MASONRY

NTQF Level -II

Learning Guide #63

Unit of Competence: - Erect Brick and Block Structures

Module Title:- Erecting Brick and Block Structures

LG Code:- **EISMAS2 M13 LO2LG-63**

TTLM Code:- **EIS MAS2 M13 TTLM 0919v1**

LO2:-Set out brickwork/ block work

Instruction Sheet 2	Learning Guide #-63

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Identifying, selecting and checking Bricks and/or blocks for conformity
- Erecting work platform
- Identifying Location and structural details of brickwork/ block work
- Setting out base brickwork below floor construction
- Setting out Load bearing brickwork
    - Engaging piers
    - Dwarfing walls
    - Isolating piers and
    - Corbelling
- Setting out ***Cavity brick wall***

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Identify, select and check Bricks and/or blocks for conformity
- Erect work platform
- Identify Location and structural details of brickwork/ block work
- Set out base brickwork below floor construction
- Set out Load bearing brickwork
    - Engage piers
    - Dwarf walls
    - Isolate piers and
    - Corbel
- Set out ***Cavity brick wall***

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 , Sheet 4,Sheet 5 and Sheet 6”**in page 4, 18, 23, 32 , 37 and 46** respectively.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 , Self-check 4, Self-check 5 and Self-check 6 **in page 16, 21, 30, 35, 44 and 49** respectively
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2, Operation Sheet 3, Operation Sheet 4, Operation Sheet 5 and Operation Sheet 6 ”**in page. 51, 52, 53,54, 55 and 56** respectively
6. Do the “LAP test” **in page 57**

Information Sheet-1	Identifying, selecting and checking Bricks and/or blocks for conformity

1.1 brick/ blockfor conformity

- Brick masonry:-is the artificial material construction of the from of rectangular block prepared by clay soil.

1.2 Types of Bricks for conformity

There are different types of bricks available on the market used for various kinds of purposes. These bricks can be categorized under various headings and subheadings on different basis. The various classifications of types of bricks are briefly discussed below.

Classification based on method of manufacturing

Bricks can broadly be categorized into two types as follows on the basis of how its manufactured:

1. Un burnt or sun-dried bricks
2. Burnt bricks

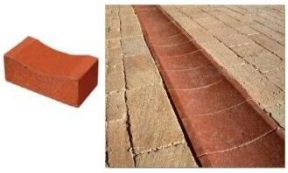
1. Un burnt bricks or sun-dried bricks are the types which are dried with the help of heat received from sun after the process of moulding. These bricks can only be used in the construction of temporary and cheap structures. Such bricks should not be used at places exposed to heavy rains.
2. Burnt bricks are prepared by burning the brick-mould in the kiln inside the factory. These are the most commonly used bricks for construction works.

Classification based on shape

The ordinary bricks are rectangular solids. But sometimes the bricks are given different shapes to make them suitable for particular type of construction. Here we have enlisted different types of bricks available with various shapes:

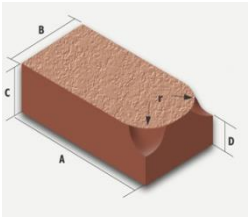
1. **Bullnose brick:** A brick moulded with a rounded angle is termed as a bull nose. This type of brick is used for a rounded quoin. A connection which is formed when a wall takes a turn is known as quoin. The centre of the curved position is situated on the long centre-line of brick.

2. **Channel bricks:** These types of bricks are moulded to the shape of a gutter or a channel and they are often glazed. These bricks are used to function as drains.

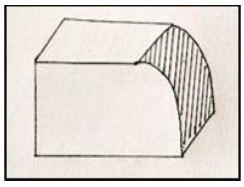


3. **Coping bricks:** These bricks are made to suit the thickness of walls on which coping is to be provided. Such bricks take various forms such as chamfered, Half round or saddle-back.

4. **Cow nose bricks:** A brick moulded with a double bullnose on end is known as a cownose.



5. **Curved sector bricks:** These bricks are in the form of curved sector and they are used in the construction of circular brick masonry pillar, brick chimneys, etc.



6. **Hollow bricks:** These are also known as the cellular or cavity bricks. Such bricks have wall thickness of about 20mm to 25mm. They

are prepared from special homogeneous clay. They are light in weigh

t about one-third the weight of the ordinary brick of the same size.

These types of bricks can be laid almost about four times as fast as the ordinary bricks and thus the use of such bricks leads to speedy

Construction. They also reduce the transmission of heat, sound and damp. They are used in the construction of partitioning.

- According to Ethiopian context using the following sizes

Standard size of brick is 25CM×12CM×6CM

- Then Length = 25cm,
- Height = 12cm &
- Base/Thickness = 6cm

- The strength of brick masonry chiefly depend on:
  - Quality of mortar
  - Quality of brick
  - Type of bonding
- Brick masonry/Brick work

- sometimes other type of masonry due to this reasons:
  - ✓ All the brick are of uniform size and shape.
  - ✓ The art of the brick lying can be easily.
  - ✓ Bricks are easily available at all site.
  - ✓ Ornamental work can be easily done with bricks
  - ✓ Brick units are light in weight and small in size

1.3 Types of Concrete Blocks for conformity

Depending upon the structure, shape, size and manufacturing processes concrete blocks are mainly classified into 2 types and they are

- Solid concrete blocks
- Hollow concrete Blocks

Solid Concrete Blocks

Solid concrete blocks are commonly used, which are heavy in weight and manufactured from dense aggregate. They are very strong and provides good stability to the structures. So for large work of masonry like for load bearing walls these solid blocks are preferable. They are available in large sizes compared to bricks. So, it takes less time to construct concrete masonry than brick masonry.

Hollow Concrete Blocks

Hollow concrete blocks contains void area greater than 25% of gross area. Solid area of hollow bricks should be more than 50%. The hollow part may be divided into several components based on our requirement. They are manufactured from lightweight aggregates. They are light weight blocks and easy to install.

Types of Hollow Concrete Blocks:

- Stretcher block
- Corner block
- Pillar block
- Jamb block
- Partition block
- Lintel block
- Frogged brick block
- Bull nose block

Concrete Stretcher Blocks

Concrete stretcher blocks are used to join the corner in the masonry. St blocks are widely used concrete hollow blocks in construction. They are with their length parallel to the face of the wall.

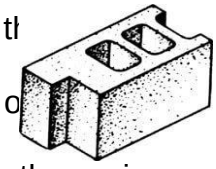
Concrete Corner Blocks

Corner blocks are used at the ends or corners of masonry. The ends may be window or door openings etc. they are arranged in a manner that their plane end visible to the outside and other end is locked with the stretcher block.

Concrete Pillar Blocks

Pillar block is also called as double corner block. Generally these are when two ends of the corner are visible. In case of piers or pillars the blocks are widely used.

Jamb Concrete Blocks



Jamb blocks are used when there is an elaborated window opening in th . They are connected to stretcher and corner blocks. For the provision o double hung windows, jamb blocks are very useful to provide space for the casing members of window.

