BUILDING CONTRACTORS POCKET HANDBOOK

CLAY BRICK for good

Environmentally Friendly

Environmentally Friendly

INTRODUCTION

ClayBrick.org is pleased to provide this builders pocket manual which has been designed as a quick handy reference guide to most of the basic principles required for planning, setting out, and constructing new buildings.

This information covers the basic requirements for constructing a well designed and durable structure. Reference has been made to the SABS Standards and Codes of Practice as well as the National Home Builders Registration Council's Standards and Guidelines.

It remains the responsibility of the designer and contractor to ensure that the building conforms to the architectural plans, appropriate building standards and site conditions of the project.

Note: The NHBRC's Standards and Guidelines are not intended to replace or overrule any existing National Building Regulations and/or SABS Codes of Practice. They are rather directed at providing a simple reference to ensure that builders adhere to acceptable building practice.

Environmentally Friendly

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Environmentally Friendly

SECTION A

SITE MANAGEMENT, KEY TO MORE PROFIT

Control of wastage and breakage is the key to more profit from building and construction. Here are a few simple ways to cut wastage and increase productivity on site.

1. Store sands for concrete, mortar and plaster separately or as near to the structure and mixing area as possible. These should be placed on well compacted clean ground or a platform constructed of broken bricks and aggregate or even a weak concrete mixture for larger projects to prevent contamination.

2. Preferably store bagged cement in a lockable area on a raised floor to protect from rain and rising damp. If outdoors, store on elevated wooden pallets, well covered with plastic sheeting or a tarpaulin, suitably weighed down to shield from wind and other external conditions.

3. Stack bricks on firm hard ground as close to the structure as possible. Make sure they are protected from storm water and splashing mud. Contamination of building materials results in an inferior end product. Pre-planning the layout of material storage areas will result in lower costs.

4. Hand-mixing of concrete and mortar should only be done on small projects or for small quantities of material. Hiring a concrete mixer at the foundation and floor slab stage could save money.

5. Draw up a simple bar chart showing the construction stages of each component of the house and plan your delivery schedule with your suppliers in advance with high value items, like window and door frames, etc arriving on the day of installation to reduce the chances of theft and additional storage. Use this planning principle for all materials and trades.

SECTION A - cont'd

SITE MANAGEMENT, KEY TO MORE PROFIT

6. Mark out an area for all rubbish and waste. A tidy building site means a more profitable contract. At the end of each day ensure that all building rubble and unused dagha is moved to the rubbish heap before it sets. The smaller the site the more important rubble control and removal becomes.

7. Protect wooden or aluminium door and window frames from damage by wheelbarrows, scaffolding, etc.

8. Place a small stack of half bricks next to planned door frames and windows, where these sizes are regularly used. Encourage brick masons to use these half bricks rather than breaking whole bricks, thus reducing unnecessary wastage.

SECTION B

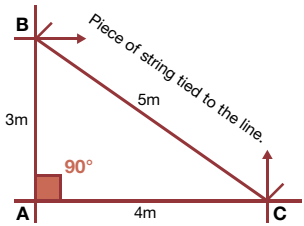
BUILDING LINES, SURVEY PEGS, SETTING OUT

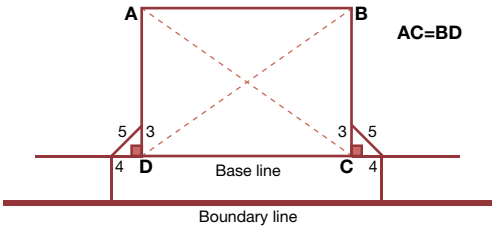
1. **Property and Boundary Pegs** - The onus of locating and marking the correct boundaries of the site or stand is that of the seller of the property. The buyer or a representative must then ensure that these pegs correctly mark the stand as purchased. The builder likewise should check these boundary pegs and be certain that they represent the stand as marked on the construction drawing. The boundary pegs should be well protected for future use or any further setting out. If these pegs are lost with the building, boundary walls or fences, offset pegs should be provided. Protection can be provided by three posts planted around the peg with brightly painted horizontal planks nailed to the posts.

2. The setting out of the building to the drawing should always be checked by a second person to ensure it is correctly positioned in terms of the building plan and regulations. The drawings should be studied, the boundary pegs identified and the building corner pegs set out on the site.

3. Having set out the corner pegs of the building they should be checked for squareness using the diagonal method shown below viz. with the 3-4-5 string length method.

The 3-4-5 method provides a 90° angle.





SECTION B - cont'd

BUILDING LINES, SURVEY PEGS, SETTING OUT

4. Building profiles should be kept at least one metre away from the temporary line located outside the corner pegs. This will allow enough room for workers and wheelbarrows to pass between the edges of the trenches.

   The profile should remain in position until after the foundation walls have been constructed.

SECTION C

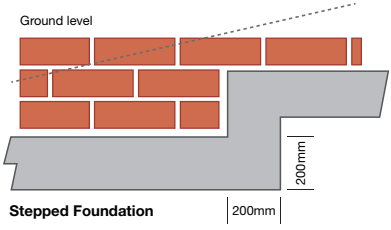
FOUNDATIONS, FOOTINGS AND SURFACE BEDS

1. The purpose of foundations is to support the walls by spreading their load uniformly over soft and hard soil, and to provide a level base for the laying of bricks. Various types used are predominantly strip footings stepped out on sloping sites, as well as padded, rafted, slabbed and piled foundations. Unconventionally loaded foundations are to be avoided unless designed by a competent person.

2. Trenches must be dug out so that the foundation rests on hard ground, with the trench width and depth conforming to the drawings and dimensions of the local authority or the National Home Builders Registration Council.

3. The trench sides must be straight and plumb with the bottom of the trench level, except for unusual circumstances.

4. To ensure that the foundation is level and of uniform thickness, level pegs are to be placed in the trenches to indicate the concrete thickness. These levels are very important as they represent the start of the brickwork. When the ground slopes, the trench bottoms must be stepped so that the foundation itself does not slope. The step should be equal to one or more courses of brickwork i.e. thickness of brick plus one mortar joint.



