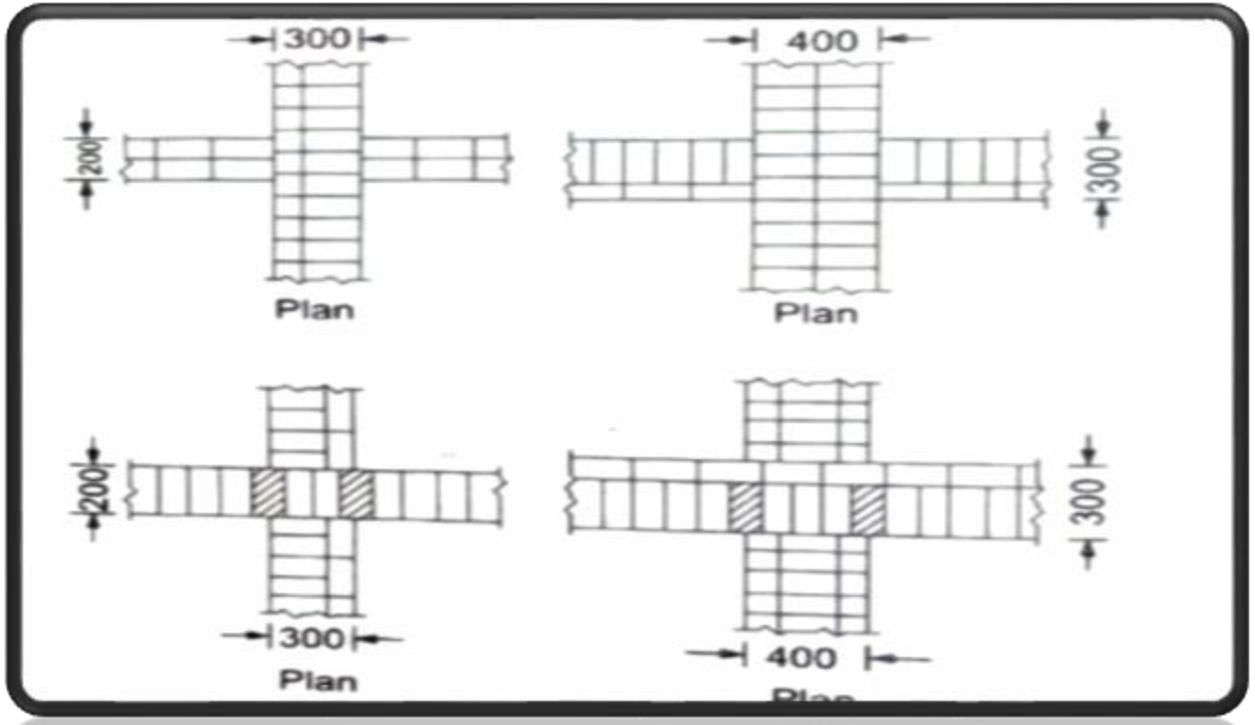
Bond at Junction:-

When two wall meet kar intersect the Meeting point is known as junction.

It of two types

1. CROSS JOINT (X joint) it is arranged using English bond.
2. T JOINT , it is arranged by using English or double Flemish Bond.
3. L joint (right angle joint)