Partition Concrete Block

Partition concrete blocks are generally used to build partition walls. Pa blocks have larger height than its breadth. Hollow part is divided into tv three components in case of partition blocks.

Lintel Blocks

Lintel block or beam block is used for the purpose of provision of bea or lintel beam. Lintel beam is generally provided on the top portion o doors and windows, which bears the load coming from top. Concrete

blocks have deep groove along the length of block as shown in
blocks, this groove is filled with concrete along with reinforceme

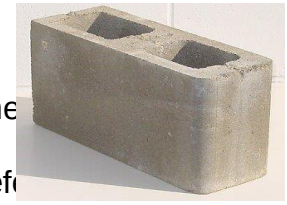
Frogged Brick Blocks

Frogged brick block contains a frog on its top along with heade

stretcher like frogged brick. This frog will helps the block to hol

mortar and to develop the strong bond with top laying block.

Bull nose Concrete Block



Bullnose blocks are similar to corner blocks. Their duties also same

but when we want rounded edges at corner bullnose bricks are pref

1.4 Checking bricks for conformity

Types of Tests On Bricks for Construction Purpose

Following checkings are conducted on bricks to determine its suitability for construction work.

1. Absorption test
2. Hardness test
3. Shape and size
4. Color test
5. Soundness test
6. Structure of brick
7. Presence of soluble salts (Efflorescence Test)

1. Absorption Test on Bricks Absorption test is conducted on brick to find out the amount of moisture content absorbed by brick under extreme conditions. In this test, sample dry bricks are taken and weighed. After weighing these bricks are placed in water with full immersing for a period of 24 hours. Then weigh the wet brick and note

down its value. The difference between dry and wet brick weights will give the amount of water absorption. For a good quality brick the amount of water absorption should not exceed 20% of weight of dry.

3. Hardness Test on Bricks

A good brick should resist scratches against sharp things.

So, for this test a sharp tool or finger nail is used to make

scratch on brick. If there is no scratch impression on

brick then it is said to be hard brick.

4. Shape and Size Test on Bricks

Shape and size of bricks are very important consideration. All bricks used for construction should be of same size. The shape of bricks should be purely rectangular with sharp edges. Standard brick size consists length x breadth x height as 25cm x 12cm x 6cm.

To perform this test, select 20 bricks randomly from brick group and stack them along its length , breadth and height and compare. So, if all bricks similar size then they

arequalified for construction work.

5. Color Test of Bricks

A good brick should possess bright and uniform color throughout its body.

<

6. Soundness Test of Bricks

Soundness test of bricks shows the nature of bricks against sudden impact. In this test, 2 bricks are chosen randomly and struck with one another. Then sound produced should be clear bell ringing sound and brick should not break. Then it is said to be good brick.

7. Structure of Bricks

To know the structure of brick, pick one brick randomly from the group and break it. Observe the inner portion of brick clearly. It should be free from lumps and homogeneous.

8. Efflorescence Test on Bricks

A good quality brick should not contain any soluble salts in it. If soluble salts are there, then it will cause efflorescence on brick surfaces.

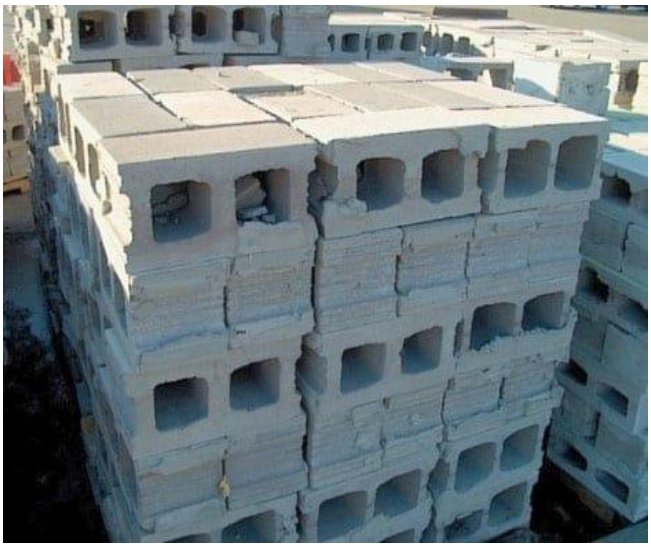
2.4 checking concrete masonry blocks for conformity

Checking concrete blocks for conformity Strength of concrete Blocks or concrete masonry units are required to know the suitability of these in construction works for various purposes.

Concrete masonry blocks are generally made of cement, aggregate and water. Which are usually rectangular and are used in construction of masonry structureThey are available in solid and hollow forms.

The nominal dimensions of concrete masonry block vary as follows:

- Length: 400 or 500 or 600mm
- Width: 200 or 100mm
- height: 50, 75, 100, 150, 200, 250 or 300mm.



Tests on Concrete Masonry Block Units

Different tests are conducted on concrete masonry unit to satisfy the all requirements. But now we are discussing about three tests conducted on concrete masonry block which are as follows.

Blocks of same mix shall be taken and divide them as follows to conduct the following check .

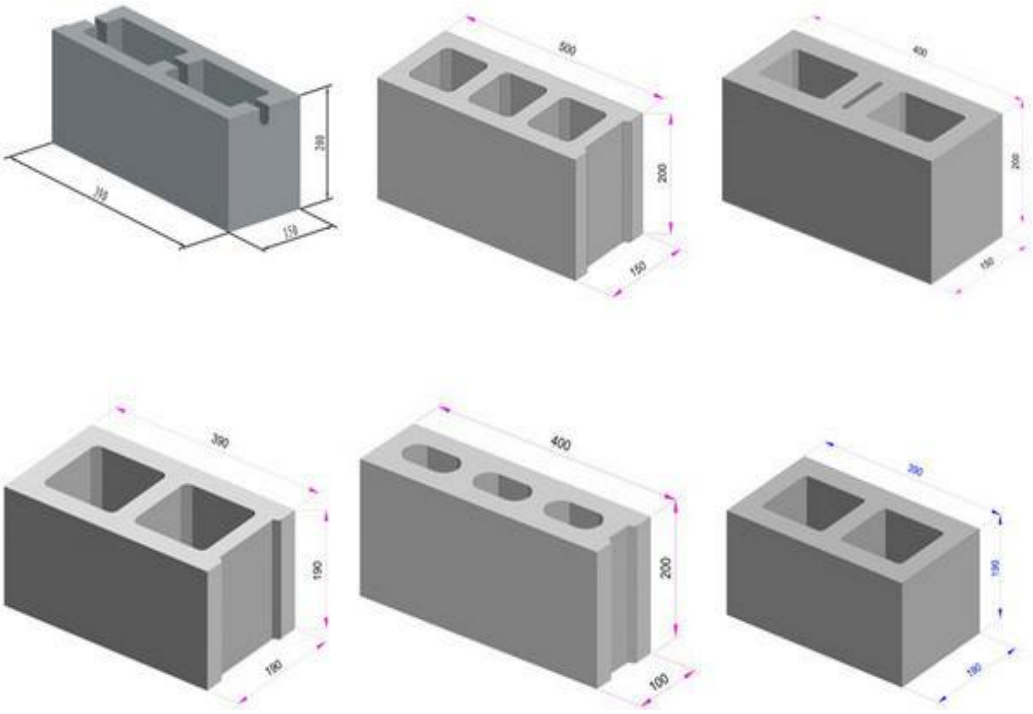
- Dimension measurement (All blocks)

Dimension Measurement

All blocks should be checked in this step. The length, width and height are measured with steel scale. If it is a hollow block, then the web thickness and face shell are measured with caliper ruler. And prepare a report of average length, width and height of block and average minimum face shell and minimum web thickness using recorded dimensions.

