



WRE 214:

Lecture Five

Bricks Works



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Brick Masonry Definition

Brick masonry is a highly durable form of construction. It is built by placing bricks in mortar in a systematic manner to construct solid mass that withstand exerted loads. There are several types of bricks and number of mortars which can be used to construct brick masonry.

The bond in brick masonry, which keep the bricks together, is produced by filling joints between bricks with suitable mortar. Special cautions shall be practiced while mortar is mixed and placed since it greatly affect the performance and durability of masonry structure.

Types of Brick Masonry Work: انواع ألبناء بالطابوق

1. Brick Work in Mud اعمال البناء بالطابوق باستخدام مونة الطين

- The mud is used to fill up various joints brick masonry work.
- Thickness of the mortar joint is 12 mm.
- It is the cheapest type of brick masonry
- Employed for construction of walls with maximum height of 4 m.



Fig. 1: Brick work in mud



Fig. 2: Brick work in cement

2. Brick Work in Cement اعمال البناء بالطابوق باستخدام مونة السمنت

- This type of brick masonry is construction by laying bricks in cement mortar rather than mud which is used in brick work in mud. There are three major classes of brick work in cement which are summarized in Table 1.

Table 1 Different classes of brick work in cement and their descriptions

Classes	Descriptions
First Class	1.Cement of lime mortar is used. 2.The surface and edges of bricks are sharp. 3.The thickness of mortar joints doesn't exceed 10mm.

Classes	Descriptions
Second Class	<ol style="list-style-type: none"> 1. Ground moulded bricks are used. 2. Bricks are rough and shape is slightly irregular. 3. The thickness of mortar joint is 12 mm.
Third Class	<ol style="list-style-type: none"> 1. Bricks are not hard ,rough surface with distorted shape. 2. Used for temporary structures. 3. Used in places where rainfall is not heavy.

Types of Bricks

There are different types of brick used in the construction of brick masonry which include:

- 1.Common Burnt Clay Bricks
- 2.Concrete Bricks
- 3.Sand Lime Bricks (Calcium Silicate Bricks)
- 4.Fly ash Clay Bricks
- 5.Engineering Bricks
- 6.Other Brick Types include bullnose, channel and hollow bricks.

