

PROVINCE OF THE EASTERN CAPE

A Basic Guide To Quality Housing Development Norms And Standards





PROVINCE OF THE EASTERN CAPE

METHODS OF CONSTRUCTION TO SATISFY THE MINIMUM PROVINCIAL NORMS AND STANDARDS IN RESPECT OF PERMANENT RESIDENTIAL STRUCTURES FOR THE PEOPLE'S HOUSING PROCESS

A Basic Guide to Quality Housing Development





FOREWORD

One of the central tenets of our housing policy in the new term of government is to shift away from quantity to quality housing.

The housing subsidy scheme has achieved the delivery of large numbers of housing units throughout the Eastern Cape Province. The quality of homes provided is, however, in many instances not at the desired standard.

Accordingly I introduced provincial norms and standards in respect of permanent residential structures erected by means of the housing subsidy, namely:

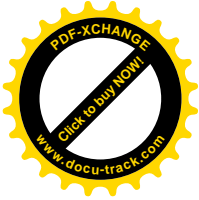
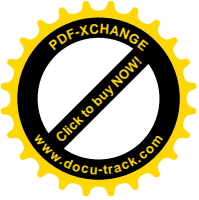
- § Maximization of the size of the top structure without compromising quality
- § Internal walls and two external doors
- § Waterbourne sewerage
- § Running water inside the house
- § Concrete floors
- § Construction to be based on job creation and skills development principles in order to contribute to the Extended Public Works Programme
- § Black Economic Empowerment

I trust that this basic guide to quality housing development will assist all stakeholders and most importantly all our beneficiaries in the housing delivery arena to “watchdog” the construction of acceptable houses.

MEC: Housing, Local Government and Traditional Affairs



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1 Introduction

This document addresses basic aspects of Norms and Standards to facilitate a common understanding for the provision of quality housing units within the Province. Through this, a foundation can be laid for a common approach to the inspection of the critical quality aspects in housing construction.

Project Managers, Building Inspectors and Clerks of Works have the authority and responsibility to withhold payment where quality workmanship and material is not being provided.

The document focuses mainly on the structural elements of house construction. Proper project planning will however benefit housing delivery. The expertise of builders needs to be improved. Funding is available for training but the training institutions need to be approached well in advance to ensure that training can be completed before construction commences.

All Contractors involved in the construction of houses must be registered with the NHBC (National Home Builders Registration Council).

2 Foundations and Floors

2.1 Raft Foundations

If poor ground conditions require a raft foundation, the foundation must be constructed according to a design prepared and certified by a competent person appointed by the Developer / Support Organisation for this purpose. These foundations normally require reinforcing steel.

(A competent person is a registered person in terms of the Engineering Profession of South Africa Act, 1990 (Act N0 114 of 1990) or a person registered in terms of section II of the Natural Scientific Professions Act (Act No 106 of 1993) and holding the indemnity insurance prescribed by the Council in respect of the certification of (a) the appropriateness of design and construction of houses (b) compliance with the Home Building Manual)

Expensive raft foundations should however only be used where absolutely necessary as a result of poor founding conditions on site.

Where raft foundations are used on sloping ground, an excavation cut must be made into the slope as shown on Figure 1. The minimum distance above finished ground level and between the foundation and the back of the cut must however be adhered to. If no gutters are provided a 1.5m wide impervious apron slab should be provided around the house to direct eroded soil washing down the slope away from the foundations and walls.

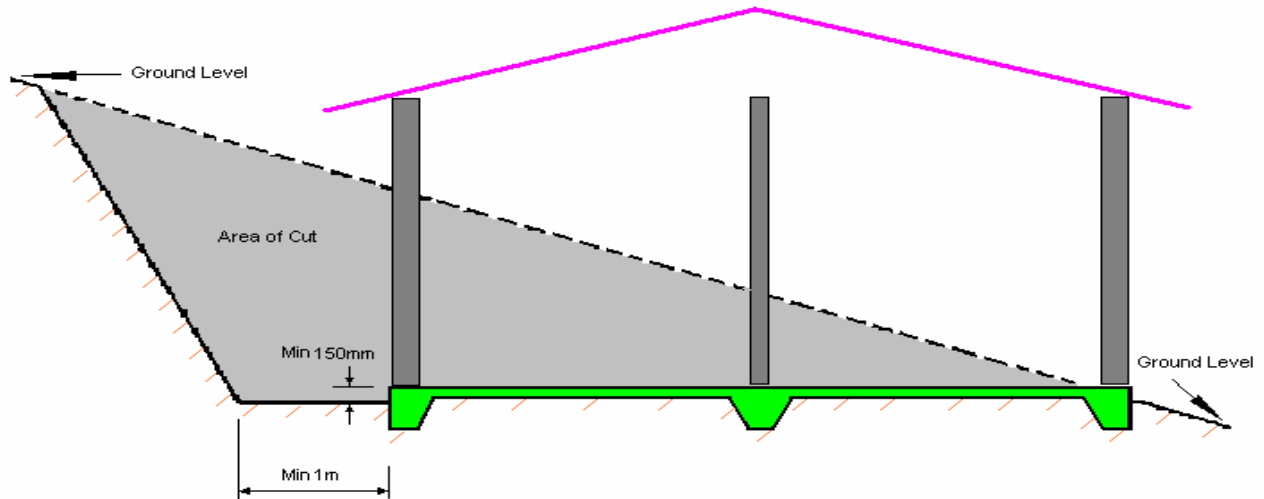


FIGURE 1 : RAFT FOUNDATIONS

2.2 Strip Footings

Strip footings for external walls must be a minimum of 500mm wide X 200mm deep and foundations for internal walls must be a minimum of 400mm wide X 200mm deep as shown in Figure 2. Foundations that are made wider than necessary waste material and place strain on an already tight project budget.

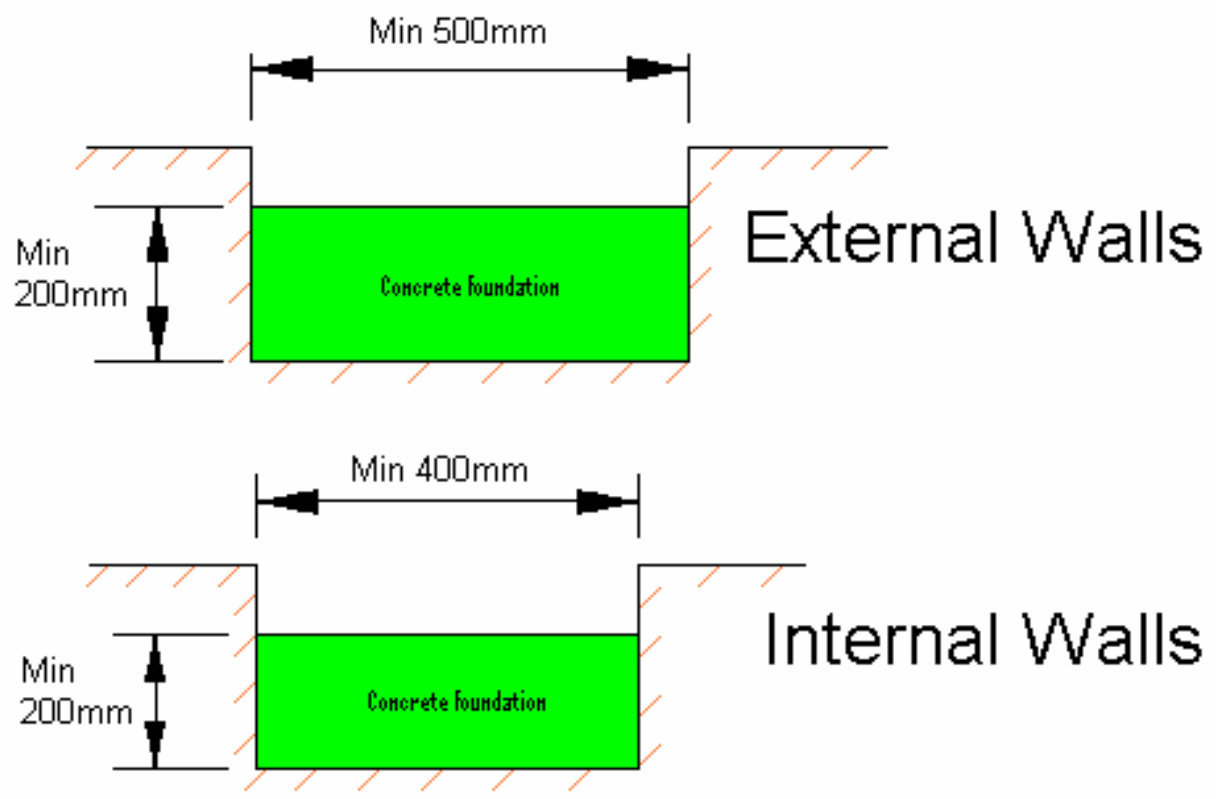


FIGURE 2 : MINIMUM FOUNDATION EXCAVATIONS

In PHP (People's Housing Process) Projects the top level of the strip footing must allow for at least one course of blockwork to be laid before reaching top of slab level. In all other projects, the foundations must be at least 400 deep. The top of the floor slab must be at least 150mm above ground level and at least 75mm thick.

The concrete is to be allowed to set for at least 24 hours before starting to lay blocks on the footing.

Foundations must be inspected by a competent person.

2.3 Foundation Walls

The maximum foundation wall height above normal ground level if 140mm blocks are used is 400mm. If 190mm blocks are used, this height can be increased to 600mm. The Developer must appoint a competent person if the fill exceeds 400mm and the depth of the cut exceeds 750mm.

In all instances, the cavity is to be filled with grade 10 concrete.

2.4 Squaring of Corners

Foundations are to be set out square and level. The 3,4,5 triangle shown in Figure 3 will assist the builder to get corners square.