Stepped Foundation

5. **Surface Beds:** Should be a minimum of 150mm thick 15mPa concrete cast on a layer of compacted fill or hard core. In wet climates or low lying situations surface beds should be cast on a polyethylene sheet at least 0.25mm thick.

   The top level should be at least 150 or 2 brick courses above external ground level.

SECTION C - cont'd

FOUNDATIONS, FOOTINGS AND SURFACE BEDS

Concrete Mixes

Basic Recommendations of the Cement and Concrete Institute

Low-strength concrete

Suitable for house foundations

CEMENT	CONCRETE SAND	STONE
		
1 Bag	2 Wheelbarrows	2 Wheelbarrows

To make 1m³ (cubic metre) of concrete you will need:
5½ bags cement + 0.75m³ sand + 0.75m³ stone.

Medium-strength concrete

Suitable for house floors, footpaths and driveways

CEMENT	CONCRETE SAND	STONE
		
1 Bag	1½ Wheelbarrows	1½ Wheelbarrows

To make 1m³ (cubic metre) of concrete you will need:
7 bags cement + 0.7m³ sand + 0.7m³ stone.

Note

a) Sufficient water should be added to the mix to make it workable and plastic.

b) Use cement that compiles with SABS ENV 197-1; strength class CEM1 32.5 or higher.

c) Stone for concrete should be 19mm to 26mm maximum in size.

d) A builder's wheelbarrow with a capacity of 65 litres is recommended for measuring.

SECTION D

WATER PROOFING AND DAMP-PROOF COURSES

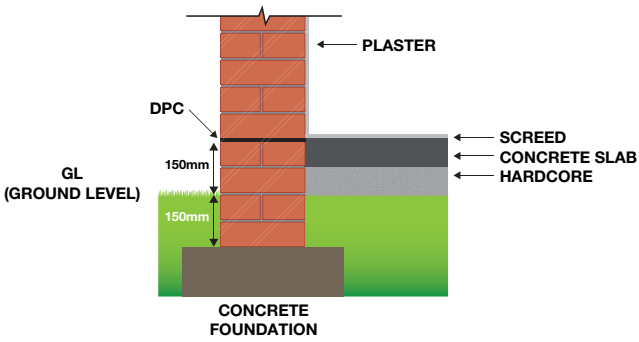
Dampness in buildings is a health hazard and can cause damage to timber, plaster, paintwork and possible structural failure.

National Building Regulations require the penetration of moisture through external walls to be prevented, by means of a damp-proof course (DPC) being provided:

- in all external walls at the same level as the top of a concrete floor slab and 150mm above ground level,
- below any ground floor slab as appropriate to local conditions,
- below any ground floor timber beam or joist.

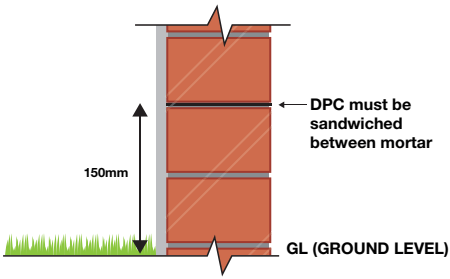
The DPC must not be placed in a free standing wall.

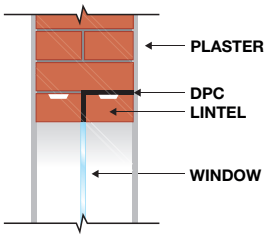
- A horizontal DPC must be laid with mortar above and below the membrane, which extends over the full width of the wall including plaster thickness.
- The DPC should overlap at junctions, corners, etc and must be 150mm or greater.
- Any wall of a room below ground level must be protected by a sealed vertical DPC.

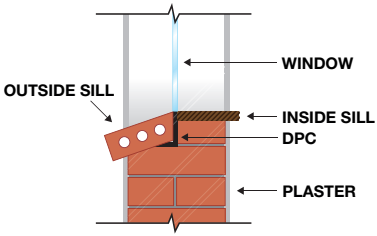


SECTION D - cont'd

WATER PROOFING AND DAMP-PROOF COURSES







SECTION D - cont'd

WATER PROOFING AND DAMP-PROOF COURSES

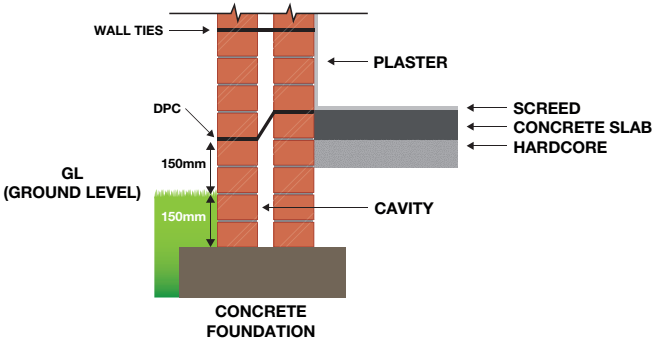
Cavity Wall Construction

The most reliable method to prevent moisture penetration through walls is to construct the outer shell with cavity walling.

Cavity walls consist of two brick leaves (or skins) with a 50mm-110mm cavity.

The two brick leaves must be tied together with wire wall ties, Butterfly and modified PWD. There must be at least 2.5 ties per m^2 set level or with a slight slope to the outside leaf

In certain areas of South Africa, the cavity has been effectively replaced by a bitumen layer painted on the outside face of the inner leaf. In coastal areas the wall ties should be galvanised.