According to Ethiopian standard concrete block can be classified into three parts based on sizes

- 40cmx20cmx20cm/40cnx20cmx18cm
- 40cmx20cmx15cm



- 40cmx20cmx10cm

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

I) Choosethe best answer

1. Which one of the following is light weight concrete block?
   a/ solid concrete block b/ hollow concrete block c/ brick d/ none
2. Which one of the following is brick checkingtesting method?
   a/ absorption test b/ crushing strength test c/ hardness test d/ all
3. Agood quality brick the amount of water absorption should not exceed
   a/ 50% b/ 30% c/ 20% d/ 25%
4. Concrete masonry blocks are generally made from
   a/ Cement b/ aggregate c/ water d/ all

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Answer multiple choices

1. _____
2. _____
3. _____
4. _____

Information Sheet-2	Erect work platform

2.1 Erecting work platform

The work at height regulations define a workingplatform as any platform used as a place of work or as a means of access to or egress from a place of work, including any scaffold, suspended scaffold, cradle, mobile platform, trestle, gangway, gantry and stairway that is so used.

The work at height regulations define a working platform as any platform used as a place of work or as a means of access to or egress from a place of work, including any scaffold, suspended scaffold, cradle, mobile platform, trestle, gangway, gantry and stairway that is so used. As you can see the definition does include trestles and therefore this equipment is subject to requirements placed on working platforms by the new regulations.

2.2 What is 'work at height'?

Work at height is work in any place, including a place at, above or below ground level, where a person could be injured if they fell from that place. Access and egress to a place of work can also be work at height.

Examples of work activities that are classified as working at height:

- working on formwork within an excavation
- working on a flat roof
  - erecting falsework or formwork
  - working on a ladder
  - working at ground level adjacent to an excavation
  - working on trestles
  - working near or adjacent to fragile materials

2.3 As an employer, what do the Work at Height Regulations mean to me?

the work at height regulations requires employers to ensure that:

- all work at height is properly planned and organized
- a risk assessment is carried out for all work conducted at height
- appropriate work equipment is selected and used
- people working at a height are competent
- equipment used for work at height is properly inspected and maintained
- risks from fragile surfaces are properly controlled
- the risks associated with the equipment during erection, maintenance and dismantling of such equipment are taken into account

There are five steps to a risk assessment:

1. Look at the hazards.
2. Decide who might be harmed and how.
3. Evaluate the risks and decide whether the existing precautions are adequate or whether more should be done.
4. Record your findings.
5. Review your assessment**.**

2.4What are the requirements for using working platforms/trestles?

In considering whether a platform is suitable for work at height, employers need to ensure that it is:

- of sufficient dimensions to allow safe passage and safe use of equipment and materials;
- free from trip hazards or gaps through which persons or materials could fall;
- fitted with toeboards and handrails;
- kept clean and tidy, e.g. do not allow mortar and debris to build up on platforms;

- not loaded so as to give rise to a risk of collapse or to any deformation that could affect its safe use. This is particularly relevant in relation to blockwork loaded on trestles;
- erected on firm level ground to ensure equipment remains stable during use.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

1. define working platform. (4 point)
2. What are the requirements for using working platforms(4 pont)
3. Mention the five steps to a risk assessment.(2 point)

Note: **Satisfactory rating –5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Answer true/false

1. _____
2. _____
3. _____

Information Sheet-3	Identifying Location and structural details of brickwork/ block work

3.1 Identify Location and structural details of brickwork/ block work

Walls can be erect Internal or external

Erection of external precast walls

The erection of precast walls generally involves the following steps:

a) moving the precast wall panels from delivery truck or site storage yard to the designated locations for installation;

b) Raising the precast panels to the required elevation (and rotating to correct orientation if necessary);

c) Fixing the precast panels in position; and

d) casting the wet joints and/or grouting and applying sealant

Internal Walls.

Load bearing or Not?

Internal walls are usually defined as walls that divide rooms, as opposed to the insides of the external walls. They come in two distinct types:

- loadbearing
- non-loadbearin

You often can't tell the difference visually, but structurally they are very different.

A loadbearing wall acts as a support for a roof, a floor, a beam or another wall above it. It needs to be stronger than a non-loadbearing wall. Crucially, it also needs extra support under it, usually an additional foundation trench.

In a new build, the structural issues will be dealt with at the design stage and you shouldn't have to pay too much attention to whether a wall is loadbearing or not.

However, it can have a major effect on renovations, especially when you want to take down an existing wall. In these cases, it is vital to know whether or not the internal wall is loadbearing:

- If it is loadbearing,you will need to provide an alternative means of support. If you are in any doubt, get the building professionally surveyed so that you know what you are dealing with.
- Non-loadbearing walls act as little more than room dividers and can be easily altered or even removed.

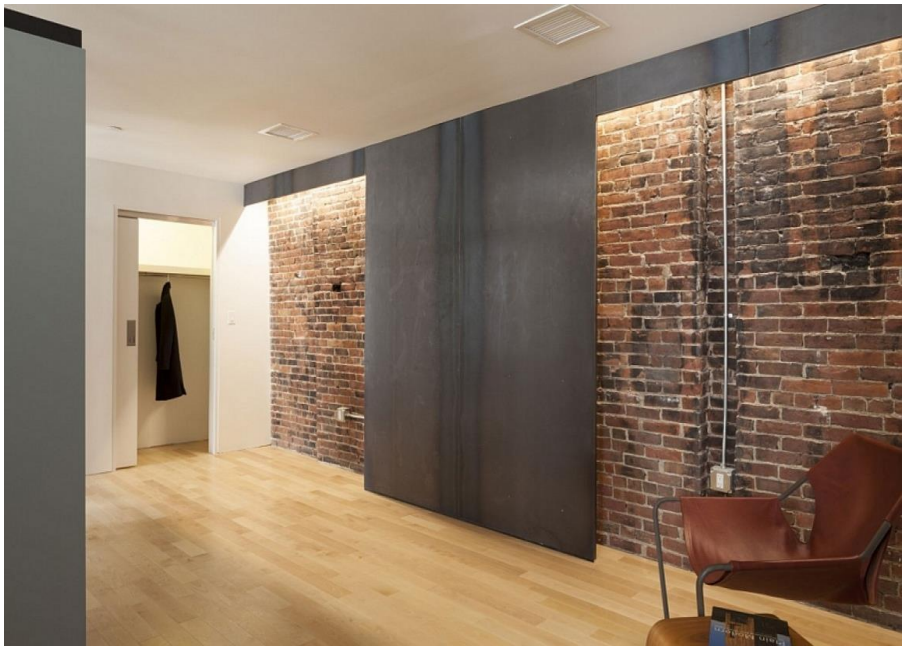


Fig 1

3.2 structural details of brickwork/ block work

Brickwork and blockwork

Bricks and blocks are components of durable masonry construction in which uniformly shaped individual units are laid in courses with mortar as the bed and binding material. They consist of high mass materials with good compressive strength formed into units that can be lifted and handled by a single worker. Materials used can include brick, stone (e.g. marble, granite, travertine, limestone), manufactured stone, concrete, glass, stucco and tile.

