

Brick Masonry:-

It is defined as;

"The arrangement or assembly of bricks in such a manner in which it form a well defined mass."

OR

"Assembly of bricks properly bounded together in mortar called brick masonry."

(Brick)

(*) It is building block of structure. It is the oldest constructional material.

(*) This brick masonry distribute load of bricks uniformly.

(*) According to survey done by UET, Peshawar about 70% of buildings made from bricks masonry in Pakistan.

Reasons for widely used bricks Masonry:-

Bricks masonry are widely used.

i. It has low cost

ii. Availability of raw material for bricks.

iii. Not involve sophisticated process for construction of brick masonry.

Terminologies:-

These names or construction material "are used in brick masonry as:

(1) Brick:-

"It is artificial masonry unit made from burnt clay."

→ Bricks can be made by pour earth's soil into uniform block of regular dimension. These are then either dry by sun which is called dried or kacha bricks or burnt in kiln which is called burnt or pucca bricks. The strength of burnt brick is more than dried brick.

Classification of Brick:-

(1) First Class Bricks:-

"The bricks which are perfectly and evenly burnt" strength = 2000 psi

(2) Second Class bricks:-

"The bricks which are evenly burnt"
strength = 1500 - 1600 psi

(3) Third class bricks:-

"Those bricks which are over burnt"
→ These bricks are used in substructure
its strength is same but not aesthetic.

Sizes of bricks:-

We have two types of sizes for brick.

i- Actual size:-

The actual size or standard size of brick is called actual size.

The actual size of brick in Pakistan is;

In Inches:-

$$8 \frac{5}{8}'' \times 4 \frac{1}{8}'' \times 2 \frac{5}{8}''$$

In millimeter:-

$$220\text{mm} \times 150\text{mm} \times 66.5\text{mm}$$

Nominal size:-

The size of brick along with 1 inch size of mortar on each side of brick.

→ When ^{we} are construction a wall so we join a brick with other through mortar at mortar joint. In case of construction of building we consider nominal size of brick.

(ii). Nominal size in Pakistan.

$$9'' \times 4 \frac{1}{2}'' \times 3''$$

Length $\times$ width $\times$ height

In millimeter

$$228.5\text{mm} \times 114\text{mm} \times 76\text{mm}$$

(*) The average mortar thickness between brick should be $\frac{3}{8}$ " or 10mm.

From this we can say that's

For 100 ft^3 we need 1420 bricks.

How to find number of bricks for different construction:-

Consider we have room of $100 \text{ ft} \times 100 \text{ ft}$
The height of wall should be 9' and
width of wall is $9" = \frac{9}{12} = 0.75 \text{ ft}$.

so first we will find the volume of room. let the volume of room is 500 ft^3

So the number of bricks required is;

$$= 1450 \times 5.$$

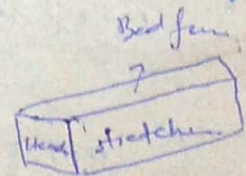
$$N = 7250 \text{ Bricks.}$$

Faces of Brick:-

i- Stretcher face:-

The face which shows length and height of brick called stretcher face.

From this face we can see the length & height of brick.



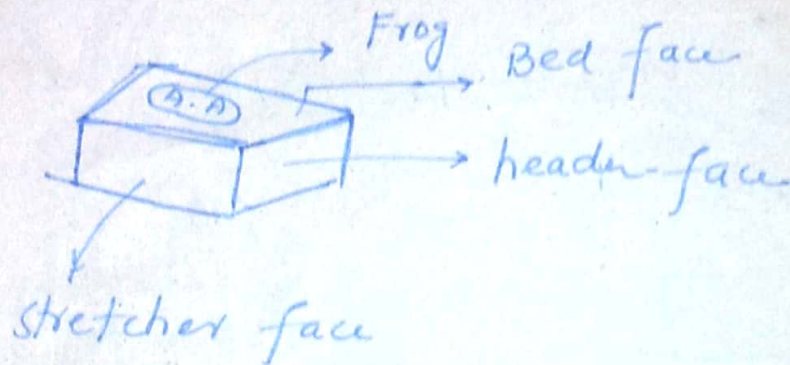
ii- Header face:-

The face from which we can see the width and height called header face.