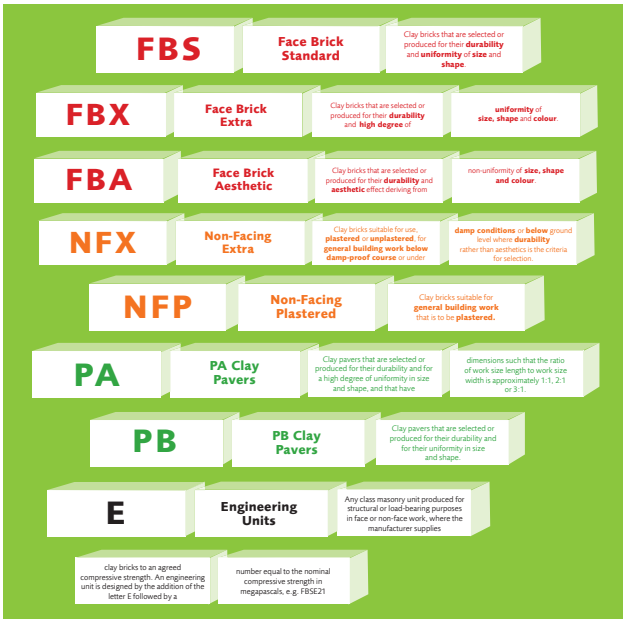


SECTION E

BRICK TYPES AND PROPERTIES

Clay bricks are defined as "burnt clay masonry units" in SABS 227, and are classified as follows:

THE LANGUAGE OF BRICKS



When ordering or specifying clay bricks, ensure the following points are discussed and made known to the supplier:

- Degree of exposure to weather conditions, closeness to the sea, etc.
- Performance record of the specified brick in the area where you are building.
- An undertaking or warranty from the supplier that the bricks delivered are fit for purpose.
- Colour expectations, particularly in the case of face bricks.
- Acceptable levels of breakage during delivery to site.

Note: To avoid colour banding it is highly recommended that face bricks are taken from different packs and carefully blended during the construction process.

SECTION E - cont'd

BRICK TYPES AND PROPERTIES

1. Brick Sizes

The most common brick size is the 'Imperial Brick', which measures 222mm long x 106mm wide x 73mm high with a mass of between 3.0kg and 3.5kg.

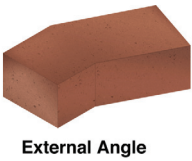
Two important criteria determine this size. First, it is the ideal width for the human hand to lift and place in position with minimum strain and secondly, it satisfies the need for bricks to be modular in terms of BOND patterns. Thus there is an approximate arithmetic relationship of length to width of 2:1 and in length to height of 3:1, which allows for bonding in any direction.

Other sizes of bricks available include:

LENGTH (mm)	222	222	222	222	222	190	190	290	290	390
WIDTH (mm)	90	40	90	140	110	90	106	90	150	190
HEIGHT (mm)	73	73	114	114	73	90	90	90	190	90

2. Special Shapes

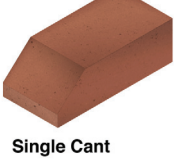
A range of special shapes are available to enhance the aesthetic detailing of buildings and landscaped areas. The most common specials available are the cants and the bullnose bricks although special shapes can also be manufactured to specification. It is advisable to discuss your requirements with your supplier.



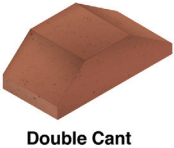
External Angle

Solid Bullnose

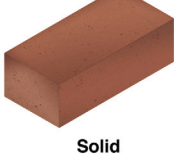
Double Bullnose



Single Cant



Double Cant



Solid

SECTION E - cont'd

BRICK TYPES AND PROPERTIES

3. Clay brick properties to consider in larger more complex structures:

- Compressive stress (varies form 7MPa to 50 MPa)
- Water absorption (face brick up to 10% - NFP up to 16%)
- Modulus of rupture - strength in bending.
- Moisture expansion - important when detailing larger structures.

Irreversible Moisture Expansion takes place with all clay bricks and pavers particularly during the first 24 months after manufacture. This expansion is dependent on the clay minerals present in the product and the firing temperature used in the process. This movement takes place in both vertical and horizontal directions.

Note: Expansion or control joint centres should not exceed the following:

	WALLS (m)	PARAPETS (m)
CATEGORY I	16.0	11.0
CATEGORY II	10.0	8.0
CATEGORY III (Requires careful detailing)	6.0	4.0

The **initial rate of absorption** affects the development of bond between the mortar and the brick. Bricks with high rates of absorption may require pre-wetting well before laying to prevent absorbing excessive water from the mortar mix. Trial and error experiments when bricks arrive on site will determine the need to pre-wet bricks.

The individual leaves of cavity walls may be constructed of dissimilar (i.e. clay and concrete bricks) materials, provided that the interconnecting wall ties are flexible and reveals that the wall ends are not in direct contact with each other.

Note: It is not recommended that dissimilar materials be used in the same leaf. Particular attention must be paid to load bearing walls of cavity construction with dissimilar materials. Failures have occurred where cavity walls with a clay outer skin and concrete inner skin support concrete floors. In time, the clay leaf may expand whilst the concrete leaf may shrink leading to a situation where the entire load might be carried by the clay leaf. This may lead to structural failure.

SECTION E - cont'd

BRICK TYPES AND PROPERTIES

4. Control joints in concrete and calcium silicate materials are placed to allow for shrinkage not expansion. Recommended spacing of 10mm joints are:

	WALLS (m)	PARAPETS (m)
CONCRETE	6.0	5.0
CALCIUM SILICATE	8.0	6.0

SECTION F

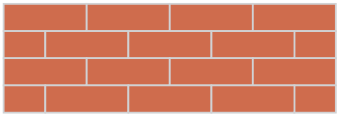
BONDS, JOINTING AND MORTAR MIXES

Bonding is required to strengthen and stabilise a brick wall and enable it to carry vertical and horizontal loads.

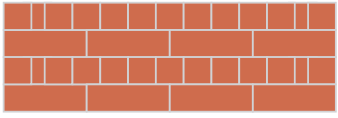
Three main **bond patterns** are used in modern building and construction, namely:

- Stretcher bond
- English bond (alternative layers stretcher and header courses)
- Flemish bond (alternative stretchers and headers in the same course).