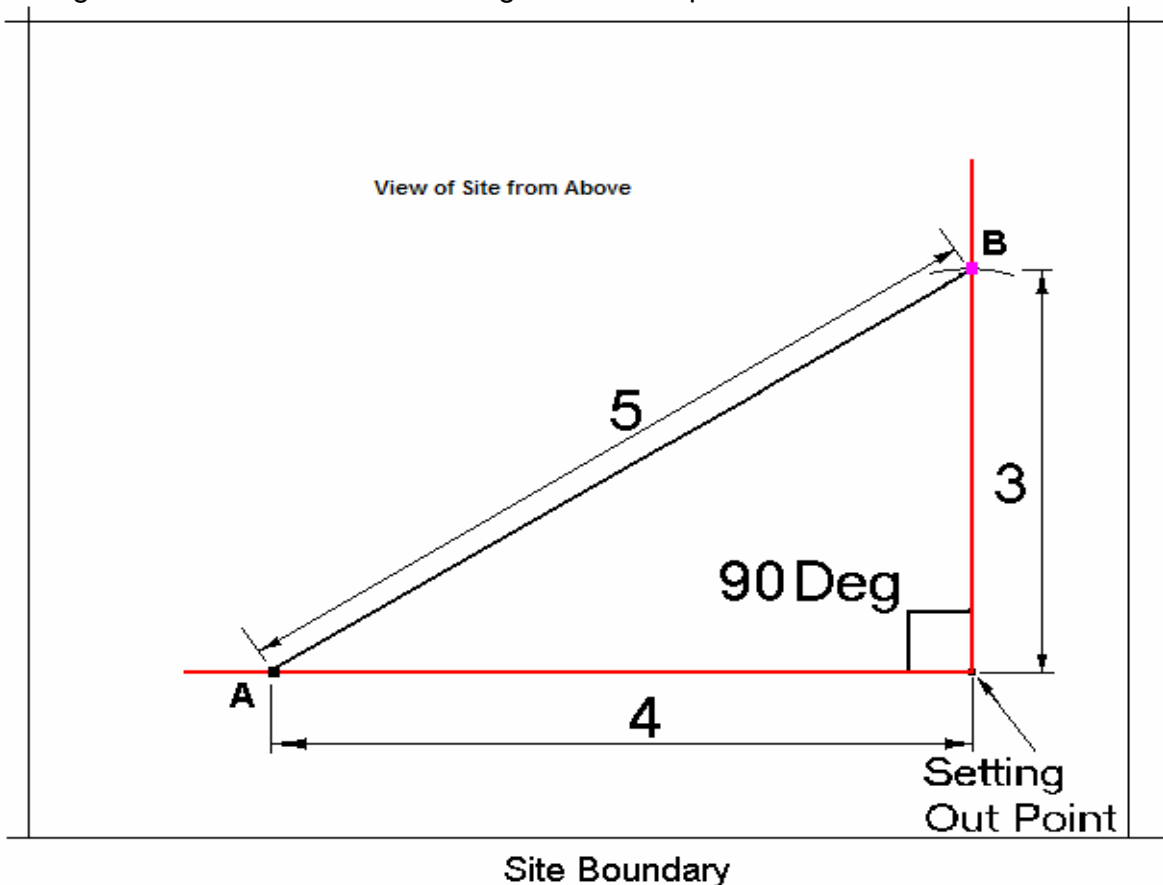


FIGURE 3 : TRIANGLE (3,4,5) FOR GETTING CORNERS SQUARE

The Setting Out point is obtained by measuring the required distances from the site boundary. A distance of 4m should then be measured parallel to the boundary from the Setting Out point to get point A. The Setting Out point and point A are then fixed and point B is obtained by measuring an arc of 3m from the setting out point. When the distance between A and B equals 5m, the angle will be 90 degrees and the corner will be square. Point A and B can then be extended from the Setting Out Point to get the lines for the excavations or walls. This process should be repeated for all the other corners.

It is good practice to clear an area of 1.5m wider around the house of all vegetation before setting out and excavation is started.

2.5 Levelling

A clear plastic pipe can be used as a water level to transfer levels from one point to another as shown in Figure 4. The pipe is laid out on the site with the ends held up. Water is poured into the pipe until it is nearly full. All air bubbles must be removed from the water in the pipe. The ends of the pipe must remain open. Water is to be added or removed to line the water in the pipe up with the level desired. Once the water in the pipe is at the required level, water must not be added or removed. One end of the pipe must be kept at the desired level and the other end of the pipe can be moved around the site effectively transferring that level throughout. It is important to keep checking that the water level at the starting point stays the same.

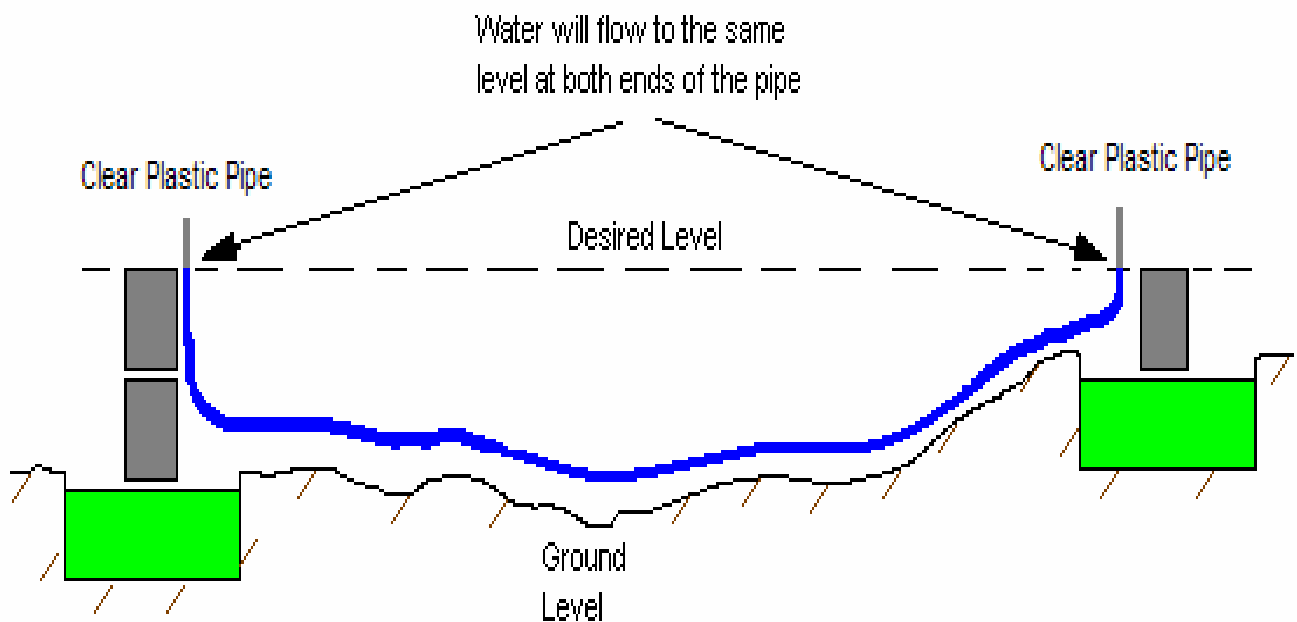


FIGURE 4 : BASIC OPERATION OF A WATER LEVEL

2.6 Under-stepping of Foundations

When strip foundations are used on sloping ground it is important that the foundation is correctly under-stepped as shown in Figure 5 when changing levels. The step is not allowed closer than 1m from the corner.

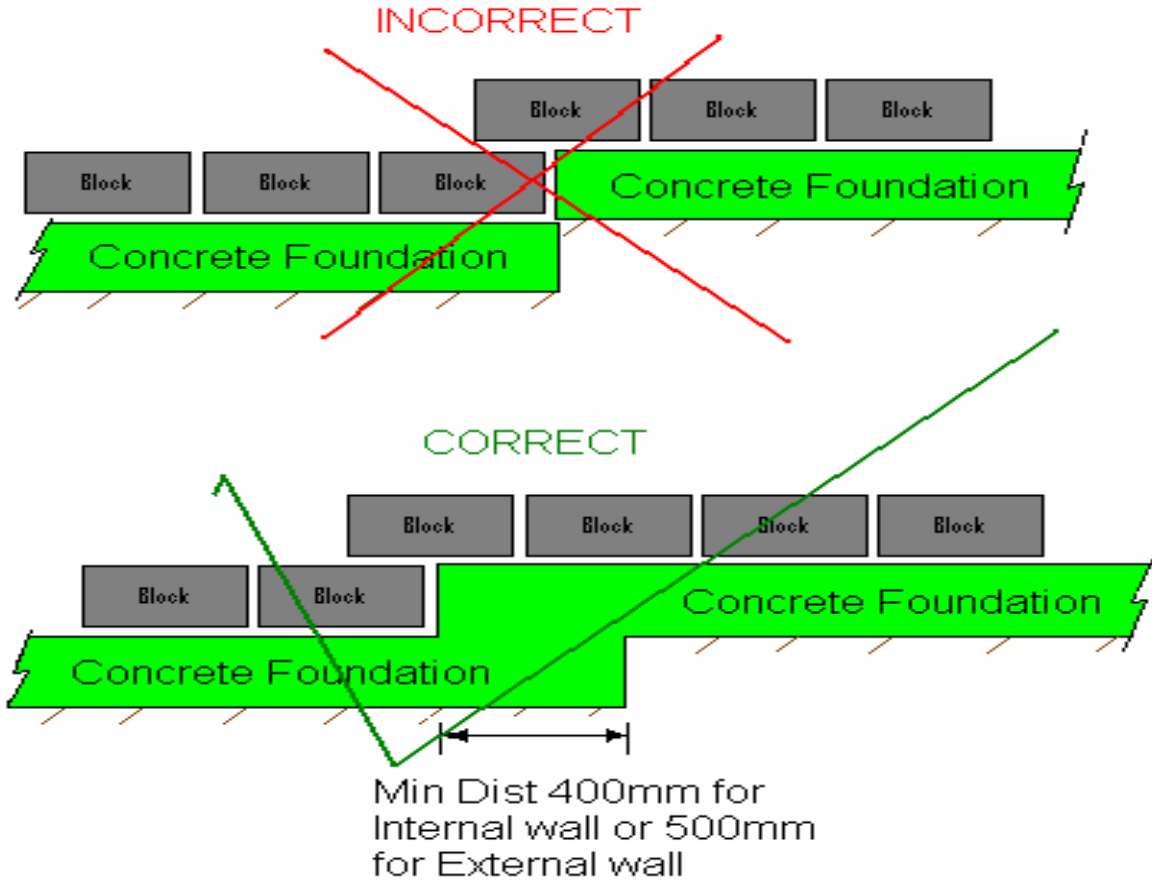


FIGURE 5 : UNDER-STEPPING OF FOUNDATIONS

2.7 Concrete Mix Proportions for Foundations

Concrete used for the foundations must have a minimum 28 day strength of 10MPa. The mix must be semi-dry, not having too much water. Adding too much water to the mix reduces the strength of the concrete. A mix of two 50kg bags of cement : 4 wheelbarrows of stone : 4 wheelbarrows of clean, damp sand is recommended as shown in Figure 6.