Brickwork is usually left exposed for its aesthetic qualities and block work is usually rendered, but most bricks and blocks can be used as facing materials or given a render coating.

Four kinds of wall

There are four main ways to use bricks and blocks to make walls. Each method has its environmental and economic merits and it is important to understand the reasons for choosing any given method in building your home. It is quite feasible to use each method in the same home but generally more economical, logistically sound and environmentally effective to use just one or two.

- **Brick veneer** — A commonly used approach in which bricks form the external skin of a timber framed home
- **Reverse brick veneer** — Bricks form the internal skin of an insulated, framed home
- **Double brick** — Consists of two leaves of brickwork with a cavity
- **Solid brick** — A high thermal mass construction mostly used for internal walls

Brick veneer

Conventional brick veneer construction places the high mass of brickwork on the outside of the building, where it contributes little to the thermal performance of the building but takes advantage of the capacity bricks possess for long life and low maintenance. The leaf of bricks is tied to the loadbearing lightweight frame.

Reverse brick veneer

Reverse brick veneer, in which the brickwork or blockwork is the inside skin tied to an otherwise conventional lightweight stud-framed construction, takes advantage of the material's thermal mass properties. It can produce high performing buildings with lower than average energy demands for both heating and cooling.

Technical Details for Blockwork

Concrete block work can generally be divided into two categories: dense aggregate, light aggregate.

Dense aggregate blocks consist of cement, sand and various aggregates, such as barite, magnetite, iron or lead pellets

Light aggregate blocks consist of cement, sand and lightweight natural aggregates such as volcanic pumice, slate, or shale, or industrial byproducts such as fly ash, slag, or FBA (fluorosilicate-based admixture),

How to Choose the Correct Block work

The main consideration to take into account when specifying concrete blocks is the structural loading that can be expected upon them.

In doing so, you should consult a structural engineer, particularly if the building is more than two stories. For buildings under two stories, any of the three main types of concrete block mentioned above will be suitable from a structural point of view.

The second issue to consider is the insulation value of the blocks you specify.

You should carefully consider the heating strategy of your building, and decide whether insulation or thermal mass is more important. While light aggregate or aerated concrete blocks will provide their own inbuilt insulation in the form of air trapped into the concrete (requiring less, or no cavity insulation, depending on regulatory reguirements), these lighter forms of blocks have the disadvantage of having less thermal mass than heavy aggregate blocks.

1. Classes of Hollow Concrete Blocks

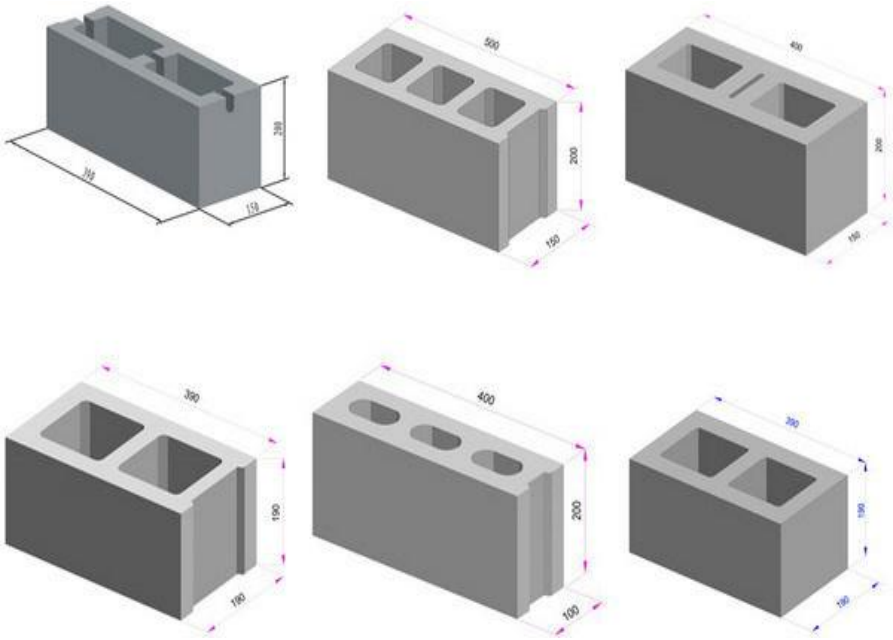
Load bearing HCB Class A and B

Non load bearing HCB Class C

a) Standard Dimensions to ESC.DC.301

10 cm x 20 cm x 40 cm

15 cm x 20 cm x 40 cm



20 cm x 20 cm x 40 cm

Lighter blocks are significantly easier to handle for builders, but may be difficult to plaster directly onto if they are not completely even.

Heavier blocks will be much more work to build with, but may be desirable for structural or thermal reasons.

It is also worth considering the sustainability of whatever concrete blocks you choose to specify.

Light aggregate blocks can also contain recycled contents as their aggregate, usually called secondary-aggregates because they are the secondary byproducts of various manufacturing processes.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

Write true if the statement is correct or false if the statement is wrong

1. Double brick Consists of two leaves of brickwork with a cavity
2. Brickwork is usually left exposed for its aesthetic qualities and block work is usually rendered
3. Lighter blocks are significantly easier to handle for builders
4. Light aggregate blocks can also contain recycled content
5. The main consideration to take into account when specifying concrete blocks is the structural loading that can be expected upon them.

Note: Satisfactory rating – 5 and above points Unsatisfactory - below 5 points

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Answer true/false

1. _____
2. _____
3. _____
4. _____
5. _____

Information Sheet-4	Setting out base brickwork below floor construction

4.1Bricklaying (how to set out and gauge you brick work)

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. For example, in the EBCS a brick is defined as a unit having dimensions less than 250x120x60mm and a block is defined as a unit having one or more dimensions greater than the largest possible brick.

Co-ordination dimensions of a brick in a wall

Working dimensions of a brick in a wall

Brick dimensions are expressed in construction or technical documents in two ways as coordinating dimensions and working dimensions.

