

BUILDING CONSTRUCTION- PART I



PREPARED BY

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CET, UOS

MASONARY

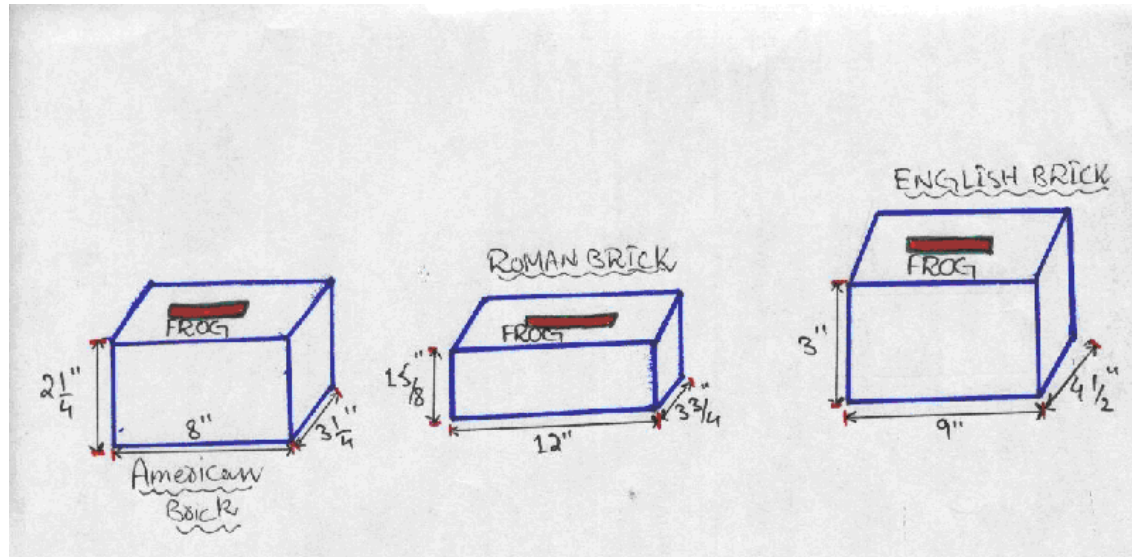
BRICK MASONRY

- When bricks are laid in mortar in a proper systematic manner, they form a homogeneous mass, which can withstand forces without disintegration. This mass of the structure, so made by the use of bricks is called "**Brick Masonry**" or simply "**Brick work**".
- Bricks are of uniform size and shape, light in weight, durable, fire resistant, have high resale value, low maintenance cost and are easily available in plain areas.
- Brick Masonry is commonly used for construction of ordinary as well as important buildings in plain areas now-a-days.

SOME IMPORTANT TERMS USED IN BRICK MASONRY

(1) BRICK

- An artificial structural element in the form of a rectangular block of clay is called a “Brick”. Bricks can be manufactured of any required shape and size. The sizes of some standard bricks are given as follows:



SOME IMPORTANT TERMS USED IN BRICK MASONRY

- These sizes are called "**Nominal, designated or format sizes**" and are used while estimating the number of bricks in a given volume of structure.
- The actual sizes in which bricks are manufactured, are slightly smaller to allow for the layer of mortar present all around the brick, usually taken as $\frac{3}{8}$ in thick.
- The **Actual or Work size** of English standard brick, which is mostly used in Pakistan, is usually taken as $8\frac{5}{8}$ in $4\frac{1}{8}$ in x $2\frac{5}{8}$ in.

SOME IMPORTANT TERMS USED IN BRICK MASONRY

(2) FROG

- The depression provided in the face of a brick is called a "Frog".
- It is provided in the brick to achieve the following purposes:
 - (a) To form a key of mortar in between any two adjacent courses of brick work, so as to increase the lateral strength of the structure.
 - (b) To reduce the weight of the bricks, so that the bricks can be laid with convenience.
 - (c) To provide a place for putting the impression of trade-mark or the year of manufacturing of the bricks.

SOME IMPORTANT TERMS USED IN BRICK MASONRY

(3) POSITION OF BRICKS

- (a) The position of brick, when laid with its Frog upward in the horizontal plane, is termed as "**Brick on bed**".
- (b) The position of the brick when laid on its side "9 in x 3 in", with frog in the vertical plane is called "**Brick on edge**".
- (c) The position of brick when laid on its side "4 1/2 in x 3 in", with frog in the vertical plane is called "**Brick on end**".

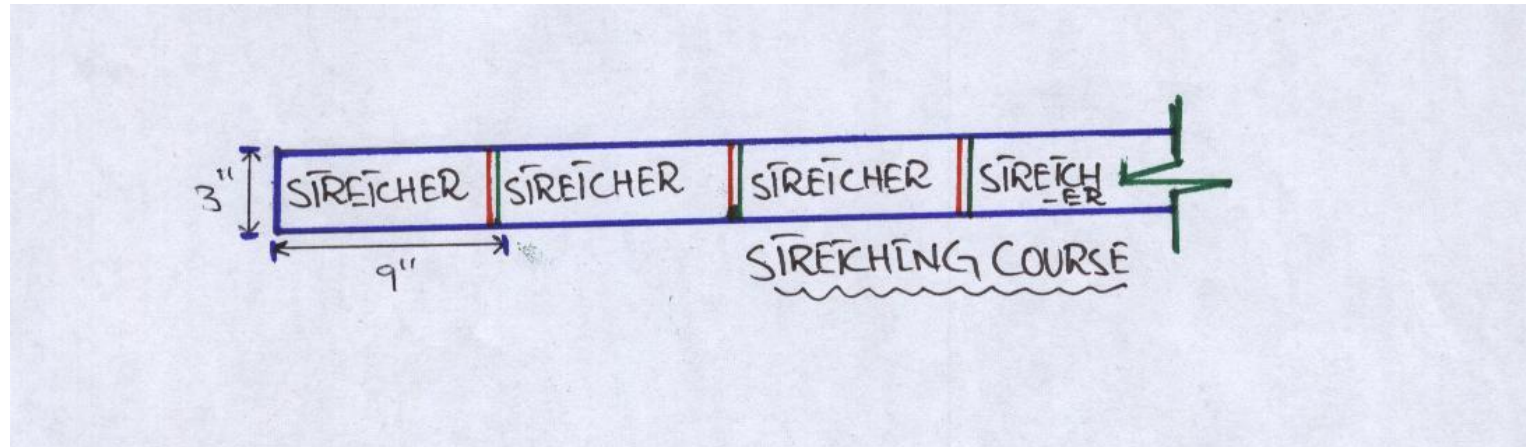
SOME IMPORTANT TERMS USED IN BRICK MASONRY

(4) COURSE

Each horizontal layer of bricks laid in mortar in a brick work is called a "course".

(5) STRETCHER

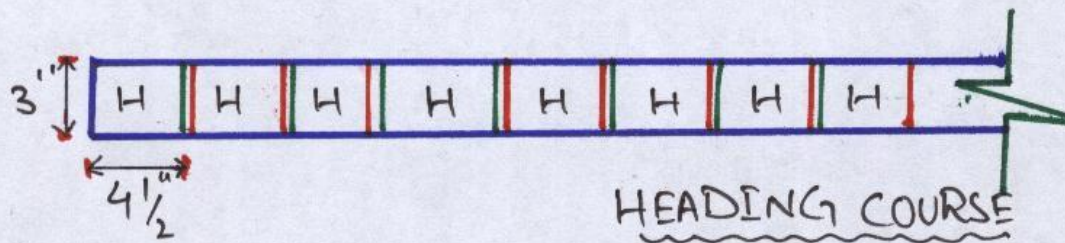
Brick, laid with its length horizontal and parallel with the face of the wall or other masonry member is called a "**Stretcher**" and a course, in which, all the bricks are laid as Stretchers is called a "**Stretching course**" or "**Stretcher course**".



SOME IMPORTANT TERMS USED IN BRICK MASONRY

(6) HEADER

A brick laid, so that only its end shows on the face of a wall is called a "**Header**" and a course, in which all the bricks are laid as headers, is known as "**Heading Course**" or "**Header course**".



SOME IMPORTANT TERMS USED IN BRICK MASONRY

(7) QUOIN

The external corner of the wall is called a "**Quoin**".

(8) QUOIN BRICK

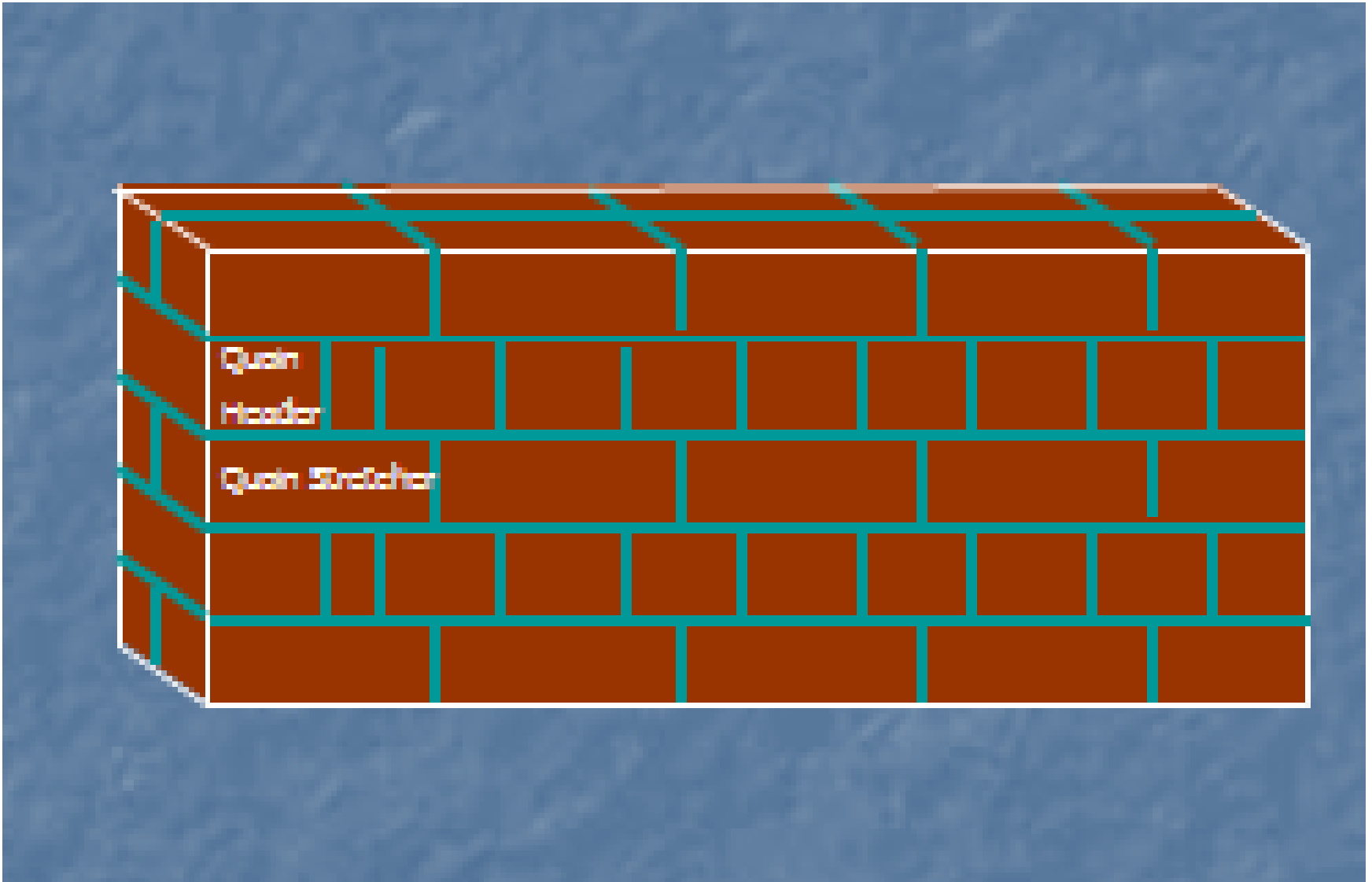
The brick, which forms the external corner of a wall is known as "**Quoin brick**".