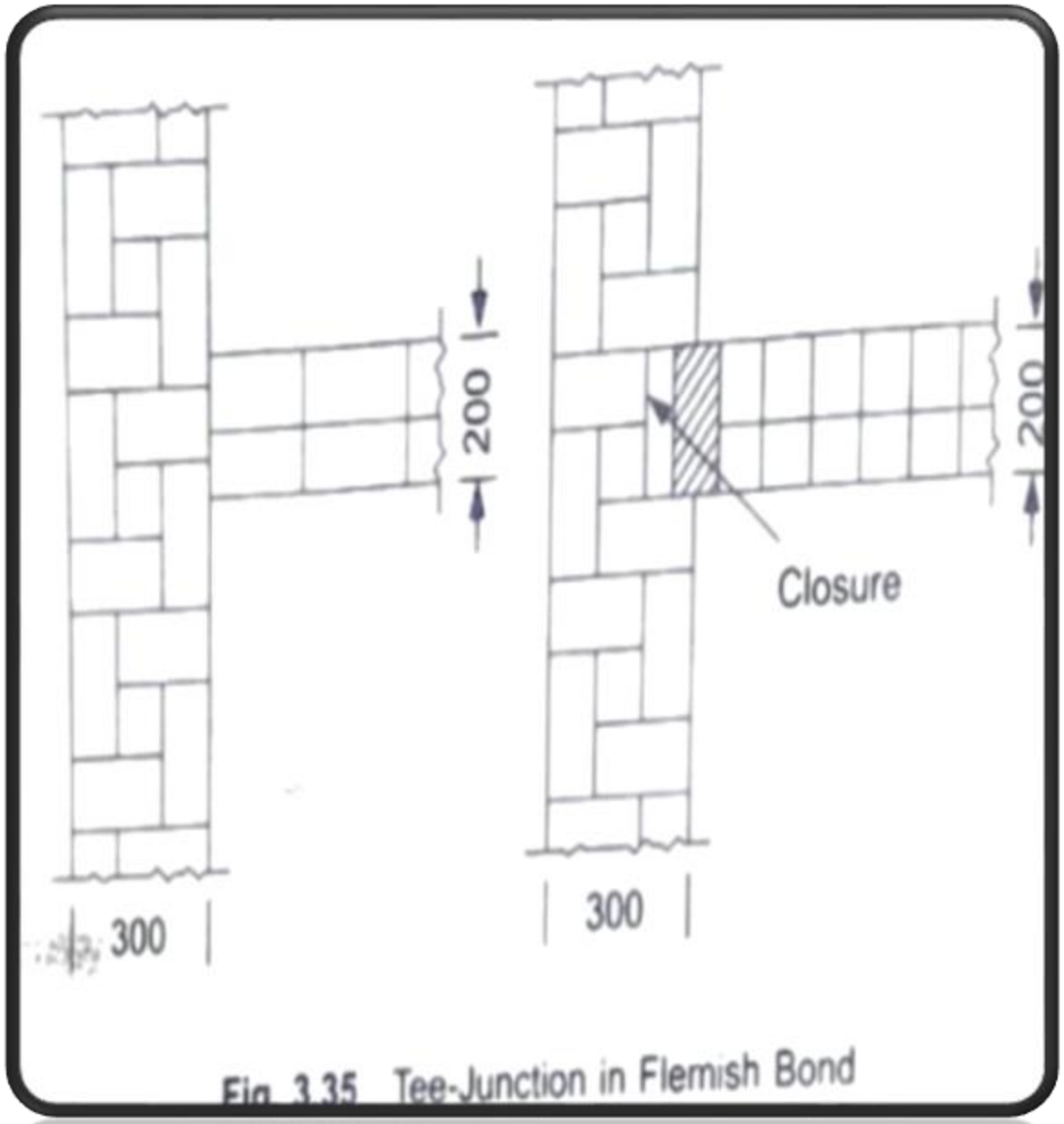
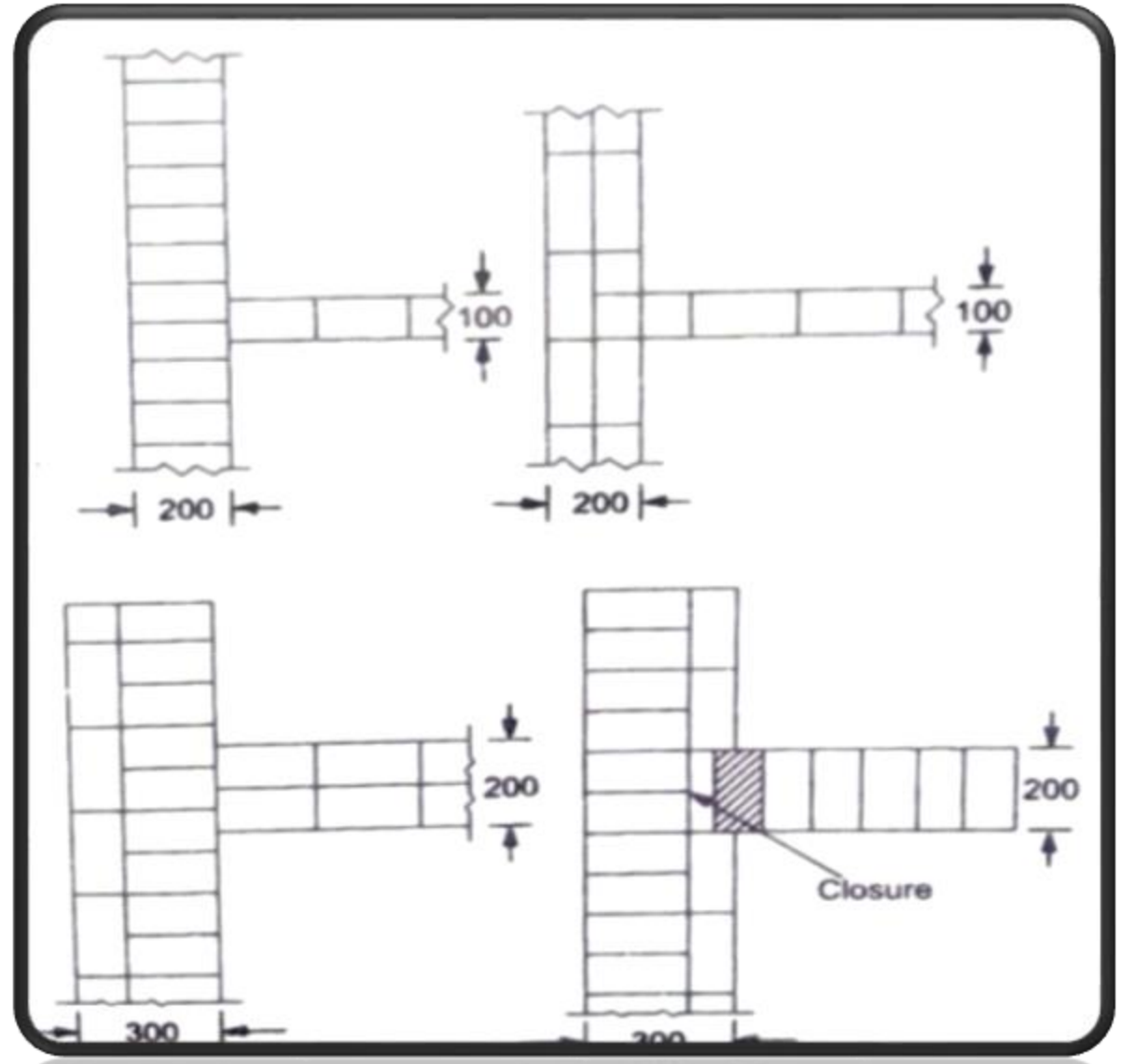
