CE-200

Details of Construction

Lecture-4

“Brick Masonry”

Masonry

- **Masonry** is the building of structures from individual units laid in and bound together by mortar.
- The common materials of masonry construction are brick, stone such as marble, granite, limestone, concrete block, glass block, and tile. Masonry is generally a highly durable form of construction. However, the materials used, the quality of the mortar and workmanship, and the pattern the units are put in, can strongly affect the durability of the overall masonry construction.

Masonry work

- Strength of brick masonry depends on –

1. Quality and strength of bricks
2. Type of mortar used
3. The method of bonding adopted

- Strength of brick wall depends on –

1. Slenderness ratio of the wall
2. Lateral pressure due to wind
3. Degree of soundness in construction

Mortar

- **Mortar** is a material used in masonry to bind construction blocks together and fill the gaps between them. The blocks may be stone, brick etc. Mortar is a mixture of sand, a binder such as cement or lime, and water and is applied as a paste which then sets hard. Mortar can also be used to fix, or *point* masonry when the original mortar has washed away.

- Masonry mortar is composed of one or more cementitious materials, clean well-graded masonry sand, and sufficient water to produce a plastic, workable mixture.
- Types of mortar used in masonry work –

1. Cement mortar
2. Lime mortar
3. Cement-lime mortar
4. Lime-surkhi mortar
5. Mud mortar

- Types of bricks used in masonry work -

1. Traditional bricks -

   Length - 20 to 25 cm, Width - 10 to 13 cm, Height - 5 to 7.5 cm

   common size - 23cm × 11.4cm × 7.6cm

2. Modular bricks –

   normal size – 20 × 10 × 10 cm

   actual size – 19 × 9 × 9 cm

- Bangladesh – 9.5 × 4.5 × 2.75 in

  with mortar – 10 × 5 × 3 in

- Bonds in brick-work:

  - on account of their uniform size and shape, the bricks can be rise to different types of bonds.
- Bonding is essential because it

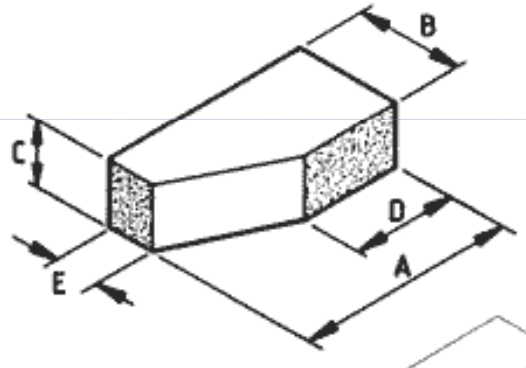
  - eliminates continuous vertical joints both in the body as well as in the face of the wall

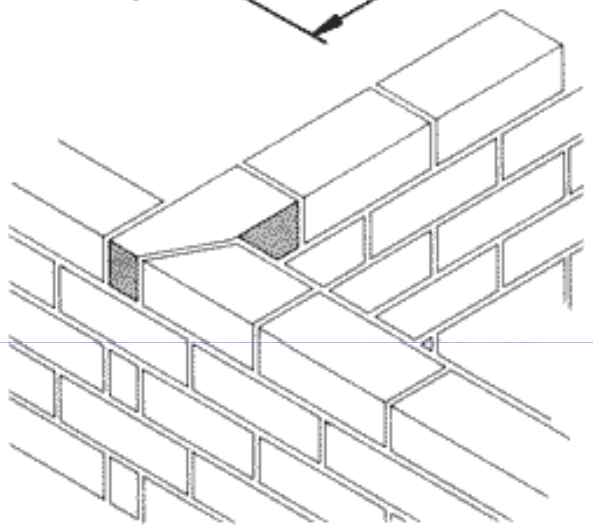
  - imparts strength to the masonry
- Defective arrangement of bricks reduces the strength and durability of the structure
- A wall having continuous vertical joints does not act as a homogeneous mass to distribute the superimposed load.

Technical terms used in masonry

1. Header
2. Stretcher
3. Bond
4. Course
5. Face
6. Back
7. Racking back
8. Toothing
9. Lap
10. Perpends
11. Bat
12. Closer
13. King closer
14. Queen closer
15. Quoin
16. Frog
17. Beveled closer
18. Mitered closer

King closer

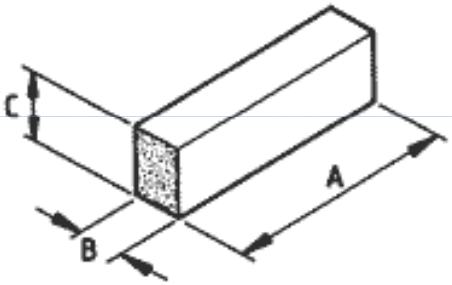


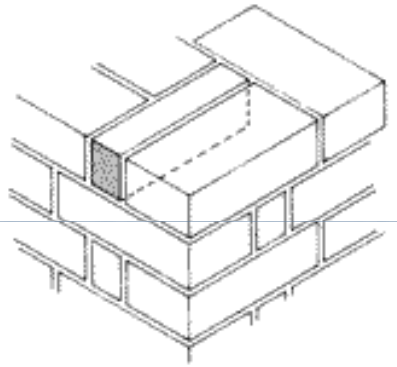


LEFT HAND SHOWN

DIMENSIONS				
A	*B*	*C*	*D*	*E*
215	102	65	102	46

Queen closer





DIMENSIONS		
A	*B*	*C*
215	46	65

Types of Bonds

- Commonly adopted types are:

1. English bond
2. Flemish bond
   - i) single flemish bond
   - ii) double flemish bond

- Other types of bonds are:

1. Heading bond
2. Stretching bond
3. Garden wall bond

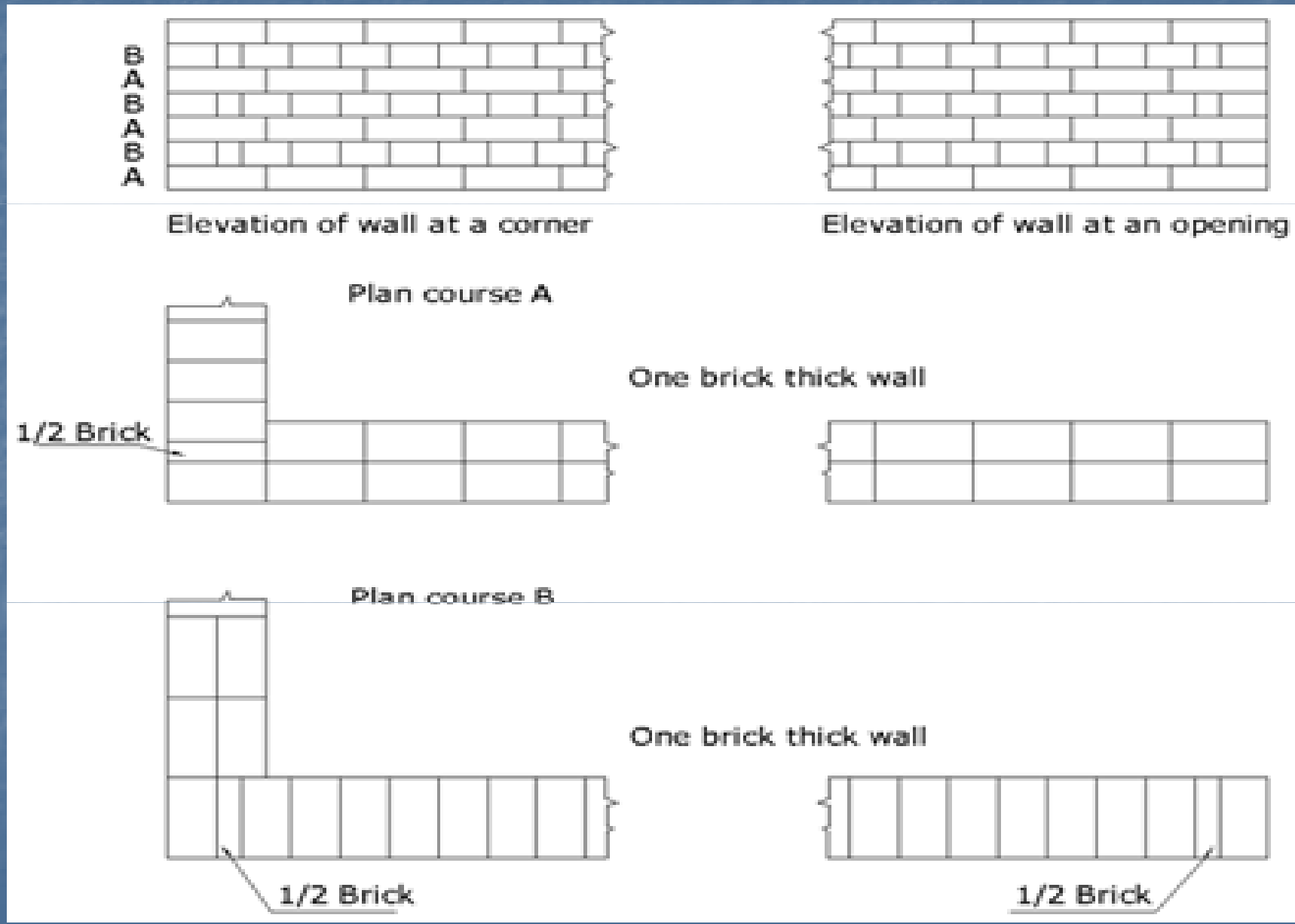
i) english garden wall bond
ii) flemish garden wall bond

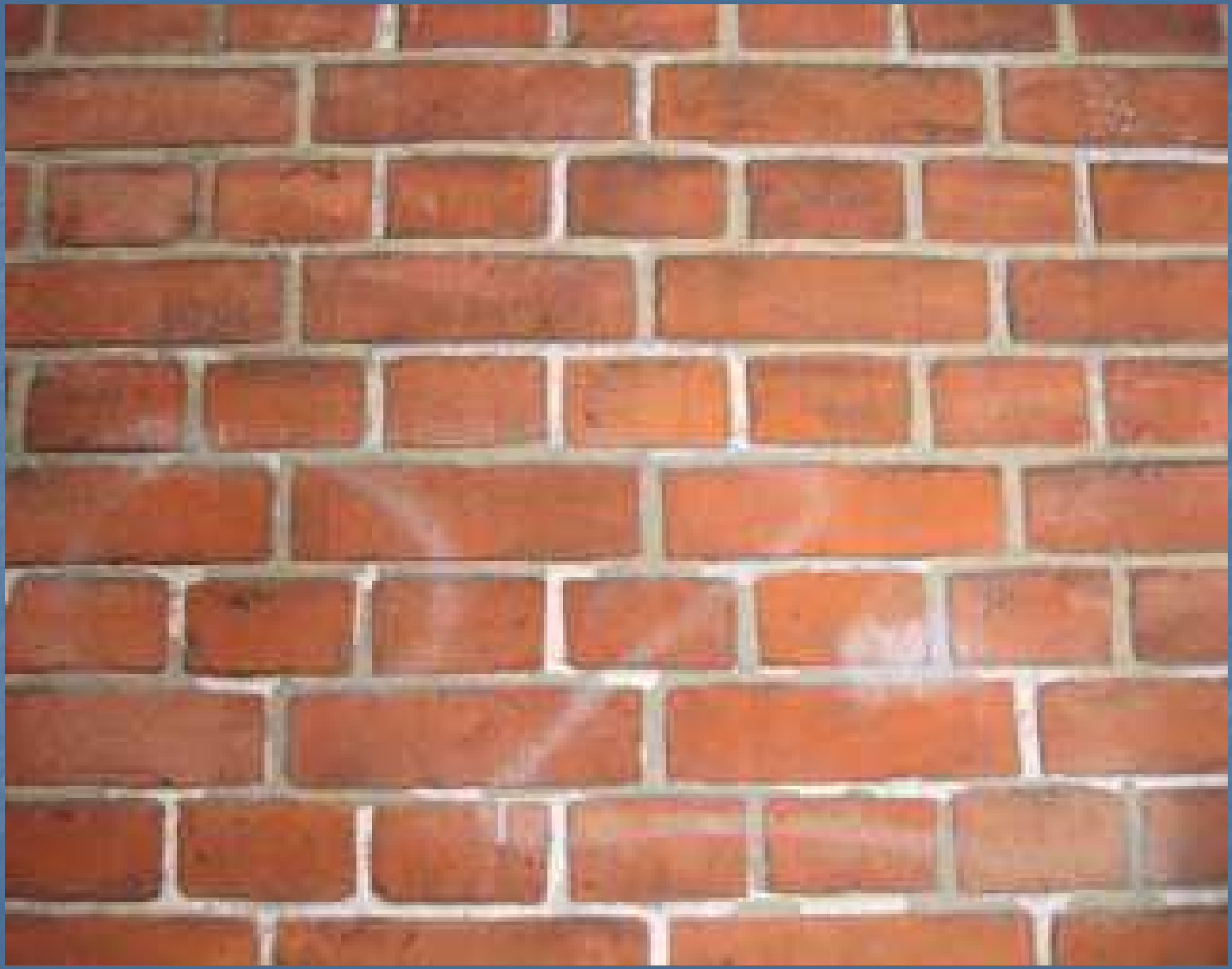
4. Raking bond
   i) herring-bone bond
   ii) diagonal bond
   iii) zig-zag bond
6. Dutch bond
7. English cross bond
8. Silver lock's bond