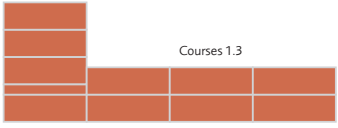
Strecher Bond
(½ Overlap)



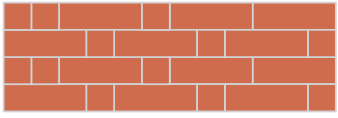
English Bond
Elevation



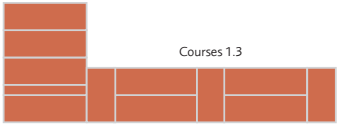
Plan View



Flemish Bond
Elevation



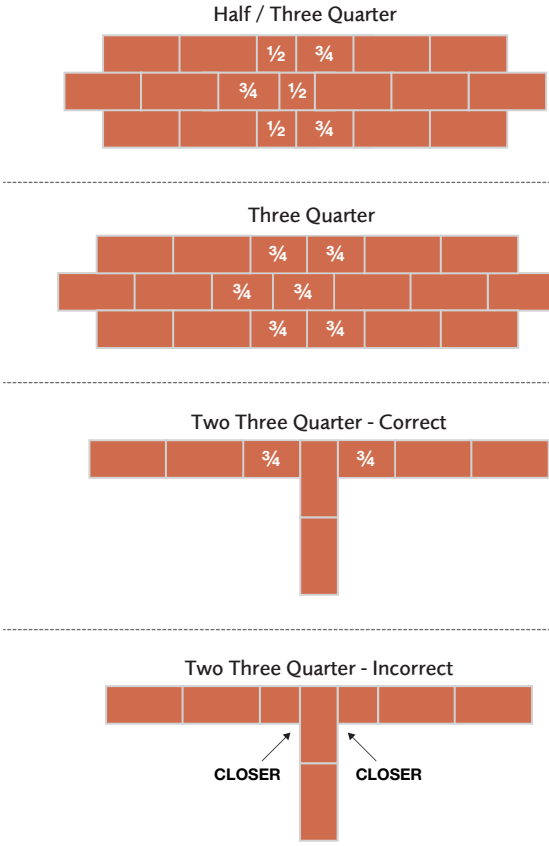
Plan View



SECTION F - cont'd

BONDS, JOINTING AND MORTAR MIXES

Broken Bonding

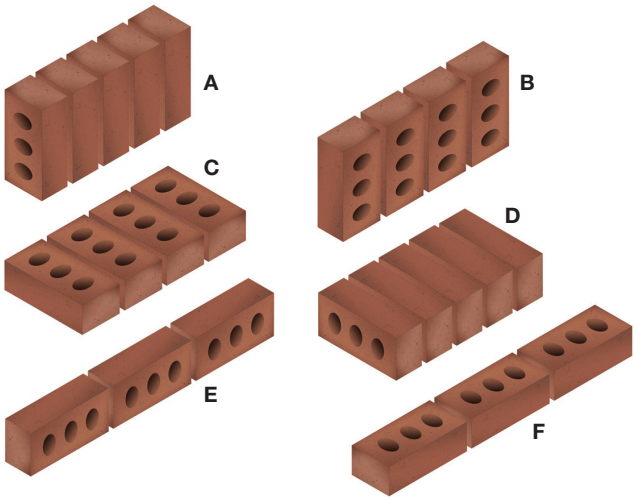


Broken Bonding occurs where the length of a brick wall is not equal to standard brick format sizes requiring for bricks to be cut to size and inserted. The cut bricks should not be less than a half brick.

SECTION F - cont'd

BONDS, JOINTING AND MORTAR MIXES

There are at least six **different ways to lay a course of bricks.** Various bond patterns are used to create different aesthetic effects.



A. Soldier course
B. Sailor course
C. Header course
D. Brick-on-edge header course
E. Brick-on-edge stretcher course
F. Stretcher course

SECTION F - cont'd

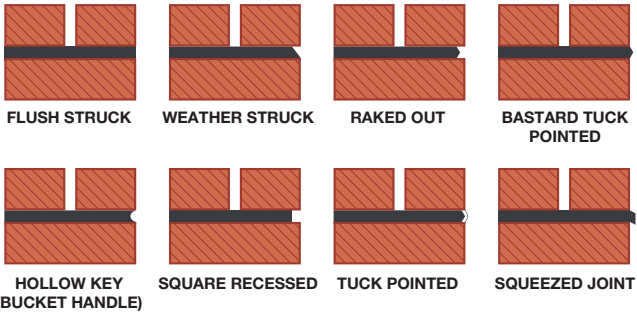
BONDS, JOINTING AND MORTAR MIXES

Joint Profiles

The main purpose of jointing brickwork is to bond the unit together, enhance the appearance of the brickwork and to consolidate the joint surface to prevent water penetration.

Jointing is the process of finishing the joints by compressing the mortar during the laying of masonry units.

The joints can be raked out for square recesses and then finished properly using the correct long and short jointers.



Note: Square recessed jointing is prone to water penetration and is not recommended in high rain fall or high wind areas unless a full cavity wall has been detailed.

Pointing is the process of raking out the joints as the work proceeds and, at a later stage, filling and finishing them with specially prepared mortar.

SECTION F - cont'd

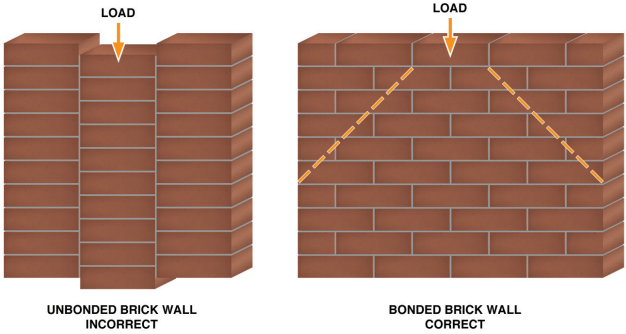
BONDS, JOINTING AND MORTAR MIXES

Setting out of jointing

(a) Horizontal positioning

To set out the bonding and avoid thick, unsightly perpendicular joints, the bricklayer should set out dry bricks for the first course in short panes.

For longer panels, the brickwork must be started from the two outside corners maintaining a 10mm-12mm mortar joint. The broken bond can then be worked out in the middle of the wall. Broken bonds can also be positioned below windows.



(a) Vertical Coursing - Preparing a Gauge Rod

- Take a random sample of 6 bricks from different areas of the brick stacks.
- Place the bricks close together on the edge of a flat surface. Measure the distance across the six bricks.
- Divide the answer by the number of bricks in the sample. This will give you the average thickness of the type of bricks being used.
- In order to mark off the brick courses a mortar joint needs to be added to the average brick thickness.

