Concrete masonry: Strong, durable and attractive
ACKNOWLEDGEMENTS

The assistance of the following organisations in compiling this publication is acknowledged.

FS Crofts
Hilti
Institute for Timber Construction Limited
MITEK
Soderlund and Schutte
The South African Institute of Steel Construction
The South African Lumber Miller Association

USE OF COMPUTER AIDED DESIGN (CAD)

The drawings in this manual are available on CD in various CAD formats.
Please contact the Concrete Manufacturers Association if you require this disc.

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Concrete masonry: Strong, durable and attractive

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Guidelines on the

DETAILING OF

CONCRETE MASONRY

VOLUME 2 HOLLOW UNITS – 140mm and 190mm

Editors: J W Lane J E Cairns JH Catsavis
Successful masonry depends on adequate design and specification of materials, sound construction practice and an acceptable quality of workmanship. Good workmanship is in turn dependent on access to accepted norms of local detailing practice and materials.

The purpose of this booklet is to provide guidelines for the detailing of concrete masonry structures. It should be read in conjunction with the Concrete Manufacturers Association’s Masonry Manual, the National Building Regulations, and National Home Builders Registration Council Home Building Manual the relevant South African Bureau of Standards specifications and codes of practice.
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140 mm and 190 mm HOLLOW UNITS
SINGLE LEAF WALLS (REFERENCE H-***)

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- Appendix E: Ties, Straps and Bedding Reinforcement
- Appendix F: Detailing practice for reinforced masonry
- Appendix G: V-Joints in plaster and mortars

Reference:  
Refer to:  
Volume 1 for details of 140 mm solid unit walls  
Volume 3 for details of cavity walls
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### Notes:
The computer reference number is the file name under which the individual drawings are stored. The last two digits (indicated with an asterix above) represent the numbering of drawing in that particular category. Where the last two digits are replaced with the letter “NB”, this file contains notes which are pertinent to the drawings in the particular category.
Concrete masonry has wide applications in modern industrial, commercial, educational and residential buildings.

The main types of masonry walls dealt with in these guidelines are: single leaf walls using solid units (Part 1), single leaf walls using hollow units (Part 2) and cavity walls (Part 3).

The details shown in this publication are intended merely as a guide. Each construction situation is unique and there are many factors to be considered before a detail is finalised – far too many for inclusion here.

The purpose of good detailing is to assist in achieving sound construction and a buildable structure that will perform well in service.

The following factors must be taken into account when detailing for concrete masonry structures:

**Materials:**
- Concrete masonry units:
  - solid/hollow – dimensions
  - non-face/face – texture, colour and profile properties and availability.
- Mortar:
  - Class to be used plus materials. (Will mortar sand result in high shrinkage of mortar and wall?)

**Environmental conditions:**
- Environment:
  - Orientation
  - Likelihood of significant movement due to temperature and moisture variations
- Earth/Seismic movement

**Service conditions:**
- Loading:
  - dead, imposed, wind, unexpected
- Aggressive conditions:
  - corrosion

**Type of structure**
- Unreinforced/reinforced/prestressed
- Composite structure:
  - masonry/reinforced concrete
  - masonry/prestressed concrete
  - masonry/structural steel
  - masonry/timber and their interaction

**Design**
- Modular co-ordination of building elements – work to 200mm module horizontally and 100mm (and 200mm when using facings) vertically.

Details in these guidelines do not necessarily apply to masonry structures over four storeys in height.

Unless otherwise stated, the details shown are based on the “deemed to satisfy” clauses of SANS 10400 and the NHBRC Home Building Manual (HBM).

In this code of practice, only strip foundations are covered, but there may be a need for special foundations in particular cases. Authoritative advice should be obtained in this regard.

The information contained in this publication is intended as a guide only. The Concrete Manufacturers Association cannot be held responsible for its interpretation and use.
**FOUNDATION AND WALL DETAILS – EXTERNAL WALLS**

### H-FG-01
See H-FG-NB

- **STRIP FOUNDATION**
- Weep hole in perpend joints every 800mm
- Bond block may be used here concrete/mortar infill sloped outside

### H-FG-02
See H-FG-NB

- **STRIP FOUNDATION**
- Stepped DPC
- Concrete floor slab
- Damp proof sheeting
- Core filled with 15 MPa concrete

### H-FG-03
See H-FG-NB

- **THICKENED SLAB FOUNDATION**
- Weep hole in bedding course on top of foundation 30mm wide every 600mm
- Shell bedding
- DPC turned up and hidden behind skirting or scree
- Screed
- Dam proof sheeting
Note:

1. Thickened slab foundations may cause cracking with ground floor slab. Consider use of fabric reinforcement in slab to limit cracking.
2. The bearing capacity and sensitivity to moisture changes of soil may be unsatisfactory with thickened slab foundations.
3. Refer to SANS 10161 for foundation sizes based on specific soil conditions and Home Building Manual.
4. Bond or U-blocks, without dampproof sheeting, may be used in place of traditional DPC’s. The position of weepholes is changed – see details below. In all cases the mortar bedding is shell bedding with no mortar under webs.

5. Foundation material conditions will determine whether wall, concrete or steel columns share a common foundation around the column foundation area. Estimates of likely settlement between wall and column will determine the need or otherwise for movement (control) joints in the wall.
**STRIP FOUNDATION**

**H-FG-05**

Cores filled with 15 MPa concrete

DPC

Screed

Concrete floor slab

Dampproof sheeting turned up at ends and hidden behind screed or skirting

See H-FG-NB

**H-FG-06**

Cores filled with 15 MPa concrete

Concrete floor slab

Dampproof sheeting continuous under slab

See H-FG-NB

**H-FG-07**

Concrete foundation & floor slab

Dampproof sheeting continuous under concrete foundation

See H-FG-NB

**THICKENED SLAB FOUNDATION**
SILLS AND LINTELS

**H-SI-01**
See H-SI-NB

190 SILL

**H-SI-02**
See H-SI-NB

‘METAL WINDOW’ SILL

**H-SI-03**
See H-SI-NB

DPC SILL

**H-SI-04**
See H-SI-NB

140 SILL

**H-SI-05**

PRECAST SILL

**H-SI-NB**

Note:
It is recommended that the external sloping face of masonry sills be painted with a clear coating of water repellent.

**H-LI-01**
See H-LI-NB

ANGLE IRON/ U BLOCK LINTEL

**H-LI-02**
See H-LI-NB

U-BEAM LINTEL

**H-LI-03**
See H-LI-NB

SASH BLOCK LINTEL

**H-LI-04**
See H-LI-NB

BOND BLOCK LINTEL

**H-LI-NB**

Note:
1. Refer to CMA Design Guide and Technical Notes on lintels.
2. Units manufactured in different lengths

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<td>U-block 190/390mm</td>
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<td>Fair face bond block 390mm</td>
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</table>
**Sash groove**

**Sealant**

**Lintel**

**Reinforcement**

**Lugs to frame turned down into core filled with 15MPa concrete**

Overall window frame size:
- 625, 825, 1025, 1425, 1625

**Note:**
Sill blocks can be used on sides of windows. See H-WW-06

**STEELE WINDOW FRAMES OF MODULAR DIMENSIONS**
**Front Elevation Section**

- **Sash groove**
- **Sealant**
- **Lintel**
- **Reinforcement**
- **Lugs to frame turned down into core filled with 15MPa concrete**

**Overall window frame size:**
- 359, 654, 949, 1245, 1540, 1854

**Lintel to suit**

**Overall window frame size:**
- 533, 1022, 1511, 2000, 2489

**Sill to suit**

**Cut unit under sill to fit modular coursing**

**Note:**
- Sill blocks can be used on sides of windows. See H-WW-06

---

**Plan at X – X**

- **Plaster**
- **Sash block**

**Overall window frame size:**
- 533, 1022, 1511, 2000, 2489
STEEL DOOR FRAME 762 x 1981 TO FIT MODULAR SPACE 800 x 2000mm
DOOR FRAME DETAILS - STEEL FRAMES

STEEL DOOR FRAME 813 x 2032 TO FIT MODULAR SPACE 900 x 2100mm
DOOR FRAME DETAILS - ALUMINIUM FRAMES

ELEVATION

Door size 813 x 2032

Finished floor level

Joint widths adjusted to fix door frame in masonry except for fluted or scored units where modular size frame required

SECTION

9 modules = 900

21 modules = 2100

PLAN AT X – X

ALUMINIUM DOOR FRAME 813 x 2032 TO FIT MODULAR SPACE 900 x 2100mm
Many factors influence the detail to be used at the junction of suspended concrete floors. Consideration should be given to the following:

**STRUCTURAL ASPECTS**
- Is wall below slab structural or non-structural (i.e. infilling panel)?
- Is allowance to be made between top of supporting structural wall and slab for horizontal movement i.e. sliding? Or should there be fixity between wall and slab? (Note: Sliding or fixity considerations are significant factors in design of both wall and slab)

**DETAILING ASPECTS**
- Does suspended slab bear on full or part width of wall?
- Is exterior of wall face or plastered?
- Is damp proofing required?