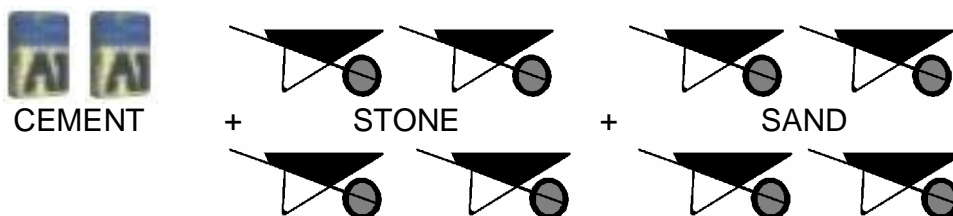


FIGURE 6 : RECOMMENDED FOUNDATION CONCRETE MIX

2.8 Floor Fill

The fill to be used under the floor slab must be clean soil with no clay, grass, sticks, stones, plastic, paper, sharp objects, or other matter. This fill material is to be watered and compacted in layers. The layer thickness is not to exceed 150mm if a machine is used and 100mm if compaction is by hand.

The last 25mm of fill (before placing the DPC & casting the floor slab) should ideally be done using clean fine sand to prevent damage to the DPC membrane.

(A good indication of proper compaction can be obtained when an adult pushes the heel of a flat shoe, using body weight only, into the compacted fill and it doesn't indent more than 5mm)

Fill should be inspected by a competent person before casting the floor slab.

2.9 Damp Proof Course (DPC)

A 250 micron thick damp proof course must be laid above the compacted fill and up over the blockwork so that it extends beyond the edge of the outside blockwork as shown in Figure 7.

The plastic must not be stretched too tightly over the area to prevent the concrete and DPC from getting into the corners properly while casting the floor slab.

Joins in the DPC must overlap by a minimum of 200mm and it is recommended that all joins be secured with adhesive tape.

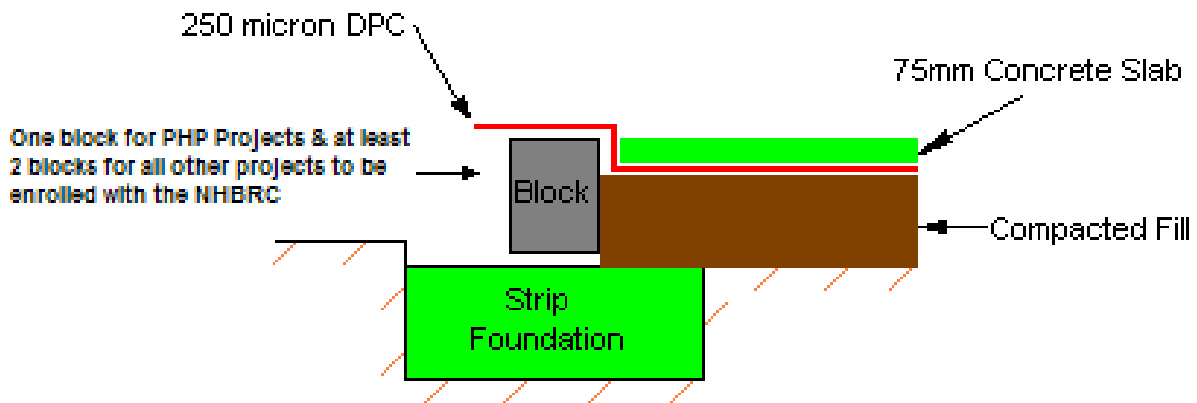


FIGURE 7 : DAMP PROOF COURSE FOR STRIP FOUNDATIONS

All raft foundations must have a polyolefin layer (DPC) and it is recommended that the plastic is laid in the excavations before fixing steel and pouring the concrete. The ends of the DPC are to be brought up over the top of the slab and be covered by 375 micron thick Brickgrip before laying the first course of blocks as shown in Figure 8. Care is to be exercised not to damage the DPC.

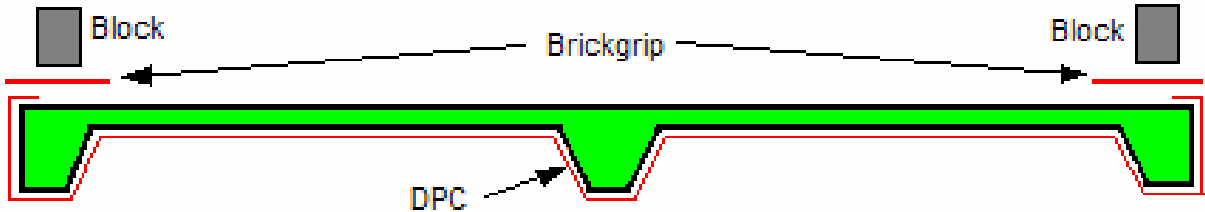


FIGURE 8 : DAMP PROOF COURSE FOR RAFT FOUNDATIONS

2.10 Floor Slab

The floor slab must be level and a minimum of 75mm thick using concrete with a minimum 28 day strength of 10MPa. A mix of two 50kg bags of cement : 3 wheelbarrows of stone : 3 wheelbarrows of clean, damp sand is recommended as shown in Figure 9.

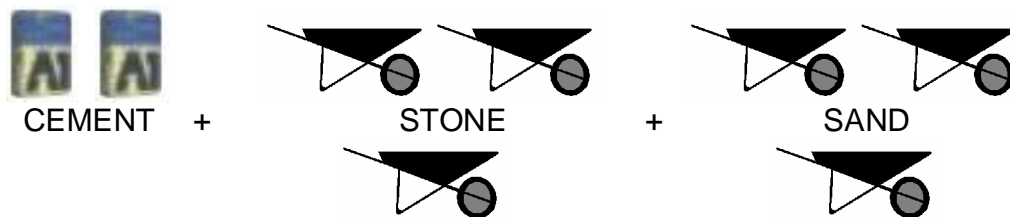


FIGURE 9 : RECOMMENDED FLOOR SLAB CONCRETE MIX

The mix must have a stiff workable consistency that would require a garden rake to work it into position. Too much water reduces concrete strength and can cause cracks in the slab. If the concrete is gathered together in a pile with a spade, it should not settle and have water coming out.

The floor slab must be wood floated and then steel troweled as a minimum. The concrete must be allowed to set for 24 hours before being covered with a 20mm layer of wetted sand or a plastic sheet to allow proper curing without cracks forming as a result of drying shrinkage. Curing must continue for at least 3 days and the sand should be re-watered about twice a day.

It is possible and beneficial to cast the floor after the roof has been put on to aid the curing. In this case the damp proof course under the slab should only be laid just before the floor is to be cast. However extra care would be needed here to get the floors in different rooms level. Finished floor level must be at least 150mm above the surrounding ground level.

3 Blockwork

Blocks used must have a minimum 28 day strength of 3MPa.

(A good indication of strength can be obtained if a block is lifted to waist height and dropped on hard ground. If the block shatters it is normally an indication that something is wrong. Sample blocks should then be taken to a laboratory for testing.)

Where Maxi Bricks are used their minimum 28 day strength must be 7MPa. Samples of suspect bricks must be sent to the laboratory for testing.

Where blocks or bricks are being sourced from different suppliers for the same house ensure that the blocks or bricks are the same size.

Recommended mortar mix – one 50kg bag of cement : 3 wheelbarrows of clean, damp sand as shown in Figure 10.

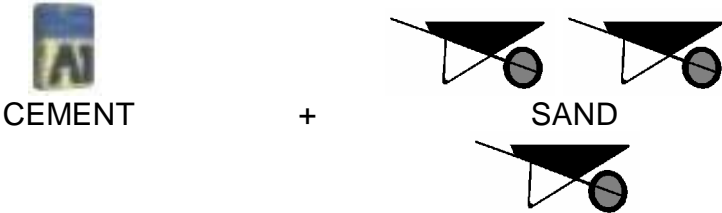


FIGURE 10 : RECOMMENDED MORTAR MIX

Before laying the first course of blocks above slab level, a strip of 140mm wide and 375 micron thick Brickgrip is to be laid around the perimeter of the house as shown in Figure 15. The DPC must extend at least 10mm beyond the external wall surface. When the external wall is plastered, the plaster must not cover the DPC and create a bridge in order to prevent the dampness to enter the wall.

External walls must be at least 140mm thick and Internal walls must be at least 90mm thick unless the internal wall is load-bearing where it should also be 140mm.

Internal Walls must be well tied into External Walls with galvanised steel straps 30mm wide and 1.2mm thick every second course or not more than 450mm apart as shown in Figure 11 below. Internal walls must be at least 2.4m (400mm above door level) above finished floor level.

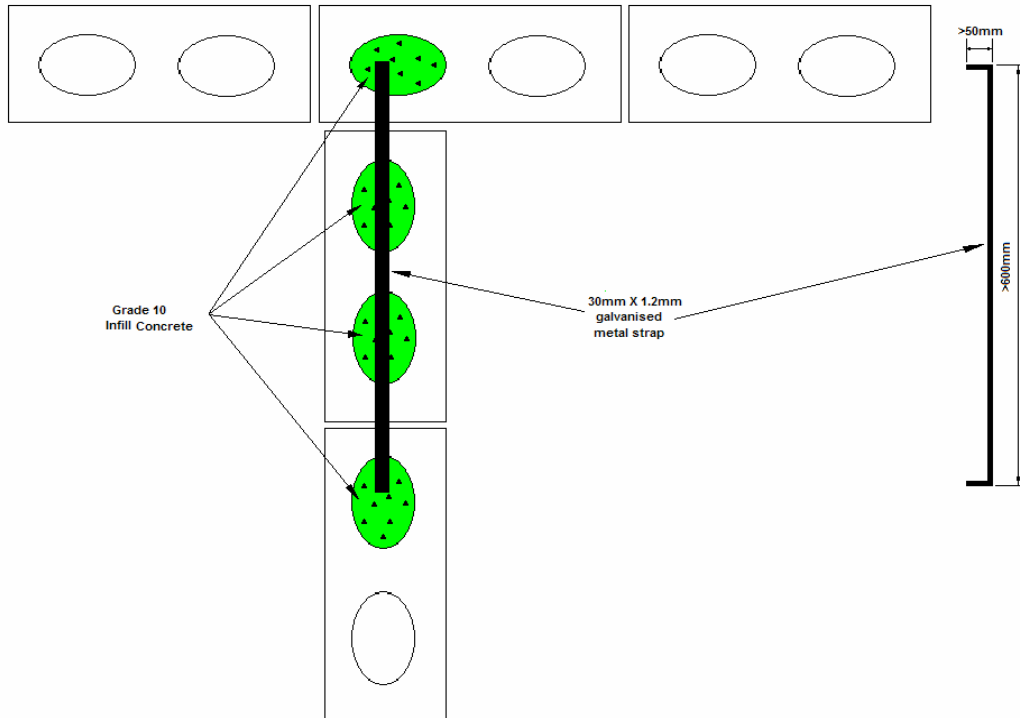


FIGURE 11 : Tying In of Internal Walls

It is important to position the internal wall over the thickened section of the raft where a raft foundation is used or over the internal wall strip foundation where strip footings are used. (Foundation walls are to be built up to floor level)

Blocks must be laid in the center of the strip foundation as shown in Figure 12. This fact must be taken into consideration when setting out for the excavations to ensure that the house is constructed to the correct size.