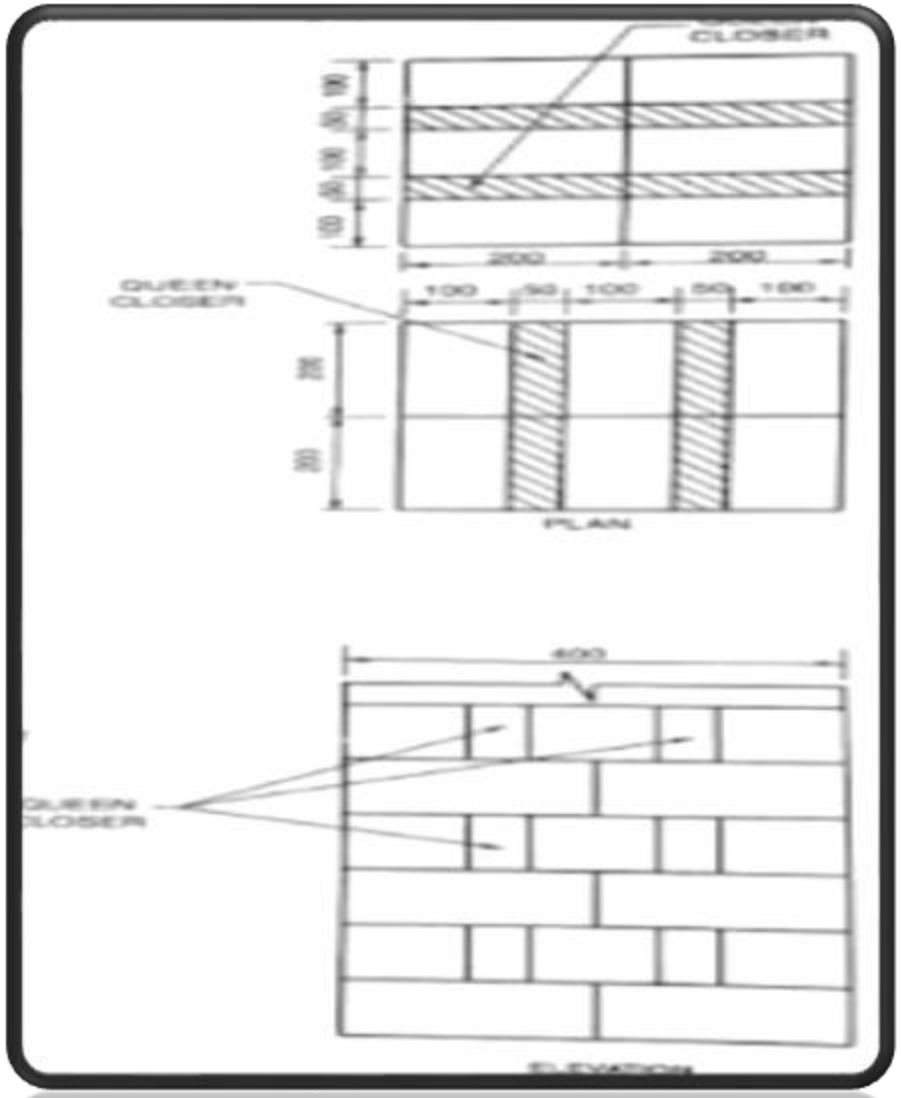
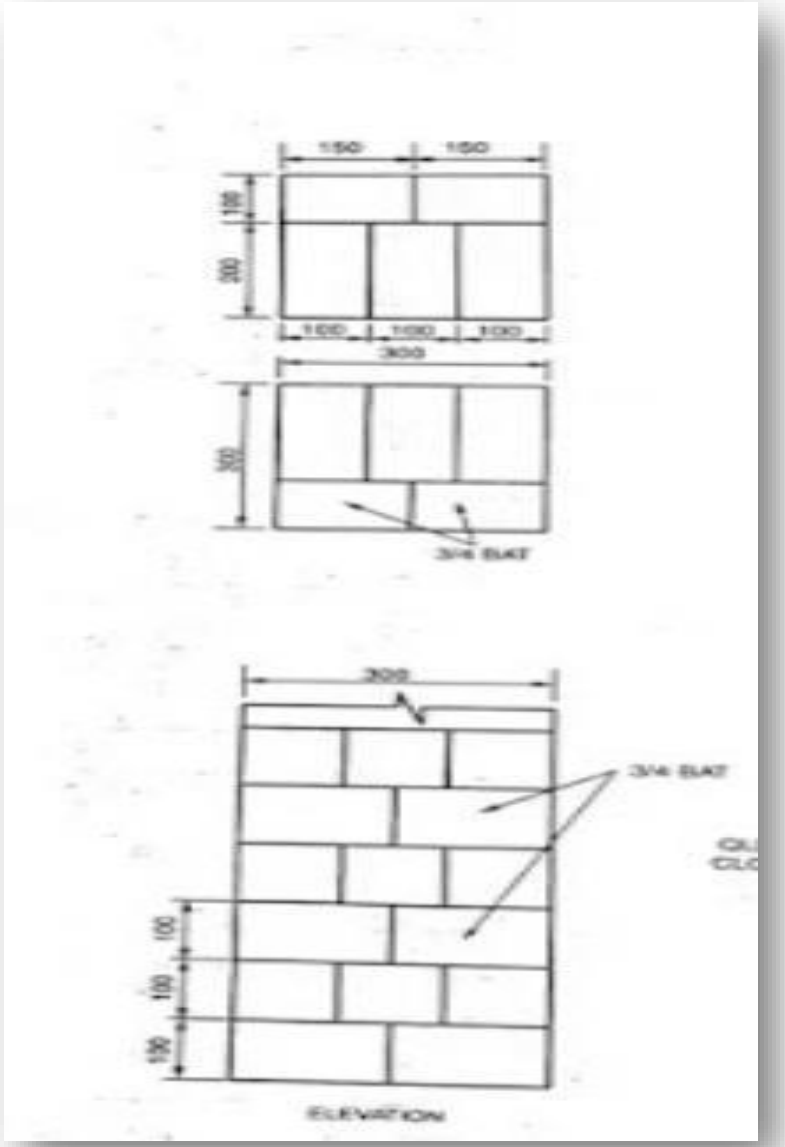