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**SUSPENDED FLOORS ON EXTERNAL WALLS**

### H-SF-01
See H-SF-NB

![Diagram](image)

- 30mm wide weep hole in bedding mortar above DPC spaced at maximum 600mm centres
- V-joints in plaster
- Slab plane – see note
- Topping if required
- DPC bent up and hidden behind skirting or topping
- Slip plane – see note
- U/bond block beam suitably reinforced

**PLASTERED STRUCTURAL WALL SUPPORTING SLAB**

### H-SF-02
See H-SF-NB

![Diagram](image)

- 30mm wide weep hole in bedding mortar above DPC spaced at maximum 600mm centres
- 6mm bar cast in U/bond block beam with projecting leg to hold 90mm block above in position
- Facework
- DPC bent up and hidden behind skirting or topping
- Cast in-situ 20MPa concrete fillet
- Topping if required
- Concrete slab of non-modular thickness
- Slip plane – see note. 90mm minimum bearing under slab

**FACE STRUCTURAL WALL SUPPORTING SLAB OF NON-MODULAR THICKNESS**
**SUSPENDED FLOORS ON EXTERNAL WALLS**

**H-SF-03**
See H-SF-NB

**FACE STRUCTURAL WALL SUPPORTING SLAB OF NON-MODULAR THICKNESS**

**H-SF-NB**

**Note:**
1. If floor slab span exceeds 6m spanning on to wall and large movements expected consider a slip joint on top of wall, such as two layers of DPC or galv. sheet iron with grease between sheets or kilcher bearing or similar.
2. Structural stability & robustness may preclude use of slip joint.
3. If designer assumes wall laterally restrained by slab then slip joint not advisable.
4. Suspended floors either precast or cast-in-situ unless otherwise stated.
5. Where fixity required between slab and wall, reinforcement to be used to be determined by calculation.
6. Slabs of non-modular thickness require concrete infill (under modular size) or cut block (over modular size) to restore block coursing.

**Note:**
If upper wall structural check if load on cut block is sufficient to dislodge
**FACE STRUCTURAL WALL SUPPORTING SLAB OF MODULAR THICKNESS**

**H-SF-04**

See H-SF-NB

- 30mm wide weephole in bedding mortar above DPC spaced at maximum 600mm centres
- DPC bent up and hidden behind skirting or topping
- Topping if required
- Concrete slab of non-modular thickness
- Slip plane – see note.
- 90mm minimum bearing under slab
- Facework

**H-SF-05**

See H-SF-NB

- 30mm wide weephole in bedding mortar above DPC spaced at maximum 600mm centres
- DPC bent up and hidden behind skirting or topping
- Topping if required
- Concrete slab of modular thickness
- Slip plane – see note.
- 90mm minimum bearing under slab
- Facework

**Note:**

If upper wall structural check if load on cut block is sufficient to dislodge

---

**FACE STRUCTURAL WALL SUPPORTING SLAB OF MODULAR THICKNESS**
PLASTERED STRUCTURAL WALL WHERE FIXITY BETWEEN WALL & SLAB REQUIRED

**H-SF-06**
See H-SF-NB

30mm wide weep hole in bedding mortar above DPC spaced at maximum 600mm centres

DPC bent up and hidden behind skirting or topping

Topping if required

V joints in plaster

Plaster

Cast in-situ concrete slab incorporating projecting bar from U/bond block beam below

FACE STRUCTURAL WALL WHERE FIXITY BETWEEN WALL & SLAB REQUIRED OF MODULAR THICKNESS

**H-SF-07**
See H-SF-NB

30mm wide weep hole in bedding mortar above DPC spaced at maximum 600mm centres

DPC bent up and hidden behind skirting or topping

Topping if required

Cut face block forming outside shutter to cast in-situ concrete infill

Concrete slab with projecting bar cast into bond block beam

Concrete infill
**NON-STRUCTURAL INFILL PANEL WALL-LATERAL SUPPORT**

**H-SF-08**

See App C

- 30mm wide weep hole in bedding mortar above DPC spaced at maximum 600mm centres
- DPC bent up and hidden behind skirting or topping
- Slab soffit fixing
- Anchor
- Topping if required

Note:
Non-structural walls not to be built tight to underside of slab

**H-SF-09**

See App C

- 30mm wide weep hole in bedding mortar above DPC spaced at maximum 600mm centres
- DPC bent up and hidden behind skirting or topping
- Concrete slab of non-modular thickness
- Use cornice fixed to slab to hide gap
- Sections of metal channel fixed to slab soffit to project into top of bond block.
- Gap between top of block and slab soffit sealed with sealant.

**H-SF-10**

See App C

- 30mm wide weep hole in bedding mortar above DPC spaced at maximum 600mm centres
- DPC bent up and hidden behind skirting or topping
- Concrete slab of modular thickness
- Use cornice fixed to slab to hide gap
- 90mm wide unit resting on MS angle (galv. if required) fixed to slab
- 10mm min. gap between top of block and angle soffit sealed with sealant.

**FACE NON-STRUCTURAL INFILL PANEL WALL – NO LATERAL SUPPORT**

SUSPENDED FLOORS ON EXTERNAL WALLS
**SUSPENDED FLOORS ON INTERNAL WALLS**

**H-SF-11**
See H-SF-NB1

**H-SF-12**
See H-SF-NB1

**H-SF-13**
See H-SF-NB1

**H-SF-14**

**Note:**
If thickness of slab is not modular then concrete infill or cut blocks to be used in first course above slab to restore unit coursing to bond with external walls.

**STRUCTURAL WALL SUPPORTING JOINTED SLAB & WALL ABOVE**

**STRUCTURAL WALL SUPPORTING CONTINUOUS SLAB & WALL ABOVE**

**STRUCTURAL WALL SUPPORTING SLAB ONLY**

**H-SF-NB1**
**H-SF-15**

See App C

See H-SF-NB1

**H-SF-16**

See App C

See H-SF-NB1

**H-SF-17**

See App C

See H-SF-NB1

**NON-STRUCTURAL WALL WITH LATERAL SUPPORT AT SLAB SOFFIT**

- **Note:**
  - Non-structural walls not to be built tight to soffit of slab.

**NON-STRUCTURAL WALL WITH LATERAL SUPPORT AT SLAB SOFFIT**

- **Note:**
  - Non-structural walls not to be built tight to soffit of slab.

**NON-STRUCTURAL WALL WITH LATERAL SUPPORT AT SLAB SOFFIT**

- **Note:**
  - Non-structural walls not to be built tight to soffit of slab.
PARAPET WALLS, COPING & WATERPROOFING

**H-PW-01**

Pre-cast concrete coping to suit with recessed water drips

**H-PW-02**

Pre-cast concrete coping to suit with recessed water drips

**H-PW-03**

Liquid applied reinforced emulsion waterproofing system with non-woven fabric on bond or U-beam or unit filled with 20 MPa concrete

**H-PW-04**

0.6 to 0.8mm galvanised or prepainted metal cap flashing usually 3m lengths – lapped at joints – screw fixed to back of wall – horizontally slotted holes in cap – on bond or U-beam or unit filled with 20 MPa concrete

**H-PW-05**

Liquid applied reinforced emulsion waterproofing system with non-woven cloth

**H-PW-NB**

1. Parapet walls to be designed for wind loading
2. Where conditions are such that the coping is likely to be dislodged some mechanical fixing of coping to wall to be considered
3. Parapet walls to be designed to accommodate horizontal movements whilst maintaining structural stability

**LIQUID APPLIED WATERPROOFING SYSTEM**

It is recommended that the external sloping face of sill block be painted with a clear water repellent.

**MASONRY COPING**

**WATERPROOFING – PARAPET WALLS / ROOF SCREEDS**

**Note:**
Details of junctions of roof slabs on walls are as for junctions of suspended slabs on walls
**ROOF TRUSS FIXING TO WALL**

**H-RT-01**

See App D

See H-RT-04

**ROOF ANCHORAGE TO BEAM**

Galv. steel wire or hoop iron strap wrapped around reinforcing bar and cast into U-beam, fixed to roof truss. Where length of anchorage is inadequate use bond/U-beam over opening then ends of beam to be anchored to greater depth into wall.