(9) QUOIN HEADER

A corner header, in the face of wall, which is a stretcher in the side wall is known as "**Quoin header**".

(10) QUOIN STRETCHER

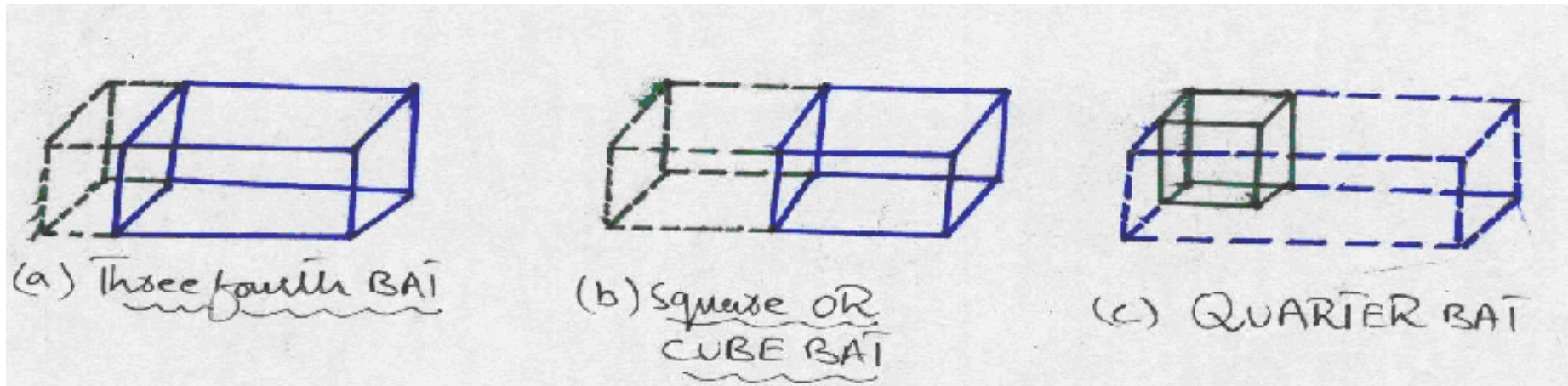
A corner stretcher in the face of a wall, which is header in the side wall is known as "**Quoin stretcher**".



SOME IMPORTANT TERMS USED IN BRICK MASONRY

(11) BRICK BATS

- Brick bats are prepared by cutting standard brick across width.
- **"Brick bats"**.
- Some common Brick Bats are shown below:



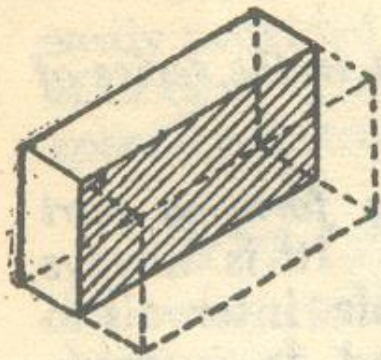
SOME IMPORTANT TERMS USED IN BRICK MASONRY

(12) CLOSER

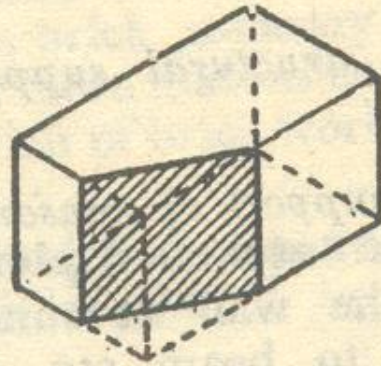
- Closer bricks are prepared by cutting standard brick across length or in different ways to fulfill the requirements of bond in straight walls, corners, junctions or crosses is called closers.
- **Queen closer** is a brick, which is half as wide as full brick and is made by cutting a whole brick lengthwise into two portions.
- These are generally used next to the Quoin header for creating bonds in brickwork.

(13) KING CLOSER

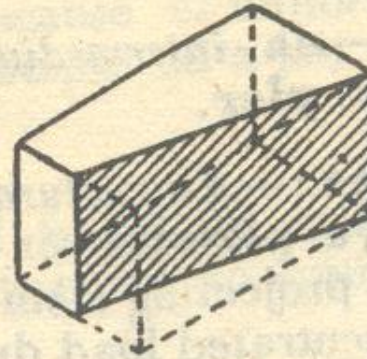
- A brick, whose one diagonal piece is cut off one corner by a vertical plane passing through the center of one end to the center of one side.
- It is actually $\frac{7}{8}$ of a full brick but is usually called a **$\frac{3}{4}$ brick**



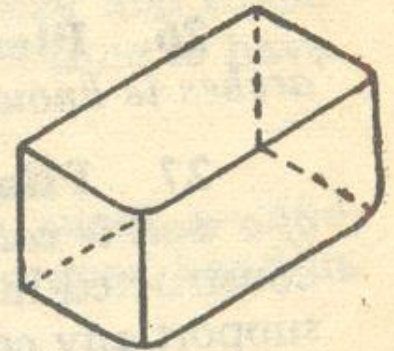
(a) QUEEN CLOSER



(b) KING CLOSER



(c) BEVELLED CLOSER



(d) BULL NOSE CLOSER

SOME IMPORTANT TERMS USED IN BRICK MASONRY

(14) BEVELED CLOSER

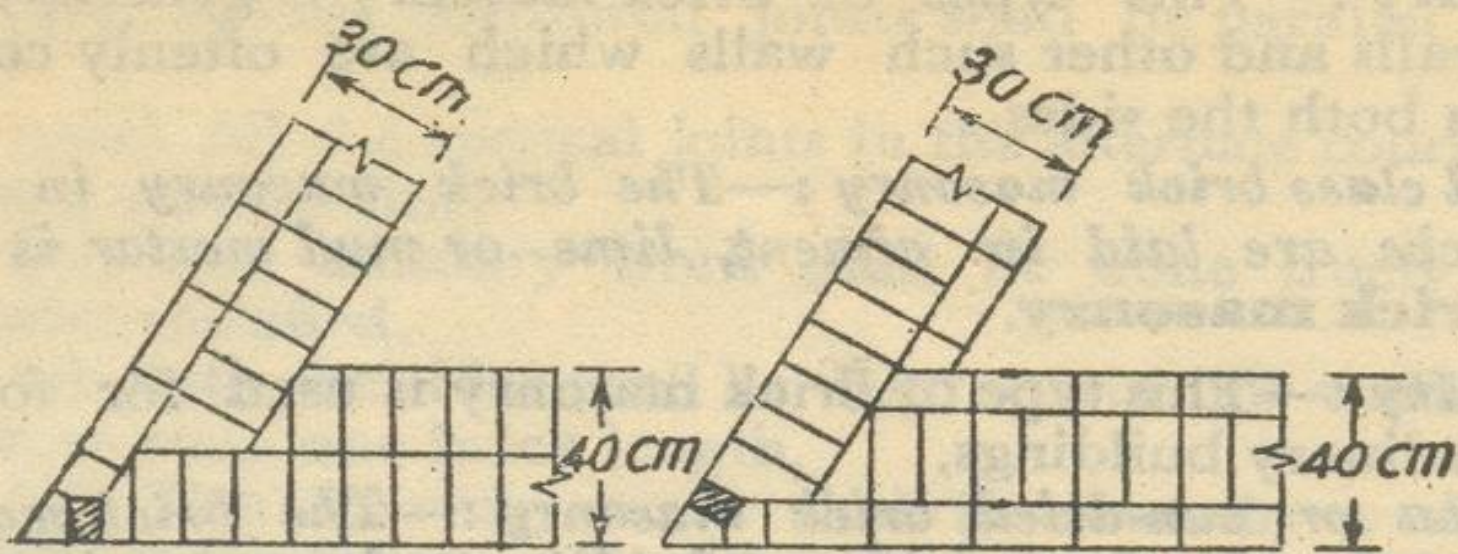
- A brick cut longitudinally along a vertical plane, starting at the middle of one end to the far corner.
- One quarter of the brick is cut off in this way.

(15) BULL NOSE BRICK

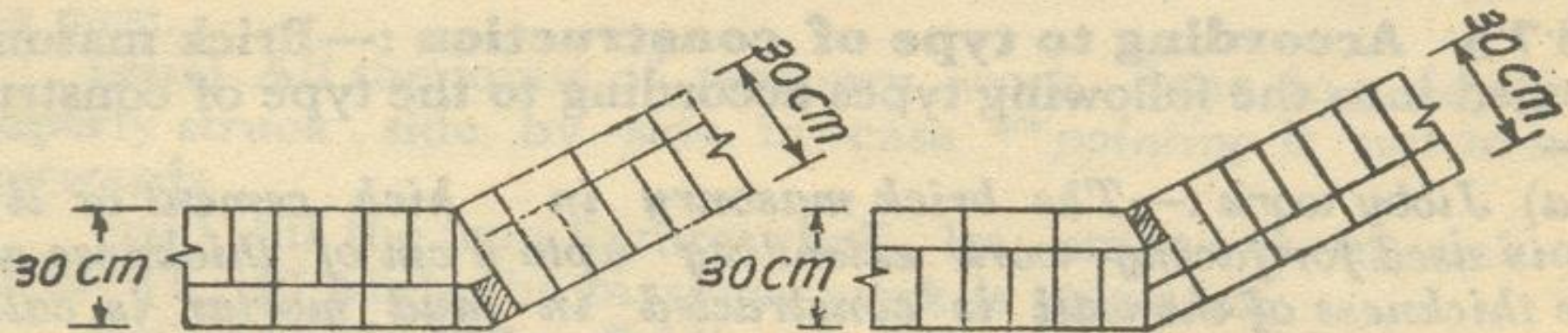
- A brick with rounded corners is called a “**Bull Nose Brick**”

(16) SQUINT BRICKS

- These bricks are used to construct acute (>90 degree) or obtuse (< 90 degree) corners in brick masonry.
- These are special forms of bricks.