SECTION F - cont'd

BONDS, JOINTING AND MORTAR MIXES

Guide to Mortar Joint Sizes

HOLLOW KEY JOINT	A 10-12mm joint is recommended Eg: Brick size ± 72mm + mortar joint 12mm = 84mm
SQUARE RECESS	A 12- 15mm joint is recommended Eg: Brick size ± 72mm + mortar joint 15mm = 87mm

(c) Typical Dimensions and General Setting Out

Burnt Clay Bricks are generally manufactured to a size of 222mm x 106mm x 73mm, and the use of 12mm mortar joints is recommended. Therefore:

- The format size becomes 234mm x 118mm x 85mm.
- The format length (234mm) is the spacing of the stretcher perpends.
- The format width (118mm) is the spacing of header perpends.
- The format height (85mm) is the coursing height.

It should be noted that:

- The actual length of a brickwork panel is less, by one 12mm joint, than the overall distance between format lines.
- The actual width of the openings between the brick reveals, are greater by one 12mm joint, than the width between format lines.
- The height of brickwork measured conveniently between the tops of the courses, and is equal to the format height multiplied by the number of courses.
- The clear height of an opening, measured to the brickwork, is therefore greater by one bed joint, than the coursing height of the opening.

SECTION F - cont'd

BONDS, JOINTING AND MORTAR MIXES

Planning and Setting Out Guides

NO	VERTICAL	HORIZONTAL	NO	VERTICAL	HORIZONTAL	NO	VERTICAL	HORIZONTAL
1	85	234	34	2890	7956	67	5695	15678
2	170	468	35	2975	8190	68	5780	15912
3	255	702	36	3060	8424	69	5865	16146
4	340	936	37	3145	8658	70	5950	16380
5	425	1170	38	3230	8892	71	6035	16614
6	510	1404	39	3315	9126	72	6120	16848
7	595	1638	40	3400	9360	73	6205	17082
8	680	1872	41	3485	9594	74	6290	17316
9	765	2106	42	3570	9828	75	6375	17550
10	850	2340	43	3655	10062	76	6460	17784
11	935	2574	44	3740	10296	77	6545	18018
12	1020	2808	45	3825	10530	78	6630	18252
13	1105	3042	46	3910	10764	79	6715	18486
14	1190	3276	47	3995	10998	80	6800	18720
15	1275	3510	48	4080	11232	81	6885	18954
16	1360	3744	49	4165	11466	82	6970	19188
17	1445	3978	50	4250	11700	83	7055	19422
18	1530	4212	51	4335	11934	84	7140	19656
19	1615	4446	52	4420	12168	85	7225	19890
20	1700	4680	53	4505	12402	86	7310	20124
21	1785	4914	54	4590	12636	87	7395	20358
22	1870	5148	55	4675	12870	88	7480	20592
23	1955	5382	56	4760	13104	89	7565	20826
24	2040	5616	57	4845	13338	90	7650	21060
25	2125	5850	58	4930	13572	91	7735	21294
26	2210	6084	59	5010	13806	92	7820	21528
27	2295	6318	60	5100	14040	93	7905	21762
28	2380	6552	61	5185	14274	94	7990	21996
29	2465	6786	62	5270	14508	95	8075	22230
30	2550	7020	63	5355	14742	96	8160	22464
31	2635	7254	64	5440	14976	97	8245	22698
32	2720	7488	65	5525	15210	98	8330	22932
33	2805	7722	66	5610	15444	99	8415	23166
						100	8500	23400

The above dimensions are in mm

SECTION F - cont'd

BONDS, JOINTING AND MORTAR MIXES

Mortars and Plaster

The cost and quality of masonry work is significantly affected by the mortar used. Mortars may account for as little as 7% of the volume of the walls, but the role it plays and the influence it has on performance are far greater than the proportion indicates.

Mortar provides a bed for laying; bond units together to give compressive and flexural strength and seals joints against rain penetration.

Four types of building mortar are detailed in SABS 0164.

COMMON CEMENT	Sand
COMMON CEMENT	Lime: sand
COMMON CEMENT	Sand plus mortar plasticizer
MASONRY CEMENT	Sand (common = Portland)

Approximate proportions for mortar:

MORTAR CLASS	COMMON CEMENT *lt*	LIME *lt*	SAND MEASURED LOOSE & DAMP *litres mix*	MASONRY CEMENT *kg*	SAND *litres*
II	50	0-40	200	50	170
III	50	0-80	300	50	200

Class II: Normal load bearing applications, as well as parapets, balustrades, retaining structures, free-standing and garden walls and other walls potentially exposed to severe damp conditions.

Class III: Lightly stressed (e.g. single storey) bearing walls where exposure to dampness is not severe but check NBR and NHBRC.

The compressive strength requirements for mortar:

MORTAR CLASS	Compressive strength at 28 days, MPa, min	
	Preliminary (Lab) tests	Work tests
I	7	5
II	2	1.5

SECTION F - cont'd

BONDS, JOINTING AND MORTAR MIXES

Cementitious Materials

CEM 1 32.5 (ordinary Portland cement) and CEM 11/A (S,V or W) 32.5 (Portland cement 15) may be used in mortar.

It is not advisable to use CEM 111/A 32.5 (PBFC), unless the mortar sands are good quality. Mortar with common cement lacks plasticity, may bleed, and will be harsh to work with. This deficiency may be overcome by using masonry cement. The use of lime in the mortar mix is beneficial but is difficult to obtain. Masonry cements are readily available.

Sand

Sand for mortar should comply with SABS 1090 and be well graded from 5mm downwards. Sand should be evenly graded and should not contain an excess of dust or other fine material. The use of fine sands, that are more or less uniform in particle size, may contribute to workability, but frequently leads to excessive shrinkage and cracking of the joints. Sands containing high percentage of clay, tend to give a conveniently plastic mix, but also leads to undue shrinkage.

Mortar

Suitable for laying bricks and blocks in normal applications (SABS Class II)

CEMENT	BUILDING SAND
	
1 Bag	3 Wheelbarrows

To lay 1000 bricks you will need:
3 bags cement + 0.6m³ sand.

Plaster

Suitable for interior and exterior work

CEMENT	PLASTER SAND
	
1 Bag	3 Wheelbarrows

To plaster 100 square metres (15mm thick) you will need:
10 bags cement + 2m³ sand.