Bed face:-

The face from which we can see length and width of brick called bed face.

(*) The bed has a portion where the some letter is written. That portion is called frog or imprint.



(*) The frog is used because we can add extra mortar so that good interlocking in order to increase its strength.

Course:-

The horizontal layer of bricks in mortar of wall is called course.

Frog:-

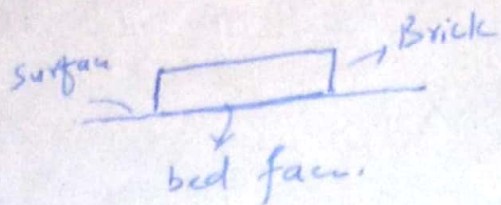
The depression made on either side of bed face called frog.

Advantages:-

- Can be used as trademark.
- It acts as key for interlocking of two courses so that to give more strength.

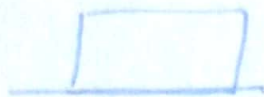
(4) Brick on bed:-

"If the brick is placed on surface in such a way so that its bed face is in contact with surface."



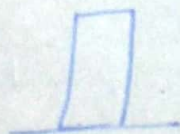
(5) Brick on Edge:-

When surface is in contact with the stretch of brick.



(6) Brick on End:-

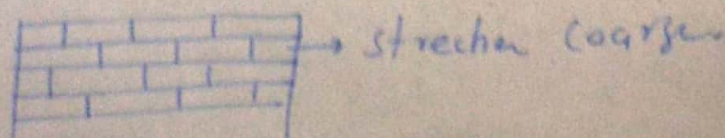
When surface is in contact with header of brick.



(7) Stretcher Course:-

When we construct a wall such that from where we see there is stretcher along the course called stretcher course.

For e.g

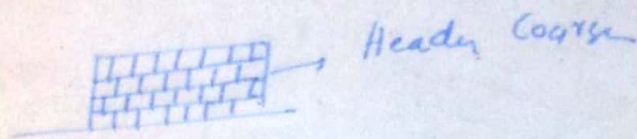


Imp. note:- It provide longitudinal strength

8) Header Course:-

When in elevation of wall we see the header of brick along a course called header course.

For e.g.



Importance:-

It provides transverse strength to wall.

Note:-

We want both longitudinal & transverse strength in wall. So there is stretcher as well as header course in wall.

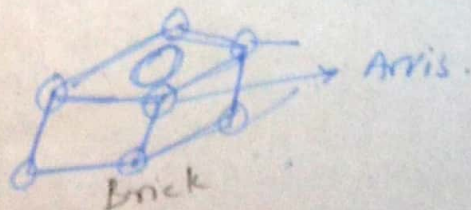
9) Quoin Brick:-

The brick that lie at external corner of wall called quoin brick.

→ The ^{brick on} external corner of wall called quoin.

(10) Arris:-

The corner edge of brick is called arris.



(11) Closer:-

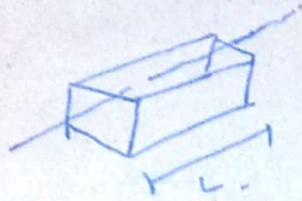
The portion of standard brick made when it is cut along the length called closer.

→ Used for forming proper bond in brick masonry.

We have two types of closer.

(12) Queen Closer:-

When brick is cut along its length into two equal halves called queen closer.



Uses:-

- It has same length as of brick but half width.
- It is used next to quoin header for forming a proper bond in brick masonry.

(13) King Closer:-

When the brick is cut in triangular form from mid of stretcher to mid of header called king closer.



King Closer.

- It is used in oblique junction and near door where we want round edge not sharp edge, i.e. to give chamfer.

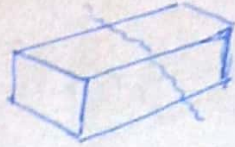
(14) Brick Bat:-

When the brick is cut along its thickness the portion obtained called brick bat.

Types of Brick bats:-

1- Half Brick bats:-

When the brick is cut into two equal along its width called half brick bat.



2) Three Quarter brick bats:-
When the brick is cut at three quarter of its width, the resulting long portion of brick called three quarter brick bat.



(3) Quarter Bat:-

The remain portion of three quarter bat is called Quarter bat.



(15) Bed Joint:-

Horizontal mortar joint that is between two course of brick.