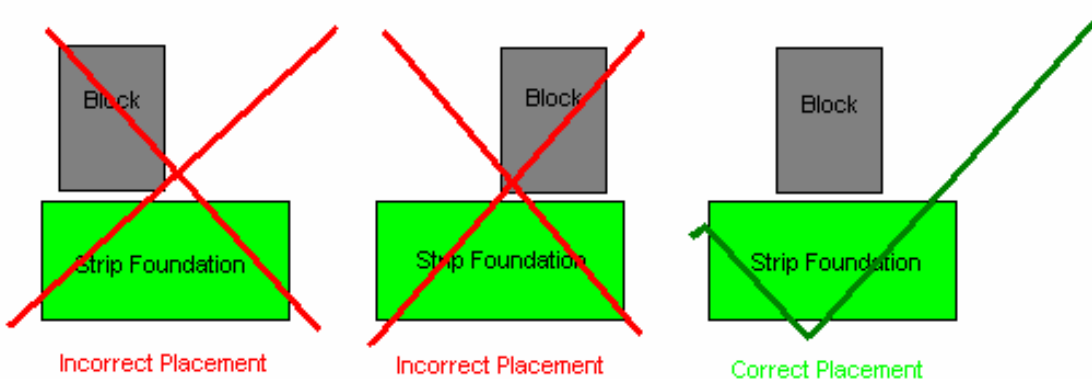


FIGURE 12 : BLOCK PLACEMENT ON FOUNDATION

3.1 Jointing

Mortar should not be scraped out from the joints between blocks as this makes applying an effective external waterproofing coating very difficult as can be seen in Figure 13.

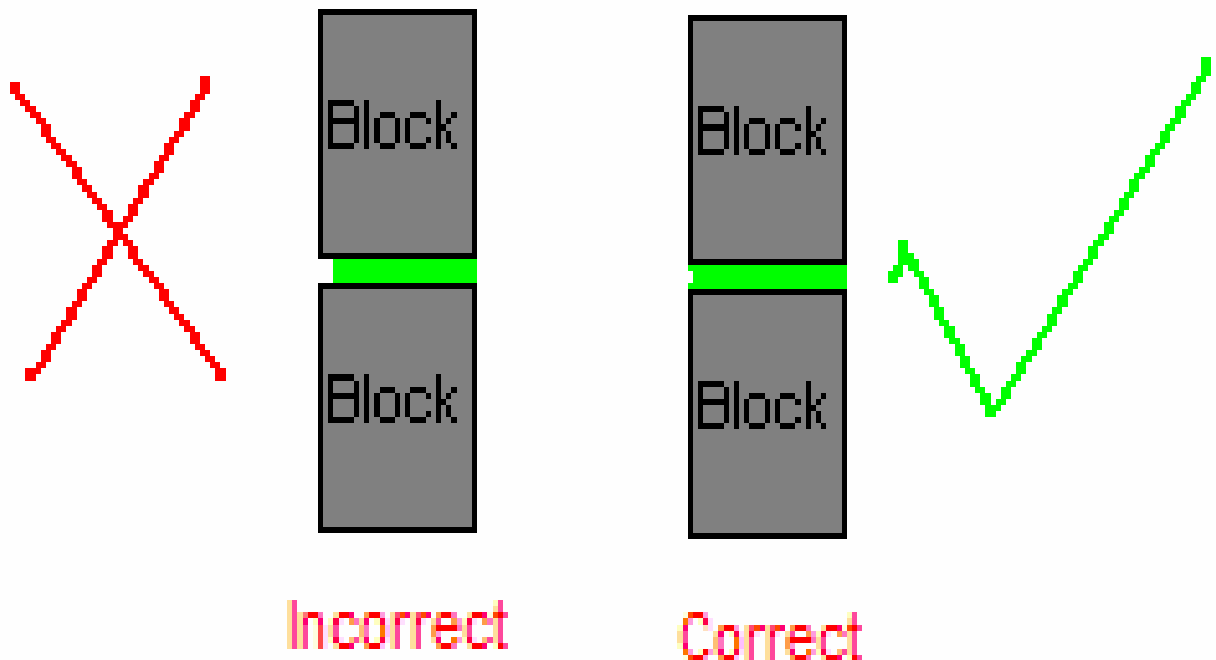


FIGURE 13 : JOINTING

3.2 Brickforce

Brickforce shall comprise hard drawn wires with the two main diameter wires of between 2.8mm - 3.55mm and crosswires of 2.5mm diameter spaced at 300mm intervals. Brickforce is to be used in every second course of blockwork up to the top of the gables as shown in Figures 14 & 15.

At corners, the brickforce should be overlapped and be tied together. When brickforce must be joined (ie when starting a new roll) the ends must overlap and be tied together to form one continuous length as shown in Figure 14.