English bond

- Heading course should never start with a queen closer
- In stretcher course, the stretchers should have a minimum lap of ¼ their length over the header
- 1, 2 or 3 brick thick walls (i.e., even number of half brick) present the same appearance on the both sides
- For odd number of half brick, same course will show stretcher on one face and header on the other
- In thick walls, the middle portion is entirely filled with header

English Bonds





Flemish bond

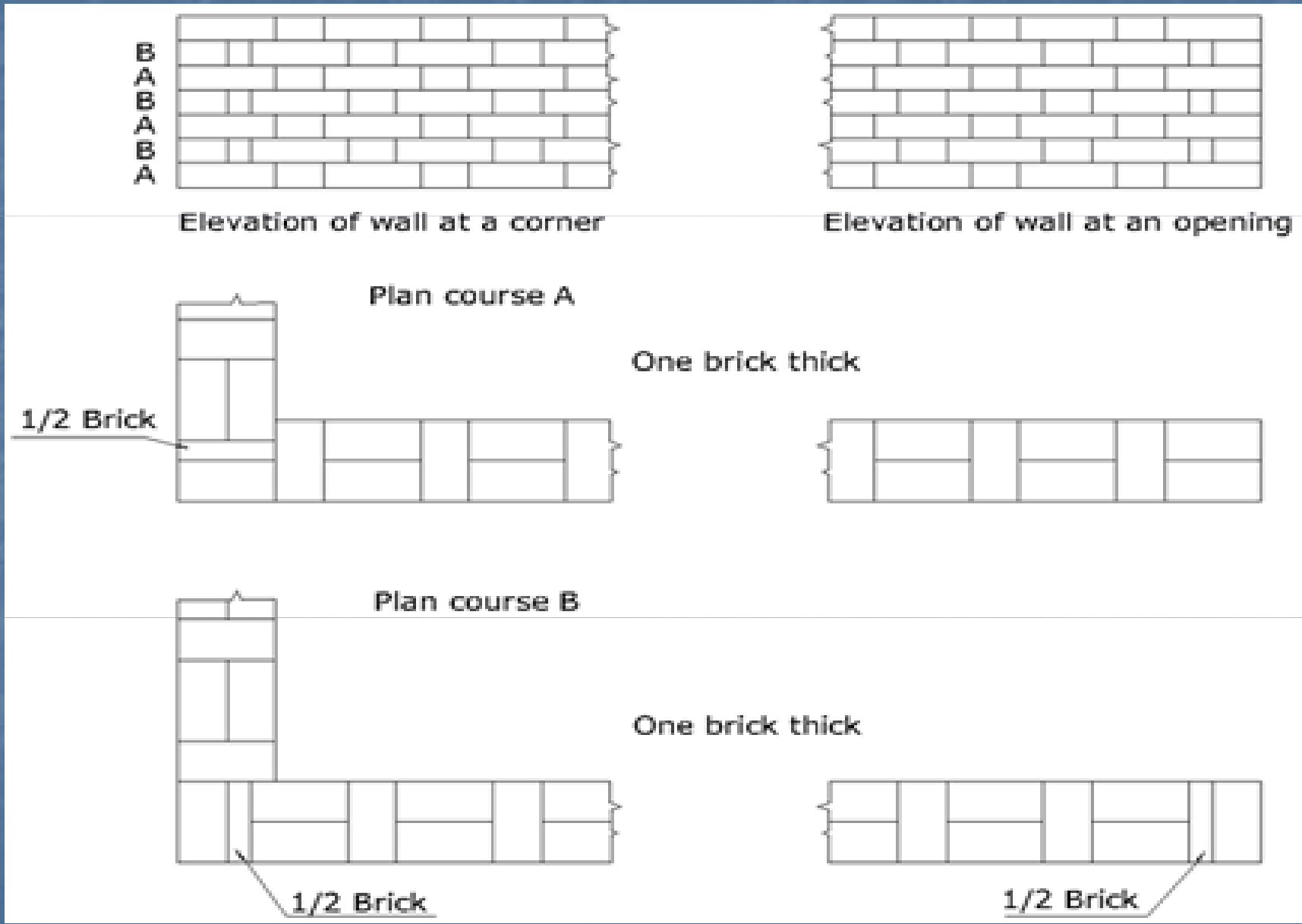
1. Single flemish bond:

- Combination of english and flemish bond
- In a course, facing is flemish and backing is english
- Cannot be adopted in walls having thickness less than one and half brick
- Provided for the attractive appearance of the flemish bond