→ These joint should have uniform thickness

(16) Header Joint:-

A vertical joint between any two consecutive bricks which connect header of bricks.

(17) Plinth Masonry:-

The masonry provided from ground level to plinth level of building called plinth masonry.

(18) Plinth Course:-

The top course of plinth masonry of a building called plinth ^{course} masonry.

(19) Jamb:-

The vertical side of door or window either made of wood or steel to support the door or window called jamb.

(20) Soffit:-

The bottom surface of lintel, arch or roof is called soffit.

(21) Column & Pillar:-

Column is isolated vertical and load bearing member of structure.

Column cannot be inside wall.

Its width should not increase four times in its length.

(22) Pillar:-

It is vertical isolated used for decorative, memorial purposes.

→ Used to support statue in European countries.

(23) Pilaster:-

A thickened vertical load bearing member forming integral part of wall called pilaster.

→ We make pilaster at certain distances found in wall.

Importance:-

It is used to increase stiffness that is provide resistance to earth quake and any longitudinal deformation.

→ To carry concentrated load due to beam, girder or truss.

(24) Facing:-

The exterior part of wall is called facing.

(25) Backing:-

The interior part of wall is called backing.

(26) Hearting:-

The internal layer of mortar between facing and backing is called hearting.

(27) Coping:-

To avoid the hearting from rain water.

We either construct a course of bricks or provide mortar in sloopy form.

(26) Tooling:-

The externally bulging out of bricks at exterior of wall for different purposes called tooling.

Types of Brick Masonry:-

We have - three types of brick masonry.

(a) Unreinforced Masonry:-

"A masonry without reinforcement is called unreinforced masonry."

Abbreviation:-

It is abbreviated as "URM."

→ In this case of masonry no reinforcement are used, the walls and building of structure is made of bricks and mortar except plinth level. This masonry is commonly seen.

Advantages:-

- (*) Easy to construct.
- (*) Required less time & low cost.
- (*) It is good to construct in non seismic region where earthquake are less coming.

Disadvantages:-

Such masonry take vertical load only.

In case of lateral load or out of plane forces this masonry not work.

→ This masonry has little resistance to earthquake loads.

(b) Rienforced Masonry:-

"When rienforced (steel) is provided in masonry called rienforced masonry."

→ It is abbreviated as RM.

(*) Quetta bond is used in this case of masonry. Hollow bricks are used so that rienforcement can be done

Advantages:-

→ This masonry provided both horizontal and vertical resistance to any load.

→ Provides good strength to structure.

Disadvantages:-

→ More time is required as difficult to construct.

→ Required more supervision.

(*) Since special bricks that are hollow so that easily ~~construct~~ steel insert it so more costly also.

(3) Confined Masonry:-

In this case wooden or confined elements like column, reinforced etc are used to confined masonry from all sides.

→ It can also be called as ~~confi~~ hybrid masonry because the brick masonry can be confined by wood or reinforced concrete.

(*) Walls are first constructed with toothing left at junction and concrete is than pour in order to develop a proper bond between masonry wall and concrete elements.

Advantages:-

↳ Its cost is less than that of Reinforce masonry and more provide strength as compare to unreinforce masonry.

→ Appropriate masonry.

Brick Masonry Bond:-

It is defined as;

The arrangement of bricks or joints in wall is in such a way that head joints not coincide or come parallel with each other called brick masonry bond.

OR

The arrangement of bricks in wall to vertical joints called masonry bond.

Explanation:-

In order to distribute the load of wall & its brick properly we arranged the bricks in such a way that two or more heads joints in different courses not come parallel to each other. For example if such condition happen i.e. two joints come parallel then load of wall will not distribute evenly and it will acts as separate column. The purpose of avoiding continuity in vertical joints is to provide gravity and lateral strength to wall by distributing load throughout the masonry.

→ For a good bond the length of brick shall be twice the width of brick & lap of between bricks of successive courses shall be not less than one fourth of the length of brick.

Types of Brick Masonry bond:-

- i. English bond (ii) Flemish bond (iii) Stretcher bond
- iv) Header bond (v) Garden wall bond (vi) Racking bond
- vii) English cross bond (viii) Dutch bond.
- ix) Monk bond (x) Zigzag bond.
- xi) Brick on edge bond xii) Silver's lock bond

① English Bond:-

In this bond alternate header and stretcher course are used.