Fig. 3.35 Tee-Junction in Flemish Bond



- Thickness for 1and 1-1/2 brick square pillars in English bond





Stone Masonry

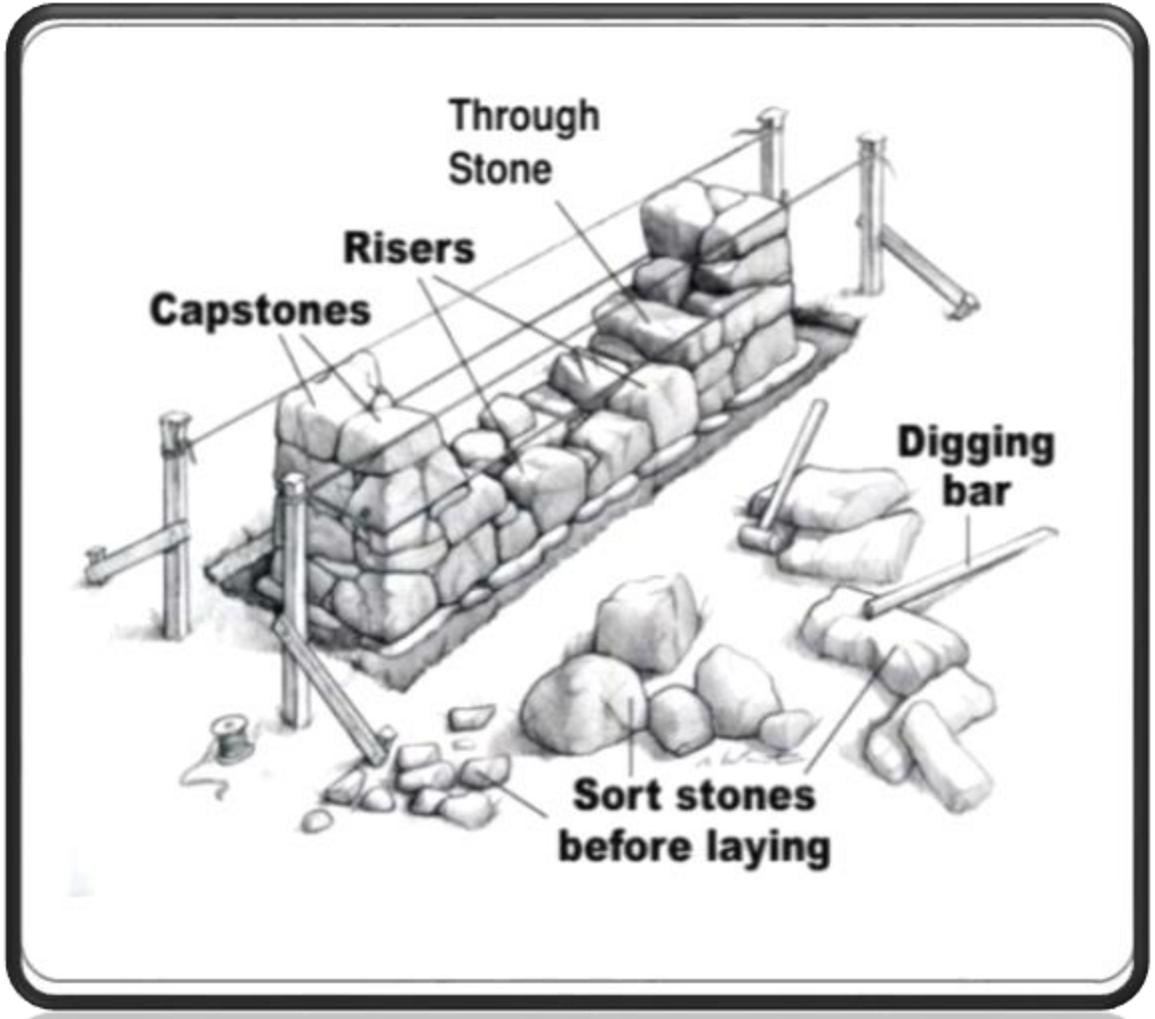
- The construction of stones bonded together with mortar is termed as stone masonry where the stones are available in a abundance in nature, on cutting and dressing to the proper shape, they provide an economical material for the construction of various building components such as walls, columns, footings, arches, lintels, beams etc.