SECTION G

GOOD BRICKLAYING

Preparation

- Store and protect all materials to minimise saturation and contamination.
- Control the wetting of bricks in hot windy weather. Do not lay surface saturated bricks.
- Set out at ground level to locate all openings before commencing with bricklaying. Lay out, dry and minimise broken bonds.
- Prepare and take care of gauge rods - they are important quality control equipment.
- Work all levels from one datum.
- Plumb perpend regularly - every fifth course.

Protection of Brickwork

- The best treatment is to prevent the brickwork from getting dirty in the first place, so protect the walls as work progresses from mortar droppings.
- After the first course of bricks has been laid, protect the base of the wall by laying sand, straw, sawdust or plastic sheeting along the ground. This minimises mud splashes and damage from mortar droppings.
- As clay brickwork should be kept as dry as possible during construction, cover the walls at the end of each day's work and during rain in order to prevent mortar droppings to fall to the ground and away from brickwork.
- Set scaffolding far enough away from the wall to allow mortar droppings to fall to the ground and away from the brickwork.
- At the end of each working day clean the toe boards closest to the wall and turn the boards back to prevent rainfall from splashing mortar and dirt onto the brickwork.

SECTION G - cont'd

GOOD BRICKLAYING

Process and Techniques

- Mix small batches of mortar to suit rate of construction and allow 20 minutes for initial setting
- Bed all DPC's on fresh mortar.
- Blend face bricks from a number of packs to minimise colour bonding.
- Fill all mortar joints solidly to minimise water penetration.
- Clean mortar dropping from cavities regularly.
- Pay attention to DPC details
- Incline brick ties downwards to the outer leaf.

Non-Face Brickwork Finishes

a) Plaster and Paint

- The most common finish applied to non-face plaster brick is plaster and paint. When applied correctly, it provides a highly durable finish for this type of brickwork.
- Plaster finishes vary considerably and paint supplier recommendations should be carefully adhered to.

NB: Do not apply paint directly onto NFP's

b) Bagwash and Paint

- It is often assumed that brick masonry walls that are to be painted can be built with less durable materials, and in some instances, with less care in workmanship than would normally be used for unpainted brick walls. This is not the case.
- When a brick wall is to be painted, the selection of materials, both brick units and mortar, and the workmanship used in constructing the wall should all be of the highest quality.
- Although popular because of a relatively low initial outlay, this application is not recommended for exterior or interior leaves of external walls as it does not always give a durable finish.

SECTION G - cont'd

GOOD BRICKLAYING

b) Bagwash and Paint - Cont'd

- Bagwashing usually has a lifespan of 3-5 years on external walls, generally failing because of flaking and peeling.
- Bagwash and paint is more durable as an interior finish for partitioned walls.
- When applying bagwash, it is important to consider the "pot lifespan" of materials.
- If the initial setting of the cement takes place prior to the application of the bagwash, its strength and durability will be greatly reduced.

c) PVA Paint

- PVA paint applied directly on to clay brick is not recommended as the two materials are incompatible. Moisture movement through the brickwork causes the paint to peel.

Face Brickwork Finishes

(a) Varnishes and Brick Dressing

- Most varnishes and brick dressings show unevenly on the wall, and deteriorate due to sunlight and moisture. As these finishes are difficult to remove from brickwork, walls can rarely be restored to their original condition.

  The best "look" a face brick wall offers is the original clean brick and mortar joint approach. Brickmakers all over the world do not recommend the use of any other finish especially the "clean engine oil and paraffin approach."

SECTION G - cont'd

GOOD BRICKLAYING

Cleaning New Face Brickwork

a) Mortar Smear and Deposits

It is best to clean brickwork by hand with a hard scrubbing brush using water and possibly a commercial mortar cleaner as work progresses.

Check List:

- For light coloured bricks which are likely to contain vanadium salts do not use hydrochloric or muriatic acid for cleaning as they will fix the salts, make them insoluble and difficult to clean.
- Do early trials to ensure chemical compatibility with materials being used.
- Ensure that all proper safety precautions are taken when using chemicals.
- When diluting concentrated acid, always pour acid to water and not vice-versa.
- Identity the nature of masonry to be cleaned and the type of stain to be removed before deciding on the cleaning method. Test this method on a small area of the wall.
- Protect metalwork, building materials and plants from chemical liquids, sprays and fumes.
- Do not clean brickwork exposed to heat and sunlight
- Do not use wire brushes or other abrasives on brick faces.
- If in doubt, contact a specialist for advice.

b) Lime Bloom Staining

Lime bloom staining originates from common cement in mortar and concrete structures. It is released into solution in the early life stages of a wall and dries out on the surface of the brick as an insoluble salt that is difficult and expensive to remove.

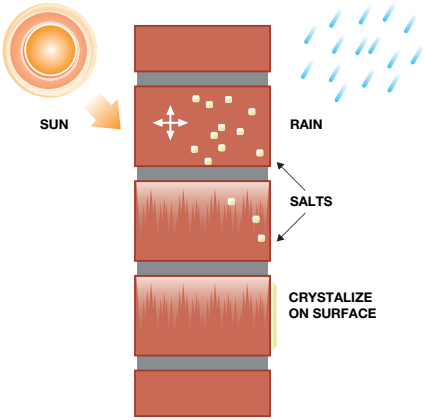
Solution: Prevent saturation in the first 24 hours. Clean in accordance with recommendations and then protect from rain for the next week.

SECTION G - cont'd

GOOD BRICKLAYING

b) Lime Bloom Staining - Cont'd

Unprotected newly built green brickwork becomes saturated. Common cement sets and releases lime into solution. Brickwork dries out calcium hydroxide precipitated on the surface. Calcium hydroxide converts to insoluble calcium carbonate, i.e. a white deposit.



c) Cleaning guide for older brickwork

- While stains can spoil the attractiveness of clay brickwork, incorrect cleaning techniques can cause permanent damage.
- Specialists should be contracted to clean prestige buildings.
- As cleaning techniques differ for different types of masonry and stains, identify the kind of brick and the nature of the stain before commencing any cleaning.
- Thoroughly saturate brickwork before and wash after application of chemical cleaners.
- When using chemicals such as acid-based solvents for removing mortar, allow the chemical to react for 5-10 minutes, and then wash down thoroughly with clean water.
- Protect adjacent features such as metal windows and the area at the foot of the wall from splashing, spraying and the fumes from chemicals.