**H-RT-02**

See App D

**ROOF ANCHORAGE TO WALL**

Galv. steel wire or hoop iron strap placed in cores of blocks. Cores filled with 15 MPa concrete

**H-RT-03**

See App D

**BEAM FILLING**

Galv. steel wire or hoop iron strap placed in cores of blocks. Cores filled with 15 MPa concrete

Mesh to support concrete infilling

**H-RT-04**

See App D

**ANCHORING ROOF TRUSSES OVER OPENINGS**

Anchors to tie lintel to wall where required, bent into lintel

U-block on end can be used to close end of masonry lintel

Plan
H-RT-05

See App D

H-RT-06

See App D

H-RT-07

See App D

ROOF TRUSS FIXING TO PARAPET WALL

Hollow units supporting roof truss members to be filled with 15 MPa concrete to take bolts

Mesh to support concrete in core

Fixing to hollow unit cores filled with 15 MPa concrete or angle support

Mesh to support concrete in core

140/190

Coping to suit

Flashings

Roof sheeting/tiles

ROOF TRUSS FIXING TO PARAPET WALL

H-RT-05

See App D

H-RT-06

See App D

H-RT-07

See App D

ROOF TRUSS FIXING TO PARAPET WALL

ROOF TRUSS FIXING TO WALL – COVERED WITH CONTINUOUS SHEETING

Dampproofing of wall requires special attention. Check structural stability

Provide DPC

Inner leaf in modular bricks

Wall plate if required

Metal roof sheeting

Roof truss

Wall plate if required

Roof truss
### Masonry Bond Patterns and Joint Profiles

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<td><img src="image10" alt="STRETCHER BOND WITH STACK BOND PIER" /></td>
</tr>
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</table>

**Ties Required between Pier and Wall:**

- H-BP-05: Ties required between pier and wall.

**Module Dimensions:**

- 400 module
- 200 module
- 100 module

---

**Notes:**

- Ensure proper alignment and spacing of masonry units to maintain structural integrity.
- Consult local building codes for approved masonry bond patterns.
**MASONRY BOND PATTERNS AND JOINT PROFILES**

**H-BP-07**

**H-BP-08**

**BANDING**

For 10mm joint use 12mm ruling tool

- CONCAVE
- VEE
- WEATHERED

* GOOD PRACTICE

**DIAGONAL PATTERN**

- FLUSH
- RAKED
- STRUCK

* FAIR PRACTICE

* POOR PRACTICE

**Note:**
With plastered walls a recessed joint to assist bonding of plaster to walls is preferable.

**JOINT PROFILES FOR EXTERNAL WALLS SUBJECT TO WEATHER**

**H-JP-01**

See S-JP-NB

**H-JP-02**

Fair face masonry with joint widths 10mm use 12mm Ø rod to rule joints when mortar thumb print hard. Rock face masonry with joint width 10mm use 9mm Ø rod to rule joints.

Fluted and scored rock face masonry with joint widths 10mm use 8x8mm square bar to rule joints when mortar thumb print hard. If concave joint profile required use 8mm Ø rod

**FINISHING OF BEDDING AND PERPEND JOINTS**

Fluted or scored units joint profile square and finished to fillet of fluting or scoring, unless otherwise specified
WALL TO WALL INTERSECTIONS - CORNERS

**H-WW-01**

140mm WALL: 400mm HORIZONTAL MODULE

**H-WW-02**

190mm WALL: 400mm HORIZONTAL MODULE

**H-WW-03**

140mm WALL: 300mm HORIZONTAL MODULE
**FACE UNITS: EXTERIOR**

Note:
Bedding and perpend joint profiles, mortar – colour and texture – to suit profile, colour and texture of unit

**FACE UNITS: INTERIOR AND EXTERIOR**

Note:
Bedding and perpend joint profiles, mortar – colour and texture – to suit profile, colour and texture of unit

**SILL BLOCK FORMING CORNER**

Sill block filled solid with 15 MPa concrete

30mm wide x 3mm thick metal strap anchored in concrete every second course
BONDING OF INTERSECTING STRUCTURAL WALLS WITH TIES – 300mm AND 400mm MODULE

COURSE 1
- Metal strap 3mm thick x 30mm wide every second course
- Cores of units filled with 15 MPa concrete

COURSE 2
- Mesh supporting concrete in core above or cores filled solid

BONDING OF INTERSECTING STRUCTURAL WALLS OF SAME THICKNESS – 400mm MODULE

COURSE 1
- Metal strap 3mm thick x 30mm wide every second course
- Cores of units filled with 15 MPa concrete

COURSE 2
- Mesh supporting concrete in core above or cores filled solid

BONDING OF NON-STRUCTURAL WALLS

COURSE 1
- 10x30 mesh 0.6mm thick x 1.0mm wide lathing 60mm wide x 550mm long every alternate course
- Cores of units filled with 15 MPa concrete

COURSE 2
PIER IN WALLS – FAIR-FACE UNITS – 300 MODULE

H-CM-01
See H-CM-NB

290mm WIDE PIER 290mm PROJECTION – 140mm WALL, 300mm MODULE

Cores filled solid with 15 MPa concrete

150
50
Metal strap

3mm thick x 30mm wide metal strap every second course

H-CM-02
See H-CM-NB

290mm WIDE PIER 290mm PROJECTION – 140mm WALL, 300mm MODULE WITH CONTROL JOINT

Cores filled solid with 15 MPa concrete

Control joint

150
50
Metal strap

3mm thick x 30mm wide metal strap every second course

Control joint
PIER IN WALLS – FAIR-FACE UNITS – 400 MODULE

H-CM-03
See H-CM-NB

390mm WIDE PIER 390mm PROJECTION – 190mm WALL, 400mm MODULE

H-CM-04
See H-CM-NB

390mm WIDE PIER 390mm PROJECTION – 190mm WALL, 400mm MODULE WITH CONTROL JOINT

Note:
1. At the end of a free-standing wall the pier width and projection must be of the same dimension as internal piers. The two adjacent piers at control joints must together be of the same overall dimension as an internal pier.

H-CM-NB

2. The thickness of the wall shown is that at the base and may be reduced nearer the top of the wall. See SANS 10400-K – Free Standing Walls.
3. Refer to CMA Design Guide on Free Standing Walls, and SANS 10400-K.
PIER IN WALLS – ROCK FACE UNITS

**H-CM-05**

See H-CM-NB

10x30 mesh 0.6mm thick x 1.0mm wide lathing 150mm wide x 900mm long every second course

**COURSE 1**

Metal strap

Fair face units

3mm thick x 30mm wide metal strap every second course

Cores filled solid with 15 MPa concrete

**COURSE 2**

Rock face unit

3mm thick x 30mm wide metal strap every second course


**H-CM-06**

See H-CM-NB

2.10x30 mesh 0.6mm thick x 1.0mm wide lathing 150mm wide x 450mm long every second course

**COURSE 1**

Metal strap

Fair face units

Cores filled solid with 15 MPa concrete

Control joint

3mm thick x 30mm wide metal strap every second course

Rock face unit


**COURSE 2**

3mm thick x 30mm wide metal strap every second course

Cores filled solid with 15 MPa concrete


**PIER IN WALLS – ROCK FACE UNITS**

**390mm WIDE PIER 390mm PROJECTION – 190mm WALL, 400mm MODULE – FACE UNITS**

**390mm WIDE PIER 390mm PROJECTION – 190mm WALL, 400mm MODULE WITH CONTROL JOINT – FACE UNITS**
**PILASTER AND PIER BLOCKS IN WALLS**

**H-CP-01**
See H-CP-NB

**H-CP-02**
See H-CP-NB

**PILASTER BLOCK IN WALL**

**H-CP-03**

**OCTAGON SHAPED PIER BLOCK**

**Note:**
1. Pilaster blocks provide lateral support while permitting longitudinal movement, provided no metal ties are used between wall and pilaster block.
2. Pilaster block shape adjusted to suit number of intersecting walls and aesthetic considerations.
3. Pilaster blocks may be filled with concrete and reinforced if required.
**COURSE 1**

WALL FIXED TO CONCRETE COLUMN PROVIDING LATERAL SUPPORT

- Concrete column
- Cores filled solid with 15 MPa concrete

**COURSE 2**

- Metal dovetail shaped anchor slot cast into column to take dovetail shaped tie – every second course

**H-CC-01**

**WALL FIXED ONE SIDE TO CONCRETE COLUMN PROVIDING LATERAL SUPPORT, WITH CONTROL JOINT**

- Concrete column
- Metal dovetail shaped anchor slot cast into column to take dovetail shaped tie – every second course

**H-CC-02**

See App E

- Control joint
- 30mm wide x 3mm thick metal strap, one end anchored in concrete in core of unit. Other end cast in concrete core of unit at bedding joint level every second course.