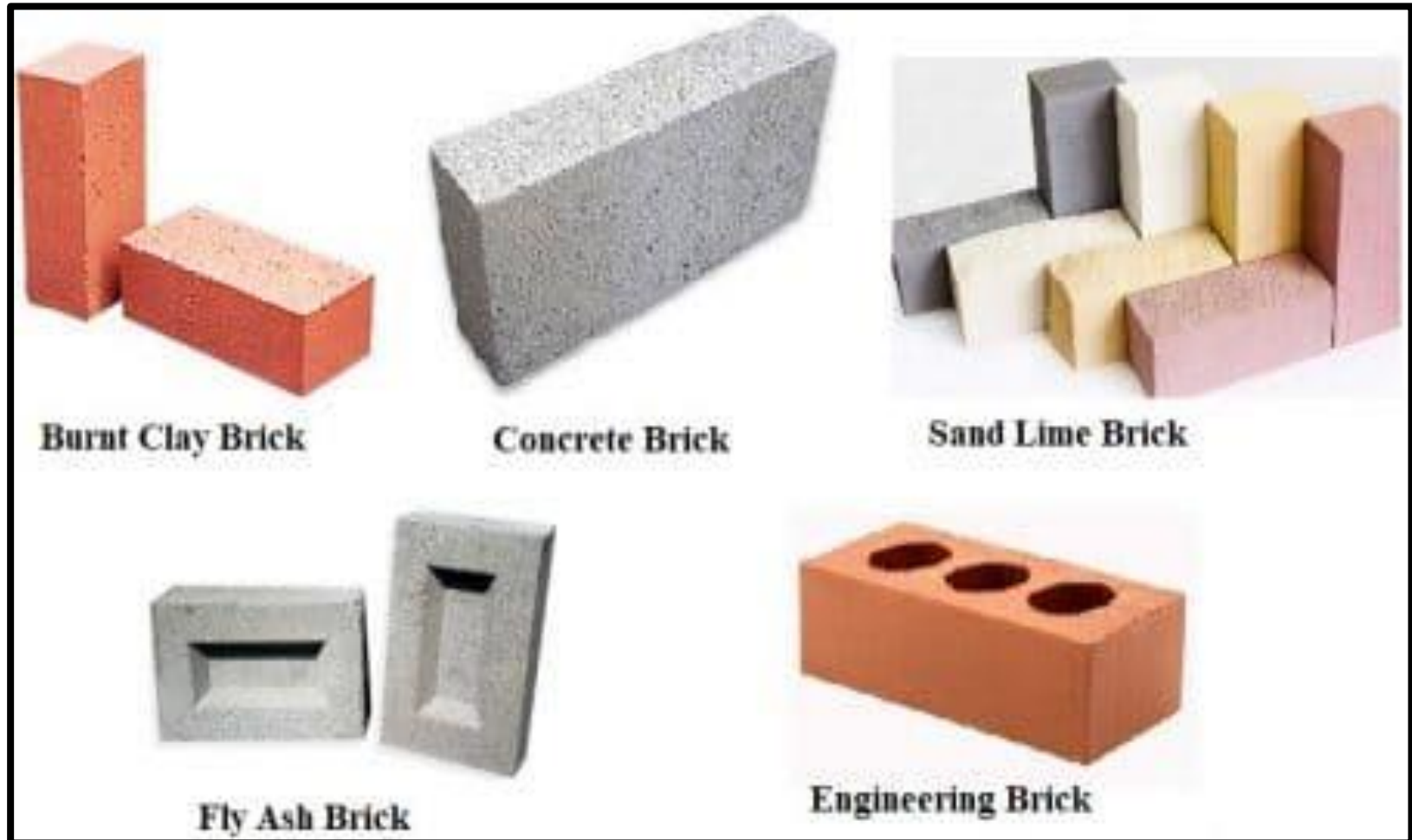


Fig. 3: Types of masonry bricks

Brick Masonry Construction

Materials and Equipment Used in Brick Masonry Construction

1. Mortar Mix or Mason Mix Bricks مونة بناء
2. Tape measure شريط قياس
3. hammer مطرقة
4. Hose, level, or theodolite صوئدة قياس او جهاز الليفل او جهاز ثيودلايت
5. Trowel Level مجرفة تسوية
6. Wheelbarrow عربة للنقل
7. Goggles نظارة واقية
8. And other equipment according to project and personal preferences.

Brick Masonry Construction Preparations

1. Check the level of the ground using level, theodolite or transparent hose level.
2. Set the layout of the structure.
3. Trace of building axis and wall alignment using gypsum powder, chalk, or similar, marking the trenches for foundation.
4. After that, install foundation wall, cure foundation for minimum two days before beginning of brick masonry construction.
5. Distribute bricks in several stacks along project site to cut time and effort later.
6. Wet bricks few hours prior to the work. Not only does this avoid absorbing too much water from mortar but also improve adherence of bricks and mortar.

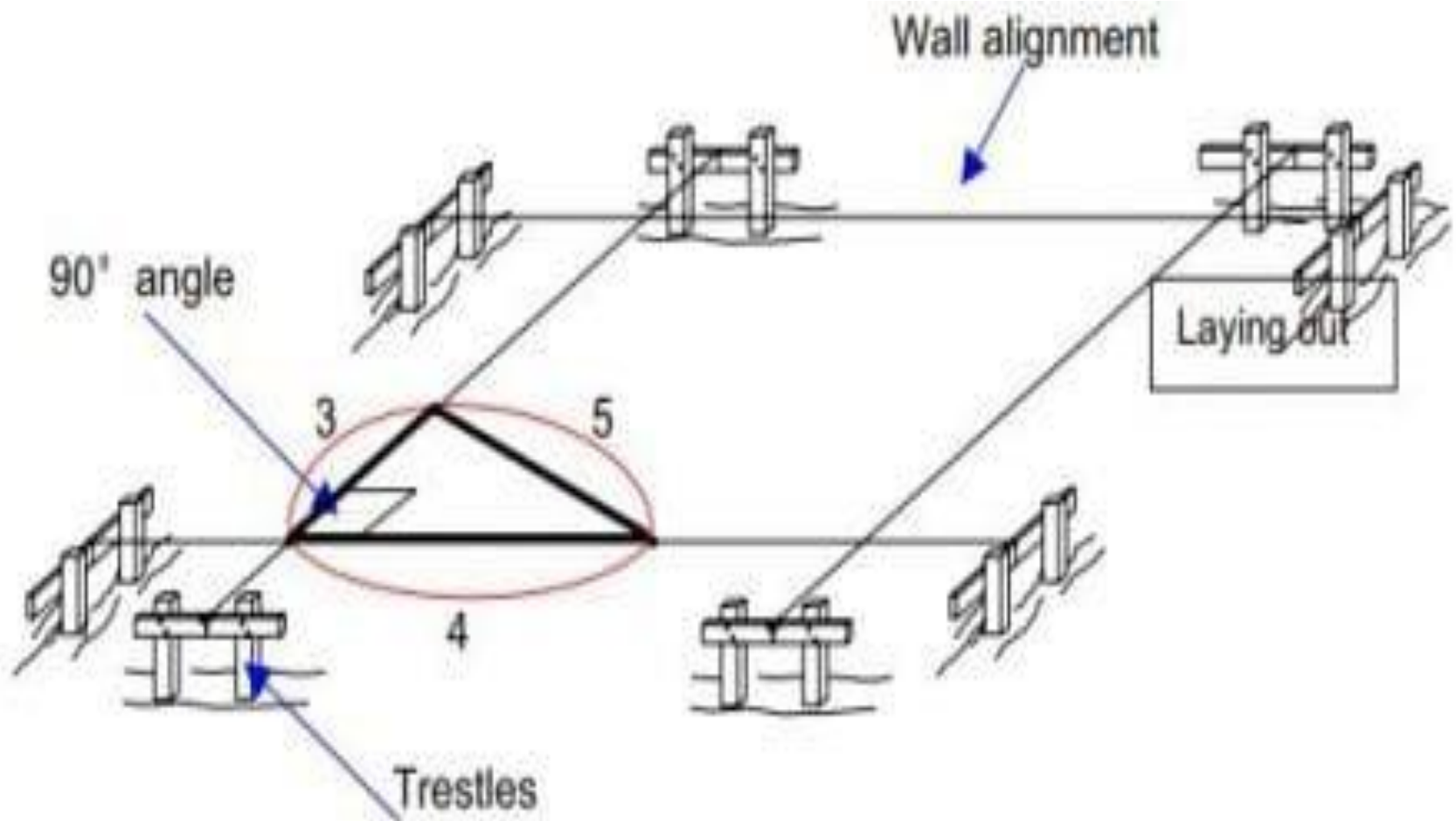


Fig. 4: Setting out layout of masonry structure

Brick Masonry Construction Procedure

1. Initially, mix the mortar with water and blend it until a smooth and plastic mortar is produced.
2. After that, place the mortar on foundation line evenly using trowel (25mm thickness and one brick wide is recommended for laid mortar).
3. Then, lay the first course of stretcher bricks in the mortar. Start with second brick, apply mortar to the head joint end of each brick, After that shove the bricks into place firmly so that the mortar is squeezed out of all side of the joints.