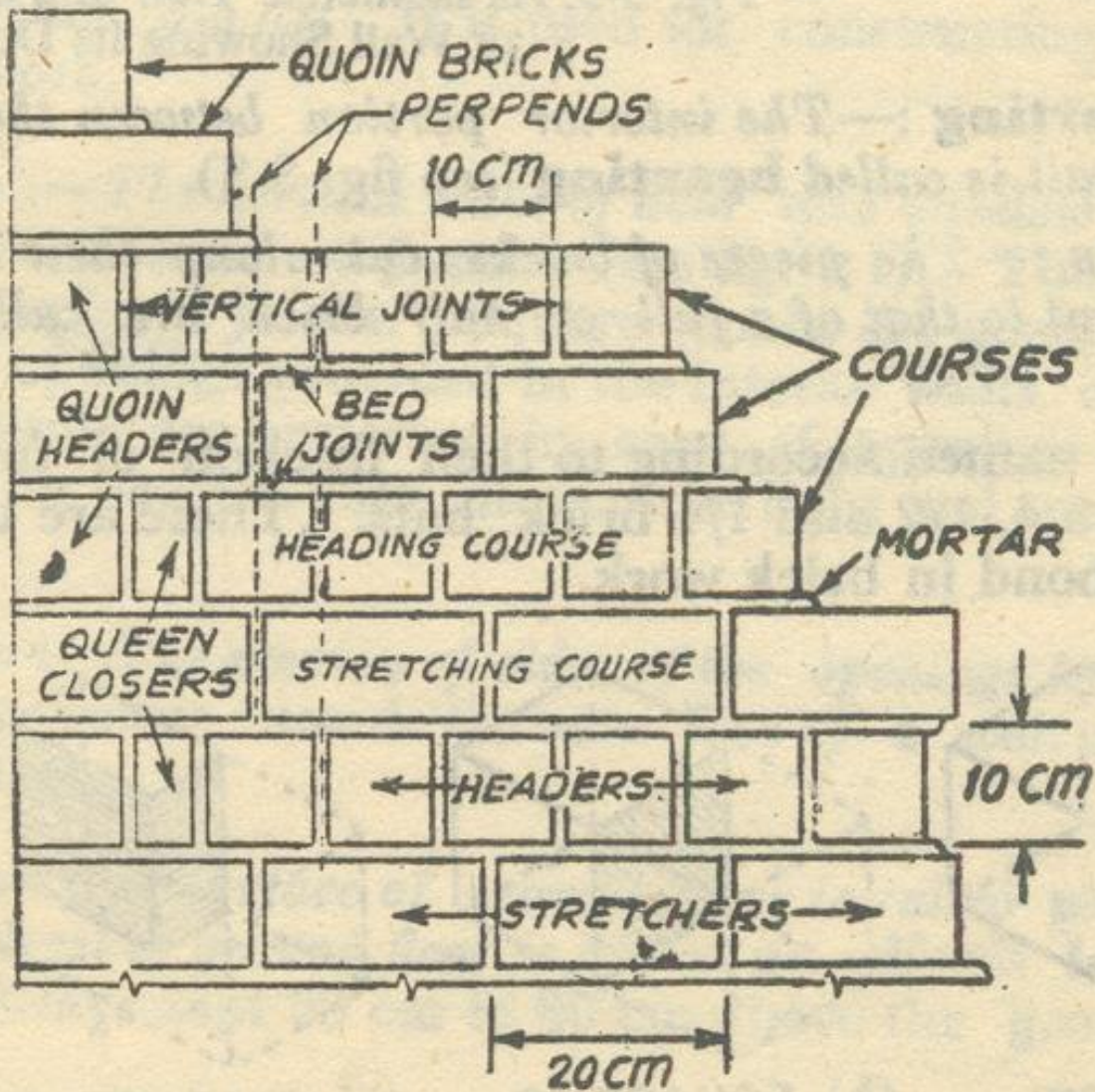
(a) ACUTE CROSSING



(b) OBTUSE CROSSING

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Elevation of the portion of a Wall Showing its Different Details

SOME IMPORTANT TERMS USED IN BRICK MASONRY

(17) JAMB

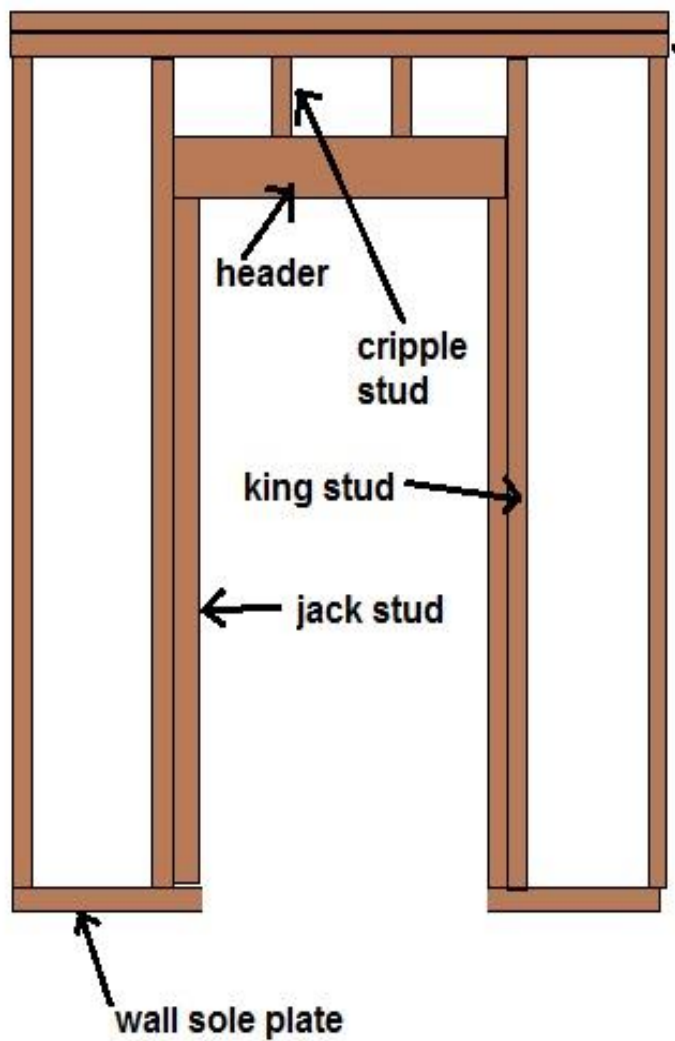
The vertical sides of door or window openings provided in a wall are known as "**Jambs**".

(18) REVEALS

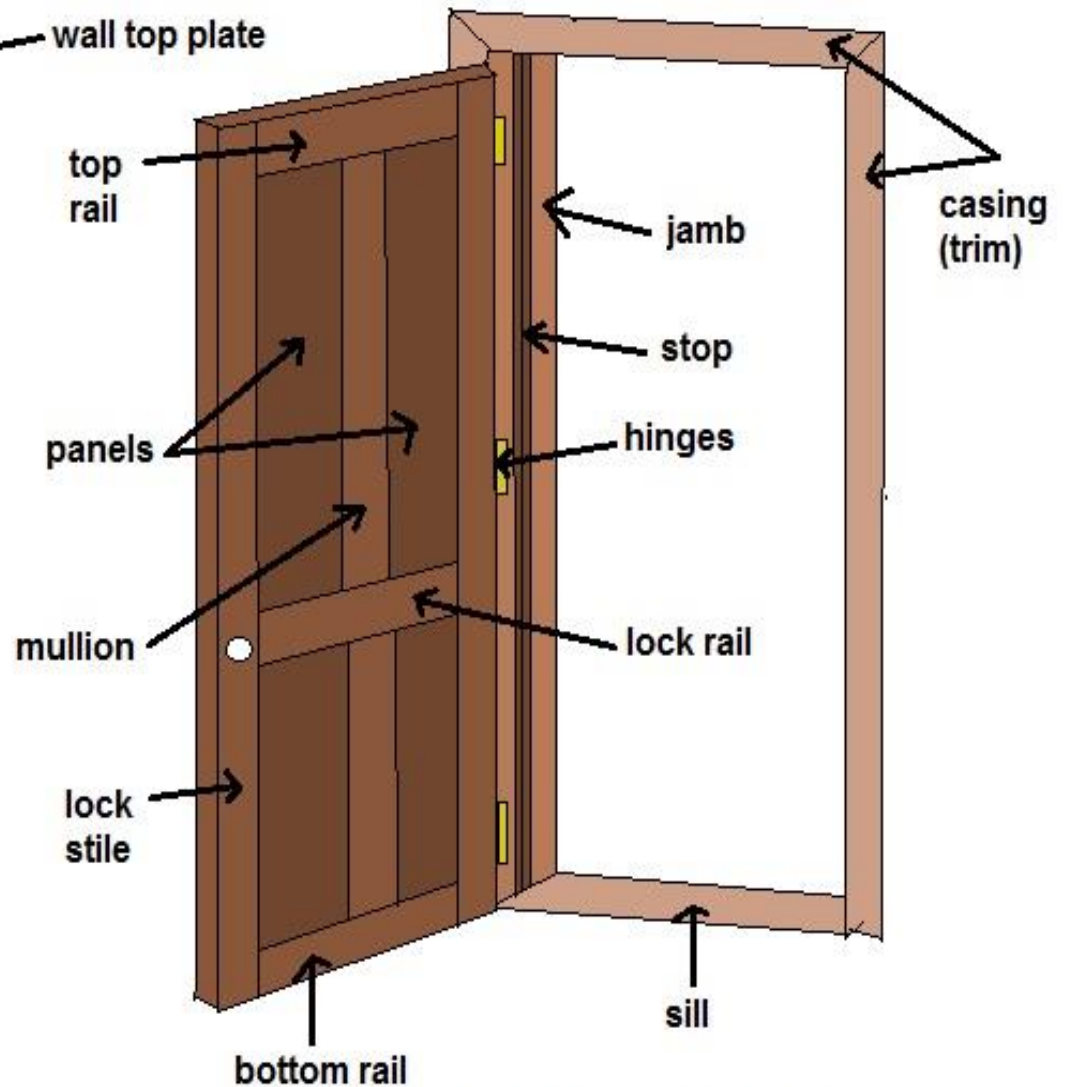
The part of the Jamb opening , which is exposed between a door or window frame and the face or back of a wall is known as "**Reveal**".

(19) SILL

The horizontal part (either of timber, concrete, stone, metal, etc) at the bottom of a door or window, supporting the vertical members of the frame is known as "**Sill** " and its height window base from the floor level is known as "**Sill level** ".



ROUGH DOOR OPENING



DOOR TERMS

SOME IMPORTANT TERMS USED IN BRICK MASONRY

(20) MORTAR

- The paste obtained by mixing a binding material and a fine aggregate in suitable proportions in addition to water is known as "**Mortar**".
- Cement and Lime are used as binding materials and Sand, Surkhi, Cinder, etc. are used as fine aggregates.
- The mortars are named according to the type of binding material used in their preparation such as, cement mortar, lime mortar, etc.
- The mortar prepared from simple earth is known as "**Mud Mortar**".
- The mortar not only acts as a cementing bed between any two courses of bricks but also, gives strength to the structure by holding the individual bricks together to act as a homogenous mass.