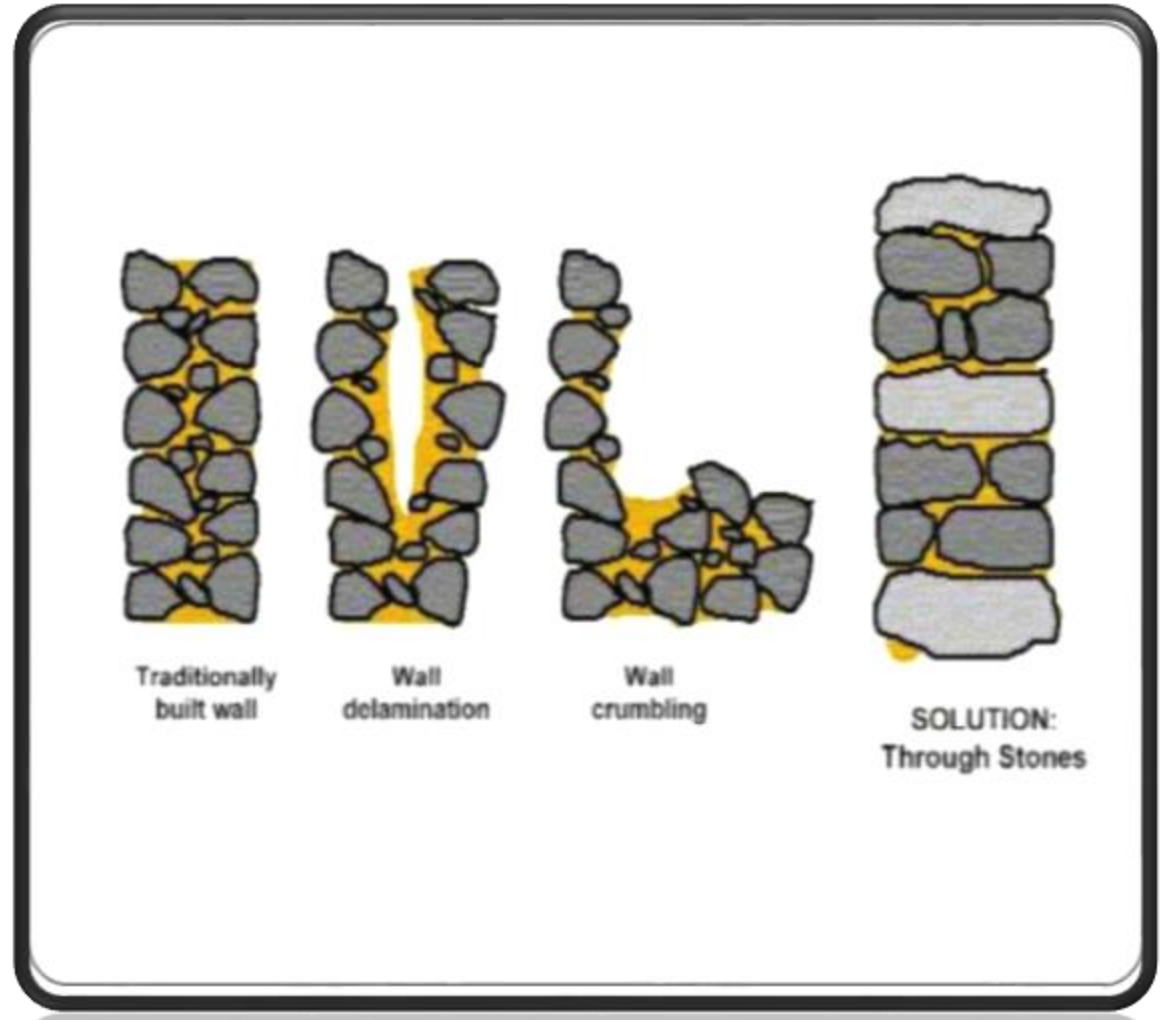
Uses

1) Building foundations, walls, piers, pillars, and architectural works.
2) Lintels, Beams, beams Arches, domes etc.,
3) Roofs and Roof coverings.
4) Cladding Works
5) Dams, light houses, monumental structures.
6) Paving jobs
7) Railway, ballast, black boards and electrical switch

Selection of Stone masonry

1) Availability
2) Ease of working
3) Appearance
4) Strength and stability
5) Polishing characteristics
6) Economy
7) Durability


Through Stone
Risers
Capstones
Digging bar
Sort stones before laying


Traditionally built wall
Wall delamination
Wall crumbling
SOLUTION: Through Stones

Types of Stone Masonry:

Based on the arrangement of the stone in the construction and degree of refinement in the surface finish, the stone masonry can be classified broadly in the following two categories

1. Rubble masonry
2. Ashlar masonry

1) Rubble masonry:

In this category, the stones used are either undressed or roughly dressed having wider joints. This can be further subdivided as uncoursed, coursed, random, dry, polygonal and bint.

- ***(i) Uncoursed rubble masonry:*** This is the cheapest, roughest and poorest form of stone masonry. The stones used in this type of masonry very much vary in their shape and size and are directly obtained from quarry. Uncoursed rubble masonry can be divided into the following.

  a) Uncoursed random rubble
  b) Uncoursed squared rubble

Uncoursed rubble masonry

- *a) Uncoursed random rubble masonry:* The weak corners and edges are removed with mason's hammer. Generally, bigger stone blocks are employed at quoins and jambs to increase the strength of masonry