→ This type of bond provide more strength as compared to astetic.

→ Most commonly used in Pakistan. About 70% of bonds are English bond, because of high strength.

→ Quoin brick with Queen closer are required at the end of wall for every header course.

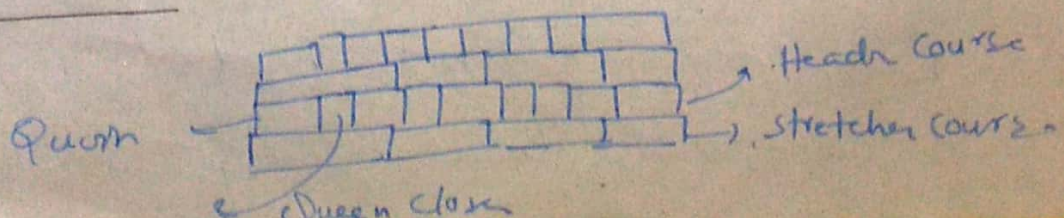
→ If the thickness of wall is even multiple of half brick length then if there header course on backing same will be header on facing and vice versa.

→ If the thickness of wall is odd multiple of half brick length then if there is header on facing then stretcher will on back.

Uses:-

This type of bond is used when we need strength not astetic.

Rough sketch:-



(2) Flemish Bond:-

A bond in which there is alternate header and stretcher at same course called Flemish bond.

→ Commonly seen in Europe.

→ This type of bond has less strength but more estatic than English bond.

→ Here, Quoin and Queen closer is provided alternately at end of wall.

Types of Flemish bond:-

① Single Flemish bond:-

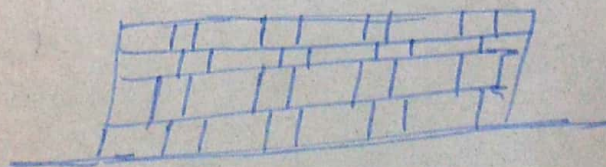
It is also called cross or hybrid bond.

In this we see flemish bond in facing and stretcher bond in backing of wall.

② Double Flemish bond:-

In this case we see Flemish bond on both sides i.e. facing & backing.

Rough sketch of Flemish bond:-



Comparison of English & Flemish bond:-

Flemish.

English
with respect to

1. Construction:-

On basis of construction there is header and stretcher in alternate course.

2. Strength:-

English bond masonry has more strength.

3. Appearance:-

Rough appearance for 1 brick thick wall.

4. Head Joint:-

No continuous vertical joint is allowed.

5. Progress:-

Special care ^{not} needed so easy to construct early.

6. Economic:-

Costly as brick bats are not used.

• There is alternate header and stretcher in same course.

• It has relative less strength as compared to English bond.

• Good appearance (more aesthetic) for all kind of thickness.

• Partially continuous vertical joints i.e why less strength.

• No special attention needed & complex so not construct early.

• Less costly as brick bats are used.

3) Stretcher bond:-

(*) The bond in which there is alternate ~~header~~ stretcher in every course.

In order to brick vertical continuity half brick bat is provide at every alternate course, as shown.



→ This type of bond is used to make a wall of $4\frac{1}{2}$ " or

half thick brick wall.

→ It is used when we provide partition wall.

(4) Header Bond:-

When the bricks are connected through stretchers with the help of mortar & we see header on facing & backing.

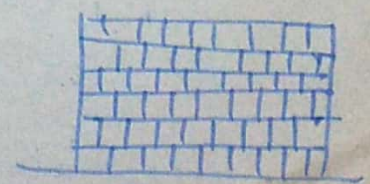
(*) Such bond is used when we required a wall of 9" or 1 thick brick wall.

(*) In this case three quarter brick bat is used along length to brick continuity two in number.

(*) Uses:-

This bond is provide when we have required more strength i.e. in footing, septic tank etc.

→ Here more bricks are used.



Header bond.

Garden Wall Bond:-

To close any open area we provide wall from all sides. Those special wall called garden wall.

→ It is also called boundary wall bond.