Ends to be overlapped & tied at corners

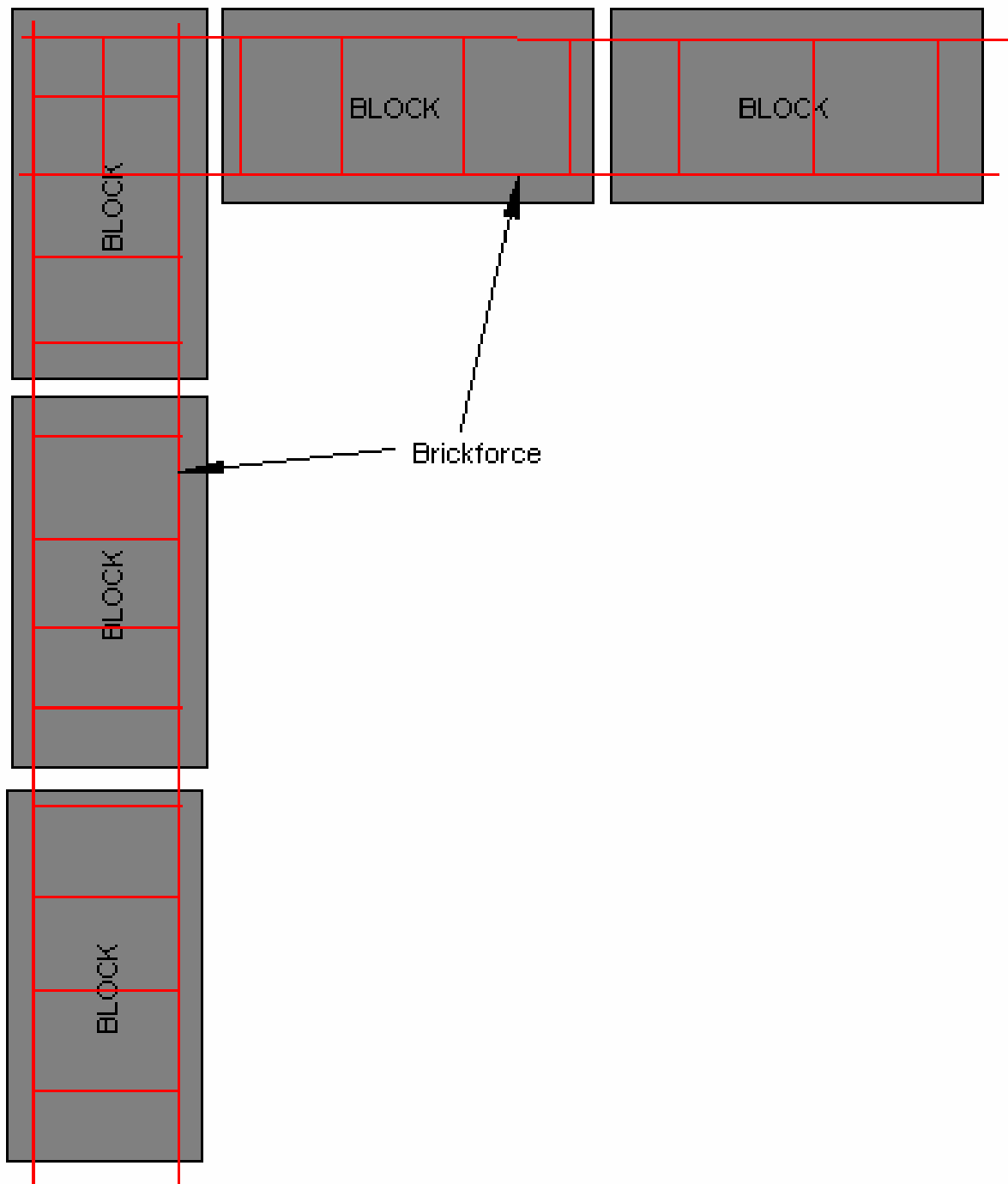


FIGURE 14 : BRICKFORCE

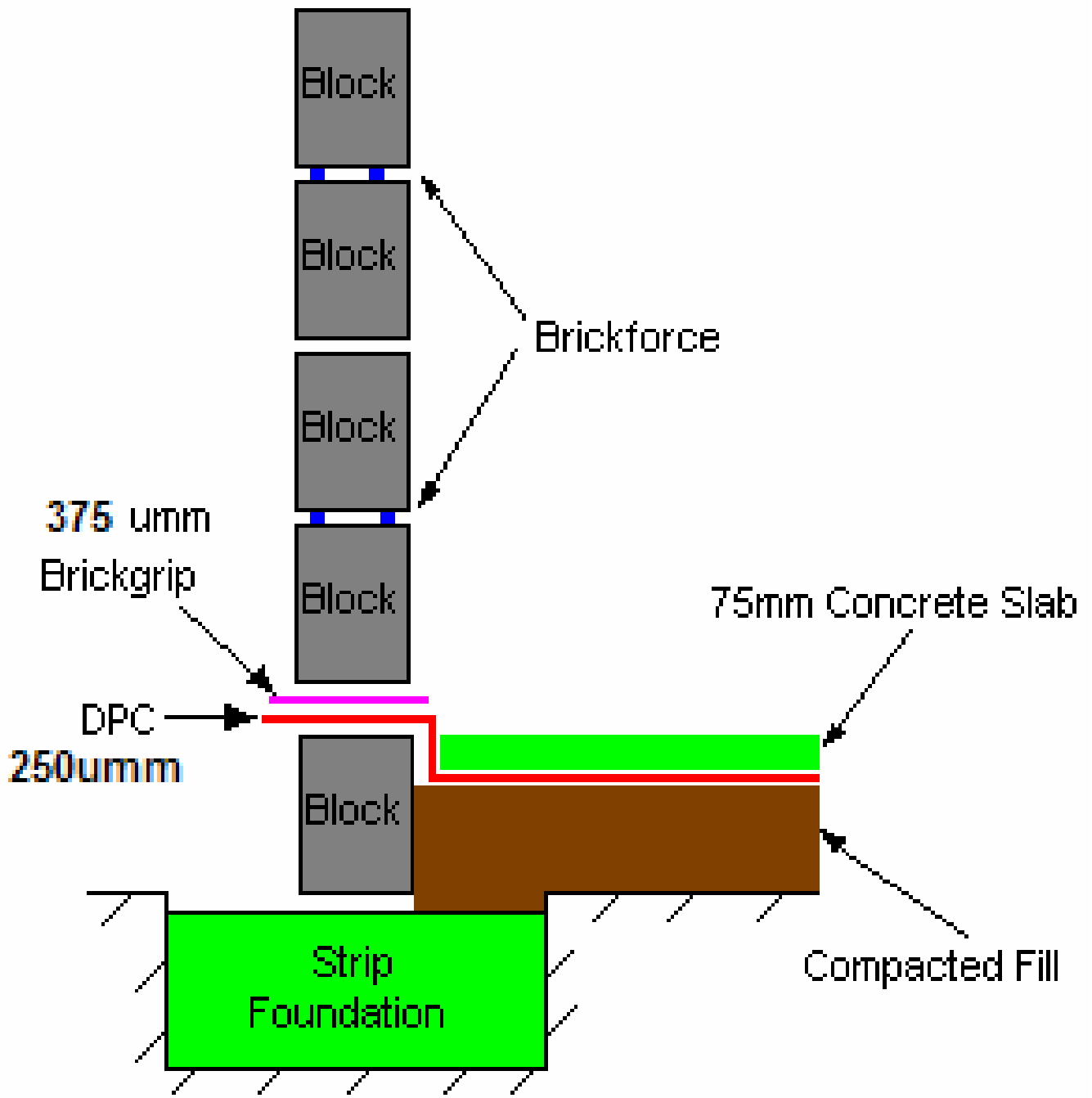
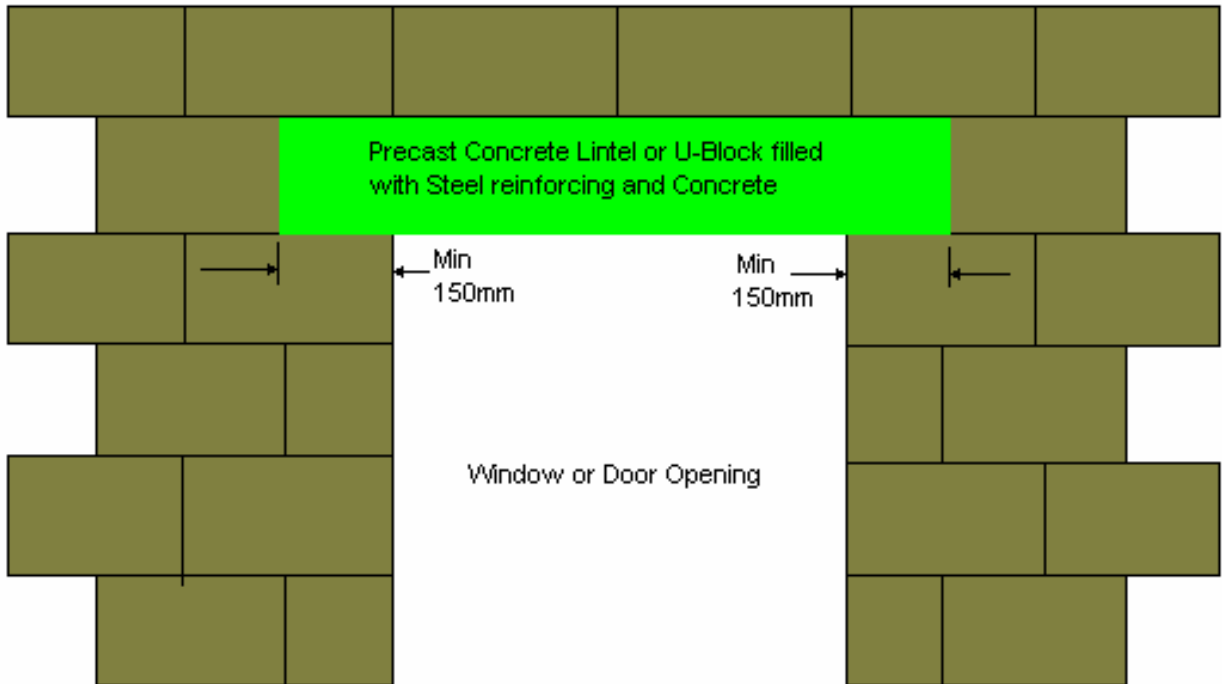


FIGURE 15 : BLOCKWORK

3.3 Lintels or U-Blocks

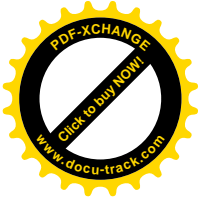
Concrete lintels or U-blocks filled with steel and concrete should be used over all door and window openings in the blockwork to prevent cracking. The lintel must extend at least 150mm past the edges of the opening as shown in Figure 16. The use of U-block ring beams and ground beams in houses are most desirable and can be used instead of lintels.



**FIGURE 16 :
CONCRETE LINTEL OR U-BLOCKS OVER DOOR & WINDOW OPENINGS**



**FIGURE 17 :
CONSEQUENCES OF NOT USING A LINTEL OR REINFORCED U-BLOCKS**



3.4 *Doors & Windows*

If a 1.0mm or thicker steel doorframe is used it may not be necessary for a lintel over this opening as the doorframe should be capable of supporting the blockwork above the opening. Special window frames are available with a steel plate welded to the top of the frame. Where these frames are used it may not be necessary to use a separate lintel over the opening. An example of this is the Clisco window.

The area of window openings required for lighting and ventilation is at least 10% of the floor area of the rooms and these openings must be in the external walls. (For a 40m² house, a minimum area of 4m² of window openings are required)

2 External treated, braced, solid-core hardwood doors are required per house.

Door and Window Frames must be properly fixed with hoop iron ties or lugs into the walls during construction. Mortar must be placed between the frame and wall.

In coastal areas (areas falling within the area between the coast and an imaginary line drawn 30km inland parallel to the coast, or the top of an escarpment or watershed of first mountain) all steel door and window frames to be hot-dipped galvanized with not less than 450g/m².

The blockwork adjacent to door openings must have a Y10 reinforcing bar included from foundation level up to lintol level and the openings must be filled with grade 25 concrete to secure the steel and form a portal.

Locksets to external and internal doors must be 3-lever and 2-lever respectively. Mortice locks and furniture must meet SANS standards.

3.5 *Window Sills*

Window Sills must be installed to guide water running down the window away from the wall. Sills must extend at least 15mm out from the wall, be sloped down and have damp proofing installed as shown in Figure 18 below. It is essential to get the overhang and damp proofing done correctly.

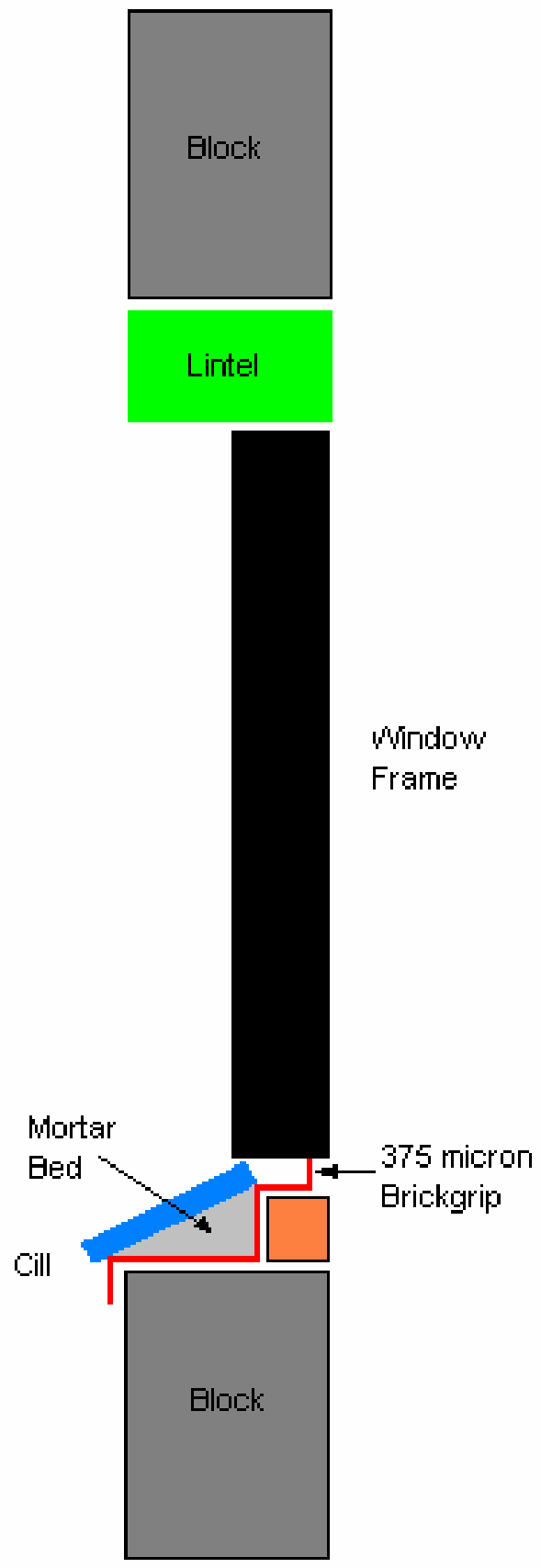
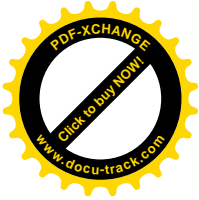
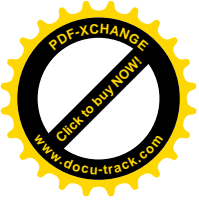


FIGURE 18 : WINDOW SILL



4 Roofing

If corrugated / IBR profile iron roof sheeting is used it must be a minimum of 0.5mm thick. To assist with preventing leaks, it is preferred if a single roof sheet is used instead of joining separate sheets or using ridge capping. Where the roof is double-pitched, a cranked roof sheet can be obtained. A minimum end lap of 250mm is however required for galvanized corrugated iron roofing. Side-laps & overhang are to be in accordance with manufacturers requirements. This is normally 1 ½ corrugations.

For asbestos-free corrugated fibre-cement sheets (e.g. Nutec) a minimum end lap of 250mm is required. Side-laps & overhang are to be in accordance with manufacturers requirements.

Timber used for trusses and other roof members must have a minimum grade 5 (Stamped SABS or SANS Approved) requirement. (ie Structural Grade & Treated)

Where the correct grade timber is not freely available, steel trusses and roofing systems should be used instead as an alternative.