BONDS

Bond is the arrangement of bricks or stones in each course, so as to ensure the greatest possible interlocking and to avoid the continuity of vertical joints in two successive courses, both on the face and in the body of a wall.

OBJECTIVES OF BONDS

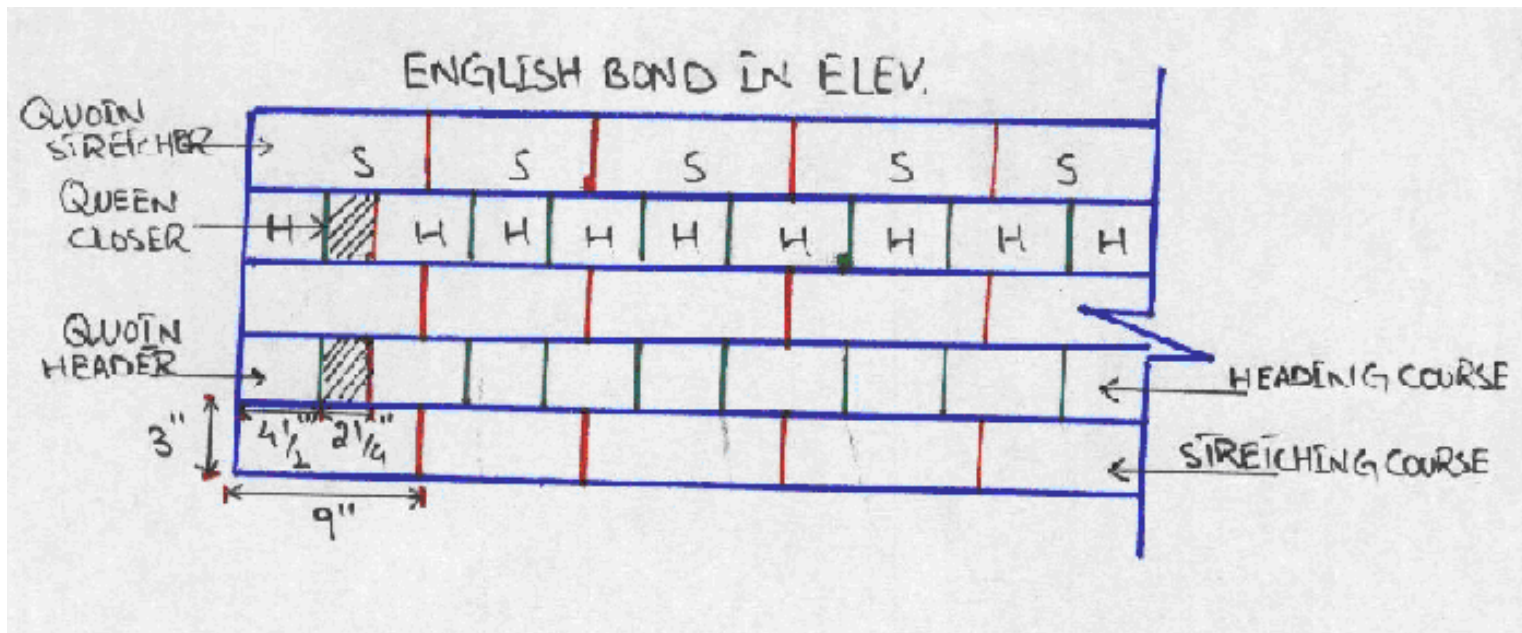
A bond is provided to achieve the following objectives:

- (a) The primary objective of providing a bond is to break the continuity of the vertical joints in the successive courses both in the length and thickness of masonry structure. As a result, the structure will act as a bounded mass and its load will be transmitted uniformly to the foundations.
- (b) To ensure longitudinal and lateral strength of the structure.
- (c) To provide pleasing appearance by laying bricks symmetrically.
- (d) To do masonry work quickly by engaging more masons on a job at a time.

TYPES OF BONDS

(1) ENGLISH BOND

The bond, in which headers and stretchers are laid in alternate courses, is called "**English bond**".



TYPES OF BONDS

ENGLISH BOND

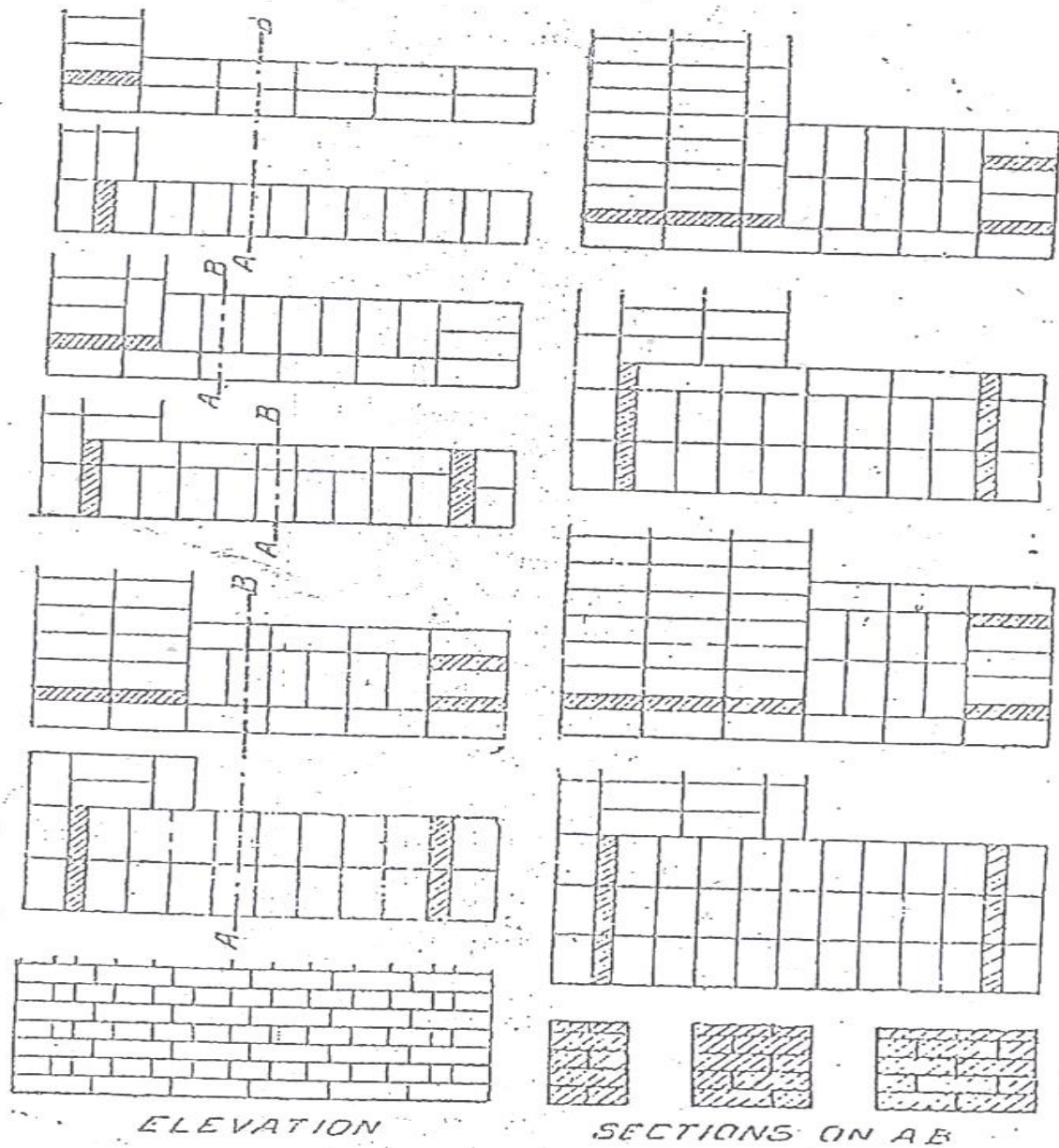
The following are the salient features of **English bond**:

- (i) Headers and stretchers are laid in alternate courses.
- (ii) In each heading course, a queen closer is placed next to quoin header and the remaining bricks are laid as headers.
- (iii) Every alternate header in a course comes centrally over the joint between two stretchers in the course below, giving an approximate lap of $2 \frac{1}{4}$ in.

TYPES OF BONDS

ENGLISH BOND

- (iv) The same course will show headers or stretchers on face and back, if the thickness of the wall is an even multiple of half bricks (e.g. 9 in, 18 in, 27 in, etc.)
- (v) The same course will show headers on the face and stretchers on the back and vice versa, if the thickness of the wall is an odd multiple of half brick. (13 1/2 in , 22 1/2 in , etc)
- (vi) The middle portion of the thicker walls consists entirely of headers.
- (vii) Every transverse joint is continuous from face to face.



ELEVATION

SECTIONS ON AB

Figs. 225—238 :

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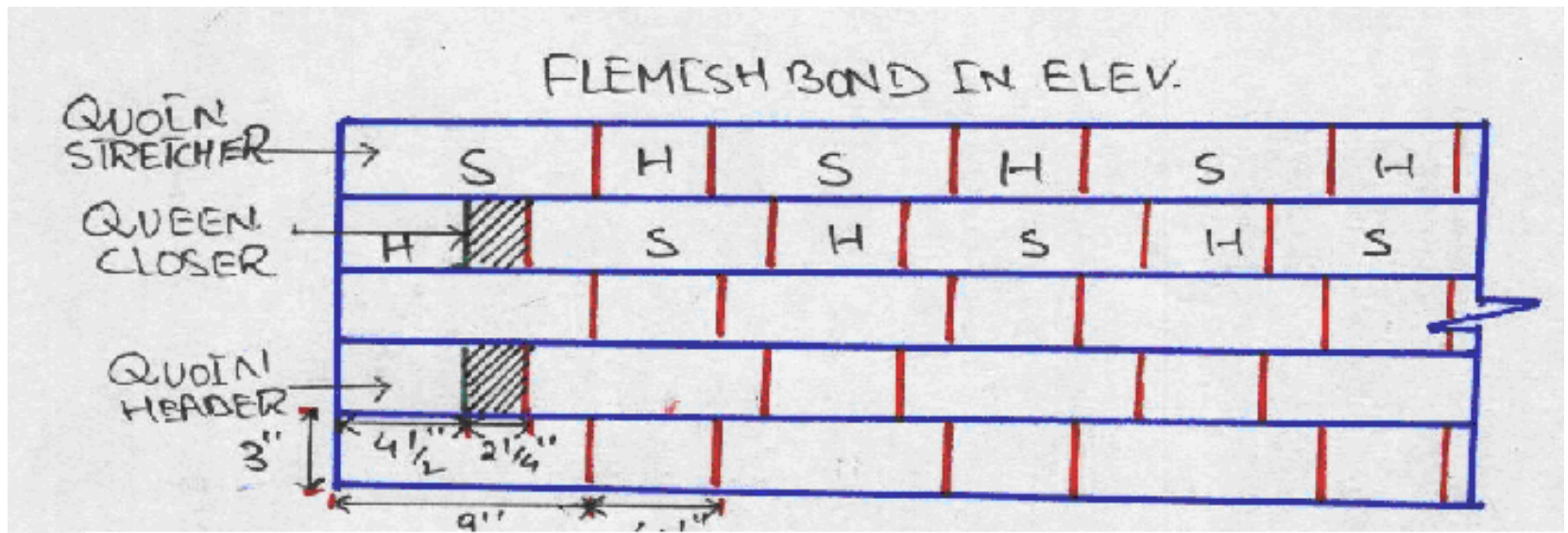
English Bond. Plans of 500 sq. ft. area of brick walls 1, 1½, 2, 2½ and 3 bricks thick. The hatched bricks are queen closers laid for accomplishing break of joints. The last three figures at bottom are cross sections on AB.