**H-CC-03**

See App C+E

- Control joint
- This end greased or enclosed in plastic envelope to permit sliding movement in concrete core

**CONCRETE COLUMN/WALL INTERSECTIONS**
**CONCRETE COLUMN/WALL INTERSECTIONS**

**H-CC-04**

See App C+E

3mm thick x 30mm wide metal strap fixed to column every second course

Mesh to support 15 MPa concrete in core above, or cores filled solid with concrete without mesh

---

**COURSE 1**

**COURSE 2**

190mm WALL RIGIDLY FIXED TO CONCRETE COLUMN – 400mm MODULE

3mm thick x 30mm wide metal strap, one end anchored in concrete in core of unit. Other end cast in concrete core of unit at bedding joint level every second course.

Control joint

This end greased or enclosed in plastic envelope to permit sliding movement

15 MPa concrete in cores

---

**H-CC-05**

See App C+E

3mm thick x 30mm wide metal strap fixed to column every second course

Mesh to support 15 MPa concrete in core above, or cores filled solid with concrete without mesh

---

**COURSE 1**

**COURSE 2**

WALL FIXING TO CONCRETE COLUMN PERMITTING LONGITUDINAL MOVEMENT – 400mm MODULE

140mm WALL RIGIDLY FIXED TO CONCRETE COLUMN 300mm MODULE (OR 400mm MODULE)

Control joint
CONCRETE COLUMN/WALL INTERSECTIONS

H-CC-07
See App C

ANGLE IN SASH GROOVE

WALL FIXED TO CONCRETE COLUMN PERMITTING LONGITUDINAL MOVEMENT

H-CC-07
See App C

CHANNEL IN OPEN END OF UNIT

WALL FIXED TO CONCRETE COLUMN PERMITTING LONGITUDINAL MOVEMENT

H-CC-08
See App C

WALL FIXED TO CONCRETE COLUMN PERMITTING LONGITUDINAL MOVEMENT

H-CC-09
See App C

TWO ANGLES TO HOLD UNIT

WALL FIXED TO CONCRETE COLUMN PERMITTING LONGITUDINAL MOVEMENT
CONCRETE COLUMNS WITH ROCKFACE SURROUNDS

H-CC-10

COURSE 1

COURSE 2

CONCRETE COLUMN 400 x 400
WITH EXTERNAL FACE UNITS

H-CC-11

COURSE 1

COURSE 2

CONCRETE COLUMN 400 x 400 BOXED
IN WITH EXTERNAL FACE UNITS
CONCRETE COLUMNS WITH ROCKFACE SURROUNDS

**CONCRETE COLUMN 300 x 300 BOXED IN – EXTERNAL FACE UNITS**

**H-CC-12**

**CONCRETE COLUMN 300 x 300 – 190mm EXTERNAL FACE UNITS**

**H-CC-13**
WALL FIXED TO COLUMN PROVIDING LATERAL SUPPORT

COURSE 1

Cores filled with 15 MPa concrete

COURSE 2

Metal dovetail shaped tie fixed to a bar, welded to steel column

This end greased or enclosed in plastic envelope to permit sliding movement in concrete core

WALL FIXED TO COLUMN PROVIDING LATERAL SUPPORT, WITH CONTROL JOINT

COURSE 1

Dovetail shaped metal tie fixed to a bar, welded to steel column

Control joint

Cores filled with 15 MPa concrete

COURSE 2

Control joint

30mm wide x 3mm thick x 600mm long galv. MS strap anchored in 15 MPa concrete one side, other side greased, every second course

ONE SIDE WALL RIGIDLY FIXED TO COLUMN OTHER SIDE FREE TO MOVE LONGITUDINALLY

COURSE 1

Control joint

Cores filled with 15 MPa concrete

COURSE 2

30mm wide x 3mm thick metal strap fixed to column one side, other side anchored in core every second course

This end greased or enclosed in plastic envelope to permit sliding movement in concrete core

30mm wide x 3mm thick x 600mm long galv. MS strap anchored in 15 MPa concrete one side, other side greased, every second course

See App C
**STEEL COLUMN/WALL INTERSECTIONS**

**H-CS-04**  
See App C+E

**WALL FIXED TO STEEL COLUMN**

- **Course 1**
  - Joint filler if required
  - 30mm wide x 3mm thick metal strap fixed to column and anchored in 15 MPa concrete in unit core every second course

- **Course 2**
  - Mesh to support concrete in core above or core filled solid without mesh

**H-CS-05**

**WALL BUTTING AGAINST STEEL COLUMN**

- **Course 1**
  - Joint filler if required
  - Cores filled with 15 MPa concrete

- **Course 2**
  - Control joint

**H-CS-06**

**WALL FIXED TO STEEL COLUMN PROVIDING LATERAL SUPPORT WITH CONTROL JOINT**

- **Course 1**
  - 30mm wide x 3mm thick metal strap fixed to column and anchored in 15 MPa concrete in unit core every second course

- **Course 2**
  - Control joint
  - Mesh in course below to support 15 MPa concrete in core
COURSE 1
Cores filled with 15 MPa concrete

COURSE 2
10 x 30 mesh 0.6mm thick x 1.0mm wide lathing – 60mm wide – every second course

STEEL COLUMN BOXED IN

H-CS-07

COURSE 1
Cores filled with 15 MPa concrete

COURSE 2
10 x 30 mesh 0.6mm thick x 1.0mm wide lathing – 60mm wide – every second course

STEEL COLUMN BOXED IN

H-CS-08

COURSE 1
Cores of units filled with 15 MPa concrete

COURSE 2
10 x 30 mesh 0.6mm thick x 1.0mm wide lathing – 60mm wide – every second course
STEEL COLUMN/WALL INTERSECTIONS – ROCKFACE FINISH

**H-CS-09**

STEEL COLUMN BOXED IN WITH CONTROL JOINTS

**H-CS-10**

STEEL COLUMN BOXED IN WITH ROCK FACE UNITS WITH CONTROL JOINT
STEEL COLUMN BOXED IN WITH ROCK FACE UNITS

H-CS-11

COURSE 1

Rockface

30mm wide x 3mm thick metal strap anchored in concrete in core of unit

Mesh to support concrete in core above or core filled solid

COURSE 2

Rockface

Mesh to support concrete in core above or core filled solid

H-CS-12

COURSE 1

Rockface

10 x 30 mesh 0.6mm thick x 1.0mm wide lathing – 60mm wide – every second course

COURSE 2

Rockface

CORNER STEEL COLUMN BOXED IN WITH ROCK FACE UNITS
Bearing stresses under steel beam will determine if steel bearing plate below beam required and depth and extent of concrete infill of cores of blocks.
30mm wide x 3mm thick metal strap placed in bedding joint. Cores of units filled with 15 MPa concrete, one end fixed, other end free to slide every second course.

H-CJ-01

See H-CJ-NB (1 TO 4)

This half of strap greased or enclosed in plastic envelope to permit sliding movement.

H-CJ-02

See H-CJ-NB (1 TO 4)

15 MPa concrete infill in cores on either side of control joint.

15 MPa concrete infill of unit core

Sash block

Sash block

COURSE 1

COURSE 2

Butt joint with cruciform strip in sash unit grooves – no lateral stability

H-CJ-03

See H-CJ-NB (1 TO 4)

15 MPa concrete infill in cores on either side of control joint.

COURSE 1

COURSE 2

Butt joint – no lateral stability
BUTT JOINT WITH OPEN ENDS FILLED TO GIVE LATERAL STABILITY

H-CJ-04
See H-CJ-NB (1 TO 4)

COURSE 1

COURSE 2

CONTROL JOINTS IN WALLS

H-CJ-05
H-CJ-NB (1 TO 4)

BUTT JOINT IN U OR BOND BEAMS WITH ROD TO GIVE LATERAL STABILITY
**CONTROL JOINTS IN WALLS**

**H-CJ-NB1**

*Note:*
1. Control joints may be filled with a joint filler such as fibre board, polystyrene or polyurethane strips, sponges, tubes or rods and sealed with sealants such as silicones, polyurethanes, polysulphides, bitumens, acrylic or polyisobutylenes. Refer to manufacturers specification.

![Diagram of INFILL STRIPS ONLY](image1)

**INTERNAL WALL**

2. If plastered then V-joint is to be cut into plaster over line of control joint.

![Diagram of CONTROL JOINTS IN WALLS](image2)

3. Control joint may be covered by a cover plate.

![Diagram of CONTROL JOINTS IN WALLS](image3)

### INFILL STRIPS ONLY

- **SPONGES, TUBES OR RODS**
- **INFEIL STRIPS ONLY**
- **SEALANTS OVER INFILL STRIPS**
- **SEALANTS OVER SPONGES, TUBES OR RODS**

**EXTERNAL WALL**

- **FLAT COVER PLATE FIXED ONE SIDE**
- **CURVED COVER PLATE FIXED CENTRALLY**
- **SPRING CLIP COVERS**
**CONTROL JOINTS IN WALLS – LOCATIONS**

**H-CJ-NB2**

**ELEVATION OF WALL SHOWING CONTROL JOINT POSITIONS BETWEEN OPENINGS, HORIZONTAL & VERTICAL REINFORCEMENT**

**H-CJ-NB3**

**ELEVATION OF WALL SHOWING CONTROL JOINT POSITIONS AT EDGE OF OPENINGS, HORIZONTAL & VERTICAL REINFORCEMENT**

**H-CJ-NB4**

**PLAN OF WALL SHOWING CONTROL JOINT POSITIONS**

---

**Note:**

Control joint spacing not to exceed recommended maximum, i.e. for unreinforced walls-6m, or twice the height of the wall. For reinforced walls-18m. Every course reinforced.