- Coordination dimensions are the actual physical dimensions of the brick with the mortar required on one header face, one stretcher face and one bed.
- Working dimensions is the size of a manufactured brick. It is also called the nominal size of a brick..

- Bricks of dimensions 250 mm × 120 mm × 60 mm;
- Mortar beds and perpends of a uniform 10 mm.

In this case the co-ordinating metric works because the length of a single brick (250 mm) is equal to the total of the width of a brick (120 mm) plus a perpend (10 mm) plus the width of a second brick (120 mm).

4.2 steps of set out base brick work

Step 1

Start by setting a level on all 4 corners, the highest corner will be where you take your gauge from you can do this by using a dumpy level or laser level and putting a mark on your peg.

Step 2

Now you have an accurate level mark you can start to bond out the brickwork, you can do this by dividing the length of your house by 225mm to find out if it works full bond, the best way though is to run a dry course from your gauged corner to the next corner. Check as you go along that every 4 bricks are 900mm long, this will make sure your bonding is accurate whether the bricks that you use are too big or small, when you reach the next corner it should hopefully work brickwork (full bricks). If it doesn't there are 2 things you can do, if its slightly off then you can open or close the joints up slightly to accommodate the difference, if this still doesnt work then you will have to use a bat (¾ cut brick), the problem with this is it will show if travelling up the building, so a good bricklayer will hide this by moving it under a window or door opening to minimize the amount of cuts showing to the naked eye, this way no one will be able to tell the difference and it will blend in.

Step 3

Now your ready to start, the building is set out square and too the right length, the gauge marks or datums are in place, you can now start laying the first course by running a line in by starting at your highest point, if the other corner is too low you can lay a bigger bed at one end or turn a brick on edge, sometimes blocks are used for the first course at one end to match the difference in height run a course all the way around now you have a level floor to start laying on.

Step 4

Start building your 4 corners up minimum200mm height, then run them fitting air bricks as you go if needed.

Step 5

Now the outside skin is built set a mark on the inside to whatever your cavity size should be, usually its 300mm, you know the buildings square so this should be easy

Step 6

Now take the inside skin up to 60mm height copying the bond used on the outside, once this is done your ready to construct your floor, fit your damp proof membrane and pour your concrete, now your brickwork is ready to be taken up to roof height.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

II) Write true if the statement is correct or false if the statement is wrong

1. The Start setting out from the highest corner of the peg
2. Brick or block laying should start from the highest place
3. The tools which used to setting out for brick laying is only string.

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Answer true/false

1. _____
2. _____
3. _____

Information Sheet-5	Setting out Load bearing brickwork

5.1 Load bearing brickwork.

Brickwork load-bearing structures have been replaced more and more in this century by structures of reinforced concrete and structural steel. Why, then, should we concern ourselves with calculated load-bearing brickwork as a construction material of the present and future? There are a number of answers to this question?

The building of a brick structure, being labor-intensive, is also a low energy activity in terms of fossil fuel requirements. Finally, because of the good thermal insulating properties of brick.

To show how load-bearing brick construction has advanced in the United States of America the following example is of interest.

The possibilities included: a steel skeleton combined with various floor systems, a reinforced concrete skeleton with various forms of infilling and load bearing brick construction. All systems were highly competitive, but the load-bearing brick solution was chosen because of:

(a) built in fire resistance; (b) built in sound insulation; and (c) low maintenance.*

Exterior load-bearing walls are 300mm thick for the basement and first two floors after which they reduce to 200mm thick. Internal bearing walls are 200mm thick throughout.

These items may seem incongruous with the use structure, separation or enclosure, finish, fire resistance, sound resistance and flexibility in design dimensions and form. At the same time construction variations are easily accommodated by the mason."

So far, only a few buildings have been erected in South Africa using load-bearing brick construction. As far as can be ascertained, load-bearing brickwork was chosen in each case because it was believed to offer economic advantages over other forms of construction. In one example, an eight storey apartment building recently erected in Durban the use of load-bearing brick work was estimated to give a saving of 7 per cent over reinforced concrete framed construction.

To sum up the case for the use of load-bearing brickwork, this form of construction has been found in Europe and America to offer distinct advantages over other forms of construction for medium rise (up to 20 storey height) apartment type buildings. In the few cases where load-bearing brickwork has been used in South Africa it has been chosen because of the economies offered by the method.

General requirements of a load-bearing brick structure

(i) Material requirements

In a well-designed load-bearing structure, the brickwork should be stressed to its safe upper limit. It follows that the designer must be aware of the properties of the material he is designing in and also of the safe stresses to which he can work at the design stage. Also, during construction, continuous checks of the quality and strength of the brickwork must be made to ensure that design requirements are being met. The strength of brickwork depends on the strength of both bricks and mortar and permissible stresses are established by means of strength tests on prisms and cubes of brickwork made with the proposed materials and under conditions as close as possible to those expected on site. In addition, brickwork is subject to movement, both as a result of loading and resulting from environmental effects. The designer must know of the existence and probable magnitude of likely movements.

(ii) Structural requirements

Load-bearing brick structures are basically gravity stable. That is to say, they resist overturning forces by virtue of their self-weight. This is a consequence of the fact that

unreinforced brick work, like unreinforced concrete, is strong in compression, but relatively weak in tension. The following structural requirements must be met:

(a) Differential settlement must be avoided. When soil conditions are difficult, piled or raft foundations should be used to limit differential movement. Alternatively, or in addition, movement joints should be incorporated into the structure so that differential movement can be accommodated without causing structural damage. Moisture, thermal and creep movements of the brickwork must also be designed for and accommodated.

(b) To avoid eccentric loading, the plan formation should, ideally, repeat itself on each floor level. This does not preclude the use of reinforced concrete construction at ground or ground and first floor levels to provide spacious column free foyers, assembly areas, etc.

(c) The walls and wall intersections should be arranged to provide shear resistance to horizontal loading due to wind, etc. This can be done either by means of cellular construction or cross-wall construction.

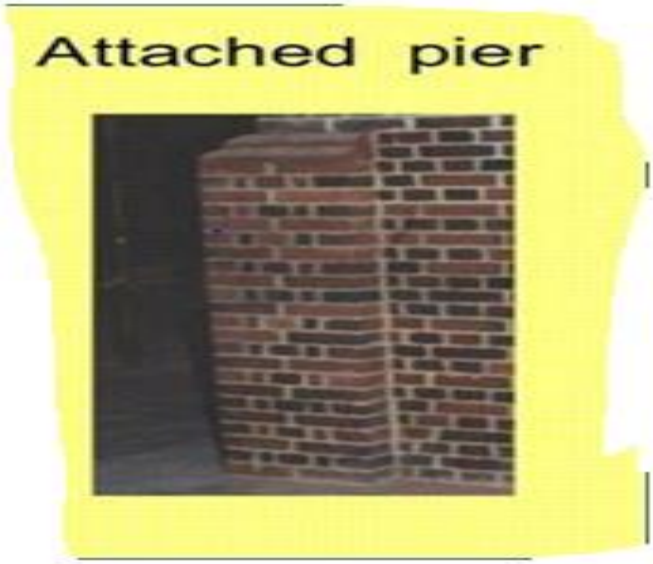
(d) The arrangement of windows is important and "hole in wall" fenestration gives greater rigidity to the building than "strips" of windows separated by vertical brick panels.