SECTION G - cont'd

GOOD BRICKLAYING

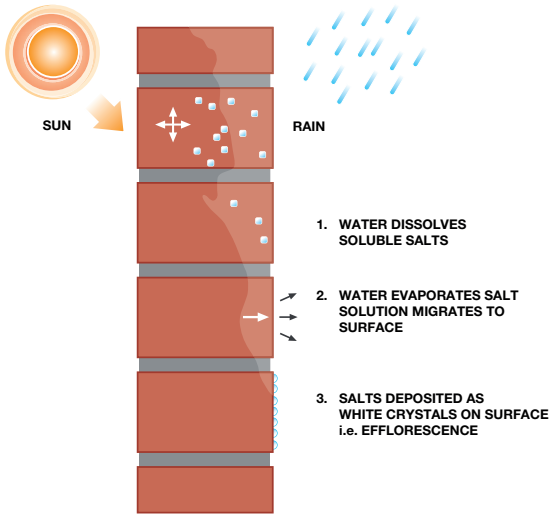
c) Cleaning guide for older brickwork - Cont'd

- When the stain is very localised, most cleaning liquids can be applied as a poultice by thickening with an inert filler such as talc or powdered chalk.
- As many recommended chemicals are either caustic or poisonous handle them with great care and wear protective clothing, gloves and goggles.
- When using volatile solvents indoors, ensure there is good ventilation.

d) Removing Efflorescence

Efflorescence is caused by salts present in the brick, sand or cement, and sometimes from ground or rain water, which is ultimately deposited on the surface of the brickwork in a dry crystallised form.

1. Brickwork contains soluble salts.
2. Brickwork saturated - dissolves.
3. Brickwork dries out - solution migrates to surface.
4. Water evaporates - soluble salts, salts crystallise on surface.



SECTION G - cont'd

GOOD BRICKLAYING

Preventative Solutions:

- Good detailing that minimises the ingress of water into the brickwork is the most important step to minimise efflorescence.
- Careful stacking of materials on site so as to eliminate salt contamination.
- Protection from ground water with a membrane.

Attending to the above may not totally eliminate the efflorescenc and the brickwork may still require cleaning.

It is first recommended to allow the efflorescence to form and dry out over approx. six months. Then try dry brush the efflorescence off or wash off with water using a hard bristle brush. If unsuccessful, refer the problem to a cleaning specialist.

Vanadium (yellow, green and brown) efflorescence can present problems. Do not use hydrochloric acid, rather refer to a specialist.

e) Moss & Plant Growth

Occasionally an exterior masonry surface, not exposed to sunlight, remains in a constantly damp condition, thus permitting plant growth.

Application of ammonium sulphate or weed killer, in accordance with directions results in the removal of such growth.

SECTION H

CALCULATING QUANTITIES

Estimates should always allow for a certain percentage of waste. When calculating quantities, the following (potential) waste factors should be accounted for:

BRICK UNITS	5% - 10% depending on the method used for unloading
MORTAR	25% - 50% or more if joints are excessively thick
CONCRETE FOUNDATION	10% depends on accuracy of excavation and thickness of footings

Concrete and Excavation

Vol = L x $_3$B x H Builders wheelbarrow - 65 litres or ± 0.375m³ sand and stone

10 MPa	Concrete 5 bags cement 0.75m³ concrete sand 0.75m³ stone
15 MPa	Concrete 7 bags cement 0.70m³ concrete sand 0.70m³ stone
MORTAR CLASS II	3 bags cement 9 barrows building sand will lay ±1000 bricks
BRICKS (Imperial)	Approximately 52-56 bricks/m² single leaf
PLASTER	1 bag cement plus 3 wheelbarrows plaster sand will plaster approximately 10m²

SECTION I

GLOSSARY OF TERMS

AGGREGATE
Any hard, inert material, i.e. sand, gravel or stone, used for mixing with cementitious materials to form mortar or concrete.

ARCH
An arrangement of bricks over an opening.

ARRIS
The sharp edges of a brick.

BAT
Portion of a brick larger than a quarter.

BEAM FILLING
A filling of brick between the roof timber, from wall plate to roof covering, to prevent the entry of birds and vermin and to render the wall weather-tight.

BED JOINT
The horizontal layer of mortar on which a masonry unit is set.

BOND 1
The arrangement of bricks in brickwork usually interlocking to distribute the load and attain a pleasant appearance.

BOND 2
The resistance to displacement of individual bricks in a wall provided by the adhesive property of mortar.

BROKEN BOND
The use of part bricks to make good a bonding pattern where dimensions do not allow regularised bond patterns of full bricks.

BUTTERING
Applying mortar to the end of a brick when laying bricks.

SECTION I - cont'd

GLOSSARY OF TERMS

CAVITY WALL
Wall of two leaves effectively tied together with wall tie with a space between them, usually at least 50mm wide.

CHASES
Recesses cut in walls to accommodate service cables or pipes.

CLOSER
The last masonry unit or portion of a unit laid in a course.

COPING
The materials or masonry units used to form a cap or a finish on top of a wall, pier, or chimney, to protect the masonry below from water penetration, commonly extended beyond the wall face and incorporating a drip.

COMPRESSIVE STRENGTH
The average value of the crushing strengths of a sample of bricks tested to assess load-bearing capability.

CONCRETE
A mixture of sand, stone, cement and water that sets and hardens.

CORBEL
A feature, or course, or courses of brick, projecting from the face of the wall.

COURSE
One complete level row of bricks in brickwork.

DAMP-PROOF COURSE (DPC)
A course or layer of impervious material which prevents vertical movement of water.

DATUM
A fixed reference point from which levels are set out.

SECTION I - cont'd

GLOSSARY OF TERMS

DURABILITY
The ability of materials to withstand the potentially destructive action of natural conditions and chemical reactions.

EFFLORESCENCE
The unsightly chalk-like appearance on a building due to the crystallisation of soluble salts contained in the bricks or mortar.

FACE WORK
Brickwork built neatly and evenly without applied finish.

FLASHING
Waterproof sheet materials, usually galvanized sheet iron shaped to prevent entry of rainwater.