For detailed information refer to CMA Masonry Manual and SANS 10145 Concrete Masonry Construction.
DETAILS OF TYPES OF REINFORCEMENT AND FIXING

**H-RE-01**

- **Reinforcement Bottom Only**
- **Reinforcement Top Only**
- **Reinforced Around Corner**

**CUT HOLLOW UNITS TO ACCOMMODATE REINFORCEMENT**

**H-RE-02**

- **Single Vertical Bar**
- **Vertical and Horizontal Bars**

**VARIOUS WIRE POSITIONERS TO HOLD REINFORCEMENT IN POSITION BEFORE CONCRETING**
LADDER PATTERN

TRUSS PATTERN

VARIOUS TYPES BEDDING JOINT REINFORCEMENT

H-RE-03

H-RE-04

H-RE-05

SINGLE BLOCK BEAM

DOUBLE BLOCK BEAM

Concrete infill
Horizontal reinforcement
Mesh to support concrete in block bond beam above

Vertical reinforcement
Bond block
Link
Lintel block
Horizontal reinforcement
Reinforcing bars alternate sides if required to engineers requirements.

CANTILEVER WALL

H-RE-06

H-RE-07
See H-RE-NB

SINGLE BAR IN BEAM
**REINFORCEMENT DETAILS – BEAMS**

**H-RE-08**
See H-RE-NB

**TWO BARS IN BEAM**

**H-RE-09**
See H-RE-NB

**REINFORCEMENT AROUND CORNERS IN BEDDING JOINT**

Maximum diameter of longitudinal bar 6mm. Ladder or truss shape bedding reinforcement preferable.
**REINFORCED MASONRY – FOUNDATIONS**

**H-RE-10**

**TOLERANCES OF SURFACES OF FOUNDATIONS, BEAMS OR SLABS SUPPORTING STRUCTURAL MASONRY**

- Underside first course Zone requiring removal
- 10mm mortar bed target thickness
- Minimum size joint
- Zone requiring infill
- Concrete foundation, beam or slab
- 20mm maximum size joint

**H-RE-11**

- Top of concrete foundation
- Starter bar
- Cranking

**CRANKING NOT PERMITTED**

**H-RE-12**

- Starter bars
- Top of foundation

**STARTER BARS IN BOND BEAM**

**H-RE-13**

- New bar
- Epoxy grout
- Drill hole in concrete
- Cut off bar

**REMEDIAL WORK ‘OUT OF POSITION’ STARTER BARS**

**FIRST COURSE INSPECTION & CLEAN OUT UNIT**
REINFORCEMENT DETAILS – U-BEAM/LINTEL AND BOND BLOCKS

**Note:**

- Bond blocks can be cut or manufactured. Typical dimensions as shown.
- Outer shell thickness:
  - Fairface – 32mm
  - Rockface – 42mm
- Bond blocks can be made with same colour and texture as standard blocks.

**U-BEAM OR LINTEL BLOCK**

**SECTION WITHOUT SASH GROOVE**

**SECTION WITH SASH GROOVE**

**PLAN**

**SECTION**

**TWO BLOCK BEAM USING LINTEL BLOCK**

**BOND BLOCK**

**TWO BLOCK BEAM USING BOND BLOCKS**

**Note:**

- Two-block beams to be cast in one operation
- Mesh supporting concrete
- Cover not < 15mm

**Note:**

- Usually 190mm long, in fair face only with sash groove in soffit
- Bond blocks can be made with same colour and texture as standard blocks.
Grille/screen blocks

Air conditioning unit in steel sheet frame slid into opening in wall

DPC with weepholes at 600mm

Bond block or lintel block

DPC sill

140/190

AIR CONDITIONING UNIT INSTALLATION

H-AC-01
**LOCATION OF SERVICES IN/ON WALLS**

**H-SV-01**
See H-SV-NB

**H-SV-02**
See H-SV-NB

**ELECTRICAL CONDUITS PLACED IN CORES OF HOLLOW UNITS**

**WATER PIPES PLACED IN CORES OF HOLLOW UNITS**
ELEVATION SECTION

**H-SV-03**

See H-SV-NB

**H-SV-04**

See H-SV-NB

ELECTRICAL CONDUITS CHASED INTO SOLID UNITS

WATER PIPES CHASED INTO SOLID UNITS

Hollow units

Solid units

Conduit chased into solid units

Basin

Pipes chased into walls
Note:

1. 'Sleeves, chases and holes should, as far as possible, be provided during the erection of the masonry, or purpose-made chased units should be built in position agreed by the designer'. Refer to SANS 10164-1
2. Vertical chases in solid units should not exceed one third of the wall/leaf thickness and horizontal chases should not exceed one sixth of the wall/leaf thickness. (See Note 4)
3. Walls constructed of hollow units should not be chased at all and services should be located in the unit cavities. Where chasing in these units is unavoidable it should be no deeper than 15mm or the core of the unit shall be filled with 15 MPa concrete.
4. Horizontal chasing should be avoided where possible. Ensure that chases do not impaire strength, stability and fire resistance properties of the walling below the minimum permitted.
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**APPENDIX A DEFINITIONS**

*Masonry wall* means an assemblage of masonry units joined together with mortar or grout. Masonry units may be either solid or hollow, and of brick or block size¹.

*Block* means any masonry unit having dimensions, which satisfy any one of the following conditions:
- a) length between 300mm and 650 mm;
- b) width between 130mm and 300 mm; or
- c) height between 120mm and 300 mm.

*Brick* means any masonry unit which is not a block. A masonry unit having dimensions, which satisfy all of the following conditions:
- a) length not more than 300 mm;
- b) width not more than 130 mm; and
- c) height not more than 120 mm.

*Hollow masonry unit*: A masonry unit containing cavities in excess of 25% but not exceeding 60% of the gross volume of the unit¹.

*Masonry accessories*: These include masonry anchors, connectors and ties other than wall ties; shelf angles and their fixings; wall ties that transmit shear; and bed joint mesh¹.

*Masonry unit*: A unit of a rectangular shape and that is intended for use in the construction of bonded masonry walling¹.

*Solid masonry unit*: A masonry unit either containing no cavities or containing cavities not exceeding 25% of the gross volume of the unit¹.

**Types of reinforced masonry**

*Grouted-cavity masonry*: Two parallel single-leaf walls spaced at least 50 mm apart, effectively tied together with wall ties. The intervening cavity contains steel reinforcement and is so filled with infill concrete or grout as to result in common action with the masonry under load¹.

*Reinforced hollow blockwork*: Hollow blockwork that is reinforced horizontally or vertically (or both) and subsequently wholly or partly filled with concrete¹.

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¹ SANS 10164-2 (See Appendix B)
APPENDIX B REFERENCES

STANDARDS AND CODES OF PRACTICE ON THE USE OF CONCRETE MASONRY

MANUFACTURE OF CONCRETE MASONRY UNITS
SANS 1215 – 1984 Concrete masonry units

USE OF MASONRY UNITS
Planning, design and specifications
SANS 993-1972
Modular coordination in building
SANS 10021-2002
Waterproofing of buildings
SANS 10155-1980
Accuracy in buildings
SANS 10249-1993
Masonry walling
NBRI R/Bou – 602
Fire resistance ratings – wall constructed of concrete blocks

Building Regulations
National Building Regulations and Building Standards
Act 1977 revised 1990
SANS10400-1990
Application of the National Building Regulations
National Home Builders Registration Council Home Building Manual

Structural Design
SANS 10100-1:2000
The structural use of concrete
Part 1: Design
SANS 10160-1989
The general procedures and loadings to be adopted for the design of buildings.
SANS 10161-1980
The design of foundations for buildings
SANS 10164-
The structural use of masonry
Part 1-1980: Unreinforced masonry walling
Part 2-2003: Reinforced and prestressed masonry walling
SANS 1504-1990
Prestressed concrete lintels

Concrete Masonry Construction
SANS 073-1974
Safe application of masonry-type facings to buildings
SANS 10145-2000
Concrete masonry construction
SANS 10155-1980
Accuracy in buildings

MATERIALS OF CONSTRUCTION

Aggregates
SANS 794-2002
Aggregates of low density
SANS 1083-2002
Aggregates from natural sources – aggregates for cement.