(e) Ducts for services should be designed and built in. Haphazard chasing of walls to install plumbing, electrical conduits, etc. cannot be allowed to weaken the structure.

(f) Appropriate measures must be taken to prevent rain penetration through exterior walls. Materials and structural requirements will now be considered in greater detail.

Engaged piers

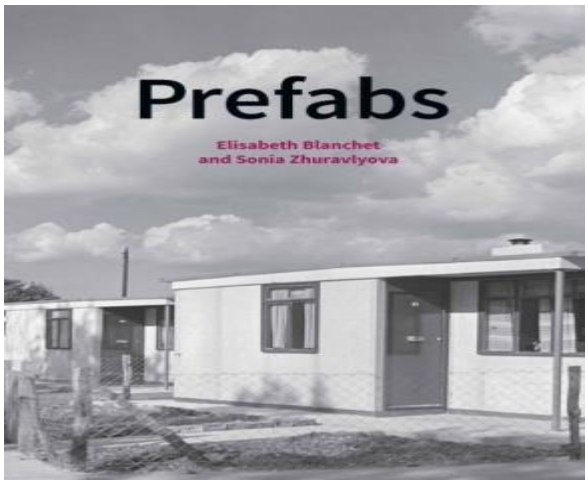
Piers are vertical structures made from brick, concrete, block, stone, timber or steel which support floor structures. An engaged pier is a pier that is bonded to or partially built into a wall. An isolated pier is separate from a wall.



Engaged piers or

Adwarf wall is a low wall that is often used as a gardenwall, or as the base for the perimeter of a conservatory or porchstructure. It can be applied to any wall that is less than one-storey in height, but typically dwarf walls are less than 1 metre tall.

In conservatories andporches, dwarf walls usually have glazing above. This is beneficial in terms of reducing the amount ofglass required, not only in terms of cost but also in terms of cleaning and maintenance. They also assist in managing internal thermal comfort, as spaces with full-height glass can become hot in sunny weather and cold at night and in the winter. The wall construction also protects the glazing from damage at low level.



Stretcher Bond for free standing Brick Piers

A free standing brick pier (or isolated pier as it is sometimes called) is a pillar of brickwork not connected to a wall. It can be used to carry the ends of beams to form a pergola, the base of a sundial or bird bath, or for hanging garden gates.

Piers vary in size (both in width and

height) and types of bond used.

On this page we show a couple of simple

stretcher bond piers, Both designs only

use full bricks so there is no need for the

brick layer to cut any bricks.

The bricks will leave a hollow centre which

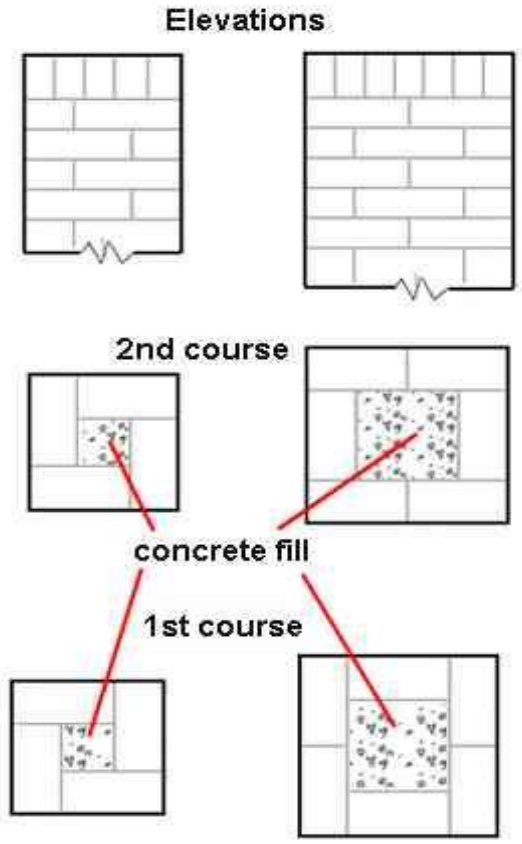
should be filled with concrete once the

mortar has been allowed to harden

wet concrete will exert an internal pressure

(which could cause the brick mortar to fail

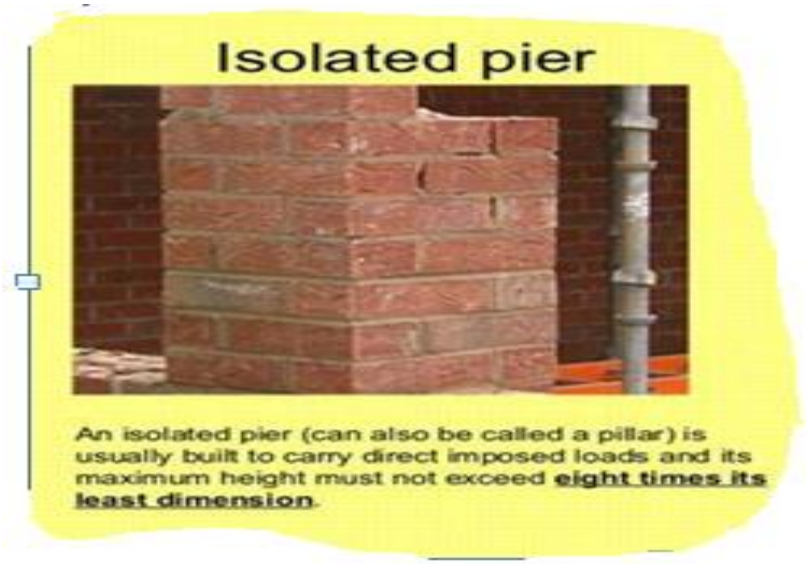
if the concrete



Isolate pier

Isolated masonry piers shall be constructed in accordance with the general masonry construction requirements. Hollow masonry piers shall have a minimum nominal thickness of 8 inches (203 mm), with a nominal height not exceeding four times the

nominal thickness and a nominal length not exceeding three times the nominal thickness. Where hollow masonry are solidly filled with concrete or grout, piers shall be



permitted to have a nominal height not exceeding ten times the nominal thickness.

Pier Cap

Hollow masonry piers shall be capped with 4 inches (102 mm) of solid masonry or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout.

Detailing brick corbeling

The total horizontal projection shouldn't exceed one-half the thickness of brick veneer or one-half the thickness of a solid masonry wall

Total allowable corbel = 1⁄2 (Wythe thickness) = 1⁄2 (35⁄8 inches) = 113⁄16 inches half the actual wall thickness. Each course of brick also can be corbeled only so much. A single brick course projection should not exceed one-half of the sum of the unit height and mortar joint thickness. In veneer walls, a single brick course projection also

shouldn’t exceed one-third the nominal unit bed depth. In a solid masonry wall, it also shouldn’t exceed one-third of the sum of the unit bed depth and collar joint thickness.