Fig. 5: Mortar Preparation



Fig. 6: laying bricks

4.Utilize a level to examine the course for correct height. ensure that bricks are plumb and level.

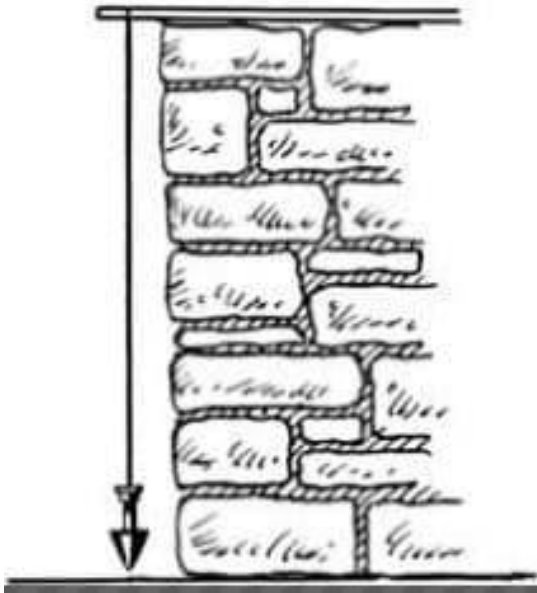


Fig. 7: Plumb line of brick masonry



Fig. 8: Checking level of brick masonry

5.Place another mortar line alongside the first course, then begin laying the second course.

6.Use the two half bricks to begin the second to ensure that the first two courses are staggered for structural purposes.

7.To finish the second course of the lead, lay three header bricks and make sure that they are plumb and level.

8.The third and fifth courses consists of stretchers similar to the first course. The fourth course begins with single header, followed by stretchers. Use the level to make sure that the lead is true on each course. Lastly, this pattern of brick laying is used till the target height is reached.

Points Considered in Supervising Brick Masonry Constructions

The following points should be observed in the construction of brick masonry:

- Use good quality bricks.
- Ensure that brick courses are perfectly horizontal.
- Verticality of the wall should be ensured by frequently checking with plumb-bob.
- Whenever work is stopped brick masonry should be left with toothed end.
- Use of brick bats should be avoided.
- Raising walls by more than 1.5 m in one day shall be prevented.

- Raise face joints to a depth of 12 to 20mm so as to be used as a key for plastering or pointing.
- Brick masonry should be regularly cured for 2 weeks.
- The thickness of mortar joints shall be 10 mm both horizontally and vertically.



Fig. 9: Brick bat

Stretcher (Bricks)bond: ربط الطابوق

The four faces of a brick which may be exposed in fairface brickwork are the two, long, stretcher faces and the two header faces illustrated in Fig. 10. The face on which the brick is laid is the bed. Some bricks have an indent or frog formed in one of the bed faces. The purpose of the frog or indent is to assist in compressing the wet clay during moulding. The frog also serves as a reservoir of mortar on to which bricks in the course above may more easily be bedded.

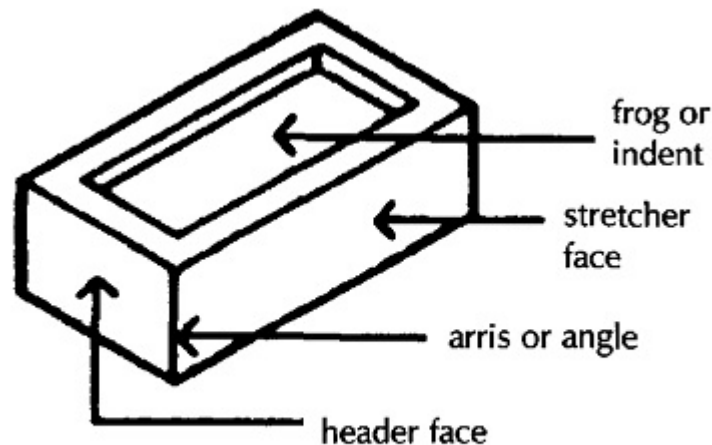


Fig. 10 Brick faces.

The thickness of a wall is dictated primarily by the length of a brick. The length of bricks varies appreciably, especially those that are hand moulded and those made from plastic clays that will shrink differentially during firing.

It has been practice for some time to describe the thickness of a wall by reference to the length of a brick as a 1 B (brick) wall, a $\frac{1}{2}$ B wall or a 2 B wall, rather than a precise dimension.

The external leaf of a cavity wall is often built of brick for the advantage of the appearance of brickwork. The most straightforward way of laying bricks in a thin outer leaf of a cavity wall is with the stretcher face of each brick showing externally. So that bricks are bonded along the length of the wall they are laid with the vertical joints between bricks lying directly under and over the center of bricks in the courses under and over. This is described as stretcher bond as illustrated in Fig. 52. This wall is described as a $\frac{1}{2}$ B thick wall.