The roof must be constructed so that the ceiling height is at least 2.4m above the finished floor level and the roof must have a minimum slope of 11°.

4.1 Roof Ties

Roof Ties are to be incorporated into the blockwork at least two block courses (400mm) below the wall plate. A galvanized strap or double strand 4mm galvanized wire is to be used. Roof ties should be tied to the brickforce layer at window height. To secure the ties, the openings in the blocks are to be filled with grade 10 concrete.

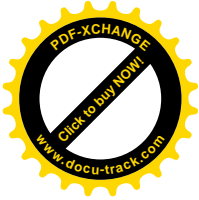
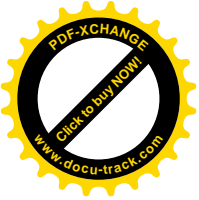
5 Painting and Wall Finishes

Houses must be adequately waterproofed to ensure that the beneficiaries will live in a safe and healthy environment. Although plastered walls are preferred, it is normally adequate to bagwash and paint the walls externally. A cementitious waterproofing paint like cemcrete or stipplecrete is most suitable for this purpose.

Budget constraints normally prohibit the plastering and painting of internal walls which is usually undertaken by the beneficiaries themselves at a later stage.

Doors and ironmongery normally get delivered with a primer. This coating usually gets damaged during delivery to site. Before painting the doors and window frames, the damaged primer must be repaired. The affected area is to be lightly sanded and painted with red oxide paint. All steel door and window frames must receive a coat of enamel paint after installation.

Paints used must be to SANS standards for external use i.e. must include UV Protection.



6 Plumbing & Drainage

Sewer pipes should be laid with a constant fall from the house to the connection provided to the erf in as straight a line as possible. Rodding eyes are to be provided at every bend.

7 House Plan

Typical House plans have been attached at the end of this document as possible examples for guidance.

Two external doors are also required for safety reasons. An internal wall is also needed to ensure privacy for the occupants.

Building Plans for each site must also be approved by the relevant local municipality. These plans are to show the house position, connection to services, building lines and access details.

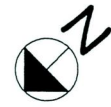
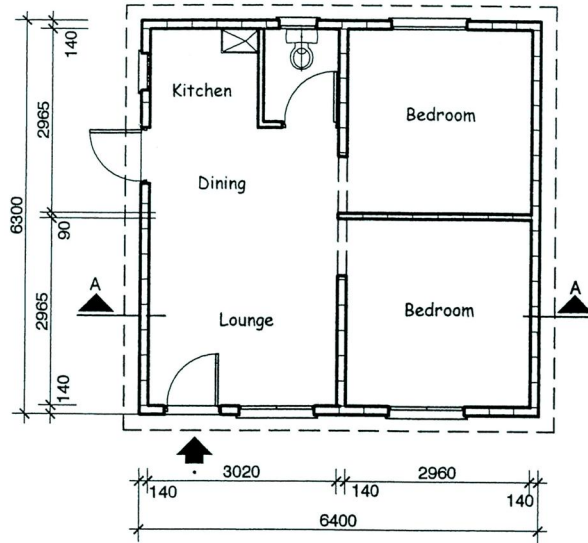
8 Housing Inspection Quality Control Checklist

A checklist has been included at the end of this document to highlight the aspects that can be inspected to ensure that quality houses are being provided.

9 Quality HOTLINE

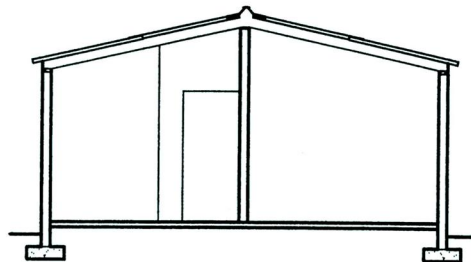
Should anyone have any questions regarding Norms and Standards or if anyone wants to report specific cases of poor quality please contact the Quality HOTLINE on 040-6095420. If the people manning the quality HOTLINE cannot immediately assist you, they will take down your details, investigate the matter and get back to you as soon as possible

Example



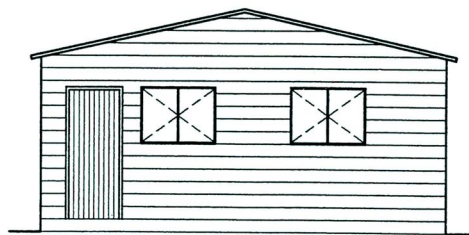
FLOOR PLAN

Scale 1:100
Area 40 m²



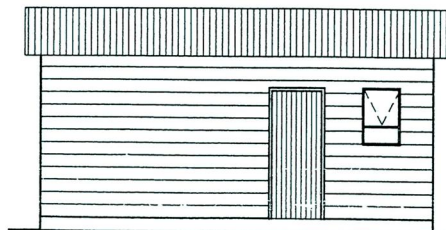
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FRONT ELEVATION

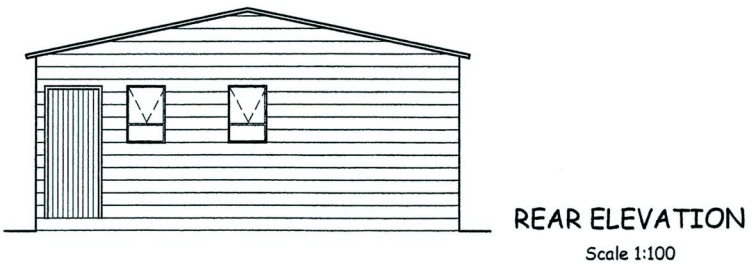
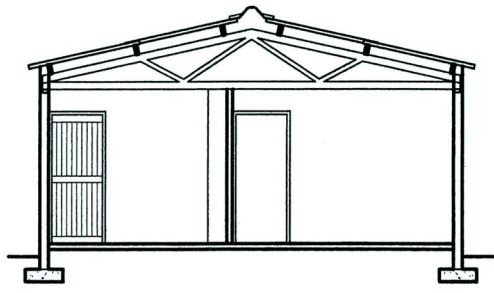
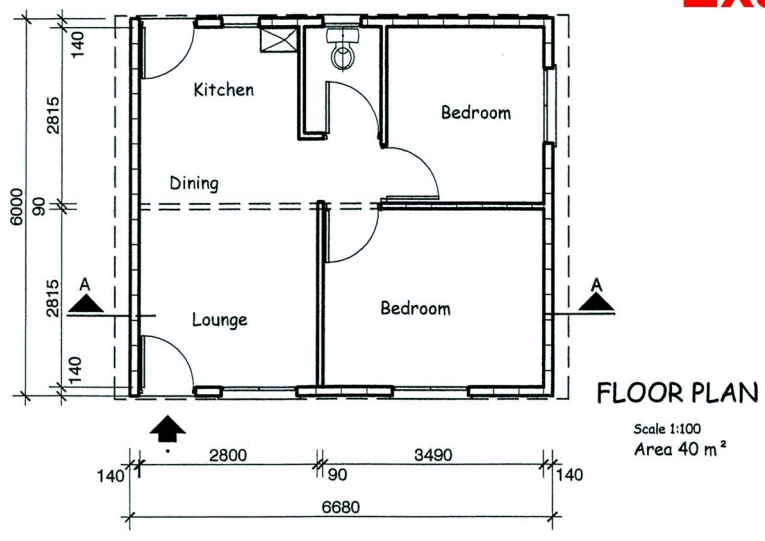
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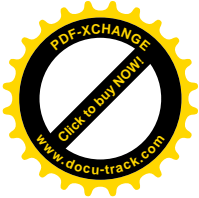
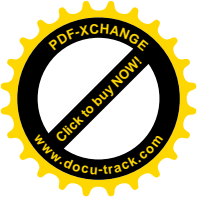


SIDE ELEVATION

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Example

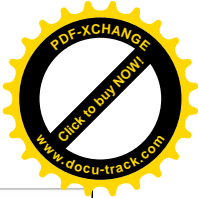
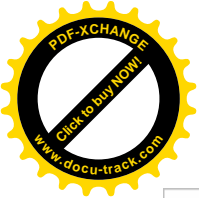




These costs are merely illustrative and were obtained during January 2005.

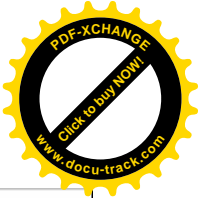
BILLS OF QUANTITIES FOR PHB MINIMUM SPEC (40m²) HOUSE (L.Diaz)						
PRICE AS OF JANUARY 2005						
Item	Supplier	Qty	Unit	Waste Factor	Rate	Price
Foundation Footing Material						
1 Sand for concrete footings		2.4	m ³	10%	65.00	169.67
2 Cement for concrete footings		21.4	Pkt	5%	40.50	908.21
3 Stone for concrete footings		2.4	m ³	5%	180.00	448.50
4 Steel reinforcement for footings		0.0	Kg	5%	0.00	0.00
						1526.37
Foundation Wall Material						
1 Grade 10 concrete in cavities of blocks		0.3	m ³	5%	550.00	173.25
2 M6 Blocks		124	No	5%	4.07	528.85
3 M4 Blocks		59	No	5%	3.33	204.55
4 Brickforce 90 in walls		12	m	5%	0.42	5.29
5 Brickforce 140 in walls		25	m	5%	0.42	11.03
6 Sand for mortar		0.1	m ³	10%	65.00	9.16
7 Cement for mortar		0.6	Pkt	5%	40.50	27.23
7 90mm Brickgrip DPC on walls		12	m	5%	0.42	5.29
8 140mm Brickgrip DPC on walls		25	m	5%	0.58	15.23
						979.86
Slab Material						
1 DPM		39	m ²	10%	3.44	148.90
2 Sand for concrete slab		2.0	m ³	10%	65.00	142.14
3 Cement for concrete slab		17.9	Pkt	5%	40.50	760.86
4 Stone for concrete slab		2.0	m ³	5%	180.00	375.73
5 Imported fill		5	m ³	10%	65.00	381.10
6 Mesh reinforcement		0	m ²	5%	0.00	0.00
						1808.73
External Wall Material						
1 M6 Blocks in walls		564	No	5%	4.07	2409.19
2 U-Block		0	No	5%	0.00	0.00
3 Brickforce 90 in walls		42	m	5%	0.42	18.52
4 Brickforce 140 in walls		136	m	5%	0.42	59.98
5 Sand for mortar / concrete		0.4	m ³	10%	65.00	31.04
6 Cement for mortar / concrete		2.2	Pkt	5%	40.50	92.30
7 Stone for concrete		0.0	m ³	10%	180.00	0.00
8 Steel reinforcement for U-block		0	Kg	5%	0.00	0.00
9 Window cill blocks		0	No.	5%	0.00	0.00
						2611.02
Internal Wall Material						
1 M4 Blocks in walls		283	No	5%	3.33	989.95
2 M4 1/2-block		0	No	5%	0.00	0.00
3 M4 corner block		0	No	5%	0.00	0.00
4 Modular block		0	No	5%	0.00	0.00
5 Brickforce 90 in walls		57	m	5%	0.00	0.00
6 Sand for mortar		0.2	m ³	10%	65.00	11.34
7 Cement for mortar		0.8	Pkt	5%	40.50	33.71
						1034.99
Roof Structure Material						
1 Designed truss		1	No	0%	307.00	307.00
2 50 x 150mm SAP rafter 3.6m long		12	No	0%	71.45	857.40
3 50 x 76mm SAP Wall plate 3.6m long		0	No	0%	0.00	0.00
4 M6 blocks in gables		119	No	5%	4.07	509.08
						1366.48
Roof Covering Material						
1 0.5mm Gms cranked IBR roof sheet , 6.8m long		9	No	0%	173.73	1563.57
2 Roll top ridging		0	m	10%	0.00	0.00
3 Roofing screws		120	No	5%	0.20	25.20
						1588.77
Internal Plumbing Material						
1 Cistern, pan & toilet seat		1	No	0%	195.90	195.90
2 Bibtap		1	No	0%	54.10	54.10
3 Pan connector		1	No	0%	19.15	19.15
4 Sink		1	No	0%	97.81	97.81
5 Water fittings (see list below)		1	item	0%	191.09	191.09
						558.05
External Plumbing Material						
1 Sewer pipe & fittings (see list)		1	No	0%	573.21	573.21
2 Water supply pipe & fittings		1	No	0%	33.55	33.55
3 Gully complete		0	No	0%	0.00	0.00
						0.00
						606.76