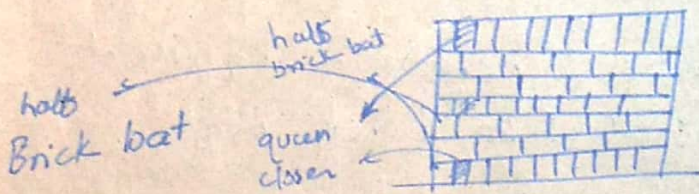
- (*) In this case we make alternate 4-5 courses of stretchers. Then we provide a header course which give more aesthetic look.
- (*) These walls are ~~two~~ one brick thick wall.

Types of Garden Wall bond:-

① English Garden Wall bond:-

In this case the first course is header course in which first break i.e. quoin will be header and then queen closer after than header will be placed. Then we in second course we provide stretcher course and upto 5 course we have stretcher course and then header course as describe above.

∴ In stretcher course we provide half brick bat to brick continuity.



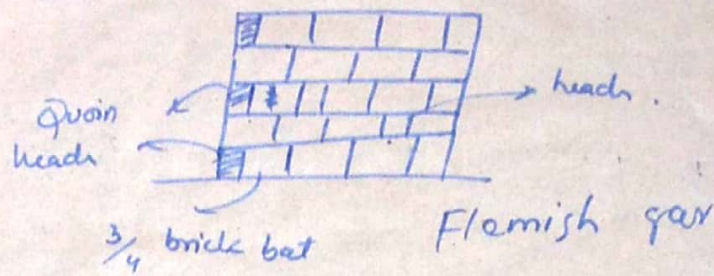
② Flemish Garden Wall bond:-

The wall in which we have alternate 3 to 5 stretchers and then header in same course and so on.

→ It is also called susses or scotch bond.

- (*) In alternate course a quoin header and 3 quarter brick bat is used than header and stretcher as describe above.

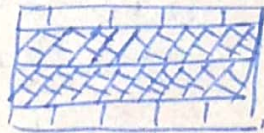
In second course header than three stretchers and so on.



Other Bonds:-

i- Raking Bond:-

The bond in which the bricks are laid inclined.



(*) English Cross bond:-

It is similar to English bond but here the quoin that we supply should be stretchers instead of header, in alternate course.

(*) Facing bond:-

"A bond in which we place different bricks at facing & backing".

(*) Dutch Bond:-

It is similar to English bond but here the quoin is three quarter brick bat is used, instead of header.
→ This bond has alternate header and stretchers

(i) Monk Bond:-

"A bond in which we provide two stretchers and one header and so on called monk bond."

(*) Zig Zag Bond:-

In which bricks are laid in zigzag manner.

(*) Brick on Edge bond:-

If we place bricks on stretcher face and we see bed face of brick.

(*) Silver lock bond:-

The bond having bricks laid in alternate courses in such a way that headers are laid on bed and stretchers are laid edge, forming a continuous cavity throughout length of wall called Silver lock bond.

Types of Brick Masonry:-

(a) On basis of Mortar:-

(1) Pucca brick Masonry:-

When we provide kiln burnt bricks and provide mortar of cement in between them.

(2) Kucha & pucca brick Masonry:-

When we used kucha or sun dried bricks and provide mortar as mud.

(b) On basis of brick's types:-

(1) 1st class brick:-

If 1st class bricks are used with mortar.

→ Substructure is made from this type of brick.

(*) Second class brick masonry:-

In which we used such bricks in mortar whose strength or which not evenly burnt.

(*) Third class brick:-

In which 3rd class bricks are used in masonry.

(*) Sun dried Masonry:-

In which Kucha or Sun dried class brick are used in mortar of mud.

Strength of different class bricks.

1st class brick
= 2000 Psi

2nd class brick
= 1500-1600 Psi

3rd class brick
= 1200 Psi

Kuch brick.
= 200-300 Psi

(3) On basis of type of construction:-

(a) Tibby work:-

is used in Brick Masonry:-

① Trowel:-

This is most important tool used in brick masonry.

Uses:-

- This tool is used for
- Lifting of mortar & spreading it
- For cutting of bricks
- & for construction of joints.

→ Sizes:-

Trowels are available in different shapes. Sizes range from 50mm to 300mm.

② Brick hammer:-

This tool has two ends one end is square and other is sharp edge.

This tool is use for breaking of bricks according to need.