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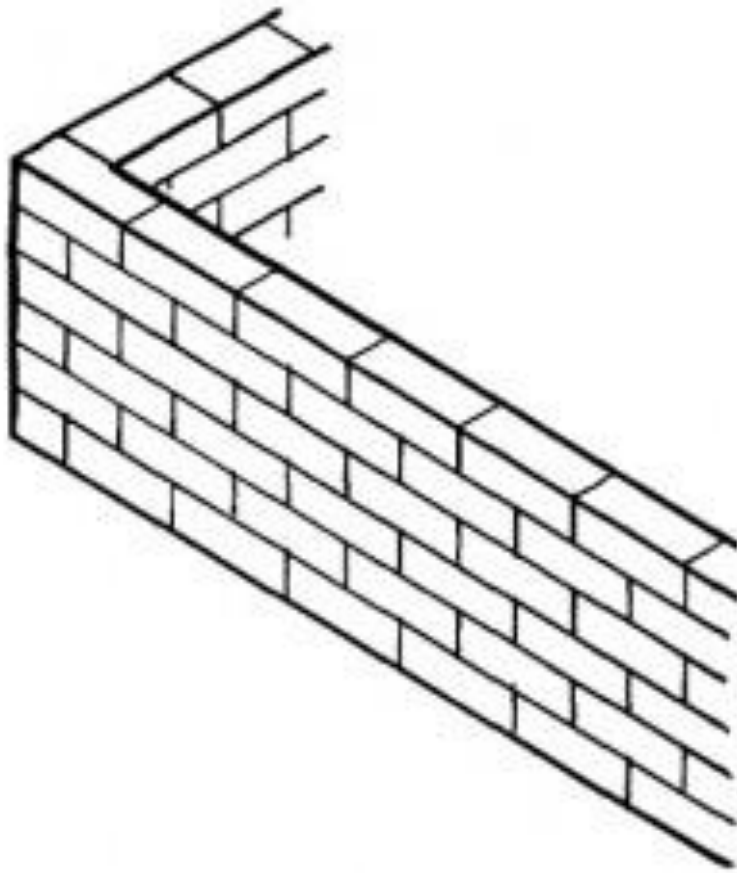


Fig. 52 Stretcher bond.

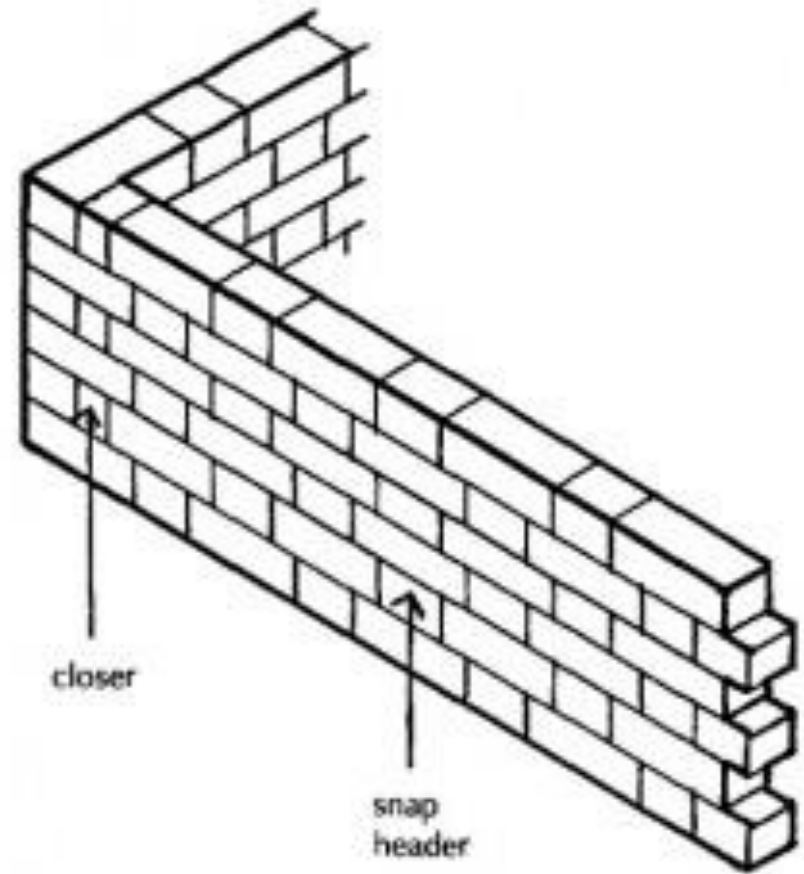


Fig. 53 Flemish bond with snap headers.

At the intersection of two half brick walls at corners or angles and at the jambs, sides of openings, the bricks are laid so that a header face shows in every other course to complete the bond, as illustrated in Fig. 52.

The appearance of a wall laid in stretcher bond may look somewhat monotonous because of the mass of stretcher faces showing. To provide some variety the wall may be built with snap headers so that a stretcher face and a header face show alternately in each course with the center of the header face lying directly under and over the center of the stretcher faces in courses below and above, as illustrated in Fig. 53.

This form of fake Flemish bond is achieved by the use of half bricks, hence the name 'snap header'. The combination and variety in colour and shape can add appreciably to the appearance of a wall. Obviously the additional labour and likely wastage of bricks adds somewhat to cost.

Types of bonds in brick masonry wall construction

Types of bonds in brick masonry wall construction are classified based on laying and bonding style of bricks in walls. The bonds in brick masonry is developed by the mortar filling between layers of bricks and in grooves when bricks are laid adjacent to each other and in layers in walls.

Mostly used material for bonds in brick masonry is cement mortar. Lime mortar and mud mortar are also used

Types of Bonds in Brick Masonry Wall Construction :

The most commonly used types of bonds in brick masonry are:

- Stretcher bond الربط على الوجه
- Header bond الربط على الرأس
- English bond الربط الانكليزي
- Flemish bond الربط الالمانى

Other Types of bonds are:

- Facing bond الربط على الوجه
- Dutch bond الربط الهولندي
- English cross bond الربط الانكليزي المتقاطع
- Brick on edge bond (الربط على الكاز) الربط بطريقة الطالوقة على الحافة
- hollow bond ربط مجوف
- Zigzag bond ربط زكزاك
- Garden wall bond ربط سياج الحديقة

1. Stretcher bond الربط على الطول

Longer narrow face of the brick is called as stretcher as shown in the elevation of figure below. Stretcher bond, also called as running bond, is created when bricks are laid with only their stretchers showing, overlapping midway with the courses of bricks below and above.