Cement
SANS 50197-1:2000
Cement
Part 1: Composition, specifications and conformity criteria, for common cements.
SANS 50413-1:1994
Masonry cement

Dampproof courses
SANS 248-1973
Bituminous dampproof course
SANS 298-1975
Mastic asphalt for dampproof courses and tanking
SANS 952-1985
Polyolefin film for dampproofing and waterproofing in buildings

Reinforcement
SANS 190-2:1984
Expanded metal
Part 2: Building products

Crofts, FS: Lane JW Structural concrete masonry, a design guide.
SANS 920-1985
Steel bars for concrete reinforcement

SANS 1024-1991
Welded steel fabric for reinforcement of concrete

**Sealants**

SANS 110-1973
Sealing compounds for building industry, two-component, polysulphide base

SANS 1077-1984
Sealing compounds for the building and construction industry, two component polyurethane base

SANS 1305-1980
Sealing compounds for the building industry, one-component silicone-rubber base

**Lime**

SANS 523-2002
Limes for use in building

**Sand**

SANS 1090-2002
Aggregates from natural sources. Fine aggregate for plaster and mortar

**Wall ties**

SANS 28-1986
Metal ties for cavity walls

**USEFUL BRITISH STANDARDS**

BS 1014-1975 (1986)
Pigments for portland cement and portland cement products

BS 4551-1998
Methods of testing mortar, screeds and plasters

BS 4887
Mortar admixtures
Part 1: 1986:
Specification for air-entraining (plasticizing) admixtures
Part 2: 1987:
Specification for set-retarding admixtures

BS 6477-1984
Water repellents for masonry surfaces

**CONCRETE MANUFACTURERS ASSOCIATION PUBLICATIONS**


Free-standing walls Design guide

Technical note: Unreinforced Reinforced
APPENDIX C ANCHORS – WALLS

Anchors are used for tying metal straps, angles and wall accessories to masonry, concrete or steel, at wall/concrete, wall/wall, wall/steel intersections, or to support a leaf of a wall or service. Anchors function by being held in position in the base material by friction, keying, bonding or a combination of these factors. Essentially the fixing of anchors to any member requires either the drilling of a hole to house the anchor, or the firing of the anchor into the supporting material.

In general terms shot-firing anchors into brittle material such as concrete or masonry may shatter the material and the quality of support may then become suspect. Drilling is preferable where anchorage stress level is significant.

Firing into ductile materials such as steel or timber is an easy and quick method of anchoring.

In both cases the amount of force exerted in drilling or shot firing should not disturb the bonding of masonry units to adjacent units.

The position of the anchor is important in ensuring optimum load carrying capacity.

In the case of angles supporting a non-structural outer leaf of a wall to the main structure then the position of the hole in the vertical leg of the angle should be as near the top of the angle as possible. It is also preferable to use an unequal angle with the longer leg of the angle in the vertical direction.

With straps holding walls to columns to provide lateral support, the anchor should be placed as near as possible to the right angle bend in the strap. This is to prevent the straightening out of the bend, with, say, shrinkage of the wall, which would tend to lift the masonry unit above the horizontal section of the strap, opening the bedding joint.

Normally a single anchor in the vertical leg of the strap is adequate but if two anchors are necessary then the spacing of these anchors should be such as not to reduce the overall anchorage. When shot firing into brittle materials the spacing should be at least 100 mm.

Heated drawn steel should be used for straps that are bent and twisted. Normally stainless steel cannot be shaped to the required shape.

The type, size and position of anchorage to be shown on drawings and/or clearly specified.
APPENDIX D ROOFING FIXING

Types of Anchor (refer SANS 10400-K)

<table>
<thead>
<tr>
<th>Roof Slope, Degrees</th>
<th>Max Roof Truss, Rafter or Beam spacing, mm</th>
<th>Type of anchor required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Light Roof</td>
</tr>
<tr>
<td>Less than 15</td>
<td>760</td>
<td>A, B or C</td>
</tr>
<tr>
<td></td>
<td>1050</td>
<td>B or C</td>
</tr>
<tr>
<td></td>
<td>1400</td>
<td>C</td>
</tr>
<tr>
<td>15-30</td>
<td>760</td>
<td>A, B or C</td>
</tr>
<tr>
<td></td>
<td>1050</td>
<td>B or C</td>
</tr>
<tr>
<td></td>
<td>1400</td>
<td>C</td>
</tr>
<tr>
<td>Greater than 30</td>
<td>Any</td>
<td>A, B or C</td>
</tr>
</tbody>
</table>

Anchors

Type A: 2 Strands 4 mm Galvanised Steel Wire
Type B: 30 mm x 1.2 mm Galvanised Steel Strap
Type C: 30 mm x 1.6 mm Galvanised Steel Strap

<table>
<thead>
<tr>
<th>Length of Anchorage</th>
<th>Type of Roof</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 mm</td>
<td>Heavy roof (Concrete or clay tiles or slate)</td>
</tr>
<tr>
<td>600 mm</td>
<td>Sheeted Roof</td>
</tr>
</tbody>
</table>

Note:
Details of types of anchors apply to buildings not exceeding two storeys in height and where span of the roof truss does not exceed 10 m.
**APPENDIX E: TIES, STRAP AND BEDDING REINFORCEMENT**

### DETAILS OF REINFORCEMENT USED IN BEDDING JOINTS

<table>
<thead>
<tr>
<th>Type</th>
<th>Ladder Type</th>
<th>Truss Type</th>
<th>Mesh/Lathing for reinforcement and tying intersecting leaves of wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Two longitudinal wires with transverse wires</td>
<td>Two longitudinal wires with diagonal transverse wires</td>
<td>Rectangular wire grid</td>
</tr>
<tr>
<td>Sketch</td>
<td><img src="image" alt="Sketch" /></td>
<td><img src="image" alt="Sketch" /></td>
<td>Diagonal flat expanded metal with diamond shape openings</td>
</tr>
<tr>
<td>Width (w), mm</td>
<td>75/150/230</td>
<td>60/110/160</td>
<td>50/150</td>
</tr>
<tr>
<td>Diameter of wire, mm</td>
<td>2.5/2.8/3.15/3.55</td>
<td>3.25/3.55</td>
<td>3.15</td>
</tr>
<tr>
<td>Wire spacing (s), mm</td>
<td></td>
<td></td>
<td>0.8 mm thick plate</td>
</tr>
<tr>
<td>Size of opening b x l, mm</td>
<td></td>
<td></td>
<td>10 x 30</td>
</tr>
<tr>
<td>Length rolls, m</td>
<td>20/25</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>Length flats, m</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Size of sheet, m x m</td>
<td></td>
<td></td>
<td>1.2 x 2.4</td>
</tr>
<tr>
<td>Note:</td>
<td>Wire manufactured for bedding joint reinforcement from high tensile steel should preferably be flat i.e. not in rolls.</td>
<td>Only available flat</td>
<td>Dimension and properties to be confirmed with local supplier. Consider stronger ties if lateral load transfer is significant</td>
</tr>
</tbody>
</table>

Check availability and quality. For quality, check if commercial or stated quality, whether mild, galvanised or stainless steel, or coated for corrosion resistance.
**DETAILS OF STRAPS, TIES AND REINFORCEMENT**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Hoop Iron</th>
<th>Straps</th>
<th>Rods/Bars</th>
<th>Wall Ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchoring roof trusses to walls</td>
<td>Wall to wall sliding joints (Concertina strap)</td>
<td>- Anchoring - concrete and steel columns to walls - Anchoring walls to walls/sliding joint - wall to wall sliding joints</td>
<td>Reinforcement of: - bedding joint - hollow unit core - cavity - Bars can be used in place of straps for anchorage.</td>
<td>Connecting two leaves of a cavity wall to ensure that the wall acts as a unit in resisting applied loads. - In multileaf walls ensures monolithic action - In diaphragm walls provides shear transfer between web and flange</td>
</tr>
<tr>
<td>Material</td>
<td>Normally cut from off cuts of rolls of sheet steel – regarded as commercial quality</td>
<td>Normally cut from flat steel sheets – regarded as stated quality</td>
<td>Mild steel or high tensile steel - May be stainless steel or coated for corrosion resistance</td>
<td>Material determined by the likelihood of corrosion viz. galvanised mild steel, copper, copper-zinc or austenitic stainless steel</td>
</tr>
<tr>
<td>Shape</td>
<td>Flat</td>
<td>Concertina at joint</td>
<td>Flat</td>
<td>Round, smooth, deformed or indented</td>
</tr>
<tr>
<td>Thickness, mm</td>
<td>1,2/1,6</td>
<td>1,2/1,6</td>
<td>2,5/3,0</td>
<td>1,5</td>
</tr>
<tr>
<td>Width, mm</td>
<td>30</td>
<td>25 30 40</td>
<td>30 40</td>
<td>13 20</td>
</tr>
<tr>
<td>Diameter, mm</td>
<td>One end of strap embedded in concrete in core of unit or in bedding joint mortar, other end fixed to roof truss or wall plate. See Appendix D.</td>
<td>Both ends embedded in mortar joint</td>
<td>One end of strap embedded in concrete in core of unit, or in bedding joint mortar, other end fixed by shot-firing bolts/pins into steel or drilling and bolting into concrete</td>
<td>Placed in - bedding joint - core hollow unit, - bond and U-beams, - cavity walls and filled with mortar or infill concrete</td>
</tr>
<tr>
<td>Fixing</td>
<td>6&lt;Ø&lt;32</td>
<td>2,8</td>
<td>3,15 4,0</td>
<td>4,5</td>
</tr>
</tbody>
</table>