- We can make closer and Quoin from brick - through brick hammer.
- Also to drive nail into wall for horizontal leveling.

③ Lines & Pins:-

This a wire which is provided between quoins at each end having two metallic pins. This is used to give horizontal alignment of course.

(4) Bubble Tube:-

↳ Also called spirit tube, checking of

This tool is used for horizontal level of floor, roof etc.

→ It has three tubes with bubble in them.

→ The bubble should be at centre for perfectly horizontally level.

(5) Straight Edge:- (used for checking alignment of facing of brickwork of wall or pillar)

This tool is used for checking of horizontal and vertical long length level.

If more length, we need straight edge.

→ It is either hollow metal or wood.

(6) Plumb rule & bob:-

Plumb rule is smooth wooden piece of 2m length, 100 mm width & 10 mm thick.

A metal bob is used with plumb rule in order to check alignment (vertical) of course.

(7) Maxon's Square:-

This is exactly like right angle piece either made of wood or steel use to check small distance and to check the perpendicularity of square given during construction of brick masonry.

(8) Steel tape:-

→ This used for measurement (small) to provide

doors and windows.
→ It can measure up to 2m.

Quality Control In Brick Masonry:-

(*) Materials:-

Bricks:-

We have to check the colour of brick in case of supervision. The actual colour after it burn in kiln is yellow.

→ We have to check the actual or nominal size of bricks, which depend on mould in which clay is placed.

→ Those broken bricks, or irregular shape, we used in quoin.

(*) We have to see the strength, structure, texture and soaking of bricks.

Soaking is soaking of water for at least two hours before used.

→ If not soaked then it will affect the water cement ratio of mortar, as it will absorb water since thirst.

(*) Mortar:-

We should have proper & finely size sand.

→ Proper mixing should be done.

→ Workability should be maintain.

(*) Fresh mortar should be used.

Proper bond:-

Whatever the bond is making you should observe not to have vertical continuity in alternate course.

(*) Proper joint filling:-

If there is any junction we should pay special attention there. So that there is no cavity left and proper interlocking there.
→ Joint size is 10mm. $\approx$ 10mm

(*) Level of course:-

check the level of vertical course with the help of plumb bob.
→ For horizontal course we used bubble tube.

(*) Per day Progress:-

If we make fresh brick masonry the height of brick masonry should not be more than 1m for half brick wall.
→ For 1 brick wall the height of masonry should not be more than 1.5m $\Rightarrow$ 5 ft.

$$\text{So number of course per day} = \frac{5}{\frac{4.5}{12}}$$

$\approx$ 13 Courses.

So in one day upto 13 courses should be made.

After construction of brick masonry we should proper cure (water it).

→ The mortar & bricks should be saturated upto 7 days to achieve maximum strength. (For summer season quarry of water more on bricks & mortar).

→ Defects In Brick Masonry:-

The defects that are not seen at time of construction of wall but after it achieve proper strength, the defects appear.

These defects are either due to improper workmanship or due to improper raw materials used for mortar or bricks (ingredients of mortar or brick made has problem).

+ Using expired cement.

* Using overburnt bricks (less strength)

* Not check alignment of course.

① Dampness:-

When water get accumulated on ceiling or near wall it becomes watery like this phenomena is called dampness. (sub)

→ This problem occur if.

a) We not provide coping to wall.

b) If there is leakage through block sanitary fitting from which water out and create dampness.

→ Solution:-

This problem can be resolved by providing coping and to block ^{the leakage from} sanitary pipes perfectly.

② Frost Action:-

When number of seasons passed over brick masonry it becomes weak and even with finger ~~it~~ easily falls its part. This phenomena is called frost action.

→ This cause cracking in brickwork.

Solution:-

- Prevent accumulation of water.
- Use first class bricks as evenly burnt.

③ Efflorescence:-

It is accumulation of white deposit on exposed surface of brick masonry due to crystallization of salt present in soil of brick.

→ If the bricks are made from such soil which has greater concentration of salt. So with passage of time after bricks used in masonry white deposit appear.

Sulphate attack:-

"The appearance of longitudinal crack in masonry along the length."

→ This appear on slab level & ground level.

Cause:-

Sulphate attack occur due to reaction between sulphate in soil of bricks and tricalcium aluminate & present in cement.