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TYPES OF BONDS

(2) FLEMISH BOND

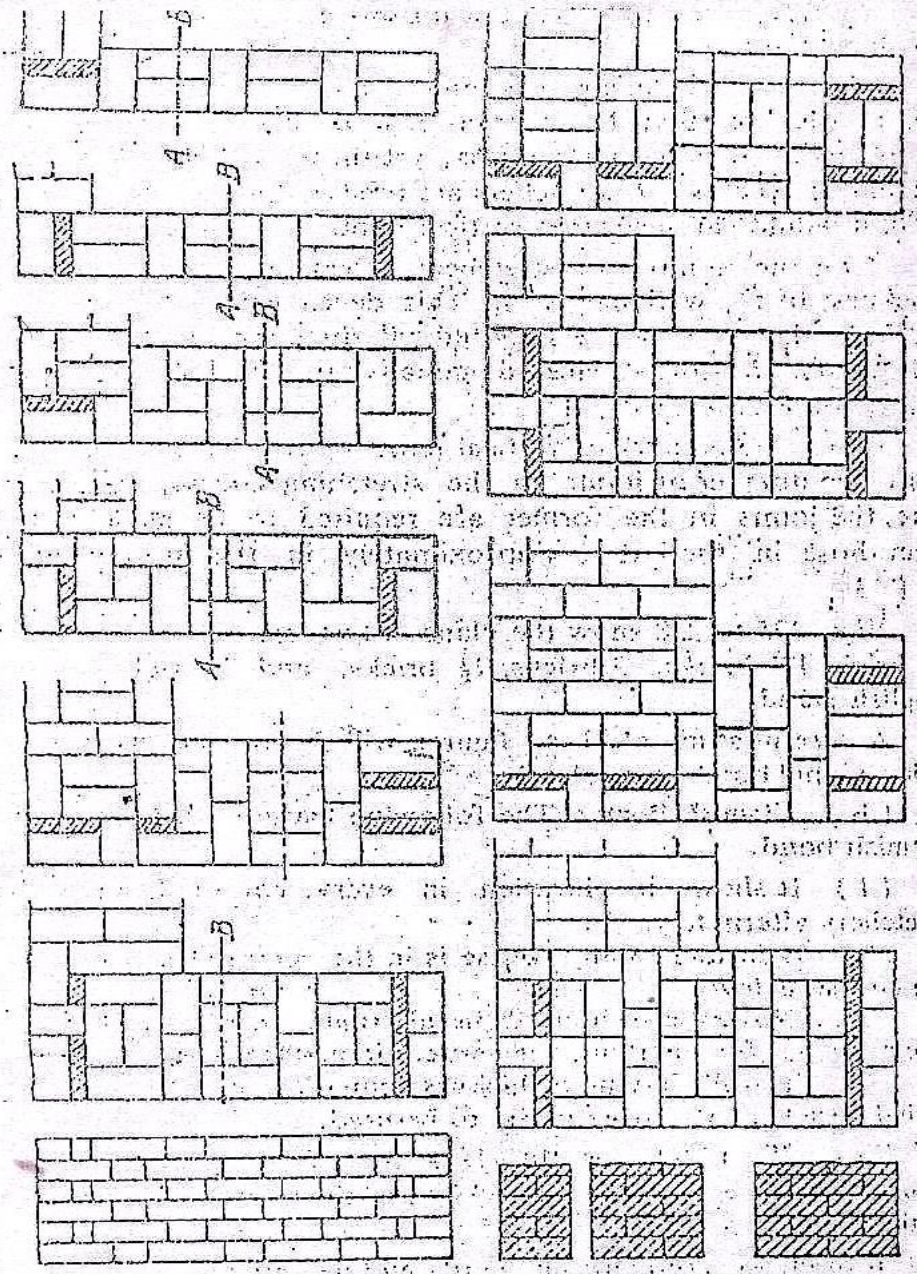
The bond, in which headers and stretchers are laid alternately in the same course, is called "**Flemish bond**".



TYPES OF BONDS

The following are the salient features of **Flemish bond**:

- (i) Headers and stretchers are laid alternately in the same course.
- (ii) Every header in each course lies centrally over every stretcher of the underlying course.
- (iii) In every alternate course a queen closer is placed next to quoin header, so as to provide a lap of approximately $2\frac{1}{4}$ in.
- (iv) Brick bats are to be used in walls having thickness equal to an odd multiple of half brick.



ELEVATION

SECTIONS ON A-B

CET, UOS

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Plans of first and second courses of brick walls in Flemish Bond, 1, 1 1/2, 2, 2 1/2 and 3 bricks thick. Hatch queen closers.

Comparison of English Bond and Flemish bond

<i>Sr No</i>	<i>English Bonds</i>	<i>Flemish bond</i>
1	This bond consists of headers and stretchers laid in alternative courses.	This bond consists of headers and stretchers laid alternatively in each course.
2	It is strongest of all the bonds.	It is less strong for walls having thickness more than 13 ½ inches.
3	It provides rough appearance especially for one brick thick walls.	It provides good appearance for all thickness of walls.
4	There are no noticeable continuous vertical joints in the structure built in this bond.	There are partly continuous vertical joints in the structure built in this bond.
5	Much attention is not required in providing this bond.	Special attention is required in providing this bond.
6	Progress of work is more.	Progress of work is less.
7	It is costly because the use of brick bats is not allowed.	It is economical because brick bats are allowed for forming this bond.

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TYPES OF FLEMISH BONDS

(a) DOUBLE FLEMISH BOND

The bond in which headers and stretchers are laid alternately in each course, both in the face and back of the wall, is called **Double Flemish Bond**.

TYPES OF FLEMISH BONDS

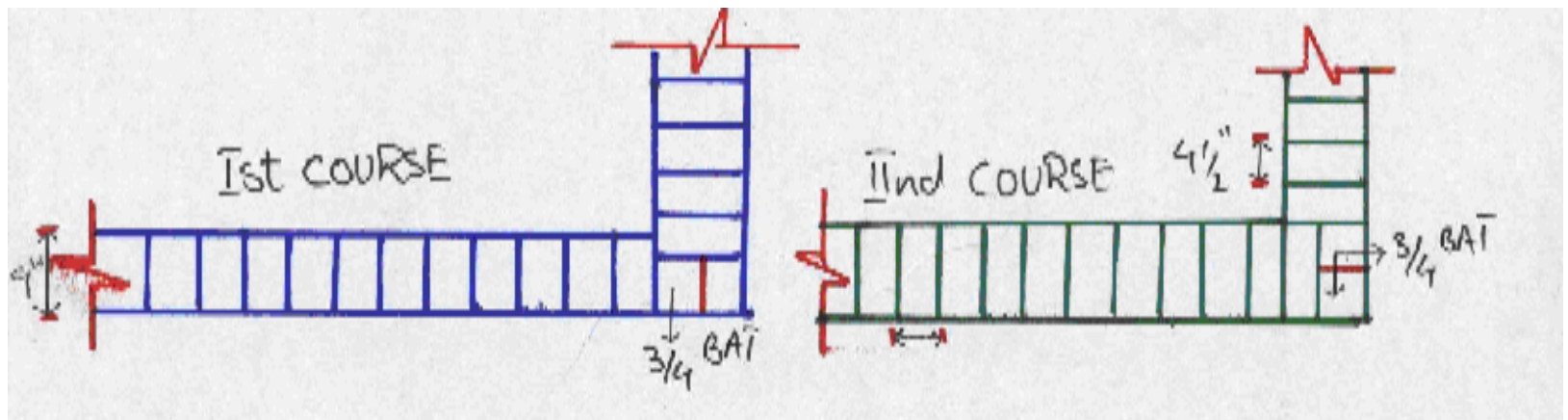
(b) SINGLE FLEMISH BOND

- The bond provided in a wall with Flemish bond in facing and English bond in backing is called "**Single Flemish bond**" or "**Cross bond**".
- This bond combines the advantages of both English and Flemish bonds and simultaneously eliminates their disadvantages.
- This bond is recommended where costly bricks are specified for facing in order to provide good appearance to the wall. Also, it can be made more economical by using cheap quality of bricks on the back of wall.
- On the other hand, it weakens the overall strength of the wall because of maximum use of brick and existence of continuous vertical joints. Also, it can not be provided in walls having thickness less than 13 ½ in.

TYPES OF BONDS

(3) HEADING BOND

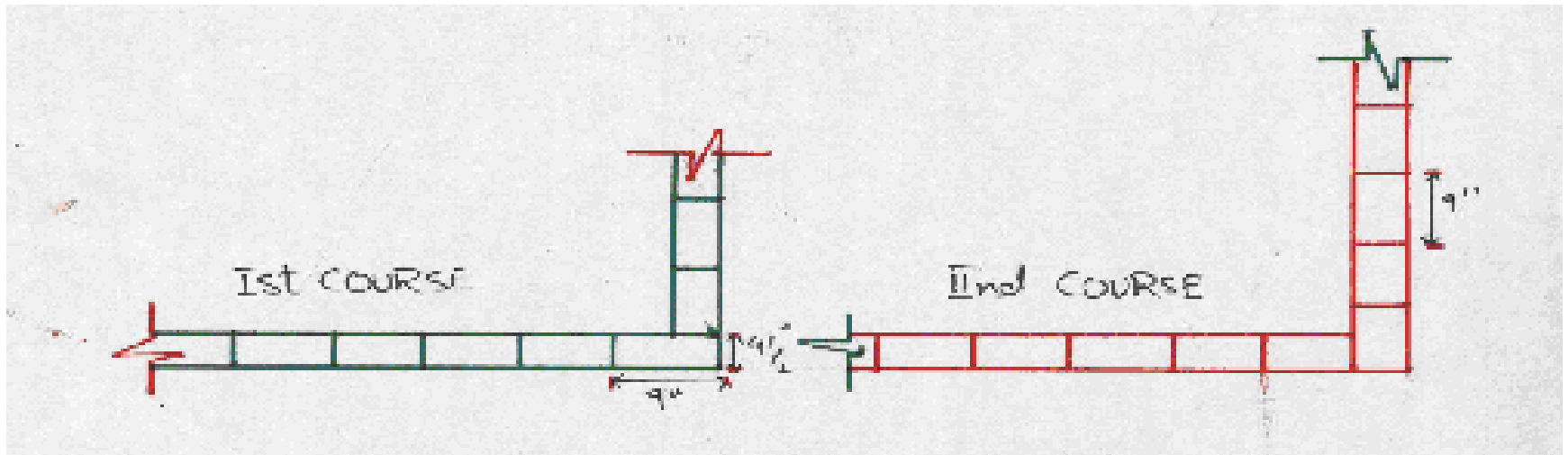
- The bond in which all the bricks are laid as headers in every course of a wall is called "**Heading bond**".
- 3/4 bats are laid as quoin bricks in the alternate courses to break the continuity of vertical joints, which increases the transverse strength but weakens the longitudinal strength of the wall.
- This bond is commonly used for constructing steining of wells, footings of walls and columns, corbels, cornices, etc.