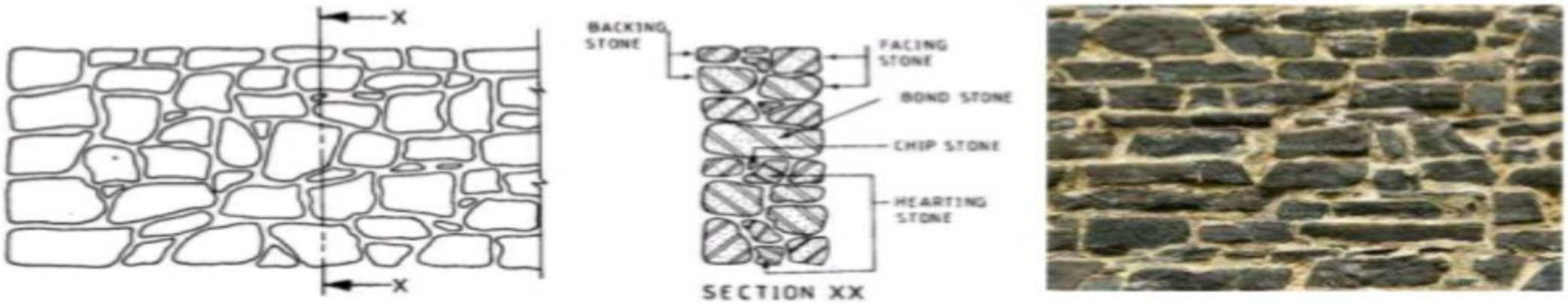
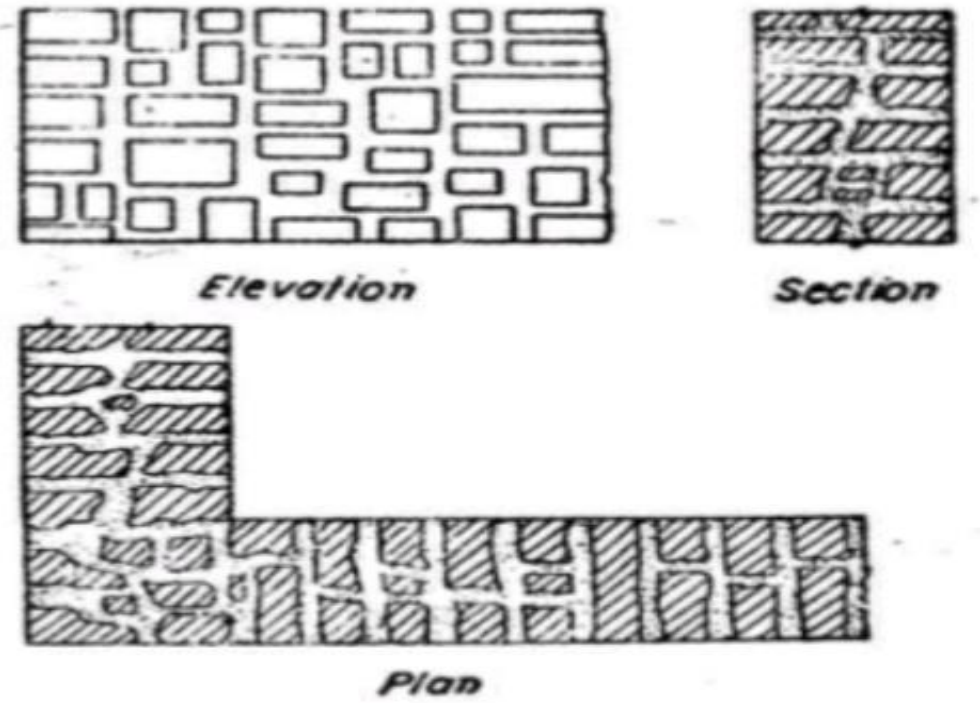


FIGURE 1- RANDOM RUBBLE MASONRY

Uncoursed rubble masonry

- *b) Uncoursed squared rubble:*

In this type the stone blocks are made roughly square with hammer. Generally the facing stones are given hammer-dressed finish. Large stones are used as quoins. As far as possible the use of chips in bedding is avoided.



Ashlar Masonry

- This type of masonry is built from accurately dressed stones with uniform and fine joints of about 3mm thickness by arranging the stone blocks in various patterns.

- The backing of Ashlar masonry walls may be built of Ashlar masonry or rubble masonry. The size of stones blocks should be in proportion to wall thickness.

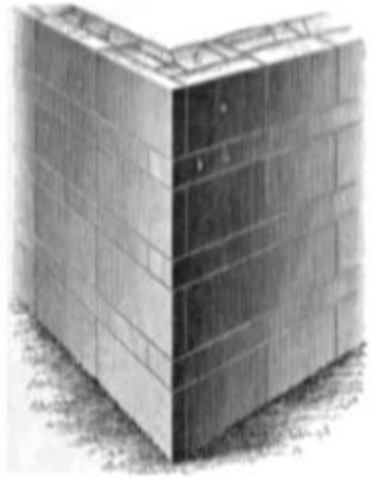
Ashlar Masonry

Ashlar fine

Ashlar rough

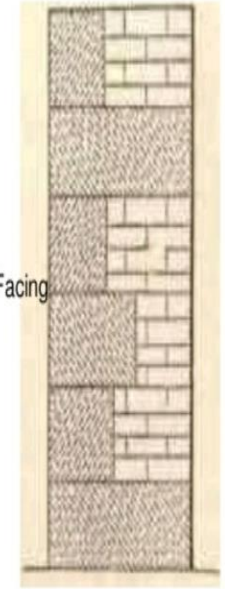
Ashlar Masonry

Ashlar rock or quarry faced



Ashlar block in course

Ashlar Masonry



Ashlar facing

Ashlar chamfered

String course.

- It is a horizontal projecting course of masonry, usually projecting from the face of the wall, intended to throw off rain water. It also gives architectural appearance and adds to the strength of the wall.

Cornice.

- It is the projecting ornamental course, usually moulded to add to the appearance of the wall. A cornice is placed in a wall, at the junction of wall and roof.

Coping.

- The top of a parapet wall is finished with a special course to protect it from rain water. This course is called coping

Parapet.

- It is a low wall built round a terrace in the case of buildings with flat roofs. It is intended primarily to act as a fence wall

Corbel:-

- A corbel is a projecting stone which is usually provided to serve as a support for roof truss, beam,weather shed etc.
- The corbel are generally moulded and given ornamental treatment.
- The Corbel should **extend at least ⅔ of their length** into the wall

Throating :

- A groove is provided on the underside of sill, cornice & coping so that the rain water can be discharged clear of the wall surface. It is known as **throating**.

Through stone:

- In stonework, some stones at regular intervals are placed right across the wall Such stones are known as the through stones or throughs or bond stones.
- The through stones should be non-porous so as to prevent the entry of moisture through the wall.
- They should also be strong and of sufficient thickness so as to avoid the danger of fracture due to any slight settlement of the wall.

BLOCKING COURSE

- It is a top most course of stone masonry provided immediately above the cornice to prevent the tendency of the cornice to overturn. It also adds to the aesthetics of the cornice.