Stretcher bond in the brick is the simplest repeating pattern. But the limitation of stretcher bond is that it cannot make effective bonding with adjacent bricks in full width thick brick walls. They are suitably used only for one-half brick thick walls such as for the construction half brick thick partition wall.

Walls constructed with stretcher bonds are not stable enough to stand alone in case of longer span and height. Thus they Then need supporting structure such as brick masonry columns at regular intervals.

Stretcher bonds are commonly used in the steel or reinforced concrete framed structures as the outer facing. These are also used as the outer facing of cavity walls. Other common applications of such walls are the boundary walls, gardens etc.

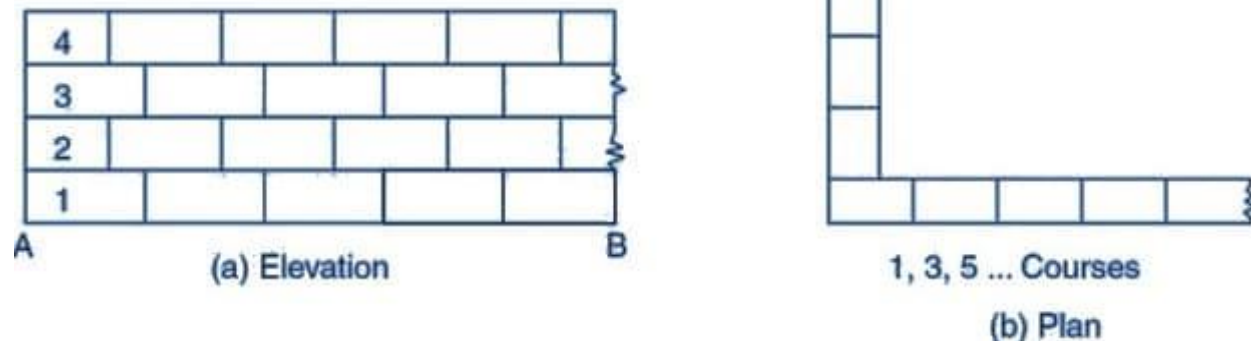
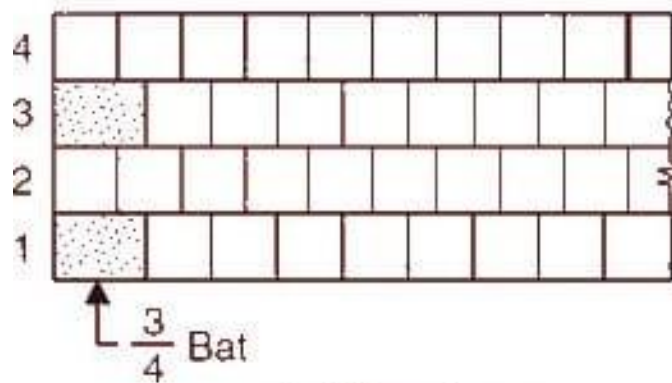


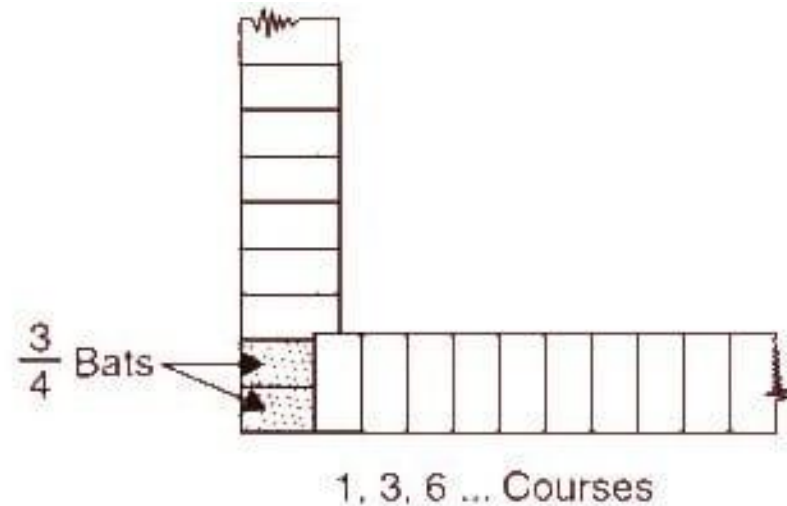
Fig-1: Stretcher Bond

2. Header bond الرّبط على الرأس

Header is the shorter square face of the brick which measures 9cm x 9cm. Header bond is also known as heading bond. In header bonds, all bricks in each course are placed as headers on the faces of the walls. While Stretcher bond is used for the construction of walls of half brick thickness whereas header bond is used for the construction of walls with full brick thickness which measures 18cm. In header bonds, the overlap is kept equal to half width of the brick. To achieve this, three quarter brick bats are used in alternate courses as quoins