TYPES OF BONDS

(4) STRETCHING BOND

- The bond in which all the bricks are laid as stretchers in every course is called "**Stretching bond**".
- This bond is provided for constructing 4 ½ in thick partition walls.



TYPES OF BONDS

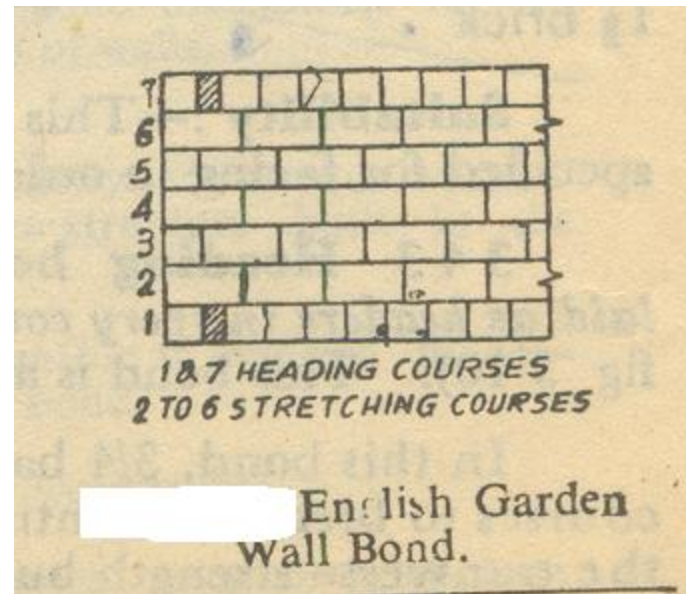
(5) GARDEN WALL BOND

This bond is used for constructing one brick thick garden walls, boundary walls, and other walls such as outer leaves of cavity walls to provide good appearance.

TYPES OF GARDEN WALL BONDS

(a) ENGLISH GARDEN WALL BOND

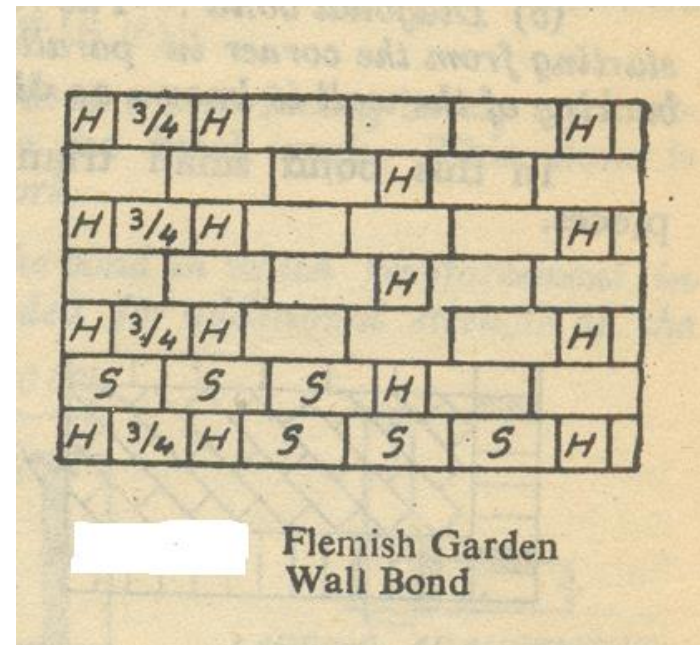
The garden wall bond in which a heading course is provided after 3 or 5 stretching courses is called "**English Garden Wall Bond**"



TYPES OF GARDEN WALL BONDS

(b) FLEMISH GARDEN WALL BOND

- In this bond a header is provided after 3 or 5 stretches in each course.
- This bond is also known as **“Sussex or Scotch Bond”**.



TYPES OF BONDS

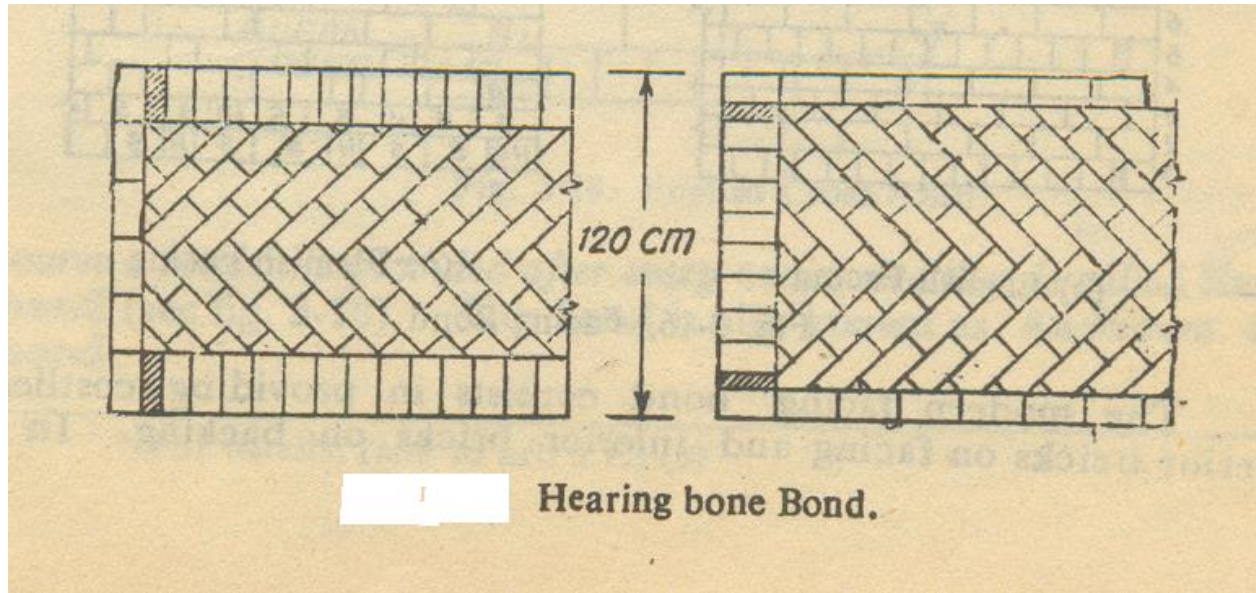
(6) RAKING BOND

- The bond in which all the bricks are laid at an angle other than 90° to the facing and backing of the wall is known as "**Raking bond**".
- This bond is used for doing inner filling of walls at suitable intervals to improve their longitudinal strength.
- The angle of rake between any two adjacent courses should be 90 degree to attain maximum transverse strength of the wall.
- This bond can also be used as paving in case of brick floors, 4 $\frac{1}{2}$ in thick.

TYPES OF RAKING BONDS

(a) HERRING BONE BOND

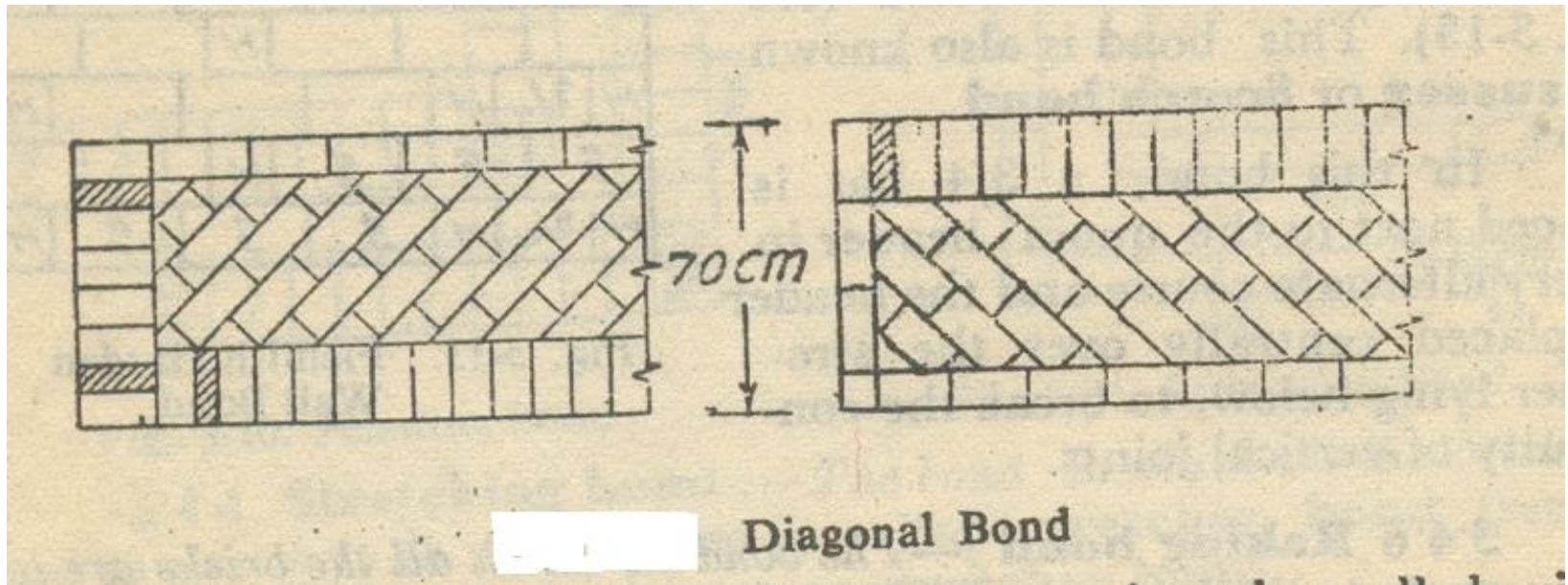
- The raking bond in which bricks are laid at an angle of 45 degree , starting at the central line and proceeding towards the facing and backing of the wall, is called "**Herring Bone Bond**"