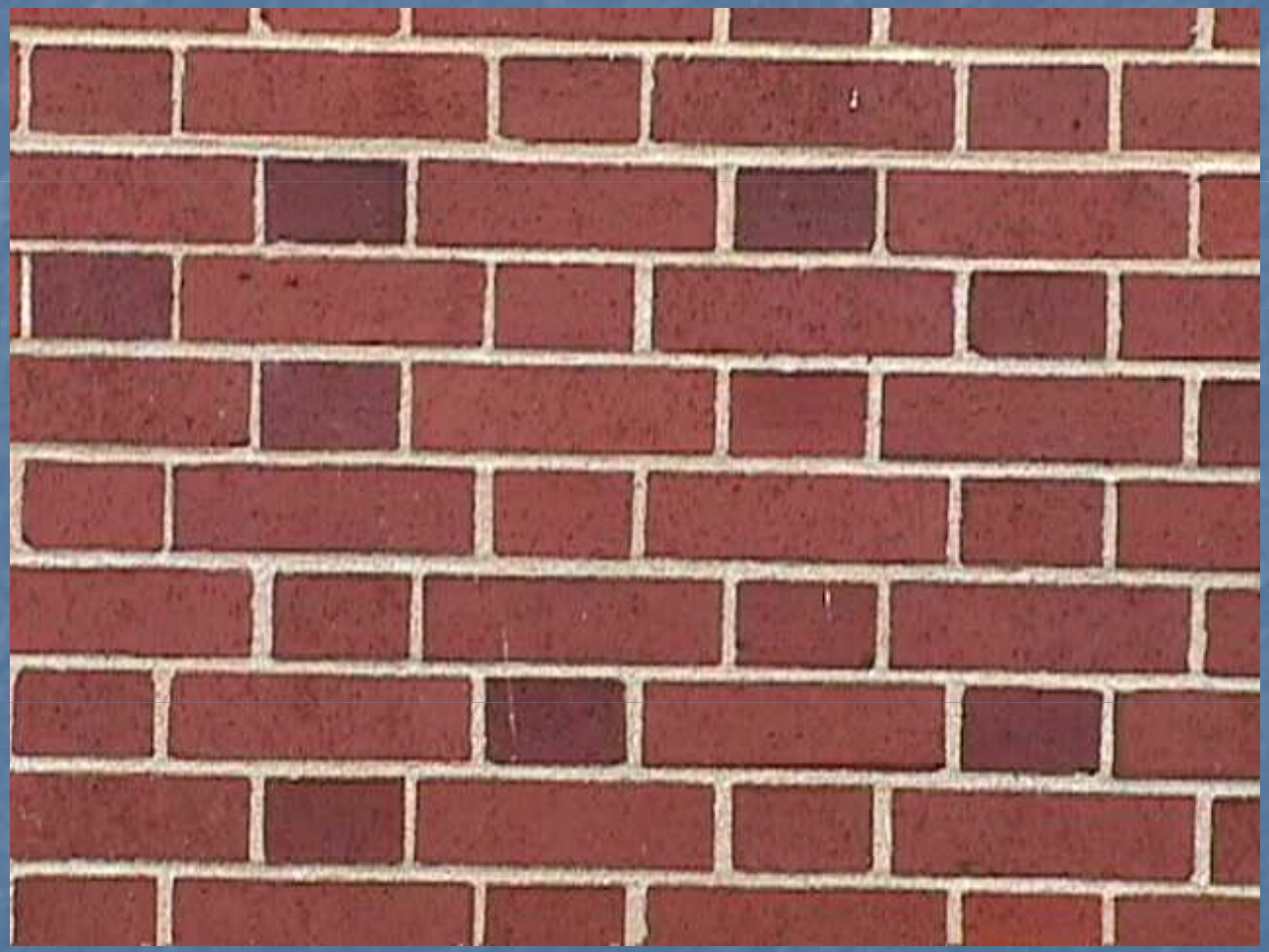
1. Double flemish bond:

- Each course presents the same appearance both in the face and back of the wall
- Every course consists of headers and stretchers alternately
- Best suited for consideration of economy and appearance
- This type of bonding is comparatively weaker than english bond

Flemish Bonds



Flemish bond



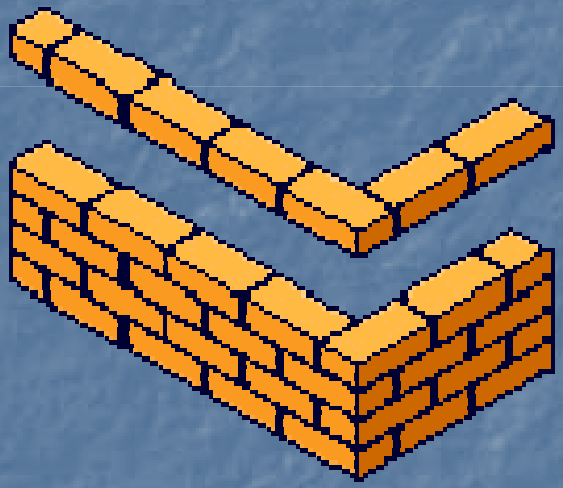
Comparative merits and demerits of English and Flemish bonds

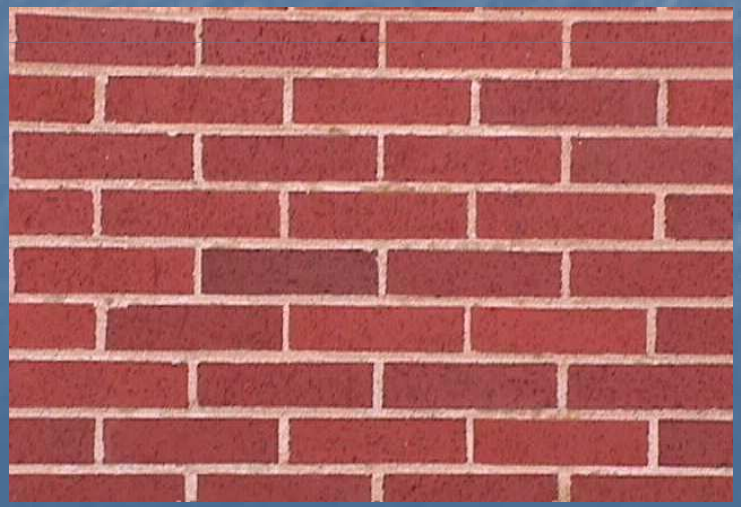
1. For walls thicker than 1.5 brick, English bond is stronger than Flemish bond.
2. Flemish bond renders the appearance of the face work more attractive.
3. Flemish bond is slightly economical as a number of bats can be used.
4. The adoption of Flemish bond requires good workmanship and careful supervision.