(a) Elevation



(b) Plan

Fig-2: Header Bond

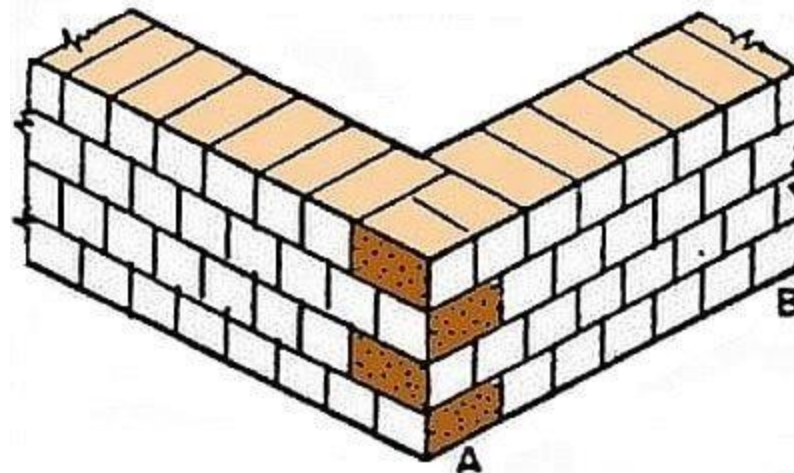


Fig-3: Header Bond Isometric View

3. English Bond الربط الانكليزي

English bond in brick masonry has one course of stretcher only and a course of header above it, i.e. it has two alternating courses of stretchers and headers. Headers are laid centered on the stretchers in course below and each alternate row is vertically aligned.

To break the continuity of vertical joints, quoin closer is used in the beginning and end of a wall after first header. A quoin close is a brick cut lengthwise into two halves and used at corners in brick walls.

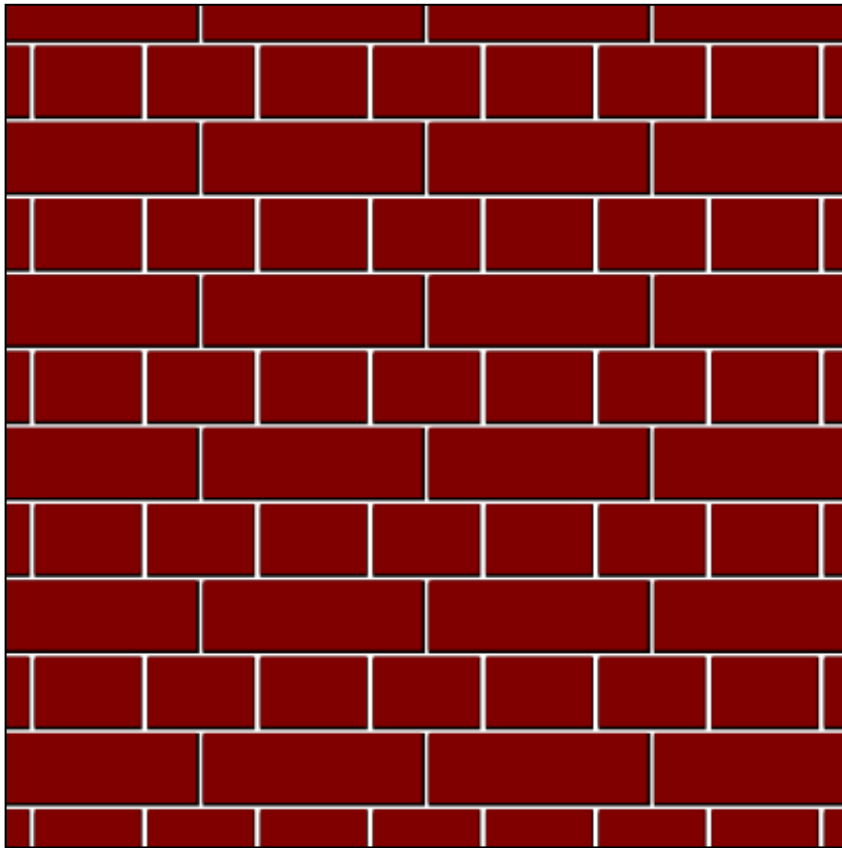


Fig-4: English Bond

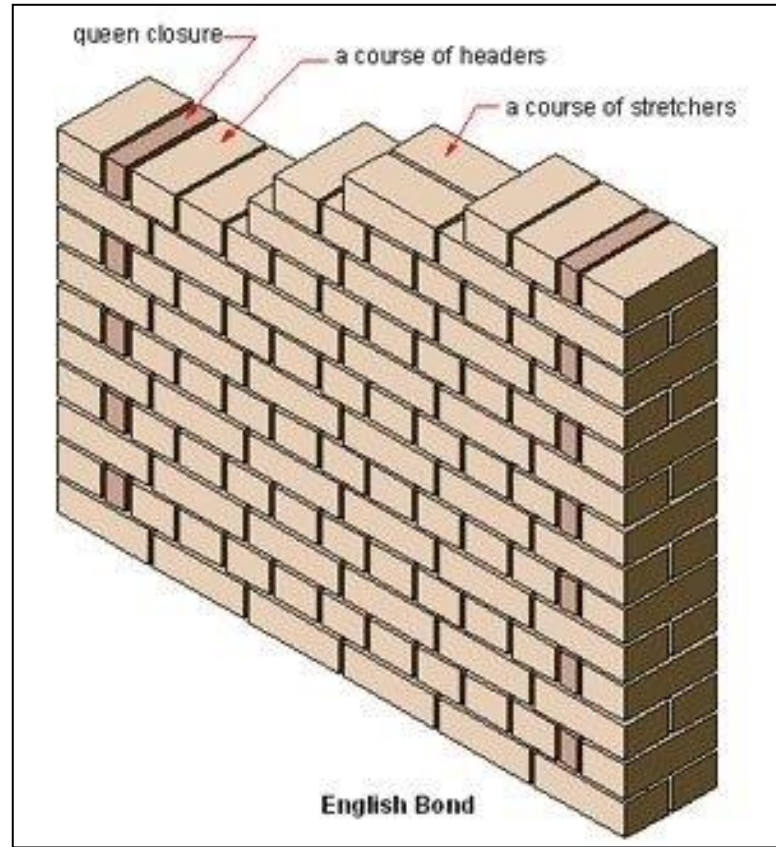


Fig-4: English Bond – Isometric View

4. Flemish Bond الربط الألماني

For the breaking of vertical joints in the successive courses, closers are inserted in alternate courses next to the quoin header. In walls having their thickness equal to odd number of half bricks, bats are essentially used to achieve the bond.