Page 1



External Door Frame								
1	1.2mm Steel door frame (140mm)	2	No	0%	138.89	277.78		
2	Grade 25 concrete in cavities of blocks	0.1	m ³	0%	500.00	50.00		
3	Y10 reinforcing bar 2.2m long	4	No	0%	10.00	40.00		
						367.78		
Internal Door Frame								
1	1.2mm Steel door frame (90mm)	3	No	0%	116.67	350.01		
2		0	No	0%	0.00	0.00		
						350.01		
Window Material								
1	Cliscoe window size 400 x 600mm	2	No	0%	147.50	295.00		
2	Cliscoe window size 1200 x 800mm	3	No	0%	250.00	750.00		
3	Concrete cill	0	m	10%	0.00	0.00		
4	PCC lintol 1500mm long	0	No	0%	33.20	0.00		
						1045.00		
External Door								
1	External Meranti door	2	No	0%	359.00	718.00		
3	Mortice lockset 3-lever	2	No	0%	52.00	104.00		
						822.00		
Internal Door								
1	Masonite HC door	3	No	0%	85.00	255.00		
2	Mortice lockset 2-lever	3	No	0%	47.00	141.00		
						396.00		
Glazing								
1	3mm Float glass in panes for wdw size 1200 x 800mm	3	No	0%	90.00	270.00		
2	3mm Obscure glass pane for wdw size 400 x 600mm	2	No	0%	21.60	43.20		
3	Putty	2.0	Bag	5%	0.00	0.00		
						313.20		
Finishing								
1	Stipplecrete	3	Bags	5%	141.40	445.41		
2	M4 blocks in beamfilling	63	No	5%	3.33	220.28		
3	Varnish to external doors	1.0	L	5%	32.00	33.60		
4	Gloss enamel to windows & door frames	0.6	L	5%	40.00	25.20		
5	Concrete in aprons	1.5	m ³	5%	550.00	866.25		
						665.69		
TOTAL MATERIAL COST						R 16,040.71		

Page 2



SCHEDULE OF PLUMBING GOODS FOR 40m² HOUSE

Internal Water Supply Fittings						
1	15mm Polycop pipe	2	m	0%	1.58	3.16
2	15mm Copper connector	1	No	0%	14.95	14.95
3	15mm Tee	1	No	0%	0.00	0.00
4	15mm Stopcock	1	No	0%	16.88	16.88
						34.99
External Water Supply Fittings						
1	15mm Polycop pipe	8	m	0%	0.00	0.00
2	15mm Copper connector	1	No	0%	5.80	5.80
3	15mm Elbow	3	No	0%	8.25	24.75
4	Thread tape	1	No	0%	3.00	3.00
						33.55
External Sewer Fittings						
1	110mm PVC pipe	8	m	0%	16.56	132.48
2	110mm Y-junction	0	No	0%	42.07	0.00
3	110mm IE bend	1	No	0%	34.62	34.62
4	110mm Socket	2	No	0%	30.00	60.00
5	110mm Plain bend	3	No	0%	34.62	103.86
6	110mm Rodding eye	2	No	0%	43.25	86.50
7	50mm PVC pipe	6	m	0%	15.00	90.00
8	40mm PVC pipe	1	m	0%	15.00	15.00
9	50mm Vent valve	1	No	0%	25.75	25.75
10	40-50mm Reducer	1	No	0%	15.00	15.00
11	PVC weld	1	No	0%	10.00	10.00
						573.21
Internal Sewer Fittings						
1	110mm PVC pipe	2	m	0%	30.03	60.06
2	110mm Pan connector	1	No	0%	0.00	0.00
3	110mm IE bend	1	No	0%	39.00	39.00
4	110mm Socket	1	No	0%	10.00	10.00
5	40mm PVC pipe	2	m	0%	15.00	30.00
6	40mm Bend	1	No	0%	1.97	1.97
7	40mm Flexitrap	1	No	0%	15.07	15.07
						156.10



Page 3

Mixes for concrete





Low-strength concrete 15MPa

Suitable for unreinforced foundations for single storey houses and free-standing walls. 1 part Holcim All Purpose Cement + 3½ parts coarse sand + 3½ parts stone. To make a mix for 1 cubic metre of low-strength concrete you will need: 5,7 bags of Holcim All Purpose Cement + 0,65 cubic metres of coarse sand + 0,65 cubic metres stone. Allow an additional 10% of required quantities for wastage.





Batching by bucket

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
1 Bucket	3½ Buckets	3½ Buckets	5½ Buckets

Batching by wheelbarrow

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
2 Bags (1=50kg)	3½ Wheelbarrows	3½ Wheelbarrows	0,35 m





Quantities per m³ of concrete

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
5,7 Bags (1=50kg)	0,65 m	0,65 m	1m





Medium-strength concrete 25 MPa

Suitable for reinforced foundations and slabs, light-duty house floors, paths, patios, steps, driveways and garage floors. 1 part Holcim All Purpose Cement + 2½ parts coarse sand + 2½ parts stone. To make a mix for 1 cubic metre of medium-strength concrete you will need: 7,7 bags Holcim All Purpose Cement + 0,63 cubic metres of coarse sand + 0,63 cubic metres stone. Allow an additional 10% of required quantities for wastage.

Batching by bucket

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
1 Bucket	2½ Buckets	2½ Buckets	4 Buckets

Batching by wheelbarrow

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
2 Bags (1=50kg)	2½ Wheelbarrows	2½ Wheelbarrows	0,26 m

Quantities per m³ of concrete

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
7,7 Bags (1=50kg)	0,63 m	0,63 m	1m

High-strength concrete 30 MPa


Suitable for suspended structural beams and slabs, precast items such as flagstones and heavy-duty floors such as workshop floors. 1 part Holcim All Purpose Cement + 2 parts coarse sand + 2 parts stone. To make a mix for 1 cubic metre of High-Strength concrete you will need: 9,23 bags of Holcim All Purpose Cement + 0,6 cubic metres of coarse sand + 0,6 cubic metres stone. Allow an additional 10% of required quantities for wastage.

Note: Specified strength is the resultant strength of the mix at an age of 28 days.

Batching by bucket

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
1 Bucket	2 Buckets	2 Buckets	3½ Buckets

Batching by wheelbarrow

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
2 Bags (1=50kg)	2 Wheelbarrows	2 Wheelbarrows	0,22 m

Quantities per m³ of concrete

All Purpose Cement	Coarse sand	Stone	Approximate yield
			
9,23 Bags (1=50kg)	0,60 m	0,60 m	1m

Mixes for mortar

Class 1
Highly stressed masonry incorporating high strength structural units as used in multi-storey loadbearing buildings and walls exposed to severe dampness.

Mix A
Exterior/ Exposed to dampness.

Mix B
Interior/ Dry.

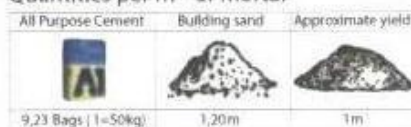
Batching by bucket



Batching by wheelbarrow



Quantities per m³ of mortar



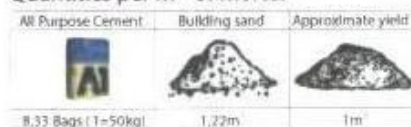
Batching by bucket



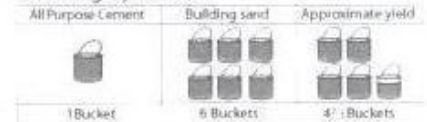
Batching by wheelbarrow



Quantities per m³ of mortar



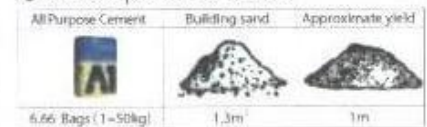
Batching by bucket



Batching by wheelbarrow



Quantities per m³ of mortar



Quantities of popular sizes of masonry units and corresponding mortar requirements

Masonry unit type	Masonry unit size (mm)			Masonry units per m ² (single leaf wall)	Mortar required in m ³	
	Length	Width	Height		Per 1 000 units	Per 100 m ² of walling
Standard brick	222	106	73	52	0.32	1.66
Maxi block	290	140	90	34	0.55	1.87
Common blocks	390	90	190	13	0.53	0.69
	390	140	190	13	0.83	1.08
	390	190	190	13	1.12	1.46

Quantities for mix B mortar

Masonry unit type	Masonry unit size (mm)			50 kg bags of All Purpose Cement per 1000 units	Cubic metres of building sand per 1000 units
	Length	Width	Height		
Standard brick	222	106	73	2,1	0,4
Maxi block	290	140	90	3,6	0,7
Common blocks	390	90	190	3,5	0,7
	390	140	190	5,5	1,1
	390	190	190	7,4	1,4

Notes

- The tables are based on exact sizes of solid masonry units with 10 mm thick bedding, 10 mm thick vertical joints and no wastage.
- There are numbers of factors which may influence mortar quantities. The following adjustments should be made:
 - To allow for wastage, increase all mortar mix quantities:
 - by 10% for excellent control on site
 - by 30% for average control on site
 - For hollow units, reduce mortar quantities by:

Width of Units, mm	% Reduction
90-110mm	20
140mm	30
190-220mm	40

- For units with perforations or holes, increase mortar quantities by 15%.
- For units with frogs with the frog laid face up (as required for structural walls), increase mortar quantities by 15%.