TYPES OF RAKING BONDS

(b) DIAGONAL BOND

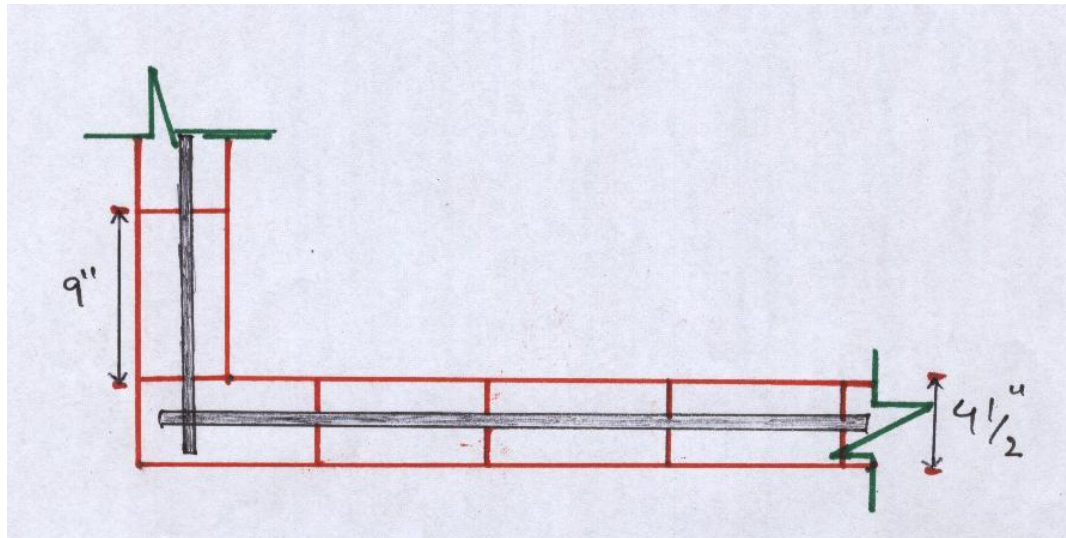
The raking bond in which bricks are laid starting from the corner in parallel rows inclined to the facing and backing of the wall is known as "**Diagonal bond**".



TYPES OF BONDS

(7) HOOP IRON BOND

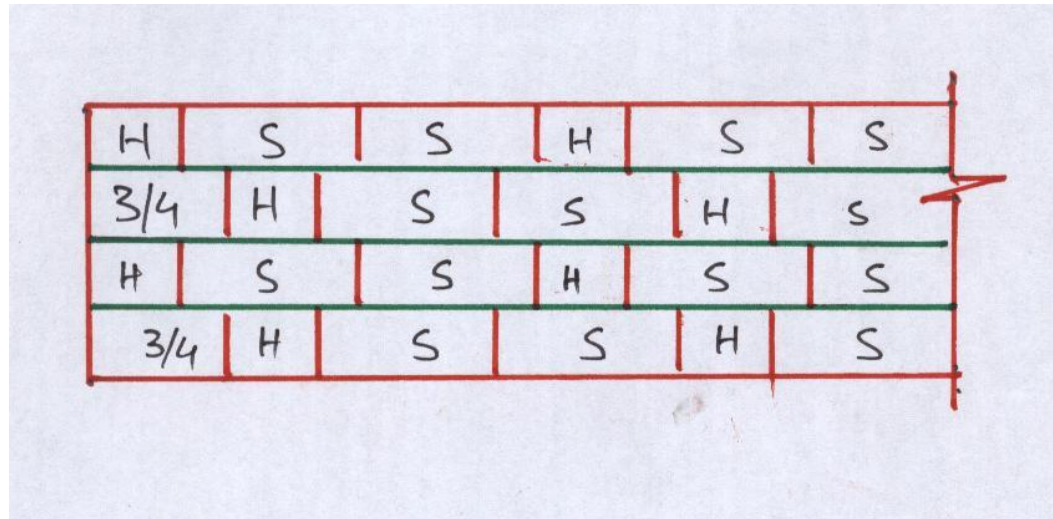
- The bond in which, after every fourth or fifth course of masonry, reinforcement in the form of longitudinal ties is provided for additional strength of the wall, is called "**Hoop Iron Bond**".
- This bond is provided for constructing 4 1/2 in thick partition walls



TYPES OF BONDS

(8) MONK BOND

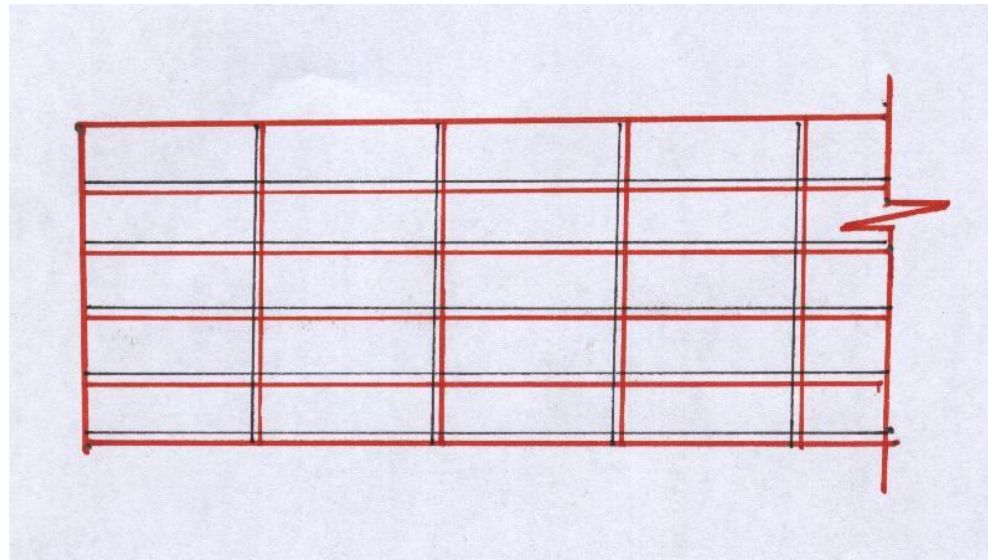
- This bond in which two stretchers and one header are laid alternately in each course is called "**Monk bond**".
- This bond is used in the construction of boundary walls.



TYPES OF BONDS

(9) RHOM BOND

- This bond in which brick/ tiles are laid in order to have straight horizontal and vertical joints in the facing is called "**Rhom bond**".
- This bond is used only in facing work to provide architectural beauty.



WALL JUNCTION

- The places where the walls of same or different widths meet or cross each other are called wall junctions.

- TYPES OF WALL JUNCTIONS

- Two types

- **Straight junctions**

- **Squint junctions**

- **Straight junctions**

The junctions formed when two walls crossing each other at right angle.

- **Corner junctions**

- **Tee junctions**

- **Cross junctions**

- **Squint quoins**

The corner formed when two walls are meeting at some angle.

- **Obtuse quoins**

- **Acute quoins**

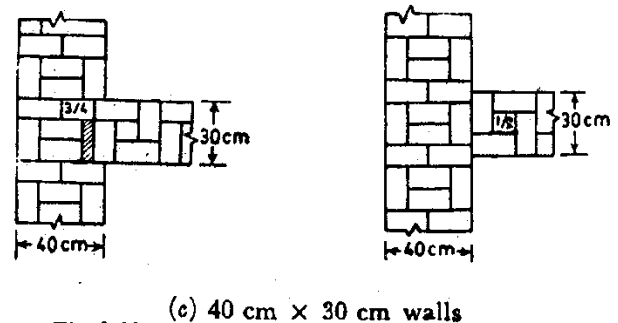
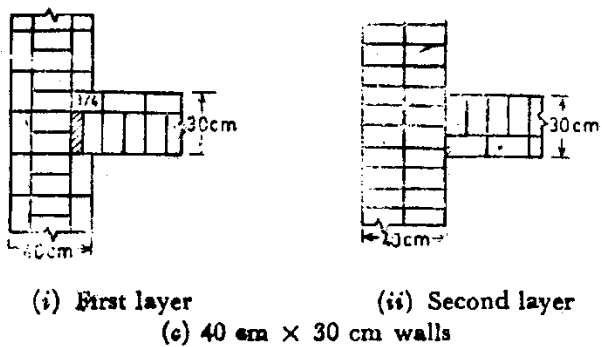
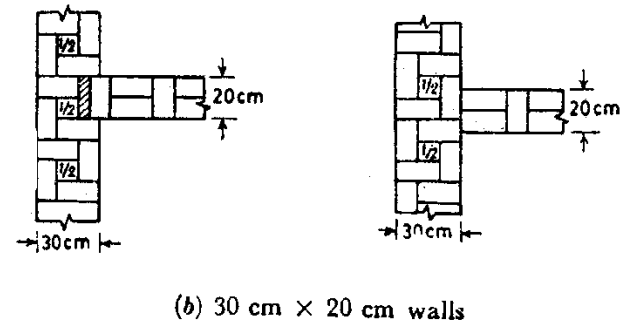
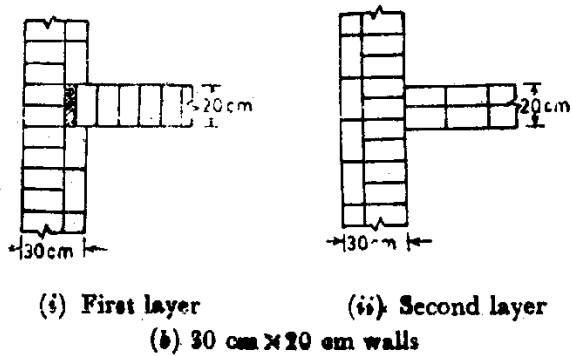
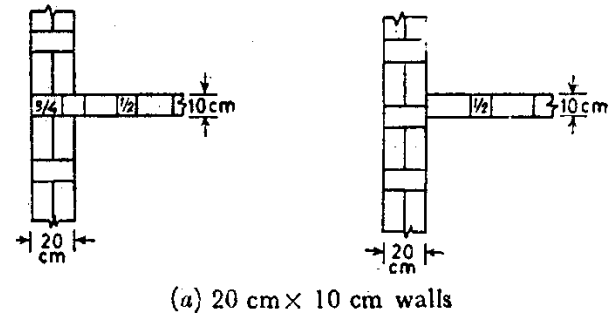
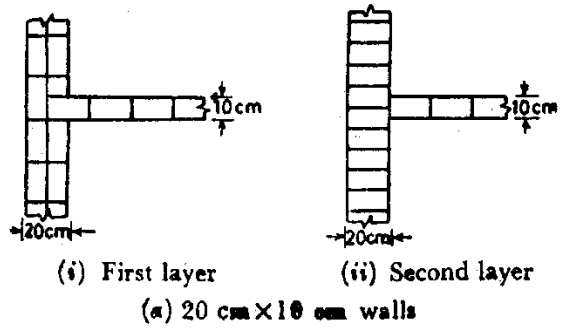
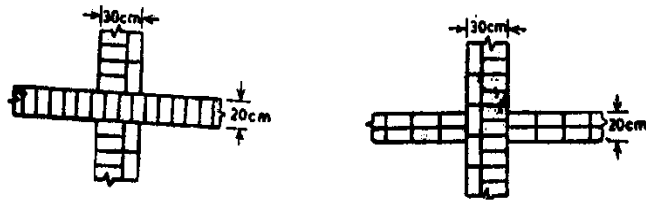


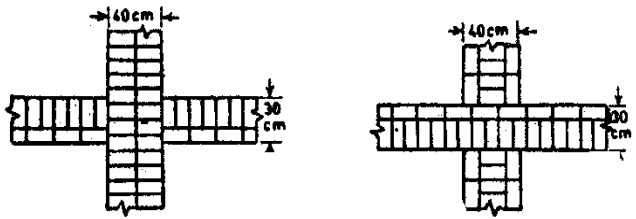
Fig. 3.32. Tee Junction of Walls in English Bond.