Flemish bond, also known as Dutch bond, is created by laying alternate headers and stretchers in a single course. The next course of brick is laid such that header lies in the middle of the stretcher in the course below, i.e. the alternate headers of each course are centered on the stretcher of course below. Every alternate course of Flemish bond starts with header at the corner.

The thickness of Flemish bond is minimum one full brick. The disadvantage of using Flemish bond is that construction of Flemish bond is difficult and requires greater skill to lay it properly as all vertical mortar joints need to be aligned vertically for best effects. For the breaking of vertical joints in the successive courses, closers are inserted in alternate courses next to the quoin header. In walls having their thickness equal to odd number of half bricks, bats are used to achieve the bond.

Flemish bonds have better appearance but are weaker than English bonds for load bearing wall construction. Thus, if the pointing has to be done for brick masonry walls, then Flemish bond may be used for better aesthetic view. If the walls have to be plastered, then it is better to use English bond.

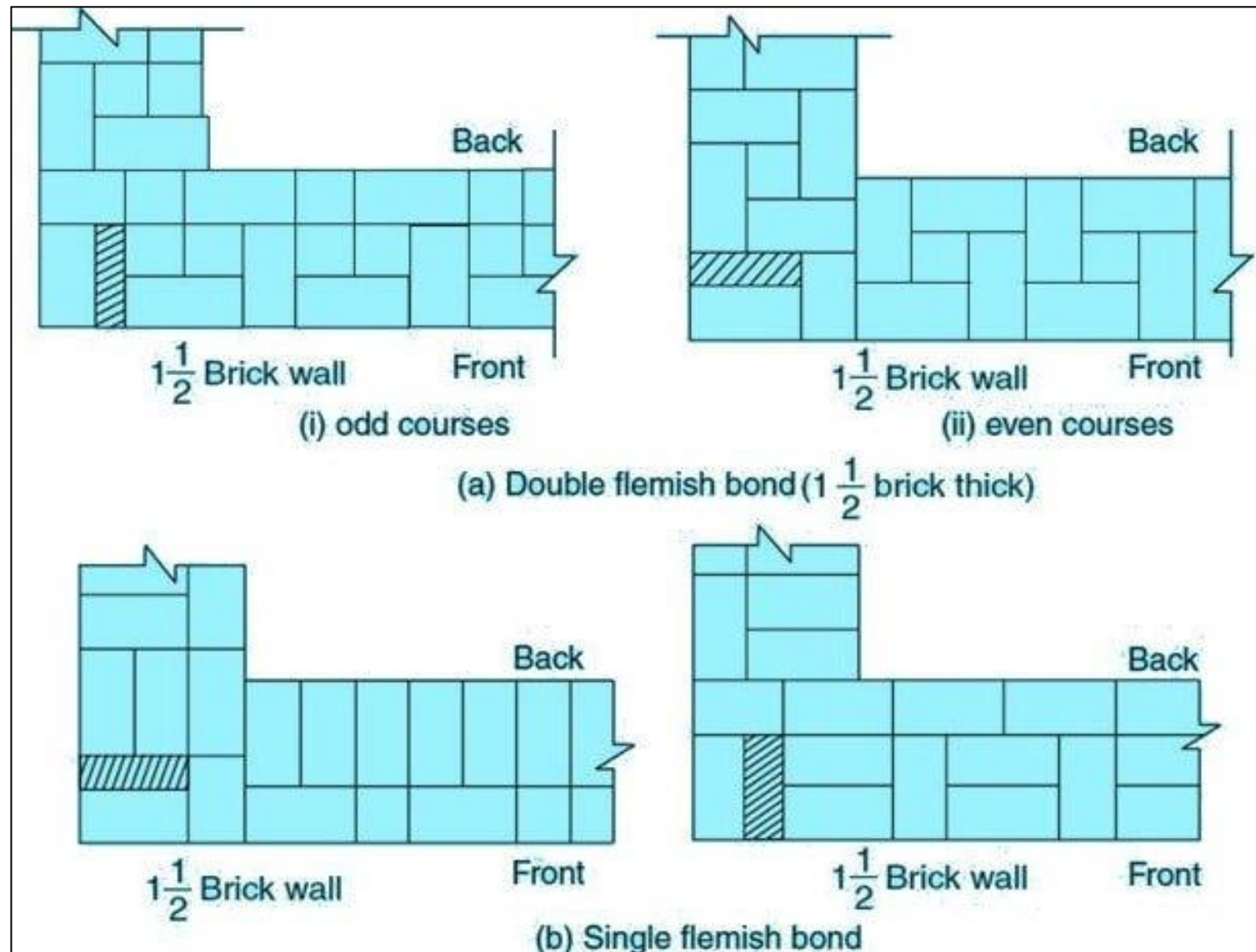


Fig-5: Flemish Bond

Flemish bonds are classified as:

- Single Flemish Bond
- Double Flemish Bond

- Single Flemish bond is a combination of English bond and Flemish bond. In this type of construction, the front exposed surface of wall consists of Flemish bond and the back surface of the wall consists of English bond in each course. Minimum thickness required for single Flemish bond is one and a half brick thickness. The main purpose of using single Flemish bond is to provide greater aesthetic appearance on the front surface with required strength in the brickwork with English bond.