Buttress:

A buttress is a sloping or a stepped pier and it is provided to work as lateral support of the wall.

Pilaster:

A right-angled columnar projection from a wall or a pier is known as a pilaster.

TEMPLATE:

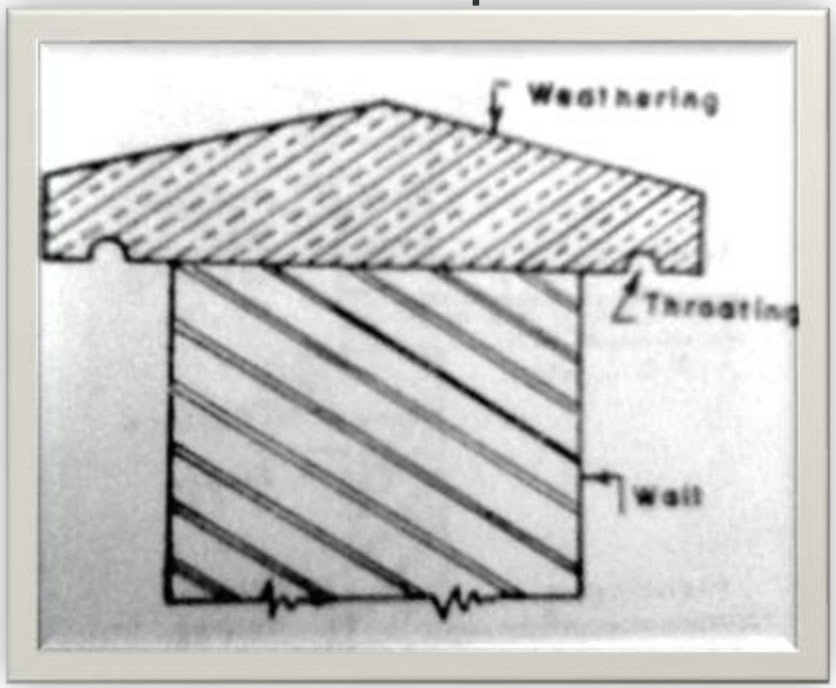
Pieces of stones placed under the end of a beam to distribute the load over a greater area.

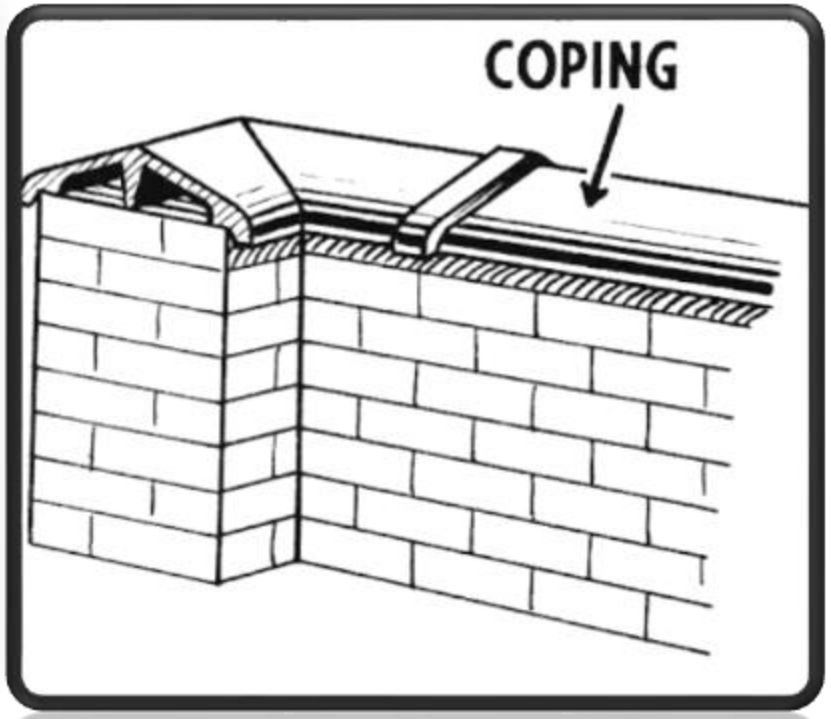
Grouting:-

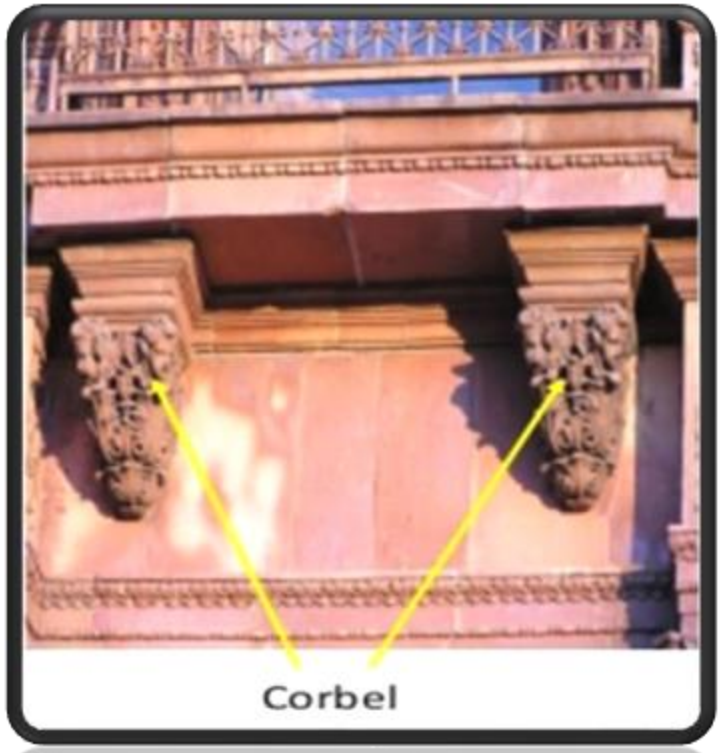
The process of filling voids in masonary of stone is known as grouting.