Corbelling brick veneer based on the rules given above, for a corbel in a nominal 4-inch brick veneer wall, the total horizontal projection should not be more than 113⁄16 inches. A single course of utility or standard brick shouldn’t be projected more than 13⁄16 inches. Architects also should know the approximate size and location of the brick cores. Unless otherwise specified, the standard specification for facing brick, allows cores to be 3⁄4 inch from any edge of the brick.

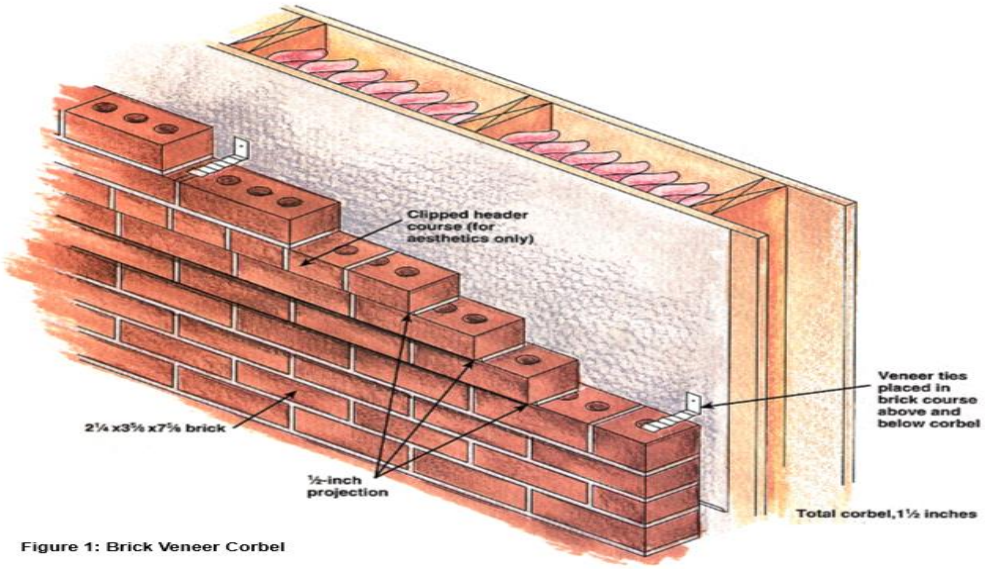


Figure 1: Brick Veneer Corbel

Corbeling cavity and solid walls Using a cavity or solid masonry wall, the architect can create a corbel with an overall projection one-half the wall thickness. This allows for more individual projections, each of which might be greater than what is possible in a brick veneer wall—as long as none exceeds the limits mentioned previously (one-half the nominal unit height or onethird the nominal unit bed depth). A few additional requirements do exist. The corbeled wall section must be completely solid. In cavity walls, the corbeled section

Total allowable corbel = 1⁄2 (wall thickness) = 1⁄2 (35⁄8" + 2" + 55⁄8") = 55⁄8 inches Should be grouted. Also, the slope of corbeling, measured from the horizontal to the

face of the corbeled surface, should be at least 60°. If the corbel slope is less than this, the increased eccentricity will introduce additional stresses into the wall. If that occurs, these stresses should be resisted by reinforcing the wall or taking other precautions

Figure 2

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

Write true if the statement is correct or false if the statement is wrong

1. Brick work load-bearing structures have been replaced more and more in this century by structures of reinforced concrete and structural steel.
2. A free standing brick pier is a pillar of brickwork not connected to a wall.
3. Adwarf wall is a low wall that is often used as a gardenwall
4. Internal load-bearing walls are 300mm thick for the basement
5. Exterior load bearing walls are 200mm thick throughout.
6. The strength of brickwork depends on the strength of bricks only.

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Answer true/false

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Information Sheet-6	Setting out *Cavity brick wall*

6.1 Set out *Cavity brick wall*

A cavity wall is a type of wall that has a hollow center. They can be described as consisting of two "skins" separated by a hollow space (cavity). The skins typically are masonry, such as brick or cinder block. Masonry is an absorbent material and therefore slowly draw rainwater or even humidity into the wall. One function of the cavity is to drain water through weep holes at the base of the wall system or above windows. The weep holes allow wind to create an air stream through the cavity that exports evaporated water from the cavity to the outside. Usually, weep holes are created by separating several vertical joints approximately two meters apart at the base of each story. Weep holes are also placed above windows to prevent dry rot of wooden window frames. A cavity wall with masonry as both inner and outer skins is more commonly referred to as a double waythe masonry wall.l

Cavity walls and ties

The advent during the mid twentieth century of the cavity wall saw the popularisation and development of another method of strengthening brickwork—the wall tie. A cavity wall comprises two totally discrete walls, separated by an air gap, which serves both as barrier to moisture and heat. Typically the main loads taken by the foundations are carried there by the inner leaf, and the major functions of the external leaf are to protect the whole from weather, and to provide a fitting aesthetic finish.

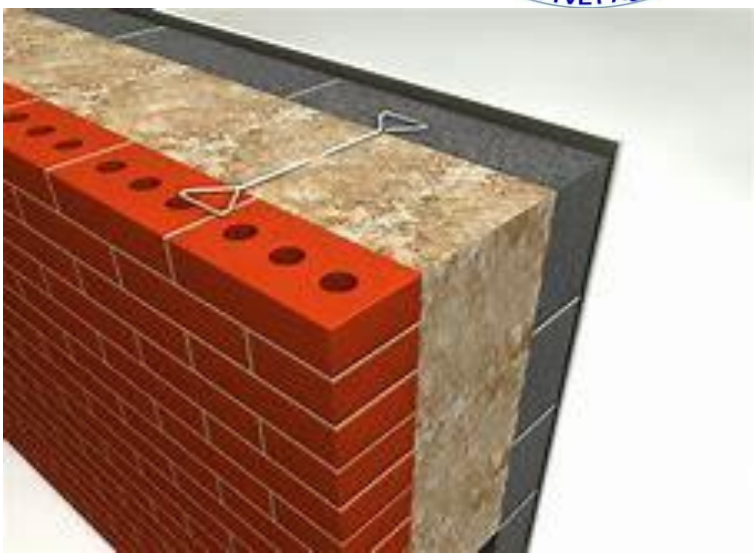


fig 1

Designing and setting out brickwork correctly creates a matching and balanced appearance, particularly at reveals on either side of door and window openings and at the end of walls.

Setting out starts at the design stage where the design of a building, including openings, should ideally be set out to brick co-ordinating dimensions, eliminating the requirement to cut bricks on site. In this document only stretcher bond, also known as half-bond, is considered, although the basic principles will apply whatever bond is used.