Fig. 3.33. Tee-junctions of Walls in Flemish Bond.

(c) *Cross junctions* :—The straight junction of two walls crossing each other in the form of plus (+) sign is called *cross junction*. (see Figs. 3.34 and 3.35)

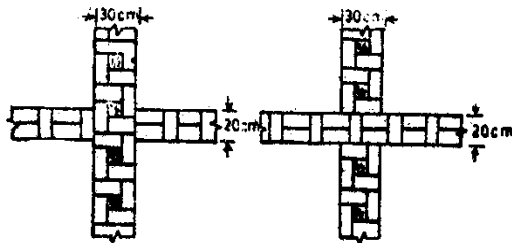


(a) 30 cm x 20 cm walls

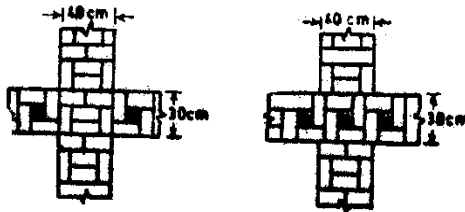


(b) 40 cm x 30 cm walls

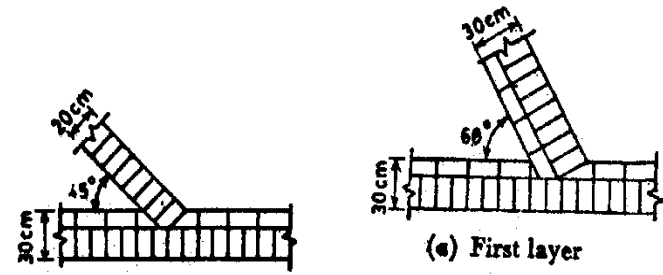
Fig. 3.34. Cross Junctions of Walls in English Bond.



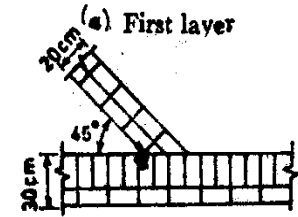
(a) 30 cm x 30 cm walls



(b) 40 cm x 30 cm walls
Cross Junctions of Walls in Flemish Bond.



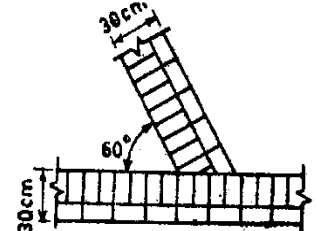
(a) First layer



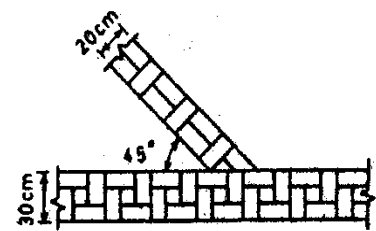
(a) First layer

(b) Second layer

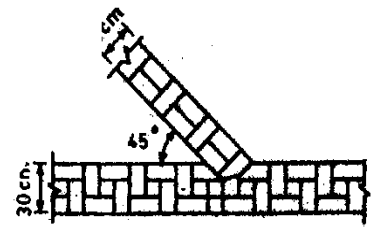
Fig. 3.36. Squint Junctions of Walls in English Bond.



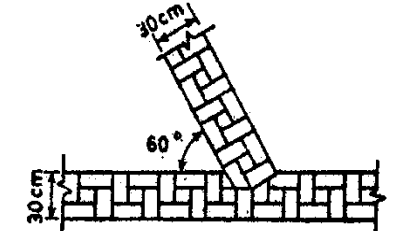
(b) Second layer



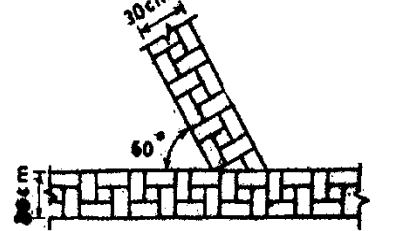
(a) First layer



(b) Second layer



(a) First layer

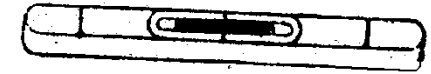
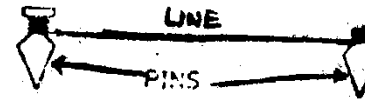
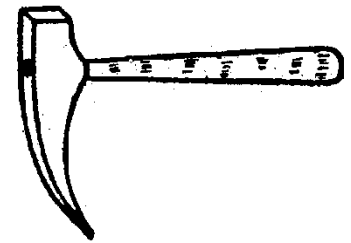
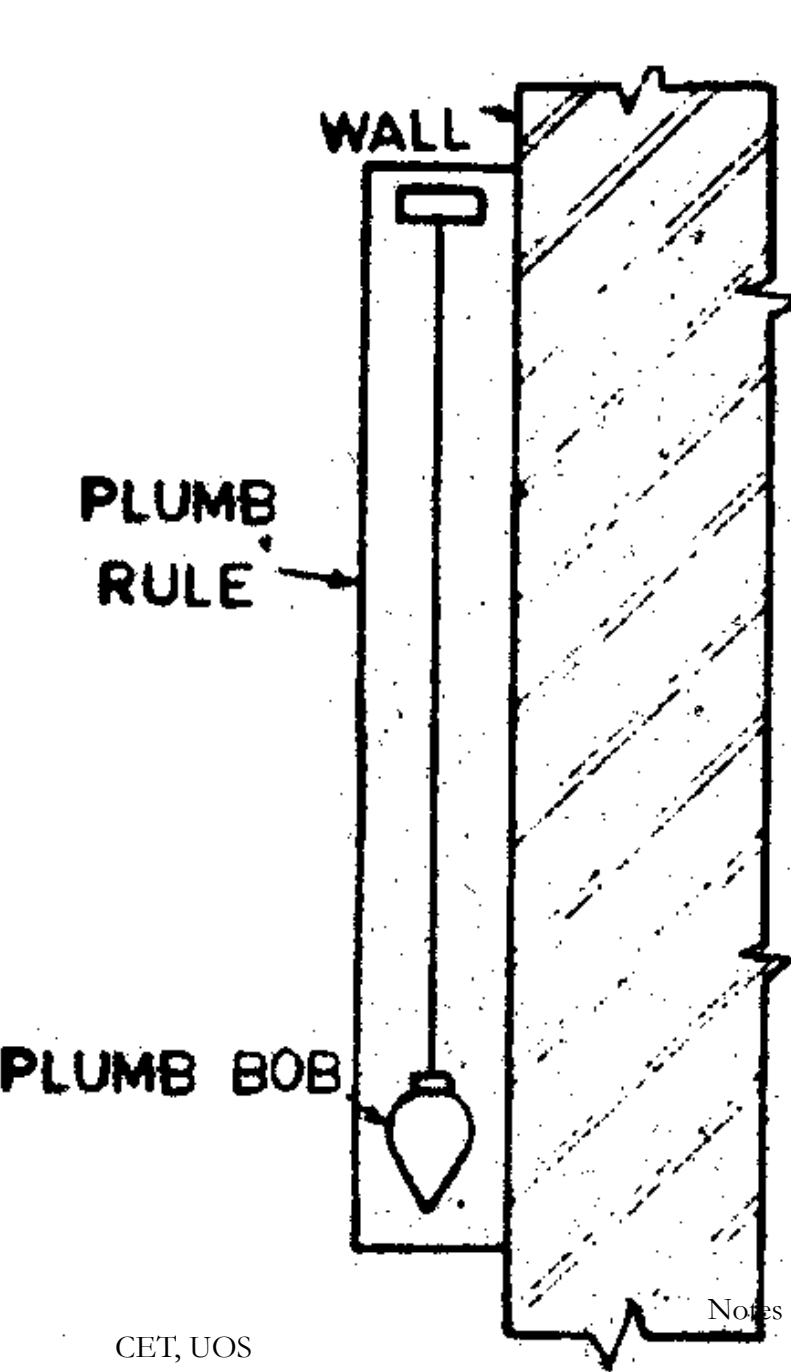


(b) Second layer

Fig. 3.37. Squint Junctions of Walls in Flemish Bond.

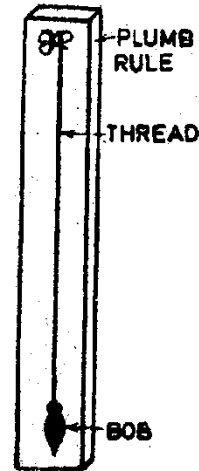
MASONS TOOLS IN BICK MASONRY

- Trowel
- Brick hammer
- Lines and pins
- Spirit level and water level
- Straight edge
- Plumb bob
- Mason's square or guniya
- Tape (steel)



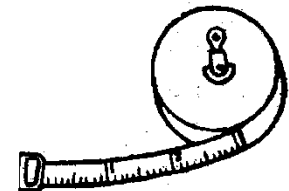
(c) Line and Pins

(d) Bubble Tube



(e) Straight Edge

(f) Plumb Rule & Bob



(g) Mason's Square

(h) Measuring Tape.

Notes Compiled By: Engr. Abdul Rahim Khan

Tools Used in Brick Masonry.

CONSTRUCTIONS OF BRICK MASONRY

- It is the art of laying bricks in a proper bond with specified mortar to form a structure.
- It involves the following activities...
- Selection of bricks
- Stacking of bricks
- Soaking of bricks
- Preparation of mortar (ASTM Specifications C 270, "Mortar for Unit Masonry")
- Laying of bricks

General Principles and precautions in Brick Masonry

- **English bond** should be used if not specified.
- Bricks used should be **well burnt** and should be **uniform in size**, shape and colour.
- For facing work selected bricks should be used.
- **Curing** of bricks should be done for at least **2 hours**.
- Bricks should be laid with **frogs** pointing upward or as specified by the Engineer In charge.
- Mortar used in brick masonry should be of good quality.
- In walls greater than **9” or 0.225 m** width hearting joints should be filled properly.
- Brick bats are avoided.

Defects and Maintenance of Brick Masonry

■ DEFECTS

- Due to Substandard materials
- Due to corrosion of metals
- Due to effect of sulphates
- Due to frost action
- Due to efflorescence

■ MAINTENANCE

- Cleaning brick masonry
 - Removing efflorescence
 - Re-conditioning the brick masonry
 - Repainting the brick masonry
-

THANK YOU!