FOUNDATION
A structure to carry brickwork onto soil or earth.

FROST DAMAGE
The destructive action of freezing water and thawing ice in saturated materials.

FOOTING
The broadened concrete base of a foundation wall or pier.

GABLES
Portion of wall above eaves level that enclosed the end of a pitched roof.

GAUGE ROD
Batten marked at intervals for vertical setting-out of brick courses.

GAUGE BOXES
Boxes of specific volumes to accurately measure the proportions of cement, lime and sand when preparing mortar.

HEADER
The end face of a standard brick.

SECTION I - cont'd

GLOSSARY OF TERMS

HEADER COURSE
A continuous course of header brick.

INITIAL SET
The first setting action of mortar, the beginning of the set.

JOINT REINFORCEMENT
Steel reinforcement placed in mortar bed joints.

JOINTING
The finishing off of joints between courses of masonry units before the mortar has hardened.

LAP
The distance the bricks of one course overlaps the bricks of another course.

LEAF
One or two parallel walls that are tied together as a cavity wall.

LIME STAINS (BLEED OR BLOOM)
White insoluble calcareous deposits on the face of brickwork derived from common cement mortars which have been subjected to severe wetting during setting and hardening.

LINTEL
A beam placed or constructed over an opening in a wall to carry the superimposed load.

MORTAR
A mixture of sand (lime), cement and water.

MOVEMENT JOINT
A continuous horizontal or vertical joint in brickwork filled with compressible material to accommodate movement due to moisture, thermal or structural effects.

SECTION I - cont'd

GLOSSARY OF TERMS

PARAPET
A low wall around the perimeter of a building at roof level or around balconies.

PIER
A vertical block of brickwork which may either be isolated or attached to the face of a wall.

PERPENDS (PERPS)
Vertical lines controlling the vertically of cross-joints appearing in the face wall.

DRAWING OR PLANS
A construction drawing showing a view of a building or object in a horizontal plane. A floor plan shows the floor area of a building or object in a horizontal plane.

PLUMB
The verticality of brickwork.

QUOIN
Corner brick — the first brick of each course at the corner.

RACKING BACK
The steps left in the brickwork back when pulling up corners.

REINFORCED BRICKWORK
Brickwork incorporating steel wire or rods to enhance resistance to loads.

REINFORCING
Metal that is built into brickwork, e.g. reinforcing bars, brickforce.

RETAINING WALL
A wall that provides lateral support to higher ground at a change of level.

REVEAL
The area of walling at the side of an opening which is at right angles to the general face of the wall.

SECTION I - cont'd

GLOSSARY OF TERMS

RETEMPERING

To moisten mortar and re-mix, after original mixing, to the proper consistency for use.

ROOF TIES

Lengths of hoop-iron or double strands of wire built into the wall to secure the roof to the superstructure.

SCAFFOLDING

A temporary framework, usually of tubular steel or aluminium, and timber boards to give access for construction work.

SEALANT

A stiff fluid material that sets but does not harden. Used to exclude wind driven rain from movement joints and around door and window frames.

SILL

The part of the brickwork directly below a window.

SOFFIT

The exposed lower surface of any overhead component of a building such as a slab lintel, vault or cornice, or an arch.

SOFT-BURNED

Clay products fired at low temperature ranges, producing units of relatively high absorptions and low compressive strengths.

STRETCHER

The longer face of a brick showing in the surface of a wall.

SUCTION RATE

The tendency of a brick or block to absorb water from the mortar used for its bedding and jointing. Dense vitrified bricks have a low suction rate. Porous bricks have a higher suction rate (IRA - Initial Rate of Absorption - affects bonding properties).

SECTION I - cont'd

GLOSSARY OF TERMS

THRESHOLD

The section of the floor at the doorway.

TOOTHING

Leaving indents in the wall. This means removing every second brick when adding new brickwork to existing brickwork

WALL TIE

A metal piece that connects leaves of masonry to each other or to other materials.

WATER ABSORPTION

The amount of water a unit absorbs, when immersed in either cold or boiling water for a stated length of time; expressed as a percentage of the weight of the dry unit.

WATERPROOFING

Prevention of moisture flow through masonry.

WEEPHOLE

An opening placed in mortar joints of facing materials at the level of flashing, to permit the escape of moisture.

SECTION J

CODES & STANDARDS

Standard Specification, Codes of Practice and Reference on the use of bricks.

MATERIALS	
BRICKS	SABS 227-1986 Amended Burnt Clay Masonry Units
CEMENT	SABS Env 197-1:1996 Part 1. Common Cement Part 1. Cement-composition, specification and conformity criteria. SABS ENV 413-1: 1996 Masonry cements. Part 1. Specification.
AGGREGATES	SABS 1083-1976: Aggregates form natural sources
LIME	Approximately 52-56 bricks/m² single leaf
SAND	SABS 1090-1996: Aggregates from natural sources - Fine aggregate for plaster and mortar.
WALL TIES	SABS 28-1986: Metal ties for cavity walls.
DAMP PROOF COURSES	SABS 248-1973: Bituminous damp proof course. SABS 298-1975: Mastic asphalt for damp proofing courses and tanking.

REFERENCES AND RECOMMENDED READING

W Kraukamp
1) Bricklaying & Plastering Theory (N1)
2) Bricklaying is Easy.

BDA UK
The BDA Guide to Successful Brickwork
www.brick.org.uk

Brick Institute of America
Pocket Guide to Brick Construction.
www.bia.org

BDRI-Australia
Technical Guide on Clay Bricks.
www.demeter.org.au

Cement & Concrete Institute
Publications on concrete, mortar, plaster and construction detailing.
www.cnci.org.za

Clay Brick Association
www.claybrick.org

National Home Builders Registration Council
Standards and Guidelines
www.nhbrc.org

Environmentally Friendly

ABOUT CLAYBRICK

ClayBrick.org is the official body representing all Clay Brick and Paver manufacturers in this country.

As the industry watchdog, ClayBrick.org monitors all legislative and standards issues and acts as liaison between the industry, government and other organisations related to housing, building and construction.

All ClayBrick.org members are committed to the production and supply of premium Clay Bricks and Pavers in the interest of best practice and quality building and construction - for good.

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