- Double Flemish Bond has the same appearance both in the front and back elevations, i.e. each course consists of alternate header and stretcher. This type of bonding is comparatively weaker than English bond.

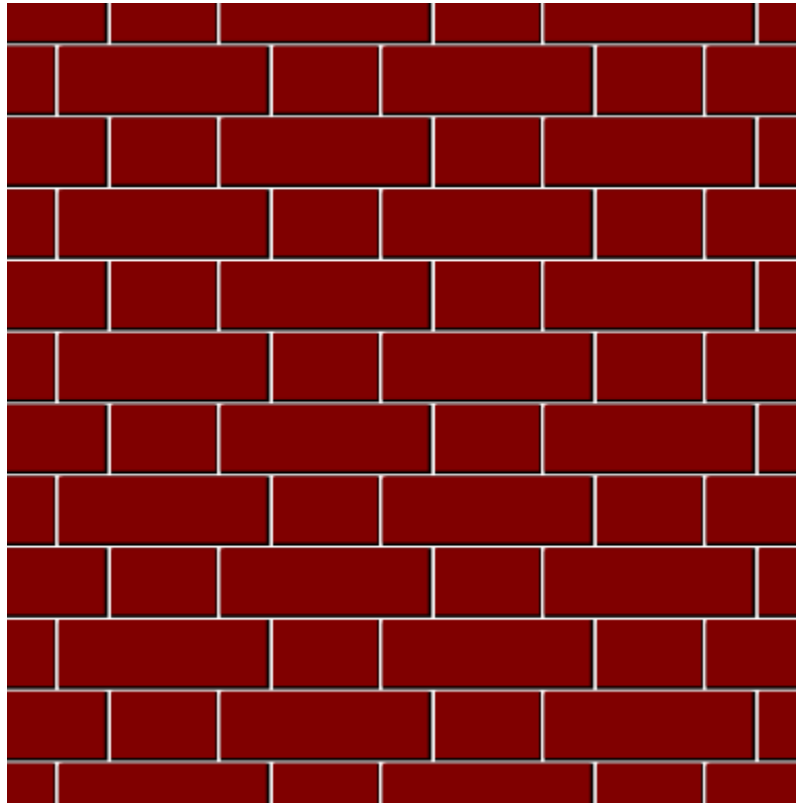


Fig-6: Flemish Bond Front Appearance

What is the purpose of building walls?

The Purpose of constructing the walls: - The walls serve one or more of the following purposes: -

1. Determination of a specific area of land .
2. Work as a structural member to carry the weights of ceilings and floors above the wall.
3. Sound and thermal insulation and prevent moisture and rain water.

And other various purposes

What are the requirements of selection Wall thickness?

Wall thickness is determined based on construction and non-structural requirements

A - Structural requirements: The walls are usually divided into:

1- Load - bearing wall: walls that resist loads "in addition to their weight. These loads include the weight of the ceilings and the walls that support them, as well as other dead loads on those ceilings and floors in addition to live loads. Loads may be sideways like loads." Wind on high external walls, soil loads, etc.

2- Nonload - bearing wall: It is the walls that bear their weight only and are created for the purposes of cutting areas and are called partitions or for thermal and sound insulation purposes, and others. In this case, the walls are designed according to mostly non-structural requirements.

B - Non-structural design requirements: The amount of bearing walls may not be the basis for choosing the required wall thickness, but may be determined by non-structural requirements such as (thermal insulation, fire resistance, sound insulation and moisture penetration) when determining the required wall thickness.

- **Thermal insulation:** - The thermal insulation scale is the so-called thermal transmittance coef. It is symbolized by the letter (U), which is the measure of the wall or ceiling susceptibility to leaking heat between inside and outside the building.
- **Fire resistance:** - Experiments on the loaded walls have demonstrated that the brick walls 100 mm thick have a fire resistance of up to two hours when they are without finish from two sides and up to four hours when the wall is finished from both sides of white plaster with light insulation while the resistance of the wall is thick 215 mm without finishing six hours.

- **Acoustic insulation:** Wall cladding is one of the ways to increase its sound insulation and the cladding efficiency increases in sound insulation when the cladding layer is separated from the walls with an appropriate and continuous antenna barrier with the lowest possible points of contact between the cladding layer and the wall itself. These points help the sound to cross the wall or vice versa.

- **Moisture penetration:**

The resistance of walls to penetration of moisture is one of the important things that must be addressed in any building. Rainwater and moisture may penetrate the walls of poorly executed masonry joints or through capillary pores between the binder and the building blocks. The outer walls should have acceptable resistance to the penetration of rain water into the interior. For example, "a wall with a single brick thickness is not sufficient" to resist the penetration of moisture in rainy areas with high humidity, but it is considered sufficient for "moderate areas, especially if the exterior is exposed," and this includes Most regions of Iraq, except perhaps some northern regions.

QUESTIONS OF LECTURE FIVE(H.W)

Q1/What is the Brick masonry and what are the Types of Brick Masonry Work depending in their mortar?

Q2/What are the classes of brick work in cement, show their descriptions?

Q3/What are the most common different types of brick used in the construction of brick masonry?

Q4/What are the common Materials and Equipment Used in Brick Masonry Construction?

Q5/ What are the usually Brick Masonry Construction Preparations?

Q6/What are the usually Brick Masonry Construction Procedure?

7/What are the usually points that should be observed in the construction of brick masonry?

Q8/What are the usually Types of Bonds in Brick Masonry Wall Construction?

Q9/What is the purpose of building walls?

Q10/ What are the requirements of selection Wall thickness?



Thanks For Your Listening