Mixes for plaster

Mix A
Exterior/ Exposed to dampness.

Mix B
Interior/ Dry.

Batching by bucket

All Purpose Cement	Plaster sand	Approximate yield
1 Bucket	4 1/2 Buckets	3 1/2 Buckets

Batching by bucket

All Purpose Cement	Plaster sand	Approximate yield
1 Bucket	6 Buckets	4 1/2 Buckets

Batching by wheelbarrow

All Purpose Cement	Plaster sand	Approximate yield
2 Bags (50 kg)	4 1/2 Wheelbarrows	0,24 m ³

Batching by wheelbarrow

All Purpose Cement	Plaster sand	Approximate yield
2 Bags (50 kg)	6 Wheelbarrows	0,3 m ³

Quantities per m³ of plaster

All Purpose Cement	Plaster sand	Approximate yield
8,33 Bags (1=50kg)	1,22m ³	1m ³

Quantities per m³ of plaster

All Purpose Cement	Plaster sand	Approximate yield
6,66 Bags (1=50kg)	1,3m ³	1m ³

Area of plaster per 2 bag mix

All Purpose Cement	Plaster thickness	Area of wall (m ²)
	10 mm	24
	15mm	16
	20 mm	12

Area of plaster per 2 bag mix

All Purpose Cement	Plaster thickness	Area of wall (m ²)
	10 mm	30
	15mm	20
	20 mm	15

Notes

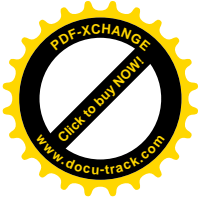
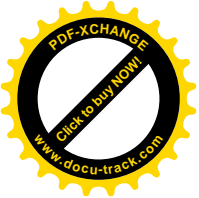
- Sand, stone and water should be clean.
- Add only enough water to make the mix workable. Too much water weakens the mix.
- Mix until the entire dry mix is the same colour before adding water.
- Stone for concrete should be between 19 and 26 mm in size. For 13,2mm or 9,5 mm stone, reduce the proportion of stone in the mix by 25%.
- Wheelbarrows used in the illustrations are builders' wheelbarrows with a 65 litre capacity.
- Concrete strengths for the mixes specified may vary ± 5 MPa at an age of 28 days.
- Special care should be taken when placing thin sections.

Retempering

All mixes should be used up within a maximum of two hours being mixed and must never be retempered by mixing in additional water, as this reduces the resultant strength of the mix.

Curing

After your concrete, mortar and plaster work has been completed, it is essential to protect it from the sun and wind by covering it with a plastic sheet, damp sand or hessian and to keep it moist for a minimum of 7 days.



Housing Inspection - Quality Control Checklist

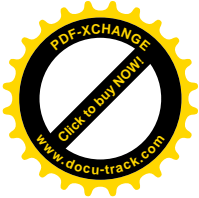
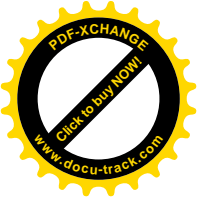
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Number Units

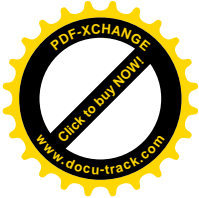
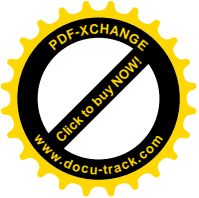
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Site Number

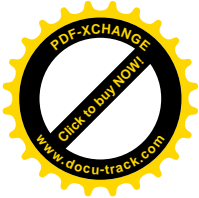
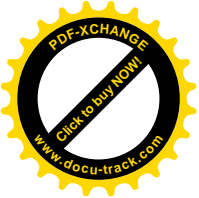
	Date	Initials	Comments
1. Site Preparation			
1	An area extending 1.5m beyond perimeter of house cleared of all refuse and vegetation		
2	Loose or disturbed ground compacted		
3	Site examined for termite workings and treated		
4	Site drainage		
5	Service trenches preferably not less than 1.5m from building		
2. Foundation Preparation			
1	Topsoil containing grassroots removed		
2	Loose or disturbed soil compacted also prior to casting of foundation		
3	Accurate setting out of foundations - square		
4	Width of trench (500mm external; 400mm internal)		
5	Depth of trench (400mm for strip footings and 300mm for slab-on-the-ground)		
6	Sides vertical		
7	Bottom level or slope of not steeper than 1:10		
8	Steps not more than 400 mm in high and in multiples of course height and not close than 1.0m from corner; overlap 400mm		
9	Correctly dealt with boulders and soft spots of less than 1.5m		
3. Fill Material			
1	Contains little or no organic material		
2	Excludes stones > 75mm; no more than 10% stone of 50mm		
3	Contains no large lumps of clay that do not break up under compaction nor predominantly clayey material		
4	Be such that it can be placed without voids		
4. Compaction			
1	Hand compaction - layer thickness not more than 100mm		
2	Machine compacted - layer thickness not more than 150mm		
3	Correct moisture content		
4	Not more than 400mm of compacted fill. If more to be approved by competent person		
5. Under floor membranes			
1	Membranes at least 0.25mm thick		
2	Over lapping of membranes at least 200mm		
3	No holes or tears in sheet		
4	Turned up around floor slab till at least thickness of floor slab		
6. Concrete and Masonry Work in Foundations			
1	Concreting as far as possible in one continuous operation		
2	Concrete placed asap after excavation and inspection		
3	Cast level and to correct height - thickness of 1st bed joint <30mm		
4	Minimum concrete thickness of 200mm except in rock, 10MPa @ 28 days		
5	Upper surface of floor slab at least 150mm above ground level		
6	Foundation Mix: 2bags cement + 4 barrows sand + 4 barrows stone		
7	Floor slab Mix: 2bags cement + 3 barrows sand + 3 barrows stone		
8	Floor slab at least 75mm thick		
9	Floor slab to be wood floated and then steel troweled		
10	Reinforcement as per specification - min cover of 50mm all round		
11	Foundation Walls: Max difference in height in ground levels for: 140mm blocks = 400mm; 190 mm blocks =600mm. Cavities filled with grade 10 infill concrete		



7. Masonry Units				
1	Block strength: Average 3.0MPa; Individual 2.4MPa			
2	Block intact - no corners broken off of more than 15mm			
3	Cement bags to carry SABS (SANS) mark			
4	Sand must contain no organic material, stones > 5mm, have a sufficiently small clay content, when mixed in correct proportions is workable			
5	Water used must be fit for drinking			
6	Brick force - main wires 2.8mm thick every 2nd course (400mm)			
7	Damp Proof Course 0.375mm			
8	Material stored: dry, safe, stored to prevent contamination			
9	Mortar Mix: 1bag cement + 3 barrows sand			
10	Mortar to be used within 2 hours, if initial set occurred - discard			
11	Bed joints nominal thickness of 10mm; between 5 and 15mm			
12	Pertend joints nominal thickness of 10mm; between 5 and 20mm			
8. Laying of Masonry Units (Walls)				
1	Concrete units must be laid dry			
2	Hollow units to be shell bedded vertical and horizontal			
3	Re-laid units if initial bond is broken when disturbed			
4	All perpend and bed joints shall have a nominal thickness of 10mm			
5	in hot windy conditions units to be laid within 1 minute of bedding mortar being spread			
6	All walls shall be built true and plumb with all alternate perpend joints in vertical alignment			
7	Brick force every 2nd layer of blocks with longitudinal wires in shell mortar			
8	Cores of hollow blocks to be solidly filled in with infill grade 10 concrete where hoop iron straps are used (1.2x30x700mm) max vertical spacing 450mm			
9	All reinforcement to be clean and free of rust			
10	Internal walls - galvanized hoop iron straps every second course			
11	Lintels set in mortar with at least 150mm bearing length			
12	Lintels cleaned and wetted prior to receiving mortar			
13	Mortar bed under window sill with DPC and sill			
14	Windowsill projected at least 15mm past finish wall face			
15	Window and door frames min 1.0mm steel			
16	All spaces between steel window frame and masonry filled with suitable sealant; window frames cleaned of mortar			
17	All spaces between steel doorframe and masonry filled with mortar; doorframes cleaned of mortar			
18	Core of blocks adjacent to door frame filled with grade 25 concrete and a Y10 bar extending from floor level to top of lintel			
19	All plumbing and wiring placed in hollow core of blocks			
20	All lugs to frames turned down into core filled with infill concrete			
9. Roof Structure				
1	Roof ties - two strands of 4mm galvanized steel wire			
2	Roof ties 400mm minimum anchor depth & core of blocks filled with grade 25 fill concrete			
3	Wall plate (50x76) in place if trusses are used			
4	Trusses inspected and correct (if used)			
5	Purlins rafter / beams: SANS 5 - 152x50 @ 1 000mm c/c; max span 3.2m			
6	Roof sheets - Galvanized iron 0.5mm; Fiber cement 5.0mm thick			
7	Over lapping of sheets at least 1.5 corrugations or manufactures specifications			
8	End overlaps: 11° - 300mm; 17° -250mm (unsealed)			
9	Roof overhang (eaves) at least 100mm or sufficient to fit gutters			
10	Beam filling done			



10. Doors and windows			
1	Hardwood solid doors for external doors (framed, ledged & braced)		
2	Hollow core internal doors		
3	Locks - SANS approved (both mortice lock sets & furniture): 3 lever external, 2 lever internal		
4	Minimum glass thickness 3mm or to manufacturers specification		
5	Door frames cleaned, primed and painted		
6	Window frames cleaned, primed and painted		
7	External doors varnished		
11. Southern Coastal Condensation Problem Areas			
1	Plaster 12mm thickness		
2	Ceiling: 6.4mm gypsum plaster board or 4mm fiber cement nailed to 38x50mm brading @ 450mm c/c		
3	Insulation: 80mm glass fiber or mineral wool insulation		
12. Site clearing			
1	Site is cleared of all building rubble		
2	Beneficiary satisfied		



Acknowledgements

MEC

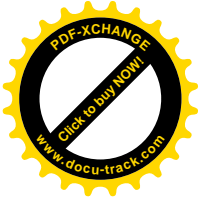
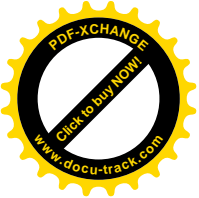
Housing, Local Government and Traditional Affairs

Mr Mzamo

General Manager Housing
Alfred Nzo District Municipality
OR Tambo District Municipality
Amathole District Municipality
Chris Hani District Municipality
Ukhahlamba District Municipality
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Nelson Mandela Metropolitan Municipality
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Developing Sustainable Communities

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