Other types of bonds

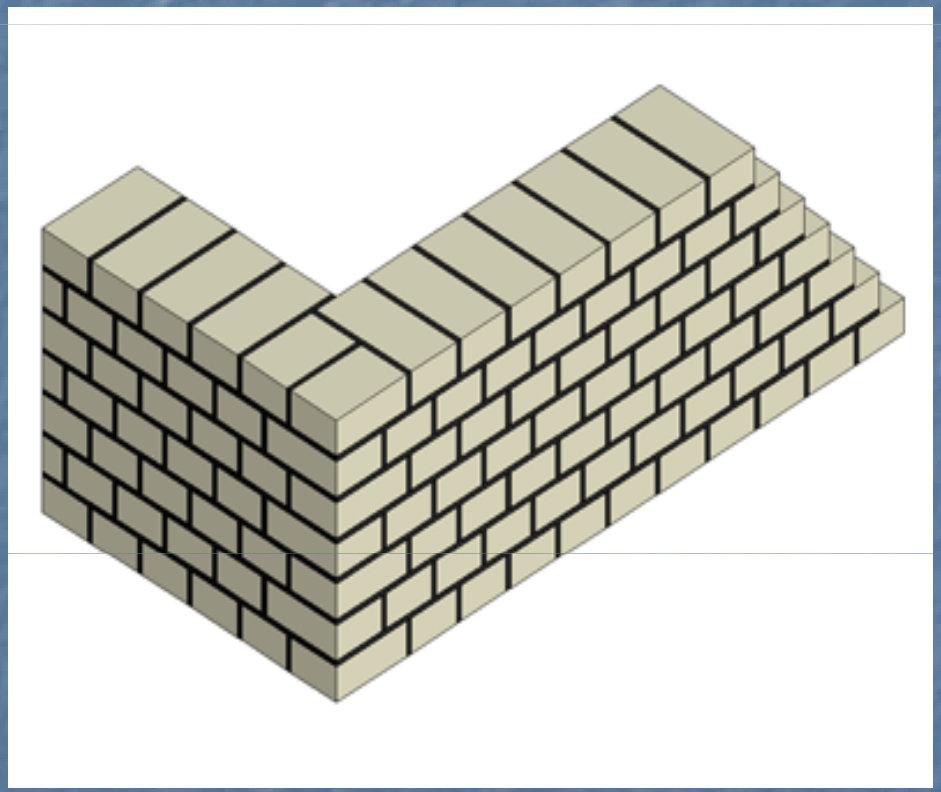
- Stretching (running) bond:
  - all bricks are laid as stretchers
  - bond is used for half brick wall only
  - commonly adopted in the construction of half brick of partition wall.
- Heading bond:
  - bricks are laid as headers on the faces.
  - overlap is done by a three-quarter bat in each alternate course.
  - mainly used for footings because of better transverse distribution of loads.

Heading and Stretching bonds

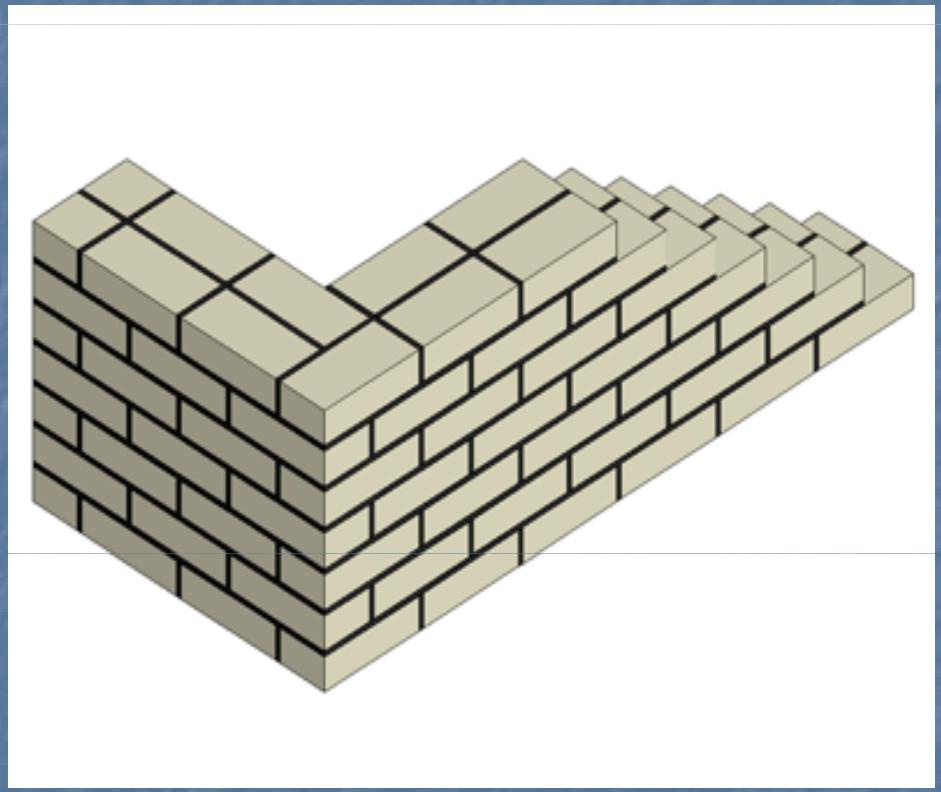




Heading bond



Stretching bond



- Garden-wall bond:

  - suitable for one brick thick wall

  - bond is not so strong, therefore, restricted to walls which are not subjected to large stresses.

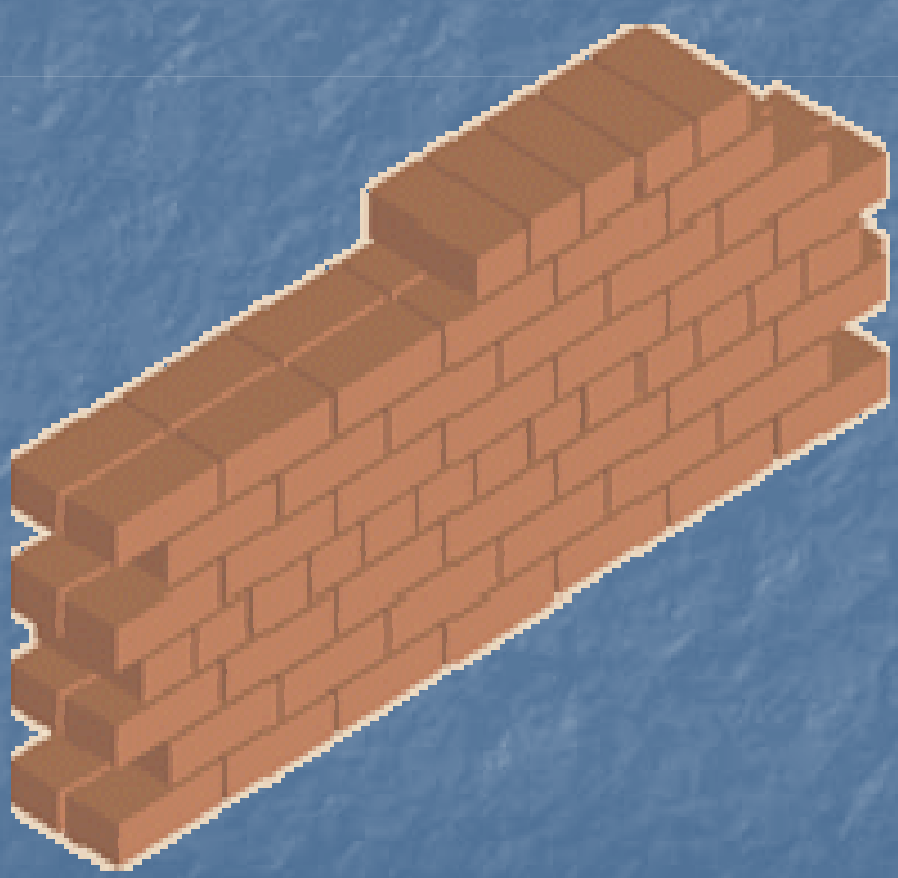
1. English garden walls:

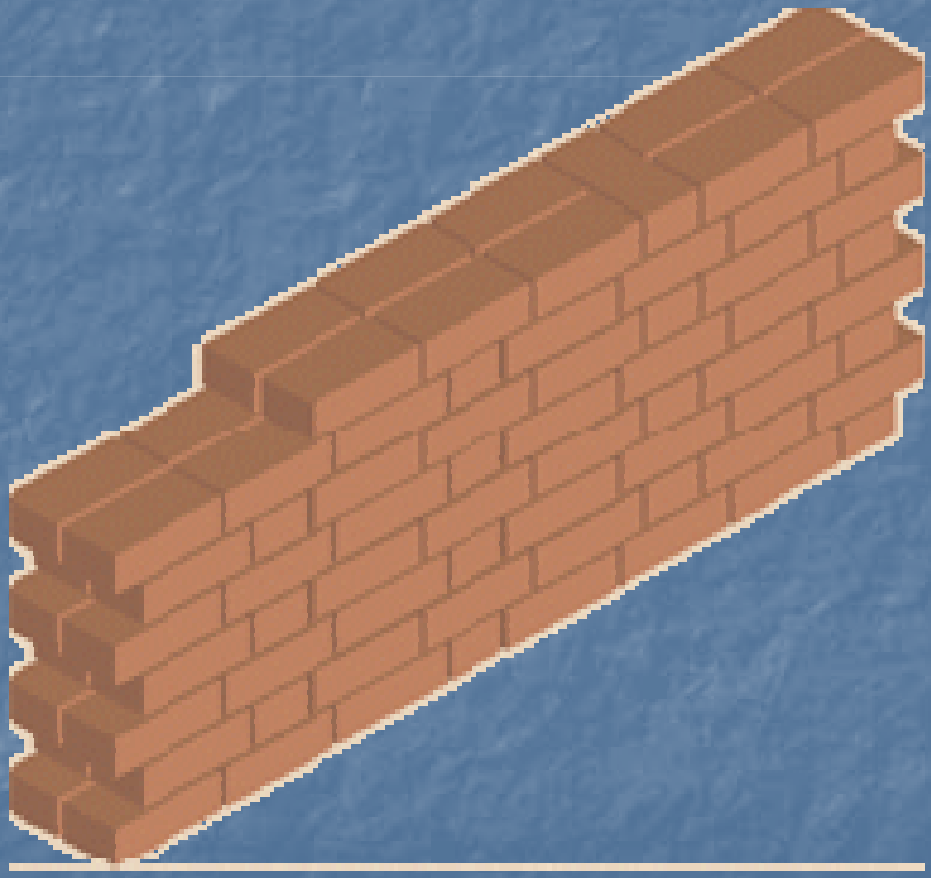
   - brick arrangement similar to English bond

   - usually one course of header and three course of stretchers

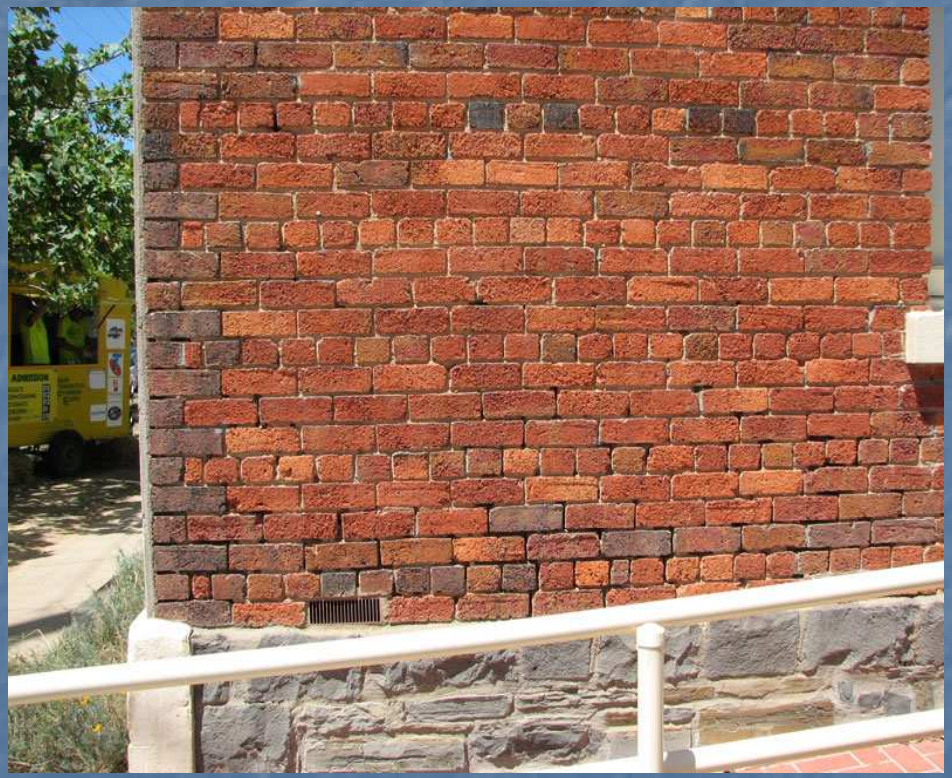
   - QC is placed next to quoin header of the heading course to give the necessary lap.