General requirements for provision of ties

<table>
<thead>
<tr>
<th>Size of cavity</th>
<th>Ties/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 75 mm</td>
<td>2,5</td>
</tr>
<tr>
<td>75 – 100 mm</td>
<td>3</td>
</tr>
<tr>
<td>100 – 150 mm</td>
<td>5</td>
</tr>
</tbody>
</table>

Check material providing connection between structural masonry elements can safely transfer loads and forces while providing lateral support.
1. **INTRODUCTION**

Drawings depicting details of reinforcement in masonry elements, supplemented by specifications are required to translate designs into physical realities. Detailing is therefore the most important link between good design and quality construction. Accordingly detailing of reinforcement should be kept simple, clear and practical while drawings should clearly define and depict the design requirements in a comprehensible manner: SANS 10164-2 offers guidance in this regard, the main provisions of which are highlighted and illustrated hereunder.

Reinforcement should be located to suit simple masonry bonding patterns. Cutting of masonry units should be kept to a minimum while the bonding of masonry should be such that an adequate void for grouting is maintained. Common practical bonding arrangements are illustrated below.

The detailing of reinforced masonry differs somewhat to that of reinforced concrete; the principle differences being:

- distribution steel is not required in certain masonry bonding patterns since bonded masonry can often span and distribute forces between reinforcing bars.
- reinforcing bars often have to be protected against corrosion in reinforced masonry applications where mortar infill is employed.
- the characteristic anchorage bond strength between mortar and steel is significantly less than that between concrete and steel.

2. **MORTAR AND CONCRETE INFILL (SANS 10164-2; CI 5.4)**

Only Class I and Class II mortar (refer to SANS 10164-1) should be used in the bedding course for reinforced masonry applications. Where masonry cement is used, the bond between steel and mortar should be investigated.

Infill concrete should be grade 25 concrete or better. Mixes should have adequate workability with a slump of between 75 and 175mm. The nominal aggregate in such concrete should be at least 5 mm less than the permitted cover to any reinforcement.

---

**APPENDIX F DETAILING PRACTICE FOR REINFORCED MASONRY**

**GROUTED CAVITY**

**POCKET TYPE**

**HOLLOW UNITS**

**BED JOINT**

**QUETTA BOND**
3. DETAILING RULES (SANS 10164-2; CI 7.6)

3.1 Main and secondary reinforcement

The main provisions of SANS 10164-2 which relate to the manner in which steel is located in reinforced elements in summarised in Table 1.

Table 1: Detailing of main and secondary reinforcement

<table>
<thead>
<tr>
<th>LOCATION OF STEEL WITHIN ELEMENT</th>
<th>MAXIMUM BAR SIZE mm</th>
<th>SECONDARY REINFORCEMENT $A_s &gt; 0.05 \text{bd}$</th>
<th>MAXIMUM BAR SPACING mm</th>
<th>SPECIAL PROVISIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grouted cavity</td>
<td>25</td>
<td></td>
<td>500</td>
<td>Low lift construction Provide ties in accordance with SANS 10164-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>High lift construction Provide purpose made ties in accordance with Appendix A of SANS 10164-2</td>
</tr>
<tr>
<td>Pockets</td>
<td>32</td>
<td>Not required*</td>
<td>No upper limit</td>
<td>Only one bar may be used if pocket is less than 125 mm x 125 mm</td>
</tr>
<tr>
<td>Quetta bond</td>
<td>25</td>
<td>$A_s &gt; 0.05 \text{bd}$</td>
<td>500</td>
<td>Only one bar may be used if core is less than 125 mm x 125 mm</td>
</tr>
<tr>
<td>Cores of hollow units</td>
<td>25</td>
<td>$A_s &gt; 0.5 \text{bd}$</td>
<td>500</td>
<td>Only one bar may be used if core is less than 125 mm x 125 mm</td>
</tr>
<tr>
<td>Bed joints</td>
<td>6#</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Wall has enhanced lateral resistance if $A_s &gt; 14 \text{mm}^2$ is provided at vertical centres $\geq 450$ mm</td>
</tr>
</tbody>
</table>

* Prestretched hard drawn wire with a minimum proof stress of 485 N/mm² as supplied by a manufacturer of welded steel fabric reinforcement is suitable for such reinforcement. (Standard bar diameters are 3.55; 4 and 5.6;)

$+ \text{ b = breadth of section; d = depth to neutral axis. } A_s = \text{ cross sectional area of reinforcement.}$

$\# \text{ Distribution steel is not required since bonded masonry, particularly in the horizontal direction, can span and distribute forces between reinforcing bars. However, distribution steel may be required to control shrinkage.}$

Usually reinforcement acts in tension. However, where reinforcement acts in compression, such reinforcement must be restrained against the tendency to buckle. This achieved by the inclusion of secondary steel reinforcement in the form of distribution steel, links or binders.

In all cases, the minimum clear horizontal or vertical distance between parallel bars should be as follows:

- Greater of aggregate size + 5mm and bar size
- Greater of aggregate size + 5mm and bar size
- $\leq 10\text{mm}$

- $\leq 10\text{mm}$
1.2 Anchorage bond, laps and joints

For reinforcement to develop the design stress, it must be adequately bonded into the surrounding masonry. This may be achieved by ensuring that:

- the cover of concrete or mortar infill is at least equal to the bar diameter; and
- a sufficient length of bar (anchorage length) extends beyond any section to develop the necessary force at that section.

The length of bar required for anchorage purposes may be calculated as follows:

$$l_{ba} = \frac{f_y \gamma_{lb} \varnothing}{4 \gamma_{as} f_b} = K \varnothing$$

where:

- $\varnothing$ = nominal bar diameter
- $\gamma_{lb}$ = partial safety factor for bond strength
- $\gamma_{as}$ = partial safety factor for strength of steel
- $f_y$ = characteristic anchorage bond strength
- $f_b$ = characteristic tensile strength of reinforcing steel
- $A_s$ = cross sectional area of steel
- $K$ = ratio of anchorage bond length to bar diameter (see Table 2)

Thus $l_{ba \ required} = K \varnothing \frac{A_s \ required}{A_s \ provided}$
### Table 2: Ratio of anchorage bond length to bar diameter

<table>
<thead>
<tr>
<th>TYPE OF REINFORCEMENT</th>
<th>CHARACTERISTIC TENSILE STRENGTH MPa</th>
<th>RATIO OF ANCHORAGE BOND LENGTH TO BAR DIAMETER (K)(\times)</th>
<th>Mortar Infill</th>
<th>Concrete Infill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tension</td>
<td>Compression</td>
</tr>
<tr>
<td>Hot rolled mild steel plain bar as in SANS 920</td>
<td>250</td>
<td>51</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>Hot rolled high yield deformed bar as in SANS 920</td>
<td>450</td>
<td>68</td>
<td>57</td>
<td>55</td>
</tr>
<tr>
<td>Hard drawn steel wire as in SANS 1024</td>
<td>485</td>
<td>98</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>Stainless steel grades 304515, 316531 and 316533 as in BS 970-1</td>
<td>460</td>
<td>93</td>
<td>77</td>
<td>78</td>
</tr>
<tr>
<td>– plain bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– deformed bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The effective anchorage length of a hook or bend, measured from the start of the bend to a point four times the bar size beyond the end of the bend should be taken as the lesser of:

- 24 times the bar size.
- 8 times the internal radius of a hook.
- 4 times the internal radius of a 90 degree bend.