Design co-coordinating Size. Brickwork should be set-out using as a 'unit' dimension the coordinating size of the brick, i.e. one brick length plus one nominal 10mm mortar joint – usually 225mm for standard metric bricks. The mortar joint acts as the 'buffer zone' and will be adjusted to suit the actual brick size during construction.

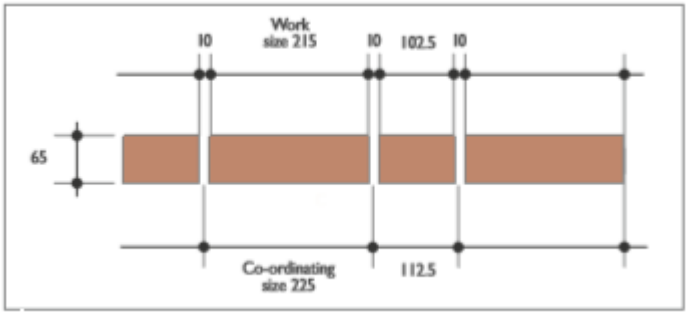


Fig 2

All brickwork dimensions are determined by one of three conditions. Brick plus two joints brickwork above or below door and window openings. Brick plus one joint brick panel with opposite return ends. Brick only brick piers or panels between openings.

For example, if a span of brickwork is required to encompass 4 whole bricks over an opening, a mortar joint will be needed at either end; therefore the co-ordinating size measurement condition) is 1040mm (4 brick lengths plus 4 x10mm mortar joints).

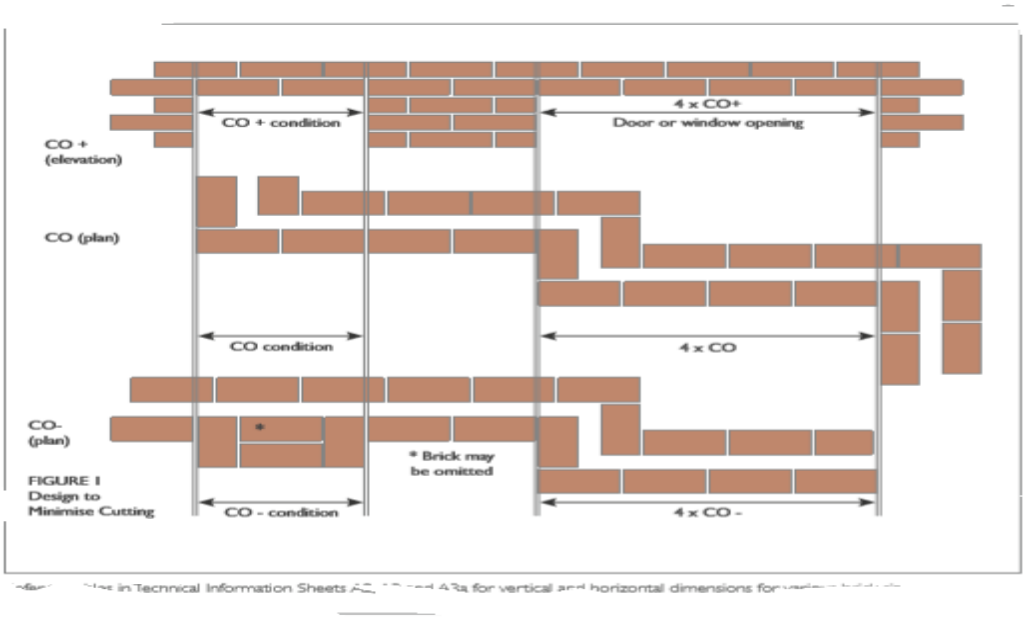


fig 3

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

Write true if the statement is correct or false if the statement is wrong

1. A cavity wall is a type of wall that has a hollow center
2. A cavity wall can be described as consisting of two "skins" separated by a hollow space (cavity)

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 2 points**

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Answer true/false

1. _____
2. _____

Operation Sheet 1	techniques of Identifying, selecting and checking bricks and/or blocks for conformity

Follow techniques of identifying/ making bricks and/or blocks

Procedures:

Step 1- wear personal protective clothes

Step 2- choose the place selected Bricks and/or blocks are storing

Step 3- check the equipment weather it is functional or not

Step 4-select the materials which are conformity

Step 5 based on these Procedures do the following lap test

Operation Sheet 2	techniques of Erecting work platform

Follow techniques of Erecting work platform

Step 1- wear personal protective clothes

Step 2- choose the place Bricks and/or blocks are storing

Step 3- check the tools and the equipment weather it is functional or not

Step 4-select the materials which are necessary

Step 5 based on these Procedures do the following lap test

Operation Sheet 3	techniques of Identifying Location and structural details of brickwork/ block work

Follow techniques of Identifying Location and structural details of brickwork/ block work

Procedures:

Step 1- wear personal protective clothes

Step 2- choose the place Bricks and/or blocks are storing

Step 3- check the tools and the equipment weather it is functional or not

Step 4-select the materials which are nessacerly

Step 5 based on these Procedures do the following lap test

Operation Sheet 4	**techniques of Setting out base brickwork below floor construction**

Follow techniques of Setting out base brickwork below floor construction

Procedures:

Step 1- wear personal protective clothes

Step 2- choose the place Bricks and/or blocks are storing

Step 3- check the tools and the equipment weather it is functional or not

Step 4-select the materials which are nessacerly

Step 5 based on these Procedures do the following lap test

Operation Sheet 5	techniques of Setting out Load bearing brickwork

Follow techniques of setting out load bearing brickwork and *Cavity brick wall*

Procedures:

Step 1- wear personal protective clothes

Step 2- choose the place Bricks and/or blocks are storing

Step 3- check the tools and the equipment weather it is functional or not

Step 4-select the materials which are nessacerly

Step 5 based on these Procedures do the following lap test

Operation Sheet 6	techniques of Setting out *Cavity brick wall*

Follow techniques of setting out load bearing brickwork and *Cavity brick wall*

Procedures:

Step 1- wear personal protective clothes

Step 2- choose the place Bricks and/or blocks are storing

Step 3- check the tools and the equipment weather it is functional or not

Step 4-select the materials which are nessacerly

Step 5 based on these Procedures do the following lap test

LAP Test 2	Practical Demonstration

LAP Test -2

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates /guide , workshop, tools and materials you are required to perform the following tasks within 4:00 hours

Task 1. Identify, select and check Bricks and/or blocks for conformity

Task 2 Erect work platform

Task 3. . Identify Location and structural details of brickwork/ block work

Task 4 Set out base brickwork below floor construction

Taske 5. Set out Load bearing brickwork

Taske 6. Set out *Cavity brick wall*

Taske 7 Clean worked area

Reference

1. “Brick Masonry Details: Caps and Copings, Corbels and Racking,” Technical Notes on Brick Construction, 36A Revised, Brick Institute of America, 11490 Commerce Park Dr., Reston, VA 22091.

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https://**www.youtube.com**/watch?v=9ZNCBMYKGjA

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