English and Flemish garden-wall bonds

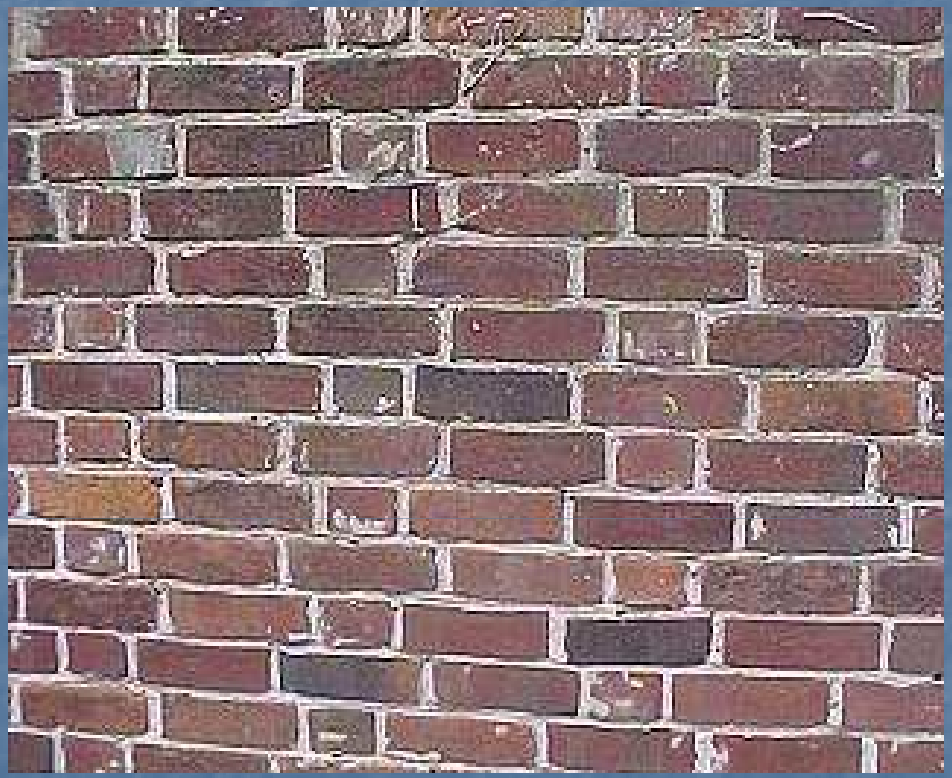




English garden wall



Flemish garden wall



2. Flemish garden wall:

   - composed of one header and 3/5 stretchers in series throughout the length.

   - each alternate course contains a 3/4th bat placed next to quoin header and a header is laid over the middle of each central stretcher.

- Raking bond:

  - bricks are laid at any angle other than 0 or 90 degrees

  - arrangement helps to increase longitudinal stability of thick walls.

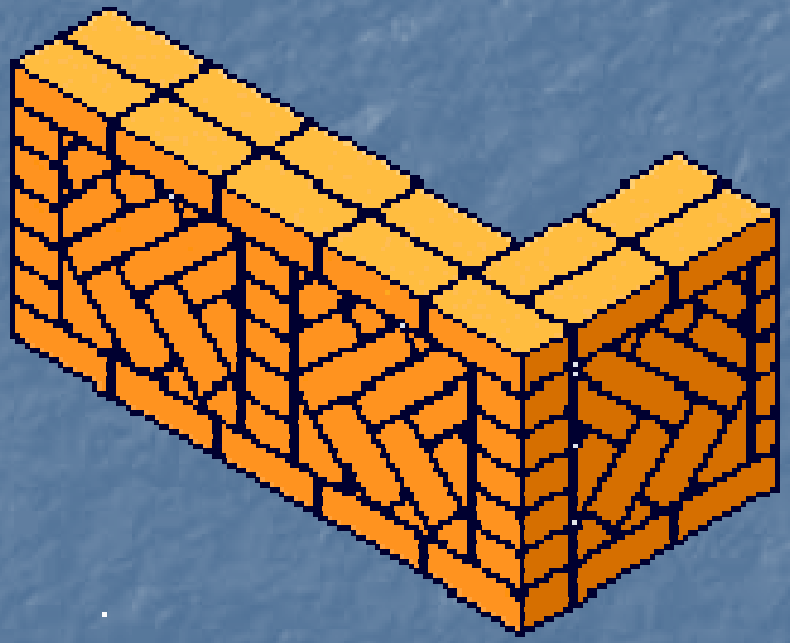
1. Herring bone bond:

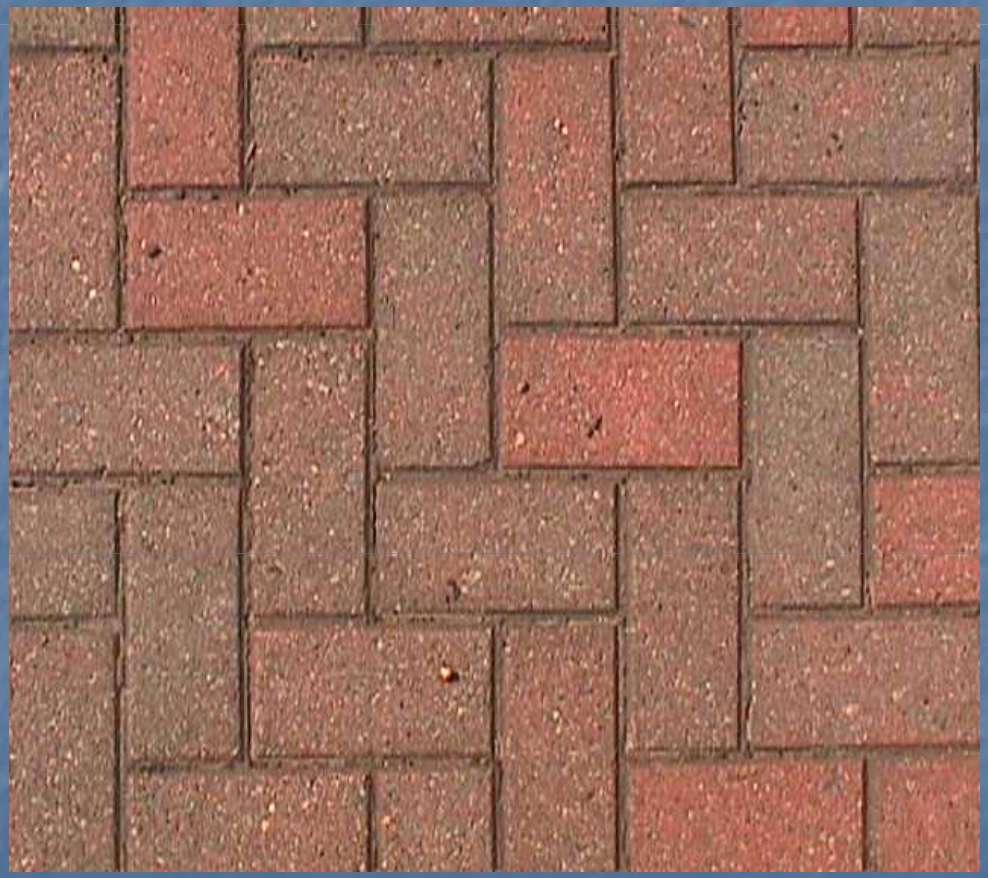
   - suited for very thick walls – not less than 4 brick thick