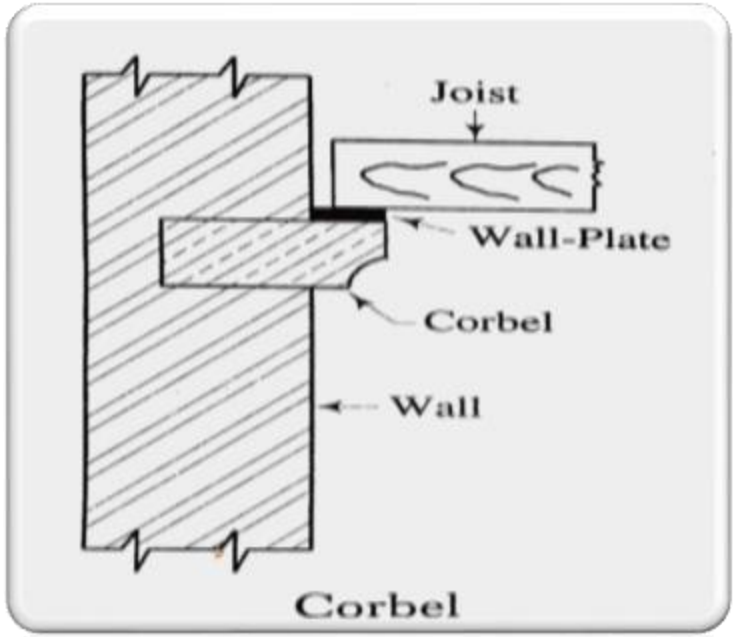
Parapet:

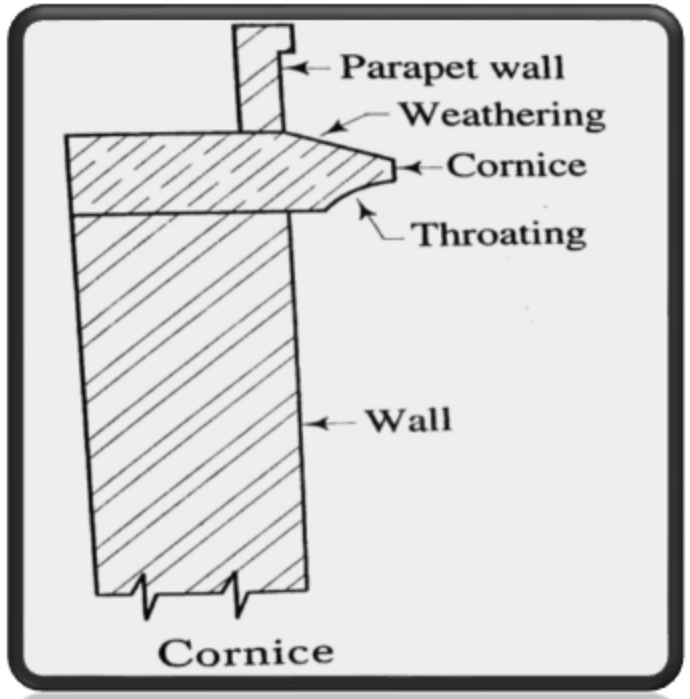
It is the portion of low height wall constructed along the edge of the roof to protect the users.

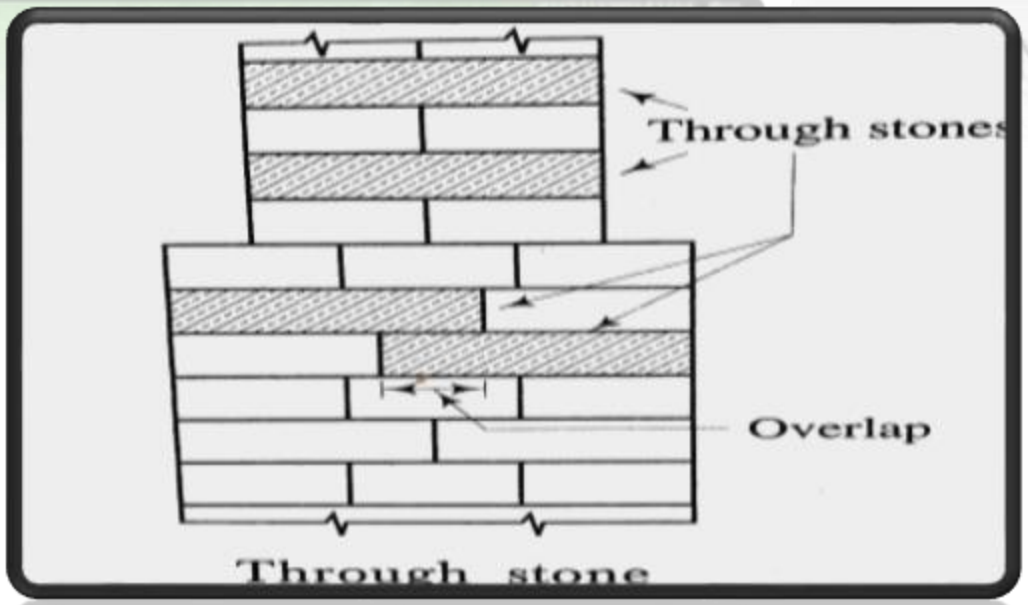







Joist
Wall-Plate
Corbel
Wall
Corbel


Parapet wall
Weathering
Cornice
Throating
Wall
Cornice


Through stones
Overlap
Through stone


Quoin