![Effective anchorage length diagram](image-url)
**Note:** Minimum radius of any bend

- \( 2 \varnothing \) (mild steel)
- \( 3 \varnothing \) (high yield steel)

The beginning of hooks should be located inside the face of support as follows:

![Diagram of hook placement](image)

Joints in reinforcement may be achieved by means of mechanical couplers or simply by lapping reinforcing bars of follows:

**Compression Reinforcement**

Greater of:
- effective anchorage length
- \( 20 \times \text{bar diameter} + 150\text{mm} \)

**Tension Reinforcement**

Greater of:
- effective anchorage length
- \( 25 \times \text{bar diameter} + 150\text{mm} \)

Generally, laps should be located away from areas of high stress and should be staggered. Account of the construction sequence, buildability, stress considerations, congestion of reinforcement etc., should be taken in the location of laps and joints.

### 1.3 Links

Links may be required to restrain reinforcement acting in compression or to provide shear reinforcement. Links may only be considered to be fully anchored if they are detailed as follows:

**90 Degree Option**

8 times link diameter (min)

**180 Degree Option**

4 times link diameter (min)
Shear reinforcement links in beams should be provided as follows:

\[
\text{Nominal link area } A_{sv} = \begin{cases} 
0.002b & \text{Mild steel} \\
0.0012b & \text{High yield steel}
\end{cases}
\]

Where compression steel is used in beams, links should be provided as for columns. Column links are required when the area of steel exceeds 0.25% of the gross area of the column and the design load exceeds 25% of the resistance capacity of the column. In such circumstances, links should be proved as follows:

\[
\text{Link spacing (s)} \
\quad s \geq 0.75d
\]

3.4 Curtailment of bars

Reinforcing bars acting in tension at simply supported ends of members should be terminated as follows:
However, should the distance between the face of the support and the edge of the nearest principal load be less than twice the effective depth, reinforcement should be curtailed as follows:

Reinforcing bars which are subjected to bending and terminate other than at an end support, should continue for a distance beyond the point at which they are no longer required, equal to the greater of the effective depth of the member or 12 times the bar size, provided, however, that one or more of the following is satisfied:

- bars extend for a distance at least equal to the effective anchorage bond length;
- the design shear strength of the section is at least twice that of the applied shear force;
- the remaining reinforcement provides at least twice the area of reinforcement required to resist the applied bending moment.
4. RESISTANCE OF METAL COMPONENTS TO CORROSION (SANS 10164-2; Cl 9.2)

4.1 General

The resistance of metal components to corrosion depends upon the following:

- exposure environment
- type and quality of cementitious surround, i.e., mortar or infill concrete
- cover
- type of protective coating of steel.

SANS 10164-2 contains recommendations regarding the minimum levels of protective coatings for reinforcement and masonry accessories used in various types of construction and exposure conditions. These recommendations are not necessarily the desirable levels of protection that may be required since local conditions or specific circumstances may warrant a higher degree of protection.

Table 3: Classification of exposure conditions

<table>
<thead>
<tr>
<th>EXPOSURE CLASSIFICATION</th>
<th>EXPOSURE ENVIRONMENTS FOR SURFACES OF REINFORCED MEMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Protected by an impermeable membrane</td>
</tr>
<tr>
<td></td>
<td>Exposed to the elements in</td>
</tr>
<tr>
<td></td>
<td>- inland areas as shown in Figure 1.</td>
</tr>
<tr>
<td></td>
<td>- interiors of buildings.</td>
</tr>
<tr>
<td></td>
<td>Beneath coatings that resist moisture penetration.</td>
</tr>
<tr>
<td>E2</td>
<td>Exposed to the elements in:</td>
</tr>
<tr>
<td></td>
<td>- inland areas as shown in Figure 1.</td>
</tr>
<tr>
<td></td>
<td>- interiors of industrial buildings where humidity is high or where repeatedly washed.</td>
</tr>
<tr>
<td></td>
<td>Submerged in non-aggressive soils.</td>
</tr>
<tr>
<td>E3</td>
<td>Exposed to the elements in:</td>
</tr>
<tr>
<td></td>
<td>- areas within 3 km of industries that discharge atmospheric pollutants.</td>
</tr>
<tr>
<td></td>
<td>- areas within 1 km of the coastline or shoreline of large expanses of salt water.</td>
</tr>
<tr>
<td></td>
<td>Submerged in fresh water.</td>
</tr>
<tr>
<td>S</td>
<td>Submerged in aggressive soils.</td>
</tr>
<tr>
<td></td>
<td>Submerged in sea water, running water or soft water.</td>
</tr>
<tr>
<td></td>
<td>In contact with corrosive liquids or gas.</td>
</tr>
</tbody>
</table>

4.2 Exposure classification

The exposure classification may be established from Table 3 and Figure 1 or Table 17 of SANS 10164-2. Elements which may be subjected to more severe exposure than the remainder of a building, such as parapets, chimneys and sills should be regarded as being located in an environment classified as E3.
4.3 Corrosion protection

The degree and type of corrosion protection required, if any, for various types of steel should be determined in accordance with Table 4, read in conjunction with Table 5. The zinc coating on galvanised steel ties should be at least equal to that in Table 2 of SANS 935 for normal environments and 470 g/m² for highly corrosive environments.

Table 4: Corrosion-resistance rating for steel in masonry

<table>
<thead>
<tr>
<th>CORROSION-RESISTANCE RATING</th>
<th>TYPE, OR COATING, OF STEEL (OR BOTH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Uncoated carbon steel; or steel whose coating is less than required for C2 rating.</td>
</tr>
<tr>
<td>C2</td>
<td>Galvanized steel; for products made from: a) sheet steel – the coating class shall be at least Z 275 as in SANS 934; b) wire of circular cross-section up to 6.0 mm diameter – the coating shall be as for class A wire in Table 2 of SANS 935; c) other forms of steel – the coating mass shall be as in Table 1 of SANS 763.</td>
</tr>
<tr>
<td>C3</td>
<td>Galvanized steel; for products made from: a) sheet – the coating class shall be at least Z 600 as in SANS 934. b) other forms of steel – the coating shall be as for rating C2.</td>
</tr>
<tr>
<td>C4</td>
<td>Steel, or steel coating, whose type and thickness are specially selected to withstand the particular corrosive conditions to which that steel and its masonry may be exposed.</td>
</tr>
</tbody>
</table>
Table 5: Selection of reinforcement for durability

<table>
<thead>
<tr>
<th>LOCATION OF REINFORCEMENT CLASSIFICATION</th>
<th>EXPOSURE RESISTANCE</th>
<th>CORROSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Located in grouted cavities or in Quetta bond construction</td>
<td>E1, E2 and E3 S E1 E2 and E3 S</td>
<td>C1 or higher C1 C2 or higher C2 or higher C3 C4</td>
</tr>
<tr>
<td>a) where concrete infill employed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) where mortar infill is employed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In bed joints</td>
<td>E1 E2 E3 S</td>
<td>C1 or higher C2 or higher C3 C4</td>
</tr>
</tbody>
</table>

4.4 Cover

Cover to reinforcement should be as follows:

- **Pocket Type**
  - Recommended minimum cover given in Table 6

- **Quetta Bond**
  - Recommended minimum cover given in Table 6

- **Hollow Units**
  - Recommended minimum cover given in Table 6

- **Bed Joint**
  - 15mm minimum
Table 6: Minimum concrete cover for carbon steel reinforcement

<table>
<thead>
<tr>
<th>EXPOSURE CONDITION</th>
<th>MINIMUM THICKNESS OF CONCRETE COVER, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concrete grade (as in SANS 10100)</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Minimum cement content kg/m³</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>20</td>
</tr>
<tr>
<td>300</td>
<td>30</td>
</tr>
<tr>
<td>350</td>
<td>35</td>
</tr>
<tr>
<td>350</td>
<td>40</td>
</tr>
</tbody>
</table>

The tooling of mortar joints gives a dense, water-shedding finish. Tooling of joints should be undertaken in elements located in environments which are classified as E3 or S.

5. FIRE RESISTANCE

SANS 10164-2 does not contain any guidance on the fire resistance of reinforced elements and simply makes reference to a code which is still in the course of preparation. BS 5628 Part 2 (Structural use of Reinforced and Prestressed Masonry) suggests that the masonry itself be considered as part of the cover and that the recommendations of BS 8110 (Structural use of Concrete) be followed. AS 3700 (SAA Masonry Code), on the other hand, specifies a minimum cover to the reinforcement for a specific fire resistance period. (See Table 7).

Table 7: Protection to reinforcement for structural adequacy (AS 3700)

<table>
<thead>
<tr>
<th>FIRE RESISTANCE PERIOD, MINUTES</th>
<th>30</th>
<th>60</th>
<th>90</th>
<th>120</th>
<th>180</th>
<th>240</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum dimension from the reinforcement to the exposed face of the masonry, mm</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>40</td>
<td>55</td>
<td>65</td>
</tr>
</tbody>
</table>
APPENDIX G V-JOINTS IN PLASTER AND MORTAR

JUNCTION OF TWO WALLS AT CONTROL JOINT

JUNCTION OF WALL WITH CONTROL COLUMN