   - bricks are laid at 45 degree in two directions from centre

   - commonly used for brick paving

Raking and Herring bone bonds





2. Diagonal bonds:
   - bricks are inclined in one direction only
   - angle of inclination is so selected that there is a minimum cutting of the bricks
   - best suited for walls which are 2 to 4 brick thick

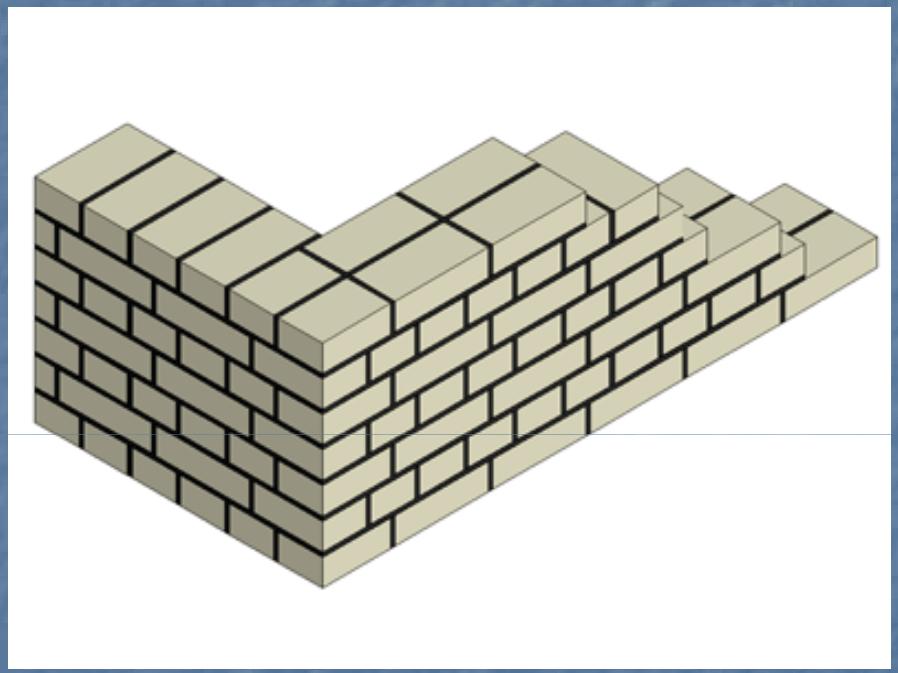
3. Zig-zag bonds:
   - similar to herringbone bond
   - bricks are laid in a zig-zag fashion
   - commonly adopted in brick paved flooring

- English cross bond:
  - similar to English bond
  - QC are introduced next to quoin header
  - each alternate stretching course has header next to quoin stretcher
  - sufficiently strong and bears good elevation

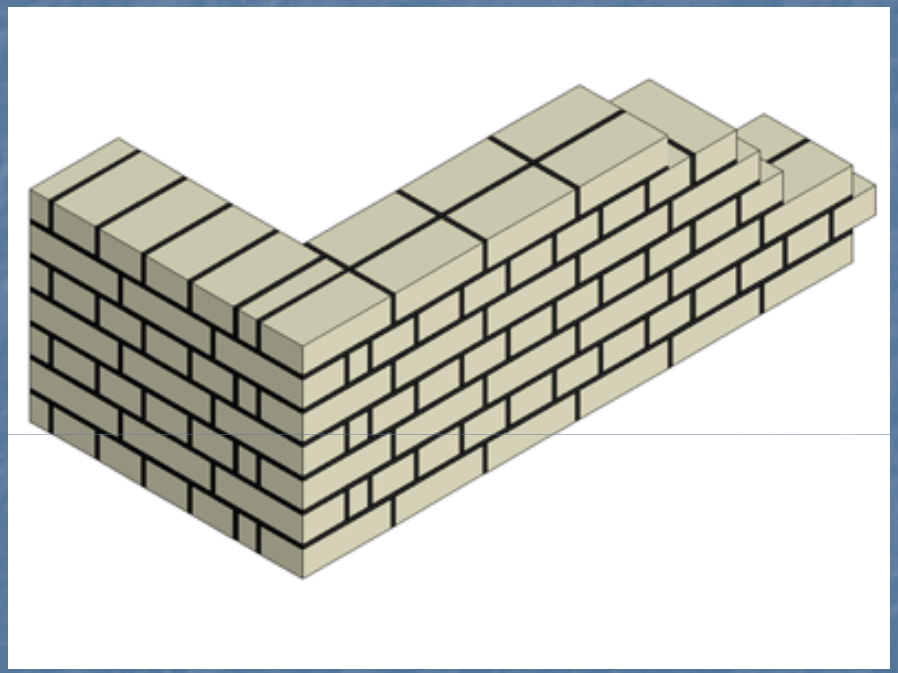
- Dutch bond:
  - modification of English cross bond
  - each stretching course starts at the quoin with a ¾ bat and every alternate stretching course has header placed next to the ¾ bat provided at the quoin

Dutch and English cross bonds

Dutch bond



English cross bond



- Silverlock’s bond:

  - headers and stretchers are laid in alternate courses

  - economical but weak in strength recommended for garden or partition wall

Tools for brick-layer

- Hammer
- Line and pin
- Brick axe
- Plumb rule
- Spirit level
- Mason’s square
- Trowel
- Two feet four fold rule

Retaining wall and Breast wall

- Retaining wall:

1. Wall built to resist the pressure of liquid, earth filling, sand or other granular material filled behind it after it is built
2. It is commonly required in the construction of hill roads, masonry dams, abutments, and wing walls of bridges and so on

- Breast wall:

1. It is constructed to protect the slippage of naturally slopping ground
2. Stone walls are provided to protect the slopes of cutting in natural ground from the action of weather
3. Section of wall depends upon the height of wall, nature of backing and slope of cutting

Conditions of stability of retaining walls

- A satisfactory retaining wall must meet the following requirements:

1. The wall should be structurally capable of resisting the pressure applied to it
2. The section of the wall should be so proportioned that it will not overturn by the lateral pressure
3. The wall should be safe from consideration of sliding

4. The weight of wall together with the force resulting from the earth pressure action on it should not stress its foundation to a value greater than safe bearing capacity of the soil on which it is found.
5. It is important to prevent accumulation of water behind a retaining wall. The backing material should be suitably drained by providing weep holes
6. As far as possible long masonry walls should be provided